Handbook of the Bruchidae of the United States and Canada

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Handbook of the Bruchidae of the United States and Canada

(Insecta, Coleoptera)

Volume I

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Handbook of the Bruchidae of the United States and Canada

(Insecta, Coleoptera)

John M. Kingsolver

Volume I

Kingsolver was research entomologist, Systematic Entomology Laboratory, PSI, Agricultural Research Service, U.S. Department of Agriculture. He is presently research associate with the Florida State Collection of Arthropods.

Abstract

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Distinguishing characteristics and diagnostic keys are given for the 5 subfamilies, 24 genera, and 156 species of the seed beetle family Bruchidae of the United States and Canada (including Hawaii). Associated data for each species description include a history of the name, synonymical names, type specimen information, geographical distribution, host plants, and parasitoids. Appendices give species, host, fossil, and parasitoid lists as well as a glossary of terms and a bibliography.

Bruchidae are found on every major land mass except Antarctica and New Zealand. Eggs are usually laid on the seed or fruit of a plant suitable for development of the larva. Immature stages are spent inside seeds that have been excavated by larval feeding. Adults live free and feed on pollen and nectar.

Johnson (1970) estimates that approximately 84 percent of the known hosts of Bruchidae are in the plant family Leguminosae. The remaining hosts are scattered among 31 other families. Sixteen plant families support larval feeding in the United States and Canada. Several species of Bruchidae, especially those with a cosmopolitan distribution, are notorious pests of stored leguminous seeds.

Keywords: Coleoptera, Bruchidae, Amblycerinae, Bruchidiinae, Bruchinae, Kytorhininae, Megacerinae, United States, Canada, Hawaii, taxonomy, insect-plant interactions.

This is part of a series of studies of bruchid genera contributing to a comprehensive database for this important seed-feeding beetle family in the Western Hemisphere. It provides the means to identify these insects for taxonomists, students, museum curators, biodiversity workers, port identifiers, and ecologists conducting studies in rangeland, pasture, and forest management in the United States and Canada.

Mention of commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture over others not mentioned.

While supplies last, single copies of this publication can be obtained at no cost from John M. Kingsolver, Florida State Collection of Arthropods, P.O. Box 147100, Gainesville, FL 32614–7100.

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Volume 2 (Illustrations)

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Abbreviations

Type Specimen Depositories

BMNH: British Museum (Natural History), London
CASC: California Academy of Sciences, San Francisco
CNCI: Canadian National Collections, Ottawa, ON
FMNH: Field Museum of Natural History, Chicago
ICCM: Carnegie Museum, Pittsburgh
MCZC: Museum of Comparative Zoology, Harvard University, Cambridge, MA
MNHP: Museum National d'Histoire Natural, Paris
NHRS: Naturhistoriska Riksmuseet, Stockholm, Sweden
OSUC: Ohio State University Collections, Columbus, OH
PURC: Purdue University Collections, West Lafayette, IN
UCDC: University of California, Davis, CA
USNM: U.S. National Museum of Natural History, Washington, DC
UZMC: University Zoological Museum, Copenhagen, Denmark
ZMUM: Zoological Museum, University of Moscow, Russia

State and Province Abbreviations

AB	Alberta
AK	Alaska
AL	Alabama
AR	Arkansas
AZ	Arizona
BC	British Columbia
CA	California
CO	Colorado
CT	Connecticut
DC	District of Columbia
DE	Delaware
FL	Florida
GA	Georgia
HI	Hawaii
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
KS	Kansas
KY	Kentucky
LA	Louisiana
MA	Massachusetts
MB	Manitoba
MD	Maryland
ME	Maine
MI	Michigan
MN	Minnesota
MO	Missouri
MS	Mississippi
MT	Montana
NB	New Brunswick
NC	North Carolina
ND	North Dakota
NE	Nebraska
NF	Newfoundland
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NS	Nova Scotia
NT	Northwest Territories
NV	Nevada
NY	New York
OH	Ohio
OK	Oklahoma
ON	Ontario
OR	Oregon
PA	Pennsylvania
PE	Prince Edward Island
PQ	Quebec
RI	Rhode Island
SC	South Carolina
SD	South Dakota
SK	Saskatchewan
TN	Tennessee
TX	Texas
UT	Utah
YT	Yukon Territory
VA	Virginia
VT	Vermont
WA	Washington
WI	Wisconsin
WV	West Virginia
WY	Wyoming

Introduction

The beetle family Bruchidae has been recognized for centuries for the ability of certain species to destroy stores of comestible leguminous seeds. About 30 species of bruchids in the world are serious pests, and at least 9 are cosmopolitan as the result of commercial activities. Bruchid larvae feed entirely within seeds, making their detection and control difficult. The most successful species are those that attack stored seeds. Because they have adapted to oviposit and develop in several hosts, they are inadvertently assisted by humans' mobility and storage methods. Although the larva is the destructive life stage, descriptions of this form are available for only a few species. For most genera of bruchids, identification is tedious and difficult because many species are closely related, individuals are small (average length 1.0–6.0 mm), and dissection of genitalia is often necessary for positive identification.

Bruchids are found naturally on all major land masses except New Zealand and Antarctica. More intense speciation has occurred in the tropical regions than in the temperate, and fewer species are found in tropical rain forests than in more xeric regions. Small isolated islands usually have little or no bruchid fauna because establishment of most bruchids depends on the previous invasion and establishment of suitable food plants for oviposition.

No single information source exists for the Bruchidae of the United States and Canada. The literature is scattered through a wide range of publications generally unavailable to most workers. Because many bruchids are critically important pests of stored legumes, their correct identification is vital to effective control. The U.S. and Canadian literature was combed for data on classification, host plant associations, geographical distributions, and parasitoids for this compilation. The world literature was scanned for the several species of cosmopolitan stored-product species in the genera *Acanthoscelides, Bruchus, Callosobruchus, Caryedon,* and *Zabrotes* to provide as broad a coverage as possible since most of the biological studies on these species were undertaken outside North America.

This handbook contains distinguishing characterizations for 156 species in 24 genera, plus generic and specific descriptions, synonymical names, references to papers on biology, and new or revised taxonomic keys for all subfamilies, genera, and species. New information on hosts and distribution was recorded primarily from specimens deposited in the National Collection of Insects in Washington, DC, and from specimens loaned by many other U.S. (including Hawaiian) and Canadian collections. Included, however, were records from faunal lists such as Kirk (1969, 1970) for South Carolina and Kirk and Balsbaugh (1975) for South Dakota. Approximately 30,000 specimens were examined during 28 years' study of the Bruchidae. Each species is illustrated with photographs and line drawings to facilitate identification. A separate key to the Hawaiian Bruchidae is included in appendix I. Other appendices include a cross-referenced index to host plants (III and IV), a list of parasitoids (V), and a synonymical checklist (II). There is also a glossary of terms used in this manual. All of the elements necessary to produce a future annotated catalog of U.S. and Canadian Bruchidae are included.

The geographical scope of the handbook is primarily the 50 United States, Canada, and the associated continental islands. Beyond these limits, only general distributions are provided.

Although bruchids are difficult to identify, information presented in this handbook should be useful to taxonomists, biological control specialists, port identifiers, plant quarantine officers, museum curators, ecologists, students and teachers, and Federal and State entomologists.

Importance of the Bruchidae

This family has received much attention during the past three decades for several reasons. Demands for more food for the expanding world population has focused on the need for better control of stored-product insects, especially those attacking comestible leguminous seeds in larders of developing countries. Storage losses can be ruinous not only from initial damage by bruchid larvae but also from ensuing invasions of other organisms (Howe 1973; Yoshida 1990).

Morallo-Rejesus (1990) estimated that in the Philippines, losses of mung beans infested by *Callosobruchus chinensis* (Linnaeus) ranged from 7.8 percent to 9.8 percent at harvest, and without protection by insecticides or proper storage post- harvest losses rose to 80 to 100 percent within 3 months. Warthen (1989) summarized the uses of neem (*Azadirachta indica* Adr. Juss.) as a control agent for bruchids in stored grains.

Laboratories in Colombia, England, France, India, Japan, Nigeria, and the United States are investigating many aspects of physiology, morphology, plant host resistance, and pheromones in relation to the principal cosmopolitan species of Bruchidae. A voluminous literature on these target species is being generated. Southgate (in Aitken 1975) summarized avenues of dispersal of the major economic bruchid species.

Another group of bruchids presents a potential threat to the propagation of trees targeted for forest plantings in undeveloped countries where firewood sources have been depleted. Seed stocks can be destroyed by bruchid larvae (Johnson 1983c; Southgate 1983).

Biological Control

The accidental introduction of undesirable plants into certain parts of the world (Australia, Hawaii, Thailand) has stimulated searches for biological agents in the native country of the plant that might assist in controlling the spread of the pest species. Since larvae usually destroy the seeds, the feeding habits of Bruchidae reduce the potential for reseeding. Other programs (for instance, in Argentina) have attempted to introduce foreign bruchids to help in controlling a native plant that is invading grazing land, but native parasites destroyed the introduced populations (Erb and Frías 1983). Efforts to control the weedy shrub *Mimosa pigra* Linnaeus using *Acanthoscelides quadridentatus* (Schaeffer) and *A. puniceus* Johnson are under way in Australia and Thailand (Kassulke et al. 1990; Forno et al. 1989; Cock and Evans 1984).

The effectiveness of bruchids as biocontrol agents needs further exploration. In Southeast Asia and the southwest Pacific, experimental efforts are underway to control the two weedy leguminous plants *Cassia tora* Linnaeus and *Senna obtusifolia* Linnaeus by the Neotropical bruchid *Sennius instabilis* (Sharp) (Cock and Evans 1984).

Recent studies in the use of resistant varieties of host plants as a means of biological control of harmful Bruchidae have been conducted by Brewer and Horber (1984), Dobie (1981), Dobie et al. (1979), Fernandez and Talekar (1990), Horber (1978), Kitamura et al. (1990), Minney et al. (1990), Nwanze and Horber (1976), Osborn et al. (1988), and others.

Medical Importance

Bruchid adults and larvae feed only on plant tissue and are not associated with any disease-causing organisms of warm-blooded animals. Instances of allergic reactions have been recorded, however. Chittenden (1912a) noted that handlers of broad beans (*Vicia faba* Linnaeus) infested by *Bruchus rufimanus* Boheman developed irritating rashes from adults crawling on their skin. Wittich (1940) reported two cases in Minnesota of allergic reaction by women who had been sorting stored beans and peas infested with *Zabrotes subfas-*

ciatus (Boheman). Symptoms included rhinitis, asthma, skin rashes, and conjunctivitis.

Biology of the Bruchidae

Definition

Bridwell (1932:101) provided an extended definition of this family, but for purposes of this handbook the following characteristics are sufficient to define the Bruchidae:

Adults.—Body surface setose; head hypognathous or opisthognathous; ocelli absent; eye shallowly to deeply emarginate; antenna 11-segmented with insertion adjacent to eye; mandibular apex acute, medial margin entire, not dentate; gular sutures short, ending in tentorial pits; fronto- clypeal suture well marked; elytral striae always present, usually 10 in number; metatibia usually longitudinally carinate; tarsal claws appendiculate; pygidium exposed beyond elytral apices; male genitalia with base of median lobe and ventral strut of tegmen modified into a pump to evert internal sac during copulation, lateral lobes (parameres) always present.

Larvae.—Labial sclerome present in instars 2–4; legs reduced or absent (except some 1st instar forms); mandible gouge-shaped; pronotal sclerites present in 1st instar.

Phyletics

Number of Genera and Species

Compared with other families of beetles, Bruchidae is relatively small. The estimated number of species generally cited in texts is 1,200. This estimate is based on the 818 species cataloged by Pic (1913a) plus the species described since then. The world catalog published in 1989 by Udayagiri and Wadhi (which had a cutoff date of 1982) included 1,346 valid species names. My working catalog for the Western Hemisphere species lists 2,200 proposed names up to 1990, of which 895 are valid. Johnson and Kingsolver's (1982) checklist for North America and the West Indies recorded 544 names, of which 366 are valid.

Relationships With Other Families

Bruchidae belongs to a group of plant-feeding beetle families loosely grouped in older classifications as the Phytophaga. Included in this group are the families Bruchidae, Anthribidae, Cerambycidae, Chrysomelidae, Curculionidae (broad sense), and Scolytidae, all of which produce plant-feeding larvae. A configuration of 5-segmented tarsi with the 4th segment small and nearly hidden in the emargination of the 3rd is a characteristic common to all.

Contemporary coleopterists generally agree that the family Bruchidae is closely related to Chrysomelidae, probably representing a seed-feeding phyletic branch of Chrysomeloidea having highly developed characteristics for the spermatophagus mode of life (Chen 1940; Crowson 1946, 1960; Monros 1955; Lawrence and Newton 1982). Crowson (1960) stated, "Larval characters, and to some extent those of the adults, clearly establish the affinity of Bruchidae and Sagrinae insomuch that it becomes difficult to justify familial separation between them. Bruchids appear to be the most derivative group." Kingsolver (1995b) listed the characters he felt were sufficient to give bruchids full family status. Lawrence and Newton (1982) and Reid (1996) placed the bruchids as a subfamily in the Chrysomelidae based on cladistic analysis. Schmitt (1989) and Hawkeswood (1996) argued that Bruchidae should be a subfamily within the Chrysomelidae but that it should retain the "-idae" ending for stability and unambiguity of scientific communication.

Evolution

No extensive evolutionary or cladistic studies have been made for the entire family, although Slobodchikoff and Johnson (1973) analyzed the phylogeny of the American species of *Acanthoscelides.*

Some concurrent evolutionary trends have been observed, however, that allow us to speculate.

The Bruchidae is apparently a monophyletic, spermatophagus, chrysomeloid group springing from an ancestor common to the chrysomelid subfamily Sagrinae (Crowson 1946; Monros 1955). Similarities in wing venation, male genitalia, form of the metafemur, presence of tibial spurs, internal feeding by the larvae, and other characters point to a relatively recent divergence of the bruchids followed by development of spermophagy to a fine degree (Kingsolver 1995b; Verma and Saxena 1996).

Kingsolver (1995b) listed the characters he thought were sufficient to give the bruchids full family status, and his view was supported by Hawkeswood (1996) and Verma and Saxena (1996). Lawrence and Newton (1982) and Reid (1996), however, placed the bruchids as a subfamily of the Chrysomelidae based on cladistic analysis. Schmitt (1989) argued that Bruchidae should properly be a subfamily within the Chrysomelidae but that Bruchidae should be retained with the *-idae* family ending for stability and unambiguity of scientific communication. Monros (1955) treated the Bruchidae as a subfamily of the Chrysomelidae.

The groups seemingly nearest to the Sagrinae are in the bruchid subfamily Pachymerinae, especially the genera *Caryoborus* and *Caryobruchus.* Although resemblance of the sagrine *Carpophagus* to these pachymerines is striking, Crowson (1946) did not think that this genus was in any way related to the Bruchidae. Without knowing what bruchid species he used in this comparison, I am of the opinion that *Carpophagus* has more in common with the pachymerine genera than with any other chrysomeloid genus. Similarities are male genitalia with a simple, curved, tubular median lobe, bases of the lateral lobes fused straplike with only the apices expanded; absence of a crop in the digestive system (Kasap 1978b); swollen metafemur with ventral denticles; metepisternum with an angular sulcus (also found in some primitive Cerambycidae); similar wing venation patterns including the presence of a wedge cell in some species (Suzuki 1969); larvae as internal feeders in plants (sagrines in stems or crowns, pachymerines in seeds). Differences are mostly external: Elytra throughout the family Bruchidae always striate whereas those of *Carpophagus* and most other sagrines lack distinct striae; frons in the pachymer ines with a median carina, sagrines with an X-shaped sulcus; larval mandibles gouge-shaped in pachymerines, toothed in those sagrines whose larvae are known. Maulik (1941) presented useful comparative characters for the Sagrinae.

Evolutionary Trends

Certain evolutionary trends are apparent within the Bruchidae. They indicate that the most likely primitive genera are in the Pachymerinae and that the Rhaebinae, which are found only in central Asia, are probably a relict group. The Amblycerinae, Eubaptinae (found only in South America), and Kytorhininae are successively more specialized, and the Acanthoscelidinae are probably the most derived group.

1. Trochantins are present in the fore and middle legs in the Pachymerinae, Amblycerinae, Eubaptinae (South America), Rhaebinae (Asia), and Kytorhininae but are modified or lost in the Bruchinae except in the mid legs of Megacerini.
2. Median lobe of male genitalia has an unmodified apex in Pachymerinae and Rhaebinae (figure 2) but is fractured into a separate ventral valve in all other subfamilies (figure 3).
3. Ocular sinus is shallow in Pachymerinae (figure 1) and in *Amblycerus* of the Amblycerinae (figure 4) but deep in more specialized subfamilies. In some species of *Meibomeus* (figure 5), the sinus nearly divides the eye.

4. Adult antennal forms range from simple serrate or flattened moniliform in Pachymerinae, Rhaebinae, and Eubaptinae to clavate, strongly serrate, or pectinate in males in the Kytorhininae and in some species in Bruchinae (figures 6–13).
5. Mesepimeron is gradually reduced by ventral encroachment of mesepisternum (figures 25–27) as the subfamilies progress in degree of specialization.
6. Venation of anal area of wing gradually lost the "wedge cell" and veins assumed an "h" shape in most of the more derived families.
7. Lateral pronotal carina modified or lost as specialization progressed.

Genetic Studies

Skaife (1925, 1926) was a pioneer in bruchid genetics. Certain species of Bruchidae are now being used in several laboratories throughout the world as test organisms for genetic studies because they are readily cultured in the laboratory and have short life cycles. Species used are those that breed continuously in stored seeds—*Acanthoscelides obtectus, Callo- sobruchus chinensis* and *C. maculatus,* and *Zabrotes subfasciatus,* for example.

Life Histories

For a general discussion of bruchid biologies, see Skaife (1926), Southgate (1979), and Zacher (1929 and 1930). See also the Proceedings of the Second International Symposium on Bruchids and Legumes (Fujii et al. 1990) for other life history studies. Johnson (1990b) contributed a paper to this symposium.

Larval Feeding

A first larval instar is faced not only with escaping from the egg but also with penetrating one or two layers of plant integument before it can reach its food source. During eclosion, larvae of most species bore directly through the floor layer of the egg, through the pod or seed integument, through the endocarp, and into the cotyledon, whereas others cut through the top of the egg and walk around on the substrate searching for a crack or crevice to help them gain purchase to bore into the seed. Some species are provided with a suckerlike appendage on the tenth abdominal segment to help them adhere to the surface during their search for a suitable entry site (Pfaffenberger and Johnson 1976). Special adaptations of the neonate larva include well-developed legs in those species that emerge from the top of the egg and shorter legs in those forms that drill directly through the floor of the egg.

The most remarkable character, however, is a toothed dorsal prothoracic plate that assists the larva in escaping from the egg and gives leverage in penetrating the pod or seed. All bruchid species for which the first larval instar is known possess this toothed plate (figure 16). Pfaffenberger and Johnson (1976) and Kannan (1923) illustrated this character for several species. In its first molt, the larva loses these special adaptations and assumes a scarabaeiform aspect with legs much reduced and with gouge-shaped mandibles. It feeds and molts through its remaining three instars inside an excavation scarcely larger than its own bulk.

In most cases, the larva, immediately before entering the pupal stage, will bore to the surface of the seed or pod, leaving a circular cap in the epidermis that can easily be cut and pushed off by the adult during emergence. After excavating this escape route, the larva returns to the feeding chamber and pupates. In some species, however, pupation occurs partly or completely outside individual seeds (for example, *Caryedon serratus).* Species too large to develop in individual seeds may feed on several seeds inside an envelope (the pod or capsule, for example) and spin a cocoon inside the envelope (examples include some species of *Amblycerus* and of *Sennius*). Glands producing the material for the cocoon have not been investigated.

Adult Nutrition

Although bruchid larvae are well known to subsist mainly on tissue of the seed cotyledon, comparatively little is known about adult food habits for most species. Most observations on adult feeding have been made on the species affecting crops—the so-called "economic species." Adult mandibles with sharp medial edges and lack of teeth are not especially adapted for biting tissue except to complete cutting of the operculum of the seed prior to emergence. Maxillae in many species are equipped with well developed, feathery setae that assist in raking pollen into the oral cavity.

Most so-called "host" records for adults, usually floristic associations with whatever plant happens to be in bloom at the time the adults are flying about, may have little or no relationship with the larval host plant. Because adults cause little damage by their food intake, it has been presumed that either they do not feed or they feed sparingly on nectar or pollen. Female *Acanthoscelides obtectus* have been observed biting the sides of green pods or the suture of more mature pods of *Phaseolus* to make an opening through which they deposit eggs into the interior of the pods. Whether or not they ingest tissue is not known (Slingerland 1892). Brindley et al. (1946, 1952) and Pajni and Sood (1975) reported that *Bruchus pisorum* can only reproduce after ingesting pollen of its larval host, the pea plant *(Pisum sativum).* Adults of *Bruchus pisorum* overwinter in trash or under bark and emerge from diapause to feed on pea blossoms; then they are ready to oviposit on green pods.

De Luca (1966) compiled a list of flower-visiting records from the world literature. No descriptions of actual ingestion were made, although his introduction to the paper is a discussion of pollen and nectar nutrition. Johnson (1977d) listed eight species of plants from which adult *Acanthoscelides pauperculus* were collected, but precise observations on actual feeding were not made. He suggested that feeding on pollen is necessary for mating and oviposition. Lago and Mann (1987) recorded several species of bruchids on inflorescences of *Daucus carota* Linnaeus (wild carrot).

Jarry (1987) identified the pollen of 18 different species of plants in the digestive tracts of *Acanthoscelides obtectus* in France. Pollen from the principal host, *Phaseolus vulgaris,* made up only 9 percent of the total, whereas weedy plants in areas surrounding the plots of *P. vulgaris* made up the bulk of pollen identified. Grass pollen was well represented.

Adults of *Acanthoscelides obtectus* can reproduce and oviposit without first taking food, but Leroi (1978) determined that well-fed, newly emerged individuals can survive more than 200 days on honey-pollen mixtures. Ovarian production by well-fed females was 50 percent more than that by starved females. Shinoda and Yoshida (1987a) found that when newly emerged *Callosobruchus chinensis* were fed on powdery mildew *(Sphaerotheca fuliginea)* or rust *(Uromyces azukiola)* their mean longevity was three times that of control individuals and the numbers of eggs produced doubled. Zacher (1929) thought that adults should be able to retain sufficient fat from the larval stages to carry them through adult life.

Larson and Fisher (1938) included a summary of the literature on adult feeding to that date. Many of the observations were made on caged bruchids and do not necessarily reflect field conditions. Slingerland (1892) claimed that bean weevils *(Acanthoscelides obtectus)* confined on live bean plants apparently fed on the parenchyma of the leaves, but he did not actually observe feeding.

Leroi et al. (1984) found that for *Acanthoscelides obtectus,* although larvae and adults utilize different types of food (that is, seed endosperm vs. pollen grains), carbohydrate compositions of the two food sources are remarkably similar. Glycosidase activity in the guts of larvae and adults are likewise similar.

For an excellent discussion of bruchid physiology and nutrition, see Johnson and Kistler (1987).

Oviposition

Huignard et al. (1990) observed that most Bruchidae are specialists developing on a limited number of host species and host selection is accomplished by females ovipositing on pods or fruits that are only available during a short period of the year. Neonate (newly hatched) larvae alone cannot search for their food substrate but depend on the female to locate suitable host plants or seeds upon which to oviposit.

Bruchid eggs are usually either cemented to the pod or seed of a suitable larval food plant, dropped into a pod after the female cuts a hole in the pod wall, or tucked into surface cracks or old emergence holes. The adhesive used originates either in the epithelium of the egg follicles (Snodgrass 1935) or in accessory glands (Wigglesworth 1947) and not only cements the egg to the substrate but also covers it. In some species, strands of adhesive resembling guy wires extend from the edge of the egg covering, apparently to aid in holding the egg to the pod surface as the pod expands during growth (Forister and Johnson 1970; Pfaffenberger and Johnson 1976).

Johnson (1981a) classified egg placement into three general types, or "guilds":

1. Mature pod guild, in which eggs are cemented to the surface of the seed pod. Neonate larvae in this guild must bore through the pod wall and into the seed. (Examples: *Acanthoscelides chiricahuae, Merobruchus* spp., *Mimosestes* spp.)
2. Mature seed guild, in which eggs are cemented to the surface of seeds still attached to the inside of a partly dehisced pod, so that larvae need only bore through the seed integument. (Examples: *Stator limbatus, S. pruininus*.)
3. Scattered seed guild, in which eggs are laid on mature seeds that have fallen to the ground from a fully dehisced pod. (Examples: *Stator sordidus, Zabrotes* spp.)

Acanthoscelides obtectus females bite holes in green *Phaseolus* spp. pods through which they insert eggs to fall freely within the pod. In later generations, they insert eggs in old emergence holes. Oviposition for this species begins early in the season on immature pods and may end on mature pods that have dropped to the ground or on naked seeds in storage.

Physiology

No attempt is made here to discuss physiological aspects of bruchids, but the following references will provide an introduction to the literature. Discussions of *Acanthoscelides obtectus, Callosobruchus chinensis, C. maculatus, Caryedon serratus,* and *Zabrotes subfasciatus* include additional references on the subject. For a discussion of nutritional ecology of bruchids, see Johnson and Kistler (1987).

Chromosomes.—Takenouchi 1955, 1971a, 1971b; Bawa et al. 1974; Smith and Brower 1974; Garaud and Lecher 1982; Garaud 1984.

Digestion.—Gatehouse et al. 1979; Choudhuri and Paul 1983; Gatehouse and Boulter 1983; Gatehouse et al. 1989.

Embryology.—Brauer 1925; Tantawi et al. 1976; Daniel and Smith 1994.

Enzymes.—Sharma and Sharma 1979, 1981; Gatehouse and Anstee 1983; Puri and Sharma 1984; Sharma and Rai 1984; Garg et al. 1990.

Egg production.—Huignard 1970; Sandner and Pankanin 1974; Hinton 1981; Choudhuri and Paul 1984; Dick and Credland 1984; Butare and Biémont 1987.

Genetics.—Breitenbacher 1925; Sano-Fujii 1986; Messina 1987, 1990.

Lipids.—Nwanze et al. 1976; Sidhu et al. 1984.

Nervous system.—Ogijewicz 1948.

Overwintering.—Brauer 1942; Hodek et al. 1981.

Pheromones.—Hope et al. 1967; Halstead 1973; Rup and Sharma 1978; Tanaka et al. 1982; Qi and Burkholder 1985; Kitch and Murdock 1986; Sakai et al. 1986.

Temperature effects.—Larson and Simmons 1924a; Menusan 1934b, 1936; Menusan and MacLeod 1938; Sano 1967; Kistler 1985.

Morphology of the Bruchidae

Adults

Little attention has been paid to the comparative morphology of New World bruchid adults. Descriptions have been written with little thought to consistency of nomenclature of body parts, causing confusion when papers of various authors are compared. Most references to morphological characters have been incidental in generic or specific descriptions. Such papers as Doyen's "Skeletal anatomy of *Tenebrio molitor*" (1966), Snodgrass' 1908 and 1909 papers on the insect thorax, or Hopkins' venerable but valid "Contributions toward a monograph of the bark-weevils of the genus *Pissodes*" (1911) are useful for general reference but, of course, do not explain morphological peculiarities of the bruchids.

Approximately 275 taxonomic papers have been written about Western Hemisphere bruchids during the past 50 years, but only two compared a structure of a body part (male genitalia) in several genera of this family (Teran 1967, Kingsolver 1970a). Although nomenclature used in the two papers differed, a basis for subsequent studies was established. In addition to offering a nomenclature for various sclerotized parts, Kingsolver included a diagnosis of the genitalic musculature. No one has surveyed the various genera for female genitalia, wing venation, elytral form, head form, legs, or antennae. Luk'yanovich and Ter-Minassian (1957) and Borowiec (1987) incidentally included illustrations of structures for several genera, including American forms, but the field has been almost totally neglected by American workers.

A moderately large resource of morphological papers has recently emerged from several Old World laboratories. Singh (1973, 1978a,b, 1981a,c, 1982, 1983), for instance, published on morphological characteristics of several Old World bruchid species. Many of the papers on Old World bruchids are cited at the end of this section.

Johnson and Kingsolver (1973) introduced the terms *lateral*, *lateroventral*, *ventral*, and *dorsomesal* to designate metatibial carinae in the genus *Sennius.* Here, I am modifying *lateroventral* to *ventrolateral* to be consistent with *dorsomesal*. These metatibial terms are valid for the majority of genera in the Bruchinae; however, the positions of the tibial carinae are different in the Pachymerinae and in the Megacerini and will be further elaborated in the descriptive sections for those taxa.

For the purposes of this handbook, only external morphology and male genitalia and considered. A thorough morphological analysis is sorely needed in order to make comparisons between various sections of the family and to provide sets of characters for phylogenetic analyses. Only those body parts that can be seen without dissection or dismemberment of the body (except male and female genitalic parts, wings, and mouthparts) will be discussed and illustrated here. One species is illustrated as a basic reference, and important variations are illustrated.

Because Bruchidae develop in a restricted space—in most instances the excavated interior of a single seed—and must emerge through a circular hole excavated by the larva, evolution has favored a smoothly rounded body lacking protuberances or spines that would hinder escape from the interior of the seed. Most bruchids are ovate or subelliptical in outline and generally circular or oval in cross section. Legs

and antennae are capable of being tucked close to the body, and the head hangs vertically and usually rests on the prosternum. In many species, the dorsal profile is arched, which leads to a shortening of sternal areas of the thorax and consequent reduction of sclerites in this part of the body. In addition, the elytra are abbreviated, exposing the heavily sclerotized seventh tergum (pygidium).

Head.—The bruchid head at rest is either vertical (hypognathous) or reflexed so that it rests on the prosternum (opistho- gnathus) (figure 17). In a frontal view (figures 18 and 68), the head is obovate with the subspherical base inserted into the anterior foramen on the front of the prothorax. In lateral aspect, the head tapers toward the apices of the mandibles. Compound eyes are usually protuberant but in some species follow the contour of the lateral margin of the head.

Most of the sutures delimiting sclerites of the head in primitive beetles are lost in Bruchidae, and only general areas can be defined. The *vertex* is the area of the head above the upper limits of the eyes, sometimes set off by a *transverse sulcus* (figure 18). The *frons* lies between the eyes and sometimes carries a vertical, median *frontal carina*. The ventral margin of the frons is the transverse *frontoclypeal suture*. In some genera (for example, *Caryobruchus* and *Amblycerus)* the *frontogenal suture* extends from the inner corner of the eye to the frontoclypeal suture separating the frons from the cheek portion of the head (the *gena*) but in most bruchids this suture is lost and the frons and gena are continuous beneath the eye. The dorsal portion of the gena carries the *antennal socket*.

The *clypeus* is a quadrangular sclerite, sometimes elongated, usually rounded basally, and truncate apically. The frontoclypeal suture limits it dorsally, the lateral margins extend to the mandibles, and the apical boundary is the *clypeolabral suture*. The clypeus partly covers the *mandibles* and *maxillae*. The *labrum* is attached to the apical margin of the clypeus and usually carries a transverse row of long setae.

The compound eye is surrounded by a narrow, setiferous channel, the *supraocular sulcus* (Kingsolver 1980a:230), which may correspond to the ocular suture found in more generalized insects (Snodgrass 1935:109) or may be secondary.

The antennal socket is situated on the ventral rim of the eye at the base of an emargination, the *ocular sinus*. The sinus varies in depth from a slight emargination (as in *Amblycerus* and *Caryobruchus*) to an almost complete division of the eye (as in *Meibomeus*). The antennal socket carries on its ventral rim a small projection, the *antennifer*, forming an articular point upon which the bulbous base of the antennal *scape* pivots. The scape is usually longer than the second segment, the *pedicel* (figures 6–13); the *flagellum* is invariably composed of nine segments and may be uniformly serrate, gradually clavate, strongly eccentric, or even pectinate.

On the ventral side of the head, the eyes are prominent on either side of a flat, central *submentum* (figure 21). The latter area is continuous with the gena in front of and behind the eye and is limited behind by a deep, transverse sulcus. At the posterior end of the head is a large opening, the *occipital foramen*, through which the digestive and nervous systems pass into other parts of the body. On the ventral part of the rim of the foramen is a quadrate or trapezoidal sclerite, the *gula*. Along the lateral margins of the gula are the *posterior tentorial pits*, which are the attachments of the internal skeleton of the head. Attached to the anterior margin of the *submentum* is the *mentum* (figure 21), an emarginate, transverse sclerite to which the *prementum* is attached. The prementum is the base for the paired, three-segmented *labial palpi* and the *ligula*, which is divided into paired *paraglossae*. On either side of the mentum and submentum is a deep emargination, the *maxillary fossa*, into which the *maxilla* is inserted. The maxilla (figure 19) is composed of five parts: the *cardo*,

the *stipes*, the three-segmented *maxillary palpus*, the *galea*, and the *lacinia*. Both the galea and the lacinia are provided with long curved setae, which, in some species, are plumose. These specialized setae are apparently used to rake pollen into the oral cavity. The inner surface of the labium and of the labrum is also provided with rows of setae to assist in ingesting pollen.

The *mandibles* project beyond the labrum, but their attachment is on each side of the head with the dorsal pivots, or articulations, at each end of the frontoclypeal suture and the ventral articulations at the lateral corner of the maxillary fossa. The apex of each mandible is acute, and the inner margin forms a sharp, entire cutting edge. In some species, the inner margin is fringed with long setae. A membranous flap, the *prostheca*, and a flattened plate near the base of the mandible, the *mola* (figure 20), are characteristic of all Bruchidae. The face of the mola is covered with short spines to form a grinding surface.

Prothorax.—The *prothorax*, the first leg-bearing segment, is composed of two sclerites: the *prosternum* (figures 22, 23, and 41) is a Y-shaped sclerite bounded by the front coxal cavities, the *pleurosternal suture*, and the anterior foramen, and the *pronotum* is a large, continuous dorsal sclerite making up the remainder of the body of the prothorax (figure 41). The pronotum consists of a dorsal surface, the *disk*, and the *hypomeron* (the lateral, concave area dorsal to the coxa). The disk is limited in some species by a distinct *lateral carina* but more often is continuous laterally with the hypomeron itself, marked only by the concave surface. The *epimeron*, an extension of the hypomeron but not a separate sclerite, projects behind the front coxae to meet the apex of the intercoxal piece.

In some species in the Pachymerinae and Amblycerinae, the margin of the pronotal disk is distinctly sulcate and corners of the disk bear one to three setiferous punctures.

The prosternum is usually short in front of the procoxae because of the ventral compression of the body. In *Spermophagus,* an Old World genus, it is reduced to a membranous bridge. The prosternal process may be flat as in *Caryobruchus* and some *Amblycerus* (figure 41) or narrow as in other *Amblycerus* (figure 45), or it may be an internal, vertical lamella partly hidden by the coxae *(Acanthoscelides).*

The attachments of the fore and middle coxae generally take two forms in bruchids. In the generalized form (as in *Amblycerus* and *Caryobruchus*), the coxa freely articulates with the trochantin, which in turn articulates with the body wall (figure 23). In the more advanced form (such as *Acanthoscelides* and *Sennius*), the trochantin is replaced by a straplike extension of the sternum forming a socket that allows the coxa to rotate freely through about 90 degrees of arc but limits lateral movement of the leg (figure 24). The triangular trochanter is rigidly attached to the basal end of the femur.

Mesothorax and Metathorax.—The two wing-bearing segments in Bruchidae are rather rigidly fused together to provide strength. Internal sutural ridges (phragma, or ingrowths from the body wall) provide attachment points for the massive muscles required to operate the mesothoracic elytra, the metathoracic flight wings, and the legs. Only the external sclerites, however, will be identified here.

Each of the thoracic segments is divided into a ventral *sternal region*, a lateral *pleural region*, and a dorsal *notal region*. Except for the apex of the scutellum protruding between the bases of the elytra (figures 30 and 60), the notal sclerites are concealed beneath the elytra and have not been included in descriptions of bruchids. The *flight wings*, concealed beneath the elytra (figures 14 and 15), are folded longitudinally and transversely.

The *mesothorax* is the shortest of the three thoracic segments. It consists of three visible plates—the *mesosternum*, the *mesepis-*

ternum, and *mesepimeron* (figure 28). The visible mesosternum is a Y-shaped plate lying in front of and between the middle coxae and is separated laterally from the ventral end of the mesepisternum by the *sternopleural suture*. The *intercoxal process* rests on the corresponding extension of the metasternum. The mesepi

sternum and mesepimeron are adjoining vertical plates extending from the elytral margin to the coxal cavity. In more generalized bruchids (figure 25) *(Caryobruchus, Amblycerus),* these two plates are approximately the same size, but in more specialized forms the mesepimeron is reduced in size and shape by the encroachment of the mesepisternum (figures 26 and 27).

The *coxal cavity* lies between the metasternum, the mesosternum, and the ventral end of the two pleural sclerites. The attachment of the leg is essentially the same as described for the prothorax.

The form of the elytra in beetles is a radical modification of the metathoracic wings to form a protective cover for the notal areas of the mesothorax, the metathorax and abdomen, and the flight wings. At rest, the elytra meet on the midline with a tongue-and-groove interlock mechanism. During flight, the elytra are rotated laterally on the mesopleural wing process to allow the flight wings to unfold and operate freely. Although the elytra in bruchids exhibit many modifications of surface sculpture and configurations of the striae, especially in the basal area, 10 striae are always present.

Venation of the flight wings throughout the family is not detailed here (except in figures 14 and 15). The wings of only a few species have been illustrated, and a thorough survey of venation in the family has not been made. References to papers that include bruchid wing patterns can be found at the end of this section.

The *metathorax* is considerably larger than the mesothorax to accommodate the volume of muscles that operate the flight wings and legs. The size and relative position of the sternal and pleural sclerites is distinctly different from that of the mesothorax. The *metasternum* is rigidly attached to the mesosternum and to the horizontal *metepisternum* (figure 28) and carries the median articulation for the metacoxa as well as the attachment of the abdomen. It also forms the posterior wall of the mesocoxal cavity and the anterior wall of the metacoxal cavity. The *pleurosternal suture* separates it from the metepisternum. The *postmesocoxal sulcus* follows the posterior margin of the mesocoxal cavity and in some genera bends sharply to parallel the pleurosternal suture *(parasutural sulcus),* but in other, more specialized genera it ends at or near this suture. Along the anterior border of the metacoxal cavity extends a narrow, transverse sclerite variously termed the *antecoxal piece* or the *precoxal strap*.

The *metepisternum* is an elongated, horizontal sclerite, set between the mesepimeron and the dorsal one-half of the metacoxal cavity, and carries the *dorsal articulation* of the metacoxa. In some more generalized genera, the face of this sclerite bears an angulate sulcus—the *metepisternal sulcus* (figure 28)—which extends toward and bends to parallel the pleurosternal suture and forms the corresponding *parasutural sulcus* to that of the metasternum. This sulcus is not present in more specialized genera. The *metapleural suture* separates the metepisternum from the narrow, horizontal *metepimeron* that, except for the posterior end, is hidden beneath the margin of the elytra.

The external face of the *hind coxa* is an elliptical or reniform plate rotating on a transverse axis between the ventral coxal articulation and the dorsal articulation. The coxa, however, is roughly triangular in cross section and projects into a cavity between the metasternum and the abdomen. The coxa can rotate on its axis about 30 degrees, and the trochanter can rotate in its fossa near the ventral end of the hind coxa more than 180 degrees. Extending laterad from the trochanteral fossa is a

thin suture usually bordered by a polished, impunctate strip. I am here applying the term "fossula" to this suture (figure 28).

The *trochanter* is more or less rigidly attached to the proximal end of the *femur* (figure 29). The latter segment of the hind leg is laterally compressed and often dorsoventrally expanded. The ventral margin is often furnished with denticles of various sizes and numbers (figures 40, 47, 49, 50, 53, and 63–65), a primary source of subfamily and generic characters and, in some instances, specific characters. Despite the obvious resemblance to the saltatorial, or jumping, hind legs in other families and orders of insects (such as fleas and fleabeetles), legs of bruchids are not equipped for jumping. The development of the internal musculature is opposite that for jumpers; that is, the greatest development of muscle bands is in those that flex the metatibia against the ventral margin of the metafemur. The hind leg thus becomes a grasping organ, probably for holding to edges of leaves or perhaps used in mating. See Furth and Suzuki (1990).

The proximal end of the metatibia hinges between two terminal plates of the metafemur and has a range of movement of about 120 degrees in the same plane as the metafemur. Terminal spurs are found in only a few genera, the most common terminal armament being a ventral spine *(mucro)* and several smaller terminal denticles *(corona*) (figures 44, 47, 49, 50, 53, and 54).

Abdomen.—The *abdomen* in Bruchidae consists of five externally visible, heavily sclerotized sternal segments, but the basal sternum is anatomically the 3rd segment, the 1st and 2nd sternites being reduced to lightly sclerotized or membranous relicts forming the vertical anterior wall of the abdomen behind the metacoxae. For convenience, the visible sternal segments are numbered from 1 to 5. The terminal segments, including those transformed into sex organs, are radically modified and are withdrawn into the end of the abdomen. Modifications of the visible sterna include a tuft of setae or a pit on the basal sternum of males in some genera, the terminal sternum in many genera being more deeply emarginate in males than in females, or the abdominal segments being telescoped.

The membranous pleural areas of the abdomen that carry the spiracles for each segment are hidden beneath the elytra, except that the spiracle for the 7th tergum (the pygidium) is located at the extreme upper corner of the tergum. The pygidium in this family is always exposed beyond the apices of the elytra and is always heavily sclerotized; however, in *Kytorhinus* the 5th and 6th terga are also sclerotized (figure 51). The sculpture, shape, and setation of the pygidium is often a good source of generic and specific characters. The male pygidium is often more convex and inflexed apically than is that of the female.

Genitalia.—Zacher (1930) was the first worker to explore the usefulness of male genitalia in the classification of bruchids, but his descriptions of the various parts were meager and poorly illustrated. Mukerji and Chatterjee (1951) compared genitalia of species in five genera and identified the various parts using the nomenclature of Snodgrass (1935). Teran (1967) illustrated genitalia of species in nine additional genera but used a different set of morphological terms. Kingsolver (1970a) made a study of male genitalia from an evolutionary standpoint, including the identification of genitalic muscle strands and a theoretical explanation of the mechanism for everting the internal sac. His nomenclature, different from that of Mukerji and Chatterjee or that of Teran, followed Sharp and Muir (1912) and has generally been employed by recent workers in the family. Most of the taxonomic papers published since 1960 use and illustrate male genitalia for species discrimination. Several papers have recently been published on male genitalia of Old World species of Bruchidae. These are referenced at the end of this section.

Little has been published in the United States on the female genitalia of Bruchidae. See below for a discussion of these structures.

Male Genitalia.—Male genitalia provide the most consistent source of generic and specific identifying characters in this family. Moreover, the combination of characteristics of the genital complex is sufficiently distinctive to warrant separation of the family from other Chrysomeloidea.

The male reproductive organs are of both mesodermal and ectodermal origin. The testes and vasa deferentia originate in the mesoderm, whereas the ejaculatory duct, accessory glands, and intromittent organs are ectodermal. Ectodermal parts contain chitin and will withstand treatment in sodium hydroxide to remove muscle fibers, whereas endodermal parts will dissolve in the same solution.

As is true of most Coleoptera, the median lobe, lateral lobes, internal sac, and associated parts are completely invaginated into the end of the abdomen and are normally not visible without dissection. To examine details of the various components, caustic treatment is usually necessary to remove extraneous body tissues (see Materials and Methods). Significant characters for specific and sometimes generic identification are usually found in the parts resistant to the caustic solution.

Male genitalia of bruchids are modified from the cucujoid type (Crowson 1955) with a basic form similar to those found in the phytophagous families Cerambycidae, Chrysomelidae, and Curculionoidae. The nearest approach of bruchids to another family appears to be that of the Pachymerine genera *Caryoborus* and *Caryobruchus* to the Sagrine genus *Carpophagus.*

The genital complex comprises three principal parts (figures 30–34):

- The *tegmen* (figure 31) comprises the *lateral lobes* (parameres), the *basal piece* (tegmen ring) surrounding the median lobe, and the *ventral strut.*
- The *median lobe* (aedeagus) (figure 30) is a sclerotized tube with an enlarged, spoon-shaped base (cucullus) modified from ventral struts found in related families.
- The eversible *internal sac* (figures 30 and 34) normally lies retracted inside the median lobe and is attached to the apical orifice of the median lobe.

These various parts are highly modified derivatives of the terminal segments of the abdomen and are enclosed in the elongate intersegmental membranes of the 7th, 8th, and 9th segments.

The *apical orifice* (figure 30a), which is the attachment for the base of the internal sac, is located near the apex of the median lobe. The *basal orifice* (figure 30b) is located at the point at which the basal piece surrounds the median lobe. Although the rigid apex of the median lobe of the bruchid subfamilies Pachymerinae and Rhaebinae is similar to that found in the Sagrinae and the Cerambycidae, the apex in the Amb-ly-cerinae, Kytorhininae, and Bruchinae has developed into a separate sclerite, the *ventral valve* (figure 30c). Some groups of bruchids also have a sclerotized or largely membranous, hoodlike *dorsal valve* (figure 30d) above the apical orifice. The configuration of the ventral valve is often one of the specific diagnostic characters.

The lateral lobes are attached to the dorsal rim of the basal piece and lie on the dorsal side of the median lobe. They take various forms, sometimes fused into an apically bilobed straplike structure, or are variously divided, sometimes nearly to their attachment with the basal piece. The basal piece surrounds the middle of the median lobe and is attached to the ventral rim of the basal orifice by a sclerotized membrane. The tegminal strut extends beneath the cucullus and may be flat or keeled. Between the rim of the cucullus and the tegminal strut extend thick muscle bands (figure 32) bridging the space between the two parts. The membrane between the basal piece and basal orifice effectively

seals the cavity formed by the muscle bands, and compression of the muscles converts the structure into a pump to evert the internal sac during copulation.

Associated sclerotized structures are the Y-shaped, ventrally positioned *8th sternite* (spiculum gastrale) (figure 32), to which muscle bands that move the genital complex in and out of the body are attached, and the modified *8th tergite*, a hood-shaped sclerite lying beneath the pygidium and dorsad of the lateral and median lobes.

The *internal sac* is the primary intromittent organ (figures 30, 33, and 34). It is attached at the apical orifice near the apex of the median lobe and is essentially an extension of that lobe. For that reason, the terminology applied to the internal sac seems contradictory but is logical if it is remembered that it is the median lobe extended. When the sac is invaginated within the median lobe in repose, its base is nearest the apex of the median lobe and its apex is nearer the base of the median lobe (figure 30). Inflation of the sac is accomplished through pumping action of the basal pump. Various *sclerites (spicules, spines, denticles, serrata)* (figure 35) attached to the sac emerge on the external surface of the sac as it is evaginated into the vaginal tract and undoubtedly act as holdfasts to keep the sac in place during copulation. The arrangement of this saccal armature is, in many instances, the source of characters for specific identification. Because of the difficulty of everting the sac of prepared specimens, illustrations of the male genitalia usually show the sac in the invaginated position.

The *vas deferens* (figure 32) extends through the muscle strands of the pump and is attached to the *closure valve*, or *transfer valve*, of the internal sac. During inflation of the sac, it follows the sac apex through the lumen of the median lobe and finally through the lumen of the sac.

Leopold (1941) discussed the role of male accessory glands in reproduction.

Withdrawal of the sac from the vaginal tract begins at its apex. Fine muscle strands attached to saccal sclerites and inserted on the internal walls of the median lobe contract to effectively peel the sac from inside the vagina and restore it to its original position inside the median lobe.

Female Genitalia.—Female genitalia generally have not been illustrated nor described due to their apparent lack of taxonomic significance. This facet of bruchid morphology, however, should be more fully explored for potential species group or generic characters.

Kingsolver and Johnson (1978) published illustrations of ovipositors for North American species of *Mimosestes,* and theirs is the only American paper illustrating female genitalia for all of the species treated. No one has made a comparative study of female genitalia for the Bruchidae in this country. Nilsson and Johnson (1990) included drawings for two species of *Caryobruchus,* and Donahaye (1974) sketched genitalic parts for seven species of *Bruchus.* Mukerji and Bhuya (1937) detailed the reproductive system of both *Callosobruchus maculatus* and *C. chinensis.* Tanner (1927) included *Acanthoscelides* (as *Mylabris*) *obtectus* in his survey of female ovipositors of Coleoptera. Johnson et al. (1989) included various female characters in New World *Stator.* Several papers detailing ovipositors and internal reproductive organs have been published for Old World bruchids, including those for *Bruchidius mackenziei* Kingsolver from Australia (figure 36), and for several species of *Bruchidius* by Iablokoff-Khnzorian and Karapetian (1973). References to these papers are listed at the end of this section.

The female genital complex, as in the male, has its origin in both the mesoderm and the ectoderm. Products of the mesoderm are the *ovaries*, the *lateral oviducts*, and perhaps part of the *common oviduct.* Of ectodermal origin are the *vagina*, the *bursa copulatrix*, the *spermatheca* and *spermathecal glands*, part of the *common oviduct*,

and the *ovipositor*. These are shown in figure 36.

In certain groups of bruchids (such as *Acanthoscelides* and *Callosobruchus*), a pair of structures first described by Mukerji and Bhuya (1937:200) are probably glandular in function and are positioned one on each side of the vaginal tube at the entrance of the bursa copulatrix (figure 36). These vary from being merely convex evaginations into the lumen of the vagina to oviform, membranous sacs nearly occluding the lumen. Their attachment is ringlike with a central opening through which pass tracheae into the gland. These are lacking in *Bruchus*, but a pair of "glands" are positioned at the anterior end of the bursa. The function of these structures is not known. A family-wide survey of their position and structure may offer phylogenetic clues.

Papers on Adult Morphology

Head morphology.—Stickney 1923; Ferris 1942; Tandon 1960; Mathur and Dhadial 1961, 1963; Singh 1981c, 1982, 1983.

Brain.—Satija et al. 1975; Sandhu and Neena 1982.

Eyes.—Schmitt et al. 1982.

Thorax.—Snodgrass 1909; Hlavac 1972.

Metendosternite.—Crowson 1938, 1944.

Wings.—Forbes 1922; Kempers 1923; Marcu 1939; Chen 1940; Seeliger 1943; Jolivet 1957; Suzuki 1969; Wallace and Fox 1975, 1980; Singh 1981a.

Alimentary canal.—Kasap 1978b; Mann and Crowson 1983a.

Ventral nerve cord.—Kasap 1978a; Mann and Crowson 1983b.

Sense organs.—Pouzat 1981.

Tracheal system.—Pajni 1969.

Reproductive systems.—Kannan 1923; Tanner 1927; Zacher 1932; Zia 1936; Mukerji and Bhuya 1937; Mukerji 1949; Mukerji and Chatterjee 1951; Srivastava 1953a,b; De Luca 1959; Pajni 1959; Surtees 1961; Iablokoff-Khnzorian 1966, 1967; Teran 1967; Huignard 1968; Kingsolver 1970a; Arora 1971; Singh 1973; Iablokoff-Khnzorian and Karapetian 1973; Spirina 1974; Ahmed et al. 1976; Leopold 1941; Thukral 1976; Pawar and Verma 1977; Singh 1978a,b; Cassier and Huignard 1979; Singh 1979; Ahmad and Murad 1980a,b; Kasap and Crowson 1980; Kumar and Verma 1980; Monga and Sareen 1980; Hamon et al. 1982; Singh 1982; Crowson 1984; Kasap and Crowson 1985; Kasap and Crowson 1988.

Larval Characters

The destructive feeding period in the Bruchidae occurs during the larval stages, yet bruchid larvae are relatively poorly known and efforts to improve on their identification are in their infancy.

G.S. Pfaffenberger, who has contributed more to the study of bruchid larvae than anyone else in the United States, kindly supplied the following description of larval characteristics.

Bruchid larvae have four instars, the first being significantly different from the others (figures 37 and 38). Body sizes of first instars of various species vary significantly but are characterized by the presence of a sclerotized X or H-shaped prothoracic plate (figure 16) and a sclerotized abdominal spine immediately above the spiracle of the first abdominal segment. These structures are used to gain leverage to penetrate the integument of the seed or pod. Appendages, when present, are highly variable in length and form.

Integument.—Cream colored except pronotum yellowish brown. Chaetotaxy of the first instar may consist of noticeably long or short sensilla, but they are distributed in recognizable patterns.

Head.—Hypognathous and retractable; yellowish brown with mouthparts more darkly pigmented.

Antenna.—With one to three telescopic segments. A single elongate sensillum chaeti-

cum and at least one sensillum basiconicum located distally (Pfaffenberger 1985b).

Clypeolabrum.—Clypeal portion with single sensillum trichodeum near each lateral border, subtended medially by sensillum ampullaceum. Labral portion rounded distally, single or double arc of sensilla trichodea located distally among mat of variable length microtrichia; lateral sensillum trichodeum and medial sensillum ampullaceum located laterally near proximal margin of labrum (Pfaffenberger 1985b: figure 34).

Epipharnyx.—Epipharyngeal groove bordered laterally by one to three pairs of decurved sensilla trichodea.

Mandible.—Monocondylic, with gouge-shaped mesal face.

Maxilla.—Cardo, stipes, palpifer, palpus, and lacinia present. Membranous stipes with variable number of sensilla trichodea. Lacinia with five contiguous, distomedial, spatulate spines. Palpus with dorsal, recessed sensillum placodeum (Pfaffen-berger 1985b: figure 36). Distal end of palpus with variable number (usually greater than 10) of retractible sensilla basiconica.

Labium.—Labial palps absent. Submentum transversely elongate. Base of mentum with lateral pair of sensilla trichodea, mental sclerite with paired islets midway toward distal end. Islets usually with single sensillum trichodeum. Glossa and paraglossa narrowed distally.

Anal cleft.—Transverse in all Bruchinae examined; Y-shaped in other subfamilies.

Pfaffenberger's papers are listed in References. The "Literature Cited" section of one of his papers (Pfaffenberger 1985a) is an excellent source of pertinent works.

Other papers on larval morphology include Kannan 1923; Anderson 1943; Srivastava 1966; Prevett 1971; Vats 1972, 1973, 1974a,b, 1976a,b; Pfaffenberger and Janzen 1984; Hassan et al. 1987. Teran's four papers on Argentine larvae are also listed by Pfaffenberger (1985a).

Materials and Methods

Collecting and Rearing

The common name "seed beetles" for the family Bruchidae is appropriate since the larvae destroy the host seeds by their internal feeding and since the pupal stage in most cases is passed within the feeding cavity. The adult, once it emerges from the seed, probably has nothing to do with the seed until time for the female to deposit her eggs. During this free period before mating and oviposition, the adult may feed on nectar and pollen of whatever plant is in bloom at the time and may even be found on flowers of plants that would not support development of the larvae.

By far the most productive collection method, both in numbers of specimens and in associating the species with its true host, is the collection of fruits containing seeds, or the seeds themselves, and confining them until the adults emerge. This method presupposes some knowledge of potential host plants but is the most likely to build a useful collection. Larvae and pupae can also be associated with the adult stage by carefully opening some of the fruits or seeds and extracting and preserving them while awaiting emergence of the adults from the remaining seeds. Larvae are best preserved by dropping them in simmering hot water for a few minutes to kill the internal body bacteria, then transferring them to 70-percent alcohol for permanent preservation.

Adults may be collected by sweeping flowers, but the usual result is small numbers of specimens. Furthermore, sweep records are unreliable as indicators of the true larval host since adults are ubiquitous in their feeding habits. Some species of bruchids diapause or aestivate in forest duff, birds' nests, or spanish moss, under bark, or in similar habitats. A few species are attracted to light, but collecting at light is usually unprofitable.

Bottimer (1961) advocated the use of pint fruit jars covered with cheesecloth held in place with a screwtop ring for rearing chambers. Johnson (1970, 1990c) essentially recommended the same procedure except that he keeps the jars in a room with controlled temperature and humidity. Pyeomitid mites and small ants can invade containers of seeds and destroy emerging adults. To avoid this, Johnson covers rearing jars with paper towels treated with 1-percent Kelthane in acetone and covers the shelves on which the jars are placed with similarly treated paper (1990c:299).

D. Janzen (personal communication, 1972) places the seeds or seed pods in a small plastic bag from which he exhausts the air, then suspends that bag inside a larger inflated bag. Any bruchid that penetrates the smaller bag has difficulty escaping due to the slippery inner surfaces of the outer bag.

Bottimer (1961) recommended maintenance of a seed collection and an accompanying herbarium for reference. Johnson follows this practice. Keeping green plant parts in a confined situation invites the development of mold. Plant specimens should be dried immediately to avoid this problem, but collections of seeds from which a worker wishes to rear bruchids cannot be subjected to the heat necessary to dry plants.

Preparation of Male Genitalia

Species identification in bruchids often depends on comparisons of characters of the male genitalia. Proper technique in preparing these organs for examination is essential for consistent results. Those parts of the genitalia used in identification are ectodermal in origin, and thus chitinous, and are connected by muscle bands to each other and to the body wall. To see the internal details clearly, this musculature must be dissolved in a potassium hydroxide or sodium hydroxide solution.

The genital complex is invaginated within the abdominal apex and must be removed for treatment in caustic solution. The following procedure will produce consistent preparations:

1. Thoroughly relax the specimen either in a humidity chamber or in hot water or alcohol.
2. Gently lift the pygidium with fine forceps to determine the sex of the specimen. Males have a hoodlike structure, the eighth tergite, lying beneath the pygidium; females do not have this structure.
3. Sever the membranes inside the terminal sternal segment and on the ventral side of the pygidium and remove the entire mass of musculature and fat bodies along with the genital parts, the eighth tergum, and the Y-shaped eighth sternite.
4. Occasionally, depending on the preservation technique, the fat bodies will be hardened and will need to be further softened with alcohol before removal of the genital parts.
5. Immerse the genital complex in a 10- to 15-percent solution of potassium or sodium hydroxide until the muscle fibers are softened and dissolved.
6. Transfer the genitalia to distilled water or 70-percent alcohol and wash thoroughly.
7. With bent forceps, or bent needles, gently press the liquified muscle tissue so that the genitalia are cleared of all debris. A second wash may be necessary to further neutralize the action of the hydroxide.

For temporary observation or for illustration, the parts may be mounted in glycerin on a microscope slide beneath a cover slip. Best results are attained when the median lobe, lateral lobes, eighth sternite, and eighth tergite are separated on the slide. Definitive characters are most often found in the apex and internal sac of the median lobe and in the form of the lateral lobes.

Genital parts can be permanently stored in minute plastic vials partly filled with glyc-

erin and closed with neoprene stoppers. Such vials can be impaled on the pin below the specimen for convenient association.

Measurements

Certain measurements are consistently used in species descriptions for comparison:

Head:

Ocular index: Greatest width across eyes divided by narrowest width between eyes measured on a horizontal plane.

Ocular sinus (emargination of eye): Measured along the axis of the sinus, length of eye divided by the length of the sinus.

Antennal length: Measured with head in normal hypognathous position and antenna fully extended along side of body.

Body length: Measured from anterior margin of pronotum to apex of abdomen. Sexual differences of the abdomen may cause some discrepancies.

Body width: Measured across greatest width of elytra.

Legs: Mucro length measured against length of basitarsus, but measured separately because of angular attitude of basitarsus.

Pecten or denticle length: Measured at right angles to metafemur, then compared with width of tibia at its base.

Resources

The Washington, DC, area was the most logical place to compile this handbook because the most comprehensive bruchid collection in the New World is at the National Museum of Natural History (Smith-sonian Institution). The most extensive library resources, holding many thousands of books and periodicals, are also located in the Washington area: National Agricultural Library, Smithsonian Institution Library, Library of Congress, National Library of Medicine, and several local universities.

Type Collection Abbreviations

The following list includes all of the museums wherein primary type specimens of American bruchid species are deposited. These abbreviations, with the exception of USNM, are from *A Catalog of the Coleoptera of America North of Mexico* (U.S. Department of Agriculture, 1978–97).

BMNH: British Museum (Natural History), London

CASC: California Academy of Sciences, San Francisco

CNCI: Canadian National Collections, Ottawa, ON

FMNH: Field Museum of Natural History, Chicago

ICCM: Carnegie Museum, Pittsburgh

MCZC: Museum of Comparative Zoology, Harvard University, Cambridge, MA

MNHP: Museum National d'Histoire Natural, Paris

NHRS: Naturhistoriska Riksmuseet, Stockholm, Sweden

OSUC: Ohio State University Collections, Columbus, OH

PURC: Purdue University Collections, West Lafayette, IN

UCDC: University of California, Davis, CA

USNM: National Museum of Natural History, Washington, DC

UZMC: University Zoological Museum, Copenhagen, Denmark

ZMUM: Zoological Museum, University of Moscow, Russia

Taxonomy of the Bruchidae of the United States and Canada

The family Bruchidae in the New World is well-developed in numbers of species, and 36 of the 41 genera of Bruchidae are presently considered endemic to the hemisphere (Kingsolver 1990a).

Seven of the 24 genera in the United States and Canada include accidently or deliberately introduced species. These are *Acanthoscelides, Borowiecius, Bruchidius, Bruchus, Callosobruchus, Caryedon,* and *Lithraeus.* Some of the most notorious stored-product pests belong to these genera. All species now found in Hawaii are introduced (appendix I).

The early history of North American bruchidology (late 18th century to early 19th century) was dominated by European taxonomists, and the type specimens for most of the species described during this period are in museums in London, Stockholm, Copenhagen, Moscow, and Paris.

Kingsolver (1990a) outlined the history of New World bruchid taxonomy, dividing it into four broad periods with considerable overlap. These periods illustrate the evolution of the current classification from random descriptions to a reasonable stability and from the generalist describing species in many families to the specialist concentrating in one family or in one genus. The early taxonomists described species in the genera *Bruchus, Caryoborus,* and *Spermophagus.*

Early generalists in the United States include Fall, Horn, LeConte, Say, and Schaeffer. Horn (1873) and Fall (1910) made the first attempts at classification by dividing all of the species then known into species groups. Bridwell (1929c, 1932, 1946) laid the foundation for a world classification of the family, and his work has not basically changed in the intervening years.

Taxonomic activities during the past 60 years have established a reasonably stable classification of North American bruchids. Principal contributors during this period have been L.J. Bottimer, J.C. Bridwell, C.D. Johnson, J.M. Kingsolver, G.S. Pfaffenberger, A.L. Teran, and D.R. Whitehead. The most recent world catalog of species was compiled by S. Udayagiri and S.R. Wadhi (1989). A key to world genera was published by S. Udayagiri and S.R. Wadhi in 1982.

History of the Family Name

The confusion over the correct name for the family Bruchidae originated in the application of the type genus and was partly due to duplication of certain generic names. Recent decisions by the International Commission on Zoological Nomenclature, stimulated by applications submitted by Borowiec, have clarified and stabilized nomenclatural situations not only in the Bruchidae but also in the Meloidae.

A brief history of each of the involved names follows:

Bruchus Linnaeus (1767), with *pisorum* Linnaeus (1767) as type species, is a large valid bruchid genus. At one time, most of the described species were placed in either *Bruchus* or *Spermophagus,* but many more genera have been proposed in the past 50 years, fragmenting these older taxa.

Bruchus Geoffroy 1762 is not available since it was proposed in a work placed on the Official Index of Rejected and Invalid Works in Zoological Nomenclature. *Mylabris* Geoffroy (1762) is not available for the same reason.

Bruchelae was the first validly proposed family group name for the Bruchidae (by Latreille in 1802) based on the species *Bruchus pisorum* (Linnaeus). The form "Bruchidae," with the "-idae" ending, was first used by Stephens in 1829. Pope (1956) was of the opinion that since this usage was the first using this ending, it should be the correct name for the family.

Laria Scopoli 1763 is not available as a bruchid generic name because Bridwell (1932) fixed the type species as *Laria dulcamarae* Scopoli, a species in the Nitidulidae. Bedel (1901) used Lariidae in error for the family name, and several papers subsequently used Lariidae.

Mylabris Müller (1764) validated *Mylabris* Geoffroy (1762), and Bridwell (1932) fixed the type species as *Bruchus pisorum* (Linnaeus), making *Mylabris* Müller synonymous with *Bruchus* Linnaeus. Several authors followed Heyden et al. (1883) in using Mylabridae, based on *Mylabris* Müller, for the seed beetles.

Mylabris Fabricius (1775) is a large valid genus in the Meloidae. To have two large genera in different families with the same name is contrary to the rules, but most workers in the seed beetles rejected Mylabridae and accepted Bruchidae as the correct name, and meloid specialists recognized which specific names belonged to their family. For many years no one moved to petition the Commission to stabilize the names.

Pope (1956) suggested that *Mylabris* Müller be placed on the Official Index of Rejected and Invalid Names but apparently never submitted the application.

Not until 1988 was an official proposal submitted by Borowiec to not only have the names *Mylabris* Müller 1764 and *Bruchus* Müller 1764 suppressed for Principle of Priority and Principle of Homonymy, but also to have the names *Mylabris* Fabricius 1775 and *Bruchus* Linnaeus 1767 conserved by the International Commission, and to have the family name Bruchidae Latreille 1802 (type genus *Bruchus* Linnaeus 1767) and the specific name *pisorum* Linnaeus 1767 (type species of the genus *Bruchus* Linnaeus) conserved. This proposal was approved by the International Commission in Opinion 1809, June 30, 1995 (International Commission on Zoological Nomenclature 1995).

Fossil Bruchidae

The only fossil Bruchidae known from North America were found in Florissant shale and White River fossil beds in the western United States and were described between 1876 and 1917 by S.H. Scudder and H.F. Wickham. At that time, nearly all Bruchidae were placed in either *Bruchus* or *Spermophagus;* however, these two genera have subsequently been restricted to species primarily found in the Old World. The only fossil specimens I have examined so far belong to the type series of six species described by Wickham. These species names were placed in the genus *Oligobruchus* Kingsolver (1965b) with *Bruchus florissantensis* Wickham designated the type species. The remaining species are here left in the original genera until type specimens and other material in the Colorado Museum and Museum of Comparative Zoology can be examined.

The latest dating techniques place both White River and Florissant formations in the Oligocene near the transition to the Eocene period (about 35 million years ago), although the Florissant beds were thought to be Miocene when Wickham described this species.

Oligobruchus belongs to the subfamily Pachymerinae and closely resembles *Pachymerus,* whose geographical range does not now extend north of Costa Rica.

A checklist of U.S. fossil Bruchidae can be found in appendix II.

Key to the Bruchidae of the United States and Canada, Including Hawaii

1. Pronotum flat or slightly convex with at least basal and lateral margins delimited by distinct submarginal sulcus (figure 39); large species with metafemur enlarged, metatibia curved to fit closely to ventral margin of femur (figure 40); antenna serrate; eye shallowly emarginate: Pachymerinae.....2

   Pronotum convex, without submarginal sulcus except on anterolateral margin behind eye, other characters variable 3

2(1) Prosternum flat between procoxal apices (figure 41); elytra uniformly red to black; metatibia lacking lateral carina (figure 40) ..... *Caryobruchus*

   Prosternum short, triangular, acute, not separating apices of procoxae; elytra yellowish brown speckled with dark brown; metatibia with lateral carina (figure 42); Hawaii and Florida..... *Caryedon*

3(1) Metatibia with two apical movable spurs (figures 4, 29, and 43); metacoxal face broader than metafemur (figure 4): Amblycerinae 4

   Metatibia lacking movable apical spurs but may have fixed apical spines or denticles (figure 44); metacoxal face as wide as or narrower than metafemur (figure 44) ..5

4(3) Eye feebly emarginate at antennal socket (figure 1); 10th stria reaching nearly to apex of elytron; prosternum separating coxae at apex (figure 45); metatibia lacking carinae; tibial spurs unequal in length (figure 29) ..... *Amblycerus*

   Eye deeply emarginate (figure 17); 10th stria abbreviated opposite metacoxa; procoxae not separated by prosternum; tibial spurs equal in length (figure 43); metatibia carinate (figure 43)..... *Zabrotes*

5(3) Pygidium and preceding two tergal sclerites fully sclerotized and exposed beyond apices of elytra (figure 51); male antenna strongly pectinate (figure 84), female antenna serrate; mesepimeron not strongly narrowed at ventral end, broadly reaching coxal cavity: Kytorhininae ... . *Kytorhinus*

   Pygidium only sclerotized and exposed beyond elytra (figures 346 and 347); antenna of various shapes; mesepimeron either very narrow between mesepisternum and metepisternum (figure 26) or reduced to triangular sclerite on dorsal margin of mesepisternum (figure 27) ..6

6(5) Lateral pronotal margin with single large tooth projecting horizontally (figure 46); metafemur with tooth or angulation on ventrolateral margin lying outside metatibia when legs are closed (figure 47)..... *Bruchus*

   Lateral pronotal margin without large tooth but may be set with small denticles (figure 48); metafemur with (figure 50) or without external tooth, lobe, angulation, or row of denticles on ventrolateral margin 7

7(6) Ventrolateral margin of metafemur with a lobe, an angulation, a tooth, or a row of denticles (figures 50, 53, and 54) 8

   Ventrolateral margin of metafemur without lobe, angulation, tooth, or row of denticles.....11

8(7) Ventrolateral margin of metafemur with row of denticles (figure 53), ventromesal margin with several denticles; pronotum gibbous; female pygidium with glabrous median spot ..... *Gibbobruchus*

   Ventrolateral margin angulate or strongly lobed (figures 50 and 53), ventromesal margin with single denticle 9

9(8) Lateral pronotal margin with a distinct, arcuate carina. .... *Stator*

   Lateral pronotal margin lacking distinct carina.....10

10(9) Hind legs red, or reddish brown with at most partial darker clouded area, especially along ventral margin of hind femur..... *Callosobruchus*

   Hind legs entirely black except tarsi yellow .... *Borowiecius*

11(7) Tenth elytral stria ending opposite metacoxa (figure 55) (except *M. impiger*); frontal carina sharp; eyes of male enlarged; male antenna pectinate (figure 6), female antenna serrate (figure 7); metafemur not enlarged, ventral face flat between ventral carinae; ventro-mesal carina smooth (figure 56) or serrate (figure 52) ..... *Megacerus*

Tenth stria extending to apical margin; frontal carina various; eyes dimorphic or not; antenna various; metafemur usually moderately or strongly enlarged with ventral face taking varied forms 12

12(11) Front of head with V- or Y-shaped, glabrous boss between dorsal margins of eyes (figure 57); male metafemur with setose pocket on ventral margin (figure 58); mucro short, usually not as long as lateral denticle ..... *Mimosestes*

Front of head otherwise; male metafemur lacking pocket; mucro variable 13

13(12) Fourth stria only abbreviated at base and ending in small denticle (figure 59); metatibia strongly bent at base; mucro minute; pecten of 5–7 minute denticles (figure 729) ..... *Meibomeus*

Fourth stria not abbreviated; with more than one stria denticulate at base, or stria not denticulate; metatibia usually slightly arcuate at base, sometimes with entire tibia arcuate; mucro of variable length 14

14(13) Scutellum 1 1/2 to 2 times as long as wide (figure 60); female pygidium with two deep, polished sulci (figure 61); male genitalia with H-shaped sclerite in armature of internal sac (figure 62) ..... *Algarobius*

Scutellum quadrate or transverse; female pygidium lacking polished sulci; male genitalia lacking H-shaped sclerite 15

15(14) Metafemur with single, sometimes minute, denticle on ventromesal margin (figures 63 and 714), or without denticle or denticles; mucro usually no longer than lateral denticle 16

Metafemur with multiple denticles on ventromesal margin (figure 64); mucro variable in length 21

16(15) Metafemoral denticle triangular, serrate on caudal margin (figure 65); in seeds of malvaceous plants; east of 100th meridian ..... *Althaeus*

Metafemoral denticle usually small, not serrate, or absent; host plants various 17

17(16) Metatibia lacking lateral and ventral carinae (figures 66, 335, and 714); metafemoral denticle absent or extremely minute 18

Metatibia with at least one carina, usually two to four; metafemur with one denticle 19

18(17) Elytral color uniform, without maculae; elytra together as wide as long; body length less than 2 mm; South Texas. In seeds of *Abutilon* ..... *Abutiloneus*

Elytra maculate, longer than wide; body length 2.4 mm; Hawaii ..... *Lithraeus*

19(17) Pronotum moderately or strongly gibbous (figures 67 and 824); southwestern United States ..... *Neltumius*

Pronotum uniformly convex, not gibbous; widely distributed 20

20(19) Body and appendages all black except two basal antennal segments sometimes reddish brown; metafemoral denticle minute, hidden among marginal setae (figures 288 and 294) ..... *Bruchidius*

Body and appendages, in part or wholly, red or reddish orange; metafemoral denticle easily visible, sometimes as long as width of metatibia at its base (figures 864 and 877) ..... *Sennius*

21(15) Head long (figures 68 and 678); width across eyes equal to distance from top of eyes to end of clypeus; 3rd and 4th elytral striae ending in prominent single basal gibbosity (figure 69); pronotum with prominent median and lateral gibbosities; Florida ..... *Caryedes*

Head short (3:1); elytral striae usually ending in basal denticles, sometimes on slight swelling; pronotum not gibbous; widely distributed 22

22(21) Antenna extremely long (figures 13 and 971), that of male extending beyond apices of elytra, that of female extending to 1st or 2nd abdominal segment; mucro slender, curved, one-half as long as basitarsus (figures 70 and 972); 3rd and 4th striae prominently denticulate (figure 968); pecten with three minute, slender denticles (figure 972); eye deeply emarginate (figure 969) .. ***Stylantheus***

Antenna not exceptionally long, never extending beyond middle of elytra; mucro various; striae denticulate or not; pecten variably formed 23

23(22) Elytral striae 3 and 4 denticulate (figure 71 and 72), denticles sometimes on transverse ridge or slight swelling (except *M. major* with denticles on 3 to 6); anal notch of female 5th sternum deep, usually laterally flanged (figure 73); metafemur strongly swollen; tibia strongly arcuate (figure 64); ventral valve of male genitalia broadly rounded or truncate (figures 74 and 761); armature of internal sac usually includes variant of forked sclerite (figures 74 and 761)..... ***Merobruchus***

Denticles of elytral striae various, sometimes absent, never on basal gibbosity; metafemur usually not strongly swollen; tibia various; female 5th sternum not notched or flanged; male genitalia of various forms, seldom with forked sclerite..... ***Acanthoscelides***

Some species of *Merobruchus* resemble certain species of *Acanthoscelides,* and the distinction between the two genera remains nebulous at various points. Unequivocal definitions of these two genera are not possible at this time.

Subfamily Pachymerinae Bridwell 1929c

Tribe Caryedontini Bridwell 1929c

Bridwell (1929c) proposed the tribal name Caryedini (emended to Caryedontini by Decelle 1968) to include only *Caryedon*, but Decelle described four additional African genera in this tribe.

Taxonomy.—Nilsson and Johnson 1993a.

Genus *Caryedon* Schoenherr

Caryedon Schoenherr 1823:1134; Bridwell 1929c:144; Southgate and Pope 1957; Johnson 1966:162; Bottimer 1968c:1043; Cancela da Fonseca 1975:71; Johnson and Kingsolver 1982:409; Singh 1982; Borowiec 1987:48; Udayagiri and Wadhi 1989:233. Type species: *Bruchus serratus* Olivier 1790:199, by monotypy.

Medium-sized bruchids (2.2–6.7 mm long).

Frontal carina prominent; eye facets hemispherical, eye shallowly emarginate (figure 1); antenna serrate (figure 1); pronotum flat, lacking lateral carina; prosternum short, not separating procoxal apices; mesepisternum broader than mesepimeron; metafemur swollen dorsoventrally, pecten with 10–15 denticles (figures 2 and 78); metatibia arcuate, curved to fit ventral margin of tibia (figures 1 and 78).

Caryedon serratus (Olivier)

(Figures 1, 38, 42, 75–78)

Bruchus serratus Olivier 1790:1134; Southgate and Pope 1957:669.

Caryedon serratus: Schoenherr 1823:1134; Decelle 1966:1; Kingsolver 1967:900, 1970c:303; Velez-Angel 1972:71; Kingsolver et al. 1977:114; Johnson 1986:264; Udayagiri and Wadhi 1989:233; Kingsolver 1992a.

Bruchus gonagra Fabricius 1798:159.

Caryoborus gonagra (Fabricius): Swezey 1912:167.

Pachymerus gonager: Chujo 1937a:82.

Caryedon gonagra: Herford 1835:22; Southgate and Pope 1957:669; Davey 1958:385; Cancela da Fonseca 1964:633; Prevett 1965; Donahaye et al. 1966; and many other references.

Pachymerus acaciae: Lepesme 1944:215; Cancela da Fonseca 1956.

Pachymerus longus Pic 1913a:8.

Bruchus fuscus Bedel 1901:341.

Pachymerus sibutensis Pic 1924:42.

Caryoborus gonagra: Gyllenhal 1833:96.

Pachymerus gonagra: Pic 1913a:7.

See Davey (1958) and Decelle (1966) for additional taxonomic combinations. Decelle succinctly summarized the taxonomic history of *Caryedon serratus.*

Color.—Integument reddish brown to piceous; elytra with irregular piceous maculations (figure 75); pygidium mostly dark brown with median line and apex yellow. Pubescence reddish brown to yellow.

Structure.—Body elongate, strongly convex (figures 1 and 75); vertex finely imbricate; frons minutely punctate, sparsely foveolate; frontal carina prominent; ocular index 7.2:1 in males, 6.5:1 in females; ocular sinus shallow, one-eighth length of eye (figure 1); facets of eye coarse, hemispherical; antenna elongate (figure 1), coarsely serrate, male antenna reaching metacoxa, female antenna reaching middle of metepisternum. Pronotum trapezoidal, lateral margins rounded anteriorly, disk slightly convex, without asperities or sulci, surface densely microfoveolate, interspaces punctulate; lateral carina blunt, extending only halfway to apex; cervical sulcus completely encircling anterior foramen; prosternum short, triangular, not separating procoxae at their apices. Scutellum rectangular, flat (figure 75); mesepisternum broader than mesepimeron. Elytra 1.5 times as long as wide, strongly convex; striae subparallel, two and three slightly divergent near base, shallow, punctures elongate, narrow; interstices minutely imbricate; metepimeron with angulate sulcus; metacoxa uniformly

punctulate except glabrous near trochanteral fossa; hind leg (figure 78) swollen dorsoventrally; pecten with 14 small denticles in arcuate row; metatibia strongly arcuate to fit against ventral margin of femur, with one lateral, one mesal, and three ventral carinae (figures 42 and 78); mucro blunt, slightly concave on dorsal face; tibial apex truncate, lacking denticles. Abdomen not modified except male 5th sternum emarginate; pygidium narrow, apically rounded, disk shallowly imbricate, densely setose.

Male genitalia.—As in figures 76 and 77; median lobe apically broadened; ventral valve subtriangular but basal angles rounded, dorsal valve subtriangular, less acute than ventral valve; internal sac with a mass of fine spicules, a pair of stout, hooklike denticles each with an auxiliary denticle near apical orifice, two pairs of slender, hooked sclerites with associated fine spicules at apical two-thirds, and a mass of microspicules and a tubelike valve at apex; lateral lobes broad, caudal faces concave, median cleft shallow.

Size.—Body length 3.5–6.8 mm; width 1.8–3.0 mm.

Type depository.—MNHP.

Type locality.—Senegal.

Distribution.—FL, HI; Mexico, Haiti, Jamaica, Virgin Islands, Dominica, Curaçao, Venezuela; Central Africa, Madagascar, Middle East, Indian Subcontinent, Southeast Asia.

Host plants.—World list: *Acacia farnesiana, A. seyal, A. spirocarpa, A. tortilis; Adenanthera pavonina; Arachis hypogaea; Bauhinia malabarica, B. monandra, B. racemosa, B. reticulata, B. thonningi, B. rufescens, B. tomentosa; Caesalpinia pulcherrima; Cajanus cajan; Cassia afrofistula, C. arereh, C. fistula, C. grandis, C. javanica javanica, C. javanica indo-chinensis, C. sieberiana; Phaseolus vulgaris; Prosopis grandulosa grandulosa, P. pallida; Senna obtusifolia; Tamarindus indica.*

Natural enemies.—World list: *Bracon kirkpatricki, Bracon* sp.; *Entedon* sp.; *Eupelmus swezeyi; Goniozus emigrata; Heterospilus prosopidis; Oedaule stringifrons; Parasierola emigrata; Sclerodermus immigrans; Stenocorse bruchivora; Urosigalphus bruchi; Uscana caryedoni, U. semifumipennis.* See Gagnepain and Rasplus (1989) for African parasitoids.

Immatures.—Prevett 1967a (larva); Arora 1978:45 (larva); Wightman and Southgate 1982 (egg).

Discussion.—This genus comprises a number of African and Asian species that attack seeds of Leguminosae and Combretaceae. *Caryedon serratus* has an artificial tropicopolitan distribution because of its association with *Tamarindus indica.* This bruchid is known from Florida and Hawaii in the United States but is found in Mexico, Colombia, Guyana, and the West Indies (Johnson 1966, 1986; Kingsolver 1970c; Velez Angel 1972; Kingsolver 1992a).

Because of its importance as a storage pest of groundnuts in Africa, various biological aspects of this species have received considerable attention by Old World workers. The following references will serve as a guide to the literature:

Chromosomes.—Yadav 1973; Smith and Brower 1974; Thiara et al. 1988.

Distribution.—Kingsolver 1970c, 1992a.

Egg morphology.—Wightman and Southgate 1982.

Larval digestive system.—Vats 1976b.

Larval malpighian tubules.—Vats 1976a.

Larval morphology.—Prevett 1967a.

Larval tracheal system.—Vats 1972.

Life history.—Lepesme 1944; Donahaye et al. 1966; Cancela da Fonseca 1965; Conway 1983.

Ovaries.—Monga and Sareen 1980.

Physiology.—Garg et al. 1990.

Population dynamics.—Amaro et al. 1958.

Reproduction.—Robert 1985; Boucher and Huignard 1987; Boucher and Pierre 1988.

Reproductive system.—Mukerji and Chatterjee 1951; Mukerji et al. 1957; Southgate and Pope 1957; Prevett 1967b; Arora 1977; Singh 1982.

Spermatheca.—Surtees 1961.

Spermathecal gland.—Thukral 1976.

Taxonomy.—Southgate and Pope 1957; Davey 1958; Prevett 1965; Decelle 1966; Singh and Yadav 1979.

Tribe Pachymerini Bridwell 1929c

Genus *Caryobruchus* Bridwell

Caryobruchus Bridwell 1929c:148; Bridwell 1946:53; Kingsolver 1965b:29; Prevett 1966a:181, 1966b:81; Bottimer 1968c:1037,1039; Johnson and Kingsolver 1982:409; Borowiec 1987:43; Udayagiri and Wadhi 1989:238. Type species: *Dermestes gleditsiae* Linnaeus, by original designation.

Large bruchids (5.0–25.0 mm). One species in the United States.

Head subtriangular, strongly constricted behind eyes, transverse sulcus distinct, eyes coarsely faceted, shallowly emarginate at antennal insertion; antenna serrate from 4th segment, terminal segment elongate-oval. Pronotum quadrate, anterior angles rounded (figure 39); disk flat, coarsely foveolate, submarginal sulcus bounding disk; lateral carina distinct, anterior corner with two or three setose punctures; prosternum narrow, flat, completely separating procoxae (figure 41); protrochantins and mesotrochantins distinct; mesepi-sternum and mesepimeron subequal in width; metafemur dorsoventrally broad (figure 40), ventral margin with 10–12 prepecten denticles, pecten with one long and 9–11 shorter denticles in arcuate row in apical one-half of mesoventral margin, denticles lying mesad to tibia in closed position; metatibia strongly curved fitting closely to ventral margin of metafemur, tibia with three ventral carinae; mucro short, acute, concave on dorsal face; apical spurs absent.

Caryobruchus gleditsiae (Linnaeus)

(Figures 2, 12, 14, 16, 18–23, 25, 28, 39–41, 79–82)

Dermestes gleditsiae Johansson and Linnaeus 1763:9.

Bruchus gleditsiae: Linnaeus 1767:605.

Pachymerus gleditsiae: Pic 1913a:7.

Caryobruchus gleditsiae: Bridwell 1929c:155; Lepesme 1947:572; Blackwelder and Blackwelder 1948:44; Craighead 1950:279; Bottimer 1968c:1038; Woodruff 1968:1; Fonseca 1981:71; Johnson and Kingsolver 1982:409; Borowiec 1987:43; Udayagiri and Wadhi 1989:239; Nilsson and Johnson 1990:50; Johnson et al. 1995:31

Bruchus arthriticus Fabricius 1801:398.

Caryoborus arthriticus: Schoenherr 1833:93; Horn 1873:312; Schwarz 1878:457; Cushman 1911:504–505; Forbes 1922 (wing venation).

Bruchus fuscus Goeze 1777:332.

Caryobruchus arthriticus: Zacher 1952:468.

Color.—Integument piceous, sometimes reddish in teneral specimens. Vestiture gray, short, inconspicuous, without pattern except for scattered, white elytral spots (figure 79).

Structure.—Vertex densely punctulate, frons punctulate with scattered foveae, frontal carina sometimes present (figure 18); clypeus sparsely punctate with scattered umbilicate foveolae; venter of head as in figure 21. Prothorax as in generic description. Scutellum quadrate (figure 79). Elytra longer than wide, convex, striae parallel, except deflected laterally near base, 1st stria curved around scutellum, strial punctures shallow, elongate; interstices moderately convex, minutely punctate-imbricate; mesotrochantins visible; postmesocoxal sulci deep, joined at midline, laterally parallel to pleurosternal suture nearly to margin of antecoxal piece (figures 28

and 80); metepisternal sulcus deep, angulate, bent mesad and extending parallel to pleurosternal suture; metacoxal face minutely punctate, fossula deep, extending to lateral articulation of coxa; 5th abdominal sternum of male broadly emarginate; pygidium subtriangular, apex rounded in male, broadly truncate in female; discal surface with irregular, lunate punctures nearly concealed by vestiture.

Male genitalia.—As in figures 81 and 82; median lobe broad (figure 81), apex ogival, tip acute, not separated into a movable ventral valve, dorsal valve broadly rounded; middle one-third of internal sac lined with minute denticles, armature consisting of a pair of falcate sclerites near base, a pair of elongate, serrate sclerites enclosed in lateral pockets of sac near apex, a pair of elongate, lightly sclerotized lobes between serrate sclerites, and a large, alate, lightly sclerotized, apical structure (transfer apparatus?); lateral lobes (figure 82) fused basally into straplike structure, apices fused into broad, alate lobe briefly cleft on midline, apical margin setose.

Size.—Body length 5.1–10.0 mm; width 3.3–4.8 mm. Body size depends largely on the size of the host seed.

Type depository.—BMNH.

Type locality.—"America septentrionalis."

Distribution.—AR, FL, LA, NC, SC, TX; West Indies, Mexico. Woodruff (1968) mapped collections in Florida.

Host plants.—Sabal etoni, S. mexicana, S. minor, S. palmetto, S. uresana; Serenoa repens; Washingtonia filifera. Woodruff (1968) and Johnson et al. (1995) list palms from which this bruchid has been reared or on whose seeds eggs have been found: *Coccothrinax argentata, C. martii; Livingstona chinensis; Phoenix sylvestris; Sabal yapa, S. parviflora, S. minor, S. glaucescens, S. mauritiaeformis, S. palmetto; Serenoa repens.* Specimens have been collected from *Tillandsia usneoides,* which apparently was being used as a hibernaculum, and in wood rat nests.

Natural enemies.—None recorded.

Immatures.—Cushman 1911 (egg); Pfaffenberger and Johnson 1976 (egg, 1st larval instar); Pfaffenberger 1991:564 (larva).

Discussion.—This is the largest species of Bruchidae in the United States; some individuals reach 10 mm in length. Specimens reared from *Sabal* by Fonseca (1981) in Veracruz, Mexico, are probably this species. The original host was mistakenly identified as *Gleditsia—hence the specific name of the beetle.*

This species has been reported to be capable of jumping considerable distance since the hind legs are greatly enlarged, but this feat does not seem logical since the depressor muscles in the femur are much more greatly developed than the levator muscle, just the opposite of that in a saltatorial leg. Stimulation of the hind leg of live beetles can bring about a grasping and pinching action, possibly a form of defense.

The wing venation (figure 14) was previously illustrated by Forbes (1922).

Subfamily Kytorhininae Bridwell 1932

Kytorrhinae Hoffman 1965:63

Kytorrhininae Luk'yanovich and Ter-Minassian 1957

Genus *Kytorhinus* Fischer von Waldheim

Kytorhinus Fischer von Waldheim 1809:298; Bridwell 1932:101,105, 1946:53; Blackwelder and Blackwelder 1948:45; Brown 1952:342; Bottimer 1961:293, 1968c:1039,1068; Johnson 1968:1269; Decelle 1971:106; Johnson and Kingsolver 1982:411; Borowiec 1987:68; Udayagiri and Wadhi 1989:223. Type species: *Kytorhinus karasini* Fischer von Waldheim 1809:298, by subsequent designation, Crotch 1870:222.

Cytorhinus Agassiz 1846:115. Unnecessary emendation of *Kytorhinus.*

Pygobruchus Sharp 1886b:38. Type species: *Pygobruchus scutellaris* Sharp 1886:38 (=*Kytorhinus sharpianus* Bridwell 1932:106, not *Kytorhinus scutellaris* (Fabricius) 1792), by monotypy.

Kytorrhinus Baudi 1886:10; Luk'yanovich and Ter-Minassian œ1957:181; Teran 1967:307.

Kytorhynus Motschulsky 1874:204.

One species in the United States and Canada. Because this at present is a monotypic genus, the generic and specific diagnoses are combined.

Redescription: Johnson 1976a:50.

Kytorhinus prolixus (Fall)

(Figures 51, 83–86)

Mylabris (Bruchus) prolixus Fall 1926:204.

Kytorhinus prolixus: Bridwell 1932:101, 1946:53; Blackwelder and Blackwelder 1948:45; Brown 1952:342; Bottimer 1961:293, 1968c:1036,1039; Johnson 1968:1269, 1976a:50; Decelle 1971:106; Johnson and Kingsolver 1982:411; Borowiec 1987:68; Udayagiri and Wadhi 1989:223.

Kytorrhinus prolixus: Teran 1967:307 (male genitalia).

Color.—Integument dark brown to black. Vestiture of short, white setae, sometimes with scattered golden brown setae; scutellum white (figure 83).

Structure.—Vertex and frons reticulately punctate, frontal carina evanescent, frontal lobes carrying antennal fossae alate, prominent; eyes more prominent in male than in female; ocular index 8:1 in males, 3.5:1 in females; ocular sinus four-fifths length of eye; male antenna strongly pectinate (figure 84), extending beyond apex of elytron, female antenna serrate, extending to 1st abdominal segment. Pronotum bell-shaped, lateral margins sinuate (figure 83); disk densely, finely imbricate, setae short, recumbent, disk shallowly depressed near posterior corners; lateral carina evanescent in some specimens, absent in others; cervical sulcus deep, extending nearly to meson; prosternum short, triangular, procoxae contiguous. Protrochantin and mesotrochantins present. Scutellum longer than wide, bifid apically; mesepimeron narrow but extending to coxal cavity. Elytra 1.3 times as long as wide, evenly convex, humeri prominent; striae parallel, slightly deflected laterad near base, shallowly impressed, punctures elongate, two to six ending basally in transverse carina; interstices finely imbricate; metacoxal face of females entirely punctate (except fossula), males with mesal one-third glabrous; metafemur slender, unarmed; metatibia slender, mucro a small tooth. Abdomen not especially modified, sterna of male telescoped; 5th and 6th terga (prepygidial) sclerotized (figure 51), similar in texture to pygidium, discal surface finely imbricate.

Male genitalia.—As in figures 85 and 86; median lobe moderately broad; ventral valve triangular, lateral margins incurved, apex acuminate; internal sac armed with

complex of brushes, clusters of spines, a pair of elongate, clavate sclerites, a pair of lateral, hooklike spines articulated to median complex of recurved spines and paired setal brushes; lateral lobes fused, apex expanded, apex with pair of digitate processes.

Size.—Body length 1.9–2.7 mm; width 1.0–1.4 mm.

Type depository.—MCZC, lectotype No. 25059, by Johnson (1976a).

Type locality.—Alaska, McKinley Park Station.

Distribution.—AB, AK, BC, ID, MB, NT, SD, SK, YT.

Host plants.—Hedysarum alpinum americanum, H. boreale (neither plant confirmed as a larval host record).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is the only North American representative of the genus; all other species are Asian.

The combination of characters—two sclerotized, prepygidial terga; strongly pectinate male antenna; prominent eyes in male; uniformly dark brown or black integument; unarmed metafemur; and lack of tibial carinae—easily characterize this species.

Subfamily Amblycerinae Bridwell

This subfamily is worldwide in distribution, and includes the following genera: *Amblycerus* Thunberg, *Zabrotes* Horn, and *Spermophagus* Schoenherr.

Characteristics of the subfamily (modified from Bridwell 1932) are metafemur not strongly swollen, only one-half as broad as metacoxa, channeled and longitudinally and ventrally bicarinate with carinae usually unarmed, never with more than a single blunt denticle; trochantins of fore legs and mid legs visible; metacoxa broad, broader than 1st length of abdominal segment; metatibia straight, not mucronate but with two movable terminal spurs (calcaria) (figure 87); protibia and mesotibia not calcarate; mesepisternum and mesepimeron subequal in width, attaining coxal cavity.

In addition, the dorsal and ventral valves of the male genitalia are separate and movable (figure 30), and the bases of the lateral lobes are fused into a flat, straplike structure (figure 31).

Both *Amblycerus* and *Zabrotes* are restricted to the Western Hemisphere (including the Galapagos Islands) except *Zabrotes subfasciatus* (Boheman), which has become a tropicopolitan tramp spread by commercial shipments of *Phaseolus* bean seeds either for propagation or for food. This species probably originated in Mexico or Central America.

Key to Genera of North American Amblycerinae

1 Emargination of eye shallow, depth less than one-third diameter of eye (figures 109 and 122); metathorax with parasutural sulci on either side of pleurosternal suture; procoxae well separated by intercoxal process (figure 45); metatibia without prominent lateral carinae ..... *Amblycerus*

Emargination of eye deep, one-half or more of diameter of eye (figure 17); parasutural sulci absent; procoxae contiguous or separated by a thin vertical lamella; metatibia with one or more prominent lateral carinae (figure 196)..... *Zabrotes*

The Old World genus *Spermophagus* as now defined is similar in form to *Zabrotes* but can be separated from it by the following: Tenth elytral stria extending nearly to apex of elytron (extending only halfway to apex in *Zabrotes*), eye in repose partly concealed by anterior corner of pronotum (eye free of pronotum), apex of ventral margin of metafemur with short, vertical sulcus (ventral margin entire).

Borowiec (1987:60–63) proposed to divide the Amblycerinae into two tribes: Amblycerini Bridwell to include only *Amblycerus*, and Spermophagini Borowiec to include *Zabrotes* and *Spermophagus*.

Although *Spermophagus* has been included in New World species catalogs, no species in that genus is now known to exist in the Western Hemisphere. See Kingsolver and Borowiec (1988) for discussion.

Tribe Amblycerini Bridwell

Amblycerinae Bridwell 1932:103

Amblycerini: Borowiec 1987:60

Genus ***Amblycerus*** Thunberg

Amblycerus Thunberg 1815:121; Hatton 1895:290; Bridwell 1930:29,1946:53; Blackwelder 1946:762; Bradley 1946:97; Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1012; Johnson 1968:1268; Kingsolver 1970a:471, 1980a:230; Johnson and Kingsolver 1982:410; Borowiec 1987:60; Udayagiri and Wadhi 1989:15; Romero et al. 1996.

Anthotribus Gistel 1856:815.

Spermophagus, of authors.

Small to medium size bruchids (U.S. species 2.6–6.0 mm).

Body subovate, arched in profile (figure 4). Head subtriangular, strongly constricted behind eyes; eyes large, convex, facets coarse; emargination at antennal fossa shallow; frons finely carinate to smooth; antenna strongly serrate from 4th segment (figure 4). Pronotum bell-shaped, trapezoidal, or semicircular, moderately convex, without asperities, with traces of submarginal sulcus on basal margin and anterolateral corners; procoxae distinctly separated by intercoxal process of prosternum. Scutellum distinct, with characteristic shape for many species. Elytra with striae not distorted, 10th stria reaching elytral apex; metasternum and metepisternum with parasutural sulci parallel to pleurosternal suture; metatibia lacking carinae. Pygidium oblique to vertical, disk nearly flat.

Armature of internal sac of median lobe characteristic for each species.

Thunberg included eight species names with his description of *Amblycerus*—three of them new. The remaining five names were cited without author—*nebulosus, robiniae, reticulatus, scabrosus,* and *varius,* but he did not designate a type species. Crotch (1870:227) designated *nebulosus,* attributing the name to "Fabr." Bridwell (1930:29) rejected Crotch's designation on the grounds that *nebulosus* could not be identified with any of the three species available then to Thunberg—*Anthribus nebulosus* Forster (1771), *Bruchus nebulosus* Olivier (1795), or *Macrocephalus nebulosus* Olivier (1795). Bridwell then selected *Bruchus robiniae* Fabricius (1781), to replace *nebulosus* as the type species. Bradley (1946) argued that Crotch's designation was valid and that Bridwell's action was unjustified since the name *robiniae* as Thunberg listed it could have referred to any of three species by that name. Bridwell's concept of *Amblycerus* was further developed in later papers (1932,1946) and was adopted by Bottimer (1968c), Kingsolver (1970b and subsequent papers), and Romero et al. (1996). Other authors (see *A. robiniae* citations) have used the name in Bridwell's concept.

Key to U.S. *Amblycerus*

1. Pronotum and elytra with scattered, black, setiferous foveae (figure 88); integument mostly reddish brown to black; apex of female pygidium trilobed (figure 89). Widespread in U.S.A. ..... ***robiniae*** (Fabricius)

   Pronotum and elytra lacking black foveae; integument red or reddish brown; female pygidium evenly rounded.....2

2. Elytral striae moderately deep, coarsely punctate, interstices uniformly convex (figure 90); pronotum densely punctate; metepisternum with elliptical stridulatory file (figure 91); metafemur with blunt tooth on mesoventral margin. Florida..... ***eustrophoides*** (Schaeffer)

   Elytral striae with fine elongate punctures, sometimes hidden by vestiture (figure 92); metepisternum lacking stridulatory file; metafemur lacking ventral tooth.....3

3. Scutellum short, triangular; pygidium with prominent median line of setae; pronotum and sometimes elytra with stripes of yellowish setae 4

   Scutellum rectangular or elongate; pronotum and elytra lacking stripes.....5

4. Male genitalia with paired prominent, thorn-like sclerites near base of internal sac (figure 101). Florida ..... ***nigromarginatus*** (Motschulsky)

   Male genitalia lacking prominent, thorn-like sclerites but may have small denticles near base of internal sac (figure 106). Texas..... ***obscurus*** (Sharp)

5. Size 2.6–3.7 mm; body uniformly red except eyes black. Known only from Arizona ..... ***vitis*** (Schaeffer)

   Size 4.5 mm or longer; color various 6

6. Scutellum trilobed at apex; elytral vestiture uniformly silvery gray; pygidium with distinct median stripe; body length 4.5–5.0 mm; male genitalia as in figures 98 and 99. Known only from Texas

   ..... ***ireriae*** Romero, Johnson, and Kingsolver

   Scutellum tapered to acute apex; elytral vestiture vaguely mottled; pygidium occasionally with diffuse stripe; body length 6–8 mm; male genitalia as in figures 114–117. In U.S.A. from Florida Keys

   .....***schwarzi*** Kingsolver

Amblycerus eustrophoides (Schaeffer)

(Figures 87, 90, 91, 93, 94)

Spermophagus eustrophoides Schaeffer 1904:228; Schaeffer 1907:293; Pic 1913a:59.

Amblycerus eustrophoides: Bottimer 1968c:1012; Johnson 1968:1268; Kingsolver 1970b:474; Johnson and Kingsolver 1982:410; Udayagiri and Wadhi 1989:9; Kingsolver 1992b; Kingsolver et al. 1993; Romero et al. 1996:48.

Color.—Body and appendages uniformly reddish yellow to dark red with margins of pronotum and scutellum piceous, frons sometimes dark brown. Vestiture of uniformly distributed fine silvery gray hairs, pygidium with narrow median line of hairs.

Structure.—Body fusiform in outline. Vertex and frons evenly convex, densely punctate, frontal carina lacking but some specimens have median impunctate line; ocular index 3:1, ocular sinus about one-fifth length of eye, ocular facets large, spherical; postocular lobe narrow, sparsely fringed; antenna serrate from 4th segment, reaching metacoxa. Pronotum trapezoidal, lateral margins nearly straight, apex truncate, disk evenly convex, densely but irregularly microfoveolate, intervals micropunctate; lateral carina extending to anterior corner, submarginal sulcus extending across midline; prosternum narrow, flat. Scutellum longer than wide, tridentate, slightly constricted on lateral margins. Elytra together 1.3 times as long as wide (figure 90), evenly convex except slightly depressed around scutellum, striae parallel, evenly spaced, deeply impressed, strial punctures deep, evenly spaced, interstices convex, finely punctate; metepisternal sulcus sharply curvate, extending posteriad and bordering a transversely striate, fusiform node (figure 91), the file of an apparent stridulatory organ; metacoxa sparsely microfoveolate in lateral two-thirds, cluster of punctures near trochanteral fossa; metafemur with angulate tooth on ventral margin (figure 87) (scraper for stridulatory organ), metatibia with apical margin diagonal, finely denticulate, lateral tibial spur two-thirds length of basitarsus, ventral spur one-half as long as lateral spur (figure 87). Abdomen unmodified except 5th segment of male broadly emarginate; pygidium convex, foveolate, apex of male rounded, of female subtruncate.

Male genitalia.—As in figures 93 and 94; median lobe moderately broad (figure 93); ventral valve triangular, apex acute, lateral margins incurved, dorsal valve rounded apically; armature of internal sac consisting of paired, acute basal sclerites with finely serrate basal margins, middle of sac with paired, elongate sclerites attached to V-shaped sclerite, apex of sac with elongate, looped closure valve; lateral lobes Y-shaped (figure 94), median cleft rounded.

Size.—Body length 6.0.–6.25 mm; width 3.0–3.5 mm.

Type depository.—USNM, lectotype No. 42284 (by Johnson).

Type locality.—Florida, Lake Worth.

Distribution.—FL; Cuba, Mexico.

Host plants.—Drypetes lateriflora; "huilotillo" (Mexico).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is easily distinguished from the other U.S. species by the combination of uniform coloration, distributional pattern, size, and the presence of the fusiform stridulatory node on the metepisternum. The scraper is a cluster of crescentic, ridgelike tubercles, probably modified setal sockets, on the mesal face of the metafemur. Rotation of the femur positions the femoral tubercles to scrape across the metasternal node.

Amblycerus eustrophoides belongs to a group of Neotropical species, and is the only representative of the group in the United States.

Drypetes lateriflora is a West Indian euphorb shrub found in southern Florida.

Amblycerus ireriae Romero, Johnson, and Kingsolver

(Figures 95–100)

Amblycerus ireriae Romero, Johnson, and Kingsolver 1996:58.

Color.—Body and appendages uniformly dark red, eyes usually black, sometimes silvery in older specimens. Vestiture of recumbent silvery gray setae intermixed with slender golden setae that on elytra are twice as long as gray setae, elytral vestiture arranged in distinct stripes; pronotum and pygidium each with indistinct gray median stripe.

Structure.—Body subfusiform in dorsal aspect, strongly arched in lateral aspect (figure 96). Vertex and frons evenly convex, densely, finely punctate, lacking median carina; ocular index 3:1, ocular sinus about one-fifth length of eye, ocular facets coarse, spherical, postocular lobe very narrow, sparsely fringed; antenna (figure 96) reaching metacoxa with segments 4–10 moderately serrate, eleventh elliptical. Pronotum trapezoidal (figure 95), sides nearly straight in basal two-thirds then strongly arcuate to anterior angle, apical margin broadly emarginate; disk densely foveolate, intervals micropunctate, lateral carina extending from posterior corner to cervical sulcus, cervical sulcus short; prosternum narrow, constricted between procoxae. Scutellum (figure 100) 1.25 times as long as wide, apex evenly rounded. Elytra together slightly longer than wide, broadest behind middle, strongly, evenly convex; striae shallowly impressed, evenly spaced; interstices flat, densely pubescent concealing dense punctation; metepisternal sulcus obtusely curvate, extending posteriad two-thirds length of pleurosternal suture; metacoxal face densely pubescent, moderately densely punctate in lateral four-fifths, glabrous near trochanteral insertion, with dense cluster of punctures; hind leg as in figure 96, lateral spur four-fifths as long as basitarsus (figures 96 and 97), ventral spur nine-sixteenths as long as lateral spur. Abdomen unmodified except posterior margin of 5th ventral segment of male broadly emarginate; pygidium gently convex, slightly more so in male, apical margin truncate, that of male with a deep submarginal puncture.

Male genitalia.—As in figures 98 and 99. Median lobe 3.5 times as long as wide, broadest at base of ventral valve; base of ventral valve broad tapering to acute apex with lateral margins sharply incurved; base of dorsal valve about one-half as wide as ventral valve, apex broadly rounded; armature of internal sac consisting of two small sclerites of varying size near base of dorsal valve, a median flask-shaped sclerite with basal end acute and bent laterad, apical end blunt, paired elongate sclerites bearing dentate ridges (figure 98), sac between elongate sclerites with several small thornlike denticles; apical end of internal sac with U-shaped transfer valve with long filamentous processes, membrane surrounding transfer valve with many minute spicules; lateral lobes (figure 99) with broad emargination between strongly setose lobes.

Size.—Body length 4.3–5.3 mm; width 2.8–3.3 mm.

Type depository.—USNM.

Type locality.—Texas, Pecos Co.

Distribution.—TX.

Host plants.—Unknown.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The arched body form and details of the male genitalia ally this species with *A. vitis* (compare figures 123–124). Only eight specimens of this species have been seen. Nothing is known of its biology or food plant associations.

Amblycerus nigromarginatus (Motschulsky)

(Figures 92, 101–103)

Spermophagus nigromarginatus Motschulsky 1874:249; Pic 1913a:60; Bondar 1936:31.

Amblycerus nigromarginatus: Bridwell 1944:135; Blackwelder 1946:763; Udayagiri and Wadhi 1989:12.

In color and size, this species closely resembles *A. obscurus* (Sharp) but basal sclerites in the male genitalia are thornlike and are much larger than those of *A. obscurus* (compare figures 101 and 106). The only U.S. records of *A. nigromarginatus* are from Florida, but the type specimen is from Surinam. Records are also known from Brazil. See discussion of *Amblycerus obscurus.*

Type depository.—ZMUM.

Type locality.—Surinam.

Distribution.—FL; Surinam, Brazil.

Host plants.—*Senna corymbosa* (Lamk.) Irwin and Barn. (Florida). Other extralimital hosts listed in Romero et al. (1996:68) are *Senna alata, S. bicapsularis bicap-sularis, S. occidentalis, S. splendida, S. uniflora; Caesalpinia* spp.; *Cassia* spp.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The genitalia of males from the Florida collections match precisely those of the type specimen of *Amblycerus nigromarginatus.* Its presence in Florida is likely an introduction and establishment since several collections have been made in the State.

Amblycerus obscurus (Sharp)

(Figures 45, 104–108)

Spermophagus obscurus Sharp 1885:495; Pic 1913a:60.

Amblycerus obscurus: Blackwelder 1946:763; Johnson and Kingsolver 1982:410; Udayagiri and Wadhi 1989:12; Romero et al. 1996:69.

Color.—Body and appendages usually dark red, occasionally piceous; eyes black; pygidium with large, median, piceous maculation divided by stripe of pale setae. Vestiture (figure 104) of yellowish-brown, aciculate setae evenly distributed over body except three indistinct stripes on pronotal disk; elytra faintly striped in some specimens and with three or four evanescent, sinuate brown bands, or rows of brown maculae in apical one-half; pygidium with narrow line of yellowish setae.

Structure.—Body subelliptical, widest at middle of elytra, dorsal outline arcuate in lateral aspect. Vertex and frons convex, mesal margins strongly convergent, sparsely punctulate; frontal carina lacking; eyes laterally convex, facets coarse, individually hemispherical; ocular index 4.3:1; ocular sinus one-fifth length of eye; postocular lobe lacking; antenna with 4th to 10th segments slightly eccentric, apex reaching middle of metepisternum. Pronotum semicircular, middle one-third strongly convex, lateral areas flat; disk densely punctulate on median convexity, lateral punctures intermixed with microfoveolae; lateral carina evident in posterior one-half of margin, evanescent anteriorly; cervical sulcus fine, nearly hidden by vestiture; hypomeron deeply concave; prosternum Y-shaped, narrowed to a vertical lamella between procoxae; mesosternum tongue-shaped. Scutellum (figure 105) slightly longer than wide, moderately attenuated, truncate and channeled apically. Elytra together 1.4 times as long as wide, moderately convex, suture elevated, 3rd interstice slightly elevated, striae parallel, deep, nearly hidden by vestiture; interstices convex, densely setose, minutely imbricate-punctate; metepisternal sulcus right-angled; postmesocoxal sulci continuous across midline, extending along pleurosternal suture. Metacoxal face with lateral three-fifths and posterior margin densely setose, fossula with thin line of setae, mesal area around trochanteral fossa densely punctate; lateral tibial spur six-tenths as long as basitarsus, ventral spur one-half length of lateral spur.

Fifth sternum of male slightly emarginate, apex of 8th tergite visible in emargination; pygidium finely punctate, punctures concealed by vestiture.

Male genitalia.—As in figures 106–108; median lobe moderately broad (figure 106); base of ventral valve broad, lateral margins sinuate to long, acute apex; armature of internal sac consisting of two small, thornlike, basal spines, two spiny pads, a cluster of fine spines in middle, two flat, sinuate blades, and small, slightly hooked sclerite between their bases; closure valve U-shaped with long posterior arms; lateral lobes short (figures 107 and 108), broad, shallowly cleft. The two small basal spines of the sac may be minute and difficult to see.

Size.—Body length 4.7–6.0 mm; width 2.7–3.5 mm.

Type depository.—BMNH.

Type locality.—Mexico, Belize, Guatemala, Panama (lectotype not selected).

Distribution.—TX (new U.S. record); Mexico south to Costa Rica and Panama.

Host plants.—No host records are known from the United States. Other records, mostly from Mexico: *Senna alata, S. bicapsularis bicapsularis, S. hirsuta leptocarpa, S. obtusifolia, S. pendula advena, S. pendula ovalifolia, S. uniflora.* These names may be found in the older literature under the generic name *Cassia.*

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The geographic range of *Amblycerus obscurus* extends from Texas to Costa Rica and probably to Panama if the record from the original description proves to be *A. obscurus.*

Sclerites of the internal sac exhibit some variation in size and form but external characters appear to be uniform. Some specimens have two basal, thornlike sclerites, whereas these may be entirely lacking in others or may be present as small slender denticles, sometimes only on one side. The middle sclerites vary as illustrated in shape and sinuation.

This species is closely related to *A. nigromarginatus* (Motschulsky) described from Surinam, recorded from Brazil, and apparently introduced into Florida. Further studies with adequate material from Mexico, Central America, and northern South America may confirm suspicions that the names *A. obscurus* and *A. nigromarginatus* apply to one variable species.

These two species as a group are related to another group of two South American species—*A. hoffmanseggi* (Gyllenhal) and *A. submaculatus* (Pic) (Ribeiro 1989).

Amblycerus robiniae (Fabricius)

(Figures 3, 4, 29–34, 88, 89, 109–112)

Bruchus robiniae Fabricius 1781:75; Fabricius 1787:41, 1792: 70; Linnaeus 1788:1734; Gmelin 1790:1781; Olivier 1790:198, 1795:7; Fabricius 1801:397; Dejean 1821:78.

Spermophagus robiniae: Gyllenhal 1833:104; Dejean 1833:233; Schoenherr 1833:104; Melsheimer 1853:99; Gemminger and Harold 1873:3218; Horn 1873:312; Riley and Howard 1892c:166; Wickham 1895b; Britton 1897; Blatchley 1910:1235; Cushman 1911:504; Pierce 1912:74; Pic 1913a:61; Leng 1920:306; Zacher 1952:468,472.

Amblycerus robiniae: Thunberg 1815:106,109,121; Bridwell 1930:29, 1932:106; Bissell 1938:536; Bradley 1946:97; Bridwell 1946:56; Craighead 1950:279; Dillon and Dillon 1961:734; Bottimer 1968c:1012; Kirk 1969:99; Kingsolver 1970a:371,377, 1970b:476; Mathwig 1971:1, 1972:200; Baker 1972:137; Gibson 1972:99; Kingsolver 1975b:35; De Luca 1977:8; Kingsolver 1979a:341; Pfaffenberger 1979:231; Johnson and Kingsolver 1982:410; White 1983:306; Pfaffenberger 1985a:2; Borowiec 1987:60; Udayagiri and Wadhi 1989:14; Romero et al. 1996:81.

Spermophagus hoffmannseggi [sic]: Boeving 1927:139; Brimley 1938; Kirk 1969:99; Wallace and Fox 1980 (wing).

Chrysomela gleditsiae Castiglioni 1790:253; Kingsolver 1979a:341.

Spermophagus hoffmanseggi or *hoffmannseggi*, of authors

Color.—Body and appendages dark red; pronotum, elytra, pygidium, metasternum, and abdomen with scattered, setiferous black spots (figure 109); metasternum with some diffusion of black; eyes black. Vestiture of golden aciculate hairs and white slender hairs; pronotum with predominantly white hairs, some with golden sheen, pair of white hair patches one-third the distance from apex; elytra with fine, golden hairs in setal punctures, rows of white hairs in striae, interstices mostly golden but with scattered clusters of white; pygidium clothed as on pronotum; ventral areas of body evenly white except abdomen tessellated.

Structure.—Body elliptical, moderately arcuate in lateral aspect (figure 4). Vertex and frons finely, densely, evenly punctate with a few slightly larger punctures, densely setose; frontal carina prominent in some specimens, in others evident only as an impunctate line; eye facets coarse; ocular index 4:1; ocular sinus one-fifth as long as eye (figure 109); postocular lobe crescentic, densely setose; antenna (figure 4) elongate, serrate, apex reaching anterior margin of metacoxa. Pronotum nearly semicircular (figure 109), basal lobe emarginate, disk moderately convex, slightly sulcate in basal one-half, surface densely foveolate, each foveola with single seta; interspaces finely imbricate; lateral carina prominent extending from posterior corner to near anterior margin then bending sharply dorsad; cervical sulcus nearly hidden by vestiture; prosternum Y-shaped, narrowly constricted between coxae then expanded slightly behind coxae; mesosternum tonguelike, slightly channeled, adjoining bulbous anterior lobe of metasternum; scutellum elongate-triangular (figure 109), slightly carinate, and cuspidate apically. Elytra together one and one-third times as long as wide, gently convex except slightly depressed in scutellar area; striae composed of lines of shallow punctures in deep sulci; interstices slightly convex, sutural interstice slightly elevated apically, each black macula with transverse setal base; wing venation as in figure 110; metepi-sternum with angulate sulcus extending for short distance along sternopleural suture; postmesocoxal sulcus not contiguous across midline, extending along sternopleural suture to margin of metacoxa; metacoxa sparsely foveolate, punctulate, and setose in distal four-fifths; fossula and proximal one-fifth glabrous, cluster of punctures near trochanteral insertion; hind leg as in figure 29, femur carinate on mesal and lateral ventral margins, channeled between carinae; metatibia slightly dilated, lacking carinae; lateral spur seven-tenths as long as basitarsus, ventral spur one-half as long as lateral spur. Abdominal sterna not modified except posterior margin of 5th slightly emarginate; pygidium slightly convex in both sexes, posterior margin of pygidium evenly rounded in male, trilobed in female (figure 89).

Male genitalia.—As in figures 3, 30–34, 111, and 112; median lobe moderately broad, constricted in middle; base of ventral valve broad with sides rounded and margins sinuate to acute apex; dorsal valve short, broad, arcuate; armature of internal sac consisting of a U-shaped sclerite near base, a pair of triangular plates in middle, and a pair of small, spatulate blades at apex, closure valve complex; lateral lobes with apices truncate, concave on mesal faces, median cleft broadly V-shaped.

Structure.—Body length 3.8–7.3 mm; width 2.2–4.1 mm.

Type depository.—UZMC.

Type locality.—"Americae seminibus."

Distribution.—AB, AL, AR, CA, DC, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, MI, MO, MS, NJ, NC, ND, NH, NM, NY, OH, OK, OR, PA, SC, SD, TN, TX, VA, WI, WV.

Host plants.—*Gleditsia triacanthos* (honey locust), *G. aquatica* (water locust); *Robinia pseudoacacia* (probably misidentification of host). *Acacia farnesiana* is a questionable record. *Tillandsia usneoides* is a hibernaculum record.

Natural enemies.—*Bracon* sp.; *Heterospilus bruchi, H. prosopidis, H. spermophagi; Urosigalphus bruchi, U. neobruchi; Eurytoma* sp., *E. tylodermatis; Eupelmus cyaniceps; Horismenus missouriensis.*

Immatures.—Patton 1895 (larva); Wickham 1895a (larva); Boeving 1927:143 (mouthparts); Pfaffenberger 1979:231 (first and final larval instars).

Discussion.—This species is one of the most common bruchids in the eastern half of the United States, generally following the distribution of *Gleditsia triacanthos,* its principal host plant. Records from New Mexico, California, and the Pacific Northwest are undoubtedly introductions through infested seed stocks. Mathwig (1971, 1972) investigated the biology of *A. robiniae* in Kansas.

The black spots on the pronotum, elytra, and other parts of the body are characteristic of a group of three species, the other two being found in Mexico and Cuba.

Amblycerus schwarzi Kingsolver

(Figures 113–120)

Amblycerus schwarzi Kingsolver 1970b:477; Udayagiri and Wadhi 1989:14; Kingsolver 1992b:78, 1996:24; Romero et al. 1996:86; Alvarez Marin and Kingsolver 1997:216; Genaro and Kingsolver, 1997:229.

Color.—Body and appendages uniformly dark red; eyes black, sometimes silvery; vestiture of fine yellowish gray setae evenly distributed over body except slightly mottled on elytra, sometimes with rounded brown subapical elytral spots, abdominal pleura with similar brown spots; pygidium with slightly denser median line of setae.

Structure.—Body subfusiform in outline. Vertex and frons convex, frons triangular, lacking median carina, eyes subglobular, coarsely facetted; ocular index 8:1; ocular sinus about one-fifth length of eye, postocular lobe absent; antenna (figure 120) subserrate in segments 4–10, 11th elongate-subelliptical, antennal apex reaching metacoxa. Pronotum quadrilateral (figure 113), margins nearly straight in basal three-fourths, sharply arcuate at anterior corner, basal margin bisinuate; disk evenly convex, densely foveolate, lateral carina arcuate in lateral view, ending dorsad of anterior coxa, not joined with submarginal sulcus, the latter extending dorsad nearly to midline; prosternum narrow, apex slightly expanded. Scutellum (figure 118) lingulate, slightly constricted medially, tapered to blunt apex. Elytra together 1.5 times as long as wide, broadest one-third from base, transversely convex, slightly depressed around scutellum, striae parallel, lightly impressed, strial punctures discrete, interstices finely punctate or imbricate; metepisternal sulcus obtusely angulate, extending one-half distance to metacoxa; metacoxal face moderately densely pubescent and sparsely punctate in lateral four-fifths, glabrous medially with dense cluster of punctures; lateral tibial spur one-half length of basitarsus (figure 119), ventral spur one-half as long as lateral spur. Abdomen unmodified, sexes similar in outline of terminal margin of pygidium and 5th sternum.

Male genitalia.—As in figures 114-117. Median lobe slender; ventral valve elongate-acute; dorsal valve rounded apically; armature of internal sac consisting of two burr-like sclerites, a large, elongate, comma-shaped median sclerite split basally, two rows of small denticles, two small hooks, and a pair of fragile, arcuate clusters of minute spicules; lateral lobes (figures 116 and 117) fused along midline, apices massive, hollow-faced.

Size.—Body length 4.7–5.7 mm; width 2.7–3.5 mm.

Type depository.—USNM Type #69943.

Type Locality.—Cuba, Las Villas Prov., Cuyamas.

Distribution.—FL; Bahamas, Cuba, Dominican Republic, Grand Cayman, Curaçao, Jamaica, Puerto Rico, Virgin Is.

Host plants.—USA: *Hippomane mancinella;* West Indies: *Guettarda* sp.; *Hippomane mancinella; Tectona grandis; Terminalia catappa; Ricinis communis.*

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—*Amblycerus schwarzi* is widely distributed in the Caribbean area and affects a variety of host plant families. *Hippomane* and *Ricinis* are in the Euphorbiaceae, *Guettarda* is in the Rubiaceae, *Tectona* is in the Verbeneaceae, and *Terminalia* is in the Combretaceae. Another species of *Amblycerus* in Mexico and Central America, *A. spondiae* Kingsolver, is also associated with hosts in four different plant families (Kingsolver 1980a:241).

Amblycerus schwarzi is related to *A. dispar* (Sharp) whose distribution extends from Mexico to Chile.

Amblycerus vitis (Schaeffer)

(Figures 121–124)

Spermophagus vitis Schaeffer 1907:293; Cushman 1911:505; Pic 1913a:63; Leng 1920:306; Essig 1958:487.

Amblycerus vitis: Bottimer 1968c:1012, 1012,1038; Johnson 1968:1268; Johnson and Kingsolver 1975:321; Center and Johnson 1976:201; Johnson and Kingsolver 1982:411; Udayagiri and Wadhi 1989:17; Romero et al. 1996:102.

Color.—Body and appendages uniformly reddish brown except eyes black. Vestiture yellow, uniformly distributed over body.

Structure.—Subovate in outline (figure 121). Vertex and frons densely punctulate with scattered larger punctures; frontal carina usually lacking, sometimes with short, impunctate ridge; eyes coarsely faceted; ocular index 2.5:1; ocular sinus shallow; postocular lobe lacking; antenna (figure 122) moderately serrate, apex reaching middle of metacoxa. Pronotum trapezoidal (figure 121), lateral margins arcuate anteriorly, disk convex, densely, uniformly microfoveolate; lateral carina arcuate, extending from posterior corner to near anterior border then bending sharply dorsad delimited by cervical sulcus and extending nearly to dorsal midline; prosternum Y-shaped, constricted between procoxae, slightly expanded behind coxae. Metasternum narrowly rounded. Postmesocoxal sulci extending across midline, laterally paralleling sternopleural suture nearly to metacoxal margin; metepisternal sulcus obtusely angulate, extending halfway along pleurosternal suture. Scutellum tridentate. Elytra together one and one-fourth times as long as wide, evenly convex; striae parallel, evenly spaced, deep, narrow; interstices flat, finely imbricate. Metacoxal face sparsely foveolate, interspaces minutely imbricate, dense patch of fine punctures near trochanteral fossa; hind leg as in figure 122, femur channeled ventrally between carinae; metatibial apex diagonal, finely denticulate, lateral spur three-eighths as long as basitarsus (figure 122), ventral spur two-thirds as long as lateral spur. Abdomen normal, male 5th sternum broadly emarginate, female 5th sternum evenly rounded; pygidium in both sexes finely punctate, sculpture concealed by vestiture.

Male genitalia.—As in figures 123 and 124; median lobe constricted in middle; base of ventral valve broad, lateral margins sinuate to elongated, acute apex; dorsal valve subelliptical; armature of internal sac consisting of large, thornlike median sclerite set in transverse band of fine spicules, and on each side a curved, denticulate sclerite with concave face; apex of sac with U-shaped closure valve with long slender posterior arms; lateral lobes (figure 124) broadly Y-shaped, densely setose.

Size.—Body length 2.6–3.7 mm: width 1.6–2.5 mm.

Type depository.—USNM, lectotype No. 42337 (by Johnson).

Type locality.—Arizona, Huachuca Mountains.

Distribution.—AZ.

Host plants.—*Vitis arizonica* Englem.

Natural enemies.—*Urosigalphus* sp.

Immatures.—Not described.

Discussion.—This species is known only from Arizona and Texas and is the smallest species of *Amblycerus* in the United States. It lacks the piceous elytral spots of *A. robiniae,* the metepisternal stridulatory node of *A. eustrophoides,* and differs by its tridenticulate scutellum and uniform pygidial vestiture from the triangular scutellum and faintly striped pronotum and elytra of *A. obscurus* and *A. nigro-marginatus.* It is probably most closely related to *A. ireriae* as evidenced by details of the male genitalia and by body form.

Johnson and Kingsolver (1975) detailed the biology of this species.

Essig (1929a) gave the common name "wild grape seed weevil" to *A. vitis.*

Tribe Spermophagini Borowiec

Spermophagini Borowiec 1987:62

Genus *Zabrotes* Horn

Zabrotes Horn 1885b:156; Leng 1920:306; Bridwell 1932:106, 1946:53,56; Blackwelder 1946:763; Bottimer 1968c:1021; Kingsolver 1970b:469; Johnson and Kingsolver 1982:411; Borowiec 1987:62; Udayagiri and Wadhi 1989:31. Type species: *Zabrotes cruciger* Horn 1885b, by subsequent designation, Zacher 1930.

Most species are small—1.0–2.5 mm—but one species reaches 3.7 mm in length. Species of *Zabrotes* vary little in many of their morphological structures. The following characteristics appear to be fairly constant in the species found in the United States.

Integument of body and appendages black except basal one or two segments of antenna usually red or reddish brown; tibial spurs dark red. Vestitural pattern relatively constant for each species, occasionally dimorphic.

Vertex and frons usually finely punctate, sometimes with mixed larger punctures, frontal carina usually prominent; ocular index 3:1 to 5:1; ocular sinus three-fourths to seven-eighths length of eye (figures 17 and 127); postocular lobe narrow, separated from gena by short sulcus; antenna elongated, narrow, laterally compressed, segments 4 to 10 subtriangular, terminal segment elongate-parallel (figures 125–126). Anterior margin of pronotum semicircular, apex sometimes truncate, base broadly angulate, basal margin gently arcuate from midline to posterior angles, disk evenly convex except basal lobe sometimes marked by short, diagonal sulci delimiting slight median dome; lateral surfaces of disk sparsely foveolate (except *Z. amplissimus*), intervals between foveolae finely punctate, median one-third usually finely punctate; lateral carina sharp, anterior end hooked toward foramen; hypo-meron deeply concave to receive fore legs in repose; prosternum short, triangular, but seldom visible because of reflexed position of head; mesosternum rounded or carinate, sometimes protruding above level of metasternum; mesepisternum and mesepimeron subequal in width; post-mesocoxal sulcus extending across metasternum. Scutellum narrowly triangular, densely pubescent. Elytra together slightly wider than long, nearly flat in middle two-thirds, convex laterally; striae regular in course, usually narrow; strial punctation varying from broad and shallow to deep and narrow, each puncture or foveola with seta emerging from beneath its anterior rim; interstices sparsely punctate (except densely foveolate in *Z. amplissimus*). Metacoxal face reniform, broader than metafemur, sparsely foveolate and densely pubescent in lateral one-half (except *Z. amplissimus*), median one-half to one-third either with cluster of about 20 fine punctures (figure 129), or polished and impunctate with deep pit adjacent to insertion of trochanter (figure 130); hind leg as in figure 128; metafemur

with ventrolateral carina gently sinuate to subacute apex, ventromesal carina more strongly sinuate to rounded apex; metatibia straight, ventrolateral, ventral, and ventromesal carina each with row of short, stiff setae, dorsolateral face with row of setiferous punctures; lateral spur shorter than mesal spur; terminal margin of tibia oblique, finely denticulate; basitarsus with two ventral, parallel, setose carinae.

Abdomen with sterna telescoped, 5th sternum of male deeply emarginate for apex of pygidium; pygidium broader than long in both sexes, convex with apex more strongly reflexed in male, disk microfoveolate.

Lateral lobes of male genitalia fused basally, straplike, expanded apically.

Characters that constitute the basis for specific differentiation are found in the color pattern of the pronotum, elytra,

Key to United States species of *Zabrotes*

1 Medial one-half of metacoxal face with cluster of coarse punctures near trochanteral insertion (figure 129). Section I: Punctate metacoxae.....2

Medial one-half of metacoxal face smooth and polished; some species with deep pit surrounding trochanteral condyle (figure 130). Section II: Smooth metacoxae 10

2(1) Dorsal color nearly uniformly gray except apex of elytra brown.....3

Dorsum of different color combination 4

3(2) 3rd and 5th elytral interstices striped in basal one-fourth (figure 186); male genitalia as in figures 188 and 189 ..... *stephani* Kingsolver

Interstices not striped, uniformly gray (figure 177); male genitalia as in figures 179 and 180 *planifrons* Horn

4(2) Pronotum, elytra and pygidium with strongly contrasting white maculae on dark brown or golden brown background; males with sutural stripe on pronotum and elytra (figures 151 and 181).....5

Coloration otherwise 7

5(4) Body length 1.3 to 1.6 mm; golden brown grading to dark brown vestiture with white pattern; male genitalia as in figures 153 and 184.....6

Body length 2.1–2.9 mm; vestiture dark brown with strongly contrasting white pattern (figure 151); male genitalia as in figures 153 and 154 ..... *cruciger* Horn

6(5) Male genitalia as in figures 157 and 158; lateral margin of pronotum with diffuse white patch . *cynthiae* Kingsolver

Male genitalia as in figures 184 and 185; lateral margins of pronotum with sharply defined white patch ..... *spectabilis* Horn

7(4) Elytra mostly yellowish orange with white maculae; male pronotum white with orange stripes, elytra with white sutural stripe, pygidium white; female pronotum orange with lateral and basal spots white, pygidium orange with white median stripe (figure 144) ... *chandleri* Kingsolver

Coloration otherwise.....8

8(7) Pronotum and elytra reddish brown or mixed gray and brown; lateral surfaces of abdominal sternites brown mottled; pygidium with indistinct median and lateral gray stripes sometimes connected by transverse band (figure 148) ..... *chavesi* Kingsolver

Pronotum and elytra brown or gray; abdominal sternites uniformly gray; pygidium with or without median stripe .9

9(8) Pygidium usually with gray median stripe (figure 209); male genitalia as in figures 210 and 211; Texas and Mexico ..... *victoriensis* Kingsolver

pygidium, and ventral areas of the metathorax and abdomen; punctation of the pronotum, elytral striae and interstices, metacoxal face, and pygidium; shape of the antenna and mesosternal apex; and form of median and lateral lobes of male genitalia.

This genus is found naturally only in the Western Hemisphere from the United States to Brazil. Host plant associations are known for only a few species but those known are with leguminous seeds.

Revision: Kingsolver 1990b (U.S. species).

Pygidium usually unicolorous (figure 134), occasionally with narrow evanescent median line; male genitalia as in figures 135 and 136; eastern United States ... ***arenarius*** (Wolcott)

10(1) Vestiture of pronotum and elytra either uniformly gray or white sometimes intermixed with reddish brown or with vaguely defined median band extending from border to border on elytra 11

Elytra with distinct maculae of different color from background (figure 191) or with mottled pattern (figure 190) 13

11(10) Body length 3.6 mm; pronotum, elytra, and pygidium finely, densely foveolate (figures 131 and 132); pygidium with small, white, subbasal spot either side of midline ..... ***amplissimus*** Kingsolver

Body length less than 3 mm; if foveolae present, not evenly distributed; pygidium lacking white spots 12

12(11) Elytra with vaguely defined, gray median band, remainder of elytra uniformly gray or gray intermixed with reddish brown setae (figure 137); Texas ..... ***bexarensis*** Kingsolver

Elytra lacking band, vestiture uniform (figure 200); eastern United States ..... ***subnitens*** Horn

13(10) Metasternum with elongate, pubescent sulcus on midline (figure 195); male with mottled elytral pattern (figure 190), pygidium uniformly clothed, or with indistinct median stripe (figure 192); female with transverse, white, curved elytral maculae (figure 191), pygidial pattern variable (figures 193 and 194) 14

Metasternum convex or flat, with only a median suture 15

14(13) Median lobe of male genitalia with armature of internal sac as in figure 198; internal armature of female bursa (arrow) as in figure 207 ..... ***subfasciatus*** (Boheman)

Median lobe of male genitalia as in figure 204; internal armature of female bursa (arrow) as in figure 206 ..... ***sylvestris*** Romero and Johnson

15(13) Male genitalia with flask-shaped median sclerite and small "stopper" sclerite (figures 161 and 174) 15

Genitalic armature differently shaped (figures 165 and 170) 16

16(15) Body length 2.0–2.5 mm; male genitalia as in figures 174 and 175; female 8th sternite as in figure 176; Texas and Arizona ..... ***obliteratus*** Horn

Body length 1.6 mm; male genitalia as in figures 161 and 162; southern California ..... ***densus*** Horn

17(15) Body length 1.7 mm; male genitalia as in figures 170 and 171; northern California ..... ***humboldtae*** Kingsolver

Body length 2.2 mm; male genitalia as in figures 165 and 166; female 8th sternite as in figure 167; Arizona ..... ***eldenensis*** Kingsolver

Zabrotes amplissimus Kingsolver

(Figures 131, 132)

Zabrotes amplissimus Kingsolver 1990b:152.

Color.—Vestiture white, uniformly distributed over entire body except pair of condensed spots near base of pygidium.

Structure.—Punctation of vertex and frons nearly concealed by vestiture, frontal carina fine but distinct; transverse sulcus at upper level of eyes; ocular index 3:1, eyes angular on lateral margin, ocular sinus five-sixths length of eye; antenna slender (female), reaching middle of metacoxa. Pronotum (figure 131) nearly semicircular but lateral margins subparallel near basal angles; disk convex, slightly domed in middle, surface evenly microfoveolate, foveolae mostly discrete; lateral carina arcuate. Mesosternum flat. Elytra together slightly wider than long; arcuately convex; densely microfoveolate as on pronotum, striae traceable only in center of disk, evanescent on lateral areas. Pygidium microfoveolate with slightly larger foveolae than on elytra. Metacoxa with lateral one-half densely foveolate, medial one-half smooth and polished. Metepisternum and lateral areas of abdominal sterna microfoveolate (figure 132).

Male genitalia. —Not described. (Only one female specimen is available.)

Size.—Body length 3.7 mm; width 2.7 mm.

Type depository.—USNM.

Type locality.—New Mexico, near Grants.

Distribution.—NM.

Host plants.—*Phaseolus metcalfi* (now *P. ritensis*).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species and a yet undescribed species from Mexico are the largest known species of *Zabrotes.* The distinctive foveolate elytra and pygidium and large size easily separate them from any other described species. Description of the genitalia must be delayed until additional collections that include males have been made. The genitalia of the undes-cribed Mexican sister species places it near *Z. subnitens.*

Zabrotes arenarius (Wolcott)

(Figures 133–136)

Bruchus arenarius Wolcott 1912:162; Pic 1913a:162.

Mylabris arenarius: Leng 1920:305.

Megacerus arenarius: Bradley 1947:37.

Zabrotes arenarius: Bottimer 1956:67, 1968c:1013,1038; Johnson 1968:1271; Johnson and Kingsolver 1982:411; Kingsolver 1990b:141.

Color.—Vestiture evenly distributed of uniformly gray to mixed gray and dark brown, occasionally with white patch on basal lobe of pronotum, and a marginal maculation on each elytron (figure 133).

Structure.—Antenna not dimorphic, reaching middle of metacoxa; head densely punctulate, frontal carina prominent. Pronotum subtrapezoidal, apex truncate, lateral margins arcuate, base broadly angulate; disk sparsely microfoveolate, foveolae shallow, inconspicuous; lateral carina prominent. Scutellum narrowly triangular. Elytra together as long as wide, slightly depressed medially in basal one-half, striae shallow, inconspicuous, strial punctures approximate; interstices flat, finely, densely punctate-imbricate. Metacoxal face sparsely, shallowly foveolate in lateral one-half, medial one-half with cluster of punctures. Abdomen not modified (figure 134) except the usual reflexed male pygidium.

Male genitalia.—As in figures 135 and 136; median lobe slightly constricted in middle; ventral valve subtriangular; dorsal valve with slender, ligulate process and strongly recurved apicolateral margins; internal sac with pair of ovate sclerites at apical orifice, folds of internal sac densely setose; middle of sac with pair of reniform sclerites; apicolateral sac lobes spinose; lateral lobes as in figure 136.

Size.—Body length 1.5–2.1 mm; width 1.2–1.4 mm.

Type depository.—FMNH, holotype No. 234.

Type locality.—Illinois, Havana, Devil's Hole.

Distribution.—AL, DC, FL, GA, IL, IN, MD, NJ, NC, OK, SC, TX, VA.

Host plants.—Swept from *Cassia fasci-culata* Michx. flowers at Havana, but the larval host is not known. Bridwell collected it on strawberry flowers in Maryland.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The male genitalia are nearly identical to those of *Z. spectabilis;* however, the color pattern is uniformly gray or brown with or without faint elytral maculae but lacking the bold pattern of *Z. spectabilis.* Specimens from Havana are uniformly brown or gray, whereas the elytra from other localities are usually maculate. *Zabrotes stephani* is also gray but with some faint striping on the elytra and with a distinctively different male genitalia (figures 188 and 189).

Zabrotes bexarensis Kingsolver

(Figures 137–141)

*Zabrote*s sp. 1, Johnson 1979a:124.

Zabrotes bexarensis Kingsolver 1990b:153.

Color.—Vestiture of head white, sparsely distributed; pronotum uniformly white to white intermixed with brown, sometimes patchy; elytra (figure 137) ranges from uniformly white to white intermixed with brown to brown with white maculation, maculation usually vaguely defined; pygidium (figure 138) uniformly white or white with evanescent median stripe or gray with brown lateral patches; ventral surfaces uniformly white.

Structure.—Frontal carina ridgelike; ocular index 6:1; ocular sinus three-fourths length of eye; antennae dimorphic (figure 139), that of male reaching beyond apices of elytra, that of female to 1st abdominal segment; 1st and sometimes 2nd segment dark red; pronotum truncate apically, disk minutely punctate with scattered micro-foveolae; elytra with striae narrow, strial punctures deep, elongate, interstices minutely punctate; apex of mesosternum flat, truncate; metacoxal face with 15–20 shallow foveae in lateral one-half, medial one-half impunctate with deep pit near insertion of trochanter; metasternum slightly depressed in posterior one-half, vestiture extending obliquely from median sulcus, pygidium minutely punctate and foveate, foveae slightly larger than on pronotum.

Male genitalia.—As in figures 140 and 141; apical one-third of median lobe slightly expanded; ventral valve evenly arcuate; dorsal valve ogival with apex produced; internal sac with pair of flat, lightly sclerotized plates at apical orifice; middle of sac with about 25 spicules and an ovate structure enclosing pair of sinuate spines; apex of sac abbreviated; lateral lobes strongly expanded, apical margin with row of flattened setae (figure 141).

Size.—Body length 1.6–1.9; width 1.1–1.5 mm.

Type depository.—CNCI.

Type locality.—Texas, Bexar Co.

Host plants.—Vicia sp. and *Vicia leavenworthii* Torr. and Gray.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Although this species has the smooth metacoxal face, it seems to be isolated from the others in this group. The broad, ogival ventral valve, the cluster of slender spines and paired aciculate spines in the middle of the sac, and the alate lateral lobes with flattened setae are unlike any other *Zabrotes* species.

The evanescent elytral pattern, long male antennae, and the uniformly clothed pygidium with a faint median line are additional salient characters for this species.

Zabrotes chandleri Kingsolver

(Figures 142–146)

Zabrotes chandleri Kingsolver 1990b:142.

Color.—Basal antennal segment red or reddish brown. Vestiture of orange and white setae in dimorphic pattern; males with head, pronotum, pygidium and ventral areas white, elytra orange with median transverse bars and sutural stripe white (figure 142), pronotum sometimes with vague orange spots on middle of disk; females with head white, pronotum orange with white spot on basal lobe and lateral margins, elytra orange, each elytron with elliptical, transverse spot (figure 143), pygidium orange with white median stripe expanded at apex, venter white except coxa, a lateral spot on 1st abdominal sternum and at apex of 5th segment orange.

Structure.—Vertex and frons minutely punctate, clypeus more coarsely punctate, frontal carina prominent; ocular index 5:1; ocular sinus four-fifths length of eye; antenna slightly dimorphic, that of male reaching 1st abdominal segment, that of female reaching metacoxa. Pronotum semicircular, disk convex, slightly domed, minutely punctate with larger punctures in lateral areas and along base; lateral carina gently arcuate. Scutellum triangular, densely pubescent; mesosternum projecting, carinate. Elytra slightly wider than long, disk nearly flat; striae nearly concealed by vestiture; interstices flat, punctulate. Pygidium 1.4 times as wide as long (figure 144), convex, apex in male strongly reflexed into 5th sternum. Metacoxal face with lateral four-fifths densely punctulate and 30–35 shallow foveolae, median one-fifth smooth, polished, with cluster of coarse punctures set in slight depression.

Male genitalia.—As in figures 145 and 146; median lobe broad, apex broadly ovate; ventral valve arcuate; dorsal valve ogival, apex moderately produced; internal sac with prominent folds; middle of sac with pair of large, L-shaped spines attached to semicircular structure; apicolateral sac lobes lined with fine spicules; lateral lobes slightly expanded, apices rounded (figure 146).

Size.—Body length 2.4–2.5 mm; width 1.7–1.8 mm.

Type depository.—UCDC.

Type locality.—California, 3 mi north of Big Pine.

Distribution.—CA.

Host plants.—Not known.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The orange and white vestitural pattern is immediately recognizable. This pattern and the form of the male genitalia place this species near *Zabrotes cruciger* and *Z. spectabilis.* The species is not known outside California.

Zabrotes chavesi Kingsolver

(Figures 147–150)

Zabrotes chavesi Kingsolver 1980a:229; Janzen 1980:949; Johnson and Kingsolver 1982:411; Romero and Johnson 1997:74.

Zabrotes vandykei Kingsolver 1990b:150; Romero and Johnson 1997:74.

Color.—Basal antennal segment and metatibial calcaria dark red. Vestiture of brown, gray, and reddish-brown slender setae (figure 147); head uniformly gray; pronotum with mixed brown and gray, lateral areas paler; elytra with mixed brown and gray setae, usually with pale transverse band, darker apically; pygidium (figure 148) with reddish-brown basal band, remainder mixed gray and brown with reddish-brown patches; ventral side of body mostly gray with reddish-brown patches along dorsal margin of abdominal segments, coxa reddish brown.

Structure.—Vertex and frons punctulate, frontal carina evanescent; ocular index 4.5:1; ocular sinus seven-eighths length of eye; antenna not dimorphic, reaching posterior margin of metacoxa. Pronotum

semicircular, moderately convex, slightly domed in middle one-third; disk punctulate on dome, more coarsely punctate on lateral surface of disk; lateral carina not arched. Mesosternum flat. Elytra together slightly wider than long; striae deep, evident in basal one-half, nearly hidden by vestiture apically, strial punctures contained within striae; interstices densely punctulate. Metacoxa shallowly foveolate in lateral one-half, lateral margin densely setose, medial one-half with cluster of about 30 punctures set in depression near trochanteral insertion. Pygidium 1.3 times as wide as long; disk shallowly foveolate, interspaces about the diameter of one foveola.

Male genitalia.—As in figures 149 and 150; median lobe suddenly expanded in apical one-fifth; ventral valve triangular; dorsal valve with elongate beaklike process, apicolateral margins evenly arcuate; internal sac with pair of small sclerites near apical orifice, pair of triangular sclerites in middle; apex of sac lined with fine denticles; lateral lobes as in figure 150.

Size.—Body length 1.6–2.2 mm; width 1.3–1.6 mm.

Type depository.—USNM *(chavesi);* CASC *(vandykei).*

Type locality.—Costa Rica, Guanacaste Prov., Santa Rosa National Park (*chavesi);* U.S.A., Arizona, 6 mi north of Chiricahua National Monument *(vandykei).*

Distribution.—AZ; Mexico to Venezuela (Romero and Johnson 1997).

Host plants.—*Senna hirsuta leptocarpa* (Benth.) Irwin and Barn. in AZ to Costa Rica; *Senna spectabilis* DC. in Venezuela.

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—This species closely resembles *Zabrotes stephani* and *Z. victoriensis,* but the lateral abdominal areas are mostly brown in *Z. chavesi,* contrasted with mostly gray in the other two species.

Romero and Johnson (1997) recognized that the description of *Z. chavesi* from Costa Rica was identical to the description of *Z. vandykei* from Arizona, and comparison of the type specimens confirmed the synonymy. Locality records from Arizona, Mexico, Honduras, Nicaragua, El Salvador, Costa Rica, and Venezuela indicate an extensive and probably continuous distrbution.

Zabrotes cruciger Horn

(Figures 151–154)

Zabrotes cruciger Horn 1885b:157; Leng 1920:306; Bottimer 1968c:1013,1038; Johnson 1968:1271; Johnson and Kingsolver 1982:411; Kingsolver 1990b:143.

Spermophagus cruciger: Pic 1913a:59.

Zabrotes cruciatus: Kingsolver 1990b:143 (misspelling).

Color.—Basal segment of antenna and tibial spurs dark brown. Vestitural pattern dimorphic: In male, pronotum dark brown dorsally with lateral patches and median stripe white, elytra with sutural stripe and lateral, oblique maculae white; in female median and sutural stripes lacking, otherwise as in male (figure 151); vestiture white ventrally except coxal face in both sexes and lateral patch on 1st abdominal segment brown; pygidium white with large, dark brown patches either side of midline (figure 152).

Structure.—Frontal carina prominent; ocular index 5:1; ocular sinus four-fifths length of eye; antenna reaching posterior margin of metacoxa. Pronotum semicircular apically, broadly angulate basally, evenly convex, basal lobe marked by short, lateral sulci; surface sparsely foveolate, foveolae elliptical, each with seta emerging from its anterior rim; intervals finely punctate; lateral carina sharp; mesosternum carinate, protruding above level of metasternum. Scutellum triangular, densely pubescent. Elytra together as long as wide, nearly flat in middle two-thirds, convex laterally; striae regular in course, consisting

of large, elliptical foveolae, each with seta emerging from beneath its anterior rim, interstices sparsely punctate. Metacoxal face sparsely foveolate in lateral two-thirds, intervals finely punctate, median one-third with cluster of deep punctures near insertion of trochanter.

Male genitalia.—As in figures 153 and 154; median lobe strongly expanded apically; ventral valve subtriangular; dorsal valve with short process; internal sac with small, paired sclerites leading to thickened median folds; apex of sac with pair of tapered, sinuate sclerites in oval, saclike structure; apicolateral sac lobes each with patch of minute denticles; lateral lobes as in figure 154.

Size.—Body length 2.1–2.9 mm; width 1.5–2.1 mm.

Type depository.—MCZC, holotype No. 3899.

Type locality.—"Colorado."

Distribution.—AR, CO, NM, OK, TX.

Host plants.—Not known.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This large, handsome species could hardly be confused with any other *Zabrotes* except *Z. spectabilis.* The bold, sexually dimorphic color pattern of the dorsal surface is similar to that of *Z. spectabilis* and *Z. chandleri,* wherein the sutural and pronotal stripes distinguish the male, and their absence, the female.

Zabrotes cynthiae Kingsolver

(Figures 155–158)

Zabrotes cynthiae Kingsolver 1990b:144.

Color.—Vestiture mostly golden brown dorsally, head sparsely white, pronotum with white median stripe from base to, or nearly to, apex, lateral margins sometimes with diffuse white patches; elytra with white sutural stripe, each elytron with oblique, elongate white bar (figure 155); pygidium variable, usually brown with white median stripe (figure 156) but some specimens nearly uniformly white with scattered golden setae, female usually darker brown than male; venter of body mostly white with golden brown on metacoxae and brown patch on lateral areas of abdomen, especially on 5th sternum; legs white. First antennal segment red, remaining segments black.

Structure.—Frontal carina prominent; ocular index 4:1; ocular sinus three-fourths length of eye; male antenna slightly broader and longer than that of female, the male's reaching pygidial margin, the female's reaching metacoxa. Pronotum punctulate with scattered foveolae; pronotal disk semicircular with apex subtruncate; lateral carina normal for genus. Scutellum minute, broadly triangular. Elytra together slightly wider than long; striae shallowly foveolate, interstices densely punctulate. Lateral two-thirds of metacoxal face extremely finely punctulate and sparsely pubescent, median one-third smooth except for depressed cluster of about 30 punctures near trochanteral insertion.

Male genitalia.—As in figures 157 and 158; median lobe broadly expanded at apex; ventral valve broadly triangular, lateral margins slightly sinuate; dorsal valve with ligulate median process, apicolateral margins evenly arcuate similar to those of *Z. spectabilis* except shoulders of dorsal valve rounded, not recurved (compare figures 157 and 184); internal sac with prominent folds near apical orifice; middle of sac with pair of small, triangular sclerites; apicolateral sac lobes each with patch of fine denticles; lateral lobes as in figure 158.

Size.—Body length 1.7–1.9 mm; width 1.1–1.3 mm.

Type depository.—USNM.

Type locality.—California, San Bernadino Co., Providence Mountains.

Distribution.—CA.

Host plants.—Swept from *Asclepias* sp., *Cupressus macnabiana, Eremocarpus* sp.,

Lotus sp., and *Quercus* sp., but with no rearing records.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Four species found in California—*Zabrotes cynthiae, Z. densus, Z. humboldtae,* and *Z. spectabilis*—are similar in size and color pattern and can easily be confused with one another. Two of the species—*Z. densus* and *Z. humboldtae*—are in the group with smooth metacoxae, whereas the remaining two are in the punctate coxa group. Differentiation of *Z. cynthiae* and *Z. spectabilis* can be made by examination of male genitalia (figures 157 and 184); the apical margin of the dorsal valve is evenly arcuate in *Z. cynthiae* but recurved in *Z. spectabilis.* The pronotal lateral margin of *Z. spectabilis* carries a lunate white mark (figure 181), but the margin of *Z. cynthiae* is without markings (figure 155).

Zabrotes densus Horn

(Figures 159–162)

Zabrotes densus Horn 1885b:158; Leng 1920:306; Bottimer 1968c:1013,1038; Johnson 1968:1271; Johnson and Kingsolver 1982:411; Kingsolver 1990b:154.

Spermophagus densus: Pic 1913a:59.

Color.—Vestiture dark brown usually with faint grayish or light brown striping on elytra (figure 159), some specimens with a gray bar on each elytron; head brown; pronotum gray on basal lobe, sometimes with faint mottling on disk; pygidium (figure 160) mostly brown, basal band and median stripe gray; venter of body gray except coxal face and sometimes lateral abdominal spot brown.

Structure.—Vertex and frons punctulate, frontal carina prominent; ocular index 3:1; ocular sinus three-fourths length of eye; antenna reaching 1st abdominal segment in both sexes. Pronotum semicircular but with apex truncated; disk convex, slightly domed medially, punctulate with sparsely placed foveolae; lateral carina arcuate. Scutellum small, equilaterally triangular. Elytra together slightly wider than long; striae not impressed, strial punctures elongate, interstices punctulate. Pygidium 1.25 times as wide as long, convex, densely but uniformly foveolate. Metacoxal face sparsely setose, sparsely foveolate in lateral one-half, smooth, impunctate in median one-half.

Male genitalia.—As in figures 161 and 162; median lobe moderately slender, margins subparallel; ventral valve ovate; dorsal valve nearly evenly rounded; armature of internal sac consisting of flask-shaped sclerite with small, ovoid sclerite (stopper) at small end, base of sclerite enclosing cluster of fine spicules; lateral lobes as in figure 162.

Size.—Body length 1.1–1.7 mm; width 0.9–1.3 mm.

Type depository.— MCZC, holotype No. 3003

Type locality.—"California."

Distribution.—AZ, CA, OR.

Host plants.—None recorded.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species closely resembles *Z. cynthiae* Kingsolver. The smooth coxal face and male genitalia (figure 161), however, ally it with *Z. obliteratus* although the elytral and pygidial patterns are not as contrasting as in that species. *Zabrotes humboldtae* is similar in appearance to *Z. densus* and *Z. cynthiae,* but the male genitalia are of a different type nearly identical to those of *Z. spectabilis.* The three species—*Z. cynthiae, Z. densus,* and *Z. humboldtae*—are found almost entirely within California.

Zabrotes eldenensis Kingsolver

(Figures 163–167)

Zabrotes eldenae: Kingsolver 1990b:139 (misspelling).

Zabrotes eldenensis Kingsolver 1990b:155.

Color.—Vestitural color of both sexes similar to that of female *Z. subfasciatus;* males with broad white spot on basal lobe of pronotum (figure 163), females with median white stripe; elytral maculation a solid bar, not composed of short stripes, the remainder of elytra uniformly dark brown except some males have short, basal stripe on 5th interstice, females occasionally have narrow, white median stripe; pygidium (figure 164) of each sex dark brown with white basal band and narrow median stripe; only 1st antennal segment dark red.

Structure.—Metasternum flat or slightly depressed, not sulcate. Female 8th sternite with broad basal process (figure 167).

Male genitalia.—As in figures 165 and 166; ventral valve of median lobe broad, lateral margins subparallel, spicules around central sclerite smaller than in *Z. subfasciatus;* dorsal valve with broad, rounded process; apical margin of each lateral lobe slightly emarginate (figure 166).

Size.—Body length 2.3–2.5 mm; width 1.5–1.9 mm.

Type depository.—USNM.

Type locality.—Arizona, Coconino Co., Flagstaff.

Distribution.—AZ.

Host plants.—None recorded.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Females of this species can easily be mistaken for *Zabrotes subfas-ciatus* unless the metasternum is examined, but males are easily differentiated by the color pattern of the pygidium. In both sexes of *Z. subfasciatus,* the metasternum is longitudinally sulcate and clothed with conspicuous yellowish-gray setae, whereas the metasternum of *Z. eldenensis* is convex or slightly depressed and is uniformly clothed; 1st and 2nd antennal segments are dark red in *Z. subfasciatus,* but only the 1st segment is red in *Z. eldenensis.* Separation of this species from the partly sympatric *Z. obliteratus* is more difficult without resorting to examination of the male genitalia and the 8th sternite of the female genitalia. Sufficient variation exists in associated females that—unless the elytra and pygidium are contrastingly black with white markings with no brown streaks to differentiate *Z. eldenensis*—identification of the female's species is problematical without examining the genitalia. In males, the genitalia are clearly diagnostic (compare figures 165 and 174). The broad ventral valve and arched sac sclerite of *Z. eldenensis* contrasts with the narrow ventral valve and lageniform sclerite of *Z. obliteratus.*

Zabrotes humboldtae Kingsolver

(Figures 168–171)

Zabrotes humboldtae Kingsolver 1990b:156.

Color.—Dorsal vestiture predominantly dark brown except median stripe of pronotum and of pygidium white (figure 168), elytra with white lateral maculae, pygidium (figure 169) with median stripe and basal band white; venter predominantly white but with dark brown patches on metacoxal face and lateral angle of 1st abdominal sternum; head and legs white.

Structure.—Vertex micropunctate, punctures more elongate on frons, frontal carina prominent; antenna not dimorphic, reaching middle of metacoxa. Pronotum semicircular but with apex truncate; disk micropunctate with coarser punctures toward lateral margins, disk evenly convex. Scutellum triangular. Elytral striae narrow, distinct in basal two-thirds changing to faint lines of punctures apically; interstices sparsely punctate. Metacoxal face sparsely, shallowly foveolate in lateral two-thirds, impunctate medially; metatibia lacking dorsolateral row of fine punctures. 5th abdominal sternum nearly divided by pygidial notch; pygidium sparsely microfoveolate.

Male genitalia.—As in figures 170 and 171; median lobe only slightly expanded in apical one-fourth; ventral valve subtri-

angular with apex narrowly rounded; dorsal valve with median, ligulate process, apicolateral margins strongly recurved; internal sac with pair of small sclerites near apical orifice leading to thickened folds in basal one-half of sac; middle of sac with pair of small, sickle-shaped sclerites; apicolateral sac lobes densely, finely denticulate; lateral lobes apically expanded (figure 171). The genitalia are nearly identical to those of *Zabrotes spectabilis.*

Size.—Body length 1.3 mm; width 1.0 mm. All specimens seen are of uniform size.

Type depository.—USNM.

Type locality.—California, Humboldt Co., Bair's Ranch, Redwood Creek.

Distribution.—CA.

Host plants.—None recorded.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The combination of the smooth metacoxal face and *Zabrotes spectabilis*-type male genitalia is puzzling since other species with this configuration of male genitalia have a puncture cluster on the metacoxa. Likewise, those species with smooth metacoxa have the genital form of *Z. obliteratus* (figure 175), *Z. subfasciatus* (figure 198), or *Z. bexarensis* (figure 140).

Zabrotes obliteratus Horn

(Figures 172–176)

Zabrotes obliteratus Horn 1885a:158; Leng 1920:306; Bottimer 1968c:1013; Johnson 1968:1271; Johnson and Kingsolver 1982:411; Kingsolver 1990b:157.

Spermophagus obliteratus: Pic 913a:60.

Color.—Basal two segments of antenna reddish brown. Vestiture of pronotum usually dark brown with light brown patches and streaks, median stripe and posterior corners white (figure 172); elytra dark brown to black with indistinct light brown stripes, each elytron with a lateral, white, sinuate band fading to light brown marginal patch; pygidium (figure 173) with basal band of white or white mixed with light brown connected to narrow median white stripe, remainder of pygidium uniformly light brown in males but dark brown to black in females; head and ventral areas gray except metacoxal face and row of vague, brown patches along lateral margins of abdomen.

Structure.—Frontal carina sharp but hidden by vestiture. Antenna reaching 1st abdominal segment. Pronotum nearly semicircular, not truncated apically, disk evenly convex, basal lobe slightly depressed, surface of disk sparsely micro-foveolate, interspaces finely punctate; mesosternal apex broad, truncate in both sexes. Elytral striae narrow, nearly hidden by vestiture, set with recumbent, curved setae; 1st stria deflected laterad near scutellum; interstices flat, punctate; metacoxal face with shallow, lunate foveolae in lateral two-thirds, medial one-third nearly impunctate but with deep pit adjacent to trochanteral insertion; pygidia of both sexes convex, male more strongly reflexed apically.

Male genitalia.—As in figures 174 and 175; median lobe with lateral margins subparallel; ventral valve broadly triangular; dorsal valve rounded, lacking ligulate process; internal sac with pair of thickened strands extending from apical orifice; middle of sac with flask-shaped sclerite and "stopper" sclerite similar to that of *Z. densus* (figure 161); apex of sac abbreviated; lateral lobes strongly expanded as in figure 175.

Female 8th sternite as in figure 176.

Size.—Body length 1.9–2.5 mm; width 1.5–1.7 mm.

Type depository.—MCZC, holotype No. 3901.

Type locality.—"Arizona."

Distribution.—AZ, TX; Mexico.

Host plants.—*Rhynchosia* sp.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—See also the discussion of *Zabrotes eldenensis. Z. obliteratus* could easily be confused with *Z. subfasciatus* but for the distinctive deep metasternal sulcus of the latter species and the male genitalia. The female 8th sternite is slender and slightly expanded at the tip of the strut (figure 176). The dimorphic pygidium in *Z. obliteratus* serves to separate the sexes, but the degree of dimorphism is not as striking as in *Z. subfasciatus.* The disjunct distribution (Kerrville, TX, and southern Arizona) probably is an artifact of random collecting.

Zabrotes planifrons Horn

(Figures 177–180)

Zabrotes planifrons Horn 1885b:158; Leng 1920:306; Bottimer 1968c:1013,1038; Johnson 1968:1271; Johnson and Kingsolver 1982:411; Kingsolver 1990b:146.

Spermophagus planifrons: Pic 1913a:61.

Color.—Vestiture mostly gray but with intermixed reddish-brown setae, especially along lateral margins of elytra, occasionally on pronotum; apex of each elytron with large patch of reddish-brown setae (figure 177); pygidium with basal band of intermixed gray and reddish brown (figure 178); scutellum white. Antennal segments one and two dark red. Vestiture on pronotal disk directed toward midline.

Structure.—Vertex densely micropunctate, punctures becoming slightly coarser on frons; frontal carina feeble or evanescent; ocular index 4.5:1; ocular sinus seven-eighths length of eye; antenna not sexually dimorphic, reaching posterior margin of metacoxa. Pronotum semicircular, not truncate apically, disk uniformly micropunctate, lateral areas microfoveolate, basal lobe slightly swollen. Scutellum triangular. Elytra wider than long, lateral margins arcuate; striae shallow, well-marked basally, evanescent in apical one-half, strial punctures elongate; interstices with single or double row of shallow punctures; apical one-half of elytra confusedly punctate. Metacoxa with scattered, shallow foveolae in lateral one-half, cluster of 30–40 fine punctures near trochantin. Abdomen with male 5th sternum deeply emarginate; pygidium micropunctate, sparsely microfoveolate.

Male genitalia.—As in figures 179 and 180; median lobe relatively short, broad; ventral valve rounded apically, lateral margins slightly sinuate; dorsal valve triangular; internal sac abbreviated, sparsely lined with fine spicules and two pairs of small, median sclerites; lateral lobes fused into ligulate median process with lateral, alate processes (figure 180).

Size.—Body length 1.3–1.5 mm; width 0.8–1.1 mm.

Type depository.—MCZC, lectotype No. 3904 (by Johnson 1968).

Type locality.—Arizona.

Distribution.—AZ, NM; Mexico.

Host plants.—*Cassia leptadenia* Greenm. (Johnson 1979a) (now *Chamaecrista nictitans mensalis*).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is usually easily separated by its small size, uniformly gray appearance except for a large brown spot at the apex of each elytron, the cluster of punctures on the metacoxal face, and the distinctive male genitalia (figure 179) with a broad, rounded ventral valve, massive apical frame around the base of the valve, and fused lateral lobes with alate lateral appendages (figure 180). It is generally similar to *Zabrotes stephani*, n.sp., in external appearance. These two species form a subgroup in which the metasternum is flat, the metacoxa is punctate, and the male genitalia are reasonably similar.

Zabrotes spectabilis Horn

(Figures 129, 181–185)

Zabrotes spectabilis Horn 1885b:157; Pic 1913a:62; Leng 1920:306; Bottimer

1968c:1013,1038; Johnson 1967:1271, 1979a:124; Johnson and Kingsolver 1982:411; Kingsolver 1990b:147.

Spermophagus spectabilis: Pic 1913a:62.

Color.—Basal antennal segment red; basic vestitural color varying from gray to golden brown to dark brown; head gray in both sexes; white maculations as follows: male pronotum with median white stripe (figure 181), lateral margin with white spot; each elytron with lateral white maculation and white sutural stripe, male pygidium (figure 183) with white basal band and median stripe; female pronotum with basal and marginal spots white, lacking sutural stripe (figure 182); elytra without sutural stripe; female lacking basal band but median stripe narrower than for male; venter of male gray except brown on metacoxal face, female with brown coxal spot and variable patch along lateral margin of abdomen.

Structure.—Frontal carina fine, short; ocular index 5:1; ocular sinus seven-eighths length of eye; antenna not dimorphic, reaching posterior margin of metacoxa. Pronotal margins semicircular but truncated apically, punctation concealed by vestiture; lateral carina slightly arcuate. Mesosternal apex carinate. Elytra slightly wider than long; striae nearly concealed by vestiture, strial punctures coarse, shallow, striae discrete basally but becoming confused apically, interstices finely punctate; metacoxal face finely punctate (figure 129) except area around medial cluster of punctures, lateral one-third of face shallowly foveolate; pygidium foveolate, sculpture nearly hidden by vestiture.

Male genitalia.—As in figures 184 and 185; apical one-fourth of median lobe expanded; ventral valve broadly triangular, apex narrowly rounded, lateral margins sinuate; dorsal valve with ligulate median process, apicolateral margins strongly recurved; internal sac with prominent folds; middle of sac with pair of small, lunate sclerites attached to ovate structure; apicolateral sac lobes lined with fine spicules; lateral lobes as in figure 185.

Size.—Body length 0.7–1.6 mm; width 0.5–0.9 mm.

Type depository.—MCZC, lectotype No. 3000 (by Johnson 1968).

Type locality.—Nevada (lectotype).

Distribution.—AZ, CA, NM, NV, OR, UT, TX.

Host plants.—Five species have been cited for this bruchid: *Senna roemeriana; S. durangensis durangensis; S. lindheim-eriana* from Big Bend National Park, TX; *Senna bauhinioides;* and *Senna covesii* from Arizona. Plant names have been updated following Irwin and Barneby (1982). Records from *Astragalus, Acacia, Condalia,* and *Stanleya* cited in Kingsolver (1990b) are probably incidental and will need confirmation by rearing procedures.

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—The pattern of the dark brown form is similar to that of *Zabrotes cruciger,* but the size and different armature in the lobes of the internal sac (compare figures 153 and 184) clearly separate them. In California, the golden brown forms could be confused with more distinctly marked forms of *Z. cynthiae,* but in the latter species, the sexes are not dimorphically marked, the pronotum lacks the marginal white patches, and the shoulders of the dorsal valve are not recurved. Two similar California species, *Z. densus* and *Z. humboldtae,* can easily be separated from *Z. spectabilis* by their smooth metacoxae.

Zabrotes stephani Kingsolver

(Figures 186–189)

Zabrotes stephani Kingsolver 1990b:149.

Color.—Vestiture on head sparse, very fine; pronotum and elytra with mixed brown and gray fine setae, elytron often with faint brown macula behind humerus and at middle of lateral margin (figure 186); interstices, especially the 5th, faintly striped with gray in basal one-half, pygidium gray

with denser median line to mixed brown and gray with gray median line (figure 187). Venter of body gray.

Structure.—As usual for genus; ocular index 6:1; ocular sinus three-fourths length of eye; antenna not dimorphic, reaching posterior margin of metacoxa; frontal carina prominent; apex of pronotum not truncated. Elytral striae lightly impressed, strial punctures elongate. Metacoxa with cluster of about 30 punctures set in smooth medial one-half of metacoxal face, lateral one-half punctulate and sparsely foveolate.

Male genitalia.—As in figures 188 and 189; median lobe narrowed then suddenly expanded at apex; ventral valve shield-shaped; dorsal valve ligulate with lateral margins incurved; internal sac abbreviated, prominently folded near apical orifice; middle of sac with slender sclerite in oval membranous structure; apicolateral sac lobes each with small cluster of spicules; lateral lobes broadly expanded, apical margin emarginate (figure 189).

Size.—Body length 1.4–1.7 mm; width 0.9–1.3 mm.

Type depository.—USNM.

Type locality.—Oklahoma, Latimer Co.

Distribution.—OK.

Host plants.—Unknown.

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—This species most closely resembles *Zabrotes chavesi* and *Z. planifrons* in the form of the male genitalia, flat mesosternum, and punctate metacoxa. All three species have a fairly uniform vestiture with muted pattern—vestiture is gray in *Z. planifrons* but with the elytral apices brown, the elytra of *Z. stephani* are usually gray with some faint basal stripes, and those of *Z. chavesi* are brown with yellowish-gray lateral maculae. The male genitalia, although similarly constructed for the three species, are distinctive.

Zabrotes subfasciatus (Boheman)

(Figures 17, 43, 125–128, 130, 190–199, 207)

Spermophagus subfasciatus Boheman 1833:111; Pic 1913a:62.

Zabrotes subfasciatus: Zacher 1930:236; Harper 1966:93; Bottimer 1968c:1013; Kingsolver 1970b:487; Howe 1973:572; Pfaffenberger and Johnson 1976:42; Kingsolver 1990b:158.

Spermophagus musculus Boheman 1833:112.

Spermophagus semifasciatus Boheman 1839:137; Lucas 1858:28; Bottimer 1968c:1015.

Bruchus nesapius Fahraeus 1839:108.

Amblycerus semifasciatus: Blackwelder 1946:763.

Zabrotes semifasciatus: Bottimer 1968c:1015; Kingsolver 1970b:487.

Bruchus cingulatus Suffrian 1870:169; Sharp 1885:493.

Bruchus leucogaster Sharp 1885:493.

Spermophagus (Zabrotes) pectoralis Sharp 1885:492; Chittenden 1902:103; Pic 1913a:60.

Spermophagus pectoralis: Back and Duckett 1918:16; Wolcott 1936:286; Back 1940:7.

Zabrotes pectoralis: Blackwelder 1946:763 (as synonym of *Z. subfasciatus*).

Spermophagus semicinctus Horn 1894:411.

Zabrotes semicinctus: Bottimer 1968c:1013 (in synonymy with *subfasciatus*); Johnson 1968:1271.

Spermophagus dorsopictus Lepesme, in Vayssière and Lepesme 1941:201.

Spermophagus minusculus Pic 1943:148 (misspelling of *musculus*).

Zabrotes obtectus: Kingsolver 1990b:169,171.

Spermophagus basicornis Pic 1928:298.

Color is sexually dimorphic:

Males.—Vestiture of head brown, pronotum and elytra with indistinct pattern of yellowish-brown and dark brown setae

(figure 190), pygidium uniformly yellowish brown with indistinct, narrow median stripe, sometimes mottled (figure 192); metacoxa and lateral areas of 1st abdominal segment dark brown, otherwise yellowish brown; integument of 1st and 2nd segments of antenna and of mouthparts reddish brown, fore legs suffused with reddish brown.

Females.—Vestiture of head gray, pronotum with variable pattern of gray and dark brown, usually with median white stripe; elytra (figure 191) with curved, median, white to gray maculation composed of short stripes, remainder of elytra light to dark brown in variable pattern, usually with vague stripes, usually with short stripe on second interval near scutellum; pygidium varying from yellowish brown with dark spots (figure 194) to dark brown with basal band yellowish brown and median line white (figure 193); ventral areas, antenna, mouthparts, and legs as in male.

Structure.—Antenna sexually dimorphic (figure 197), that of male reaching 1st abdominal segment, that of female reaching metacoxa. Apex of pronotum truncate; disk moderately convex, basal lobe slightly prominent; pronotum extremely densely punctulate, lateral areas of pronotal disk with sparse microfoveolae; strial punctures of elytra elongate, deep, interstices densely punctulate, each with a single row of slightly coarser punctures; metasternum of both sexes with a median, depressed sulcus, the sulcus densely setose (figure 195); lateral one-half of metacoxal face with 40 to 50 lightly impressed, crescentic foveolae, medial one-half impunctate except for deep pit near trochanter (figure 130); pygidium densely punctulate with scattered, elliptical foveolae.

Male genitalia.—As in figures 198 and 199; median lobe moderately broad, margins subparallel; ventral valve subconical with margins slightly curvate, dorsal valve with short, ligulate process; internal sac with hourglass-shaped median sclerite surrounded by clusters of short, stout spines; lateral lobes as in figure 199.

Size.—Body length: males 2.0–2.3 mm; females 2.2–2.8. Body width: males 1.4–1.5 mm; females 1.3–1.4 mm.

Type depositories.—NHRS *(subfasciatus, semifasciatus, musculus);* Havana, Cuba *(cingulatus);* BMNH *(leucogaster, pectoralis);* MCZC *(semicinctus);* unknown *(dorsopictus).*

Type localities.—*subfasciatus,* "Brasilia, Insula Saint-Barthelemi"; *musculus,* Brazil; *semifasciatus,* St. Barthelemy; *cingulatus,* Cuba; *leucogaster,* Central America; *semicinctus,* Baja California; *dorsopictus,* Madagascar.

Distribution.—Tropicopolitan. Bottimer (1968c) reported it as being established in Texas. Blanc (1965) reported finding a single adult on cotton at Blythe, CA, but its establishment in that State is doubtful. Harper (1966) also reported it from California. In recent years, the species has become widespread in South America, Africa, and India (Southgate 1964).

Host plants.—*Cajanus cajan*; *Cicer arietinum*; *Dipogon lignosus; Glycine max*; *Lablab purpureus*; *Phaseolus acutifolius*, *P. angularis angularis, P. coccineus*, *P. lunatus*, *P. vulgaris*; *Pisum sativum arvense; Vicia faba*; *Vigna angularis*, *V. mungo, V. subterranea, V. unguiculata sesquipedalis, V. unguiculata unguiculatus.* A record for *Sebastiania palmeri* is questionable since that species belongs in the Euphorbiaceae.

Natural enemies.—I have been unable to find reports of any parasites reared from this bruchid in the United States, but at least 13 species are reported from other parts of the world: *Anisopteromalus calandrae; Bruchocida orientalis; Charitopodinus swezeyi, C. terryi; Choetospila elegans; Dinarmus laticeps, D. vagabundus; Entedon* sp.; *Heterospilus prosopidis; Pseudocatolaccus bruchocida; Tetrastichus* sp.; *Triaspis thoracica; Uscana mukerjii, U. semifumipennis; Pyemotes ventricosus.*

Immatures.—Kannan 1923 (egg); Pfaffenberger and Johnson 1976; Steffan 1945 (first larval instar); Arora 1978, Zacher 1930, Peterson 1951 (final instar); Pfaffenberger 1991:568 (larva).

Discussion.—Zabrotes subfasciatus is usually easily distinguished from other species of *Zabrotes* by the sulcate, tomentose metasternum and by the sexual dimorphism in antennae, color pattern, and form of pygidium (but see *Z. sylvestris*). *Zabrotes eldenensis* closely resembles *Z. subfasciatus* but lacks the metasternal sulcus (although in some specimens the metasternum is slightly depressed) and the sexes are similar, especially in the color pattern of the pygidium. The male genitalia are also diagnostic to separate these two species.

This species undoubtedly originated in Central America where it has been found breeding in "wild" *Phaseolus vulgaris* and *P. lunatus.* It was described from Brazil in the early nineteenth century but through commerce, mainly in shipments of dried beans, it has become tropicopolitan in distribution. Various species and varieties of *Phaseolus* seem to be preferred hosts, but in the past 20 years, it has become a storage pest of cowpeas in Africa (Meik and Dobie 1986). Some of the hosts listed above are probably experimental or adventitious.

Zabrotes subfasciatus is a continuous breeder in stored seeds, a logical result of its trait of ovipositing only on seeds that have fallen from a pod or that are still attached inside a partly dehisced pod. The bruchid apparently does not oviposit on the seed pod itself. Detection of infested seeds is difficult unless the prepupal stage has been reached, in which case the larva has excavated to the inner surface of the integument and has partly cut a "window" to facilitate emergence of the adult after eclosion. Pierre and Pimbert (1981) reported on reproductive activity of this species.

Wittich (1940) reported that in Minnesota *Z. subfasciatus* caused allergic reactions in humans as a result of handling infested beans.

Recent studies by Osborn et al. (1988) have isolated a seed protein in wild strains of *Phaseolus vulgaris,* arcelin, that is toxic to *Z. subfasciatus* larvae. Experimental transfer of this trait to lines of cultivated beans has resulted in a high degree of resistance to the bruchid.

Common names: Mexican bean bruchid, la bruche brasilienne, der Brasilenbohnenkäfer.

Because of its importance as a stored legume pest, references to studies on various aspects of the morphology and life history of *Zabrotes subfasciatus* are listed. Full citations will be found in "References."

Adult illustration.—Bondar 1936; Kingsolver 1990b.

Adult morphology.—Zacher 1930; Seeliger 1943.

Chromosomes.—Smith and Brower 1974:322.

Eclosion.—McFarlane and Wearing 1967 (pupal window).

Egg morphology.—Bondar 1936; Wightman and Southgate 1982.

Female genitalia.—Singh 1973; Monga and Sareen 1980 (ovarioles); Romero and Johnson 1999.

Host plant change.—Pimbert 1985b; Meik and Dobie 1986.

Larval digestive system.—Vats 1976b.

Larval malpighian tubules.—Vats 1976a.

Larval parasites.—Kistler 1985.

Life histories.—Zacher 1930; Lepesme 1944; Steffan 1945; Howe and Currie 1964; Carvalho and Rosetto 1968; Davies 1972; Singh et al. 1979; Jarry and Bonet 1981; Pimbert 1985c; Pajni and Jabbal 1986; Pfaffenberger 1990.

Male accessory glands.—Singh 1978b.

Male genitalia.—Kingsolver 1970b (figures 48 and 49), 1990b:174 (figures 74 and 75).

Mating and reproduction.—Pierre 1980; Pierre and Pimbert 1981; Pimbert and Pierre 1983; Pimbert 1985b.

Nervous system.—Kasap 1978a; Sandhu and Neena 1982 (brain).

Oviposition.—Howe and Currie 1964; Utida 1967; Pimbert 1985a.

Physiology.—Sharma and Sharma 1979 (proteins); Minney et al. 1990.

Pheromones.—Pouzat et al. 1989.

Spermatheca.—Surtees 1961.

Wing venation.—Singh 1981a.

Zabrotes subnitens Horn

(Figures 200–203)

Zabrotes subnitens Horn 1885b:158; Bottimer 1968c:1015; Johnson 1968:1271; Johnson and Kingsolver 1982:411; Kingsolver 1990b:160.

Spermophagus subnitens: Pic 1913a:62.

Color.—First antennal segment sometimes dark red beneath, metatibial spurs dark red. Vestiture white, uniformly distributed over body (figure 200).

Structure.—Antenna dimorphic, that of male reaching margin of pygidium, that of female reaching 1st abdominal segment; pronotal disk sparsely microfoveolate, each foveola elliptical, interspaces densely punctate; elytral striae deep and narrow, strial punctures elongate, interstices minutely punctate; pygidium (figure 201) foveolate as on pronotum; apex of meso-sternum truncate; lateral one-half of metacoxal face with about 25 shallow, crescentic foveae, medial one-half polished, impunctate except for trochanteral pit.

Male genitalia.—Of the *Z. obliteratus* type (figures 202 and 203); lateral margins of median lobe subparallel; ventral valve subtriangular with apex narrowly rounded; dorsal valve likewise rounded; internal sac with two elongate, spinous structures, two small spinous sclerites, and median, flask-shaped sclerite, apex of sac abbreviated; lateral lobes as in figure 203.

Size.—Body length 2.1–2.3 mm; width 1.5–1.8 mm.

Type depository.—MCZC, lectotype No. 3902 (by Johnson 1968).

Type locality.—"Georgia."

Distribution.—AZ, AL, FL, IL, KY, MS, NJ, OK, SC, TX, VA.

Host plants.—Unknown.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Salient characters for this species include the smooth medial one-half of the metacoxa, evenly distributed white body setae, dimorphic antennae, and male genitalia with a narrow ventral valve and lageniform median sclerite, a pair of spiny, bladelike sclerites, and a pair of small, curved, spiny sclerites. This species is most similar to *Z. bexarensis,* but the elytra of the latter species is faintly maculate, and the male genitalia are distinctive (compare figures 140 and 202).

Zabrotes sylvestris Romero and Johnson

(Figures 204–206)

Zabrotes sylvestris Romero and Johnson 1999:87–98

Color.—Body black, head with basal antennal segments yellowish. Vestiture of intermixed yellow and white pubescence, yellowish brown spot of setae on vertex, pronotum with scattered minute brown and yellowish spots; scutellum white; elytron with variable small brown and yellow spots; pygidium yellowish with median stripe; abdomen white except for yellowish spot either side of first sternum; metacoxa brown; metepisternum with small yellowish spot; abdomen with mixed yellow and white pubescence.

Female color.—Similar to male except has contrasting white band across middle of elytra.

Structure.—Antenna seven-eights length of body; ocular sinus two-thirds length

of eye; head with evanescent median carina. Pronotum semicircular; disk densely punctulate and microfoveolate. Scutellum small, triangular. Elytral disk micropunctulate, striae deep, basal punctures deep; metasternum with mesal fossa; metacoxal face foveolate in lateral one-half, medial one-half smooth and polished, finely striate, cavernous at trochanteral insertion; metatibia with only one ventral carina.

Female structure.—Ocular sinus two-thirds to three-quarters length of eye; antenna shorter than male, three-fifths to three-fourths length of body. Otherwise as male.

Male genitalia.—As in figures 204 and 205; median lobe moderately broad, margins subparallel; ventral valve (figure 204) with base broad, apex broadly rounded; dorsal valve ogival; internal sac with long bifid process near base; median sclerite broadly circular with two horn-like processes, surrounded with fine spicules, a larger apical cluster of fine spicules; lateral lobes as in figure 205.

Female genitalia.—Genitalia with large, spiny sclerite in bursa copulatrix.

Size.—Body length of males 1.5–2.0 mm; of females 2.1–2.5 mm.

Type depository.—Colección Entomológica del Instituto de Fitosanidad, Colegio de Postgraduados, Montecillo, Mexico.

Type locality.—Mexico, Tehuacan, Puebla.

Distribution.—CA; Mexico.

Host plant.—Phaseolus vulgaris.

Natural enemies.—Not known.

Immatures.—Not known.

Discussion.—Zabrotes sylvestris and *Z. subfasciatus* are similar in size, shape, and color, so positive identification should ultimately be made by comparing male genitalia of the two species (figure 204, *sylvestris,* and figure 198, *subfasciatus*). *Zabrotes sylvestris* is described as lacking the spot of yellowish brown setae found on the vertex of *Z. subfasciatus,* but this should be relied on with caution because of abrasion. In addition, the pronotum is foveolate over the entire disk and the metatibia has only a ventral carina, whereas in *Z. subfasciatus* the pronotum is foveolate only on lateral areas of disk and the metatibia has a faint lateral carina in addition to the ventral carina.

Differences in the male and female genitalia are illustrated (figures 204 and 198 for male; figures 206 and 207 for female).

Zabrotes victoriensis Kingsolver

(Figures 208–211)

Zabrotes victoriensis Kingsolver 1990b:151.

Color.—Vertex with extremely fine, white setae, clypeus densely clothed with white; dorsal vestiture mostly reddish brown but intermixed with white; white patches on basal lobe, lateral margins of pronotum, scutellum, and in middle of 6th and 7th interstices of elytra (figure 208); pygidium predominantly white with some intermixed reddish-brown setae either side of narrow median white stripe (figure 209); venter of body densely clothed with white setae except metacoxal face reddish brown.

Structure.—Vertex finely, shallowly micropunctate, punctures slightly deeper on frons; frontal carina prominent, minutely granulose; ocular index 5:1; ocular sinus three-fourths length of eye; antenna not sexually dimorphic, reaching middle of metacoxal face. Pronotum semicircular, slightly swollen medially, minutely punctate on swelling, lateral areas microfoveolate. Scutellum minute, triangular; mesosternum acute and carinate. Elytra together about as long as wide; striae shallow, distinct in basal four-fifths but becoming confused near apex, strial punctures elongated; interstices flat, each with a single row of punctures. Metacoxal face microfoveolate in lateral one-half, medial one-half with cluster of 20–25 punctures near trochanter. Male 5th abdominal sternum deeply emarginate; pygidium punctulate with two sizes of punctures, male pygidium strongly reflexed.

Male genitalia.—As in figures 210 and 211; median lobe with lateral margins sub-par-

allel; ventral valve triangular with margins incurved; dorsal valve arcuate, lacking median process; internal sac with flask-shaped sclerite with "stopper" sclerite at narrow end; sac abbreviated; lateral lobes as in figure 211.

Size.—Body length 1.5–1.7 mm; width 1.2–1.4 mm

Type depository.—USNM.

Type locality.—Texas, Victoria.

Distribution.—TX.

Host plants.—The host cited on the holotype label, *Xanthoxylum clava-herculis,* is doubtful since other species of *Zabrotes* for which the host is recorded prefer legumes whereas *"Xanthoxylum,"* (now *Zanthoxylum*) is in the Rutaceae.

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—This species most closely resembles *Zabrotes chavesi* Kingsolver, but that species is mostly gray with some reddish mottling on the dorsal surfaces and the pygidium, the mesosternum is flat, and the male genitalia is of a different type (compare figures 149 and 210).

Subfamily Bruchinae Pic 1913a

Tribe Megacerini Bridwell

Megacerini Bridwell 1946:53; Bottimer 1968c:1033,1039,1042; Teran and Kingsolver 1977:27. Type genus: *Megacerus* Fahraeus 1839.

Elytra with 10th stria not extending past epipleural lobe (except *M. impiger);* front carinate; antenna serrate in females (figures 7 and 231), strongly pectinate in males (figures 6 and 230); pronotum conical, lateral margin straight or slightly convex, lateral carina sharp, sinuate; elytra depressed along suture, interstices variable in width, 4th and 5th striae abbreviated apically; metafemur (figure 215) moderately thickened, ventral face flat or slightly convex, both margins carinate, mesoventral carina smooth or dentate or with subapical angular tooth; metatibia with four longitudinal carinae—dorsolateral and ventrolateral on lateral face (figure 215), dorsomesal and ventromesal on mesal face[1]; pygidium flat or with slight relief or vertical or slightly oblique.

The structure of the male genitalia in the Megacerini is unlike that of any other bruchid tribe. The median lobe consists of an apical ring to which is attached the ventral valve (figure 216). The ventral part of the ring is narrowed to a long, bifurcate ventral rod expanded at the anterior end to form the cucullus. In most other bruchids, the body of the median lobe is sclerotized to some degree, whereas in *Megacerus* the middle of the median lobe is a membranous tube attached to the apical ring and to the cucullus with the rod providing rigidity. Pressure to evert the internal sac is accomplished by the usual muscle masses connecting the rim of the cucullus and the ventral strut to form a bulblike pump. Lateral lobes are fused along the midline to form a hoodlike structure covering most of the median lobe with the apical portion of the fused lobes demarcated by a transverse ridge bearing setae or pores or small sensory structures (figure 217). Lateral margins of the lobes extend ventrad partly enveloping the median lobe.

Since Megacerus is the only included genus, the above description applies to it as well.

Genus *Megacerus* Fahraeus

Megacerus Fahraeus 1839:34; Bridwell 1929b:112, 1932:105, 1946:54; Bottimer 1968c:1033; Teran and Kingsolver 1977:27. Type species *Bruchus pescaprae* Fahraeus 1839, monotypic.

Pachybruchus Pic 1912:92; described as a subgenus of *Bruchus* for *"coryphae* Ol., *pescaprae* et voisins," Bridwell 1929a:113; Bottimer 1968c:1034; Teran and Kingsolver 1977:140. Type species *Bruchus coryphae* Olivier, by subsequent designation, Bridwell 1929b:113.

Serratibruchus Teran and Kingsolver 1977:174 (as subgenus of *Megacerus*). Type species: *Bruchus maculiventris* Fahraeus 1839, by original designation.

Nine species of *Megacerus* are known from the United States.

Using the manuscript name *Megacerus pescaprae,* Faldermann sent a bruchid to Schoenherr for naming. Fahraeus described it as *Bruchus pescaprae* citing *Megacerus* in synonymy. Bridwell (1929b:112) regarded *Megacerus* as a valid generic name based on "Opinion No. 4" of the International Code. Under Article 11e of the third edition of the Code, the name is valid since it was used by Bridwell prior to 1961. The name *Pachybruchus* was taken by Pic from a Jekel manuscript.

Morphology of this genus is described under tribe Megacerini above.

Revision: Teran and Kingsolver 1977.

[1]Nomenclature herein proposed for the metatibial carinae is different from that proposed by Johnson and Kingsolver (1973) for Sennius, which is applicable to most of the Acanthoscelidini.

Key to U.S. *Megacerus*

[The following key includes subgeneric as well as specific distinctions.]

1 Metafemur serrate on mesoventral margin (figure 52); metacoxal face foveolate or punctate and setose in lateral one-half, polished on mesal one-half; mucro of metatibia shorter than width of tibial apex (figure 249) (subgenus *Serratibruchus*) 2

Metafemur not serrate on mesoventral margin (figure 215); metacoxal face foveolate or punctate over entire surface (except fossula), setose or not (figure 237); mucro short or long 3

2(1) Vestiture uniformly white on body (figure 252) except pygidium with four round, black spots (figure 253); 5th sternum unicolorous ..... *schaefferianus* Bridwell

Vestiture mostly black on elytra with tufts of white setae, especially on 3rd interstice (figure 247); pygidium with two or four spots (figure 248); 5th sternum with one or two spots on each side of pygidium *maculiventris* (Fahraeus)

3(1) Strial punctures large, deep (figure 212); interstices convex or ridgelike; metacoxa with large but shallow punctulate foveae (figure 215); pygidium white with black or dark red spots; male with hooklike mucro on protibia (subgenus *Pachybruchus*) 4

Strial punctures fine (figure 218); interstices flat; metacoxa finely punctate; pygidium various (subgenus *Megacerus*) 5

4(3) Elytra red, usually with median sutural patch of white hairs, remainder of elytra with short, scattered, inconspicuous hairs (figure 212) ..... *coryphae* (Olivier)

Elytra with complete or interrupted stripes of white setae especially on 3rd, 5th, and 7th interstices (figure 243) ..... *leucospilus* (Sharp)

5(3) Pygidium white with horizontal black line, sometimes broken into two segments (figure 225); elytra red with black sutural stripe (figure 224) . *cubicus* (Motschulsky)

Pygidium and elytra otherwise 6

6(5) Elytra black with large red maculation in basal one-half (figure 228) ..... *discoidus* (Say)

Elytra reddish brown with black lateral maculations (figure 235) 7

7(6) Anterior margin of male metacoxa with broad, polished area, extending posteriorly onto coxal face (figure 237); apex of elytra extending past base of pygidium (figure 237); epipleural lobe slightly sinuate (figure 237), 10th stria extending to 1st abdominal segment; elytra with faint diagonal ridge extending from prominent humeral gibbosity ..... *impiger* (Horn)

Anterior margin of male metacoxa narrow (figure 220); apex of elytra not reaching past base of pygidium (figure 220); epipleural lobe strongly sinuate (figure 220), 10th stria ending abruptly opposite metacoxal angle; elytra without diagonal ridge extending posteriorly from humeral gibbosity 8

8(7) Size larger than 2.3 mm long X 1.4 mm wide ..... *cubiculus* (Casey)

Size smaller than 1.7 mm long X 1.2 mm wide; Florida ..... *ripiphorus* (Fahraeus)

Megacerus (Pachybruchus) coryphae (Olivier)

(Figures 6, 7, 212–217)

Bruchus coryphae Olivier 1795:16, no. 79; Fabricius 1801:402; Gyllenhal 1833:42; Fahraeus 1839:39; Jekel 1855:1; Horn 1873:321; Blatchley 1919:66; Bondar 1936:43; Johnson 1969c:56.

Bruchus (Pachybruchus) coryphae: Pic 1913a:23; Teran 1967:312.

Mylabris coryphae: Leng 1920:305.

Megacerus coryphae: Bridwell 1929b:112; Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1034,1039,1042; Johnson and Kingsolver 1982:412; Borowiec 1987:72; Udayagiri and Wadhi 1989.

Megacerus (Pachybruchus) coryphae: Teran and Kingsolver 1977:153.

Color.—Head and antenna black, thoracic sterna and legs dark red to black, pronotum and elytra dark red (figure 212), apex of pronotum and elytral suture usually

piceous; pygidium dark red but thickly covered with white, tomentose pubescence except pair of black marginal subapical spots and small, black spiracles near dorsal angles (figure 214). Vestiture white, short and sparse on head, pronotum, and elytra except for common, tomentose patch at middle of suture; ventrally tomentose except metacoxal face bare.

Structure.—Head finely, densely punctate; ocular index 20:1 in males, 10:1 in females; male antenna as in figures 6 and 213, female as in figure 7; pronotum subpentagonal, lateral margins sinuate, disk strongly convex, densely but discretely foveate, sulcate along basal margin either side of scutellum, basal lobe shallowly sulcate, lateral carina short, serrate. Scutellum prominent, densely pubescent. Elytra together as long as wide; sulcate along suture; strial punctures deep, round, encroaching on sinuate interstices, crest of each interstice with small, shallow foveolae. Metacoxal face finely punctate between large, flat-bottomed but umbilicate foveae (figure 215); hind leg as in figure 215, ventral carinae entire; metatibia with dorsolateral and ventrolateral carinae divergent toward apex, ventromesal and dorsomesal carinae complete; mucro three-tenths as long as basitarsus, apical margin crenulate. Pygidium nearly flat in both sexes; male 5th sternum emarginate, 8th tergum protruding between emargination and pygidium.

Male genitalia.—As in figures 216 and 217; median lobe slender, rodlike, expanded into ring apically; ventral valve ogival with apex acute; armature of internal sac consisting of cluster of fine spicules at apical orifice, a pair of amorphous structures apicad of cluster; another smaller cluster in middle of sac at one end of double row of 20–22 elongate denticles, sac sparsely lined with minute denticles; lateral lobes (figure 217) fused into broad, troughlike structure, apex evenly rounded, setose, transverse row of minute setae near apex, interior surface with many circular pores.

Size.—Body length 3–3.5 mm; width 2–2.5 mm.

Type depository.—Type apparently lost.

Type locality.—"Amerique septentrionale."

Distribution.—AL, FL, LA, MS, SC, TX.

Host plants.—*Ipomoea pes-caprae, I. sagittata.*

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The dark red, nearly bare pronotum and elytra except for white median sutural patch, densely white pygidium with two subapical black spots, deep, rounded strial punctures, smooth ventral carinae of metafemur, foveolate metacoxa, and long mucro should be sufficient to distinguish this species from others in this handbook.

The other U.S. species in this subgenus, *M. cubicus,* superficially resembles *M. coryphae* but differs in that in addition to the median sutural patch of vestiture, the simply punctate interstices are alternately striped with white hairs and the apices of the 2nd and 3rd interstices are pubescent (figure 224). These two species are distinguished from others in the genus by characters in the key separating the subgenus; however, *M. cubicus* with similar coloration can be separated by the presence of a horizontal black pygidial line (figure 225) in addition to the subapical elytral spots.

Megacerus (Megacerus) cubiculus (Casey)

(Figures 218–223)

Bruchus cubiculus Casey 1884:183; Horn 1885a:110; Pic 1913a:23; Schaeffer 1907:295.

Mylabris impiger var. *cubiculus:* Leng 1920:305.

Megacerus cubiculus: Bottimer 1968c:1034,1039; Johnson 1969e:237; Johnson and Kingsolver 1982:411; Udayagiri and Wadhi 1989:209.

Megacerus (Megacerus) cubiculus: Teran and Kingsolver 1977:50.

Color.—Body mostly reddish brown with vertex and sternal regions black, metacoxal face and portions of the ventral margin of the metafemur black, fore legs and mid legs reddish brown; middle of pronotum usually with two quadrate black patches (figure 218), elytra usually with elongate black spot on humerus, at middle of 7th interstice, and rounded subapical spot (figure 218); variably maculate with black; pygidium usually with two subapical black spots (figure 219). Antenna usually with apical four or five segments dusky or black. Vestiture white or yellowish white; head mostly yellow with white patch above eye and adjoining frontal carina; pronotum yellow with white curved stripes; scutellum white; elytra with stripes of alternating white and yellow; pygidium densely pubescent on lateral borders and median stripe but more sparse between; ventral areas of body white.

Structure.—Vertex punctulate, male eyes narrowly separated, ocular index 24:1 in male, 7:1 in female; male antenna as in figure 223; pronotum bell-shaped, convex, with shallow sulcus either side near apex and on basal margin opposite 3rd and 4th elytral striae (figure 218); disk finely reticulate-punctate, lateral margins slightly convex with short segment of carina opposite mesepisternum. Scutellum quadrate, bifid apically. Elytra together slightly longer than wide (figure 218), convex, except slightly depressed medially, apices not extending beyond basal margin of pygidium (figure 220), strial punctures fine, elongate, not encroaching on margins of interstices; interstices flat, finely imbricate; metacoxal face densely microfoveolate (figure 220), foveolae mostly discrete, becoming more crowded medially; meta-femur as in figure 220; ventral margin of metafemur flat between two entire ventral carinae; metatibia with dorsolateral carina absent, ventrolateral, dorsomesal, and ventromesal carina complete; mucro one-seventh length of basitarsus. Fifth abdominal sternum broadly emarginate; pygidium in both sexes vertical.

Male genitalia. —As in figures 221 and 222; median lobe rodlike, Y-shaped, with broad, terminal ring; ventral valve narrowly triangular, apex acute; armature of internal sac consisting of cluster of fine spicules at apical orifice, an amorphous, saclike structure; apex of sac with 20–22 slender denticles and many fine, acute denticles, a pair of denticles near apex; lateral lobes fused, hoodlike, apex bluntly triangular, porous, delimited by transverse porous, setose ridge (figure 222).

Size.—Body length 2.5 mm; width 1.7 mm.

Type depository.—USNM, holotype No. 49229.

Type locality.—"Arizona."

Distribution.—AZ, FL, GA, LA, MD, OK, SC, TX, VA; Mexico.

Host plants.—Ipomoea batatas, I. lacunosa, I. purpurea, I. trifida; Merremia quinquefolia. Records in the literature for *Senecio salignus* (floral record), *Baccharis sarathroides* (floral record), and *Convolvulus* sp. are probably misidentifications or accidental floral visits.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species most nearly resembles *M. impiger.* See the discussion of that species for comparison. Geographical ranges of the two species overlap in the Southwest.

Megacerus (Megacerus) cubicus (Motschulsky)

(Figures 224–227)

Kytorhinus cubicus Motschulsky 1874:206.

Bruchus cubicus: Sharp 1885:487.

Bruchus (Pachybruchus) cubicus: Pic 1913a:23.

Megacerus cubicus: Blackwelder 1946:762; Janzen 1980:948; Pfaffenberger 1980:350; Johnson and Kingsolver 1982:411; Pfaffenberger 1984:24.

Megacerus (Megacerus) cubicus: Teran and Kingsolver 1977:57.

Bruchus leucosomus Sharp 1885:488; Horn 1894:345; Fall 1910:164.

Bruchus (Pachybruchus) leucosomus: Pic 1913a:31.

Mylabris leucosomus: Leng 1920:305.

Megacerus leucosomus: Blackwelder 1946:762; Bottimer 1961:296, 1968c:1035; Udayagiri and Wadhi 1989:210.

Color.—Integument black except legs red, disk of elytra red with black border. Vestiture white, sometimes shading to yellow on pronotal disk, pronotum with broad, nearly bare median stripe (figure 224) but pubescent on lateral margins, sparse to dense on elytra, tomentose on pygidium and ventral areas; pygidium with horizontal black mark in middle of disk and pair of subapical, marginal black maculae (figure 225).

Structure.—Vertex punctulate, frons with triangular bare area at dorsal end of frontal carina; ocular index 18:1 in male, 10:1 in female; ocular sinus one-half length of eye in male, four-fifths length of eye in female; antenna of each sex as for genus. Pronotum subpentagonal (figure 224), lateral margins straight, convergent, disk convex, medially sulcate, basal margin with curved sulcus each side of basal lobe, middle of disk densely, irregularly microfoveolate, each foveola with fine seta beneath its anterior rim; lateral carina curved, concealed by vestiture. Scutellum ovate, convex, apically emarginate. Elytra together as long as wide; striae impressed, punctures small, deep; interstices convex to flat, densely imbricate. Metacoxal face densely punctulate, lateral two-thirds of face concealed by dense vestiture; metatibia lacking dorsolateral carina; mucro short, curved, one-sixth as long as basitarsus, lateral and coronal denticles small, inconspicuous.

Male genitalia.—As in figures 226 and 227; median lobe slender, apical ring broad, ventral valve subelliptical with apex bent ventrad; armature of internal sac consisting of two rows of minute spicules at apical orifice, a pair of flat plates in middle, and two irregular rows of elongate denticles in middle, apex with four elongate denticles, closure valve C-shaped; apex of fused lateral lobes evenly rounded (figure 227), setose, with a pair of membranous alae behind apical plate, inner surface of lobes porous.

Size.—Body length 1.7–2.5 mm; width 1.1–1.5 mm.

Type depository.—ZMUM *(cubicus);* BMNH *(leucosomus).*

Type locality.—Mexico *(cubicus, leucosomus).*

Distribution.—TX; Mexico to Peru.

Host plants.—*Ipomoea* sp. Extralimital hosts: *Argyreia nervosa; Calystegia sepium; Ipomoea arborescens, I. carnea fistulosa, I. crassicaulis, I. hederifolia, I. leptophylla, I. meyeri, I. nil* (Janzen 1980:948). No specimens of this bruchid have been reared from seeds grown in the United States although *I. crassicaulis, I. hederifolia,* and *I. nil* occur here.

Natural enemies.—None recorded.

Immatures.—Pfaffenberger (1980) described the egg and first larval instar and later included the species in a key (1984:24).

Discussion.—Characters to distinguish this species are the black pronotum, black-bordered red elytra, and horizontal black line on the pygidium (sometimes broken into two short lines). It resembles *M. discoidus,* but the red elytral patch extends to, or nearly to, the apex in *M. cubicus,* whereas in *M. discoidus* it extends only two-thirds to the apex. Pygidial markings of *M. discoidus* consist of four black dots, whereas in *M. cubicus* the mark is a horizontal black line (compare figures 225 and 229).

Pfaffenberger (1980:354) described oviposition for this species.

Megacerus (Megacerus) discoidus (Say)

(Figures 56, 228–234)

Bruchus discoidus Say 1824:307; Schoenherr 1833:102, 1839:131.

Bruchus discoideus: Melsheimer 1853:99, and authors; LeConte 1859:171; Horn 1873:321; Blatchley 1910:1235; Cushman 1911:494; Weiss and Dickerson 1919:9; Carr 1920:7; Brimley 1938:232; Johnson 1969c:56.

Bruchus discoidens: Dury 1879:11.

Kytorhinus discoidii: Motschulsky 1874:205.

Bruchus (Pachybruchus) discoideus: Pic 1913a:24.

Mylabris discoideus: Leng 1920:305.

Megacerus discoideus: Bridwell 1929b:112; Blackwelder and Blackwelder 1948:44; Teran 1967:312; Parella and Kok 1975:44.

Megacerus discoidus: Bottimer 1968c:1034; Mohyuddin 1969:143; Teran and Kingsolver 1977:67; Johnson and Kingsolver 1982:411; Wang and Kok 1983:109; Pfaffenberger et al. 1984:2; Pfaffenberger 1985a:4; Wang and Kok 1986a:359, 1986b:834; Udayagiri and Wadhi 1989:210.

Color.—Integument black, occasionally with some reddish suffusion on hind legs, each elytron with large red spot extending from lateral margin to 2nd interstice and from posterior margin of humerus two-thirds toward apex leaving narrow black basal and sutural borders, apical one-third of elytra black (figure 228). Vestiture white; head, middle of pronotum, and elytra sparsely pubescent, pronotum usually with narrow median line and flanks more densely pubescent; pygidium and ventral areas densely pubescent except metacoxal face sparse; 5th abdominal segment with black spot at lateral margin; pygidium with four black spots (figure 229).

Structure.—Vertex finely, densely punctate; frontal carina nearly hidden by transversely directed setae; ocular index 16:1 in males, 8:1 in females; ocular sinus three-fifths length of eye in both sexes; antenna (figures 230 and 231) as for genus. Pronotum subpentagonal, basal margin arcuate, lateral margins slightly sinuate, disk convex, faintly sulcate, basal margin sulcate either side of basal lobe (figure 228); disk densely foveolate, each foveola with seta under anterior rim; lateral carina short, curved. Scutellum cuneate, emarginate apically. Elytra as long as wide (figure 228); striae impressed, strial punctures moderately deep; interstices convex in middle of elytra, imbricate; metacoxal face irregularly foveolate in lateral two-thirds with interspersed punctures, medial one-third punctate, fossula narrow; metafemur as in figure 232, metatibia with dorsolateral carina intermittent or absent, remaining carinae sharp, mucro one-sixth length of basitarsus, lateral denticle distinct but short. Male with apex of 8th tergite visible between apex of pygidium and emargination of terminal abdominal sternum.

Male genitalia.—As in figures 233 and 234; median lobe with apical ring broad, angular; ventral valve narrowly ogival with sinuate side margins, apex acute; armature of internal sac consisting of two elongate, spiculate processes attached at their bases to two flat, membranous lobes; middle of sac with two irregular rows of elongate denticles separated by gap from four similar denticles near apex of sac; closure valve C-shaped, entire sac lined with minute denticles; fused lateral lobes rounded or slightly emarginate apically (figure 234), lateral alae angulate, apex of lobe porous, inner surface with grid of fine, transverse ridges.

Size.—Body length 2.6–3.6 mm; width 1.8–2.4 mm.

Type depository.—Type destroyed.

Type locality.—"Arkansa."

Distribution.—AB, AR, BC, CO, DC, FL, GA, IN, KS, MD, MI, MN, MO, MS, MT, NB, NC, ND, NE, NH, NJ, NM, NS, NY, OH, OK, ON, PA, PQ, SC, SD, SK, TX, VA; Mexico.

Host plants.—Calystegia macounii, C. sepium, C. sepium repens; Convolvulus arvensis; Ipomoea leptophylla, I. tiliacea, I. pandurata. Flowers of *Daucus carota* and *Hibiscus* sp.

Natural enemies.—Uscana semifumipennis; Dinarmus sp.

Immatures.—Pfaffenberger 1984 (egg, first and final larval instars).

Discussion.—This handsome species with its quadrate, red elytral maculae can hardly be mistaken for any other eastern American bruchid.

The original spelling of the specific name by Say (1824) is *"discoidus,"* but Melsheimer (1853) inexplicably changed it to "*discoideus,"* the form used by LeConte (1859). This spelling was used by subsequent authors until Bottimer (1968c) reverted to the original.

Mohyuddin (1969), Wang and Kok (1983, 1986a,b), and Keeler (1980) have detailed the life history of this species.

Adults are commonly found on flowers of many different plant species.

Megacerus (Megacerus) impiger (Horn)

(Figures 235–242)

Bruchus ramicornis Boheman 1859:112 (not Erichson 1848).

Megacerus ramicornis: Blackwelder 1946:762.

Bruchus impiger Horn 1873:323, 1875:151; Sharp 1885:486; Schaeffer 1907:295.

Bruchus (Pachybruchus) impiger: Pic 1913a:28.

Mylabris impiger: Leng 1920:305.

Megacerus impiger: Bridwell 1929b:112; Blackwelder 1946:762; Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1035,1039; Johnson 1968:1269, 1969c:55; Teran and Kingsolver 1977:86; Schlising 1980:1; Johnson and Kingsolver 1982:411; Udayagiri and Wadhi 1989:212.

Megacerus eugenie Bottimer 1968c:1034 (replacement name for *ramicornis* Boheman 1859); Teran and Kingsolver 1977:86.

Megacerus (Megacerus) impiger: Teran and Kingsolver 1977:86.

Color.—Integument reddish brown with variable darker shading on ventral areas of body, on elytra, and on pronotum; humeri and elytral apices piceous, pygidium usually with four irregular, dark blotches sometimes blended into two lateral maculae or into one large, central, piceous spot (figures 239 and 240). Vestiture white, arranged in variable linear striping on elytra, uniformly distributed on pronotum, pygidium, and ventral areas.

Structure.—Vertex finely punctate, frons carinate in both sexes, ocular index 25:1 in male, 5:1 in female; ocular sinus 0.4 as long as eye in male, 0.6 as long as eye in female; male antenna as in figure 238, 3rd and 4th segments of male antenna unusually elongated. Pronotum bell-shaped, evenly convex, lateral margins slightly arcuate, disk microfoveolate (figure 235), lateral carina brief, located in middle of lateral margin. Scutellum broader at apex than at base, apex emarginate. Elytra 1.2 times as long as wide (figure 235), male with prominent humeri extended posteriorly as a low, curved ridge to middle of elytron, striae subparallel except that two approaches three at base; epipleural lobe not prominent, 9th stria reaching posterior margin of metacoxa, interstices minutely imbricate, apices of elytra usually extending beyond base of pygidium in male (figure 237); female evenly convex except humeri slightly prominent, striae and interstices as in male; metacoxal face of male with large polished extension on anterior margin (figure 237), otherwise finely punctate; female with small fossular spot; metafemur slender; metatibia with evanescent dorsolateral carina, ventrolateral, ventromesal, and dorsomesal carinae absent; mucro short, bent at angle to ventral margin of tibia, lateral denticle nearly as long as mucro. Male abdomen slightly telescoped, 5th sternum broadly emarginate; male and female pygidia vertical, disk finely, shallowly punctate.

Male genitalia.—As in figures 241 and 242; median lobe with apical ring broad; ventral valve narrowly triangular; armature

of internal sac consisting of small cluster of spicules at apical orifice, two ovate, flat structures, and 28–30 elongate denticles in two irregular rows; closure valve C-shaped; apex of fused lateral lobes bluntly triangular (figure 242), margins setose, inner surface densely setose; transverse, arcuate band densely setose, middle of lobes porous.

Size.—Body length 2.0–3.1 mm; width 1.3–1.8 mm.

Type depository.—MCZC *(impiger),* lectotype not selected (Johnson 1968); NHRS *(ramicornis).*

Type locality.—California *(impiger, ramicornis).*

Distribution.—AZ, AR, CA, FL, GA, MS, SC, TX; Mexico.

Host plants.—Calystegia atriplicifolia, C. occidentalis fulcrata, C. longipes, C. macrostegia arida, C. macrostegia cyclostegia, C. macrostegia macrostegia, C. malacophylla deltoidea, C. malacophylla malacophylla, C. malacophylla pedicellata, C. occidentalis occidentalis, C. piersonii, C. purpurata, C. soldanella, C. stebbinsii, C. subacaulis; Convolvulus arvensis; Ipomoea sp.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species resembles *M. cubiculus,* but its range is generally western with only scattered records east of Texas. Males are easily distinguished from males of *M. cubiculus* by the shape of the antenna, the prominent humeri, the pronotal integumental pattern, the larger fossular spot on the metacoxa, and the less prominent epipleuron. Elytral apices of *M. impiger* often extend beyond the vertical plane of the pygidium, whereas those of *M. cubiculus* appear to end at the dorsal margin, but this character is variable. Females of *M. impiger* are more difficult to separate than males from those of *M. cubiculus,* but the pronotal pattern of *M. impiger* is usually a broad median stripe with lateral "wings," whereas that of *M. cubiculus* is composed of a broken median stripe (compare figure 218 with figure 235). The dorsomesal carina of the metatibia is absent in *M. impiger* but is strong in *M. cubiculus.*

These two species belong to a closely related group of reddish-brown species that are variable in color pattern and difficult to separate.

Schlising (1980) conducted an intensive study of the life history of *M. impiger* in California.

Megacerus (Pachybruchus) leucospilus (Sharp)

(Figures 243–246)

Bruchus leucospilus Sharp 1885:489.

Bruchus (Pachybruchus) leucospilus: Pic 1913a:31.

Megacerus leucospilus: Bridwell 1929b:113; Blackwelder 1946:762; Bottimer 1961:297, 1968c:1035; Teran and Kingsolver 1977:160; Johnson and Kingsolver 1982:412; Udayagiri and Wadhi 1989:218.

Megacerus leucorpilus: Bridwell 1929b:113 (misspelling).

Megacerus alternatus Bridwell 1929b:113; Hinckley 1960:260; Bottimer 1968c:1034; Johnson 1968:1269; Kingsolver 1970a:383.

Bruchus (Pachybruchus) coryphae var. *lineatipennis* Pic 1938:23; Hinckley 1960:260.

Color.—Head and antennae, occasionally anterior borders of elytra, and metatibia black, remainder of body dark red, legs sometimes piceous. Vestiture white to yellow on head, pronotum, and elytra, otherwise white. Pronotal disk with alate glabrous pattern, often divided by median line of setae (figure 243); vestiture of elytra striped on alternate interstices, intervening interstices glabrous, stripes sometimes fractured or lacking. Pygidium uniformly setose except for two subapical, marginal spots (figure 244).

Structure.—Vertex finely punctate, frontal carina prominent, transverse sulcus separating vertex from frons; eyes dimorphic,

male eyes enlarged, ocular index 15:1 in male, 6:1 in female; antennae as for genus. Pronotum bell-shaped (figure 243), strongly convex, lateral margins slightly convex; disk moderately convex, densely microfoveolate; lateral carina indistinct; cervical sulcus lacking. Scutellum elongate, densely pubescent. Elytra striae sinuate, punctures deep, rounded (figurse 243); interstices convex, not imbricate; sutural stria depressed. Metacoxal face shallowly foveate; metafemoral margins nearly parallel; metatibial carinae distinct and complete, ventrolateral carina contiguous with dorsal margin of mucro; mucro curved, slender, one-third as long as basitarsus, similar to that of *M. coryphae* (figure 215). Apex of 8th tergite visible at apex of pygidium.

Male genitalia.—As in figures 245 and 246; median lobe moderately broad at apex; ventral valve ogival, apex acute; armature of internal sac consisting of broad, dense cluster of fine spicules attached to ovate amorphous structures, middle of sac with 30–32 curved, elongate denticles, closure valve C-shaped; fused lateral lobes with apical plate evenly rounded (figure 246), marginal setae stout, inner surface with small clusters of fine setae, transverse ridge setose, inner surface anteriad of ridge finely setose in fanlike pattern and with two clusters of pores.

Size.—Body length 3.4–4.2 mm; width 2.2–2.6 mm.

Type depository.—BMNH *(leucospilus);* USNM holotype No. 41901 *(alternatus);* MNHP *(lineatipennis).*

Type locality.—Mexico, Veracruz (*leuco-spilu*s lectotype); Hawaii, Oahu, Barber's Point *(alternatus);* Hawaii *(lineatipennis).*

Distribution.—LA, TX, HI; Mexico.

Host plants.—Ipomoea cairica, I. carnea fistulosa, I. crassicaulis, I. leptophylla, I. pes-caprae; Merremia aegyptia (Hawaii). Janzen (1980) records it from Costa Rica in *Ipomoea carnea fistulosa* and *I. pes-caprae.* De Luca (1967a) lists *I. biloba* without locality or source.

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—This species was evidently introduced into Hawaii sometime before 1923, when O.H. Swezey first collected it. Bridwell compared his *Megacerus alter-natus* to *M. leucospilus* but considered them to be distinct species. The alternate striping of pubescence tends to be complete in the Hawaiian specimens but may be fragmentary in Mexican and Central American specimens.

Megacerus (Serratibruchus) maculiventris (Fahraeus)

(Figures 52, 55, 247–251)

Bruchus maculiventris Fahraeus 1839:38.

Bruchus (Pachybruchus) maculiventris: Pic 1913a:33.

Megacerus maculiventris: Blackwelder 1946:762; Teran and Kingsolver 1977:196; Janzen 1980:948; Johnson and Kingsolver 1982:412; Pfaffenberger 1984:21; Udayagiri and Wadhi 1989:221.

Kytorhinus quadratus Motschulsky 1874:205, synonymized by Teran and Kingsolver 1977.

Bruchus impiger var.: Sharp 1885:487; [Schaeffer (1907:295) stated that his new species, *serratifemur,* is the species Sharp illustrated as a variety of *impiger*].

Bruchus serratifemur Schaeffer 1907:294; Pic 1913a:49; Johnson 1968:1269, synonymized by Teran and Kingsolver 1977.

Bruchus (Pachybruchus) kytorrhinensis: Pic (1913a:29) proposed this new name for *quadratus* Motschulsky (not Suffrian 1870)

Mylabris serratifemur: Leng 1920:305.

Megacerus kytorrhinensis: Blackwelder 1946:762.

Bruchus mactatus Pic 1932:36, synonymized by Teran and Kingsolver 1977.

Acanthoscelides mactatus: Blackwelder 1946:760.

Bruchus (Pachybruchus) triangularifer Pic 1942:10, synonymized by Teran and Kingsolver 1977.

Bruchus (Pachybruchus) triangularifer var. *multisparsus* Pic 1942:10, synonymized by Teran and Kingsolver 1977.

Pachybruchus triangularifer: Pic 1954:184.

Pachybruchus triangularifer var. *multisparsus:* Pic 1954:184.

Bruchus kytorrhinensis Pic 1913b:110.

Megacerus (Serratibruchus) maculiventris: Teran and Kingsolver 1977:196.

Color.—Integument varying from red to black; head always black, antenna varying from basal seven and terminal segments red to black with some reddish suffusion; pronotum all black to black median shield with red flanks (figure 247); elytra varying from all black to red with black basal patch; venter of body variable with red and black patches; legs red to black. Vestiture of head mostly yellow with white patch behind eye; pronotum mixed white and yellow in pattern shown in figure 247; elytral vestiture varying from black with scattered white spots in those specimens with uniformly black elytra to black with white patches on red integument; pygidium uniformly yellow, uniformly white, or yellow with white patches, always with paired subapical black spots, sometimes with another pair at one-third from base (figure 248); venter of body with variable-sized patches of red, white, yellow, and red vestiture in no consistent pattern.

Structure.—Vertex finely, densely punctate, frontal carina prominent; ocular index 9:1 in males, 5:1 in females; ocular sinus three-fifths as long as eye in males, one-half as long as eye in females; antennae as for genus. Pronotum subpentagonal (figure 247), lateral margins nearly straight, disk convex, basal lobe slightly elevated and sulcate, surface microfoveolate on basal lobe, interspaces punctate, lateral areas more finely punctate; lateral carina curved. Scutellum rectangular, pubescent. Elytra 1.1 times as long as wide (figure 247), convex but sulcate in basal one-half along suture; striae narrow, deeply impressed, punctures elongate; interstices finely, densely imbricate. Metacoxal face densely punctate in lateral two-thirds, smooth and impunctate medially; metafemur serrate on ventromesal margin (figure 52); metatibia with ventrolateral, dorsomesal, and ventromesal carinae complete, dorsolateral carina intermittent or evanescent, ventral face of tibia with partial carina ending in mucro, mucro short, scarcely longer than lateral denticle, coronal denticles minute (figure 249). Pygidial punctation concealed by vestiture.

Male genitalia.—As in figures 250 and 251; median lobe slender, apical ring broad; ventral valve narrowly triangular, apex produced, margins slightly sinuate; armature of internal sac consisting of small cluster of fine spicules at apical orifice attached to bilobed, amorphous structure, middle of sac with dense, V-shaped cluster of fine spicules, apex of sac with eight curved, elongate denticles in two irregular rows; closure valve angulate; lateral lobes with apical plate rounded but slightly emarginate (figure 251), densely setose on margin, transverse row of pores caudad of plate, ridge extended laterally into small, membranous alae; main body of lobes porous and marked with diagonal lines.

Size.—Body length 2.0–2.5 mm; width 1.1–1.6 mm.

Type depository.—NHRS *(maculiventris);* ZMUM *(quadratus);* MNHP *(mactatus, triangularifer, multisparsus);* USNM, holotype No. 42338 *(serratifemur).*

Type locality.—Venezuela, Caracas *(maculiventris);* Brazil *(quadratus, multisparsus);* Arizona *(serratifemur);* Colombia *(mactatus)*; Peru *(triangularifer).*

Distribution.—AZ, TX; Mexico, Central America, northern South America.

Host plants.—No hosts are known for the United States records. Extralimital hosts are *Ipomoea pes-caprae, I. purpurea,*

I. marginisepala, I. aristolochiaefolia, I. rubriflora, I. nil.

Natural enemies.—None recorded.

Immatures.—Pfaffenberger 1980 (Egg, first and final larval instars).

Discussion.—The serrate ventromesal margin of the metafemur will immediately separate this species from all other species in this report except *M. schaefferianus,* from which *M. maculiventris* may be distinguished by its mottled integumental and vestitural pattern (no pattern in *M. schaefferianus*), by the two or four small, black pygidial spots (four large spots in *M. schaefferianus*), and by the fine setae on the metacoxal face (tuft of coarse white setae in *M. schaefferianus). Megacerus maculiventris* is widespread in the Western Hemisphere.

Megacerus (Megacerus) ripiphorus (Fahraeus)

Bruchus ripiphorus Fahraeus 1839:35; Pic 1913a:44.

Acanthoscelides ripiphorus: Blackwelder 1946:761.

Megacerus ripiphorus: Teran and Kingsolver 1977:133; Johnson and Kingsolver 1982:412; Udayagiri and Wadhi 1989:215.

Mylabris wheelocki Blatchley 1930a:35, 1930b:59.

Megacerus wheelocki: Bottimer 1968c:1035; Johnson 1969e:237.

Except for its smaller dimensions, this species is indistinguishable from *M. cubiculus* (Casey).

Size.—Body length 1.7 mm; width 1.2 mm.

Type depository.—NHRS *(ripiphorus);* PURC *(wheelocki).*

Type locality.—Colombia *(ripiphorus);* Florida, Royal Palm Park *(wheelocki).*

Distribution.—FL; Colombia, Venezuela.

Host plants.—Ipomoea alba (cited by Blatchley as *I. bona-nox*).

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—The two specimens Blatchley described as *Megacerus wheelocki* appear to be identical to the type specimen of *M. ripiphorus,* but the presence of this species in Florida is puzzling since the other three specimens examined are from Venezuela and Colombia. No additional records are known from the United States. Mislabeling of the specimens seems unlikely since Blatchley collected them. Since the range of *M. cubiculus* extends from eastern United States to Panama, it and *M. ripiphorus* may eventually prove to be one species. Horn (1885a) synonymized *cubiculus* with *M. impiger,* but the problem of the correct application of the three names needs further study.

The small size of this species will for the present separate it from *M. cubiculus* and *M. impiger,* the other two reddish-brown species in the United States.

Megacerus (Serratibruchus) schaefferianus (Bridwell)

(Figures 252–255)

Bruchus crenatus Schaeffer 1909:385; Pic 1913a:23; Johnson 1968:1269 (lectotype designation).

Megacerus schaefferianus Bridwell 1929b:112 (as new name for *B. crenatus* Schaeffer, not Thunberg 1791); Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1035; Teran and Kingsolver 1977:206; Johnson and Kingsolver 1982:412; Udayagiri and Wadhi 1989:221.

Megacerus crenatus: Johnson 1968:1269.

Megacerus (Serratibruchus) schaefferianus: Teran and Kingsolver 1977:206.

Color.—Integument entirely black. Vestiture white, uniformly distributed (figure 252), denser on ventral parts of body. Pygidium with four black spots (figure 253), 5th ventral abdominal segment with black spot either side of emargination.

Structure.—Vertex finely, densely punctate; frontal carina prominent; ocular index 3.25:1; ocular sinus one-half length of eye. Pronotum (figure 252) subpentago-

nal, apex rounded, posterior angles acute; basal lobe broadly sulcate between gibbosities; disk strongly convex in lateral aspect; lateral carina present in anterior one-half of margin; cervical sulcus brief. Scutellum quadrate, densely setose. Elytra 1.5 times as long as wide (figure 252); striae regular, punctures deep, scarcely encroaching on interstices, 1st and 2nd deflected laterally at base; interstices finely imbricate. Metacoxal face irregularly foveolate in lateral one-half, polished and impunctate in medial one-half. Metafemur serrate on ventrolateral margin. Metatibia with dorsolateral, ventrolateral, ventromesal, and dorsomesal carinae present; mucro short, not as long as lateral denticle. Fifth abdominal segment of both sexes deeply emarginate; pygidium convex.

Male genitalia.—As in figures 254 and 255; median lobe slender, apical ring broad; ventral valve triangular with margins straight; armature of internal sac consisting of small cluster of fine spicules at apical orifice connected to bilobed structure; middle of sac with short, V-shaped cluster of sharp spines, apex with another V-shaped cluster of eight spines, and a median rod, closure valve C-shaped; lateral lobes with fused apices rounded (figure 255), densely setose, transverse ridge membranous with rows of sensory pores, middle of lobes porous.

Size.—Body length 3.9 mm; width 2.2 mm.

Type depository.—USNM, lectotype by Johnson 1968 (as *Bruchus crenatus*).

Type locality.—Arizona, Nogales.

Distribution.—AZ; Mexico.

Host plants.—*Ipomoea longifolia* (flowers)

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The large size, uniformly gray vestiture, and four pygidial spots should distinguish this species easily from others in this handbook. Available specimens are remarkably uniform in size.

Tribe Bruchini Bridwell

Genus *Bruchus* Linnaeus

Bruchus Linnaeus 1767:604 (not *Bruchus* Geoffroy 1762). Type species: *Dermestes pisorum* Linnaeus 1758:356, by subsequent designation, Latreille 1810.

Laria Scopoli 1763:21, of authors.

Mylabris Müller 1764:14. Type species: *Dermestes pisorum* Linnaeus 1758, by subsequent designation, Bridwell 1932 (not *Mylabris* Fabricius 1775).

Bruchoides Ramos 1978:317. Type species: *Bruchus tesselatus* Mulsant and Rey 1858:38, by original designation (as subgenus, not North American).

Acanthobruchus Ramos 1978:317. Type species: *Bruchus venustus* Fahraeus 1839:75, by original designation (as subgenus, not North American).

For a full explanation of the involved applications of the names *Bruchus* and *Mylabris*, see Pope (1956) and Borowiec (1988). Donahaye (1974) illustrated male and female genitalia for seven of the most common stored-product *Bruchus* species.

Although *Laria* was substituted for *Bruchus* by numerous authors, it cannot be used in the Bruchidae since Bridwell (1932) designated *Laria dulcamarae* Scopoli, a nitidulid, as the type species.

Three species have become established in continental North America, two of these also in Hawaii.

Integument black with legs sometimes red or reddish orange. Vestiture of white or yellowish setae in relatively consistent dorsal and pygidial patterns.

Head lacking frontal carina, antenna subserrate; pronotum transverse, apex truncate, lateral margin with median tooth. Elytral striae straight, lacking basal denticles; interstices subequal in width; middle tibia of male with terminal armature characteristic of species; ventrolateral margin of metafemur with distinct subapical angle,

or tooth, ventromesal margin with or without subapical denticle.

Male genitalia elongate, slender.

Most species of *Bruchus*—including all of the species described herein—are univoltine (producing one generation a year) because eggs are laid only on green pods of the host legume (Southgate 1981). These species do not breed in storage; however, they may emerge under storage conditions.

This Old World genus is diverse as it now stands and needs a thorough review. Characters used to distinguish *Bruchus* are the lateral pronotal margins each with a single tooth (figure 46), or denticle; ventrolateral margin of the metafemur with a denticle or angular tooth (figure 47); ventromesal margin of metafemur with or without a denticle; and bases of elytral striae lacking denticles.

The taxon *Bruchus* was used for many years as the repository for new species of Bruchidae described in both the Old World and the New World. Schilsky (1905) described *Acanthoscelides* and *Bruchidius* and transferred several species names to *Bruchidius.* Subsequent authors transferred the New World *"Bruchus"* species to *Acanthoscelides.* The three New World species belonging to the "true" *Bruchus*—*pisorum* (Linnaeus), *rufimanus* Boh., and *brachialis* Fahraeus—were introduced from the Old World. *Bruchus lentis* Froelich has been reported from the Pacific Northwest as an escape from imported seeds but apparently has not become established in the United States or Canada.

References to *Bruchus* are extensive in Old World literature but are limited in the New World. See Luk'yanovich and Ter-Minassian (1957:70) for a summary of Old World references to that date. Aitken (1975) lists most of the commercially important species of *Bruchus* and their host plants and distribution.

Key to U.S. *Bruchus*

1 Hind femur with long external tooth near apex; mucro of hind tibia shorter than lateral denticle (figure 47); protibia and apical one-half of mesotibia and tarsus red ..... ***pisorum*** (Linnaeus)

Hind femur with only an angulation in ventral border of femur (figure 257); mucro short or long; at least part of fore legs red, mid legs black 2

2(1) Mucro of metatibia set at angle, twice as long as lateral denticle (figure 274); basal four antennal segments red, remainder black; mesofemur of male inflated (figure 276); mesotibia of male sinuate with sharp terminal hook; 3.6–3.8 mm long ..... ***rufimanus*** Boheman

Mucro of metatibia straight, short, no longer than lateral denticle (figure 257); basal five and apical antennal segments red in female, entirely yellow in male; protibia and mesotibia curved in male; mesotibia with flat, bifid, toothlike terminal process in male ..... ***brachialis*** Fahraeus

Bruchus brachialis (Fahraeus)

(Figures 256–263)

Bruchus brachialis Fahraeus 1839:79; (American references only follow) Bottimer 1931:347; Bridwell and Bottimer 1933:739; Annand and Pinckney 1936:1; Bottimer 1936:807, 1937:379; Pinckney 1937:621; Vayssière and Lepesme 1941; Osborn 1949:159; Neilson and Handford 1954; Randolph and Gillespie 1958:401; Steinhauer 1959:955; Bottimer 1968c:1033,1039; U.S. Department of Agriculture 1971:736; Johnson and Kingsolver 1982:416; Udayagiri and Wadhi 1989:183.

Bruchus pallidicornis Mulsant and Rey 1858:33.

Laria brachialis: Bedel 1901:357.

Mylabris brachialis: Baudi 1886a:13.

Color.—Body and appendages black except four basal antennal segments reddish orange (female) or entire antenna reddish orange (males), no more than apical one-half of profemur and all of protibia reddish orange (females) or fore leg entirely reddish orange (males). Dorsal vestiture intermixed black and brown with irregular rows of white spots elytra, pronotum mostly brown with white on posterior corners, usually along lateral borders and on basal lobe; scutellum white; pygidium mostly white with scattered brown setae and two variable black subapical spots; venter of body white with some brown intermixed with white on metepisternum, row of condensed white spots near lateral border of abdomen.

Structure.—Vertex and frons densely punctulate tending in places to be imbricate, frontal carina absent, dorsal margin of frons with small, glabrous boss; ocular index 3.2:1; ocular sinus three-fifths length of eye; antenna with club segments broad, terminal segment ovate, extending to humerus. Pronotum trapezoidal (figure 256), lateral margins strongly sinuate, marginal denticle prominent, disk convex, basal lobe sulcate, margin depressed either side of basal lobe; surface densely foveolate, asperate, interspaces imbricate; lateral carina brief at lateral denticle; cervical sulcus hidden in vestiture. Scutellum quadrate, deeply emarginate. Elytra together slightly longer than wide; convex, depressed near scutellum; striae narrow, deep, parallel; interstices densely punctate-imbricate in basal one-half, more sparsely punctate toward apex; metacoxal face densely punctulate to imbricate, fossula glabrous; hind leg as in figure 257; metafemur with ventrolateral carina angulately toothed near apex, ventromesal margin neither carinate nor denticulate, mesal face minutely tuberculate; mesotibia (figure 257) slightly arcuate and dilated; lateral, ventral, and dorsomesal carinae present, ventrolateral carina absent, mucro short, subequal to lateral denticle, three coronal denticles small; male mesofemur slightly dilated medially; male mesotibia slightly arcuate, apical spine bifid (figure 258). First abdominal segment of male concave with setae arranged in circular pattern; pygidium (figure 259) slightly convex, surface foveolate.

Male genitalia.—As in figures 260 and 261; median lobe slender (figure 260), slightly expanded toward apex; ventral valve ovate, apex broadly rounded, dorsal valve rounded; armature of internal sac consisting of a pair of small setal patches at apical orifice, sac lined with fine spicules for entire length, closure valve undifferentiated; lateral lobes elongate (figure 261), slender, cleft one-half their length, apices strongly curved, each with setose, alate process; 8th sternite bilobed, apices conjoined; male spiculum gastrale Y-shaped. Eighth tergite of male hoodlike, apical margin thickened, setose (figure 262); female 8th tergite hoodlike, apical margin bilobed, serrate and setose; 8th sternite (figure 263) elongate, T-shaped.

Size.—Body length 2.5–2.9 mm; width 1.7–1.7 mm.

Type depository.—NHRS.

Type locality.—Germany.

Distribution.—AL, AR, BC, CA, CO, CT, DC, DE, FL, GA, ID, IA, IN, KS, LA, MA, MD, MI, MO, MS, NC, NE, NJ, NY, OH, OK, ON, OR, PA, SC, TN, TX, VA, WA, WY; Old World.

Host plants.—Lathyrus sativus; Vicia benghalensis, V. caroliniana, V. cracca, V. grandiflora, V. pannonica, V. sativa nigra, V. sativa sativa, V. villosa dasycarpa, V. sepium, V. villosa villosa. Waterworth (1986) listed several other host records of this species found in seeds imported from Europe. Adults found on *Daucus carota* flowers.

Natural enemies (Old World and New World).—*Anisopteromalus calandrae; Dibrachys cavus; Dinarmus acutus; Eupelmus amicus, E. cyaniceps; Eurytoma obtusa, E. tylodermatis; Habrolepoidea tarsalis; Laelius utilis; Lariophagus distinguendus; Macroneura vesicularis; Microdontomerus anthonomi; Pteromalus* sp.; *Tetrastichus*

bruchivorus, T. bruchophagi; Triaspis thoracica; Zatropis incertus.

Immatures.—Pfaffenberger 1977 (final larval instar), 1991:564 (larva); see below for description of the egg.

Discussion.—The "vetch bruchid" was first detected in 1931 in pods of *Vicia villosa* in New Jersey, Delaware, and Maryland and reported by Bottimer (1931). A distribution map was published by USDA (1971), and the species has now spread to 33 of the 48 contiguous states and British Columbia and Ontario in Canada. Downie (1950) found specimens of *B. brachialis* from Washington State dated 1931, the same year as the first detection on the East Coast.

This species is smaller than either *Bruchus pisorum* or *B. rufimanus.* Male antennae and fore legs are entirely yellow. The male mesotibial spine is bifid contrasted to the single hook of the other two species. Useful characters are found in female as well as male genitalia for this species.

Eggs of *Bruchus brachialis* are 0.5–0.6 mm long, white, cylindrical, slightly tapered with ends rounded, and are elevated above the pod surface on an elongated basal "foot" cemented to the pod.

Bruchus pisorum (Linnaeus)

(Figures 46, 47, 264–271)

Dermestes pisorum Linnaeus 1758:356.

Bruchus pisi: Linnaeus 1767:604; Gmelin 1790:1767; Jacquet 1888.

Bruchus pisorum: Linnaeus 1758:34; Latreille 1810:192; Horn 1873:315; Hubbard and Schwarz 1878:660; Abeille de Perrin 1888; Riley 1892:185; Blatchley 1910:1235; Fall 1910:161; Cushman 1911:507; Pic 1913a:41; Bridwell 1932:104; Bissell 1938:536; Larson et al. 1938; Metcalf and Flint 1939:808; Back 1940:7; Vayssière and Lepesme 1941:198; Hoffman 1945:46; Blackwelder 1946:758; Bridwell 1946:52,54; Brindley et al. 1946, 1952; Zacher 1952:461; Pope 1956:45; Kingsolver 1964b:3; Bottimer 1968c:1033,1039,1042; Decelle 1975:115; Johnson and Kingsolver 1982:416; Borowiec 1987:70, 1988:194; Udayagiri and Wadhi 1989:197; Decelle and Lodos 1989:172.

Mylabris pisorum: Baudi 1886a:16; Leng 1920:305; Kannan 1923:27; Essig 1929a:484.

Mylabris cruciger Geoffroy 1785:112.

Laria salicis Scopoli 1763:22.

Bruchus sparsus Fabricius 1801:398.

Bruchus intermedius Motschulsky 1854:10.

Bruchus lunarius Rey 1893:3.

Bruchus pisorum var. *unifasciatus* Rey 1893:3.

Bruchus fabae Brulle 1873:3228.

Mylabris pisorum: Baudi 1886a:16.

Color.—Integument black with four basal antennal segments, protibia and tarsi, part or all of mesotibia, and tarsus reddish orange. Vestiture white, yellowish brown, and dark brown or black in pattern of figure 264 on pronotum and elytra; head white or white mixed with yellowish brown; pronotum mostly yellowish brown with intermixed white, scattered white patches on disk, basal lobe with intense white patch; scutellum white; elytra mostly yellowish brown with dark brown lateral maculae separated from dark brown apical patches by diagonal row of white patches, small white patches on 3rd interstice, on anterior margin of maculae, and near apices; pygidium mostly white, apex yellowish brown, basal and subapical patches black; venter mostly white but intermixed with yellowish brown on metepisternum and sides of abdomen.

Structure.—Vertex, frons, and clypeus densely foveolate; frontal carina absent; ocular index 3.6:1; ocular sinus three-fifths as long as eye; postocular lobe wedge-shaped, densely setose; antenna moderately eccentric, club segments ovate in cross section, extending to humerus. Pronotum transverse (figure 265), broadly semicircular; each lateral margin with

small tooth at midpoint; disk densely foveolate, interspaces punctulate; lateral margin beneath with fine, polished sulcus from posterior corner to tooth; cervical sulcus fine, indistinct. Scutellum transverse (figure 264), densely setose; mesepi-meron narrowly reaching mesocoxa. Elytra together 1.1 times as long as wide, depressed or slightly sulcate along suture, laterally convex; striae deep, narrow, subparallel, lacking basal denticles; interstices coarsely but sparsely foveolate and imbricate; humeri coarsely imbricate; apex of mesotibia acuminate (figure 266); metacoxae densely, finely punctate; hind leg as in figure 47; ventrolateral margin with long, tapered denticle; ventromesal margin with small, blunt denticle; metatibia slender, slightly dilated toward apex, lateral, ventral, and dorsomesal carinae distinct; mucro short, equal to lateral denticle, three minute coronal denticles. Abdomen not modified, male 5th ventral slightly emarginate; pygidial disk (figure 267) densely foveolate, on male apex truncate exposing apex of 8th tergum, on female apex evenly rounded. Middle tibia of male with short, curved hook.

Male genitalia.—As in figures 268 and 269; median lobe slender, cucullus scarcely widened; ventral valve subtriangular, strongly curved; dorsal valve evenly rounded; armature of internal sac consisting of double row of fine spicules at apical orifice, an elongate mass of fine, acute spicules in middle, a pair of curvate masses of spicules at apex enclosing a large patch of imbricate, scalelike setae; apical closure valve membranous; lateral lobes elongate, slender, cleft nearly to base, apices strongly bowed, finely setose; male 8th sternite reduced to paired lobes, apex of 8th tergite bluntly rounded, spiculum gastrale (figure 270) T-shaped; female 8th tergite (t8) sinuately lobed; 8th sternite (s8) as shown in figure 271.

Size.—Body length 3.9–4.9 mm; width 2.3–2.8 mm.

Type depository.—Uncertain. Possibly destroyed.

Distribution.—Cosmopolitan. AB, AL, BC, CA, CO, CT, DC, FL, GA, ID, KS, KY, MA, MB, MI, MN, MO, MS, MT, NB, NC, NF, NH, NJ, NM, NS, NY, ON, OR, PA, PE, PQ, SC, SD, SK, TX, UT, WA.

Host plants.—Lathyrus sativus; Pisum sativum arvense, P. elatius; Vicia sp., *Vicia faba; Vigna radiata* var. *radiata.* The *Vicia* and *Vigna* records may be the result of misidentifications.

Natural enemies (Old World and New World).—*Anisopteromalus calandrae; Aprostocetus aethiops, A. claviger; Bruchobius laticeps; Bruchocida orientalis; Dinarmus laticeps, D. magnus; Eupelmus amicus; Eurytoma* sp.; *Gastrancistrus undulatus; Microdontomerus anthonomi; Pteromalus leguminis, P. micans, P. sequester; Pyemotes ventricosus; Staphylinus nigrellus; Systasis encyrtoides; Tetrastichus claviger, T. nerio; Triaspis gibberosus, T. thoracica; Trichomalopsis leguminis; Uscana semifumipennis, U. senex.*

Immatures.—Riley 1892 (1st larval instar); Pfaffenberger 1977 (final larval instar), 1991:564 (larva).

Discussion.—Bruchus pisorum is one of the most widely distributed species in the world. Old World literature is voluminous on its control (see Luk'yanovich and Ter-Minassian 1957). The species is most destructive to the common varieties of *Pisum sativum* and usually emerges in storage. It does not, however, reinfest stored pea seeds as does *Acanthoscelides obtectus* and some other species. Because it must oviposit on green pods in the field, it has only one generation each year.

Larson et al. (1938) and Pajni (1981) detailed the life history of this species. Smith and Brower (1974:322) recorded the karyotype. Back (1940:9) and Brindley et al. (1952) discussed field infestations.

The common name for this bruchid is "pea weevil."

Bruchus rufimanus (Boheman)

(Figures 272–280)

Bruchus rufimanus Boheman 1833:58; Horn 1873:315; Hamilton 1892b:162; Pic 1913a:45; Campbell 1920:1; Kannan 1923:28; Essig 1929a:485; Back 1940:7; Vayssière and Lepesme 1941; Decelle 1975:115; Pfaffenberger 1977:133. Many other references can be found in Luk'yanovich and Ter-Minassian 1957:100 and Udayagiri and Wadhi 1989:200.

Laria rufimana: Chittenden 1912a:59.

Mylabris rufimana: Baudi 1886a:14.

Mylabris rufimana var. *velutina:* Baudi 1886a:31.

Mylabris rufimanus: Leng 1920:305; Essig 1929a:485.

Bruchus granarius, of authors (not Linnaeus 1767).

Bruchus fabae Motschulsky 1854:6.

Bruchus rufimanus var. *velutinus* Mulsant and Rey 1858:27.

Bruchus rufimanus var. *diversipubens* Pic 1930b:14.

Bruchus rufimanus var. *rufimanus* Luk'yanovich and Ter-Minassian 1957:100.

Color.—Body and appendages black except four basal antennal segments and fore legs reddish orange. Vestiture variable; head and pronotum usually with yellowish-brown vestiture, lateral pronotal margin and discal spots white, basal lobe with white, triangular patch; scutellum white; elytra varying from pattern of white spots on black background with short, yellowish-brown sutural stripe (figure 272) to intermixed yellowish brown, black, and white, with variably distributed white spots, an occasional specimen with elytra entirely white; pygidium varying from white to brownish yellow, two subapical black spots bordered with brown; venter of body white, usually with some yellowish brown on metepisternum.

Structure.—Vertex and frons densely foveolate in circular pattern around median, glabrous boss, each foveola round and setate; frontal carina absent; ocular index 3:1; ocular sinus four-fifths as long as eye; antenna slightly eccentric from 5th segment, terminal segment ovate, reaching to metacoxal border. Pronotum trapezoidal (figure 273), lateral margins sinuate, with denticle at midpoint of margin, apex truncate; disk convex, slightly depressed near posterior corners, basal lobe with triangular sulcus; surface densely, irregularly punctate; lateral carina absent; cervical sulcus hidden in vestiture. Scutellum quadrate, emarginate. Elytra slightly longer than wide, moderately convex; striae deep, narrow, subparallel, slightly sinuate toward base; interstices flat, punctate-imbricate in basal one-third, densely punctulate in apical two-thirds, humeri coarsely imbricate; metacoxal face densely, finely punctate, fossula glabrous; hind leg as in figure 274; ventrolateral margin with angulate subapical denticle, ventromesal margin with minute subapical denticle; mesotibia straight, slightly dilated, ventral and dorsomesal carinae distinct, lateral carina intermittent, ventrolateral carina absent; mucro one-fifth as long as basitarsus; male mesofemur strongly dilated and sulcate (figure 276), ventral margin of mesotibia sinuate, apex with small, angulate hook. Fifth abdominal sternum shallowly emarginate in male, straight in female; pygidium of both sexes convex (figure 275), apex of male truncate with apex of 8th tergite visible, apex of female evenly arcuate.

Male genitalia.—As in figures 277 and 278; median lobe elongate, apical one-eighth slightly expanded, cucullus scarcely expanded; ventral valve broadly ogival, apex narrowly acute; dorsal valve not differentiated; armature of internal sac consisting of convergent pair of fine spicules at apical orifice, a mass of fine, acute spicules in basal one-half, imbricate scales and scale-like setae in apical one-half, a curved, dentate sclerite near apex; closure valve undifferentiated; lateral lobes short, cleft one-half their length, apices strongly incurved; male 8th sternite bilobed with apex narrow

and truncate (figure 279), spiculum gastrale Y-shaped; female 8th tergite narrowly thickened (figure 280) on apical margin; 8th sternite as shown in figure 280 (S8).

Size.—Body length 3.1–4.4 mm; width 2.2–2.6 mm.

Type depository.—NHRS.

Type locality.— Mediterranean.

Distribution.—CA, HI, LA, MB, NH, ON, PQ, SK.

Host plants.—*Vicia faba* and *V. sativa sativa* in the United States. Twenty other legumes have been reported as hosts in the Old World, but many of these are questionable.

Natural enemies (Old World and New World).—*Bruchocida orientalis; Charitopodinus swezeyi, C. terryi; Choetospila elegans; Chremylus elaphus; Dinarmus acutus, D. laticeps, D. magnus; Eurytoma watchli; Lariophagus distinguendus; Pyemotes tritici, P. ventricosus; Triaspis forbesii, T. gibberosus, T. luteipes, T. pallipes, T. similis, T. stictostiba, T. thoracica; Zelus renardii.*

Immatures.—Chittenden 1912a (egg, 1st larval instar); Pfaffenberger 1977 (final larval instar), 1991:564 (larva).

Discussion.—This species is similar in size and general appearance to *Bruchus pisorum,* but the lateral denticle of the metafemur is much smaller than in *B. pisorum* (compare figures 47 and 274) and the black subapical spots on the pygidium are smaller and less pronounced than in *B. pisorum.* Both species are much larger than *B. brachialis.*

The swollen mesofemur and sinuate mesotibia of the male is a good key character.

Campbell (1920) investigated the biology of *B. rufimanus,* and Smith and Brower (1974:322) recorded the karyotype profile. Back (1940:11) discussed field infestations.

The common name for this bruchid is "broadbean weevil.

Tribe Bruchidiini Bridwell

Genus *Borowiecius* Anton

Borowiecius Anton 1994:108. Type species: *Bruchus ademptus* Sharp 1886, by original designation.

Small beetles, 1.1–3.0 mm long. One species in southeastern United States; origin eastern Asia.

Head with prominent frontal carina; eyes and antennae not sexually dimorphic; antenna subserrate; pronotum bell-shaped, disk evenly convex except shallowly sulcate on basal lobe and slightly depressed along basal margin; lateral carina absent; prosternum short, triangular, not dividing coxae; scutellum short, quadrate; elytra ovate, striae sharply defined, 2nd and 3rd ending basally in dentate gibbosity; ventral margin of metafemur sulcate with single acute ventromesal denticle, ventrolateral carina with shallow sinus; male pygidium reflexed at apex; female pygidium vertical.

Male genitalia broad; internal sac with apparent hinge sclerites on either side of apical orifice; basal strut of tegmen ring lacking ventral keel; lateral lobes slender, deeply cleft.

This genus closely resembles *Calloso-bruchus*, especially in the configuration of the hind leg and the basal elytral gibbosity found in some *Callosobruchus,* but the internal sac of species of *Callosobruchus* is armed with burr-like sclerites, the number and shape being characteristic of the species, whereas the internal sac in species of *Borowiecius* is devoid of such sclerites. In contrast to the species of *Callosobruchus* found in the United States and Canada, which have reddish brown or reddish yellow hind legs at most clouded with darker areas, the
hind legs of *B. ademptus* are entirely black, except that the tarsi are yellow.

Borowiecius ademptus (Sharp)

(Figures 281–286)

Bruchus ademptus Sharp 1886:36; Pic 1913a:13.

Callosobruchus ademptus: Chujo 1937a:35; Bridwell 1938a:75; Bottimer 1961:295; Kingsolver 1969a:7; Johnson and Kingsolver 1982:412; Udayagiri and Wadhi 1989:186; Morimoto 1990:132.

Borowiecius ademptus: Anton 1994:108.

Color.—Body black except fore legs and mid legs, antenna and apical three or four abdominal segments yellow, hind legs black except tarsi yellow. Vestiture of black, white, and yellow hairs in pattern shown (figure 281). Head sparsely yellow; pronotum yellow on flanks and basal lobe, otherwise black; scutellum white; elytra with sutural interstices yellow, 3rd interstice with elongate, white basal, median, and apical spots, lateral interstices with alternating white and yellow fragmentary stripes and spots; pygidium uniformly yellow except for basal triangular patch and subapical paired bare spots.

Structure.—Vertex, frons, and clypeus coarsely, densely punctate; frontal carina prominent; ocular index 2.5:1; ocular sinus one-half length of eye; antenna (figure 282) not dimorphic, reaching middle of metepisternum. Pronotum subconical (figure 281), convex, densely foveolate; basal lobe slightly domed; lateral carina obscured by vestiture. Scutellum appearing bilobed. Elytra about as long as wide, evenly convex; striae subparallel, slightly sinuate, 3rd and 4th deflected laterad basally but not reaching basal margin; interstices densely imbricate; metacoxal face densely fossulate except fossula smooth; metafemur with ventrolateral margin carinate, with subapical angulation (figure 283), ventromesal margin carinate, with single sharp denticle as long as the ventrolateral angulation; metatibia with lateral carina prominent ending in sharp denticle, ventrolateral carina sometimes reaching base of mucro, ventral and dorsomesal carinae complete; mucro short, less than one-sixth length of basitarsus. Pygidium not modified, apex of male reflexed into notch in 5th abdominal, disk sculpture hidden by vestiture (figure 284).

Male genitalia.—As in figures 285 and 286; median lobe 5 times as long as wide; ventral valve broad, semicircular, apex slightly produced, middle of internal sac with conical mass of elongate spicules, apical one-half of sac lined with fine, elongate spicules, apex with ring. Lateral lobes simple, elongate, expanded apically.

Size—Body length 2.5–2.9 mm; width 1.6–1.9 mm.

Type depository.—BMNH.

Type locality.—Japan, Yuyama and Nagasaki.

Distribution.—AL, DC, MD, NC; Japan, Korea, China.

Host plants.—*Pueraria montana lobata* (kudzu).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species was formerly assigned to *Callosobruchus* because of the structure of the hind femur, which bears a denticle on the ventromesal margin as well as a blunt angulation on the lateroventral margin. The male genitalia, however, are broad, not long and slender as in *Callosobruchus,* and the internal sac lacks the burrlike sclerites characteristic of *Callosobruchus.* The dorsal pattern resembles that of many *Bruchidius,* and the late B.J. Southgate (personal communication, 1978) expressed the opinion that *ademptus* would be better placed in that genus rather than in *Callobruchus.*

Genus *Bruchidius* Schilsky

Bruchidius Schilsky 1905:B; American references: Bridwell 1932:104; Hoffman 1945:61; Bottimer 1968a:139, 1968c:1028; Udayagiri and Wadhi 1989:114. Many additional references to the genus can be found in the European literature: Hoffman 1945; Luk'yanovich and Ter-Minassian 1957; Borowiec 1987, 1988; Udayagiri and Wadhi 1989. Type species: *Bruchus*

quinqueguttatus Olivier 1795, by subsequent designation Bridwell 1932.

Sparteus Bridwell 1946:55. Type species: *Bruchus villosus* Fabricius, by original designation.

Spermophagus: Arnett 1962:957 (error).

Small bruchids (1.4–2.8 mm). Two species have been introduced into the North American fauna.

Body and appendages entirely black or piceous, basal segments of antenna sometimes reddish yellow. Vestiture white, sparse.

Frontal carina lacking or briefly indicated; eyes deeply emarginate; antenna only slightly eccentric. Pronotum convex, punctate, lacking lateral carina. Elytra with striae parallel, with or without basal denticles. Metafemur with single, minute subapical denticle; mucro short or lacking.

Median lobe of male genitalia lacking hinge sclerites.

This genus consists of about 300 described species and is widespread in the Old World. It is characterized principally by the minute single denticle on the ventromesal margin, absence of denticles on the ventrolateral margin of the metafemur, and lack of lateral marginal denticles on the pronotum. These characters are also descriptive of several other genera (for instance, *Sennius*).

Key to North American *Bruchidius*

[Adapted from Bottimer 1968a]

1 Body and appendages entirely black; 4th stria with prominent, subbasal denticle (figure 287); mucro absent; western United States and Canada ..... ***cisti*** (Fabricius)

Body black with basal four antennal segments reddish yellow, legs sometimes piceous; striae lacking denticles (figure 292); mucro one-eighth as long as basitarsus; eastern United States and Canada....***villosus*** (Fabricius)

Bruchidius is comparable to the New World *Acanthoscelides* in numbers of described species and complexity and needs a thorough monographic treatment.

Bruchidius villosus could be difficult to separate from melanistic forms of *Sennius*, especially *Sennius cruentatus*, in the eastern United States unless male genitalia are dissected. An important character marking *Sennius* is the presence of "hinge sclerites" at the apical orifice of the male genitalia.

Bruchidius cisti (Fabricius)

(Figures 287–291)

Bruchus cisti Fabricius 1775:65.

Bruchidius cisti: Southgate 1963:796; Decelle & Lodos 1989:182.

Bruchus unicolor Olivier 1795:7.

Bruchidius unicolor var. *debilis:* Schilsky 1905:41.

Bruchidius unicolor: Bottimer 1968a:143; Hewitt and Burleson 1976.

Bruchus canus Germar 1824:183.

Bruchus debilis Gyllenhal 1833:53.

Bruchidius villosus var. *pubescens:* Luk'yanovich and Ter-Minassian 1957:143.

Bruchus ater Curtis 1839: vol. 16, p. 745.

Bruchus ater var. *pubescens:* Jacquet 1888:19.

Bruchus autumnalis Motschulsky 1874:226.

Bruchus nugax Motschulsky 1874:226.

Bruchus pulverulentus Motschulsky 1874:218.

Bruchus rostratus Motschulsky 1874:232.

Bruchus tibiellus Stephens 1829:266.

Bruchus villosus var. *pubescens:* Pic 1913a:56.

Mylabris villosa var. *pubescens:* Baudi 1886a:100.

Spermophagus cisti: Schilsky 1905:3.

See Aldridge and Pope (1986:182) for additional discussions of the taxonomic history of this species.

Color.—Body and appendages entirely black (figure 287). Vestiture white with golden sheen on dorsal surfaces, white on ventral areas, pygidium with evanescent white basal triangle.

Structure.—Vertex and frons densely punctulate, punctures crowded, coalescent, frontal carina evanescent or absent; ocular index 7:2; ocular sinus seven-eighths length of eye; antenna extending to humerus, segments only slightly eccentric. Pronotum subconical (figure 287), apex rounded, basal margin sinuate, lateral margins straight; disk evenly convex, faintly sulcate on basal lobe, basal margin impressed either side of basal lobe; surface densely, irregularly foveolate-punctate, foveolae crowded, coalescent; lateral carina absent; cervical sulcus distinct, deep. Scutellum quadrate, emarginate. Elytra 1.2 times as long as wide, evenly convex except depressed in middle of basal margin; striae deep, narrow, slightly sinuate; 4th stria with prominent basal denticle; interstices flat, minutely imbricate; metacoxal face densely punctate except fossula glabrous; metafemur with minute denticle on ventromesal margin (figure 288); metatibia nearly straight, slightly dilated toward apex; lateral carina usually present, sometimes intermittent; dorsomesal carina fine; ventrolateral and ventral carinae absent; mucro minute, lateral denticle and coronal denticles minute, subequal in size. First abdominal segment of male flattened, bearing long, silky setae; 5th sternum deeply emarginate; pygidium of male strongly reflexed, that of female oblique; disk densely punctulate and setose (figure 289).

Male genitalia.—As in figures 290 and 291; median lobe slightly expanded apically (figure 290), apex of dorsal valve rounded, fringed with fine setae; ventral valve triangular, strongly arched in lateral aspect; armature of internal sac consisting of paired, spiny, ovoid sclerites near base of sac with remainder of sac elongate, densely lined with small, thornlike denticles; lateral lobes as in figure 291, deeply cleft.

Size.—Body length 2.3–3.4 mm; width 1.4–1.9 mm.

Type depository.—BMNH (*cisti,* lectotype by Aldridge and Pope 1986:183); Halle (*canus,* lectotype by Zampetti 1981:404); unknown *(unicolor* and *debilis).*

Type locality.—Great Britain.

Distribution.—BC, MT; Europe, Asia.

Host plants.—Cynoglossum sp.; *Onobrychis viciifolia; Spartium junceum.*

Natural enemies.—Dynarmus acutus; Pteromalus sequester; Pyemotes tritici; Uscana semifumipennis, U. senex.

Immatures.—Not described.

Discussion.—Because of its totally black integument and restricted range in the United States, this species should present no problem in identification. The lack of a substantial mucro and the prominent denticle at the base of the 4th stria will separate it from *Bruchidius villosus.*

Bruchidius cisti was first reported in the United States (Montana) in 1976 (Hewitt and Burleson, as *Bruchidius unicolor*).

Bruchidius villosus (Fabricius)

(Figures 292–296)

Bruchus villosus Fabricius 1792:373.

Sparteus villosus: Bridwell 1946:55.

Bruchidius villosus: Zacher 1952:464. Frick 1962; Southgate 1963:795.

Bruchus cisti sensu Paykull 1800 (not Fabricius 1775).

Bruchus ater Marsham 1802:236.

Bruchidius ater: Southgate 1963:795; Parnell 1964:73; De Luca 1967b; Bottimer 1968a:142; Frankenhuyzen and Perquin 1971, 1972.

Bruchus fasciatus: Steffan 1946 and others (not Olivier 1795).

Spermophagus fasciatus (Olivier) of Arnett 1962:957.

Mylabris villosus: Baudi 1886a:44.

Color.—Body and appendages black except antennal segments 1–4 reddish brown.

Vestiture uniformly white with golden sheen on dorsal surfaces, white on ventral surfaces.

Structure.—Vertex and frons densely punctulate; frontal carina short, not prominent; ocular index 2.5:1; ocular sinus four-fifths as long as eye; antennal segments slightly eccentric from 5th segment, extending to humerus. Pronotum bell-shaped (figure 292), lateral margins straight except constricted at apex by cervical sulcus; disk convex, basal lobe shallowly sulcate, basal margin impressed either side of basal lobe; surface irregularly punctulate-foveolate; lateral carina absent; cervical sulcus distinct, extending across prosternum. Scutellum subquadrate, emarginate. Elytra together slightly longer than wide (figure 292), convex, lightly impressed around scutellum; striae narrow, deep, subparallel, 3rd, 4th, and 5th each ending in deep basal pit, the rim of which is sometimes extruded into blunt denticle; interstices densely imbricate; metacoxal face densely punctulate, fossula glabrous; hind leg as in figure 294; ventro-mesal margin with one minute, subapical denticle nearly hidden in pubescence; metatibia slightly dilated toward apex, lateral and ventral carinae sometimes evanescent; mucro short, acute, one-tenth as long as basitarsus, lateral and coronal denticles subequal. Fifth abdominal sternum broadly emarginate; pygidium (figure 293) densely punctate and pubescent.

Male genitalia.—As in figures 295 and 296; median lobe slender; dorsal valve membranous; ventral valve broad at base, strongly narrowed, apical portion subparallel; internal sac armed with round or truncate denticles in basal one-third, two parallel patches of elongate spicules at midpoint, and a large, single patch of spicules near apex; lateral lobes slender, deeply cleft (figure 296).

Size.—Body length 2.4–3.2 mm; width 1.5–2.2 mm.

Type depository.—UZMC *(villosus);* BMNH *(ater).*

Type locality.—Germany *(villosus,* lectotype); Great Britain (*ater,* lectotype).

Distribution.—DE, MA, MD, NJ, NY, ON, VA; Europe.

Host plants.—Cytisus scoparius; Laburnum alpinum, L. anagyroides; Petteria ramentacea; Spartium junceum. Several other host plants are recorded from Europe (Frick 1962). Adults feed in flowers of *Cytisus scoparius.*

Natural enemies.—Dinarmus acutus; Pteromalus sequester; Torymus persicariae; Triaspis sp.; *Trichogramma* sp.

Immatures.—Frick 1962 (oviposition, eggs); Parnell 1964 (all instars—larvae, prepupa, pupa; illustrated).

Discussion.—Bruchidius villosus has appeared in literature under several names, and Aldridge and Pope (1986) have summarized the complexities. Southgate (1963) concluded that *Bruchidius ater* was the proper name, and Bottimer (1968a) followed his interpretation.

This Old World species was first reported in the United States by Olsen (1918), who found it in Massachusetts. It was subsequently found in Virginia and several other eastern states and provinces. See Bottimer (1968a) for a discussion of early history of its invasion.

Characters in the key to genera and key to *Bruchidius* species will separate it from other species.

Genus *Callosobruchus* Pic

Bruchus (Callosobruchus) Pic 1902:6. Type species: *Curculio chinensis* Linnaeus 1758, by subsequent designation, Bridwell 1929a.

Callosobruchus Pic 1912:92; Bridwell 1929a:40; Bottimer 1968c:1029,1042 (history of usage of the name *Callosobruchus*).

Small beetles, 1.1–3.0 mm long. Four species are found in the United States and Canada.

Integument black, red, or yellow.

Head with prominent frontal carina; eyes and antenna sometimes dimorphic; antenna subserrate (figure 300) to strongly pectinate (figure 299); pronotum bell-shaped, disk usually medially sulcate, sometimes moderately gibbous; elytra with or without dentate basal gibbosity; striae distinct, generally parallel; ventral margin of metafemur sulcate, ventrolateral and ventromesal carinae dentate or angulate (figure 310); metatibia with four complete carinae.

Male genitalia usually long, slender, lateral lobes slender, deeply cleft.

Callosobruchus differs from *Bruchus* principally by lack of a tooth on each lateral margin of the pronotum (compare figures 265 and 297) and lack of a hooklike appendage on the middle tibia of males.

Key to U.S. *Callosobruchus*

[Also see Haines (1989) for a key to *Callosobruchus* species]

1 Elytral striae three and four each with prominent subbasal denticles on slight gibbosity (figures 281 and 297) 2

Elytral striae extending to basal margin, lacking prominent denticles or gibbosity (figure 305) 3

2(1) Pattern of pronotum and elytra as in figure 327; pygidium in both sexes only slightly convex, nearly immaculate except for subapical, paired spots (figure 331); antennae as in figures 328 and 329..... ***pulcher*** Pic

Pattern of pronotum and elytra as in figure 297; pygidium in both sexes convex, male with vague patches at middle and at apex (figure 301), female with more intense patches sometimes connected to form paired crescents (figure 302); antennae as in figures 299 and 300 ..... ***chinensis*** (Linnaeus)

3(1) Pronotum yellowish with brown or black longitudinal lines (figure 321); elytral pattern as in figure 321; eye with narrow posterior fringe..... ***phaseoli*** (Gyllenhal)

Pronotum dark red to black, lacking longitudinal lines (figures 305 and 306); elytral pattern variable (figures 305–307); eye with posterior margin lobed . ***maculatus*** (Fabricius)

Callosobruchus chinensis (Linnaeus)

(Figures 8, 9, 297–304)

Curculio chinensis Linnaeus 1758:386.

Pachymerus chinensis: Schilsky 1905, no. 99; Chittenden 1912b:1; Reitter 1912:226.

Mylabris chinensis: Harold 1878:86; Baudi 1886b:45; Leng 1920:305.

Callosobruchus chinensis: Bridwell 1918:467; Herford 1935:5; Chujo 1937a:38; Back 1940:7; Vayssière and Lepesme 1941; Bottimer 1944:23; Lepesme 1944:209; Hoffman 1945:87; Southgate 1958, 1964; Bottimer 1968c:1029; Howe 1973:572; Borowiec 1987:132; Furusawa 1987:388; Udayagiri and Wadhi 1989:167.

Bruchus (Callosobruchus) chinensis: Zacher 1930:282.

Bruchus chinensis: Cushman 1911:505; Pic 1913a:20.

Bruchus pectinicornis Linnaeus 1767:605.

Bruchus rufus De Geer 1775:281.

Bruchus scutellaris Fabricius 1792:372.

Bruchus bistriatus Fabricius 1801:402.

Bruchus biguttatus Fabricius 1801:402.

Bruchus biguttellus Schoenherr 1833:42.

Bruchus bistriotus: Bridwell 1929a:41 (error).

Bruchus (Callosobruchus) chinensis: Pic 1912:92.

Bruchus elegans: Sturm et al. 1843:3222.

Bruchus rufobrunneus: Wollaston 1870:25.

References are numerous for this species because of its wide distribution and importance as a pest of leguminous grains. Selected references are listed under Dis-

cussion. Consult Luk'yanovich and Ter-Minassian (1957:67) and Pic (1913a:20) for older literature pertaining to *Calloso-bruchus chinensis.* Synonyms listed above are extracted from Southgate (1958).

Color.—Integumental color red to black; vertex red with broad median stripe black, frons black; antenna of male mostly black with two basal segments and dorsal face of one or more additional segments yellow, antenna of female dark red with distal segments gradually darkening. Pronotum black to red; if black, with red median line. Elytra red to black but usually with diagonal yellow band in basal one-half, only faintly visible on red specimens. Venter of body usually black, sometimes partly red. Male pygidium black; female usually yellow laterally, red median stripe with four black or red spots sometimes connected in curvate maculae (figure 302); fore legs and mid legs yellow, hind legs black with red to yellow dorsal margin. Vestiture of head yellow; of pronotum mostly yellow but with small, white spot either side of midline, basal lobe with elongate bilobed spot of waxy, matted white and golden setae (figure 297). Scutellum white. Elytra golden in basal one-half (figure 297), 3rd interstice with elongate, white patch and irregular, diagonal line of white patches at apical one-third; male pygidium white with vague to strong dark apical and median spots (figure 301). Venter of body white, condensed into spots on metepisternum and lateral margins of abdominal sterna (figure 298).

Structure.—Frontal carina prominent; ocular index 4:1; ocular sinus one-half length of eye; male antenna (figure 299) pectinate, female antenna serrate (figure 300). Pronotum convex, basal lobe prominent, medially sulcate, laterally bounded by sulci; disk minutely punctate-reticulate; lateral carina lacking. Scutellum minute, appearing bilobate. Elytra together slightly longer than wide; striae deep, strial punctures elongate, 3rd and 4th ending in basal gibbosity; interstices slightly convex, imbricate; metacoxa evenly punctate (figure 298) except fossula polished. Male pygidium strongly reflexed nearly to apical margin of basisternum; hind leg as shown in figure 298; mucro one-fourth as long as basitarsus.

Male genitalia.—As in figures 303 and 304; median lobe elongate (figure 303), ventral valve elongate, apically triangular, internal sac with two burrlike sclerites near apex; lateral lobes elongate (figure 304), divided nearly to base.

Size.—Body length 2.7–3.0 mm; width 1.8–2.3 mm.

Type depository.—Not known, possibly BMNH.

Type locality.—"China."

Distribution.—Tropicopolitan. HI, AL, CA, DC, FL, GA, HI, LA, MD, MS, OH, PA, SC, VA.

Host plants (Old World and New World).—*Cajanus cajan; Cicer arietinum; Cyamopsis tetragonoloba; Glycine max; Lablab purpureus; Lathyrus sativus; Lens culinaris; Nelumbo nucifera; Phaseolus lunatus, P. vulgaris; Pisum sativum; Psophocarpus tetragonolobus; Vicia faba; Vigna aconitifolia, V. angularis, V. mungo, V. radiata radiata, V. unguiculata unguiculata.* All host plants are in the Leguminosae except *Nelumbo,* which is in the Nelumbonaceae (Kingsolver 1979b; Furusawa 1987).

Natural enemies (Old and New World).—*Anisopteromalus calandrae; Bruchocida orientalis; Choetospila elegans; Dinarmus colemani, D. laticeps, D. vagabundus; Heterospilus prosopidis; Lariophagus distinguendus; Pteromalus* sp., *P. schwenkei; Pyemotes tritici, P. ventricosus; Stenocorse bruchivora; Urosigalphus bruchi; Uscana mukerjii, U. semifumipennis.*

Immatures.—Wightman and Southgate 1982 (egg); Pfaffenberger 1991:564 (larva).

Discussion.—Although this species is variable in the intensity of its color pattern, the characters given in the key and description should separate it easily. Salient characters are the waxy white pad of setae on the pronotal basal lobe, the white patch

on the lateral margin of the abdomen, the 3rd and 4th elytral striae each ending in a basal gibbosity, and the pectinate male antenna.

Common names for this species are cowpea weevil, gorgojo del caupi, Kundekäfer, mung bean bruchid, tonchio chinese, chinesischer Bohnenkäfer, and la bruche chinoise.

Callosobruchus chinensis, like its congener *C. maculatus,* has been the laboratory animal for a multitude of research projects.

Selected references pertaining to various aspects of biology and morphology are listed below:

Adult feeding.—Shinoda and Yoshida 1984, 1987a.

Adult illustration.—Hoffman 1945:87; Luk'yanovich and Ter-Minassian 1957; Kingsolver 1969a; Arora 1977.

Head morphology.—Singh 1981c.

Chromosomes.—Smith and Brower 1974.

Digestion.—Choudhuri and Paul 1983.

Digestive tract.—Mansour 1934.

Dimorphism.—George and Verma 1997.

Eclosion.—Southgate 1984.

Egg morphology.—Howe and Currie 1964; Wightman and Southgate 1982.

Host resistance.—Fernandez and Talekar 1990; Kitamura et al. 1990.

Identification.—Vats 1974a,b.

Larval development.—Podoler and Applebaum 1971; Rahman and Ameen 1986.

Larval illustration.—Arora 1978:4; Begum et al. 1982.

Life history.—Back 1940:7; Lepesme 1944; Sawaf 1956; Howe and Currie 1964; Fujii 1965; Applebaum et al. 1968; Raina 1970; Arora and Singh 1971; Okamoto 1971; Bato and Sanchez 1972; Begum et al. 1978; Singh et al. 1980; Singh 1981b; Giga and Smith 1983; Bellows and Hassell 1984; Shinoda and Yoshida 1987b; Yoshida 1989.

Male genitalia.—Mukerji and Chatterjee 1951; Kingsolver 1969a:13; Arora 1977:28; Pawar and Verma 1977 (musculature); Ahmad and Murad 1980a.

Malpighian tubules.—Rahman and Ameen 1990.

Oviposition.—Srivistava and Bhatia 1959; Avidov et al. 1965; Nakamura 1968; Oshima et al. 1973; Bhattacharya et al. 1977; Tikku et al. 1978; Gokhale et al. 1990; Yamamoto 1990.

Parasites.—See "Natural Enemies" above; Utida 1961; Roomi et al. 1973; Fujii and Khin Mar Wai 1990.

Pheromones.—Tanaka et al. 1981, 1982; Qi and Burkholder 1985.

Sexual dimorphism.—Shukla and Pandey 1977.

Spermatheca.—Surtees 1961.

Temperature effect.—Choudhuri and Paul 1984.

Callosobruchus maculatus (Fabricius)

(Figures 48, 50, 305–320)

Bruchus maculatus Fabricius 1775:65

Callosobruchus maculatus: Bridwell 1929a:40; Herford 1935:5; Larson and Fisher 1938:5; Back 1940:7; Bissell 1940:846; Vayssière and Lepesme 1941; Hoffman 1945:89; Blackwelder 1946:761; Utida 1954:161; Southgate et al. 1957:79; Southgate 1958:591, 1964:277; Howe 1973:572; Borowiec 1988:175; Udayagiri and Wadhi 1989:169.

Bruchus quadrimaculatus Fabricius 1792:371; Olivier 1795:19; Horn 1873:317; Sharp 1885:478; Blatchley 1910:1237; Cushman 1911:493; Pic 1913a:44; Larson and Fisher 1924:297; Brauer 1942; Lepesme 1944:212.

Mylabris quadrimaculatus: Baudi 1887:36; Leng 1920:305.

Pachymerus quadrimaculatus: Schilsky 1905:MM1.

Bruchus ornatus Boheman 1829:103; Baudi 1886b:47.

Bruchus vicinus Gyllenhal 1833:36.

Bruchus litteratus Schoenherr 1833:102.

Bruchus ambiguus Gyllenhal 1839:11; Fall 1910:163.

Bruchus sinuatus Fahraeus 1839:8.

Bruchus arachidis Fahraeus 1839:10.

Laria quadrimaculata: Bedel 1901:349

Pachymerus ornatus: Schilsky 1905:MM.

Bruchus (Acanthoscelides) trabuti Caillol 1919:236.

Callosobruchus ornatus: Hoffman 1945:90; Zacher 1952:466.

Callosobruchus sinuatus: Zacher 1952:466.

Callosobruchus quadrimaculatus: Shomar 1963:182.

Acanthoscelides sinuatus: Blackwelder 1946:761.

Southgate et al. (1957) presented a thorough discussion of the synonymy of *Callosobruchus maculatus,* and there is no need to repeat it here.

Color and Structure

Callosobruchus maculatus is variable in coloration, leading to confusion with other species of *Callosobruchus.* Part of the variation is due to the presence of "two distinct adult forms, which differ not only in their morphology, but in physiology, behaviour, etc." (Utida 1981). Utida (1954) named these "flightless form" and "flight form," which Caswell (1960) later termed "normal" and "active," respectively. Utida (1981) discusses at length the basis of the two forms. Striking differences in the male genitalia of the two forms were illustrated by Spirina (1974). Other references to this phenomenon are listed in the discussion below.

Utida (1972) illustrated male and female patterns he claimed would distinguish the two forms. In my own examinations of several long series of both the flightless and flight forms, however, color patterns were so variable as to be unreliable for distinguishing the forms, although the patterns were moderately consistent within each series. Characteristics of both male genitalia (figures 315 and 317) and female bursae couplatrices (figures 319 and 320) are consistently diagnostic (Spirina 1974).

The flightless form, having normal wings, is capable of flight but prefers to remain in on the substrate of seeds in relative darkness. A population buildup with the ensuing crowded conditions in a granary situation can, due to metabolic overheating by larval activity, trigger the development of the flight form that readily flies and seeks light. Females of the flight form are lighter in weight, their ovaries are poorly developed, and their abdomens are filled with fat bodies; also, they develop few fertile eggs. Testes of the flight males are immature at emergence but gradually develop as the individual ages (Utida 1981). For further information, see Utida (1981) and his included bibliography.

Illustrating the many variants in color pattern would require more space than is here justified. The following descriptions and associated illustrations can give only a hint of the variety. Other references to this phenomenon are listed in the discussion below.

Flightless or normal form:

Male (figures 305 and 306).—Integument mostly black with red areas on abdomen, legs, and elytra; head black, red spot behind eye; antenna mostly dark red (figure 309); pronotum piceous with reddish margins; elytra red with small maculae on humerus and lateral margin; hind leg as in figure 310; pygidium black with reddish suffusion (figure 311); legs reddish yellow. Vestiture yellowish on dorsal surfaces, venter white; densely white patch on basal lobe of pronotum, faint median line on pygidium.

Male genitalia as in figures 315 and 316; median lobe parallel-sided; ventral valve triangular, apex rounded, bent ventrad; internal sac armature consisting of a small mass of spicules at apical orifice, two lunate masses of scalelike, flat spines continuous with two dense masses of large spicules; apical closure valve not well

defined; lateral lobes slender, parallel-sided, cleft to base, apices each with membranous lobe and mesally directed setose pad.

Female.—Head red to black, red spot behind eye, antenna red to piceous (figure 309); pronotum as in male except with median line; elytra red with basal border, large lateral and apical maculae piceous or black; pygidium black; venter red to black; legs mostly red with some darker suffusion. Vestiture yellow on head, pronotum black with yellow to white spot on basal lobe and on flanks; elytra black on darker maculae, white bordering maculae, brown along suture; pygidium black with white median stripe, or yellow with apical spots. Venter and legs white.

Bursa copulatrix as in figure 319.

Flight or abnormal form:

Male (figure 307).—Similar to flightless form except basic integumental color of venter darker, distal seven or eight antennal segments piceous; hind legs piceous with dorsal margin brownish yellow, fore legs and mid legs yellow; elytral maculae larger than in flightless form; pygidium as in figure 312.

Male genitalia as in figures 317 and 318; median lobe slender, parallel-sided; ventral valve triangular, apex slightly produced; armature of internal sac consisting of divided mass of spicules connected by transverse sclerite at apical orifice, two slender masses of mixed, minute scales and spines, two elongate masses of slender, thornlike spines, two semicircular thorny sclerites, and two clusters of spines near apex; closure valve circular; lateral lobes as for normal form.

Female.—Head black, antennal color as in male, pronotum black; elytra dark red except basal marginal spots, lateral and apical maculae black; pygidium dark red with lateral maculae black; venter black except abdominal sutures red; fore legs and mid legs dark red, hind legs usually piceous, sometimes with reddish suffusion. Vestiture of head, pronotum, dark red portions of elytra, and pygidium yellow, darker portions of elytra black, border of lateral maculae not prominent; 3rd interstice with elongate white stripe,; venter white.

Bursa copulatrix as in figure 320.

Size.—Body length: males 2.7–3.1 mm; females 3.3–3.8 mm. Width: males 1.5–1.9 mm; females 1.5–1.9 mm.

Type depository.—UZMC *(maculatus, quadrimaculatus);* NHRS *(ornatus, litteratus, vicinus, ambiguus, sinuatus);* MNHP *(tabuti);* NHRS *(arachidis).*

Type locality.—"America" *(ambiguus, maculatus, sinuatus);* Senegal *(vicinus);* Sierra Leone *(ornatus);* Timbuctu *(trabuti);* Brazil and Greece *(arachidis);* "North, Central, and South America" *(quadrimaculatus).*

Distribution.—Cosmopolitan. U.S. and Canadian records: AK, AR, AZ, CA, DC, FL, GA, HI, IA, ID, IN, KS, LA, MD, MO, MS, NC, NM, NY, OH, OK, ON, PA, SC, SD, SK, TN, TX, VA. Southgate (1964) reasoned that the most likely region of origin was on the African continent.

Host plants.—Cajanus cajan; Cicer arietinum; Glycine max; Lablab purpureus; Lathyrus aphaca, L. clymenum, L. sativus; Lens culinaris; Phaseolus acutifolius, P. lunatus, P. vulgaris; Pisum sativum arvense; Vicia faba, V. lutea, V. sativa sativa; Vigna mungo, V. radiata radiata, V. unguiculata unguiculata.

Natural enemies.—Anisopteromalus calandrae, A. pratti; Bruchobius laticeps; Bruchocida vuilleti (Terrasse and Rojas-Rousse 1986, bionomics); *Cephanolomia gallicola; Chaetostricha mukerjii; Choeto-spila elegans; Dinarmus laticeps, D. vagabundus; Heterospilus prosopidis; Lariophagus distinguendus, L. texanus; Oedaule magnus; Pyemotes ventricosus; Senegalella acythopoensis; Uscana lariophaga, U. marilandica, U. mukerjii, U. semifumipennis, U. senex.*

Immatures.—Larson and Fisher 1938:23–27 (larva and description of egg); Mukerji 1938 (1st larval instar); Lepesme 1944

(larva); Prevett 1971 (larva); Vats 1974a,b (larva); Arora 1978 (larva); Wightman and Southgate 1982 (egg); Pfaffenberger 1991:564 (larva).

Discussion.—This cosmopolitan species is one of the best known and most universally destructive of the Bruchidae. Like its sister species, *Callosobruchus chinensis,* it has the ability to infest and reinfest many species of stored legumes, resulting in enormous post-harvest losses. In recent years, much research has focused on the morphological and biological aspects of *C. maculatus,* especially in a laboratory at Tours, France. The species has proven to be an important laboratory animal in genetic studies.

The common name for this bruchid is "cowpea weevil."

Identifying characters are found in the key.

Selected references pertaining to various aspects of biology and morphology are listed below:

Adult emergence.—Yadav 1977; Highland 1986 (package penetration).

Adult illustration.—Larson and Fisher 1938; Johnson 1983a.

Larval alimentary canal.—Vats 1976b.

Antenna.—Rup 1988.

Body chemistry.—Nwanze et al. 1976; Sharma et al. 1983; Sidhu et al. 1984; Wasserman 1987; Gatehouse et al. 1990.

Chromosomes.—Smith and Brower 1974.

Digestive tract.—Neelgund and Kumari 1983; Vats 1976b.

Dimorphism.—Utida 1954; Southgate et al. 1957; Arora and Pajni 1959; Caswell 1960; Arora et al. 1967; Sano 1967; Utida 1969; Gill et al. 1971; Bawa et al. 1972; Utida 1972; Bawa et al. 1974; Taylor 1974; Taylor and Agbaje 1974; Taylor and Aludo 1974; Utida 1974; Staneva 1980; Utida 1981; Nwanze and Horber 1975; Staneva 1982; Sano-Fujii 1984, 1986; Messina 1987.

Eclosion.—Mukerji 1938.

Egg morphology.—Wightman and Southgate 1982.

Egg development.—Kannan 1923; Brauer 1925, 1942, 1946; Tantawi et al. 1976; Miyamoto and Van Der Meer 1982.

Enzymes.—Gatehouse and Anstee 1983; Gatehouse and Boulter 1983; Gatehouse et al. 1985; Kitch and Murdock 1986.

Eye.—Schmitt et al. 1982.

Female genitalia.—Mukerji and Bhuya 1937; Pajni 1968b; Monga 1972; Spirina 1974; Monga and Sareen 1980 (ovaries).

Genetics.—Breitenbacher 1925; Wasserman and Futuyma 1981; Messina 1990; Taper 1990.

Hormones.—Tantawi et al. 1976.

Host plants.—Kingsolver 1979b; Staneva 1982.

Host resistance.—Janzen et al. 1976; Gatehouse et al. 1979; Dobie 1981; Gatehouse and Boulter 1983; Brewer and Horber 1984; Birch et al. 1985; Kitamura et al. 1990.

Larval development.—Arora and Pajni 1959; Fujii 1965; Mookherjee and Chawla 1965; Satija and Kaur 1967a,b; Pajni 1968b,c; Satija and Kaur 1968; Yadav and Pant 1975; Janzen 1977b; Osuji 1980; Aldana Alfonso 1983; Sano-Fujii 1984; Boughdad et al. 1987; Credland and Dick 1987.

Larval illustration.—Larson and Fisher 1938; Vats 1974b; Arora 1978.

Larval malpighian tubules.—Vats 1976a.

Larval penetration of seeds.—Nwanze and Horber 1976; Janzen 1977b.

Larval salivary glands.—Pajni 1965.

Life history.—Chittenden 1912b; Paddock and Reinhard 1919; Wade 1919; Larson and Simmons 1923, 1924a,b; Larson and Fisher 1924; Back 1940:7; Schoof 1941; Lepesme 1944; Sawaf 1956; Mookherjee and Chawla 1965; Raina 1970; Chokouhian 1973; Ahmed et al. 1978; Saplina 1980; Singh et al. 1980; Giga and Smith 1983; Staneva 1983; Roche et al. 1985; Credland et al. 1986; Germain et al. 1987;

Messina 1990; Mitchell 1990; Moller et al. 1990.

Male genitalia.—Mukerji and Bhuya 1937; Pajni 1968a; Arora 1971; Gill et al. 1971 (testes); Spirina 1974; Taylor and Agbaje 1974; Taylor and Aludo 1974; Ahmed et al. 1976; Pawar and Verma 1977 (musculature); Kasap and Crowson 1979; Messina and Renwick 1985.

Mating and reproduction.—Credland 1986; Rup 1986.

Oviposition.—Brauer 1944; Nakamura 1968; Gokhale and Srivastava 1975; Mitchell 1975; Monga and Sareen 1980; Wasserman 1981; Dick and Credland 1984; Gupta and Bhaduri 1984; Messina 1984; Singh et al. 1984; Giga and Smith 1985; Messina 1985; Wasserman 1985; Messina et al. 1987a,b; Ofuya 1987; Wilson 1988; Ofuya 1989; Ofuya and Agele 1989; Credland and Wright 1990; Gokhale et al. 1990; Yamamoto 1990; Fox and Tatar 1994.

Parasitoids.—See "Natural Enemies," above; Utida 1961; Taylor and Aludo 1974; Mizell and Nebeker 1982.

Pheromones.—Sakai et al. 1986; Yamamoto 1986; Pouzat et al. 1989.

Population studies.—Bellows 1982.

Respiration.—Seurat 1900; Yadav and Singh 1977.

Spermatheca.—Surtees 1961.

Spermiogenesis.—Brauer 1928; Mickey 1935; Bawa and Kanwar 1975; Bawa et al. 1971, 1975; Eady 1994.

Tracheal system.—Pajni 1969; Vats 1972.

Wing venation.—Suzuki 1969.

Callosobruchus phaseoli (Gyllenhal)

(Figures 321–326)

Bruchus phaseoli Gyllenhal 1833:37; Pic 1913a:40; Swezey 1936:201; Mukerji and Chatterjee 1951:8 (male genitalia).

Mylabris phaseoli: Baudi 1886b:46.

Pachymerus phaseoli: Bridwell 1919:17.

Callosobruchus phaseoli: Herford 1935:6; Bridwell 1938b:75; Hoffman 1945:88; Blackwelder 1946:761; Luk'yanovich and Ter-Minassian 1957:67; Bottimer 1961:296, 1968c:1032; Decelle 1981:195; Wightman and Southgate 1982:95; Borowiec 1988:178; Udayagiri and Wadhi 1989:171.

Bruchus figuratus Gyllenhal 1839:12, **New Synonymy.**

Bruchus conicicollis Fairmaire 1898:247.

Color.—Integument reddish brown except eyes black, variable black patches on elytra (figure 321), vertex sometimes black; legs reddish brown; distal antennal segments brown to piceous except apical segment red. Vestiture of yellow, medium brown, dark brown, and white hairs; head yellow, pronotum mostly yellow with dark brown paired stripes and white basal lobe; elytra mostly yellow with elongate white patches at base and at middle of 3rd interstice; lateral and apical parts of disk with curvate dark brown and black maculation. Pygidium (figure 324) uniformly yellow, or with dusky sublateral spots.

Structure.—Vertex and frons finely punctate; frontal carina fine but evident; ocular index 6:1 in male, 4:1 in female; ocular sinus about one-half length of eye; antenna dimorphic (figure 322). Pronotum subconical, lateral margins slightly sinuate; disk unevenly convex; basal lobe domed, vestiture not matted; lateral carina absent. Scutellum narrow, parallel. Elytra together one-fifth longer than wide, subdepressed along suture, convex laterally; striae subparallel, slightly sinuate, 2nd to 5th reaching basal margin, 2nd and 3rd nearly conjoined and with minute basal denticles; interstices flat, finely imbricate-punctate. Metacoxal face finely, evenly foveolate except fossula smooth; metafemur as in figure 323, ventrolateral carina of metafemur with distinct toothlike angulation, ventromesal carina with short, acute denticle about as long as lateral angulation; metatibia (figure 323) dilated toward apex, with lateral carina sinuate apically, ventral and dorsomesal carinae complete, ventrolateral evanescent apically; mucro short, only slightly longer

than lateral denticle; pygidium (figure 324) slightly tumescent at apex in both sexes.

Male genitalia.—As in figures 325 and 326; median lobe elongate, about 8 times as long as wide; ventral valve hastate, produced into slender apex, base constricted; internal sac with small bundle of spicules at apical orifice, two pairs of burrlike sclerites in middle, and pair of spine clusters near apex; most of sac lined with fine spicules; lateral lobes elongate (figure 326), cleft to base, and curved inward at tips.

Size.—Body length 2.3–2.9 mm; width 1.4–1.6 mm.

Type depository.—NHRS.

Type locality.—"Brasilia."

Distribution.—Tropicopolitan. FL, HI.

Host plants.—Cajanus cajan; Cicer arietinum; Crotalaria spectabilis; Lablab purpureus; Phaseolus lunatus, P. vulgaris; Pisum sativum arvense; Sesbania sp.; *Vicia faba; Vigna angularis, V. radiata radiata.*

Natural enemies.—Anisopteromalus calandrae; Heterospilus prosopidis; Uscana semifumipennis.

Immatures.—Wightman and Southgate 1982 (egg).

Discussion.—This species is easily separated from other *Callosobruchus* by the yellowish appearance with dark brown to black, lunate elytral maculae, red terminal antennal segment, enlarged eyes in male, 2nd and 3rd striae nearly conjoined, and slightly tumescent pygidium. Male genitalia are distinctive.

Callosobruchus pulcher Pic

(Figures 327–333)

Callosobruchus pulcher Pic 1922:15; U.S. Department of Agriculture 1973:149 [as *C. albocallosus* (Pic)], 1973:171 (corrected to *pulcher*); Udayagiri and Wadhi 1989:171.

Color.—Integument dark red to black, occasionally purple. Head black, labrum red, vertex with red spot behind eye; antennae reddish yellow; pronotum all black or with reddish apical margin; elytra dark red to black; pygidium and most of abdomen red; fore legs and mid legs red, hind legs black with dorsal one-half red. Vesti-ture of black, white, and yellow hairs in variable dorsal pattern (figure 327); head yellow. Pronotum yellow with black apical and lateral diagonal streaks (figure 327), basal lobe with waxy secretion on matted hairs. Scutellum white. Elytra with basal yellow band leading medially to yellow patch surrounding scutellum, 3rd interstice with elongate yellow patch, sutural interstice with narrow black streak reaching nearly to scutellum, lateral one-half of each elytron with narrow lines of white hairs. Pygidium in both sexes uniformly white with one pair of subapical spots (figure 331). Venter of body mostly white, lateral margin of abdomen, anterior spot on metepisternum, and mesepimeron golden yellow, white patches on lateral margin of 3rd, 4th, and 5th abdominal segments; small, white tuft on apical margin of 5th sternum.

Structure.—Head with prominent frontal carina; eyes dimorphic, ocular index 9:1 in male, 6:1 in female; antennae dimorphic (figures 328 and 329). Pronotum narrowly trapezoidal, lateral margins incurved, disk gibbous, medially sulcate. Scutellum triangular, bifid apically. Elytra subde-pressed; striae slightly impressed, sinuate, punctures discrete, 3rd and 4th striae ending basally in subbasal gibbosity; interstices imbricate. Pygidium (figure 331) with slight tumescence between subapical spots. Metacoxa densely punctate; metafemur (figure 330) sulcate ventrally, ventrolateral carina straight with subapical notch, ventromesal carina with small, acute denticle; metatibia with lateral, ventrolateral, ventral, and dorsomesal carinae complete; mucro one-fourth as long as basitarsus.

Male genitalia.—As in figures 332 and 333; median lobe elongated, ventral valve triangular, middle of internal sac with two large, curvate and dentate sclerites, apical

one-half of sac lined with minute, aciculate spicules, apical orifice with conspicuous bundle of spicules, apical one-third of sac pleated, lined with minute, overlapping, semicircular scales; lateral lobes slender, expanded suddenly at apex, divided to attachment with tegmen (figure 333).

Size.—Body length 2.3–3.1 mm; width 1.4–1.9 mm.

Type depository.—MNHP.

Type locality.—Philippine Is., Luzon.

Distribution.—Hawaii (introduced); Philippine Islands.

Host plants.—Cajanus cajan; Cicer ari-etinum; Phaseolus vulgaris, Vigna angularis; flowers of *Cajanus cajan.*

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—According to specimen data, this handsome Philippine species was first collected in Hawaii in 1965 by N.L.H. Krauss on Maui. It was subsequently collected at light at Honolulu, Manoa, and Ewa (all in Oahu) and at Haiku, Maui. It was reared from *Cajanus cajan* at Ewa in 1965.

This species would most likely be confused with *Callosobruchus chinensis,* but the lateral extensions of each of the male antennal segments are broader in *C. pulcher* (figure 328), the ventral vestiture is all white, and the lateroventral tooth of the metafemur is more blunt (compare figures 298 and 330). The key characters will suffice for differentiation from other species of *Callosobruchus.*

Tribe Acanthoscelidini Bridwell, 1946

Genus *Abutiloneus* Bridwell

Abutiloneus Bridwell 1946:55; Blackwelder and Blackwelder 1948:45; Kingsolver 1965a:125; Bottimer 1968c:1016,1038; Johnson 1968:1267; Johnson and Kingsolver 1982:416; Johnson 1983d:378; Udayagiri and Wadhi 1989:34. Type species: *Abutiloneus idoneus* Bridwell (=*Bruchus flavicornis* Sharp 1885, not Fabricius 1792), by original designation.

Borowiec (1987) synonymized this genus with *Acanthoscelides,* but Johnson and I agree that this action was premature. Johnson (1990c:306) resurrected *Abutiloneus* to generic status.

Because this at present is a monotypic genus, the generic and specific diagnoses are combined.

Taxonomy was summarized by Kingsolver (1965a).

Abutiloneus idoneus Bridwell

(Figures 66, 334–339)

Bruchus flavicornis Sharp 1885:480; Townsend 1903:88; Schaeffer 1907:296; Zacher 1952:462.

Bruchus (Abutiloneus) idoneus: Zacher 1952:462.

Acanthoscelides flavicornis: Blackwelder 1946:759.

Abutiloneus flavicornis: Kingsolver 1965a:125 (misidentification).

Abutiloneus idoneus Bridwell 1946:55 (new name for *flavicornis* Sharp); Black-welder and Blackwelder 1948:759; Bottimer 1968c:1016,1038; Johnson 1968:1267; Johnson and Kingsolver 1982:416; Johnson 1983d:378; Borowiec 1987:88; Udayagiri and Wadhi 1989:34.

Althaeus idoneus: De Luca 1967a:16.

Color.—Integument black except antenna, labrum, and labial and maxillary palpi bright yellow. Pubescence on pronotum

and elytra evenly yellowish gray; that on pygidium and ventral areas of body ashy gray.

Structure.—Body short and broad (figure 334). Vertex and frons minutely punctate; frontal carina lacking but frons marked by impunctate median line; ocular index 3:1; ocular sinus two-thirds length of eye; antenna (figure 336) not dimorphic. Pronotum nearly semicircular in outline, evenly convex, disk sparsely microfoveolate, surface densely pubescent, minutely imbricate; lateral carina ridgelike, arched; cervical sulcus short, deep; fore coxae contiguous at apices. Scutellum slightly longer than wide, bidentate apically. Elytra as long as wide, striae parallel, 2nd and 3rd slightly bent laterad near base, 2nd to 5th minutely denticulate on basal margin; interstices minutely imbricate; metacoxal face densely imbricate-punctate, densely setose in lateral one-half; hind leg (figure 335a) usually without subapical denticles, sometimes with one minute, black denticle (figure 335b); metatibia slightly dilated toward apex, ventrolateral carina absent, lateral carina evanescent (figure 335a); mucro short, scarcely longer than lateral and the four coronal denticles. Abdomen not modified, male 5th sternum broadly emarginate; pygidium of both sexes convex, male's more strongly reflexed than female's.

Male genitalia.—As in figures 337–339; median lobe slender; ventral valve ogival, acute, strongly curvate; internal sac armed with paired, elongate clusters of slender spicules in basal one-half of sac, pair of small, thornlike spines in middle, and pair of larger, thornlike spines near apex; lateral lobes slender, slightly expanded apically, extreme apex acute and recurved, cleft between lobes nearly to base.

Size.—Body length 1.5–1.8 mm; width 1.0–1.2 mm.

Type depository.—USNM (*idoneus,* holotype No. 5766); BMNH *(flavicornis).*

Type locality.—Texas, Brownsville *(idoneus);* Mexico, Guanajuato *(flavicornis).*

Distribution.—TX; Mexico.

Host plants.—Abutilon berlandieri (=californicum), A. abutiloides (=lignosum); Allowissadula holosericea. Johnson (1983d) summarized the host plant data.

Natural enemies.—Zatropis incertus (Ashmead).

Immatures.—Not described.

Discussion.—The small size, bright yellow appendages, subapical femoral denticle minute or lacking, and distinctive male genitalia will distinguish this species. Of similar size and shape and also breeding in *Abutilon* spp. are *Acanthoscelides aequalis* and *A. subaequalis,* but in both the legs are dark brown, at least in part, and male genitalia are distinctly different.

Kingsolver (1965a:125) erroneously listed *Abutiloneus idoneus* as a synonym of *Bruchus flavicornis* Sharp.

Genus *Acanthoscelides* Schilsky

Acanthocelides (sic) Schilsky 1905: IV,41F,41C,41L.

Acanthoscelides Schilsky 1905:95–95a; Pic 1913a:13 (as subgenus of *Bruchus*); Leng 1920:304; Bridwell 1929a:39, 1932:104, 1946:52; Blackwelder 1946:758; Luk'yanovich and Ter-Minassian 1957:170; Bottimer 1968c:1016,1038,1040; Johnson 1968:1267, 1970:1–116, 1981b:73; Johnson and Kingsolver 1982:409–422; Johnson 1983a:1–370, 1990c:297–618.

Acanthoscelides was described in 1905 by Schilsky for *Bruchus irresectus* Fahraeus, now a synonym of *Acanthoscelides obtectus* (Say). Schilsky included species under two different spellings—*Acanthoscelides* and *Acanthocelides;* however, Bottimer (1968c), followed by Johnson (1970), adopted *Acanthoscelides* as the spelling Schilsky probably intended, with *Acanthocelides* regarded as a lapsus.

Pic, in his world catalogue (1913a:13), listed *Acanthoscelides* as a subgenus, but the name did not come into general use until Bridwell's papers in the 1920–1930 era in which he transferred some of the U.S. species from *Bruchus* into *Acantho-scelides.* Blackwelder, in his Neotropical checklist (1946), transferred 322 species names, mostly from *Bruchus,* into *Acanthoscelides.* Some of these names have subsequently been transferred to other genera.

The following description is modified from Johnson (1983a) to apply to North American species of *Acanthoscelides.*

Small bruchids (1.1–3.5 mm).

Vertex and frons usually punctate, interspaces impunctate, punctate, or granulose, frons sometimes with median vertical carina or impunctate line; eyes protruding from lateral margins of head, often sexually dimorphic with eyes larger in male than in female, posterior border of eye usually separated from side of head by postocular sulcus, eye partly divided by setose ocular sinus; antennal insertion at anterior margin of eye; antenna subserrate from 4th or 5th segment except 11th segment elliptical, often sexually dimorphic with male antenna longer or broader. Pronotum bell-shaped or subconical, disk convex without elevations, usually with slight depressions either side of basal lobe and near posterior corners, basal lobe usually with brief sulcus; lateral carina absent or represented by blunt ridge; cervical sulcus usually conspicuous; prosternum /T/- or /Y/-shaped, triangular between procoxae but not separating their apices; protrochantin absent, replaced by trochantinal flap (figure 24); mesepimeron reduced to small triangular sclerite by encroachment of mesepisternum (as in figure 27). Scutellum quadrate or slightly elongated, apical margin bidentate with angulate emargination between points. Elytra together as long or longer than broad, striae varying in width and depth, often with basal or subbasal denticles; interstices usually flat, sometimes alternately variable in width, surface usually minutely imbricate. Metasternum convex, postmesocoxal sulci prominent, median sulcus extending half-way to anterior border; metacoxal face usually punctate and at least partly setose, fossula always glabrous and impunctate; metafemur expanded dorsoventrally, ventral margin often shallowly sulcate; subapical ventral margin usually with cluster of one to four acute denticles (pecten); metatibia straight to moderately arcuate, dilated toward apex, ventral and dorsomesal carinae always present, lateral and ventrolateral carinae varying in extent; apex with acute spine (mucro) on ventral margin extending one-tenth to nearly same length of basitarsus, a lateral denticle at end of lateral carina, and two to four coronal denticles. First abdominal sternum often modified in male with median setose pit, sometimes flattened or concave, or with posterior margin lobed and fringed with long setae, 5th sternum moderately to deeply emarginate in male for reception of pygidial apex; 1st sternum of female not modified, 5th usually slightly emarginate; pygidium broadly obovate, arcuate in lateral aspect, male pygidium usually strongly inflexed at apex, female pygidium usually vertical at apex; disk microfoveolate or punctulate.

Male genitalia usually elongate, median lobe lacking distinct dorsal valve, ventral valve with base usually broad, apex of various shapes, usually diagnostic; base of median lobe spoon-shaped; internal eversible sac armed with variously shaped spines, spicules, and denticles (figure 35) whose arrangement is usually species-specific; lateral lobes variously shaped, separated by cleft of various lengths, apices with sensory setae.

The genus *Acanthoscelides* is a large and diverse, poorly defined aggregate of mostly small species of Bruchidae. C.D. Johnson is the leading authority on this genus with his many papers published on taxonomy and host associations (1968, 1969a,b,

1970, 1974, 1977a,b,c,d, 1979a,b, 1981b,e, 1983a, 1988b, 1990a,c,d). His studies on western United States, Mexico-Central American, and northern South American species of *Acanthoscelides* have failed to provide a wholly satisfactory definition of the genus but have resulted mostly in defining species groups within the genus. None of these species groups appear to be sufficiently distinct to warrant separation as a new genus.

Key to Species of *Acanthoscelides*

This key is based on a combination of integumental and vestitular color and morphological features. In using color, especially in beetles, one must be cautious because of variation in intensity of melanism. Beetles that have recently emerged are often red or brown but darken after a few days.

1 Integument of body and appendages entirely black except basal two or three antennal segments red or reddish yellow, some species with reddish suffusion on legs in teneral specimens, or with red postocular patch.....2

Body black or red or mottled; appendages entirely or in part red or reddish orange.....21

2(1) Metatibia lacking lateral carina (figures 539 and 444) or carina evanescent (figure 378); ventrolateral carina absent 3

Metatibia with distinct lateral carina (figure 348).....8

3(2) Elytral vestiture uniform or maculate (figures 377 and 482) 4

Elytral vestiture ocellate, small glabrous spots each centered on fine, curved seta (figure 443) 6

4(3) Dorsal vestiture uniform with no pattern (figure 377); scutellum contrasting white; body length 3.0–3.2 mm; male genitalia as in figures 380 and 381; east of 100th meridian..... *calvus* (Horn) (part)

Dorsal vestiture with faint to distinct pattern (figure 538); scutellum not strongly contrasted; body length 2.0 mm or less; western United States.....5

5(4) Metatibial mucro slender, curved; about one-third length of basitarsus (figure 539); male genitalia as in figures 541 and 542; 1st abdominal sternite of male with small pit ..... *pauperculus* (LeConte)

Mucro less than one-fourth length of basi-tarsus (figure 483); male genitalia as in figures 485 and 486; 1st abdominal sternite of male with prominent lobe on posterior margin..... *margaretae* Johnson (part)

6(3) Body length 2 times greatest width across elytra; mucro slightly longer than lateral denticle (figure 633); pecten with one large and two minute denticles; median lobe (figure 635) without large spines ..... *tenuis* Bottimer

Body length 1.6 to 1.8 times width; mucro long, slender (figures 353 and 444); pecten with two or three minute denticles; male genitalic armature includes two large, thornlike spines.....7

7. Body length 0.9–1.2 mm; ventral valve broadly triangular (figure 355) ..... *atomus* (Fall)

Body length 1.4–1.7 mm; ventral valve narrowly triangular (figure 446) ..... *helianthemum* Bottimer

8(2) Elytral vestiture ocellate, each rounded, glabrous spot centered on a single, curved seta (figure 345) .... *alboscutellatus* (Horn)

Elytral vestiture not ocellate.....9

9(8) Elytral vestiture maculate (figure 517).....10

Elytral vestiture uniformly distributed (figure 555) 12

10(9) Bases of 3rd and 4th striae each with prominent denticle; vestiture of dark brown, yellowish-brown, and white setae in mottled pattern (figure 517); great denticle of metafemur longer than tibial width at base (figure 518); body length 2.1–2.9 mm ..... *obsoletus* (Say)

Strial bases lacking denticles, or denticles minute, nearly hidden in vestiture; great denticle of pecten small, shorter that width of tibial base (figures 551 and 570) 11

11(10) Mucro of metatibia long, slender, curved, slightly longer than apical width of tibia (figure 551) .... *pedicularius* (Sharp)

Mucro of metatibia short, not as long as tibial width (figure 570)..... *pullus* (Fall)

12(9) Strial punctures rounded or ovate, encroaching on adjacent interstices (figure 555); pronotum subconical, densely, coarsely, punctate; pecten of metatibia with two minute denticles (figure 557); 1st abdominal sternum of male concave with median pit and long fringe of golden setae..... *perforatus* (Horn)

Strial punctures elongate; other characters varied 13

13(12) Lateral tibial carina evanescent, sometimes with portions visible (figure 378); pronotum subconical (figure 377); 2nd stria curved laterad to meet 3rd at basal margin;

1st denticle of pecten 2–3 times as long as 2nd and 3rd (figure 378); 1st abdominal sternum of male not modified ..... *calvus* (Horn) (part)

Lateral carina visible for entire length; other characters varied 14

14(13) Elytra with striae shallow, especially in lateral one-half, sometimes with only elongate punctures visible; 1st denticle of pecten two times as long as 2nd or 3rd (figure 433); 1st abdominal sternum of male not modified .....*fumatus* (Schaeffer)

Elytra with striae narrow, deep, distinct; femoral denticles subequal in length; 1st sternum of male modified by a lobe or pit (except *compressicornis)* 15

15(14) Metafemur with three or four denticles on ventral margin between trochanter and pecten (figure 390); pronotum with tuft of setae opposite base of 5th stria; 1st abdominal sternum of male not modified; male antenna broad and elongated (figure 391)

..... *compressicornis* (Schaeffer)

Ventral margin of metafemur with denticles present only in pecten (figure 465); pronotum lacking setal tuft; 1st abdominal segment modified; male antenna not especially broad

.....16

16(15) Male with setose lobe and rounded depression on 1st abdominal segment; pygidium with lateral margins nearly straight (figure 464) .....*lobatus* (Fall)

Male lacking lobe although posterior margin of 1st segment sinuate and with large rounded depression; female pygidium with lateral margins more rounded (figure 427) 17

17(16) Apex of metatibia with deep clefts between coronal denticles (figure 606); male genitalia with acute spine in internal sac (figure 609)

.....*seminulum* (Horn)

Apex of metatibia with shallow intervals between denticles (figure 575); internal sac differently armed 18

18(17) Male genitalia with small, U-shaped sclerite in internal sac (figure 577); elytra maculate (figure 574).....

..... *pusillimus* (Sharp)

Internal sac differently armed; elytral vestiture uniform ....

.....19

19(18) Eye in lateral aspect protruding below plane of gula; lateral margins of ventral valve straight (figure 404); body covered with dense, white setae giving pruinose appearance .....*daleae* Johnson

Eye in lateral aspect not protruding below plane of gula; lateral margins of ventral valve usually incurved (figure 430); vestiture of body white to yellow 20

20(19) Vestiture of moderately dense to extremely dense white setae; body and appendages usually all black except basal four antennal segments reddish orange, sometimes with elytral apices and apical portions of legs reddish orange; male genitalia as in figure 430 .....

..... *fraterculus* (Horn)

If integument of head, body, and legs mostly black, then vestitural color usually yellow; if integumental color paler, then vestiture white, yellow, or intermixed white and golden; male genitalia as in figure 360

.....*aureolus* (Horn) complex.

21. Metatibia lacking lateral carina, or carina evanescent (figure 528) 22

Metatibial carina present and distinct (figure 477) 24

22(21) Metafemur lacking ventromesal denticles (pecten) (figure 528) 23

Metafemur with one or more ventromesal denticles (figure 454) .....*inquisitus* (Fall)

23(22) Pronotal lateral margins sinuate (figure 527); metatibia yellow; apical one-third to one-half of each elytron yellow; 1st abdominal sternite of male with small pit enclosing setal tuft; male genitalia as in figure 530

.....*oregonensis* Johnson

Pronotum nearly semicircular (figure 504); legs dark red to black; elytra black with faint golden maculae; 1st abdominal sternite of male convex, without pit; male genitalia as in figure 507..... *napensis* Johnson

24(21) Elytral integument basically red, or reddish brown, sometimes with darker maculae, or darker marginal or sutural stripe 25

Elytral integument basically black, sometimes with reddish stripe, or with apices reddish yellow.....41

25(24) Third and 4th elytral striae strongly bent laterad at base (figures 474 and 493), nearer to each other than to adjacent striae, sometimes nearly merging, each stria ending in prominent subbasal denticle, sometimes with denticles merging into bidentate ridge 26

Third and 4th striae parallel, equidistant from each other and from adjacent striae, with or without basal denticles.. 32

26(25) Pronotum lacking distinct pattern.....27

Pronotum with distinct pattern 28

27(26) Mucro longer than lateral denticle of meta-tibia (figure 477); eyes prominent, ocular index of males 14:1 (figure 475), of females 6.25:1 (figure 476); frontal carina prominent..... .....*macrophthalmus* (Schaeffer)

Mucro equal to or shorter than lateral denticle (figure 494); ocular index 6:1 or less; frontal carina evanescent.. ..... *modestus* (Sharp)

28(26) Head red with frons black, black area extending dorsad from median spot on vertex; thoracic sterna, humeri, elytral margins and apex, and leg bases piceous, abdomen red; elytral denticles nearly confluent on common gibbosity (figure 543) ..... *pectoralis* (Horn)

Head red or black; thoracic sterna usually black, sometimes red or piceous; elytral pattern of dark maculae extending toward suture from middle of lateral margins; elytral denticles basal or subbasal (figures 561 and 367) 29

29(28) Scutellum elongate, nearly 2 times as long as wide (figure 561); frontal carina absent; elytral denticles subbasal; 2nd and 3rd striae divergent laterad at base (figure 561); pronotum without pattern ..... *prosopoides* (Schaeffer)

Scutellum quadrate or transverse (figure 367); frontal carina present; elytral denticles on basal margin; 2nd and 3rd striae subpar-allel (figure 367).....30

30(29) Head red, or red with median, black maculation.....31

Head black; male genitalia as in figures 370 and 371 .... *bisignatus* (Horn)

31(30) Head red with median black maculation; pygidium with three basal patches of white setae; male genitalia as in figures 409 and 410..... *desmanthi* Johnson

Head red with at most small, black postocular spots; male genitalia as in figures 614 and 615 ....*speciosus* (Schaeffer)

32(25) Pronotal integument uniformly black in contrast to red elytra; pronotum sometimes with pale, thin, median line of setae (see also *A. kingsolveri*).....33

Pronotal and elytral integument similarly colored, sometimes with darker brown, broad, median pronotal stripe... 35

33(32) Internal sac of male genitalia with one thorn- like and one serrate sclerite (figure 399); lateral lobes cleft nearly one-half their length (figure 400); Texas .... *comstocki* Johnson

Internal sac with one large tapered sclerite (figure 536); lateral lobes cleft about one-fourth their length (figures 537 and 425).....34

34(33) Lateral margins of ventral valve of male genitalia incurved (figure 536); mostly west of 100th meridian .....*pallidipennis* (Motschulsky) (part)

Lateral margins of ventral valve straight (figure 424); east of 100th meridian.....*floridae* (Horn)

35(32) Vestiture of pronotum, elytra, and pygidium bright golden yellow, uniformly dense; venter of body densely white; 1st sternite of male with pit; male genitalia as in figure 536... ..... *pallidipennis* (part)

Dorsal vestiture otherwise; ventral vestiture various 36

36(35) Pronotum and sometimes pygidium with broad, median stripe usually divided by narrow stripe or line of pale setae 37

Dorsal vestiture otherwise.....44

37(36) Body slender, ratio of length to width 2:1 (figure 592); pronotum usually with broad, brown stripe divided by narrow stripe of pale setae; ocular sinus nearly dividing eye; male antenna extending to 1st abdominal segment; male genitalia as in figure 596 .....*schaefferi* (Pic)

Body broader, ratio 1.67–1.78:1; pronotal and dorsal vestiture various; ocular sinus no deeper than two-thirds length of eye; male antenna various 38

38(37) Metatibia usually lacking lateral carina, or carina evanescent (figure 628); male genitalia as in figure 630 (compare *A. floridae,* figure 424) ....*submuticus* (Sharp) (part)

Metatibial lateral carina distinct; male genitalia otherwise 39

39(38) Vestiture of elytra and pygidium dense, pale yellow, uniformly distributed, pygidium with at most a pale, median line of setae; frontal carina distinct.....40

Vestiture of elytra striped or maculate; pygi-dium faintly or strongly striped; frons with at most a bare, impunctate median line 44

40(39) Dorsal coronal denticle of metatibia prominent, separated from adjoining denticle by deep cleft (figure 417); 3rd and 4th striae lacking basal denticles; 1st abdominal sternite of male without pit; male genitalia as in figure 419 ....*flavescens* (Fahraeus)

Dorsal coronal denticle not prominent, similar to adjacent denticles (figure 439); male 1st abdominal sternite with prominent pit.....41

41(24,40) Vertex with black integumental spot; male internal sac with forked sclerite (figure 441) .....*griseolus* (Fall)

Vertex lacking black spot; internal sac densely lined with needle-like spicules (figure 515) .... male *obrienorum* Johnson

42(36) Pronotum and elytra with prominent lateral maculae; pygidium as in figure 512 ....female *obrienorum* Johnson

Pronotum, elytra, and female pygidium striped, or with small, inconspicuous lateral spots 43

43(42) Vestiture of 3rd elytral interstice uniform throughout its length (figure 579); male genitalia as in figures 584 and 585.....*quadridentatus* (Schaeffer)

Vestiture of 3rd elytral interstice interrupted by two brown spots (figure 637); male genitalia as in figures 641 and 642..... *tridenticulatus* Bottimer

44(39) Basal lobe of pronotum and base of pygidium each with intensely white setal patch (figure 498); 2nd, 3rd, and 4th striae deflected laterad at base, 4th with subbasal denticle; male genitalia as in figure 502 .... *mundulus* (Sharp)

Pronotum and pygidium not so marked; striae not deflected, or 3rd and 4th slightly deflected and denticulate 45

45(44) Pygidial integument red, abdominal segments and legs usually partly red.....46

Pygidial integument and abdominal segments black, legs variously colored.....47

46(45) Antenna unicolorous from 5th segment to apex; mucro slender, base with adjacent deep sinus (figure 588); male with rounded pit on 1st abdominal sternite; male genitalia as in figure 590 .....*rufovittatus* (Schaeffer)

Antenna with apical segment red; mucro short, triangular, scarcely longer than lateral denticle, lacking deep sinus (figure 523); 1st sternite without pit; male genitalia as in figure 525..... *obtectus* (Say)

47(45) Hind legs entirely black, fore legs and mid legs reddish yellow; metacoxa with impunc-tate median area (figure 384); 3rd and 4th striae ending in common, or approximate, basal denticles (figure 382) 48

Legs variously colored; metacoxa uniformly punctate; strial denticles in various conformations.....49

48(47) Impunctate area of metacoxa finely striate (figure 384); apical sclerites of internal sac with five to eight serrations (figure 387) ..... *chiricahuae* (Fall)

Impunctate area not striate (figure 600); apical sclerites with 9–13 serrations (figure 602) ...*schrankiae* (Horn)

49(47) Mucro at least one-half length of basitarsus (figure 470); elytra maculate (figures 469 and 616); 1st abdominal sternum of male with setose pit; 4th stria and sometimes 3rd with basal tubercle 50

Mucro no more than one-third length of basitarsus; 1st sternum pitted or not; 4th stria tuberculate or not 52

50(49) Male genitalia with many small spines lining internal sac (figure 472); base of mucro without deep sinus (figure 470); distribution east of 100th meridian ....*longistilus* (Horn)

Male genitalia with either forked sclerite and cluster of small spines (figure 620) or with large, acuminate sclerite and row of thornlike spines (figure 375); base of mucro with deep sinus (figure 373); distribution Arizona, New Mexico, Texas, Mexico 51

51(50) Male genitalia with forked sclerite and cluster of small spines (figure 620)..... *stylifer* (Sharp)

Male genitalia with large, acuminate spine and row of thornlike spines (figure 375) .....*biustulus* (Fall)

52(49) Pronotal and elytral vestiture with brown and white pattern (figure 411); male genitalia as in figure 414; male antenna strongly serrate (figure 413), extending to 1st abdominal sternite.....*distinguendus* (Horn)

Vestiture not with distinct pattern; male antenna not strongly serrate, not extending beyond metacoxa.....53

53(52) Elytra with red integumental stripe of variable width, sometimes extending nearly to lateral margin, or apical one-third or more of elytra red, or reddish yellow 54

Elytral integument entirely black.....56

54(53) Apical one-third or more of elytral integument red or reddish yellow, coloration occasionally extending narrowly to elytral base; male genitalia as in figure 491..... ..... *mixtus* (Horn)

Each elytron with narrow to broad, median integumental stripe.....55

55(54) Lateral margins of pronotum nearly straight in basal two-thirds but convergent toward apex (figure 362); pecten of metafemur composed of two or three minute, subequal denticles (figure 363); red stripe faint in some specimens; male genitalia as in figure 365 .... *baboquivari* Johnson (part)

Lateral margins of pronotum moderately arcuate (figure 458); pecten with basal denticle 2 times as long as distal denticles (figure 459); red stripe narrow to broad; male genitalia as in figure 461... *kingsolveri* Johnson (part)

56(53) Body elongate ovate (figure 340), length 1.7–2.2 mm; mucro aciculate, about one-fourth as long as basitarsus (figure 341) 57

Body elliptical (figure 362), length 1.3–1.7 mm; mucro short, slightly longer than lateral denticle (figure 363) 59

57(56) Hind legs mostly reddish yellow with only basal one-fourth black 58

Hind legs black or with apex of metafemur and tibia dark red; male genitalia as in figure 451 ..... *herissantitus* Johnson

58(57) Male genitalia as in figure 343 ..... *aequalis* (Sharp)

Male genitalia as in figure 625 .. *subaequalis* Johnson

59(56) Lateral margins of pronotum nearly straight but convergent toward apex (figure 362); pecten of metafemur composed of two or three minute, subequal denticles (figure 363); red stripe faint in some specimens; male genitalia as in figure 365 .... *baboquivari* Johnson (part)

Lateral margins of pronotum moderately arcuate (figure 458); pecten with basal denticle two times as long as distal denticles (figure 459); red stripe narrow to broad; male genitalia as in figure 461 .... *kingsolveri* Johnson (part)

Acanthoscelides aequalis (Sharp)

(Figures 340–344)

Bruchus aequalis Sharp 1885:481; Schaeffer 1907:304; Fall 1910:173; Pic 1913b:13.

Mylabris aequalis: Leng 1920:305.

Acanthoscelides aequalis: Moreno and Bibby 1943:23; Blackwelder 1946:758; Bridwell 1952:50; Kingsolver 1965a:128; Bottimer 1968c:336; Johnson 1970:15,16,18,87; Johnson and Kingsolver 1982:414; Johnson 1983a:24; Udayagiri and Wadhi 1989:35.

Color.—Body black; 1st to 4th antennal segments red, 5th to 11th dark brown to piceous, fore and middle legs reddish orange with basal one-fourth to one-third and trochanter reddish brown, hind leg with at least trochanter and basal one-third of femur reddish brown, remainder of hind leg reddish orange except tarsi sometimes brown. Vestiture white, evenly distributed.

Structure.—Vertex and frons micropunctate except glabrous median frontal line; ocular index 2.5:1; ocular sinus one-half length of eye; antenna as in figure 342, reaching middle of metepisternum. Pronotum bell-shaped (figure 340), disk microfoveolate; lateral carina obsolete; cervical sulcus well-defined. Scutellum rectangular. Elytra convex, lateral margins moderately arcu-

ate (figure 340), striae distinct, parallel except 2nd slightly divergent at base, 3rd, 4th, and 5th striae each with minute basal denticle, interstices flat, microimbricate. Metacoxal face densely micropunctate, with distal pubescent patch; hind leg as in figure 341; pecten with one large and two minute denticles; metatibia gradually dilated toward apex, lateral, dorsomesal, and ventral carinae complete, ventrolateral carina absent; mucro short, acute (figure 341), lateral denticle and coronal denticles minute, acute. Fifth abdominal sternum of male deeply emarginate to receive apex of pygidium, of female nearly straight; pygidium more strongly convex in male.

Male genitalia.—As in figures 343 and 344; median lobe with ventral valve subelliptical (figure 343); internal sac armed with many fine denticles near base, then in order toward apex two small burrs, two clublike, spiny sclerites, 10–11 burrs, two slender, thornlike spines, a lightly sclerotized, spinose structure; apex finely denticulate, closure valve C-shaped; lateral lobes flat (figure 344), spatulate, setose, cleft about one-half their length.

Size.—Body length 1.2–2.0 mm; width 0.9–1.3 mm.

Type depository.—BMNH.

Type locality.—Mexico, Guanajuato, Toxpam.

Distribution.—AZ, TX; Mexico to Guatemala.

Host plants.—Abutilon berlandieri; Allowissadula holosericea, A. lozani. Johnson (1983a:25) lists four additional host plants in Mexico.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This is one of the smallest bruchids in the United States, rivaled only by *Abutiloneus idoneus,* with which it is sometimes associated, and *A. atomus,* which is found on the east coast. The evenly distributed white vestiture and the metafemur with black base and red apex and with three denticles will separate it from *A. idoneus* with golden vestiture, all legs red or yellow, and metafemur lacking denticles or at most with one small denticle.

Acanthoscelides alboscutellatus (Horn)

(Figures 345–351)

Bruchus alboscutellatus Horn 1873:334; Hubbard and Schwarz 1878:660; Casey 1884:184; Hamilton 1892b:253; Riley and Howard 1892c:165; Townsend 1895:277; Fall and Cockerell 1907:201; Schaeffer 1907:303; Blatchley 1910:1239; Fall 1910:168; Cushman 1911:505; Pic 1913a:14; Bridwell 1918:494.

Bruchus albiscutellaris: Ashmead 1894:328 (misspelling)

Bruchus alboscutellaris: Zacher 1952:461 (misspelling).

Mylabris alboscutellatus: Leng 1920:305; Essig 1926:485, 1958:486.

Acanthoscelides alboscutellatus: Bottimer 1935:128; Bridwell 1935:186; Bissell 1940:846; Bradley 1947:40; Blackwelder and Blackwelder 1948:44; Peck 1963:956; De Luca 1965:1017,1038; Johnson 1969c:55, 1970:15, 1974:272; Center and Johnson 1974:1097; Johnson 1976b:260; Kingsolver 1979a:341; Johnson 1981b:79; Johnson and Kingsolver 1982:414; Johnson 1983a:29; Udayagiri and Wadhi 1989:36; Ott 1991:641; Ott and Lampo 1991.

Bruchus conspersus Motschulsky 1874:224; Bottimer 1968c:1040.

Acanthoscelides conspersus: Kingsolver 1979a:341.

Bruchus abutilonis Motschulsky 1874:232; Zacher 1952:461,468.

Acanthoscelides abutilonis: Kingsolver 1979a:341.

Color.—Body usually entirely black except basal four antennal segments reddish brown on ventral face, some teneral specimens piceous with legs and antenna

dark red. Vestiture white, more densely set on lateral parts of pronotal disk than in middle (figure 345), dense on mesepimeron and caudal margin of metepisternum (figure 347), conspicuous on scutellum; elytra with regular rows of white patches of setae (figure 345); pygidium slightly mottled.

Structure.—Vertex and frons convex, lacking frontal carina, micropunctate, setae of punctures directed toward center of frons; ocular index 3:1; ocular sinus one-half length of eye; antenna as in figure 349, extending to anterior margin of metacoxa. Pronotum strongly convex, bell-shaped (figure 345), disk microfoveolate, foveolae circular, usually discrete but sometimes coalescent. Scutellum cordate, densely pubescent. Elytral striae deep, narrow, set with short, curved setae, without basal denticles, arising basally from simple punctures; interstices flat, of uniform width, microimbricate; metacoxa uniformly punctate; hind leg as in figure 348, pecten with one curved denticle followed by one or two minute denticles; metatibia gradually dilated, lateral, ventral, and dorsomesal carinae complete to apex, ventrolateral carina evanescent in apical one-half; mucro short, acute, about one-seventh length of basitarsus; lateral denticle and three coronal denticles acute. Pygidium of male bulbous (figure 346), that of female moderately convex (figure 347).

Male genitalia.—As in figures 350 and 351; median lobe medially constricted; ventral valve triangular with lateral extensions at base; dorsal valve membranous; armature of internal sac consisting of, in order, a section of fine denticles, a section of broad, rounded, serrate denticles (see inset, figure 350), another section of fine denticles, two small thornlike denticles; apex finely spiculate; closure valve C-shaped; lateral lobes slender, slightly spatulate toward apex, mesal faces concave, bordered with fine setae, deeply cleft.

Size.—Body length 1.1–2.3 mm; width 0.8–1.4 mm.

Type depository.—MCZC (*alboscutellatus,* lectotype No. 8202, by Johnson 1968), ZMUM *(abutilonis, conspersus).*

Type locality.—"Georgia, Louisiana, and Missour" *(alboscutellatus);* America Borealis *(abutilonis, conspersus).*

Distribution.—AL, AR, CO, CT, DC, DE, FL, GA, IL, IN, KS, LA, MD, MI, MO, MS, NC, NJ, NY, OH, OK, PA, SC, TN, TX, VA, WV; Mexico.

Host plants.—Daucus carota (floral record); *Glycyrrhiza lepidota; Ludwigia alternifolia, L. palustris.*

Natural enemies.—Dinarmus acutus; Eupelmus amicus; Uscana semifumipennis.

Immatures.—Not described.

Discussion.—Salient characters for this species are the mottled elytra, prominent white scutellum, convex pronotum, bulbous male pygidium, and host plant specificity. This species might be confused with *A. helianthemum,* but that species averages smaller (1.4–1.7 mm), the scutellum, although white, is not prominent, the male pygidium is not bulging, and the male genitalia are distinctive (compare figure 446). The pygidium of *A. tenuis* is slightly convex, and the elytra are mottled as in *A. alboscutellatus,* but the average size is smaller and the male genitalia are distinctive (compare figures 350 and 635). These three species breed in seeds of three different plant families, none of which is leguminous.

Acanthoscelides atomus (Fall)

(Figures 352–356)

Bruchus atomus Fall 1910:188; Pic 1913a:17.

Mylabris atomus: Leng 1920:306; Frost 1931:3.

Abutiloneus atomus: Bradley 1947:41; Blackwelder and Blackwelder 1948:45.

Acanthoscelides atomus: Bottimer 1935:128, 1968c:1017; Johnson 1968:1267; Bottimer 1969a:981;

Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:37.

Color.—Body black with reddish highlights on antenna and legs. Vestiture of slender, white, scalelike hairs uniformly distributed over body except elytral interstices with elongate white patches separated by setiferous black spots forming ocellate pattern (figure 352).

Structure.—Vertex and frons micropunctate, sparsely setose; frons with glabrous median line; ocular index 2.3:1; ocular sinus three-fifths length of eye; antenna as in figure 354, reaching middle of metepisternum. Pronotum bell-shaped (figure 352), evenly convex, disk micro-punctate, sparsely setose; lateral carina absent; cervical sulcus well defined. Scutellum quadrate, pubescence not contrasting. Elytral margins arcuate (figure 352); dorsal surface strongly convex; striae parallel, narrow, 2nd through 5th arising from minute basal denticles; interstices flat, minutely, sparsely punctulate. Meta-coxa shallowly micropunctate, sparsely pubescent; metafemur (figure 353) moderately swollen, pecten with two minute, separate denticles; metatibia gradually dilated toward apex, mucro slender, one-third length of basitarsus with deep sinus at base; ventral and dorsomesal carinae present, lateral and ventrolateral carinae absent. First sternum unmodified; 5th sternum slightly emarginate in male, margin straight in female; pygidium convex in both sexes, apex of male more deeply reflexed than female.

Male genitalia.—As in figures 355 and 356; median lobe not constricted in middle; ventral valve subtriangular, apex with small nipple; dorsal valve evenly rounded; armature of internal sac consisting of cluster of spicules at apical orifice, a dense cluster of semicircular, serrate sclerites, a pair of slender spines, and a spinose, bifurcate structure; closure valve V-shaped; lateral lobes slender (figure 356), flat, slightly bowed, deeply cleft.

Size.—Body length 0.95–1.2 mm; width 0.6–0.8 mm.

Type depository.—MCZC, holotype No. 25045.

Type locality.—Massachusetts, Hyannis.

Distribution.—FL, IA, MA, MD, ME, NH, NJ.

Host plants.—Lechea racemulosa, L. tenuifolia (Bottimer 1969a). Swept from *Hudsonia ericoides* (Frost 1931).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species can hardly be mistaken for any other eastern species (except *A. helianthemum*) because of its minute size, ocellate elytral vestiture, and lack of lateral and ventrolateral tibial carinae. The male genitalia are distinctive. In *A. atomus,* the ventral valve is broadly triangular, whereas in *A. helianthemum* this sclerite is narrowly triangular. Body length for *A. atomus* ranges from 0.9–1.2 mm; for *A. helianthemum,* the range is 1.4–1.7 mm.

Host plants for both *A. atomus* and *A. helianthemum* are in the family Cistaceae.

Acanthoscelides aureolus (Horn) complex

(Figures 357–361)

Bruchus aureolus Horn 1873:328; Riley and Howard 1892c:166; Horn 1894:345; Fall 1901:29; Fall and Cockerell 1907:201; Schaeffer 1907:299; Fall 1910:173,184; Cushman 1911:505; Pic 1913a:17.

Mylabris aureolus: Leng 1920:305.

Acanthoscelides aureolus: Blackwelder 1946:758; Bottimer 1968c:1017,1038; Johnson 1968:1267, 1969c:55, 1970:33; Johnson and Kingsolver 1982:414; Johnson 1983a:38; Boe et al. 1988; Udayagiri and Wadhi 1989:38.

Bruchus fraterculus: Fall 1910:184 (not Horn 1873).

Bruchus pauperculus: Schaeffer 1907:299 (not LeConte 1857).

Mylabris pauperculus: Leng 1920:305 (not LeConte 1857).

Acanthoscelides pauperculus: Bottimer 1968c:1020.

Bruchus pulicarius: Motschulsky 1874:233.

Bruchus rufus: Motschulsky 1874:238.

Color.—Body reddish orange to black; head black, sometimes with dark red spot behind eye, antenna usually black with basal four or five segments red, rarely all red; pronotum varying from all red to all black; elytra varying from all red to all black, often with base black and apex red; sternal areas variable; legs red to black, sometimes bicolored. Vestiture white or grayish yellow if integumental color of head, body, and legs mostly black; vestiture usually white but may appear yellow or intermixed white and golden on yellow or red integumental background.

Structure.—Head finely punctate, or, in some forms, minutely granulose; frons evenly punctate or with median impunctate line; ocular index 2:1 to 2:7; ocular sinus one-half to three-fifths length of eye; antenna as in figure 359, extending to middle of metepisternum. Pronotum bell-shaped (figure 357), disk convex, slightly depressed either side of basal lobe and near posterior corners, lateral margins gently sinuate, slightly constricted by cervical sulci near apex, surface densely microfoveolate, interspaces minutely imbricate, lateral ridge extending half-way to procoxal cavity. Scutellum slightly longer than wide, bidentate apically. Elytra together slightly longer than wide (figure 357), lateral margins convex, disk slightly depressed; striae narrow, indistinct because of dense vestiture, 3rd and 4th with minute basal denticle; interstices flat, densely setose, minutely imbricate. Meta-coxal face minutely, densely punctate, fossula glabrous; hind leg as in figure 358, pecten with three minute denticles of nearly equal size; metatibia bent only at base (figure 358), slightly dilated toward apex, lateral, ventral, and dorsomesal carinae distinct, ventrolateral carina lacking; mucro one-fourth length of basitarsus, lateral and coronal denticles of equal size. First abdominal sternum of male flattened or concave, with median pubescent pit and several large punctures, posterior margin of sternum sinuate with fringe of long hairs; 5th male sternum deeply emarginate; 1st sternum of female slightly curvate, 5th only slightly emarginate; pygidium of male strongly reflexed into sternal emargination, that of female less strongly convex, disk in both sexes finely, densely punctate.

Male genitalia.—As in figures 360 and 361; median lobe slightly constricted at middle; ventral valve triangular; internal sac with large, tapered sclerite; apical one-half with paired, setose, slender structures; apex with circular closure valve; lateral lobes fused at base for two-thirds their length, apices spatulate, mesal faces setose.

Size.—Body length 1.1–2.7 mm; width 0.9–1.5 mm.

Type depository.—MCZC, lectotype No. 8199, by Johnson 1968.

Type locality.—California.

Distribution.—AB, AZ, BC, CA, CO, ID, MB, MN, MT, ND, NE, NM, OR, SD, SK, TX, UT, WY; Mexico.

Host plants.—Astragalus allochrous, A. amphioxys, A. asymmetricus, A. bisulcatus, A. calycosus, A. crotalariae, A. douglasii, A. drummondii, A. fucatus, A. grayi, A. humistratus, A. lancearius, A. lentiginosus, A. lonchocarpus, A. mollissimus mollissimus, A. oxyphysus, A. pattersonii, A. praelongus, A. pterocarpus, A. racemosus, A. thurberi, A. trichopodus antisellii, A. trichopodus phoxus, A. trichopodus trichopodus, A. wootoni; Glycyrrhiza lepidota; Lotus purshianus, L. scoparius; Oxytropis lambertii, O. sericea.

Natural enemies.—Eupelmus sp.; *Horismenus missouriensis; Microdontomerus anthonomi.*

Immatures.—Pfaffenberger and Johnson 1976:21 (first larval instar).

Discussion.—Johnson (1970) treated this as a complex of forms, perhaps cryptic species, varying in size, color, and vestiture somewhat related to host plant and

geographical distribution. To further complicate the picture, the *A. aureolus* complex is part of a closely related species group that includes *Acanthoscelides pallidipennis* (Motschulsky), *A. fraterculus* (Horn), *A. seminulum* (Horn), *A. perforatus* (Horn), *A. lobatus* (Fall), *A. pullus* (Fall), *A. mixtus* (Horn), *A. daleae* Johnson, *A. oregonensis* Johnson, *A. margaretae* Johnson, and *A. floridae* (Horn). The male genitalia are similar in form in species included in this group, and some species are difficult to distinguish.

Nelson and Johnson (1983a,b) described the effect of selenium on this bruchid feeding in three species of Astragalus.

Acanthoscelides baboquivari Johnson

(Figures 362–366)

Acanthoscelides baboquivari Johnson 1974:268; Center and Johnson 1976:196; Johnson 1976b:260; Johnson and Kingsolver 1982:414; Johnson 1983a:40; Udayagiri and Wadhi 1989:38.

Color.—Body black except reddish yellow or piceous as follows: ventral sides of 1st to 4th antennal segments, postocular spot on head, occasionally on each lateral one-third of pronotal disk, often with broad median stripe on each elytron, fore legs, distal one-half of mesofemur, mesotibia, and metatarsus, often on middle of pygidial disk. Vestiture of slender, white setae evenly distributed over body except often condensed into faint median stripe on pronotal disk; elytral interstices regularly interrupted by small, rounded, setiferous spots; pygidium with faint to obvious basal triangle and median stripe; mesepimeron and metepisternum usually prominently setose.

Structure.—Vertex finely, densely punctate, intervals minutely granulose, frons often with median impunctate line, setae in circular pattern; ocular index 2.5:1; ocular sinus about two-thirds length of eye; antenna subserrate (figure 364), reaching middle of metepisternum. Pronotum bell-shaped (figure 362), lateral margins gently arcuate, disk strongly convex, surface closely set with setiferous microfoveolae; lateral carina ridgelike; cervical sulcus well-defined. Scutellum quadrate, bifid apically. Elytra widest behind middle (figure 362); striae parallel, 3rd, 4th, and 5th with minute basal denticles; interstices flat. Metacoxal face densely, finely punctate except fossula glabrous; hind leg as in figure 363; pecten with one small denticle and one or two minute denticles; metatibia (figure 363) dilated toward apex, lateral, ventral, and dorsomesal carinae complete, ventrolateral carina evanescent apically; mucro acute, slightly curved, with deep sinus at base, one-third length of basitarsus, lateral denticles and coronal denticles subequal in size. Male with small tuft of setae in middle of 1st abdominal sternum; pygidium strongly convex in male, slightly convex in female.

Male genitalia.—As in figures 365 and 366; median lobe not constricted at middle; ventral valve transverse with apical nipple; armature of internal sac consisting of cluster of spicules at apical orifice, basal one-third of sac lined with fine denticles and a slender, serrate sclerite, middle of sac armed with two pairs of thornlike spines, of which one pair is setose at basal end, a curvate, spinose median sclerite, and a pair of lightly sclerotized structures; apex with elongate, bifid closure valve; lateral lobes flat (figure 366), cleft about one-half their length, setose on mesal faces and on apices.

Size.—Body length 1.7–2.2 mm; width 0.9–1.4 mm.

Type depository.—USNM, holotype No. 71401.

Type locality.—Arizona, Pima Co., Kitt Peak, 5,500 ft.

Distribution.—AZ; Mexico.

Host plants.—Indigofera platycarpa, I. sphaerocarpa.

Natural enemies.—None recorded.

Immatures.—Pfaffenberger and Johnson 1976 (first larval instar).

Discussion.—Johnson (1983a) tentatively placed this species in his *flavescens* group. Salient characters are the black body with red elytral stripe, ocellate interstices; curved, slender mucro with a deep sinus at its base; dark red elytral stripes; and red legs. It resembles *Stylantheus macrocerus* but the black body and appendages of that species, its elongated antennal segments, and the male genitalia easily distinguish the species.

Acanthoscelides bisignatus (Horn)

(Figures 367–371)

Bruchus bisignatus Horn 1873:334; Fall and Cockerell 1907:201; Schaeffer 1907:302; Fall 1910:170,174; Cushman 1911:505; Pic 1913a:19; Bridwell 1918:479; Zacher 1952:461.

Mylabris bisignatus: Leng 1920:305.

Acanthoscelides bisignatus: Glick 1939:36; Peck 1963:956; De Luca 1965:53; Bottimer 1968c:1017,1038; Johnson 1968:1267, 1969c:55, 1970:37; Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:40.

Color.—Body mostly black except greater part of elytra, 1st to 5th and 11th segments of antenna, fore and middle legs, and apical one-half of metafemur and all of tibia and tarsus red; mouth parts dark brown. Vestiture of white, dark brown, and brassy setae; head black with reddish postocular spot; pronotum with intermixed white and brassy setae and paired dark brown spots; elytra with sutural interstice brassy, remainder with intermixed white and brassy, 3rd interstice and apex with prominent white spots, lateral marginal dark brown spots prominent; pygidium with basal triangle and lateral patches white, remainder brassy.

Structure.—Vertex and frons densely punctate, frons with prominent protuberance and median carina; ocular index 5:1 in male, 4:1 in female; ocular sinus about one-half length of eye, male's eyes larger those of female; antenna (figure 369) with 5th to 10th segments eccentric, 11th elliptical, those of male reaching metacoxa, those of female reaching middle of metepisternum; Pronotum bell-shaped (figure 367), lateral margins strongly sinuate, disk evenly convex, without depressions or protuberances except shallow sulcus on basal lobe; disk densely, evenly microfoveolate. Scutellum small, quadrate, densely pubescent. Elytra evenly convex, widest at middle (figure 367); striae sinuate in middle of elytra, 2nd and 3rd bent laterad near base, 3rd and 4th approximate at base, each with prominent black denticle; interstices flat, imbricate. Metacoxa evenly punctate except fossula glabrous; hind leg as in figure 368; pecten with three slender denticles; metatibia arcuate basally, with lateral, ventral, and dorsomesal carinae complete, ventrolateral carina evanescent near apex of tibia; mucro short, slender, one-tenth length of basitarsus, lateral denticle and three coronal denticles minute or absent. Fifth abdominal sternum of male broadly emarginate to receive apex of pygidium, that of female evenly rounded; pygidium of both sexes convex, apex more reflexed in male.

Male genitalia.—As in figures 370 and 371; median lobe slender, not constricted at middle; ventral valve ogival with apex attenuate; internal sac armature consisting of fine, acute denticles and truncated denticles in basal one-half, middle of sac with small, thornlike denticles of several sizes, apex of sac with cluster of fine spicules; closure valve ringlike; lateral lobes slender (figure 371), apically spatulate, cleft about one-half their length.

Size.—Body length 1.75–2.00 mm; width 1.1–1.3 mm.

Type depository.—MCZC, lectotype No. 8203, by Johnson 1968.

Type locality.—Kansas.

Distribution.—KS, LA, NM, OK, SD, TX; Mexico.

Host plants.—*Baptisia* sp.; *Desmanthus* sp. *D. illinoensis, D. leptolobus, D. velutinus, D. virgatus virgatus.*

Natural enemies.—*Catolaccus hunteri; Eupelmus cyaniceps; Heterospilus proso-pidis; Pteromalus piercei.*

Immatures.—Not described.

Discussion.—This species is nearly inseparable from *Acanthoscelides desmanthi* Johnson except by comparing the male genitalia. The head of *A. bisignatus* is mostly black whereas that of *A. desmanthi* is reddish orange with a broad, black stripe on the vertex and frons. The vestiture of *A. desmanthi* is brighter when examples of the two species are compared. Each species has sexually dimorphic eyes and antennae, red terminal antennal segments, and a prominent frontal carina. Both species belong to the *mexicanus* species group according to Johnson (1983a).

The geographical range of *A. desmanthi* (south Texas to Chiapas, Mexico) is concurrent with that of *Desmanthus virgatus,* whereas that of *A. bisignatus* coincides closely that of *Desmanthus illinoensis.*

Acanthoscelides biustulus (Fall)

(Figures 372–376)

Bruchus biustulus Fall 1910:178; Pic 1913a:19.

Mylabris biustulus: Leng 1920:305.

Acanthoscelides biustulus: Johnson 1968:1267; Bottimer 1968c:1017,1038; Johnson 1970:39; Slobodchikoff and Johnson 1973:282; Center and Johnson 1976:196; Johnson 1976b:260, 1977a:64, 1979b:62, 1983a:46; Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:40.

Color.—Body and appendages black except apex of fore and middle femur, all of tibia and tarsus and basal four segments of antenna red. Vestiture of white, dark brown, and brassy setae; head sparsely set with white but with intensely white postocular patch; pronotum white with paired, median, dark brown stripes separated by narrow white stripe; elytra intermixed white and brassy except brown spots as follows: paired spots near scutellum, paired lateral marginal spots at middle of margin, small paired spots on 3rd interstices, apical patches of variable size; pygidium with narrow, median, white stripe; ventral areas of body evenly white except metepisternum and lateral margin of abdomen with white patches.

Structure.—Vertex densely punctulate; frons with median impunctate line; ocular index 2.5:1; ocular sinus one-half length of eye; antenna as in figure 374, reaching middle of metepisternum. Pronotum bell-shaped (figure 372), lateral margins nearly straight, apex semicircular; disk evenly convex, densely, uniformly microfoveolate. Scutellum quadrate, densely pubescent. Elytra convex, widest at apical one-third (figure 372); striae parallel, narrow, base of 4th with small denticle; interstices flat, minutely imbricate. Metacoxa densely, evenly punctate except fossula glabrous; hind leg as in figure 373, pecten with one long and two shorter denticles; metatibia (figure 373) slightly arcuate in basal one-fourth, all carinae complete, mucro curved, about four-tenths as long as basitarsus, sinus at base of mucro deep, lateral denticle and coronal denticles of equal size. First abdominal sternum of male with small white tuft of setae; pygidium of both sexes convex, male with apex reflexed.

Male genitalia.—As in figures 375 and 376; median lobe broad; ventral valve ogival, acute; armature of internal sac consisting of angulate cluster of fine spicules at apical orifice, a large, pointed sclerite, a median row of thornlike sclerites, two curved, acute sclerites, and apex lined with fine spicules; closure valve circular; lateral lobes broad (figure 376), truncate, setose on mesal faces and on apical borders, cleft about two-thirds of their length.

Size.—Body length 1.2–2.3 mm; width 1.0–1.5 mm.

Type depository.—MCZC, holotype No. 25047.

Type locality.—Arizona, Santa Rita Mountains.

Distribution.—AZ, NM, TX; Mexico.

Host plants.—*Desmodium* sp. *D. bato-caulon, D. cinerascens, D. grahamii, D. neomexicanus.* Johnson (1983a) lists other species of *Desmodium* in Mexico for this bruchid.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Johnson (1983a) places *Acanthoscelides biustulus* in the *pertinax* species group. Salient characters are the elongated, curved mucro, red apices of femur and tibia, maculate pattern on elytra, fourth stria with prominent basal denticle, and male with small, white tuft on 1st abdominal sternum and tibial carinae all present.

Acanthoscelides calvus (Horn)

(Figures 377–381)

Bruchus calvus Horn 1873:336; Hubbard and Schwarz 1878:660; Blatchley 1910:1239; Fall 1910:173; Pic 1913a:20; Olsen 1918 (misidentification of *Bruchidius villosus*).

Mylabris calvus: Leng 1920:305.

Acanthoscelides calvus: Bridwell 1925:80; Bradley 1947:40; Blackwelder and Blackwelder 1948:45; Bottimer 1968c:1018; Johnson 1968:1267, 1969c:55; Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:40.

Color.—Body and appendages uniformly black, fore and middle legs occasionally dark brown. Vestiture white, uniformly distributed over body, except scutellum prominently white.

Structure.—Head elongate; vertex and frons sparsely, evenly punctulate, interspaces minutely granulate, frons with median carina barely indicated; ocular index 3:1; ocular sinus three-fourths length of eye, postocular fringe prominent; antenna as in figure 379; extending to middle of metepi-sternum. Pronotum subconical, lateral margins straight or slightly incurved (figure 377), disk evenly convex with slight swelling anteriad to basal lobe; surface finely, densely punctulate, each puncture setiferous; cervical sulcus prominent; lateral carina evanescent. Scutellum subtriangular, slightly wider than long, densely pubescent, prominent. Elytra (figure 377) evenly convex, humeri prominent; striae parallel except 2nd bent at base to approach 3rd; 2nd to 6th striae each with minute basal denticle; interstices flat, minutely imbricate. Metacoxa densely punctulate; hind leg as in figure 378; metatibia with lateral, ventral, and dorsomesal carinae complete, lateral and ventrolateral carinae evanescent, mucro slender, curved, one-third as long as basitarsus, lateral denticle slender, coronal denticles two or three. First abdominal sternum convex in male but not modified, 5th male sternum broadly emarginate.

Male genitalia.—As in figures 380 and 381; median lobe broad; ventral valve sharply triangular; dorsal valve evenly rounded with cluster of spicules; armature of internal sac consisting of clusters of acute denticles in basal one-half, two pairs of large, thornlike sclerites, and a spiny structure near apex; closure valve circular; lateral lobes slender (figure 381), moderately spatulate, cleft nearly to base.

Size.—Body length 2.25–3.25 mm; width 1.5–2.0 mm.

Type depository.—MCZC, lectotype No. 3891, by Johnson 1968.

Type locality.—Massachusetts (lectotype).

Distribution.—CT, IL, IN, MA, MD, MI, NC, NH, NJ, NY, ON, PA, SC, TN, TX, VT, WI.

Host plants.—*Helianthemum canadense;* on *Aronia* flowers.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species will most likely be confused with *Acanthoscelides*

fraterculus with its comparable size, black body and legs usually black, but the prominent white scutellum of *A. calvus* should immediately separate them. The 1st sternum of male *A. calvus* is convex whereas that of *A. fraterculus* is concave with a fringe of long hair along the posterior border of the segment. The male genitalia of *A. calvus* are distinctive and are unlike any other eastern species.

Acanthoscelides chiricahuae (Fall)

(Figures 382–388)

Bruchus chiricahuae Fall 1910:181.

Bruchus chiracahuae: Pic 1913a:21 (misspelling).

Mylabris chiricahuae: Leng 1920:305.

Acanthoscelides chiricahuae: Johnson 1968:1267; Bottimer 1968c:1018,1038, 1969b:1187; Johnson 1970:41; Slobodchikoff and Johnson 1973:282; Center and Johnson 1976:196; Pfaffenberger and Johnson 1976:24; Ward et al. 1977:4; Johnson 1979b:62, 1981b:76; Johnson and Kingsolver 1982:414; Johnson 1983a:57; Pfaffenberger 1985b:256; Udayagiri and Wadhi 1989:42.

Color.—Body black except fore legs, apical one-half of middle femur, and all of middle tibia; antenna reddish orange to piceous with apical segment reddish brown. Vestiture of fine white setae densely, uniformly distributed on body, pygidium sometimes with median condensed line.

Structure.—Vertex and frons micropunctate, densely pubescent; frontal carina evident, transverse sulcus shallow; ocular index 3.5:1 in male, 3:1 in female; ocular sinus three-fifths length of eye; postocular fringe narrow but prominent; antenna as in figure 385, reaching middle of metepisternum. Pronotum bell-shaped (figure 382), disk strongly convex, lateral margins arcuate, lateral carina evanescent, cervical sulcus prominent. Elytra convex with lateral margins arcuate (figure 382); striae parallel except 2nd and 3rd deflected laterad at base, 3rd and 4th each with prominent raised denticle; interstices flat, minutely imbricate. Metacoxa densely punctate and pubescent in lateral one-half, median one-half with fine, radiating strigae bisected by arcuate ridge (figure 384); hind leg as in figure 383; mesoventral face of femur with fine carina (figure 386), possible scraper over metacoxal ridges; metatibia (figure 383) arcuate in basal one-third, straight apically; lateral, ventrolateral, ventral, and dorsomesal carinae complete; mucro short, scarcely longer than lateral denticle, two or three coronal denticles. Male abdomen with sterna telescoped, 5th sternum nearly divided by emargination; pygidium of both sexes finely punctate, apex of male strongly reflexed, female pygidium subvertical.

Male genitalia.—As in figures 387 and 388; median lobe slender, slightly constricted near apex; ventral valve ogival, apex slightly produced; internal sac densely lined with small acute and truncate denticles; two arcuate, apical sclerites, each with five to eight serrations; lateral lobes bowed (figure 388), deeply cleft, arms narrow, apices spatulate.

Size.—Body length 1.7–2.4 mm; width 1.1–2.4 mm.

Type depository.—MCZC, holotype No. 25049.

Type locality.—Arizona, Chiricahua Mountains.

Distribution.—AZ, NM, TX; Mexico.

Host plants.—Mimosa biuncifera, M. borealis, M. dysocarpa, M. grahamii, M. laxiflora, M. wherryana. Johnson (1983a) lists five additional species from Mexico. Pfaffenberger (1985c) lists *Acacia greggi.*

Natural enemies.—Eupelmus sp.; *Horismenus missouriensis; Urosigalphus bruchivorus; Zatropis incertus.*

Immatures.—Pfaffenberger and Johnson 1976:24 (first larval instar).

Discussion.—Distinguishing characters for this species are the evenly distributed body setae, the prominent raised denticles at the bases of striae three and four, the

telescoped abdominal sterna, and the radiating lines on the metacoxal face. This species most closely resembles *Acanthoscelides schrankiae,* a species found from eastern United States to Venezuela (Johnson 1983a). The metacoxa of *A. chiricahuae* is finely striate in a radiating pattern with a low ridge bisecting the radiating lines, whereas in *A. schrankiae* the metacoxa is simply punctate. Each of the serrate apical sclerites in the male internal sac (figure 387) has five to eight teeth in *A. chiricahuae* but nine to thirteen in *A. schrankiae* (figure 602).

Acanthoscelides compressicornis (Schaeffer)

(Figures 389–394)

Bruchus compressicornis Schaeffer 1907:305; Fall 1910:188; Cushman 1911:506; Pic 1913b:23; Zacher 1952:461,471.

Mylabris compressicornis: Leng 1920:306.

Bruchus subserripes Fall 1910:183; Pic 1913a:51.

Acanthoscelides compressicornis: Muesebeck et al. 1951:509; Peck 1963:965; De Luca 1965:54; Bottimer 1968c:1018,1038; Johnson 1968:1267; Bottimer 1969a:977; Johnson 1970:46; Slobodchikoff and Johnson 1973:282; Center and Johnson 1974:1097, 1976:260; Johnson 1977a:70, 1981d:74; Johnson and Kingsolver 1982:414; Johnson 1983a:63; Luckow and Johnson 1987:49; Johnson 1990e:324.

Acanthoscelides subserripes: Bottimer 1968c:1018,1038; Johnson 1968:1268, 1970:46; Udayagiri and Wadhi 1989:43.

Color.—Body and appendages black except fore and middle legs occasionally reddish. Vestiture of fine white setae uniformly distributed over body except basal margin of pronotum with small patch opposite base of 5th interstice and faint median line of setae on pygidium.

Structure.—Vertex and frons punctulate, setae directed toward center of vertex; frontal carina usually evident but faint in some specimens; ocular index 3:1; ocular sinus about three-fourths length of eye; postocular lobe with narrow fringe; antenna sexually dimorphic as in figures 391 and 392, in the male reaching 1st abdominal sternum, in female middle of metepisternum. Pronotum trapezoidal (figure 389), disk strongly convex, microfoveolate, lateral margins straight, lateral carina absent; cervical sulcus deep. Scutellum elongate, small, densely pubescent. Lateral margins of elytra arcuate (figure 389); striae parallel, 2nd to 5th striae minutely denticulate basally; interstices flat, punctation concealed by pubescence. Metacoxal face evenly punctate except for narrow fossula; hind leg as in figure 390; metatibia nearly straight with lateral, ventrolateral, ventral, and dorsomesal carinae complete, mucro slender, curved, about two-fifths length of basitarsus. Male abdomen with basal sternum unmodified, 5th sternum shallowly emarginate; female 5th sternum not modified; pygidium convex in both sexes, disk with punctures concealed by vestiture, apex in male reflexed apically.

Male genitalia.—As in figures 393 and 394; median lobe slender, elongate; ventral valve semicircular, apex subtruncate; basal two-thirds of internal sac lined with truncate denticles, middle of sac with clusters of acute denticles, apex with three pairs of thornlike spines; lateral lobes (figure 394) fused from base for most of their length, apices divergent, setose.

Size.—Body length 1.3–2.3 mm; width 0.9–1.4 mm.

Type depository.—USNM (*compressicornis,* lectotype No. 42348, by Johnson 1968); MCZC (*subserripes,* holotype No. 25063).

Type locality.—Texas, Brownsville *(compressicornis);* Texas, Ysleta *(subserripes).*

Distribution.—AR, AZ, FL, IA, KS, LA, MO, NE, NM, OH, OK, SD, TX; Mexico, Guatemala.

Host plants.—Desmanthus sp., *D. cooleyi, D. covillei, D. illinoensis, D. leptolobus, D. leptophyllus, D. obtusus, D. subutatus, D.*

velutinus, D. virgatus acuminatus, D. virgatus depressus, D. virgatus glandu-losus, D. virgatus virgatus; Hoffmanseggia densiflora, H. drepanocarpa, H. glauca, H. tenella; Mimosa dysocarpa, M. grahamii. Johnson (1977a) lists *Desmanthus covillei* and (1983a) *D. subulatus* from Mexico.

Natural enemies.—Catolaccus hunteri; Eupelmus cyaniceps; Heterospilus prosopidis; Pteromalus piercei.

Immatures.—Not described.

Discussion.—Salient characters of this species are the black coloration (except basal antennal segments), strial denticles at extreme base, slender, curved mucro, the greatly enlarged, triangular antennal segments of the male, and the distinctive male genitalia. From other all-black species in its range, it may be distinguished as follows: *A. perforatus* by coarse strial punctures and lobate 5th male sternum; *A. calvus* by the elongate head; *A. fraterculus* by the more elongate body and lobate male 5th sternum; *A. fumatus* by the broad body and distinctive male genitalia.

Johnson tentatively places this species in his *flavescens* group. Blatchley (1919:66) misidentified Florida specimens of *A. helianthemum* Bottimer as *A. compres-sicornis,* but in *A. helianthemum* the elytral vestiture is mottled similarly to *A. alboscutellatus* (Horn).

Acanthoscelides comstocki Johnson

(Figures 395–400)

Acanthoscelides comstocki Johnson 1990a:8.

Color.—Integument black except most of elytra, fore and middle legs, apical three-fourths of metafemur, and all of metatibia red. Vestiture mostly white except variable pronotal stripe golden, elytral margins white, middle and apical one-half yellow with reddish-brown lateral maculae, 3rd interstice with anterior and posterior reddish-brown spots delimiting short, white elongated spot; head, venter of body and pygidium uniformly white.

Structure.—Vertex and frons punctate-granulose, frontal carina absent; ocular index 5:2; ocular sinus one-half length of eye; antenna (figure 398) extending to middle of metepisternum. Pronotum bell-shaped (figure 395), lateral margins slightly sinuate, apex round; disk strongly convex, posterior angles and middle of basal lobe depressed, surface densely foveolate, covered by vestiture; lateral carina ridgelike, abbreviated; cervical sulcus well defined. Scutellum one and one-half times as long as wide, densely setose. Elytra 1.1 times as long as wide (figure 395), evenly convex; striae narrow, subparallel, hidden in vestiture, lacking basal denticles; interstices minutely imbricate. Metacoxal face uniformly punctulate except fossula glabrous; hind leg as in figure 397; pecten with three small denticles; metatibia with lateral, ventral, and dorsomesal carinae complete, ventrolateral abbreviated; mucro acute, three-tenths as long as basitarsus; lateral denticle and one coronal denticle subequal, dorsal coronal denticle more slender, acute. Male basal abdominal segment with small pit, setae arranged in circular pattern, 5th segment broadly emarginate in male, truncate in female; male pygidium evenly convex (figure 396), female pygidium vertical at apex.

Male genitalia.—As in figures 399 and 400; median lobe moderately broad, expanded at apex; ventral valve broadly triangular, basal angles rounded; armature of internal sac consisting of thornlike spine near base, elongate, serrate sclerite in middle, and symmetrical pair of elongate, setose sclerites near apex; closure valve C-shaped; lateral lobes cleft one-third their length (figure 400), apical lobes obliquely truncate, setose.

Size.—Body length 1.3–2.0 mm; width 0.8–1.2 mm.

Type depository.—CNCI.

Type locality.—Texas, Comstock.

Distribution.—TX.

Host plants.—Eysenhardtia texana.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Johnson placed this species in the *puellus* group. It most closely resembles *Acanthoscelides pallidipennis* in the armature of the internal sac, the pit on the 1st abdominal segment, and dorsal coloration.

Acanthoscelides daleae Johnson

(Figures 401–405)

Acanthoscelides daleae Johnson 1970:48; Center and Johnson 1976:196; Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:44.

Color.—Body and appendages reddish orange to black; in black specimens, basal two segments of antenna, basal one-half of fore femur and mid femur, and fore tibia and mid tibia reddish; in more reddish specimens, all appendages reddish orange. Vestiture of fine, white setae densely but uniformly distributed over body giving a pruinose sheen to body.

Structure.—Vertex and frons densely punctulate, pubescence sparse, frons with impunctate median line; ocular index 3:1; ocular sinus one-half length of eye, postocular lobe narrow; antenna as in figure 403, extending to middle of metepister-num. Pronotum bell-shaped (figure 401), lateral margins slightly arcuate; disk evenly convex except slightly depressed near posterior corners, finely sulcate on basal lobe; surface microfoveolate, foveolae nearly hidden by pubescence; lateral carina marked by slight basal ridge; cervical sulcus well-defined, deep. Scutellum 2 times as long as wide, bidentate apically. Elytra moderately convex (figure 401), lateral margins arcuate; striae parallel except 2nd slightly divergent at base approaching 3rd, 2nd to 6th striae each with minute basal denticle; interstices flat, minutely imbricate. Metacoxa densely, minutely punctate except for smooth fossula; hind leg as in figure 402; metatibia straight, slightly dilated toward apex, lateral, ventral, and dorsomesal carinae complete, ventrolateral carina present in basal one-half, mucro about one-sixth as long as basitarsus, lateral denticle and two coronal denticles slender, acute. First abdominal sternum of male with median basal pit set in posterior margin of 1st sternum lobed with fringe of long hairs; 5th sternum broadly emarginate; female lacking modifications of basal sternum, apical margin evenly rounded; male pygidium strongly convex, reflexed apically, that of female moderately convex; discal surface in both sexes densely punctulate, concealed by pubescence.

Male genitalia.—As in figures 404 and 405; median lobe slender, slightly constricted near apex; ventral valve broadly triangular; internal sac lined with fine, transverse clusters of minute setae (see inset, figure 404), middle of sac with large irregular sclerite, apex with paired, slender, spinose structures; closure valve circular; lateral lobes fused for nearly their entire length (figure 405), cleft only at apices, apices and mesal faces of lobes setose.

Size.—Body length 1.5–1.75 mm; width 1.0–2.0 mm.

Type depository.—USNM, holotype No. 69686.

Type locality.—California, San Bernadino Co., 8 mi west of Needles.

Distribution.—AZ, CA, NV, UT; Mexico (Baja California).

Host plants.—Dalea sp.; *Psorothamnus fremonti, P. schotti, P. spinosa.*

Natural enemies.—Heterospilus prosopidis.

Immatures.— Not described.

Discussion.—The extensive range of size and integumental coloration and its resemblance to *Acanthoscelides fraterculus* makes this species difficult to characterize. Johnson (1970) described it as a separate species entity based principally on its restricted geographical range and host plants. The male genitalia are identical to those of *A. fraterculus.* The elongate scutellum, the uniformly gray, pruinose appearance, the basal abdominal pit of the male,

and the host association are key characters.

Acanthoscelides desmanthi Johnson

(Figures 406–410)

Acanthoscelides desmanthi Johnson 1977a:64, 1983a:71; Johnson and Kingsolver 1982:414; Luckow and Johnson 1987:49; Udayagiri and Wadhi 1989:44; Johnson 1990e:324.

Color.—Body dark red to orange; head dark red with vertex and frons black; pronotum mostly red with darker maculations; elytra reddish brown with darker red spots and maculations; pygidium dark red, venter of body black; antenna with basal four and terminal segments black; legs red except proximal one-half of metafemur black. Vestiture of white, yellow, dark brown, and black hairs in dorsal pattern (figure 406), legs and venter of body uniformly white; male pygidium uniformly yellow, female pygidium with white basal and lateral patches.

Structure.—Eye and antenna dimorphic; ocular index 6:1 in male, 4:1 in female; frontal boss prominent, frontal carina hidden by vestiture; ocular sinus two-thirds as long as eye; male lacking postocular lobe, female with lobe narrow; antenna (figure 408) serrate, reaching 1st abdominal segment in male, reaching metepisternum in female. Pronotum bell-shaped (figure 406), unevenly convex, lateral margins sinuate, apex slightly constricted; disk microfoveolate, lateral carina evanescent. Scutellum small, quadrate, bidentate. Elytra convex, lateral margins subparallel (figure 406); striae parallel, sinuate in middle, 2nd, 3rd and 4th bent laterad at base, 3rd and 4th with basal denticles. Metacoxa finely, evenly punctulate except fossula glabrous; hind leg as in figure 407; metatibia slightly arcuate, dilated toward apex; lateral, ventrolateral, ventral, and dorsomesal carinae complete; mucro short, one-third as long as basitarsus, lateral denticle nearly as long as mucro; two coronal denticles present. First abdominal sternum of male not modified, 5th sternum slightly emarginate in male, arcuate in female; male pygidium slightly reflexed apically.

Male genitalia.—As in figures 409 and 410; median lobe slender, elongate; ventral valve concave (figure 409a), apex attenuate; armature of internal sac consisting of an elongate cluster of denticles near base, a cluster of elongate rodlike sclerites in middle, a cluster of fine, acute denticles, and seven thornlike spines; apex finely spiculate, closure valve circular; lateral lobes (figure 410) extremely long, slender, cleft full length, apices scarcely expanded.

Size.—Body length 1.5–2.1 mm; width 0.9–1.2 mm.

Type depository.—USNM, holotype No. 72782.

Type locality.—Mexico, Chiapas, 3.5 mi west of Ocozocoautla.

Distribution.—TX; Mexico.

Host plants.—*Desmanthus* sp., *D. bicornutus, D. covillei, D. leptophyllus.* Johnson (1983a) also lists *Desmanthus subulatus, D. virgatus virgatus,* and *D. virgatus depressus* from Mexico.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is closely related to *Acanthoscelides bisignatus,* and the two can only be consistently separated by comparison of the male genitalia (figures 370 and 410). The antennae and eyes of both species are dimorphic and the color patterns are similar. *Acanthoscelides speciosus* resembles *A. desmanthi* and *A. bisignatus* but its eyes are not dimorphic and its antennae are consistently and entirely red. *Acanthoscelides speciosus* breeds only in *Mimosa* species.

Acanthoscelides distinguendus (Horn)

(Figures 411–415)

Bruchus distinguendus Horn 1873:336; Hubbard and Schwarz 1878:660;

Schwarz 1878:457; Blatchley 1910:1238; Fall 1910:171; Cushman 1911:499; Pic 1913a:24; Zacher 1952:462.

Mylabris distinguendus: Leng 1920:305.

Acanthoscelides distinguendus: Bissell 1940:846; Bottimer 1968c:1018,1038; Johnson 1968:1267; Bottimer 1969b:1187; Johnson 1969a:279, 1969c:55; Kingsolver 1969b:51,54; Johnson 1970:18, 1979b:63, 1981a:79; Johnson and Kingsolver 1982:414; Johnson 1983a:80; Udayagiri and Wadhi 1989:45.

Color.—Body mostly dark brown, legs reddish brown, antenna with basal four segments reddish yellow, remaining segments black. Vestiture of white and brown slender hairs uniformly distributed on body except in pattern of alternating brown and white elongate patches on elytral striae, pronotum with broad, dark brown median stripe and lateral white spots (figure 411); pygidium with evanescent median line of hairs.

Structure.—Vertex and frons densely punctulate, setae directed toward polished median boss, frontal carina prominent; ocular index 3:1; ocular sinus about three-fifths length of eye; antenna sexually dimorphic (figure 413), reaching 1st abdominal sternum in male, reaching middle of metepisternum in female. Pronotum bell-shaped (figure 411), lateral margins straight to slightly arcuate, disk evenly convex, densely microfoveolate, foveolae nearly hidden by vestiture; lateral carina present only in basal one-third; cervical sulcus well-marked, deep. Scutellum one-third longer than wide, bidentate apically. Elytra evenly convex, lateral margins arcuate (figure 411); striae slightly sinuate in middle, 3rd and 4th striae basally denticulate; interstices flat, finely imbricate, densely pubescent. Metacoxa densely punctulate except fossula polished; hind leg as in figure 412; metatibia slightly bent basally, straight and slightly dilated apically, with lateral, ventrolateral, ventral, and dorsomesal carinae complete; mucro acute, about one-fourth as long as basitarsus, lateral denticle separated from mucro by deep sinus, lateral and coronal denticles subequal. Fifth abdominal segment deeply emarginate; pygidium in both sexes convex, reflexed apically; disk densely microfoveolate.

Male genitalia.—As in figures 414 and 415; median lobe slender, slightly expanded at apex; ventral valve transverse, arcuate either side of small, median nipple; armature of internal sac consisting of fine, acute denticles in basal one-half, a small cluster of larger denticles at middle, two thornlike sclerites, and subapical, elongate cluster of fine spicules, closure valve circular; lateral lobes (figure 415) narrow, elongate, cleft nearly to base, apices spatulate, setose.

Size.—Body length 1.9–2.6 mm; width 1.3–1.8 mm.

Type depository.—MCZC, lectotype No. 8206, by Bottimer 1968b.

Type locality.—Georgia.

Distribution.—AL, FL, GA, IN, LA, MI, MS, NC, OK, SC, VA, TX; Mexico.

Host plants.—Mimosa strigillosa; Rhyn-chosia americana, R. difformis, R. erecta, R. galactoides, R. intermedia, R. latifolia, R. tomentosa. Blatchley (1910) recorded *"Cracca" virginiana* (now placed in *Tephrosia*), but this is undoubtedly a misidentification of the bruchid, probably of *Acanthoscelides obsoletus* (Say).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Salient characters for this species are the brown and white mottled pattern of the pronotum and elytra, the strongly serrate antenna of the male, the sharp frontal carina, and the distinctive male genitalia. This species most closely resembles *Acanthoscelides obsoletus* but the following differences apply *(A. obsoletus* characters in parentheses): Striae 3 and 4 lacking distinct strial denticles (prominent basal denticles); head unicolorous behind eye (red spot); mucro one-fourth length of basitarsus (one-third length); 1st abdomi-

nal sternum of male unmodified (median sulcus and disarrangement of setae). There are also differences in the male genitalia (compare figures 414 and 520). *Acantho-scelides obtectus* has a similar dorsal pattern to those of *A. distinguendus* and *A. obsoletus,* but its abdomen is mostly or entirely red and the apical antennal segment is also red. The male genitalia of *A. obtectus* is distinct from either *A. obsoletus* or *A. distinguendus,* but the general form of *A. distinguendus* relates *A. distinguendus* to *A. flavescens.*

Acanthoscelides flavescens (Fahraeus)

(Figures 416–420)

Bruchus flavescens Fahraeus 1839:32; Pic 1913a:25.

Acanthoscelides flavescens: Blackwelder 1946:759; Kingsolver 1975a:60; Janzen 1980:941,946; Johnson 1981b:79; Johnson and Kingsolver 1982:414; Johnson 1983a:85; Udayagiri and Wadhi 1989:46.

Bruchus ochraceus Schaeffer 1907:303; Fall 1910:170; Cushman 1911:501,507.

Bruchus ochraceicolor Pic 1913b:110 (new name for *ochraceus* Schaeffer 1907 not Baudi 1886b); Pic 1913a:38; Zacher 1952:462.

Mylabris ochraceicolor: Leng 1920:305.

Acanthoscelides ochraceicolor: Wolcott 1936:286; Moreno and Bibby 1943:23; Blackwelder 1946:760; Zacher 1952:462,475; Peck 1963:956; De Luca 1965:55; Bottimer 1968c:1019,1039; Kingsolver 1969b:51; Johnson 1970:19; Forister and Johnson 1971:232; De Luca 1972:106; Kingsolver 1975a:60.

Color.—Body and appendages reddish brown except thoracic sterna sometimes piceous, apical margin of each antennal club segment dusky. Pubescence of white, golden, and brown hairs in pattern shown in figure 416, the white and golden hairs intermixed over most of body with patches of white on lateral portions of pronotum and stripes and spots on elytra, elongate white spot on 3rd interstice delimited by brown spots; pygidium with faint white median stripe and lateral median brown spots.

Structure.—Vertex densely punctulate, frons sparsely punctulate, intervals granulose, frontal carina prominent; ocular index 3:1; ocular sinus about one-half length of eye; antenna (figure 418) reaching middle of metepisternum. Pronotum bell-shaped (figure 416), lateral margins slightly arcuate, disk evenly convex with slight depression each side of basal lobe; lateral carina evanescent; cervical sulcus distinct, deep. Scutellum quadrate, emarginate apically, densely pubescent. Elytra together as long as wide (figure 416), lateral margins arcuate, disk evenly convex; striae parallel, indistinct, not deflected at base, 3rd, 4th, and 5th each with minute basal denticle; interstices flat, densely pubescent, minutely imbricate. Metacoxa densely punctulate except fossula smooth; hind leg as in figure 417, metatibia with lateral, ventral, and dorsomesal carinae complete, ventrolateral carina abbreviated apically; mucro acute, slender, one-third as long as basitarsus, separated from acute lateral denticle by deep sinus, dorsal coronal denticles separated by deep sinuses. First abdominal sternum of male smooth, 5th deeply emarginate; 5th of female shallowly emarginate; pygidium of both sexes strongly convex, punctation nearly hidden by pubescence.

Male genitalia.—As in figures 419 and 420; median lobe moderately broad; ventral valve transverse, broadly arcuate with median nipple; armature of internal sac consisting of an elongate cluster of minute denticles in basal one-third, a pair of small, curvate sclerites in middle, a spinescent structure and C-shaped closure valve in apical one-third; lateral lobes slightly bowed (figure 420), cleft three-fourths their length.

Size.—Body length 1.5–2.5 mm; width 0.9–1.5 mm.

Type depository.—NHRS *(flavescens);* USNM (*ochraceus,* lectotype No. 42345, by Johnson).

Type locality.—St. Vincent Is. *(flavescens);* Texas, Brownsville *(ochraceus).*

Distribution.—FL, LA, TX; Mexico to Panama, West Indies, South America.

Host plants.—Abutilon hypoleucum; Galactia striata; Rhynchosia minima; Vicia sp. *Eriosema violaceum* and *Rhynchosia longeracemosa* are extralimital.

Natural enemies.—Bracon sp.; *Eupelmus cushmani, E. cyaniceps; Eurytoma* sp.; *Heterospilus prosopidis.*

Immatures.—Not described.

Discussion.—The reddish-brown integument, yellowish vestiture, prominent frontal carina, and male genitalia are characters to separate this species. Although *A. distinguendus* has a more distinct dorsal pattern on a piceous integument, the two species are closely related by host preferences and form of the male genitalia (compare figures 414 and 419). *Acanthoscelides griseolus* is similar in external appearance, but the principal sclerite of the internal sac in that species is forked, the geographic range is more western, and its host plants are in the genus *Sesbania.*

Acanthoscelides floridae (Horn)

(Figures 421–425)

Bruchus floridae Horn 1873:332; Schwarz 1878:457; Fall 1910:170; Bradley 1947:40.

Mylabris floridae: Leng 1920:305.

Acanthoscelides floridae: Brett 1946:84; Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1018; Johnson 1968:1267, 1970:14,18; Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:46.

Color.—Body and appendages mostly red with following areas black: Headexcept red patch above each eye, pronotum in most specimens sometimes with lateral areas of disk red, ventral sclerites of thorax, semicircular patch around scutellum sometimes extending as stripe along elytral suture, 1st and sometimes 2nd abdominal sterna, base of metafemur; antenna varying from red to black. Vestiture of slender, white hairs in pattern on elytra and pygidium, intermixed with dark brown and yellow hairs on pronotum and with indistinct white spots either side of midline, often with faint median white stripe (figure 421); pygidium with basal triangle and median line white.

Structure.—Vertex and frons densely punctulate, setae directed toward impunctate median knob; frontal carina faintly indicated in some specimens; ocular index 2.5:1; ocular sinus about two-thirds length of eye; antenna (figure 423) reaching middle of metepisternum. Pronotum bell-shaped (figure 421), evenly convex, lateral margins gently arcuate, disk densely microfoveolate; lateral carina obsolete; cervical sulcus well-marked. Scutellum quadrate, densely pubescent. Elytra together slightly longer than wide (figure 421), marginal profile continuous with pronotal margin; striae shallow but well-marked, subparallel, 2nd to 6th minutely denticulate at base, 3rd, 5th, and 7th interstices slightly wider than alternates, flat, minutely imbricate. Metacoxa densely punctulate except fossula glabrous; hind leg as in figure 422; metatibia nearly straight, slightly dilated toward apex, with lateral, ventral, and dorsomesal carinae complete, ventrolateral carina basal abbreviated apically; mucro short, acute, one-fourth as long as basitarsus, lateral denticle short, as long as 1st coronal denticle, dorsal denticle one-half as long as mucro. Male with rounded, setiferous pit on 1st abdominal sternum; pygidium strongly convex and apically reflexed in male, moderately convex with apex vertical in female, surface of pygidial disk microfoveolate, densely pubescent.

Male genitalia.—As in figures 424 and 425; median lobe moderately broad, slightly expanded at apex; ventral valve equila-terally triangular, tip acute; armature of

internal sac consisting of transverse rows of minute spicules in basal one-half of sac, and a large, blunt sclerite about one-third length of sac, apical one-half with symmetrical, setose structure; closure valve C-shaped; lateral lobes fused most of their length (figure 425), apical lobes setose.

Size.—Body length 2.0–2.5 mm; width 1.25–1.50 mm.

Type depository.—MCZC, lectotype No. 8201, by Johnson 1968.

Type locality.—Florida (lectotype).

Distribution.—DC, IA, IL, IN, FL, KS, MI, MO, MS, NC, ND, NE, NJ, NM, OK, SC, SD, TX, VA, WY; Mexico, West Indies.

Host plants.—Amorpha fruticosa fruticosa.

Natural enemies.—Catolaccus sp.; *Eupelmus amicus, E. inyonesis; Horismenus missouriensis.*

Immatures.—Not described.

Discussion.—This species closely resembles *Acanthoscelides submuticus.* The only certain method of separating the two species is by examining the male genitalia (compare figures 424 and 630). The presence or absence of the metatibial lateral carina is variable in *A. submuticus*, but it is always present in *A. floridae.* The ratio of length to width of the female pygidium is 10:9 in *A. floridae* and 1:1 in *A. submuticus*.

Johnson (1970) did not include *A. floridae* in his monograph of the western species of *Acanthoscelides* but he compared it with *A. submuticus* and *A. collusus* [now *A. pallidipennis* (Motschulsky)].

Acanthoscelides fraterculus (Horn)

(Figures 426–431)

Bruchus fraterculus Horn 1873:336; Riley and Howard 1892c:165; Baker 1895:29; Fall and Cockerell 1907:201; Schaeffer 1907:301; Fall 1910:184; Cushman 1911:506; Pic 1913b:26; Zacher 1952:462.

Mylabris fraterculus: Leng 1920:184; Essig 1929a:486.

Acanthoscelides fraterculus: Trelease and Trelease 1937a:590, 1937b:448; Bridwell 1938a:76; Bradley 1947:40; Blackwelder and Blackwelder 1948:45; Zacher 1952:465; De Luca 1965:54; Bottimer 1968c:1018,1038; Johnson 1968:1267, 1969c:55, 1970:50; Green and Palmbald 1975; Center and Johnson 1976:196; Johnson and Kingsolver 1982:414; Clement and Miller 1982; Udayagiri and Wadhi 1989:47.

Bruchus aureolus: Fall 1910:184 (misidentification).

Color.—Integument black except occasionally with reddish spots on elytra; legs black, partly red, or entirely red; basal three antennal segments red beneath. Vestiture of fine, slender, gray hairs densely, uniformly distributed over body.

Structure.—Vertex and frons densely punctulate, interspaces minutely granulate, midline of frons with impunctate line; ocular index 3:1; ocular sinus about two-thirds length of eye; postocular lobe narrow, fringed with white hairs; antenna as in figure 429, reaching posterior margin of metepisternum. Pronotum bell-shaped, strongly convex (figure 426), lateral margins nearly straight, discal surface densely microfoveolate, sculpture nearly hidden by vestiture; lateral carina ridgelike, reaching nearly to procoxal cavity. Scutellum nearly 2 times as long as wide, bidentate apically. Elytra together slightly longer than wide (figure 426), lateral margins gently rounded; striae parallel, conspicuous, slightly sinuate, 2nd stria approaching 3rd at base, 2nd to 6th striae denticulate on basal margin; interstices flat, minutely imbricate. Metacoxa densely punctulate except fossula glabrous; hind leg (figure 428) nearly straight, slightly dilated toward apex; lateral, ventral, and dorsomesal carinae complete, ventrolateral carina evanescent in apical one-half, mucro about one-fourth length of basitarsus, lateral denticle separated from mucro by deep sinus, two coronal denticles each one-half as long as lateral denticle. Posterior margin of 1st abdominal sternum slightly lobed

and with deep basal pit in male, 5th sternum deeply emarginate for apex of pygidium; 1st and 5th sterna of female not modified; pygidium convex in both sexes, more strongly reflexed in male, disk densely foveolate (figure 427).

Male genitalia.—As in figures 430 and 431. Nearly identical to those of *A. aureolus* except cleft between lateral lobes deeper in *A. fraterculus.*

Size.—Body length 1.5–3.5 mm; width 1.0–2.0 mm.

Type depository.—MCZC, lectotype No. 8207, by Johnson 1968.

Type locality.—"Plains of Kansas, Nebraske, and Colorado."

Distribution.—AB, AR, AZ, BC, CA, CO, IA, ID, IN, KS, MB, MO, MT, ND, NE, NJ, NM, NT, NV, OK, ON, OR, SD, SK, TX, UT, WA, WY.

Host plants.—Astragalus bisulcatus, A. cibarius, A. crassicarpus crassicarpus, A. crassicarpus paysonii, A. drummondii, A. falcatus, A. hyalinus, A. missouriensis, A. mollissimus bigelovii, A. mollissimus mollissimus, A. pattersonii, A. pectinatus, A. pterocarpus, A. racemosus, A. utahensis; Glycyrrhiza lepidota; Lotus crassifolius, L. mearnsii, L. rigidus, L. scoparius. Hedy-sarum boreale is reported in the literature but no authentic rearings are known; it may be a flower-visiting record. Zacher (1952:462) listed *Abrus precatorius,* but the highly toxic seeds of this plant support only species of *Caryopemon* in the Old World.

Natural enemies.—Bracon mellitor; Eurytoma sp.; *Pteromalus* sp.

Immatures.—Not described.

Discussion.—This species is difficult to separate from *A. daleae* and *A. aureolus.* From *A. aureolus, A. fraterculus* can usually be distinguished by its black body and appendages covered by white setae, whereas in *A. aureolus,* the appendages usually have some reddish coloration and the vestiture is usually partly yellowish. The variation in body color of *A. fraterculus* makes color ambiguous, but differences in male genitalia are reasonably consistent. The male genitalia of *A. daleae* are almost identical to those of *A. fraterculus,* and coloration of the integument and vestiture are indistinguishable from that species (except that *A. daleae* is usually pruinose); however, *A. daleae* is restricted to the host genus *Dalea* in the desert areas of Arizona, California, Nevada, Utah, and northern Mexico (Johnson 1970). *Acanthoscelides lobatus* is similar to *A. fraterculus,* but the 1st abdominal segment of the male carries a rounded, setose lobe that extends beyond the margin of the segment and the brush-like structure in the male genitalia is smaller as is the buttonlike median sclerite. *Acanthoscelides perforatus* is also uniformly black with white vestiture and the 1st abdominal segment is similar to that of *A. lobatus,* but the elytral striae are deep and perforate.

Acanthoscelides fumatus (Schaeffer)

(Figures 432–436)

Bruchus fumatus Schaeffer 1907:302; Fall 1910:183; Pic 1913a:26.

Mylabris fumatus: Leng 1920:305.

Acanthoscelides fumatus: Johnson 1968:1267; Bottimer 1968c:1019; Johnson 1969a:284; Center and Johnson 1976:196; Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:47.

Color.—Body and appendages entirely black except basal three antennal segments dark red beneath, some specimens with red postocular spot. Vestiture of slender white setae densely, uniformly distributed over body.

Structure.—Body ovate, lateral margins of pronotum continuous with elytral margins (figure 432). Vertex densely punctulate medially, reticulate laterally, frons densely punctulate, punctures crowded, frontal carina distinct; ocular index 3.5:1; ocular sinus two-thirds as long as eye, postocular lobe distinct, fringed with white setae; antenna (figure 434) reaching elytral

humerus. Pronotum bell-shaped (figure 432), lateral margins nearly straight; disk strongly convex, lacking depressions, surface densely foveolate; lateral carina ridge-like. Scutellum quadrate, densely pubescent, bidentate. Elytra moderately convex (figure 432), lateral margins arcuate; striae shallow, inconspicuous, nearly hidden by vestiture, parallel, lacking basal denticles. Metacoxa entirely punctulate; hind leg as in figure 433; metatibia strongly bent basally, gently curved and slightly dilated toward apex, lateral, ventrolateral, ventral, and dorsomesal carinae complete; mucro slender, acute, curved, one-fifth as long as basitarsus. First abdominal segment of male sometimes with median tuft of setae, 5th sternum deeply emarginate; pygidium of both sexes convex, that of male strongly reflexed apically, disk microfoveolate, nearly concealed by vestiture.

Male genitalia.—As in figures 435 and 436; median lobe moderately broad, slightly expanded toward apex; ventral valve triangular, apex not produced; armature of internal sac consisting of a cluster of fine denticles at apical orifice, a large button-like sclerite in basal one-fourth; middle of sac with scattered, fine denticles, apical one-third with paired, spinose structures and fine spicules near C-shaped closure valve; lateral lobes deeply cleft (figure 436), narrow at base, expanded apically, apices setose.

Size.—Body length 2.3–3.1 mm; width 1.5–2.0 mm.

Type depository.—USNM, lectotype No. 42344, by Johnson 1968.

Type locality.—Arizona, Huachuca Mountains (lectotype).

Distribution.—AZ, NM, TX; Mexico.

Host plants.—Rhynchosia texana.

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—Characters to separate this species are the distinct frontal carina, shallow elytral striae, 1st denticle of the femoral pecten elongated, lateroventral carina of the metatibia complete to apex, male 1st abdominal sternum not lobed. It closely resembles *A. fraterculus* and *A. daleae* in general facies, but the frontal carina of those species is evanescent, denticles of the pecten are small and subequal, the lateroventral carina extends only three-fourths the length of the metatibia, and the male 1st abdominal segment is pitted and lobed. *Acantho-scelides lobatus,* another evenly gray species, is distinguished from *A. fumatus* by a more slender body, minute denticles in the femoral pecten, and the male 1st sternum with a strongly developed lobe. Male genitalia are distinctive for all four species.

Acanthoscelides griseolus (Fall)

(Figures 437–442)

Bruchus griseolus Fall 1910:175; Pic 1913a:27.

Mylabris griseolus: Leng 1920:305.

Acanthoscelides griseolus: Bridwell 1923a:79; Zacher 1952:465; Bibby 1961:324; Kingsolver 1965a:128; Johnson 1968:1267; Bottimer 1968c:1019,1038; Johnson 1969a:284, 1970:53; Slobodchikoff and Johnson 1973:282; Center and Johnson 1976:196; Janzen 1977a:419, 1978:185, 1980:946; Johnson and Kingsolver 1982:414; Johnson 1983a:90; Morimoto 1990:133.

Bruchus kiotoensis Pic 1913c:14.

Bruchidius kiotensis: Udayagiri and Wadhi 1989:138.

Bruchidius kiotoensis: Chujo 1937b:194.

Acanthoscelides kiotoensis: Morimoto 1990:133.

Color.—Integument mostly red with black areas as follows: spot on vertex, scutellar area sometimes extended into sutural stripe, thoracic sterna, abdominal sterna partly or entirely black, usually with only 1st and 2nd sterna black. Vestiture yellowish white, evenly distributed on body except sparse on median pronotal stripe,

elytra sometimes with ephemeral pattern of spots.

Structure.—Vertex densely punctulate and setiferous, frons punctulate changing to imbricate either side of prominent frontal carina; ocular index 3:1, ocular sinus two-thirds length of eye; antenna extending nearly to metacoxa, serrate from fourth segment (figure 440). Pronotum bell-shaped (figure 437), evenly convex, surface densely microfoveolate, intervals imbricate; lateral carina obsolete; cervical sulcus narrow but distinct. Scutellum slightly longer than wide, emarginate and biden-tate apically, densely pubescent. Elytra flattened medially, lateral margins arcuate (figure 437); striae parallel, shallow, 3rd and 4th denticulate at base, 2nd with transverse ridge at base. Metacoxa densely punctulate except fossula smooth, polished; hind leg as in figure 439; metatibia sharply bent at base, straight in apical two-thirds, lateral, ventral and dorsomesal carinae complete to apex; mucro slender, slightly curvate, one-half as long as basitarsus, lateral denticles separated from mucro by deep sinus. First abdominal sternum of male slightly depressed medially with setiferous medial pit, 5th sternum nearly divided by apical emargination; female abdomen normal; male pygidium strongly convex, reflexed apically (figure 438); female with apex vertical; disk densely punctulate.

Male genitalia.—As in figures 441 and 442; median lobe moderately broad, apex expanded; ventral valve broadly triangular, apical margin arcuate; armature of internal sac with large, wishbone-shaped sclerite in apical one-third, cluster of fine denticles in middle, symmetrical, setose structure and circular closure valve in apical one-third; lateral lobes slender (figure 442), apices oblique, cleft two-thirds their length.

Size.—Body length 1.4–2.7 mm; width 0.9–1.7 mm.

Type depository.—MCZC, holotype No. 25053.

Type locality.—California, near Yuma.

Distribution.—AZ, CA, TX; Mexico to Costa Rica; Japan.

Host plants.—*Sesbania emerus, S. exaltata.*

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—Distinguishing characters for this species are the dorsal integument red with a uniformly yellow vestiture, integument often darker on ventral areas, a black spot on the vertex, all legs red, and the male genitalia with a wishbone-shaped median sclerite. See discussion of *A. flavescens.*

Acanthoscelides helianthemum Bottimer

(Figures 443–447)

Acanthoscelides helianthemum Bottimer 1969a:977; Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:49.

Bruchus compressicornis: Blatchley 1919:66 (misidentification).

Color.—Integument mostly black with legs and antenna dark brown. Vestiture of fine, white setae in ocellate pattern on elytra, otherwise evenly distributed.

Structure.—Vertex and frons minutely imbricate, without frontal carina; ocular index 3:1; ocular sinus about three-fifths length of eye; postocular lobe narrow, fringed; antenna (figure 445) reaching humerus. Pronotum bell-shaped (figure 443), strongly convex, slightly depressed along sides of basal lobe; lateral margins feebly emarginate; lateral carina obsolete; cervical sulcus well-defined. Scutellum as long as wide, slightly tapered, bidentate. Elytra with lateral margins gently arcuate (figure 443); striae parallel except 2nd deflected laterally at base to join 3rd stria, 4th, 5th, and 6th striae with basal denticles; interstices flat, finely imbricate. Metacoxa densely punctulate except fossula smooth; hind leg as in figure 444, metafemur with one small, acute denticle and three minute denticles following; metatibia with only

dorsomesal carina present, lateral face devoid of carinae; mucro slender, slightly curvate, about one-half as long as basitarsus, lateral and coronal denticles minute. Male abdomen with small tuft of white setae between metacoxal bases; pygidium in both sexes densely punctulate and setose, apex of male only slightly reflexed into ventral emargination.

Male genitalia.—As in figures 446 and 447; median lobe moderately broad, straight-sided; ventral valve narrow, sharply triangular; armature of internal sac consisting of cluster of fine spicules at apical orifice, basal one-third of sac lined with blunt denticles, middle with two thornlike sclerites and a dense patch of fine denticles, extreme apex lined with fine spicules and closure valve as figured; lateral lobes slender (figure 447), cleft nearly to base, apices slightly expanded, setose.

Size.—Body length 1.4–1.7 mm; width 0.8–1.1 mm.

Type depository.—CNCI, holotype No. 10906.

Type locality.—Florida, Gainesville.

Distribution.—FL, NC.

Host plants.—Helianthemum corymbosum.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Acanthoscelides helian-themum is one of the smallest species in the North American fauna. Its size, ocellate elytral vestiture, minute denticles in the pecten, and the slender, curved mucro distinguish it. It appears to be related to *A. alboscutellatus* in the form of the male genitalia and ocellate elytral vestiture but is much smaller than that species. (See discussion of *A. atomus*.)

The host genus, *Helianthemum,* and the host genus for *Acanthoscelides atomus, Lechea,* are both in the family Cistaceae, whereas the host genus for *A. alboscutel-latus, Ludwigia*, belongs to the Onagraceae.

Acanthoscelides herissantitus Johnson

(Figures 448–452)

Acanthoscelides herissantitus Johnson 1983a:96

Color.—Body black; basal four or five antennal segments, fore legs, and mid legs reddish orange, apex of metafemur usually dark red. Vestiture uniformly silvery gray; elytral interstices distinct with three to four rows of setae; pygidial vestiture lacking pattern.

Structure.—Vertex densely punctulate, punctures on frons elongated, median line impunctate but not carinate; ocular index 2.6:1; ocular sinus about one-half length of eye; antenna (figure 450), extending to anterior margin of metacoxa. Pronotum bell-shaped (figure 448), lateral margins sinuate; disk evenly convex, sparsely punctulate; lateral carina evanescent; cervical sulcus distinct but short. Scutellum quadrate, bidentate. Elytra together 1.1 times as long as wide (figure 448), strongly convex, greatest width at one-third from apex; striae parallel, distinct, 3rd, 4th, 5th, and sometimes 6th minutely denticulate at basal margin; interstices densely setose. Metacoxa with narrow, dense band of punctures, fossula smooth; hind leg as in figure 449; metafemur with one to three minute denticles on ventral margin; metatibia with lateral, ventral, and dorsomesal carinae complete; mucro short, less than one-eighth length of basitarsus, lateral denticle and three coronal denticles subequal in size; 1st abdominal segment not modified, 5th segment deeply emarginate in male; male pygidium reflexed into terminal emargination; disk sparsely punctulate.

Male genitalia.—As in figures 451 and 452; slender, ventral valve elongate-triangular; armature of internal sac consisting of strands of minute denticles in basal one-third of sac, a median, thornlike sclerite, two pairs of curved, serrate sclerites, a brushlike apical cluster, and a crescentic closure valve; lateral lobes short (figure

452), broad, cleft about one-half their length.

Size.—Body length 1.0–1.4 mm; width 0.7–0.9 mm.

Type depository.—USNM.

Type locality.—Mexico, Queretaro, 7 mi N Queretaro.

Distribution.—TX; Mexico. Known from Big Bend National Park, Texas.

Host plants.—Not yet associated in United States. In *Herissantia crispa* (Linnaeus) Brizicky and *Malvastrum bicuspidatum* (Wats.) Rose in Mexico; however, both hosts are found in the southwestern United States.

Natural enemies.—Not recorded.

Immatures.—Not described.

Discussion.—Johnson places this species in his *aequalis* species group, all members of which attack seeds of malvaceous genera. The male genitalia are remarkably similar to those of *A. brevipes* (Sharp) which ranges from northern Mexico to Colombia. Externally, *A. herissantitus* most closely resembles *A. aequalis* among the U.S. species, and genitalic characters are the only certain means of distinguishing the two, although dimensions of *A. aequalis* average slightly larger and its metafemur and metatibia are largely reddish orange.

Acanthoscelides inquisitus (Fall)

(Figures 453–457)

Bruchus inquisitus Fall 1910:180; Pic 1913a:29.

Mylabris inquisitus: Leng 1920:305.

Acanthoscelides inquisitus: Johnson 1968:1267; Bottimer 1968c:1019,1038; Johnson 1970:55; Johnson and Kingsolver 1982:414; Udayagiri and Wadhi 1989:49.

Color.—Body black except basal four or five antennal segments, fore legs, mid legs, apical one-half of metafemur, and all of tibia red, metatarsi sometimes darker than tibia. Vestiture of fine intermixed golden and gray setae on pronotum, elytra with two pairs of golden discal maculae centered on third interstice, three lateral, golden maculae on each elytron; venter of body gray.

Structure.—Vertex and frons densely punctulate, vestiture on vertex long, fine; frons with impunctate median line, frontoclypeal suture lacking; ocular index 3.5:1; ocular sinus about one-half length of eye; antenna as in figure 455. Pronotum bell-shaped (figure 453), evenly convex, lateral margins gently arcuate, disk irregularly foveolate and punctulate; lateral carina evanescent; cervical sulcus short, inconspicuous. Scutellum transverse, densely setose. Elytra together 1.2 times as long as wide (figure 453), convex, lateral margins feebly arcuate; striae parallel, inconspicuous, 3rd, 4th, and 5th with minute basal denticles; interstices imbricate, densely setose. Metacoxal face densely punctulate except fossula smooth; hind leg as in figure 454; metafemoral pecten with one long denticle followed by 0–3 minute denticles; metatibia carinate only on ventral margin, other carinae absent; mucro slender, about four-tenths as long as basitarsus. Fifth abdominal sternum of male broadly emarginate; male pygidium reflexed into terminal emargination of abdomen; disk densely punctulate.

Male genitalia.—As in figures 456 and 457; median lobe slender, elongated; ventral valve ovate, apex acute; armature of internal sac consisting of mixture of transverse and acute denticles in basal two-thirds, two slender, spinescent bands and symmetrical, spinescent structure in apical one-third; closure valve circular; lateral lobes slender (figure 457), cleft about two-thirds their length, apices scarcely broadened, setose.

Size.—Body length 2.3–3.0 mm; width 1.3–1.6 mm.

Type depository.—MCZC, holotype No. 25054.

Type locality.—California, Deep Creek, San Bernardino Mountains, 6,500 ft.

Distribution.—CA.

Host plants.—Not known.

Natural enemies.—Not recorded.

Immatures.—Not described.

Discussion.—Distinguishing characters for *Acanthoscelides inquisitus* are body integument black, fore legs and mid legs red, metafemur and metatibia partly red, and vestiture of elytra and pronotum intermixed golden brown and white. The frontoclypeal suture is absent, and the lateral, ventrolateral, and dorsomesal carinae of the metatibia are lacking. Male genitalic characters include median lobe long and slender and lateral lobes slender and straight.

Johnson (1970) placed this species near *A. pauperculus* and *A. napensis,* both of which lack lateral and ventrolateral metatibial carinae.

Acanthoscelides kingsolveri Johnson

(Figures 458–462)

Acanthoscelides kingsolveri Johnson 1973:169; Johnson 1974:268; Center and Johnson 1974:1097; Janzen 1975:172; Center and Johnson 1976:196; Janzen 1977a:419, 1978:185; Johnson 1979b:63; Janzen 1980:946; Johnson 1981b:79, 1981e:1009; Johnson and Kingsolver 1982:414; Johnson 1983a:106; Udayagiri and Wadhi 1989:49

Color.—Integument mostly black except red in spot on side of head behind eye, basal four or five antennal segments, fore legs and mid legs, at least one-half of meta-femur, all of metatibia and tarsus, and broad median stripe on each elytron. Vestiture white, evenly distributed on body except faint median stripe on pronotum and pygidium, darker maculae either side of median line on pronotum, and spots of bronzy hairs on elytra.

Structure.—Vertex and frons punctulate and minutely granulose, frontal carina not prominent, impunctate; ocular index 2.5:1; ocular sinus about three-fifths length of eye; antenna (figure 460) reaching middle of metepisternum. Pronotum bell-shaped (figure 458), strongly convex, disk densely microfoveolate, interspaces punctulate, lateral margin not carinate; cervical sulcus deep, narrow. Scutellum quadrate, emarginate, bidentate. Elytra widest near apices (figure 458), strongly convex; striae parallel, shallow, slightly sinuate, 2nd, 3rd, 4th, and 5th with minute basal denticles; interstices punctate-imbricate. Metacoxa densely punctulate except fossula smooth; hind leg as in figure 459, pecten with three denticles; metatibia with carinae complete to apex; mucro one-third as long as basitarsus, lateral and coronal denticles small. Male 1st abdominal sternum with median pubescent spot, 5th sternum nearly divided by deep emargination; female 5th sternum slightly emarginate; male pygidium strongly reflexed, disk in both sexes shallowly foveolate.

Male genitalia.—As in figures 461 and 462. Ventral valve triangular, armature of internal sac with two short rows of spicules basally, a large saddle-shaped sclerite in middle, a cluster of small spicules within a thin, sclerotized envelope, and an apical sclerotized ring; lateral lobes slender (figure 462), deeply cleft.

Size.—Body length 1.5–2.5 mm; width 1.0–1.7 mm.

Type depository.—USNM, holotype No. 71400.

Type locality.—Mexico, Sinaloa, 29 mi north of Mazatlan.

Distribution.—AZ, TX; Mexico to Panama.

Host plants.—Indigofera lindheimeriana, I. sphaerocarpa, I. suffruticosa. Other species of *Indigofera* are host to this bruchid in Mexico and Central America (Johnson 1983a).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Distinguishing characters for *A. kingsolveri* are the black body with red

median stripe of variable width, fore legs and mid legs red, hind legs usually all red, sometimes with base black, frontal carina prominent, 2nd, 3rd, 4th, and 5th elytral striae with prominent, equally spaced basal denticles, and the basal abdominal segment of the male with a pubescent depression. The large, asymmetrical sclerite in the internal sac of the male genitalia is unique.

This species resembles *A. submuticus* in size and host preferences. The integument of *A. submuticus* is uniformly red, frontal carina and prominent basal denticles are lacking, and armature of the internal sac is composed of many small denticles.

Acanthoscelides lobatus (Fall)

(Figures 463–468)

Bruchus lobatus Fall 1910:182; Pic 1913a:32.

Mylabris lobatus: Leng 1920:305.

Acanthoscelides lobatus: Johnson 1968:1267; Bottimer 1968c:1019,1038; Johnson 1970:56; Center and Johnson 1976:196; Faustini and Halstead 1982:47; Johnson and Kingsolver 1982:415; Udayagiri and Wadhi 1989:50.

Color.—Body and appendages entirely black, basal antennal segments sometimes dark red. Vestiture of fine white hairs uniformly distributed on body, except ventral lobe of male 1st abdominal sternum with golden fringe; pygidium with small basal triangle (figure 464).

Structure.—Vertex and frons densely punctulate, interspaces granulose, frons with median impunctate line; ocular index 3:1, ocular sinus six-tenths as long as eye; postocular lobe narrow, setose; antenna sexually dimorphic (figure 466), that of female reaching middle of metepisternum, that of male reaching middle of metacoxa. Pronotum subconical (figure 463), lateral margins slightly sinuate, constricted near apex by cervical sulcus; disk strongly convex, basal margin with slight depressions, surface densely microfoveolate; lateral carina lacking; cervical sulcus elongate, conspicuous. Scutellum slightly longer than wide, emarginate apically. Elytra together slightly longer than wide, convex but depressed at scutellum; striae parallel, deep, narrow, 2nd, 3rd, and 4th striae denticulate basally, interstices flat, finely imbricate. Metacoxa densely micropunctate except fossula glabrous, lateral one-fourth of coxal face densely setose; hind leg as in figure 465, pecten with one acute denticle and one or two minute denticles; metatibia nearly straight, slightly dilated, lateral, ventral, and dorsomesal carinae complete, ventrolateral carina evanescent; mucro one-fourth as long as basitarsus, lateral denticle and two or three coronal denticles subequal in length. First abdominal sternum of male with mesal concavity extending as a lobe fringed with golden setae from the posterior margin of the segment, 5th sternite nearly divided by emargination; female 1st and 5th sternites not modified; pygidium of both sexes finely punctate, that of male strongly reflexed.

Male genitalia.—As in figures 467 and 468; median lobe moderately broad, gradually widened toward apex; ventral valve broadly triangular, apex attenuate; armature of internal sac consisting of transverse rows of minute spicules in basal one-half, two pockets lined with fine denticles and a median, hooked sclerite at middle, a symmetrical, elongate, spinose structure and C-shaped closure valve at apex; lateral lobes (figure 468) fused for two-thirds their length, apical lobes subelliptical, setose on apical margins and on mesal faces.

Size.—Body length 2.1–2.6 mm; width 1.2–1.7 mm.

Type depository.—MCZC, lectotype No. 25055, by Johnson 1968.

Type locality.—New Mexico, Las Vegas, Hot Springs.

Distribution.—AZ, CA, CO, ND, NM, TX, UT, WY.

Host plants.—Astragalus humistratus, A. lentiginosus, A. mollissimus bigelovii, A.

mollissimus marcidus, A. mollissimus mollissimus, A. troglodytus.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The salient characters for *A. lobatus* include the setiferous sternal lobe of the male, the total black coloration of the body and appendages, and absence of the ventrolateral carina on the metatibia. Females of *A. lobatus* are difficult to separate from those of *A. fraterculus*.

Acanthoscelides longistilus (Horn)

(Figures 469–473)

Bruchus longistilus Horn 1873:331; Blatchley 1910:1240; Fall 1910:171; Pic 1913a:32; Zacher 1952:462.

Bruchus longistylus: Ulke 1902:30; Brimley 1938:232 (misspelling).

Mylabris longistilus: Leng 1920:305.

Acanthoscelides longistilus: Bridwell 1935:186; Bissell 1940:846; Bradley 1947:40; Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1019,1039; Johnson 1968:1267; Johnson and Kingsolver 1982:415; Udayagiri and Wadhi 1989:51.

Acanthoscelides sp. near *longistylus:* Glick 1957:9.

Color.—Integument black except basal two or three antennal segments reddish brown, fore legs and mid legs dark brown to red, mesal face of metafemur red, and entire metatibia red. Vestiture of fine, white setae in two elongated patches each side on pronotal disk, in broken stripe pattern on elytra, each elytron with two large, rounded maculae of dark brown setae; sides of metathorax and abdomen with dense, white patches, remainder of body with sparse white vestiture; pygidium with three basal white triangular patches, sometimes with median white line.

Structure.—Vertex and frons densely imbricate-punctulate, frontal carina absent; ocular ratio 2:1; ocular sinus three-fourths as long as eye; antenna eccentric from 5th segment (figure 471), reaching elytral humerus. Pronotum bell-shaped (figure 469), strongly but evenly convex, reticulate-punctate; lateral carina absent; cervical sulcus distinct. Scutellum quadrate, densely pubescent. Elytra evenly convex (figure 469); striae distinct, deep, parallel, 4th with distinct basal denticle; interstices flat, imbricate-punctate; metacoxa densely punctulate except fossula glabrous; hind leg (figure 470) with tridenticulate pecten; metatibia moderately dilated toward apex, tibial carina complete to apex, mucro long, curved, two-thirds length of basitarsus, lateral denticles separated from mucro by deep sinus, three coronal denticles acute. Male 1st abdominal sternum with median tuft of setae, 5th segment nearly divided by pygidial emargination; pygidium convex, disk densely, shallowly foveolate.

Male genitalia.—As in figures 472 and 473; median lobe broad at apex, ventral valve subtriangular, lateral margins arcuate; internal sac armed with many small, acute denticles, four larger spines, and a sleeve-like, thinly sclerotized structure lined with many fine spicules; lateral lobes flat (figure 473), spatulate, appearing slightly bowed.

Size.—Body length 1.8–2.3 mm; width 0.9–1.3 mm.

Type depository.—MCZC, lectotype No. 3894, by Johnson 1968.

Type locality.—Tennessee (lectotype).

Distribution.—AL, CT, DC, FL, GA, IL, IN, KS, LA, MD, MI, MO, NC, NH, NJ, NY, OK, ON, PA, SC, TN, VA, TX.

Host plants.—Desmodium illinoense; Lespedeza capitata, L. frutescens, L. hirta, L. intermedia, L. texana, L. virginica. "Said to breed in mallows" (Blatchley 1910). Zacher (1952) listed *Desmodium virginianum*, but this apparently a misidentification.

Natural enemies.—Zatropis incertus; Catolaccus sp.; *Tetrastichus* sp.

Immatures.—Not described.

Discussion.—This species is one of four similar and probably related species *(A. biustulus, A. longistilus, A. pedicularius,* and *A. stylifer)* that have long, curved

metatibial mucro, maculate elytra, basal abdominal segment of male with setose dimple, and fourth stria with basal tubercle. The geographical distribution of *A. longistilus* (generally east of the 100th meridian) usually will separate it from the southwestern U.S. distributions of the other three. In areas of overlap, male genitalia will need to be dissected. The mucro length of *A. longistilus, A. stylifer,* and *A. pediculariu*s is about one-half the length of the basitarsus, whereas that of *A. biustulus* is about one-third. Body and appendage color of *A. pedicularius* is totally black, whereas the hind legs of the other three are often partly reddish orange. Male genitalia of these four species are distinctive.

Acanthoscelides macrophthalmus (Schaeffer)

(Figures 474–481)

Bruchus macrophthalmus Schaeffer 1907:300; Fall 1910:168; Pic 1913a:33.

Mylabris macrophthalmus: Leng 1920:305.

Acanthoscelides macrophthalmus: Johnson 1968:1267; Bottimer 1968c:1019; Pfaffenberger and Johnson 1976:26; Johnson 1979b:64; Johnson and Kingsolver 1982:415; Johnson 1983a:116, 1985:209; Mead 1989:2; Udayagiri and Wadhi 1989:51.

Color.—Integument red, occasionally with diffuse piceous marginal shading on elytra. Vestiture of fine dark brown, gray, and golden setae in pattern shown in figure 474, pattern usually more pronounced in females; head and pronotum golden with little or no pattern; elytra with 1st, 2nd, 4th, 7th, and 10th interstices golden, 3rd, 5th, 7th, and 9th with brown, golden, and white quadrate or elongate maculae; male pygidial vestiture golden, evenly distributed, that of female golden with divergent brown maculae sometimes joined dorsally to form inverted "U" or "V" (figure 478), some specimens with indistinct golden setal patches; venter of body gray, vestiture evenly distributed.

Structure.—Vertex punctulate, punctures tending to coalesce into sulci on frons; frontal carina in both sexes prominent (figures 475 and 476); male eyes prominent; ocular index 14:1 in male, 6.25:1 in female; ocular sinus one-half length of eye; male antenna strongly serrate (figure 479), reaching 1st abdominal segment, female antenna (figure 479) moderately serrate, reaching middle of metepisternum. Pronotum subconical, lateral margins feebly arcuate (figure 474), disk evenly convex, feebly depressed at posterior corners, shallowly sulcate on basal lobe; surface densely foveolate, foveolae concealed by vestiture; lateral carina evanescent; cervical sulcus distinct. Scutellum quadrate, densely setose, bidentate. Elytra together slightly longer than wide (figure 474), convex laterally, depressed medially; striae shallow but distinct, 3rd and 4th each with subbasal denticle set on common gibbosity, remaining striae lacking basal denticles; interstices flat, parallel-sided, densely setose; metacoxa finely, densely punctulate except fossula glabrous; hind leg as in figure 477; pecten with one long acute denticle separated by gap from two smaller denticles; distal ventral face of femur sulcate; metatibia basally arcuate, apically dilated, tibial carinae present and complete, mucro acute, one-sixth as long as basitarsus, lateral denticle short, acute, coronal denticles inconspicuous. Male 5th abdominal sternum deeply, broadly emarginate; male pygidium apically reflexed, female pygidium oblique; disk punctulate, densely setose.

Male genitalia.—As in figures 480 and 481; slender, slightly expanded at apex, ventral valve subtriangular, lateral margins incurved; internal sac armature consisting of many blunt denticles, apex of sac with symmetrical, spiny structure; lateral lobes cleft three-fourths their length, apically spatulate (figure 481).

Size.—Body length 2.9–3.8 mm.; width 1.8–2.0 mm.

Type depository.—USNM, lectotype No. 42342, by Johnson 1968.

Type locality.—Texas, Brownsville, Esperanza Ranch.

Distribution.—FL, HI, TX; Mexico, Central America.

Host plants.—Leucaena leucocephala, L. pulverulenta, L. retusa. Johnson (1983a:117) lists other species of *Leucaena* in Mexico and Central America.

Natural enemies.—None recorded.

Immatures.—Pfaffenberger and Johnson 1976:26 (first larval instar).

Discussion.—Johnson (1983a) redescribed and illustrated *Acanthoscelides macrophthalmus.* Salient characters for this species are red integument, eyes strongly enlarged in both sexes, narrowly divided on midline in male, frons carinate and narrowed, third and fourth striae ending in denticles on a gibbosity, and female pygidium with paired, curvate maculae. Johnson (1983a) placed *A. macrophthalmus* in the *mexicanus* group, but the male genitalia are of different construction (compare figure 480 with figure 614 of *A. speciosus,* which is also in the *mexicanus* group). Armature of the metafemur and configuration of the metatibial mucro resemble those found in species of the *mexicanus* group (compare figures 477 and 612) and of some species of *Merobruchus* (compare figure 773).

Acanthoscelides macrophthalmus was recently collected in Florida for the first time (Mead 1989) although *Leucaena leucocephala* has been growing in the State for many years, and it was collected for the first time in Hawaii associated with *Leu-caena leucocephala* (Samuelson 1991:2).

This bruchid has been introduced into South Africa for possible suppression of *Leucaena leucocephala* (B. Grobbelaar, personal communication, 1996).

Acanthoscelides margaretae Johnson

(Figures 482–486)

Acanthoscelides margaretae Johnson 1970:58; Johnson and Kingsolver 1982:415; Udayagiri and Wadhi 1989:51.

Color.—Body and appendages black except ventral face of three basal antennal segments red. Vestiture very fine, mostly white except coppery on dark patches at middle of pronotum and elytra; venter of body evenly gray.

Structure.—Vertex and frons densely punctulate, sparsely setose, some specimens with distinct frontal carina; ocular index 2.6:1; ocular sinus two-thirds as long as eye; antenna (figure 484) reaching middle of metepisternum. Pronotum bell-shaped (figure 482), apex constricted in dorsal aspect by cervical sulci; disk evenly convex except posterior corners slightly depressed; densely foveolate, foveolae crowded, sometimes coalescing, each with seta emerging from its anterior rim; lateral carina absent; cervical sulcus deep, reaching nearly to dorsal midline. Scutellum quadrate, emarginate, sparsely setose. Elytra together longer than wide (figure 482), broadest behind middle; striae shallow but distinct, parallel, 2nd to 6th with minute basal denticles; interstices flat, sparsely punctate-imbricate and setose. Metacoxal face densely punctate and setose except fossula glabrous; pecten of metafemur (figure 483) consisting of one short, acute denticle followed by two minute denticles; metatibia slender, bent only at base, slightly dilated toward apex; ventral and dorsomesal carinae present, ventrolateral carina absent, lateral carina represented by an ephemeral, obtuse ridge, or tibial face evenly rounded; mucro slender, short, one-sixth as long as basitarsus, lateral denticle short, acute, two coronal denticles. First sternum of male abdomen medially flattened with small median pit, posterior margin of flattened area sinuate with fringe of long setae; posterior border of male 5th sternum nearly divided by emargination; male pygidium strongly reflexed, female vertical; disk in both sexes feebly, evenly variolate.

Male genitalia.—As in figures 485 and 486; median lobe slender, ventral valve subtri-

angular, lateral margins incurved, apex acute; internal sac with minute spicules and large, saddle-shaped sclerite in middle, apex with pair of slender, setose lobes; lateral lobes spatulate (figure 486), cleft about one-half their length.

Size.—Body length 1.7–2.8 mm; width 0.9–1.3 mm.

Type depository.—USNM, holotype No. 69687.

Type locality.—California, San Mateo Co., 10 mi south of Half Moon Bay.

Distribution.—CA.

Host plants.—Astragalus pycnostachys.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The integument of this species is usually entirely black except that the legs are sometimes piceous. The metatibial lateral carina is usually evanescent, and an occasional specimen will have an intermittent lateroventral carina. The male 1st abdominal sternum is dimpled, depressed, and fringed. The male genitalia closely resemble those of *Acanthoscelides mixtus* (figures 485 and 491) and of *A. pullus* (figure 572), which led Johnson (1970) to place these three species in a subgroup of the *aureolus* group. Elytral apices of *Acanthoscelides mixtus* are usually yellowish red and lack distinct spots, whereas those of *A. pullus* are usually gray with well-defined brown spots. Vestiture of *margaretae* is easily abraded, and the pattern is often obscured. Distribution of *margaretae* is confined to San Mateo and Marin Counties in California whereas the other two species have a wider range.

Acanthoscelides mixtus (Horn)

(Figures 487–492)

Bruchus mixtus Horn 1873:340; Fall 1910:172,180; Pic 1913a:35.

Mylabris mixtus: Leng 1920:305.

Acanthoscelides mixtus: Johnson 1968:1268; Bottimer 1968c:1019,1039; Johnson 1970:62; Center and Johnson 1976:196; Pfaffenberger and Johnson 1976:27; Johnson and Kingsolver 1982:415; Pfaffenberger 1985a:3; Udayagiri and Wadhi 1989:52.

Color.—Integument black except basal two or three antennal segments, legs, and rounded spot covering most of apical one-half of each elytron orange, rarely extending to base. Vestiture of fine, golden and white setae, colors often intermixed on pronotum and elytra, pronotum with feeble, median white stripe, each elytron with elongate white spot on 3rd interstice, occasionally with indistinct white stripe on 7th and 9th interstices; scutellum, pygidium, and venter of body white.

Structure.—Vertex and frons densely punctulate, intervals granulose; frons sometimes with impunctate median line; ocular index 3:1; ocular sinus two-thirds length of eye; antenna not dimorphic (figure 490), reaching middle of metepi-sternum. Pronotum bell-shaped (figure 487), lateral margins arcuate; disk convex, sparsely foveolate; lateral carina marked by blunt ridge; cervical sulcus well-marked. Scutellum quadrate, densely pubescent. Elytra convex (figure 487) except feebly depressed around scutellum; striae inconspicuous, parallel, partly obscured by vestiture, 3rd and 4th each with a minute basal denticle; interstices flat, densely pubescent, finely imbricate beneath vestiture. Metacoxa densely punctate except fossula glabrous, lateral one-half of coxa densely pubescent; hind leg as in figure 489; pecten with three denticles; ventrolateral carina of metatibia absent, the others complete to apex; mucro slender, about one-fourth as long as basitarsus. Male 1st abdominal sternum with median tuft of setae set on slight concavity, integumental setae surrounding tuft in circular pattern, posterior border of 1st sternum sinuate with fringe of fine setae; male 5th sternum broadly, deeply emarginate; pygidium subtriangular (figure 488), convex, apex of male reflexed.

Male genitalia.—As in figures 491 and 492; median lobe broad, ventral valve subtri-

angular, apex bluntly angulate, internal sac with large, scutiform median sclerite bearing a blunt tooth, apex with paired, brushlike, slender sclerites; lateral lobes broad (figure 492), spatulate cleft about one-third their length.

Size.—Body length 1.7–2.2 mm; width 0.9–1.2 mm.

Type depository.—MCZC, lectotype No. 3896, by Johnson 1968.

Type locality.—Utah.

Distribution.—AZ, CA, NM, OR, TX, UT, WA.

Host plants.—Eysenhardtia texana; Astragalus allochrous, A. lentiginosus, A. lonchocarpus, A. praelongus, A. sabulonum, A. thurberi, A. wootoni.

Natural enemies.—Eupelmus sp., *Microdontomerus anthonomi.*

Immatures.—Pfaffenberger and Johnson 1976:27 (first larval instar).

Discussion.—This species usually can be distinguished by the yellowish-gray appearance with the apical one-third to one-half of the elytra reddish yellow, the male 1st abdominal segment concave with a median setal tuft and posterior fringe, lateral carina of metatibia evanescent, and ventrolateral carina absent. The male genitalia are similar to those of *A. margaretae* and *A. pullus* (figures 485 and 572); see also the discussions of these species.

Nelson and Johnson (1983a,b) reported effects of selenium on *A. mixtus* in three species of *Astragalus.*

Acanthoscelides modestus (Sharp)

(Figures 493–497)

Bruchus modestus Sharp 1885:461; Pic 1913a:35.

Acanthoscelides modestus: Blackwelder 1946:760; Kingsolver and Whitehead 1976:2; Johnson 1979b:65; Johnson and Kingsolver 1982:415; Johnson 1983a:134; Udayagiri and Wadhi 1989:53; Johnson 1990c:433; Kingsolver 1995a:170.

Bruchus atrocephalus Pic 1938:78.

Acanthoscelides atrocephalus: Blackwelder 1946:758; Johnson 1990c:433.

Color.—Body varying from all red with pronotum piceous, to all piceous with broad red stripe on elytron, to all piceous; antenna piceous except segments 1–3 are red; legs all red to all piceous. Vestiture fine, short, gray, everywhere dense but evenly distributed.

Structure.—Body obovate (figure 493); head turbiniform, densely punctulate, frons vaguely carinate or with median glabrous line; eyes prominent; ocular index 8:1 in male, 4:1 in female; ocular sinus one-half length of eye; male antenna (figure 495) reaching first abdominal segment, female antenna reaching middle of metepisternum; ocular lobe absent in male, narrow and fringed in female. Pronotum subconical, lateral margins slightly sinuate; disk evenly convex, densely punctulate, with shallow antescutellar depression; basal margin strongly sinuate; lateral margin represented by sinuate ridge. Prosternum acutely triangular. Scutellum quadrate, apical angles minutely dentate. Elytra convex, together as long as broad, lateral margins gently arcuate, disk briefly depressed around scutellum; striae regular in course except 2nd, 3rd, and 4th divergent laterad at base, 3rd and 4th ending short of basal margin, 4th ending in small denticle; interstices flat, of equal width, finely granulose. Fore and mid leg not especially modified; metacoxa finely, evenly punctulate except fossula glabrous; metafemur (figure 494) not strongly swollen, pecten consisting of one long and two smaller denticles; metatibia with mucro and lateral denticle small, of equal size, corona with one or two minute denticles; lateral, dorsomesal, and ventral carinae complete, ventrolateral carina obsolete near apex. Pygidium broadly triangular, moderately convex in male, nearly flat in female.

Male genitalia.—As in figures 496 and 497. Median lobe slender (figure 496), lateral margins constricted in middle of lobe; ventral valve ogival; armature of internal sac consisting of two parallel rows of elongate denticles set diagonally and extending nearly one-half distance from base to margin of cucullus then gradating into thornlike denticles in apical portion of sac; lateral lobes (figure 497) spatulate, setose, cleft nearly to base.

Size.—Body length 1.4–2.5 mm; width 0.9–1.5 mm.

Type depository.—BMNH *(modestus);* MNHP (*atrocephalus).*

Type locality.—Guatemala, San Gerónimo.

Distribution.—FL (introduced). Brazil, British Guiana, Colombia, Cuba, Dominica, Grenada, Guatemala, Honduras, Jamaica, Mexico, Panama, Puerto Rico, Trinidad, Venezuela.

Host plants.—Aeschynomene indica, A. histrix incana. The latter host is a recent introduction from tropical America (Isely 1990). Johnson (1990c) lists other host species of *Aeschynomene* from tropical America.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—A record from Texas is based on a single specimen identified by C.D. Johnson, but the presence of this bruchid in central Florida (Polk County) is puzzling. Previous records of the host plant, *Aeschynomeme hystrix* var. *incana,* are from the extreme northwest part of the state. *Aeschynomeme indica* is widespread in the southeastern United States.

Johnson (1990c) places this bruchid in the *megacornis* group of *Acanthoscelides,* which comprises Neotropical species.

Salient characters for this species are the enlarged male eyes, strongly serrate male antenna, the denticle at the base of the fourth elytral stria, denticle-like mucro, and details of the male genitalia.

This species does not appear to be closely related to any other U.S. species. It shares some characteristics with *Acanthoscelides macrophthalmus* (Schaeffer): 4th stria ending in basal denticle, male eyes enlarged, male antenna elongate and serrate; but in *macrophthalmus* the lateral margins of the pronotum are arcuate, the basic integumental color is dark red, the male genitalia are distinctly different, and the metafemur is broader (compare figures 477 and 494).

Acanthoscelides mundulus (Sharp)

(Figures 498–503)

Bruchus mundulus Sharp 1885:448; Pic 1913a:36.

Acanthoscelides mundulus: Blackwelder 1946:760; Bottimer 1961:294, 1968c:1021,1039; Kingsolver and Whitehead 1976:2; Johnson 1977b:161, 1981b:79; Johnson and Kingsolver 1982:415; Johnson 1983a:136; Udayagiri and Wadhi 1989:53.

Color.—Integument black; antenna black except segments two and three yellowish red; legs red. Vestiture dark brown, light brown, and white; pronotum mostly light brown with feeble lateral patches of white, midline with elongated, triangular white stripe (figure 498); scutellum white; elytra mixed dark brown and light brown with two diagonal series of white maculae; pygidium light brown with elongate, intensely white basal stripe (figure 499), remainder of disk with variable white patches; venter of body mostly white with brown patches on metepisternum and abdomen, the abdominal patch divided by a white line of setae.

Structure.—Vertex and frons densely punctulate, sparsely setose, frontal carina feeble; ocular ratio 3.5:1; ocular sinus two-thirds length of eye; postocular lobe fringed with long, brown setae; antenna (figure 501) with distal seven segments strongly eccentric, not dimorphic. Pronotum subconical (figure 498), lateral margins

nearly straight, disk strongly convex, feebly impressed either side of basal lobe, surface densely microfoveolate, each foveola with centrally placed seta; lateral carina brief, arcuate. Scutellum slightly longer than wide, densely pubescent. Elytra together slightly longer than wide (figure 498), evenly convex except slightly depressed around scutellum; striae narrow, distinct, 3rd to 5th not reaching base, 4th denticulate at base; 3rd, 7th, and 9th interstices slightly wider than alternates; metacoxa densely, evenly punctulate except fossula glabrous; pecten of metafemur (figure 500) of one long and two minute denticles, ventral femoral margin shallowly channeled, distally; lateral, ventral, and dorso-mesal metatibial carinae distinct, complete, ventrolateral carina arched toward base of mucro; mucro short, acute, less than one-eighth length of basitarsus; lateral denticle and two coronal denticles minute. Male 5th abdominal segment broadly emarginate for apex of reflexed pygidium, female pygidium oblique, pygidial disk shallowly foveolate.

Male genitalia.—As in figures 502 and 503; median lobe broad, ventral valve truncate, lateral margins deeply incurved; internal sac lined with triangular denticles, basal one-third with pair of lightly chitinized sclerites with leaflike lateral appendages, middle of sac with two pairs of thin, arcuate, serrate sclerites, apex of sac with spiny, clavate sclerite; lateral lobes spatulate (figure 503), emargination between lobes shallow.

Size.—Body length 1.7–3.0 mm; width 1.5–1.7 mm.

Type depository.—BMNH.

Type locality.—Mexico, Guanajuato.

Distribution.—AZ; Mexico.

Host plants.—Nissolia schottii, N. wislizenii. For Mexican host plants, see Johnson (1983a:137).

Natural enemies.—Horismenus productus; Urosigalphus bruchivorus, U. neobruchi.

Immatures.—Not described.

Discussion.—This species is immediately recognizable by the brown basic body color with contrasting white setal stripes of the pronotal disk and pygidium and by the conspicuous white scutellum. The prominent denticle at the base of the 4th stria and the male genitalia are diagnostic. Johnson (1983a) places *mundulus* by itself in the mundulus group, and it is the only North American representative of the group. Other species in the group are scattered on the South American continent.

Acanthoscelides napensis Johnson

(Figures 504–508)

Acanthoscelides napensis Johnson 1970:63; Johnson and Kingsolver 1982:415; Udayagiri and Wadhi 1989:53.

Color.—Integument variable in color from all black (except basal four antennal segments) to all reddish brown (except distal segments of antenna light brown). Vestiture fine white and bronze setae; pronotum usually white, sometimes intermixed with bronze; elytra with evanescent, rounded bronze spots; pygidium sparsely white; venter of body white.

Structure.—Vertex and frons shallowly, coarsely foveolate, sparsely setose; ocular index 2.5:1; ocular sinus one-half length of eye; antenna (figure 506) not sexually dimorphic, extending to middle of metepisternum. Pronotum bell-shaped (figure 504), lateral margins straight in basal one-half, apically arcuate; disk evenly convex, coarsely foveolate-imbricate, each foveola with seta emerging from anterior rim; lateral carina lacking. Scutellum quadrate, sparsely setose. Elytra slightly longer than wide (figure 504), lateral margins arcuate; striae parallel, shallowly impressed, strial punctures elongate, 3rd, 4th, 5th, and 6th minutely denticulate at basal margin; interstices flat, minutely imbricate; metacoxa shallowly foveolate, sparsely setose, fossula glabrous; hind leg (figure 505) moderately swollen, ventromesal margin

with one or two minute denticles; metatibia lacking distinct carina; mucro slender, straight, one-third as long as basitarsus, coronal denticles slender, dorsal denticle set at angle, longer than lateral denticles. First male abdominal segment shallowly impressed, 5th ventral nearly divided by broad emargination; pygidial disk shallowly foveolate-imbricate, apex of male reflexed into abdominal emargination.

Male genitalia.—As in figures 507 and 508; median lobe slender, ventral valve ogival, apex narrowly produced, basal one-half of internal sac lined with blunt, transverse denticles and transverse rows of minute denticles, apical one-half with paired, slender, setose structures; lateral lobes long (figure 508), slender, cleft three-fourths their length.

Size.—Body length 1.1–1.8 mm; width 0.7–0.9 mm.

Type depository.—USNM, holotype No. 69688.

Type locality.—California, Napa Co., 9 mi south of Pope Valley.

Distribution.—CA, ID, OR.

Host plants.—On flowers of *Malacothrix incana* and *M. saxatilis implicata* (Miller and Davis 1986).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Salient characters for this species are its small size, arcuate lateral pronotal margins, white vestiture with bronze spots on the pronotum and elytra, 1st abdominal segment of male impressed, details of the male genitalia, the lack of metatibial carinae, and the minute metafemoral denticle.

Johnson (1970) placed *A. napensis* near *A. pauperculus* and *A. inquisitus.*

Acanthoscelides obrienorum Johnson

(Figures 509–516)

Acanthoscelides obrienorum Johnson 1970:65; Slobodchikoff and Johnson 1973:282; Whitehead and Kingsolver 1975b:113; Center and Johnson 1976:196; Janzen 1977a:419, 1978:185; Johnson 1979b:65; Janzen 1980:946; Johnson 1980:29–32; Johnson and Kingsolver 1982:415; Johnson 1983a:141; Pfaffenberger 1985a:3; Udayagiri and Wadhi 1989:54.

Color.—Sexually dimorphic (figures 509 and 510); male integument mostly dark red, antenna and legs brown, thoracic sterna piceous; female integument piceous except head dark red, antenna and legs dark red. Male vestiture gray, golden, and dark brown; pattern subdued with small, brown pronotal patches; elytra gray with intermixed golden setae; pygidium gray with two faint brown stripes; female dorsal vestiture contrasting, pronotal disk usually with four large, dark brown patches but sometimes coalescing, smaller lateral patches, otherwise gray with a few lateral intermixed golden setae; elytral pattern of dark brown maculae on gray background with scattered golden diffusion; pygidium gray with two divergent dark brown stripes; venter of body in both sexes uniformly gray.

Structure.—Vertex and frons finely punctate, interspaces minutely granulose, frontal carina feeble; ocular index 4:1 in male, 3.8:1 in female; ocular sinus two-thirds length of eye; antenna (figure 514) not dimorphic. Pronotum bell-shaped (figure 509), lateral margins slightly sinuate; disk convex, feebly impressed on basal lobe and near posterior angles, surface of disk irregularly microfoveolate, interspaces finely imbricate; lateral carina ridgelike, feebly arched at middle; cervical sulcus short, deep. Scutellum quadrate, densely setose. Elytra together as long as wide (figure 509); striae distinct, narrow, strial punctures elongate, 2nd, 3rd, and 4th each with minute basal denticle; 3rd, 5th, 7th, and 9th interstices slightly wider than alternates; metacoxal face densely, finely punctate except fossula glabrous; hind leg as in figure 513; metafemur slightly channeled in distal one-third, pecten with four or five denticles, the first longest; base of

metatibia arcuate, apical four-fifths nearly straight, slightly dilated toward apex, lateral, ventral and dorsomesal carinae prominent and complete to apex, ventrolateral carina joining ventral near base of mucro; mucro short, subequal to lateral denticle, about one-eighth as long as basitarsus, coronal denticles minute. Male 1st abdominal sternum with oval setose pit, 5th sternum broadly, deeply emarginate; pygidial disk finely punctate-imbricate, that of male nearly concealed by vestiture, male reflexed apically, female oblique, with slight tumosity near apex.

Male genitalia.—As in figures 515 and 516; median lobe moderately broad; ventral valve semicircular with flaring base; basal one-third of internal sac lined with poorly defined, broad denticles, middle one-third lined with elongate spicules, apical one-third saclike, lined with fine spicules, apical sclerite C-shaped; lateral lobes slightly broadened apically (figure 516), cleft two-thirds their length.

Size.—Body length 2.1–2.5 mm; width 1.3–1.7 mm.

Type depository.—USNM, holotype No. 69689.

Type locality.—Arizona, Pima Co., Santa Rita Mountains., Box Canyon.

Distribution.—AZ, TX; Mexico to Costa Rica, Jamaica.

Host plants.—Senna armata, S. polyantha, S. wislizenii wislizenii. Johnson (1983a) lists *S. wislizenii* from Mexico.

Natural enemies.—Eupelmus sp.; *Stenocorse bruchivora.*

Immatures.—Not described.

Discussion.—Few species of Bruchidae are sexually dimorphic in color pattern to the extent found in *Acanthoscelides obrienorum.* I could find no intergradation between the bold pattern of the female and the muted pattern of the male.

Johnson (1983a) placed *A. obrienorum* as a marginal member of the *mexicanus* group, which includes *A. speciosus,* but the male genitalia of the two species are of distinctly different construction, especially in the shape of the ventral valve and lateral lobes.

Acanthoscelides obsoletus (Say)

(Figures 517–521)

Bruchus obsoletus Say 1831:2; Hamilton 1892a:162; Riley and Howard 1892c:30; Pic 1913a:37.

Mylabris obsoletus: Leng 1920:305.

Acanthoscelides obsoletus: Yip 1936:625; Bradley 1947:40; Bottimer 1968b:287, 1968c:1019,1039; Kingsolver 1968:9; Johnson 1970:69; Johnson and Kingsolver 1982:415; Udayagiri and Wadhi 1989:54.

Bruchus obscurus: Fitch 1861:62; Hamilton 1892b:253 (misspelling).

Bruchus distinguendus: Horn 1873:336 (in part); authors (in part).

Color.—Integument black, two basal antennal segments and postocular spot red, mesal surfaces of legs usually reddish brown. Vestiture white, dark brown, and brassy; elytra mottled with brassy; head white, setae directed toward median fovea; pronotum with median, broad, black stripe bisected by evanescent white setal line, lateral areas of disk intermixed white and brassy, white condensed into spots; scutellum, pygidium, and venter of body white.

Structure.—Vertex and frons punctulate, transverse sulcus well marked; frontal carina represented by impunctate median line; ocular index 3.5:1; ocular sinus two-thirds length of eye; antenna of both sexes serrate, dimorphic (figure 519). Pronotum bell-shaped (figure 517), lateral margins straight; disk evenly convex, uniformly foveolate, each foveola with a seta under its anterior rim; lateral carina obsolete; cervical sulcus deep, well-marked. Scutellum conspicuous, slightly longer than wide, bidentate. Elytra about as long as wide (figure 517), widest near apex, convex; striae narrow, deep, punctures oval, setose, 3rd and 4th with prominent denticles on basal margin; interstices regularly foveolate, imbricate; metacoxal face densely,

evenly punctulate, fossula glabrous. Hind leg (figure 518) with pecten of metafemur bearing one long denticle and two or three minute denticles; metatibia arcuate in basal one-third, dilated apically, carinae reaching apex of tibia, ventrolateral carina approaching mucro base; mucro long, slender, curved, less than one-half length of basitarsus, lateral and coronal denticles inconspicuous. First abdominal sternum of male shallowly sulcate and depressed, partly glabrous, setae surrounding depression arranged in circular pattern; 5th sternum deeply emarginate, segments telescoped ventrally; 5th female sternum shallowly emarginate; pygidium in both sexes foveolate, interspaces punc-tulate, male pygidium reflexed.

Male genitalia.—As in figures 520 and 521; median lobe slender, ventral valve ogival, slightly produced at apex; internal sac with cluster of fine denticles at apical orifice, middle of sac with numerous denticles of several sizes (figure 520), apex with symmetrical, setose structure; lateral lobes (figure 521) suddenly expanded apically, cleft one-half their length.

Size.—Body length 2.1–2.9 mm; width 1.4–1.9 mm.

Type depository.—Type destroyed.

Type locality.—Indiana.

Distribution.—AL, AR, CT, DC, FL, GA, IL, IN, KS, MD, MO, MS, NC, NJ, OK, PA, SC, TX, VA, WI.

Host plants.—Tephrosia ambigua, T. spicata, T. virginiana.

Natural enemies.—Because of past confusion of the names of *A. obsoletus* and *A. obtectus,* any parasitoids listed for *A. obsoletus* are suspect.

Immatures.—Not described.

Discussion.—The name *Acanthoscelides obsoletus* for many years was applied to the bean bruchid, *A. obtectus* (Say) and even today appears in Old World literature as the name for that species. Bottimer (1968b) gave a thorough discussion of the confusion in usage of these two names.

The color pattern of *A. obsoletus* is one that frequently recurs in this genus: 3rd interstice with a rectangular, pale setal spot anteriorly and posteriorly limited by a darker, quadrate spot, and lateral parts of elytra with irregular bands composed of pale setal patches. The dimorphic, all-black antennae, modified male abdomen, and distinctive male genitalia should easily separate this species. In contrast, the male abdomen of *A. obtectus* is not modified, the apical segment of the antenna and most of the abdomen is red, antennae are not dimorphic, and male genitalia are diagnostic (figure 525).

Acanthoscelides obtectus (Say)

(Figures 11, 15, 24, 44, 522–526)

Bruchus obtectus Say 1831:1; Jekel 1855:14; Horn 1873:337; Sharp 1885:458; Riley 1892:291; Riley and Howard 1892a:27, 1892c:165; Slingerland 1892; Riley 1893:171; Schilsky 1905:12; Schaeffer 1907:302; Blatchley 1910:1238; Fall 1910:172; Cushman 1911:499,507; Bridwell 1918:466, 1919:17.

Laria obtecta: Bedel 1901:345.

Mylabris obtectus: Leng 1920:305; Kannan 1923:1; Essig 1929b:858.

Mylabris irresecta: Baudi 1886b:58.

Bruchidius (Acanthoscelides) obtectus: Reitter 1912(IV):224.

Acanthoscelides obtectus: Skaife 1926:576; Bridwell 1929a:42, 1932:104; Bottimer 1935:129; Bridwell 1938b:4; Back 1940:7; Bridwell 1942:249; Blackwelder 1946:760; Bradley 1947:40; Blackwelder and Blackwelder 1948:45; Decelle 1951:173; Luk'yanovich and Ter-Minassian 1957:172; Hinckley 1960:261; Bottimer 1968b:286, 1968c:1009,1019,1039,1040; Huignard 1968:233; Kingsolver 1968:4, 1970a:371; Johnson 1970:67; Forister and Johnson 1971:231; De Luca 1972:105; Howe 1973:571; Slobodchikoff and Johnson 1973:282; Center and Johnson 1974:1097; Smith and

Brower 1974:322; Rogers and Garrison 1975:242; Center and Johnson 1976:196; De Luca 1976:127; Pfaffenberger and Johnson 1976:29; Schoonhoven 1977:691; Bell 1978:148; Southgate 1978:221; Dobie et al. 1979:169; De Luca 1980:1; Stampoulos and Huignard 1980:38; Johnson 1981b:74; Szentesi 1981:219; Johnson and Kingsolver 1982:415; Johnson 1983a:144, 1983c:10, 1985:208; Pfaffenberger 1985a:3, 1985b:239; Bonet et al. 1987:378; Johnson and Kistler 1987:266; Kingsolver 1990c.

Bruchus leguminarius: Gyllenhal 1833:69 (misidentification).

Bruchus irresectus Fahraeus 1839:18; Pic 1913a:38.

Bruchus melanocephalus Fahraeus 1839:87 (misidentification).

Bruchus tetricus Gyllenhal 1839:22; Pic 1913a:52; Kingsolver 1979a:341.

Bruchus pallidipes Fahraeus 1839:91; Pic 1913a:38.

Bruchus subellipticus Wollaston 1854:420; Pic 1913a:38.

Bruchus acanthocnemus Jekel 1855:15 validation of Dejean 1837 page 253 in synonymy with *obtectus*.

Bruchus fabae Fitch 1861:63; Riley 1871:52; Pic 1913a:38 (not Motschulsky 1874).

Spermophagus incretus Motschulsky 1863:519.

Bruchus breweri Crotch 1867:389; Pic 1913a:38.

Bruchus fabi Rathvon 1870:119.

Bruchus obsoletus, of authors (not Say 1831): Horn 1873:337; Pic 1913a:37, and other authors.

Bruchus gilvipes Motschulsky 1874:238.

Bruchus varicornis Motschulsky 1874:239 (not Brulle 1832); Pic 1913a:38; Kingsolver 1979a:342.

Bruchus mimosae: Gemminger and Harold 1873:3226 (not Fabricius 1781).

Bruchus leguminarius var. *melanocephalus* Blackwelder 1946:760 (error)

Because of its almost universal distribution, this bruchid species has a vast bank of literature pertaining to control, brief life histories, and identification. I have been selective in recording here only the most important references in which different combinations of the name appear or that contain significant contributions to biology, physiology, illustration, or host relationships. Many references to the occurrence of the species in Old World countries have been omitted since this handbook is primarily American in scope.

Color.—Body mostly black except abdomen variably red, pygidium red, antenna with basal four and terminal segments red, legs red except ventral margin of each femur piceous brown. Vestiture of yellowish-gray and dark brown slender setae, brown setae forming three vaguely defined, dark brown bands across elytra (figure 522), head, pronotum, and ventral areas of body uniformly yellowish gray, pygidium with narrow median stripe of yellowish setae, remainder of pygidium evenly clothed.

Structure.—Vertex microfoveolate, frons punctate, intervals minutely granulose; frontal carina absent; ocular index 3:1, ocular sinus two-thirds length of eye; postocular lobe narrow but prominent, densely setose; antenna (figure 524) not strongly dimorphic, reaching elytral humerus. Pronotum with bell-shaped lateral margins (figure 522), disk evenly convex except shallowly sulcate on basal lobe and with shallow depressions near posterior corners; surface densely microfoveolate, intervals finely punctate; lateral carina evanescent; cervical sulcus short, deep, nearly hidden by vestiture. Scutellum quadrate, densely setose, apex deeply emarginate and bidentate. Elytra together slightly longer than wide (figure 522), laterally convex but medially depressed, striae mostly parallel, occasionally slightly sinuate, shallow, with elongated punctures, 3rd and 4th striae with minute basal denticles; interstices flat, shallowly imbricate, 3rd,

5th, 7th and 9th interstices wider than alternates. Metacoxa densely punctate except fossula glabrous; pecten of metafemur (figure 523) with one long and two shorter denticles; metatibia slender, slightly dilated toward apex; lateral, ventral, and dorsomesal carinae prominent and complete, ventrolateral carina evanescent in apical one-third of tibia; mucro short, slender; lateral denticle short, acute, two coronal denticles minute. First abdominal sternum not modified, 5th sternum broadly emarginate in male, shallowly emarginate in female; pygidium evenly convex, slightly reflexed into sternal emargination in male; disk of pygidium moderately densely foveolate, intervals punctate.

Male genitalia.—As in figures 525 and 526; median lobe elongate, slender; ventral valve short and broadly triangular; armature of internal sac lined with fine, acute spicules in basal one-half, broad scalelike denticles in apical one-half, apical one-fourth with scattered denticles, closure valve circular; lateral lobes deeply cleft (figure 526), expanded at apices.

Type depository.—Type apparently destroyed.

Type locality.—Louisiana.

Distribution.—Cosmopolitan. AL, BC, CA, CT, DC, DE, FL, GA, HI, IA, IL, IN, KS, LA, MA, MB, MD, MN, MO, MS, NE, NJ, NY, OH, OK, ON, OR, PA, PQ, RI, SC, SD, TN, TX, VA.

Host plants.—Many host plants have been listed for this species in the literature. The primary hosts are species and varieties of the fabaceous genus *Phaseolus* (common beans, lima beans, etc.), but seeds of other fabaceous genera are attacked as well. Reported host plants from which this species has been reared include *Cajanus cajan; Cicer arietinum; Dolichos melanophthalmus; Glycine max; Lablab purpureus; Lathyrus sativus; Lens culinaris; Phaseolus acutifolius latifolius, P. coccineus, P. lunatus, P. ritensis, P. vulgaris; Pisum sativum arvense; Sesbania aegyptiaca, S. sesban; Vicia faba; Vigna aconitifolia, V. radiata radiata, V. subterranea, V. umbellata, V. unguiculata sesquipedalis, V. unguiculata unguiculata.* Doubtful records include *Albizia* sp., *Dolichos melanophthal-mus, Lupinus albus, Zea mays,* and inflorescences of *Daucus carota.*

Natural enemies.—Bruchobius laticeps; Chryseida spinola bennetti; Dinarmus laticeps; Eupelmus cushmani, E. cyaniceps; Pyemotes ventricosus; Torymus atheatus; Uscana semifumipennis.

Immatures.—Kannan 1923 (egg, first larval instar); Skaife 1926 (egg, larva); Larson and Fisher 1938 (all stages); Lepesme 1944; Pfaffenberger 1985b (larval instars), 1991:564 (larva).

Discussion.—This species, along with *Callosobruchus maculatus* (Fabricius) and *Callosobruchus chinensis* (Linnaeus), are well known pests of stored legumes in nearly all parts of the world. Probably originating in Middle America or northern South America, *A. obtectus* has spread through commercial interchange of infested seed stocks or of beans for consumption.

Following Horn's (1873) error of confusing *Bruchus obtectus* and *Bruchus obsoletus, obtectus* was listed as a synonym of *obsoletus* in many publications including Maurice Pic's bruchid fascicle in *Catalogus Coleopterorum* (1913a). The application of the name *obsoletus* to the common bean weevil persisted until the 1960's. See discussion following the description of *obsoletus* and Bottimer (1968b:286–288) for more complete discussion of the confusion of these two names.

The oviposition habit of *A. obtectus* well equips it to be a storage pest. In the field, eggs are almost always attached to bean seeds either through partly dehisced pod valves or on seeds left in containers, in sheds, or in bean fodder. Larson and Fisher (1938:35), however, state that females will oviposit on immature pods after chewing a hole in the pod in the valley between developing seeds. On more mature pods,

the female will chew a hole in the suture through which she inserts her ovipositor and then drops eggs into the seed cavity. In storage, eggs are attached to naked beans, sometimes several to a seed if populations are dense. Eggs are also laid in old emergence holes in seeds. Hatching and larval penetration of the seed was reported by Thiery and Jarry (1985).

Other aspects of morphological and physiological studies may be found in the following references. Complete information can be found in the bibliography. Individual papers can be found in Fujii et al. (1990).

Adult feeding.—Leroi 1978, 1981; Huignard and Leroi 1981; Jarry 1987.

Adult illustration.—Larson and Fisher 1938; Lepesme 1944; Johnson 1983a.

Chromosomes.—Smith and Brower 1974; Garaud and Lecher 1982; Garaud 1984.

Coevolution.—Huignard et al. 1990.

Diapause.—Biémont and Bonet 1981; Hodek et al. 1981.

Digestive tract.—Leroi et al. 1984.

Disease transmission.—Heinze 1959.

Enzymes.—Horler 1970; Agadzhanyan 1984; Leroi et al. 1984; Gatehouse et al. 1989.

Egg development.—Leroi 1981; Biémont and Bonet 1981; Loi and Fornasari 1985.

Eclosion.—Lepesme 1942; Thiery and Jarry 1985.

Female genitalia.—Huignard 1968; Johnson 1983a.

Field infestation.—Back 1940:7; Biémont and Bonet 1981; Jarry 1981; Menten and Menten 1984; Jarry et al. 1985; Bonet et al. 1987.

Flight.—Perttunen and Häyrinen 1969, 1970a,b; Perttunen 1972; Menten et al. 1981.

Genetics.—Garaud and Lecher 1982; Garaud 1984.

Geographical origin.—Essig 1929b; Southgate 1975; Bonet et al. 1987.

Host resistance.—Stampoulos and Huignard 1980; Stampoulos and Desroches 1981; Thiery 1982a,b; Thiery and Jarry 1985; Stampoulos 1987; Gatehouse et al. 1989.

Integumental glands.—Bushnell 1936; Biémont et al. 1989.

Laboratory rearing techniques.—Strong et al. 1968.

Larval development.—Leroi and Jarry 1981.

Larval parasites.—Perez 1982; Perez and Bonet 1984.

Larval illustration.—Larson and Fisher 1938; Pfaffenberger and Johnson 1976 (first instar); Pfaffenberger 1985b (all instars); Costa et al. 1988 (as *A. obsoletus*).

Lateral oviduct secretions.—Hamon et al. 1982, 1983.

Life history.—Hamilton 1892b; Riley 1892; Riley and Howard 1892a,b; Slingerland 1892; Riley 1893; Gibson 1906; Manter 1917; Daviault 1928; Menusan 1934b; Herford 1935; Menusan 1936; Zachariae 1959; Filipek 1962; Howe and Currie 1964; Biémont and Bonet 1981; Bonet 1981; Bonet et al. 1987; Shade et al. 1987; Pichard et al. 1991.

Male accessory glands.—Huignard 1968, 1975; Huignard et al. 1977; Cassier and Huignard 1979; Das et al. 1980; Huignard 1983, 1984.

Male genitalia.—Huignard 1968; Johnson 1970; Kingsolver 1970a; Johnson 1983a.

Mating and reproduction.—Labeyrie 1968; Huignard 1971, 1976; Biémont 1979a; Huignard and Biémont 1981; Huignard and Leroi 1981; Labeyrie 1981; Burkholder 1982; Biémont and Jarry 1983; Monge 1985.

Natural enemies.—See above.

Oogenesis.—Bushnell and Boughton 1940; Huignard 1970; Pouzat 1970; Biémont 1979a,b; Pouzat 1982; Biémont et al. 1981, 1987; Butare and Biémont 1987.

Oogenesis, effect of host on.—Sandner and Pankanin 1974; Huignard 1976; Pouzat 1977, 1978, 1981; Leroi 1980; Huignard and Leroi 1981; Leroi and Jarry 1981; Monge 1985; Jarry et al. 1987.

Oviposition.—Kannan 1923; Menusan 1934a; Huignard 1970; Labeyrie 1970; Pouzat 1970; Sandner and Pankanin 1974; Pouzat 1975, 1976; Szentesi 1976; Pouzat 1977; Szentesi 1981; Hamon et al. 1982; Pouzat 1983; Menten and Menten 1984.

Parasites.—Perez 1982; Perez and Bonet 1984; Fujii and Khin Mar Wai 1990.

Pathogens.—Mierzejewska 1982.

Penetration of host seeds.—Thiery 1982a,b; Thiery and Jarry 1985.

Pheromones.—Hope et al. 1967; Horler 1970:859; Halstead 1973; Errard 1981a,b; Szentesi 1981.

Photoperiodism.—Stampoulos 1989.

Population density.—Desroches 1983.

Spermatheca.—Surtees 1961.

Radiation, effects of.—MacLeod 1933.

Acanthoscelides oregonensis Johnson

(Figures 527–531)

Acanthoscelides oregonensis Johnson 1970:69; Johnson and Kingsolver 1982:415; Udayagiri and Wadhi 1989:57.

Color.—Body mostly black, elytra varying from all yellow with base black to all black; legs yellow to yellowish red, antenna black except basal three or four segments yellow. Vestiture uniformly silvery gray, without pronotal or elytral pattern.

Structure.—Vertex and frons sparsely punctulate, interspaces granulose; frontal carina vague in some specimens but usually appears as an impunctate median line; ocular index 3:1 in male, 5:2 in female; ocular sinus about two-thirds length of eye; postocular lobe very narrow, sparsely fringed; male antenna as in figure 529, male antenna reaching nearly to metacoxa, female to elytral humerus. Pronotum bell-shaped (figure 527), lateral margins slightly arcuate to the brief apical constriction by the cervical sulci, disk convex with trace depressions along base, surface densely imbricate-punctate, lateral carina basally evanescent, apically absent; cervical sulcus long, narrow. Scutellum nearly twice as long as wide (figure 527), densely setose, apex shallowly emarginate. Elytra together about as long as wide, convex; striae deep, narrow, parallel except 3rd stria slightly arched toward 4th at base, 3rd, 4th, 5th, and 6th striae minutely denticulate, arched laterad toward base; interstices densely, finely punctate. Metacoxal face densely punctate and setose except fossula glabrous; metafemur as in figure 528, pecten usually with one minute denticle, occasionally with two; metatibia relatively slender, expanded gradually toward apex, all tibial carinae lacking, mucro short, less than one-sixth length of basitarsus, lateral carina and three slender coronal denticles subequal in form. First abdominal sternum of male slightly concave with median setal tuft, 5th sternum nearly divided by apical emargination, 1st sternum of female not modified, 5th sternum not emarginate; pygidium finely punctate, densely setose, apex of male strongly reflexed apically into sternal emargination.

Male genitalia.—As in figures 530 and 531; median lobe slender, slightly expanded toward apex; ventral valve subtriangular, apex slightly produced; armature of internal sac consisting of transverse rows of minute spicules in basal one-third, minute spicules and an elongate, acute sclerite in middle one-third, a pair of setose, elongate lobes, fine spicules and C-shaped closure valve in apical one-third; lateral lobes fused two-thirds their length (figure 531), apices slightly divergent, setose.

Size.—Body length 1.5 mm; width 0.9 mm. Specimen size is remarkably uniform.

Type depository.—USNM, holotype No. 69690.

Type locality.—Oregon, Malheur Co., Ontario.

Distribution.—AB, ID, OR, WA, WY.

Host plants.—Dalea ornata.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The small size, black body with yellow legs and variable yellow and black elytra, the single minute femoral denticle, the lack of tibial carinae, and the three slender coronal denticles should suffice to distinguish this species. Coloration in *Acanthoscelides pallidipennis* is similar but that species has well defined tibial carinae and three denticles in the pecten. Johnson (1970) places *A. oregonensis* tentatively near *A. aureolus.*

Acanthoscelides pallidipennis (Motschulsky)

(Figures 532–537)

Bruchus pallidipennis Motschulsky 1874:210; Pic 1913a:39; Bottimer 1968c:1040 (as unrecognized species).

Mylabris pallidipennis: Leng 1920:306.

Acanthoscelides pallidipennis: Kingsolver 1979a:341; Wendt 1980:223, 1984:165; Udayagiri and Wadhi 1989:57.

Bruchus collusus Fall 1910:176; Pic 1913a:22

Mylabris collusus: Leng 1920:305.

Acanthoscelides collusus: Johnson 1968:1267; Bottimer 1968c:1018,1038; Johnson 1970:44; Rogers and Garrison 1975:241.

Bruchus perplexus Fall 1910:177; Pic 1913a:40.

Mylabris perplexus: Leng 1920:305.

Acanthoscelides perplexus: Johnson 1968:1268; Bottimer 1968c:1020,1030; Johnson 1970:44; Pfaffenberger and Johnson 1976:25.

Acanthoscelides tarnawskii Borowiec 1980:167; Wendt 1984:165.

Color.—Body piceous with following exceptions: elytra usually reddish yellow to reddish brown, rarely piceous, often with piceous sutural stripe; legs reddish yellow to yellow; basal four segments of antenna reddish yellow, distal segments piceous. Vestiture everywhere dense, yellowish gray on pronotum, elytra, and legs, gray on remainder of body.

Structure.—Head elongate; vertex and frons sparsely punctate, interspaces finely granulate, frontal carina absent but often with impunctate median line; ocular index 3:1; ocular sinus three-fifths as long as eye; postocular lobe with short, white fringe; antenna as in figure 535, extending to middle of metepisternum. Pronotum bell-shaped (figure 532), lateral margins slightly sinuate, disk strongly convex, slightly depressed at posterior corners, surface densely microfoveolate, interspaces finely imbricate, sculpture hidden by dense vestiture; lateral carina evanescent; cervical sulcus conspicuous, deep. Scutellum 1.5 times as long as wide, densely pubescent, lateral margins arcuate, apex bifid. Elytra together slightly longer than wide (figure 532), strongly convex, striae shallow, hidden by vestiture, parallel except 2nd bent laterad at base; 3rd, 4th, and 5th each with minute basal denticle. Metacoxal face densely punctate and pubescent except fossula glabrous; hind leg as in figure 534; pecten with one short denticle followed by two minute denticles; metatibia slender basally, gradually expanded api-cally, with lateral, ventral, and dorsomesal carina complete, ventrolateral carina absent; mucro one-seventh as long as basitarsus, lateral denticle and two coronal denticles subequal in size. First abdominal sternum of male with tomentose pit, 5th sternum deeply emarginate; 1st and 5th sterna in female not modified; pygidium in both sexes convex (figure 533), apex of male reflexed into 5th sternal emargination.

Male genitalia.—As in figures 536 and 537; median lobe moderately broad, sides straight; ventral valve triangular, lateral margins incurved, apex attenuate; armature of internal sac consisting of many minute denticles and one large, thornlike

median spine in basal one-half, apical one-half with pair of elongated, setose structures, apex lined with fine spicules, closure valve C-shaped; lateral lobes cleft nearly one-half their length (figure 537), apices rounded, flat, densely setose.

Size.—Body length 1.1–2.7 mm; width 0.9–1.6 mm.

Type depositories.—ZMUM *(pallidipennis);* MCZC (*collusus,* holotype No. 25050; *perplexus,* holotype No. 25058); Borowiec, private collection, Wroclaw, Poland, *(tarnawskii).*

Type localities.—"Californie" *(pallidipennis);* California, S. Bernadino Mountains, Deep Creek, 6,500 ft. *(collusus);* New Mexico, Albuquerque *(perplexus);* Bulgaria, East Rodopi *(tarnawskii).*

Distribution.—AZ, CA, CO, IA, ID, MT, NE, NM, OK, TX, WA, WY; Bulgaria.

Host plants.—*Amorpha californica, A. canescens, A. fruticosa fruticosa; Astragalus* sp.; *Dalea* sp.; *Desmanthus virgatus acuminatus, D. virgatus virgatus; Errazu-rizia rotundata; Glycyrrhiza* sp.; *Lotus* sp.; *Parryella filifolia.*

Natural enemies.—*Horismenus missou-riensis, H. productus.*

Immatures.—Pfaffenberger and Johnson 1976:25 (as *A. collusus*; first larval instar)

Discussion.—Several color forms are discussed by Johnson (1970). Specimens from northern California reared from *Amorpha californica* have bright golden yellow vestiture, whereas those from *Errazurizia rotundata* from northern Arizona have dense yellow vestiture. A form in Arizona, New Mexico, and Texas of which the type of *perplexus* is representative has all white vestiture.

The male genitalia indicate that this species is very near *A. aureolus* but differ in the shape of the medial spine (compare figures 360 and 536). This species can usually be distinguished by the reddish or yellowish elytra and legs contrasted with the piceous pronotum and underside of the body, but identification is sometimes problematical because of the multiplicity of forms (compare with *A. mixtus*). One series of specimens from Washington State is nearly indistinguishable from *A. floridae,* even in characters of the male genitalia.

Acanthoscelides pauperculus (Le Conte)

(Figures 538–542)

Bruchus pauperculus LeConte 1857:52 (not Philippi and Philippi 1864); Horn 1873:329; Fall 1901:29; Fall and Cockerell 1907:201; Schaeffer 1907:299; Fall 1910:172, 1912:322; Pic 1913a:40; Zacher 1952:462.

Mylabris pauperculus: Leng 1920:305; Kannan 1923:24 (probable misidentification).

Acanthoscelides pauperculus: Bottimer 1968b:285, 1968c:1020,1039; Johnson 1968:1268; Bottimer 1969b:1188; Johnson 1977d:303; Johnson and Kingsolver 1982:415; Udayagiri and Wadhi 1989:58.

Bruchus pulicarius Motschulsky 1874:233; Pic 1913a:43; Bottimer 1968c:1040 (as unrecognized name); Kingsolver 1979a:341.

Mylabris pulicarius: Leng 1920:306.

Bruchus rufus Motschulsky 1874:223; Pic 1913a:47; Bottimer 1968c:1040 (as unrecognized name); Kingsolver 1979a:341.

Bruchus simplex Motschulsky 1874:220; Pic 1913a:50; Bottimer 1968c:1040 (as unrecognized name); Kingsolver 1979a:341.

Mylabris simplex: Leng 1920:306.

Color.—Body and appendages black except mouthparts and basal four antennal segments reddish brown, occasional specimens all reddish brown (teneral). Vestiture of intermixed bronzy and gray setae on pronotum and elytra, often with vague gray maculae on elytra, sometimes with gray postscutellar stripe, ventral areas of body gray.

Structure.—Vertex and frons densely but shallowly foveolate, frontal carina lacking but sometimes with evanescent impunctate median line; ocular index 5:2; ocular sinus about three-fifths length of eye; antenna as in figure 540, extending to middle of metepisternum. Pronotum bell-shaped (figure 538), lateral margins arcuate, disk convex, slightly depressed near posterior corners; disk densely, shallowly foveolate, each foveola with seta emerging from under its anterior rim, interspaces glabrous, impunctate; lateral carina evanescent; cervical sulcus conspicuous, extending two-thirds distance to midline, visible in dorsal aspect as a constriction of apex of pronotum. Scutellum quadrate, bidentate apically. Elytra 1.2 times as long as wide (figure 538), lateral margins arcuate, disk convex; striae moderately deep, parallel, not basally divergent, basal margin with upturned carina dentate at each stria; interstices finely imbricate. Metacoxal face finely, densely foveolate, conspicuously setose only in lateral one-fourth; hind leg as in figure 539; pecten with three denticles; metatibia usually lacking carinae, mucro slender, straight, about one-third length of basitarsus, lateral denticle and two coronal denticles acute, subequal. First abdominal sternum in male not modified, 5th sternum deeply emarginate in male, only slightly emarginate in female; pygidium in both sexes shallowly punctate, that of male strongly reflexed into sternal emargination.

Male genitalia.—As in figures 541 and 542; median lobe long, slender; ventral valve subelliptical, acute; armature of basal three-fourths of internal sac consisting of fine, transverse rows of minute setae, and minute, acute denticles, apex with symmetrical, brushlike structure; closure valve small, C-shaped; lateral lobes long (figure 542), arms slender, only slightly expanded toward apex, cleft three-fourths their length.

Size.—Body length 1.2–2.3 mm; width 0.8–1.3 mm.

Type depository.—MCZC, lectotype No. 4469, by Bottimer (1968b) *(pauperculus);* ZMUM *(pulicarius, rufus, simplex).*

Type locality.—California, San Jose and San Diego *(pauperculus);* "Californie" *(pulicarius, rufus, simplex).*

Distribution.—AZ, BC, CA, CO, ID, OR, WA.

Host plants.—Trifolium obtusiflorum. Johnson (1977d:303–304) lists several plants from which adults of *A. pauperculus* have been swept *(Achillea* sp., *Asclepias* sp., *Lotus* sp., *Rorippa nasturtium-aquaticum, Veronica anagallis-aquatica, Boisduvalia stricta),* but specimens have been reared only from *T. obtusiflorum.*

Natural enemies.—None recorded.

Immatures.—Kannan 1923 (egg).

Discussion.—This species can usually be distinguished from others in the genus by the black body and appendages, the lack of metatibial carinae (figure 539), slender mucro, deep clefts between coronal denticles, three denticles in the pecten, and host plant association. The species appears to be most closely related to *Acantho-scelides inquisitus,* a larger (2.3–3.0 mm.) sympatric species also with a black body but with the legs partly red. The male genitalia of the two species are similar. *A. napensis* is a small (1.1–1.8 mm), similar California species without metatibial carinae and either one or no denticles in the pecten.

Acanthoscelides pectoralis (Horn)

(Figures 543–548)

Bruchus pectoralis Horn 1873:333; Blatchley 1910:1238 (probably a misidentification); Fall 1910:170; Pic 1913a:40.

Mylabris pectoralis: Leng 1920:305.

Acanthoscelides pectoralis: Bradley 1947:40; Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1020; Johnson 1968:1268; Johnson and Kingsolver 1982:415; Luckow and

Johnson 1987:49; Udayagiri and Wadhi 1989:58.

Color.—Body mostly dark red except thoracic sternal areas, coxa, femur, and basal one-fourth of each leg, frons, clypeus, humerus, and apical margin of each elytron piceous, antenna dark red to piceous; pronotum and 3rd elytral interstice with variable patches of dark brown. Vestiture mostly of grayish-yellow, short, slender setae; pronotal and elytral patches dark brown; small patch of white setae occasionally present on elytral margin.

Structure.—Vertex densely punctulate, frons and clypeus coarsely punctate; frontal carina usually present, sometimes only as a punctate knob; ocular index 4:1; ocular sinus two-thirds length of eye; postocular lobe narrow, fringed; antenna (figure 546) strongly serrate, reaching metacoxa. Pronotum subconical (figure 543), lateral margins nearly straight; disk strongly convex, basal lobe sulcate, basal margin slightly depressed; surface densely foveolate, sculpture nearly concealed by vestiture; lateral carina lacking; cervical sulcus short, deep. Scutellum quadrate, bidentate. Elytra together as long as wide (figure 543), evenly convex, humeri prominent; striae parallel, shallow, concealed by vestiture, basal denticles of 3rd and 4th striae set on feeble tumescences; interstices flat, finely imbricate. Metacoxa densely punctulate, fossula glabrous; hind leg as in figure 545, metafemur swollen, pecten with one long, acute denticle and two smaller denticles; metatibia nearly straight, slightly dilated with lateral, ventral, and dorsomesal carinae prominent and complete, ventrolateral carina evanescent in apical one-half; mucro short, acute, only slightly longer than lateral denticle; coronal denticles three or four. First abdominal sternum not modified, 5th sternum broadly emarginate in male, evenly rounded in female; pygidial disk in both sexes finely punctate, punctation hidden by dense vestiture (figure 544), male pygidium reflexed apically into sternal emargination.

Male genitalia.—As in figures 547 and 548; median lobe long (figure 547), slender; ventral valve triangular, lateral margins incurved, apex acute; armature of internal sac consisting of densely set, minute denticles entire length of sac, middle of sac with elongate clusters of spines; closure valve circular; lateral lobes cleft about one-half their length (figure 548), apices broadly expanded, densely setose.

Size.—Body length 2.3–3.1 mm.; width 1.4–1.7 mm.

Type depository.—MCZC, holotype No. 8205.

Type locality.—Texas.

Distribution.—AZ, TX; Mexico.

Host plants.—*Desmanthus* sp., *D. leptolobus, D. obtusus, D. reticulatus, D. velutinus, D. virgatus virgatus.*

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Distinguishing characteristics for this species are body largely red with black frons and vertex, thoracic sterna, legs, and elytral border; dorsal vestiture yellowish; and mucro short. The color pattern resembles that of *Acanthoscelides griseolus;* however, the elytral border and legs of the latter species are yellow. Male genitalia of the two species are radically different (figures 441 and 547).

Acanthoscelides pedicularius (Sharp)

(Figures 549–554)

Bruchus pedicularius Sharp 1885:479; Pic 1913a:40.

Acanthoscelides pedicularius: Blackwelder 1946:760; Johnson and Kingsolver 1982:415; Johnson 1983a:152; Udayagiri and Wadhi 1989:58.

Bruchus pulloides Fall 1910:179; Pic 1913a:43.

Mylabris pulloides: Leng 1920:305.

Acanthoscelides pulloides: Johnson 1968:1268; Bottimer 1968c:1020,1039; Johnson 1970:78; Slobodchikoff and

Johnson 1973:282; Center and Johnson 1976:196; Johnson 1976b:260; Johnson and Kingsolver 1982:415; Johnson 1983a:152; Udayagiri and Wadhi 1989:60.

Color.—Body and appendages black. Vestiture on elytra white or of intermixed white and bronzy or golden setae often with dark, lateral maculae, white setae on pronotum more laterally abundant; underside of body gray.

Structure.—Vertex and frons shallowly foveolate; vague transverse sulcus between vertex and frons; frontal carina sometimes distinct, more often an impunctate median line, ocular index 3:1; ocular sinus about one-half length of eye; postocular lobe marked by very narrow fringe of setae; antenna as in figure 552. Pronotum bell-shaped (figure 549), lateral margins straight with slight apical restriction, disk convex, slightly depressed either side of basal lobe; surface densely foveolate, each setose foveola deeper on anterior margin; lateral carina absent; cervical sulcus moderately deep. Scutellum quadrate, biden-tate, setose. Elytra together slightly longer than wide (figure 549), convex; striae conspicuous, narrow, deep, parallel, 4th stria with minute basal denticle; interstices minutely imbricate. Metacoxal face confusedly punctulate in lateral two-thirds, fossula glabrous; hind leg as in figure 551; pecten with one long and two short denticles; metatibia slender at base, expanded toward apex, lateral, ventral, and dorso-mesal carinae complete, ventrolateral evanescent or absent; mucro slender, slightly curved, three-tenths as long as basitarsus, base of mucro with deep sinus; lateral denticle and two coronal denticles subequal. First abdominal sternum of male flattened medially or slightly concave with setae set in circular pattern, 4th sternum of male narrow and broadly emarginate, sterna of female not modified; pygidium of both sexes finely punctulate, that of male strongly reflexed into sternal emargination.

Male genitalia.—As in figures 553 and 554; median lobe moderately broad, apex truncate; ventral valve ogival, apex acute; armature of internal sac consisting of a large, median, thornlike spine set in midst of longitudinal rows of triangular denticles, sometimes appearing as elongate, serrate rods, a cluster of three or four slender spines in middle, a spinose, symmetrical structure and many fine spicules in apical one-half, closure valve circular; lateral lobes elongate (figure 554), slender, cleft three-fourths their length, apices with only a few setae.

Size.—Body length 1.3–1.5 mm; width 0.8–0.9 mm.

Type depositories.—BMNH *(pedicularius);* MCZC, holotype No. 25061 *(pulloides).*

Type localities.—Guatemala, near the city *(pedicularius);* New Mexico *(pulloides).*

Distribution.—AZ, NM; Mexico, Guatemala.

Host plants.—Dalea carnea albida.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species belongs to Johnson's *pertinax* group characterized by small size, lateral maculae on the elytra, an elongate, curved mucro, and slender lateral lobes. The single denticle at the base of 4th stria is a good key character. Because several other species of *Acantho-scelides* are marked with similar lateral elytral maculae, positive identification may require dissection of male genitalia.

Acanthoscelides perforatus (Horn)

(Figures 555–560)

Bruchus perforatus Horn 1873:335; Schaeffer 1907:301; Fall 1910:173,182; Pic 1913a:40.

Mylabris perforatus: Leng 1920:305.

Acanthoscelides perforatus: Bradley 1947:40; Blackwelder and Blackwelder 1948:45; Bottimer 1968c:1020,1039; Johnson 1968:1268, 1969c:54, 1970:74; Center and Johnson 1976:196,198; Johnson and Kingsolver 1982:415; Udayagiri and Wadhi 1989:58.

Color.—Body entirely black except ventral side of antennal segments 1–3 reddish brown, legs of some specimens dark red. Body uniformly clothed with short, aciculate setae; pronotal, elytral, and pygidial pattern lacking.

Structure.—Vertex densely punctulate with median area nearly bare but finely granulose, interspaces of vertex and frons granulose, frons with median impunctate line sometimes faintly carinate; ocular index 3:1; ocular sinus two-thirds length of eye; postocular lobe with narrow fringe of white setae; antennae sexually dimorphic (figure 558), that of male reaching margin of abdomen, that of female reaching metacoxa. Pronotum bell-shaped (figure 555), lateral margins slightly sinuate, apically constricted, disk strongly convex, slightly depressed along basal margin, surface densely set with small, round, setate foveolae, interspaces punctulate and setate; lateral carina evanescent; cervical sulcus conspicuous, deep, extending dorsad and delimiting apical constriction. Scutellum slightly longer than wide, api-cally deeply emarginate. Elytra nearly quadrate (figure 555), widest behind humeri, convex but slightly depressed around scutellum; striae conspicuous, deep, parallel, strial punctures large, rounded, encroaching into interstices, each puncture with caudally directed seta, 1st to 6th striae each ending basally in large, marginal pit with anterior rim. Metacoxal face densely, very finely punctulate except fossula glabrous, lateral two-thirds of face densely setose; hind leg as in figure 557, pecten with one small denticle followed in some specimens by a minute denticle; metatibia nearly straight, slightly expanded toward apex, lateral, ventral, and dorso-mesal carinae present in some specimens, evanescent in others, ventrolateral carina absent; mucro short, curved, about one-fifth length of basitarsus, lateral denticle and one or two coronal denticles subequal in size. First abdominal sternum of male with median concave or flattened area, posterior margin of sternum lobed and with fringe of long hairs, 5th sternum of male nearly divided by emargination on caudal border, that of female with slight emargination; pygidial face densely microfoveolate, interspaces punctulate, apex of male strongly reflexed into sternal emargination.

Male genitalia.—As in figures 559 and 560; median lobe slender, elongate, apex dilated; ventral valve ogival, apex acute; armature of internal sac consisting of transverse denticles in basal one-half, longitudinal rows of fine, acute denticles, a single spine near a symmetrical, spinous structure; closure valve circular; lateral lobes fused two-thirds their length (figure 560), apices setose.

Size.—Body length 1.9–2.7 mm; width 1.2–1.7 mm.

Type depository.—MCZC, lectotype No. 7145, by Johnson 1968.

Type locality.—Arizona.

Distribution.—AB, AZ, DC, IA, IL, KS, MD, MI, MN, MO, NC, ND, NY, SD, TX, VA, VT, WI, WV.

Host plants.—Astragalus canadensis.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—No other U.S. *Acanthoscelides* has the deep, wide strial punctations of *A. perforatus.* This character, in addition to the all-black body and appendages, minute femoral denticles, relative size, and the concave and fringed basal abdominal sternum of the male should sufficiently segregate the species. The female pygidium is sharply triangular compared with the more rounded pygidium of *A. fraterculus* (compare figures 427 and 556).

Johnson (1970) redescribed and illustrated the male genitalia of this species.

Acanthoscelides prosopoides (Schaeffer)

(Figures 561–567)

Bruchus prosopoides Schaeffer 1907:299; Fall 1910:169; Pic 1913a:43.

Mylabris prosopoides: Leng 1920:305.

Acanthoscelides prosopoides: Johnson 1968:1268; Bottimer 1968c:1020,1039; Johnson 1969c:284, 1970:75; Forister and Johnson 1971:224; Johnson and Kingsolver 1982:415; Johnson 1983a:160; Udayagiri and Wadhi 1989:59.

Color.—Body dark red to piceous; appendages reddish brown to piceous except basal four antennal segments always reddish brown ventrally. Vestiture predominantly gray with dark brown in elytral and pronotal patterns (figure 561); pattern of pronotum varying from uniformly gray to a large central brown patch sometimes bisected by narrow gray line; elytra varying from all gray with faintly indicated humeral, lateral, and terminal brown maculae to more extensive dark brown maculations; pygidium usually gray with intermixed dark brown setae in vague pattern (figure 562); ventral areas of body uniformly gray.

Structure.—Vertex minutely punctate, frons more coarsely punctate, clypeus imbricate, frontal carina absent; ocular index 3.3:1; ocular sinus one-half length of eye, postocular lobe narrow with fringe of short setae; antenna moderately serrate, sexually dimorphic (figures 564 and 565), reaching middle of mesepisternum. Pronotum subconical (figure 561), lateral margins nearly straight, disk strongly convex, basal lobe sulcate, basal margin depressed either side of basal lobe, surface densely, irregularly foveolate; lateral carina threadlike, extending from posterior corner of prono-tum to procoxal cavity; cervical sulcus hidden by vestiture. Scutellum 1.5 times as long as wide, attenuate, apex emarginate, bidentate. Elytra together slightly longer than wide (figure 561), laterally convex from 6th stria to margin, median one-third subdepressed; striae narrow, distinct, parallel except 2nd to 5th curved laterad at base, 3rd and 4th on common, bidentate basal elevation; interstices densely setose, ocellate, minutely imbricate; humeri imbricate. Metacoxa densely punctulate, densely setose in lateral one-half, fossula glabrous; hind leg as in figure 563, pecten with one long denticle and two smaller denticles; metatibia slender, slightly dilated, lateral, ventral, and dorsomesal carinae distinct and complete, ventrolateral carina two-thirds length of tibia; mucro slender, acute, extending at slight angle to ventral margin, lateral denticle prominent and acute, coronal denticles three. First abdominal sternum of male not modified, 5th sternum broadly, deeply emarginate for pygidial apex; 5th sternum of female slightly emarginate; pygidial disk densely micropunctulate, vestiture dense, concealing punctation, male pygidium apically reflexed, female oblique.

Male genitalia.—As in figures 566 and 567; median lobe moderately broad, elongate, dorsal valve hoodlike, ventral valve ogival, apex acute; armature of internal sac consisting of cluster of fine spicules at apical orifice, five thornlike spines at middle, a pair of setose lobes, closure valve subtriangular; lateral lobes elongated (figure 567), cleft nearly to base, arms slender, moderately expanded and setose at apex.

Size.—Body length 1.8–3.1 mm; width 1.3–1.9 mm.

Type depository.—USNM, lectotype No. 42341, by Johnson 1968.

Type locality.—Texas, New Braunfels.

Distribution.—AZ, CA, NM, OK, TX; Mexico.

Host plants.—Condalia lycioides; Ziziphus obtusifolia.

Natural enemies.—Eupelmus cushmani; Urosigalphus neobruchi.

Immatures.—Forister and Johnson 1971:224 (egg and first larval instar); Pfaffenberger and Johnson 1976:30 (first larval instar).

Discussion.—Salient characters for recognition of this species are the color pattern, the elongate scutellum, subconical pronotum, and especially the laterally deflected 3rd and 4th strial bases ending in a carinate or toothed subbasal ridge. It

resembles species of *Algarobius* in the dorsal pattern and elongate scutellum but does not have the pygidial sulci found in females of that genus.

Johnson redescribed *Acanthoscelides prosopoides* twice (1970, 1983a). Forister and Johnson (1971) published on its life history.

Acanthoscelides pullus (Fall)

(Figures 568–573)

Bruchus pullus Fall 1910:180; Fall 1912:322; Pic 1913a:43.

Mylabris pullus: Leng 1920:305.

Acanthoscelides pullus: Bridwell 1923b:260; Zacher 1952:465; Bottimer 1968b:285, 1968c:1020,1038; Johnson 1968:1268; Udayagiri and Wadhi 1989:60.

Bruchus brunneostictus Fall 1912:322; Pic 1913a:19.

Mylabris brunneostictus: Leng 1920:305.

Acanthoscelides brunneostictus: Johnson 1968:1267; Bottimer 1968c:1017,1038.

Color.—Body black, legs all black to black with apex of femur and of tibia reddish brown, mesal face of each leg sometimes reddish brown, antenna black except basal three segments reddish brown. Vestiture largely yellowish gray with dark brown characteristic pattern on pronotum and elytra (figure 568), ventral areas of body uniformly gray but 1st sternum of male with caudal fringe of golden setae.

Structure.—Vertex and frons densely imbricate-punctate except for mesal impunctate line on frons; ocular index 3:1; ocular sinus one-half length of eye; postocular lobe narrow, fringed; antenna (figure 571) serrate from 4th segment, reaching middle of metepisternum. Pronotum bell-shaped (figure 568), lateral margins arcuate, apically slightly constricted by cervical sulci, disk convex, slightly depressed along basal margin, surface densely microfoveolate, interspaces imbricate; lateral carina evanescent; cervical sulcus deep, prominent. Scutellum slightly longer than wide, densely setose, apically emarginate. Elytra together about as long as wide (figure 568), moderately convex; striae usually parallel, sometimes slightly sinuate, narrow but shallow, 2nd to 6th basally denticulate; interstices flat, finely punctate-imbricate. Metacoxal face entirely punctulate except fossula glabrous, densely setose in lateral one-half; hind leg as in figure 570; pecten with one long and two shorter denticles; metatibia straight, slightly dilated toward apex; lateral carina threadlike, not prominent, ventrolateral carina evanescent, ventral and dorsomesal carinae evident and complete; mucro about one-fifth as long as basitarsus, set at slight angle to ventral carina; lateral denticle acute; three coronal denticles of uneven lengths. First abdominal sternum of male concave with mesal setose pit surrounded by long hairs set in radiating pattern, caudal margin of sternum arcuate, 5th sternum nearly divided by broad emargination with liplike carina, 1st and 5th sterna of female not modified; pygidium of both sexes convex, densely punctate, that of male strongly reflexed.

Male genitalia.—As in figures 572 and 573; median lobe narrowed in middle, moderately broad at apex; ventral valve subtriangular, lateral margins incurved, apex acute; armature of internal sac consisting of mixed acute denticles and transverse rows of minute setae in basal one-half, an irregular, toothed sclerite in middle, a pair of elongate, setose lobes near apex, closure valve C-shaped; lateral lobes fused two-thirds their length (figure 573), apices truncate and setose.

Size.—Body length 1.5–2.7 mm; width 0.9–1.5 mm.

Type depository.—MCZC, holotype No. 25062 *(pullus);* holotype No. 25048 *(brunneostictus).*

Type locality.—California, Ojai *(pullus);* California, Contra Costa Co., Alhambra *(brunneostictus).*

Distribution.—AZ, BC, CA, ID, NV, OR, UT.

Host plants.—*Astragalus allochrous, A. asymmetricus, A. bolanderi, A. crotalaria, A. douglasii, A. lentiginosus, A. oxyphysus, A. praelongus, A. thurberi, A. trichopodus antisellii, A. trichopodus phoxus, A. wootoni.*

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Salient characters for *A. pullus* are the gray color with brown spots of varying size on the elytra, pronotum with a large central, black maculation usually with a median and transverse gray line of setae forming a cross on the pronotum, and the concave 1st abdominal sternum of the male with a radiating fringe of setae. Johnson (1970:81–82) correlated variations in color pattern with host and altitude in California.

The male genitalia of *A. pullus* are indistinguishable from those of *A. mixtus* and *A. margaretae;* however, in *A. mixtus*, the apical one-half of the elytra and at least the fore and middle legs are yellowish red, whereas in *A. margaretae,* the body and legs are all black, the vestiture is sparse, and the elytral pattern indistinct. The first abdominal segment is lobed similarly to that of *A. lobatus.*

Nelson and Johnson (1983a,b) described the effects of selenium in *Astragalus* spp. on seed size and its effect on host preference of *Acanthoscelides pullus, A. aureolus,* and *A. mixtus.*

Acanthoscelides pusillimus (Sharp)

(Figures 574–578)

Bruchus pusillimus Sharp 1885:479; Sharp 1886:37; Zacher 1952:462.

Bruchidius pusillimus: Zacher 1952:464,473.

Acanthoscelides pusillimus: Chujo 1937a:43, 1937b:193; Blackwelder 1946:760; Johnson 1981b:80; Johnson and Kingsolver 1982:415; Johnson 1983a:168; Udayagiri and Wadhi 1989:152.

Acanthoscelides sp. 20: Johnson 1979b:70.

Color.—Body black, fore leg and mid leg dark brown to black, hind leg piceous with reddish-brown suffusion in some specimens, basal four segments of antenna reddish yellow, terminal segments piceous. Vestiture mostly gray with bronze setae in three vague bands on elytra, ventral areas of body gray.

Structure.—Vertex and frons imbricate to granulose, frontal carina weakly defined; ocular index 3:1; ocular sinus six-tenths as long as eye; postocular lobe narrow, fringed; antenna as in figure 576, reaching middle of metepisternum. Pronotum bell-shaped (figure 574), lateral margins arcuate in anterior one-half, slightly constricted apically by cervical sulci; disk evenly convex, basal margin with slight depression; surface densely microfoveolate, foveolae nearly concealed by vestiture; lateral carina represented by blunt ridge; cervical sulcus deep but nearly concealed by vestiture. Scutellum slightly longer than wide, apically bidentate, densely setose. Elytra together slightly longer than wide (figure 574), convex except depressed around scutellum; striae parallel, evenly spaced, deep, narrow, 2nd stria bent laterad at base, 3rd, 4th, and 5th denticulate; interstices flat, finely imbricate. Metacoxal face shallowly punctate in caudal one-half, fossula glabrous; hind leg as in figure 575, pecten with three small denticles, the first sometimes slightly larger than the others; metatibia nearly straight, slightly dilated; lateral, ventrolateral, ventral, and dorso-mesal carina usually complete but sometimes evanescent; mucro one-fourth as long as basitarsus, lateral denticle and two coronal denticles subequal. First sternum of male abdomen flattened or slightly concave, densely punctate, setae divergent from midline, 5th sternum of male nearly divided by broad emargination, 5th sternal margin of female even; pygi-dium in both sexes convex, male reflexed into sternal emargination.

Male genitalia.—As in figures 577 and 578; median lobe moderately broad; ventral valve broadly triangular, lateral margins at

base rounded, apex right-angled; armature of internal sac consisting of crownlike cluster of denticles around apical orifice, cluster of acute denticles and one U-shaped sclerite in middle, apical one-third with setose structure, closure valve angulate; lateral lobes fused about one-half their length (figure 578), arms slender, apices suddenly expanded, setose.

Size.—Body length 1.1–1.5 mm; width 0.5–1.0 mm.

Type depository.—BMNH, lectotype by Johnson 1983a.

Type locality.—Guatemala, Guatemala City.

Distribution.—TX; Mexico to Honduras.

Host plants.—Johnson (1983a) lists several species of *Dalea* in Mexico and Central America, including *Dalea scandens paucifolia,* also a U.S. species, but the specific host in Texas is not known. The species is occasionally intercepted in cut flowers from south of the Rio Grande. Zacher's (1952) record of *Trifolium pratense* is questionable.

Natural enemies.—None recorded.

Immatures.— Not described.

Discussion.—Salient characters include the minute dimensions, short mucro, minute spines in the pecten, and the concave, punctulate 1st sternum of the male. Johnson (1983a) was unable to place *A. pusillimus* in any of the species groups he had established in *Acanthoscelides.* It resembles *A. pertinax* but the short mucro, small femoral spines, and characters of the male genitalia exclude it from the *pertinax* group.

Acanthoscelides quadridentatus (Schaeffer)

(Figures 579–585)

Bruchus quadridentatus Schaeffer 1907:304; Fall 1910:186; Cushman 1911:492,507; Pic 1913a:43; White 1941:190; Zacher 1952:462.

Mylabris quadridentatus: Leng 1920:306.

Acanthoscelides quadridentatus: Zacher 1952:465,470; De Luca 1965:55; Bottimer 1968c:1020,1039; Johnson 1968:1268; Bottimer 1969b:1192; Johnson 1970:19; Janzen 1977a:418, 1978:185; Johnson 1979b:66; Janzen 1980:946; Kingsolver 1980b:282; Janzen 1981:272; Johnson and Kingsolver 1982:415; Johnson 1983a:172; Udayagiri and Wadhi 1989:61; Mead 1989:2; Kassulke et al. 1990; Center and Kipker 1991; Harley et al. 1995.

Acanthoscelides quadridentatum: Moreno and Bibby 1943:23.

Color.—Body reddish brown, eyes black, head often with median black stripe, thoracic sterna and sometimes abdominal sterna with dusky suffusions, pronotum and pygidium usually with paired elongate piceous stripes, elytra usually with variable piceous markings; legs invariably red, antenna usually uniformly red, occasionally with apical margin of each segment piceous. Vestiture of fine straw yellow and dark brown setae in variable pattern (figure 579), usually strongly striped on pronotum and pygidium (figures 580 and 581), faintly striped on elytra, ventral areas of body uniformly straw yellow.

Structure.—Vertex convex, finely, densely punctate, frons with evanescent median ridge marked at the dorsal end by a small pit, ridge occasionally appearing as a carina; ocular index 3:1; ocular sinus about two-thirds length of eye; postocular lobe very narrow, densely fringed; antenna as in figure 583, reaching middle of metepisternum. Pronotum bell-shaped (figure 579), lateral margins slightly sinuate, slightly constricted apically by cervical sulci; disk evenly convex, slight depressions near posterior corners, surface densely microfoveolate, lateral sculpture nearly hidden by vestiture; lateral carina represented by short ridge; cervical sulcus conspicuous. Scutellum quadrate, apically emarginate and bidentate, setose. Elytra together as long as wide (figure 579), convex; striae parallel, 2nd stria slightly bent at base,

2nd, 3rd, and 4th striae minutely denticulate basally; interstices subequal in width, flat, minutely imbricate-punctate. Metacoxa finely, evenly punctate, setose only at lateral angle, fossula glabrous; metafemur (figure 582) with one long denticle and usually four smaller, slender denticles set on triangular blade; metatibia slender basally, moderately expanded apically; lateral, ventrolateral, ventral, and dorsomesal carinae conspicuous and complete; mucro less than one-sixth length of basitarsus, lateral denticle and three coronal denticles subequal. First abdominal sternum of male not modified, 5th sternum deeply, broadly emarginate; 5th sternum of female only slightly emarginate; pygidium convex in both sexes, strongly reflexed into sternal emargination in male.

Male genitalia.—As in figures 584 and 585; median lobe broad, dorsal valve hoodlike, ventral valve triangular, apex blunt; armature of internal sac consisting of dense setal patches lining dorsal hood and apical orifice, two elongate spines, a cluster of fine denticles near apex, closure valve C-shaped; lateral lobes cleft three-fourths their length (figure 585), broad, mesal faces setose entire length of cleft.

Size.—Body length 2.1–3.3 mm; width 1.1–1.9 mm.

Type depository.—USNM, lectotype No. 42347, by Johnson 1968.

Type locality.—Texas, Brownsville.

Distribution.—TX, FL; Mexico through Central America to Brazil and Paraguay; Australia and Thailand (introduced).

Host plants.—Mimosa pigra, M. pigra berlandieri, M. strigillosa.

Natural enemies.—Eupelmus sp.; *Heterospilus bruchi, H. prosopidis; Parasierola distinguenda; Phanerotoma* sp.; *Stenocorse bruchivora; Urosigalphus bruchi, U. neobruchi.*

Immatures.—None described.

Discussion.—Salient characters for identification of this species are the straw yellow color with dark brown dorsal markings, pronotum broadly striped and pygidium usually narrowly striped, elytral striae parallel, femoral pecten with one long and four shorter denticles, mucro short, and male genitalia distinctive. *Acanthoscelides tridenticulatus* Bottimer and *A. quadridentatus* were reared from the same collection of seed pods of *Mimosa strigillosa* in Texas. The two species are similar in appearance but with the following differences: (*A. tridenticulatus* in brackets) antenna not sexually dimorphic, segments slightly eccentric (figure 583) male antenna strongly serrate [figure 640; 3rd elytral interstice evenly pubescent throughout its length figure 579) 3rd interstice interrupted by two brown spots figure 637; median lobe as in figure 584 (compare with figure 641).

Acanthoscelides quadridentatus and *A. puniceus* Johnson, the latter from Mexico, were selected for experiments in biocontrol of *Mimosa pigra* introduced into Australia and Thailand (Harley et al. 1988; Forno et al. 1989; Harley et al. 1995). The biology of these two species in Australia was published by Kassulke et al. (1990), and male and female reproductive organs were illustrated.

Center and Kipker (1991) investigated the biology of this species in Florida.

Acanthoscelides rufovittatus (Schaeffer)

(Figures 586–591)

Bruchus rufovittatus Schaeffer 1907:303; Fall 1910:172; Pic 1913a:47.

Mylabris rufovittatus: Leng 1920:305.

Acanthoscelides rufovittatus: Johnson 1968:1268; Bottimer1968c:1020, 1039; Johnson 1969a:284, 1970:82; Slobodchikoff and Johnson 1973:282; Center and Johnson 1976:196; Johnson 1979b:66, 1981b:79; Johnson and Kingsolver 1982:415; Johnson 1983a:178; Udayagiri and Wadhi 1989:62.

Color.—Body varying from all black with basal four antennal segments, fore and middle legs, and lateral spot on head red,

to body and appendages all red with black median stripe on vertex of head. Vestiture mostly gray with brown or bronze in indistinct pattern on pronotum and elytra; pygidium often with median stripe of setae (figure 587).

Structure.—Vertex sparsely to densely punctulate, frons densely punctulate, frontal carina usually present, sometimes as an impunctate line; ocular index 2.8:1; ocular sinus about two-thirds as long as eye; postocular lobe narrow, densely setose; antenna (figure 589) reaching anterior margin of metacoxa. Pronotum bell-shaped (figure 586), lateral margins arcuate, disk convex, without depressions, surface densely microfoveolate, nearly concealed by vestiture; lateral carina represented by obsolete ridge; cervical sulcus narrow, deep, narrowly separated from anterior margin. Scutellum nearly quadrate, densely setose. Elytra 1.1 times as long as wide (figure 586), convex; striae subparallel except 2nd stria bent laterad at extreme base, 3rd and 4th striae, sometimes 2nd and 5th, with basal denticles; interstices flat, of equal width, densely, finely imbricate. Metacoxa densely micropunctate except fossula glabrous; metafemur (figure 588) with one long, slightly curved denticle and two smaller denticles, metatibia slender and strongly bent basally, expanded toward apex, lateral, ventrolateral, ventral, and dorsomesal carinae all prominent and complete; mucro slender, slightly curvate, four-tenths length of basitarsus, with deep sinus at base, lateral denticle short, broad; two or three small coronal denticles. First abdominal sternum in male flattened medially with rounded setose pit, 5th sternum broadly emarginate; 1st sternum in female not modified, 5th sternum only slightly emarginate; pygidium (figure 587) in both sexes slightly convex, punctulate but punctures concealed by vestiture, apex in male reflexed into sternal emargination.

Male genitalia.—As in figures 590 and 591; median lobe moderately broad; dorsal valve rounded, densely setose, ventral valve ogival with truncate base, apex acute; armature of internal sac consisting of one slender, acute sclerite and four burrlike sclerites in middle, a pair of spiny lobes near apex, and apex lined with fine setae; closure valve C-shaped; lateral lobes (figure 591) slender, slightly spatulate, cleft three-fourths their length.

Size.—Body length 1.9–2.5 mm; width 1.3–1.7 mm.

Type depository.—USNM, holotype No. 69685.

Type locality.—Arizona.

Distribution.—AZ, TX; Mexico to Venezuela.

Host plants.—Galactia wrightii; Tephrosia cinerea, T. purpurea, T. thurberi. Other species of *Tephrosia* were reported by Johnson (1979b) from Mexico.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Despite the implication of the name, most specimens of *A. rufovittatus* are black, although entirely red and partly red specimens are known. Key characters are the distinct frontal carina, the flattened male 1st sternum with a median pit, and the distinctive male genitalia (figure 590). This species appears to have no close relatives in the genus.

Acanthoscelides schaefferi (Pic)

(Figures 592–597)

Bruchus rufescens Schaeffer 1907:304 (preoccupied, Motschulsky 1874); Fall 1910:184; Pic 1912:92.

Acanthoscelides rufescens: Johnson 1968:1268.

Bruchus schaefferi Pic 1912:92; Pic 1913a:47.

Mylabris schaefferi: Leng 1920:306.

Acanthoscelides schaefferi: Bottimer 1968c:1020,1039; Johnson 1977a:118; Johnson and Kingsolver 1982:416; Johnson 1983a:183; Udayagiri and Wadhi 1989:62.

Color.—Body variable in color, head usually black but with red lateral spots above eyes, pronotum usually black, sometimes dark red; each elytron usually with a broad red stripe; pygidium black; antenna with first three segments red, remainder brown to black, legs red. Vestiture gray, except very dark specimens with bronzy spots on elytra; some specimens with bronzy setae on piceous median stripe.

Structure.—Body elongate (figure 592). Vertex and frons minutely punctate, frons with evanescent carina in some specimens; ocular index 3:1; ocular sinus three-fourths length of eye, appearing in lateral aspect to nearly divide the eye; postocular lobe narrow, fringed; antenna (figure 595) moderately serrate, terminal segment elongate-ovate. Pronotum bell-shaped (figure 592), lateral margins arcuate, slightly constricted at apex by cervical sulci, disk convex, without depressions, surface minutely foveolate, more coarsely imbricate toward lateral margins, lateral carina evident only at posterior corners, cervical sulcus deep, conspicuous. Scutellum quadrate, densely setose. Elytra together slightly longer than wide (figure 592), convex; striae parallel, shallow, nearly hidden by vestiture, 2nd, 3rd, and 4th striae minutely denticulate at base, interstices flat, minutely imbricate. Metacoxa densely, uniformly punctulate except fossula glabrous, densely setose in lateral one-third; hind leg as in figure 594; pecten with one long and two smaller denticles; metatibia slender basally, gradually expanded; lateral, ventral, and dorsomesal carinae complete and prominent, ventrolateral carina evanescent; mucro slender, about one-half as long as basitarsus, deep sinus at base of mucro, lateral denticle and two or three coronal denticles subequal in length, slender. First abdominal sternum of male not modified, 5th sternum broadly emarginate, 5th sternum of female evenly rounded; pygidium (figure 593) in both sexes convex, that of male reflexed into sternal emargination.

Male genitalia.—As in figures 596 and 597; median lobe slender, elongated; dorsal valve angulate, setose, ventral valve semicircular, apex slightly angled; armature of internal sac consisting of two small, burrlike sclerites near apical orifice, major portion of sac lined with minute, thornlike sclerites, apex with two large, thornlike sclerites, closure valve circular; lateral lobes fused one-half their length (figure 597), apical lobes divergent, rounded, setose.

Size.—Body length 1.8–2.5 mm; width 1.1–1.6 mm.

Type depository.—USNM, holotype No. 42346.

Type locality.—Texas, Brownsville.

Distribution.—AZ, CA, TX; Mexico to Guatemala.

Host plants.—Not known.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Salient characters are the small size, narrow body, arcuate pronotal margins, the red stripe on each elytron (most specimens), and the large number of denticles lining the internal sac in the male genitalia.

Acanthoscelides schrankiae (Horn)

(Figures 598–603)

Bruchus schrankiae Horn 1873:330; Riley and Howard 1892c:165; Fall 1910:182; Cushman 1911:499,508; Pic 1913a:47; Zacher 1952:462,471,474; Johnson 1968:1268, 1983a:184.

Mylabris schrankiae: Leng 1920:305.

Acanthoscelides schrankiae: Bissell 1940:846; Kingsolver 1965a:128; Bottimer 1968c:1020,1039, 1969b:1189; Johnson 1970:16,19,43, 1979b:66; Johnson and Kingsolver 1982:416; Udayagiri and Wadhi 1989:63.

Color.—Body reddish brown to black, elytral stripe and pygidium with reddish-

brown integument; legs red; antenna with basal four or five segments red, terminal segment sometimes red. Vestiture yellowish gray to white uniformly distributed over body except condensed into white stripe on pronotum, a short postscutellar line, and often in a narrow line on pygidium.

Structure.—Body almost identical to that of *Acanthoscelides chiricahuae* but with following differences: vertex and frons finely punctate, frontal carina varying from impunctate line to raised ridge; ocular index 3:1; metacoxal face punctate as in figure 600, without arcuate ridge and radiating striae (compare figure 384).

Male genitalia.—As in figures 602 and 603; median lobe slender, slightly expanded at apex; ventral valve subelliptical, apex acute, set at right angle to ventral face of valve; armature of internal sac consisting of dense lining of mixed acute and truncate denticles extending nearly to apex, two curved, serrate sclerites near apex, each with 9 to 13 teeth; lateral lobes long, slender, sinuate, cleft three-fourths their length (figure 603), apices triangularly expanded, setose.

Size.—Body length 1.7–2.3 mm; width 1.1–1.3 mm.

Type depository.—MCZC, holotype No. 3895 (Johnson 1968).

Type locality.—Missouri, near St. Louis.

Distribution.—AR, FL, GA, KS, MO, MS, ND, OK, SC, SD, TX, WY; Mexico to Venezuela.

Host plants.—Acacia amentacea; Desmanthus virgatus acuminatus; Mimosa sp., *M. borealis; Schrankia microphylla, S. nuttallii, S. roemeriana, S. uncinata.* Several species of *Mimosa* south of the Rio Grande are recorded as hosts by Johnson (1983a).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species and *Acanthoscelides chiricahuae* are closely related as indicated in the description above and that of *A. chiricahuae.* Johnson (1983a:60) presents a full description of their relationships. The distribution of *A. schrankiae* generally follows the distribution of *Schrankia* in the United States, but in Mexico and farther south it moves to *Mimosa.* On the other hand, *A. chiricahuae,* feeding in *Mimosa* spp., is found only in Texas, New Mexico, and Arizona and follows the general range of the host genus.

Salient characters are the stubby appearance of the body, especially of the male, raised basal denticles on 3rd and 4th striae, uniform distribution of vestiture except for median pronotal and pygidial stripes on some specimens, and the distinctive male genitalia with sinuate lateral lobes and arcuate, serrate apical sac sclerites. *A. chiricahuae* has 5 to 8 denticles on each of the sclerites, in contrast to 9 to 13 for *A. schrankiae* (compare figures 387 and 602).

Acanthoscelides seminulum (Horn)

(Figures 604–610)

Bruchus seminulum Horn 1873:342; Fall 1901:160; Cockerell 1902:379; Fall and Cockerell 1907:201; Blatchley 1910:1238; Fall 1910:188; Bridwell 1935:186; Fox 1943:206.

Bruchus seminulus: Pic 1913a:49 (misspelling).

Mylabris seminulum: Leng 1920:306.

Abutiloneus seminulum: Bradley 1947:41; Blackwelder and Blackwelder 1948:45.

Megacerus seminulum: Zacher 1952:466.

Acanthoscelides seminulum: Bottimer 1935:129, 1968c:1020,1039; Johnson 1968:1268, 1969c:55, 1970:84; Center and Johnson 1976:196,200; Johnson and Kingsolver 1982:416; Udayagiri and Wadhi 1989:63.

Color.—Body uniformly dark red to black except basal three or four antennal segments reddish brown, mesal face of metafemur and tibia reddish brown. Vestiture of fine, white setae uniformly distributed over body.

Structure.—Vertex finely imbricate-punctate, frons punctate except granulose median line; ocular index 3:1; ocular sinus seven-tenths length of eye; postocular lobe very narrow, setose; antennae (figures 607 and 608) sexually dimorphic, that of male extending to metacoxa, that of female to middle of metepisternum. Pronotum bell-shaped (figure 604), lateral margins nearly straight; disk strongly convex, slightly depressed along base at corners; surface microfoveolate, sculpture nearly hidden by vestiture; lateral carina ridgelike; cervical sulcus conspicuous. Scutellum 1.5 times as long as wide, bidentate apically. Elytra slightly longer than wide (figure 604), strongly convex; striae narrow, shallow, well-defined, parallel except 2nd and 3rd converging basally, 3rd, 4th, and 5th basally denticulate; interstices finely imbricate; metacoxal face evenly punctulate and setose except fossula glabrous; hind leg as in figure 606; pecten usually with one or two minute denticles hidden by vestiture, denticles sometimes lacking; metatibia slightly dilated, lateral, ventral, and dorsomesal carinae complete, ventrolateral carina absent; mucro one-third as long as basitarsus, deep sinus at base of mucro, lateral denticle and three coronal denticles slender, acute, and separated by deep sinuses. First abdominal sternum of male flattened with a median setose pit, setae of flattened area long, curved toward midline, posterior margin of sternum sinuate, 5th sternum of male nearly divided by deep emargination; 1st sternum of female sinuate on posterior border, 5th sternum slightly emarginate; pygidium in both sexes convex, that of male strongly reflexed into ventral emargination, sculpture of pygidial disk obscured by vestiture (figure 605).

Male genitalia.—As in figures 609 and 610; median lobe moderately broad, straight-sided; ventral valve sharply triangular; armature of internal sac consisting of a lining of mixed acute and rounded denticles, a large spine in middle, two similar, elongate, spinose structures; closure valve C-shaped; lateral lobes fused about two-thirds their length (figure 610), apical lobes rounded, densely setose.

Size.—Body length 1.3–2.1 mm; width 0.9–1.1 mm.

Type depository.—MCZC, lectotype No. 8212, by Johnson 1968.

Type locality.—(Green disk) (Pennsylvania, Nebraska, "Dacota", California). The exact locality of the lectotype can not be determined.

Distribution.—AB, AZ, CA, CO, FL, IA, IL, IN, KS, LA, MB, MN, MO, ND, NE, NM, OK, OR, SD, SK, TX, WI, WY.

Host plants.—Dalea aurea, D. candida, D. enneandra, D. feayi, D. frutescens, D. stanfieldii, D. tenuis. Some of these names appear in literature under the genus *Petalostemon.* On dogwood flowers.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Salient characters for this species are small size, black body and appendages (except antennal base), deep clefts between tibial spines, 1st abdominal sternum flattened with a median pit and long curved hairs, and metafemur with one or two minute spines, or lacking spines.

Acanthoscelides speciosus (Schaeffer)

(Figures 611–615)

Bruchus speciosus Schaeffer 1907:301; Fall 1910:170; Pic 1913a:50.

Mylabris speciosus: Leng 1920:305.

Acanthoscelides speciosus: Johnson 1968:1268; Bottimer 1968c:1020,1039, 1969b:1189,1197; Udayagiri and Wadhi 1989:52.

Acanthoscelides mexicanus: Johnson 1970:60; Johnson and Kingsolver 1982:415 (not *mexicanus* Sharp 1885).

Color.—Dorsal integument mostly red with elongated, black elytral maculae; venter of body mostly black with variable red areas on abdominal sterna and metepisternum; antennae red, legs red except ventral margin of metafemur black; mouthparts

usually black. Dorsal vestiture black, white, dark brown and golden; pronotum mostly golden with variable brown spots, white lateral spots and elongate basal stripe; elytra mostly golden with brown humeral and basal spots, alternate interstices with series of brown, white, and golden spots, lateral maculae often coalescing into large, submarginal patch; pygidium white to golden with denser, white patches at middle of basal margin and on lateral margins, sometimes with median white stripe, usually with paired, subapical brown spots of variable size; venter of body white to golden or golden with white spots, especially along lateral margins of abdomen and on metepi-sternum. First and 2nd abdominal sterna usually with glabrous spots where metafemora rub.

Structure.—Vertex and frons densely punctulate, frons with prominent, median boss; ocular index 3.7:1, eyes not dimorphic; ocular sinus one-half length of eye; antenna (figure 613) not dimorphic. Pronotum bell-shaped (figure 611), lateral margins sinuate; disk convex, feebly impressed at posterior corners, sulcate on basal lobe; surface of disk sparsely microfoveolate on middle of disk, dense and crowded laterally with interspaces imbricate; lateral carina blunt, ridgelike, arched; cervical sulcus short, deep, nearly concealed by vestiture. Scutellum quadrate, deeply emarginate, densely setose. Elytra together as long as wide (figure 611); striae subparallel, alternate interstices slightly wider, 3rd and 4th denticulate at base, both denticles on a slight elevation. Metacoxa densely, evenly punctate except fossula glabrous; hind leg as in figure 612; pecten with one long and two shorter denticles, ventral margin feebly channeled; metatibia arcuate, lateral, ventral, and dorsomesal carinae complete, ventrolateral carina joining ventral carina at base of mucro; mucro short, about one-eighth as long as basitarsus, lateral and coronal denticles inconspicuous. First abdominal segment of male not modified, 5th segment broadly emarginate; 5th segment of female with glabrous patch each side of anal opening, this patch lacking in male; pygidium feebly convex, sexes similar.

Male genitalia.—As in figures 614 and 615; median lobe broad; ventral valve narrow, attenuate, bluntly rounded at apex; dorsal valve membranous, margin setose; internal sac with clusters of short denticles at apical orifice; middle section and two lobes of sac densely lined with spicules and denticles, apex of sac lined with fine spicules; closure valve C-shaped; lateral lobes strongly bowed (figure 615), cleft two-thirds their length, apices bilobed.

Size.—Body length 1.5–2.6 mm; width 1.0–1.7 mm.

Type depository.—USNM, lectotype No. 42343, by Johnson 1968.

Type locality.—Arizona, Huachuca Mountains.

Distribution.—AZ, TX; Mexico.

Host plants.—Mimosa biuncifera, M. malacophylla, M. wherryana.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species belongs to the *mexicanus* group which extends from the southwestern United States into South America (Johnson 1983a:131). It superficially resembles *A. bisignatus* in its color pattern but does not have the dimorphic eyes of that species. The apical antennal segment of *A. bisignatus* is red, the pygidium lacks subapical spots, and the male genitalia are distinctive (figure 370). Johnson (1970:60) synonymized *A. speciosus* with *A. mexicanus* (Sharp), but in 1983a (p.131) resurrected it to a valid species name. It closely resembles *A. mexicanus* (see Johnson 1970).

Acanthoscelides stylifer (Sharp)

(Figures 616–621)

Bruchus stylifer Sharp 1885:479; Pic 1913a:51.

Acanthoscelides stylifer: Blackwelder 1946:761; Johnson and Kingsolver

1982:416; Johnson 1983a:191; Udayagiri and Wadhi 1989:64.

Bruchus pugiunculus Fall 1910:178.

Bruchus pygionculus: Pic 1913a:43.

Mylabris pugiunculus: Leng 1920:305.

Acanthoscelides pugiunculus: Johnson 1968:1268; Bottimer 1968c:1020,1039; Johnson 1970:77; Slobodchikoff and Johnson 1973:282; Center and Johnson 1976:196; Johnson 1976b:260; Johnson and Kingsolver 1982:415; Johnson 1983a:191; Udayagiri and Wadhi 1989:68.

Color.—Body black, legs red except basal one-half to three-fourths of metafemur black, apical denticles of metatibia usually black, antenna black except basal four segments dark red. Vestiture of predominantly gray setae with some intermixed bronzy or dark brown setae on pronotal disk and condensed into maculae of variable intensity on elytra; vestiture of ventral areas uniformly white.

Structure.—Vertex and frons densely, finely punctate, frontal carina visible in some specimens, usually only as an impunctate line; ocular index 2.5:1, ocular sinus two-thirds as long as eye, postocular lobe densely fringed; antenna as in figure 619. Pronotum nearly semicircular (figure 616), slightly constricted at apex by cervical sulci, disk evenly convex, surface imbricate-punctate; lateral carina absent; cervical sulcus conspicuous but narrow. Scutellum quadrate, densely setose. Elytra together one-fifth longer than wide (figure 616), convex; striae parallel, deep, narrow, bases of 3rd, 4th and 5th striae minutely denticulate; interstices minutely imbricate-punctate. Metacoxal face densely, shallowly punctate in posterior one-half, glabrous anteriorly; hind leg as in figure 618, pecten with three small denticles; meta-tibia basally slender, apically strongly expanded, lateral, ventral, and dorsomesal carinae prominent and complete, mucro long, slender, curved, one-half to six-tenths as long as basitarsus, base of mucro with deep sinus; lateral denticle and two or three coronal denticles subequal in size. First abdominal sternum of male with small, shallow, densely setose pit, 5th sternum of male deeply, broadly emarginate, 5th sternum of female slightly emarginate; pygidium in both sexes sparsely foveolate, densely setose, concealing foveae, pygidium of male strongly reflexed into sternal emargination.

Male genitalia.—As in figures 620 and 621; median lobe broad; ventral valve broadly triangular, lateral margins ogival, apex blunt; armature of internal sac consisting of cluster of minute spicules at apical orifice, a large V-shaped median sclerite, a cluster of thornlike denticles, a spinose, bilaterally symmetrical structure near apex; closure valve C-shaped; lateral lobes spatulate (figure 621), cleft nearly to base, apices setose.

Size.—Body length 1.3–1.9 mm; width 0.9–1.1 mm.

Type depository.—BMNH (*stylifer,* lectotype by Johnson 1983a:193); MCZC, holotype No. 25060 *(pugiunculus).*

Type locality.—Mexico, Guanajuato *(stylifer);* Arizona, Chiricahua Mountains *(pugiunculus).*

Distribution.—AZ, NM, TX; Mexico.

Host plants.—*Desmodium* sp., *D. grahamii.*

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.— The small size, the elongate, curved mucro, black body, legs red except metafemur bicolored, and distinctive male median lobe and lateral lobes should readily separate this species. Its apparent nearest relative is *Acanthoscelides biustulus* which differs in its all-black metafemur and slightly shorter mucro and in details of the male genitalia (figure 375).

Acanthoscelides subaequalis Johnson

(Figures 622–626)

Acanthoscelides subaequalis Johnson 1970:85; Johnson and Kingsolver 1971:145; Slobodchikoff and Johnson

1973:282; Center and Johnson 1976:196; Johnson and Kingsolver 1982:416; Johnson 1983a:195; Udayagiri and Wadhi 1989:65.

Color.—Body black; front and middle legs, apical one-fourth to three-fourths of metafemur, metatibia, and basal four segments of antenna reddish brown, apical segments piceous. Vestiture of pronotum and elytra gray to yellowish gray, sometimes with a golden sheen, ventral areas of body gray.

Structure.—Vertex and frons minutely punctate, frons with carina or impunctate line; ocular index 3:1; ocular sinus two-thirds length of eye; postocular lobe narrow; antenna as in figure 624, reaching middle of metepisternum. Pronotum nearly semicircular in outline (figure 622), lateral margins arcuate, disk strongly convex, with slight depressions on basal border, surface finely imbricate with scattered small foveolae, setae densely set; lateral carina reaching half the distance to coxal cavity; cervical sulcus inconspicuous, nearly hidden by vestiture. Scutellum quadrate, apically emarginate. Elytra together as long as wide (figure 622), evenly convex, striae parallel, deep, narrow, slightly sinuate, 2nd and 3rd slightly bent at base, 2nd to 6th basally denticulate; interstices flat, minutely imbricate. Metacoxal face densely punctulate in lateral two-thirds, mesally sparsely punctate, fossula glabrous; hind leg as in figure 623, pecten with one denticle sometimes followed by another minute denticle; metatibia slender, apically slightly expanded, lateral, ventral, and dorsomesal carinae evanescent, ventrolateral carina lacking; mucro short, scarcely longer than lateral denticle, three coronal denticles subequal. First sternum of male not modified, convex; 5th broadly, deeply emarginate, 5th sternum of female perceptibly emarginate; pygidium in both sexes convex, densely, minutely punctate, that of male reflexed into sternal emargination.

Male genitalia.—As in figures 625 and 626; median lobe moderately broad; ventral valve semicircular; armature of internal sac consisting of two large, spinose thornlike sclerites, two slender spines, two burrlike sclerites, and a sleevelike, spinose structure; closure valve C-shaped; lateral lobes widely separated nearly to base (figure 626), arms slender, apices slightly expanded, densely setose.

Size.—Body length 1.4–1.9 mm; width 0.9–1.3 mm.

Type depository.—USNM, holotype No. 69940.

Type locality.—Arizona, Santa Catalina Mountains, Sabino Canyon.

Distribution.—AZ, TX; Mexico.

Host plants.—Abutilon abutiloides, A. berlandieri, A. incanum, A. trisulcatum.

Natural enemies.—Horismenus missouri-ensis; Zatropis incertus.

Immatures.—Not described.

Discussion.—Salient characters to distinguish this species are the minute size, quadrate appearance, semicircular pronotum, single denticle in the pecten, short mucro, slender, widely spaced lateral lobes, and the pattern of the armature in the median lobe. *Abutiloneus idoneus* Bridwell has been reared from the same lot of seeds of *Abutilon berlandieri;* it is similar in appearance and size but the legs and antennae are bright yellow.

Acanthoscelides submuticus (Sharp)

(Figures 627–631)

Bruchus exiguus Horn 1873:341 (not Rosenhauer 1856); Riley and Howard 1892c:166; Fall 1901:160; Fall and Cockerell 1907:201; Blatchley 1910:1238; Fall 1910:175,184; Cushman 1911:506; Pic 1913a:28; Bridwell 1918:479; Zacher 1952:462.

Mylabris exiguus: Leng 1920:305.

Acanthoscelides exiguus: De Luca 1965:54; Bottimer 1968c:1019; Johnson 1968:1267, 1969c:55.

Bruchus submuticus Sharp 1885:455; Pic 1913a:51.

Acanthoscelides submuticus: Glick 1939:36; Blackwelder 1946:761; Bottimer 1961:294, 1968c:1019; Johnson 1969c:55, 1970:87; Slobodchikoff and Johnson 1973:282; Center and Johnson 1976:196,198; Johnson 1979b:67; Johnson and Kingsolver 1982:416; Udayagiri and Wadhi 1989:65.

Bruchus horni Pic 1912:92 (as new name for *exiguus* Horn, not Rosenhauer 1856).

Mylabris horni: Leng 1920:305; Kannan 1923:16.

Acanthoscelides horni: Caffrey 1943:27; Peck 1963:956; De Luca 1965:54; Bottimer 1968c:1019,1038.

Color.—Body mostly red with thoracic sterna and sometimes 1st and 2nd abdominal sterna black, head black with red patch above each eye, pronotum red with darker red or piceous median spot, elytra red, sometimes with black suture and border, occasionally with piceous lateral maculae, pygidium red to piceous, legs red except base of metafemur and coronal denticles usually piceous, antenna with basal four segments red, remainder piceous. Vestiture yellowish gray, maculae brown, ventral areas uniformly white.

Structure.—Vertex and frons shallowly punctate, appearing granulose, frontal carina present in some specimens, in others frons with a glabrous knob; ocular index 2.5:1; ocular sinus about one-half length of eye; antenna as in figure 629. Pronotum bell-shaped (figure 627), slightly constricted apically by cervical sulci, disk convex, without depressions, surface densely microfoveolate, interspaces sparsely punctulate, lateral carina lacking; cervical sulcus deep, conspicuous. Scutellum slightly longer than wide, apically bidentate. Elytra together nearly quadrate (figure 627), convex, striae narrow, deep, parallel except 2nd and 3rd slightly bent at base, 3rd and 4th striae basally denticulate; interstices minutely imbricate. Metacoxal face evenly punctulate except fossula glabrous, setose in lateral one-fifth; hind leg as in figure 628, pecten with one long and three minute denticles; metatibia basally slender, apically expanded, ventral and dorsomesal carina present, lateral and ventrolateral carinae usually lacking; mucro four-tenths as long as basitarsus, slender, with moderately deep sinus between base and lateral denticle; lateral and two coronal denticles subequal in shape and length; basal tarsal segment without lateral carina. First abdominal sternum of male with small setose pit between coxae, 5th sternum broadly emarginate about one-half its length, 5th sternum of female slightly emarginate; pygidium shallowly foveolate, in male strongly reflexed into sternal emargination.

Male genitalia.—As in figures 630 and 631; ventral valve broadly triangular, apex with short nipple; armature of internal sac consisting of cluster of fine setae at apical orifice, lining of mixed acute and rounded denticles in middle, a pair of spinose structures near apex, fine setae near C-shaped closure valve; lateral lobes cleft about three-fourths their length (figure 631), apices spatulate, densely setose.

Size.—Body length 1.4–2.4 mm; width 0.8–1.5 mm.

Type depository.—BMNH *(submuticus);* MCZC (*exiguus,* lectotype No. 8211, by Johnson 1968).

Type locality.—Mexico, southern Sonora *(submuticus);* Kansas *(exiguus).*

Distribution.—AZ, CA, CO, IA, IL, KS, MN, MO, NE, NM, OK, TX, WI, WY; Mexico.

Host plants.—Amorpha californica, A. fruticosa fruticosa, A. fruticosa angustifolia, A. fruticosa occidentalis. Some records taken from the older literature are questionable because of confusion with *Acanthoscelides floridae.*

Natural enemies.—Eupelmus brevicauda, E. bruchivorus, E. cyaniceps, E. inyoensis; Eurytoma sp., *E. tylodermatis*; *Heterospilus prosopidis; Horismenus missouriensis, H. productus; Microdontomerus anthonomi; Stenocorse bruchivora; Zatropis incertus,*

Z. orontas. Parasite records from older literature may be found under *Acanthoscelides submuticus, A. horni,* or *A. exiguus,* but may also be confused with records of *Acanthoscelides floridae.*

Immatures.—Kannan 1923 (egg, first larval instar).

Discussion.—This species is similar in color and size to the more eastern *Acanthoscelides floridae,* but the two species can be distinguished by examining the male genitalia. The internal sac of *A. submuticus* does not have the large, acuminate median spine of *A. floridae* (figure 424), and the metatibia of *A. submuticus* usually does not have lateral and lateroventral carinae that are always present in *A. floridae* (figure 422). Both *A. submuticus* and *A. floridae* attack seeds of *Amorpha fruticosa.*

Kannan (1923) described the oviposition habits of this species.

Acanthoscelides tenuis Bottimer

(Figures 632–636)

Acanthoscelides tenuis Bottimer 1935:127; Bradley 1947:40; Bottimer 1968c:1021,1039, 1969a:977; Johnson 1968:1268; Johnson and Kingsolver 1982:416; Udayagiri and Wadhi 1989:66.

Bruchus tenius: Blackwelder 1939:64.

Color.—Integument black; antenna, fore legs, and mid legs dark brown. Vestiture of long, white setae in mottled pattern on pronotum, elytra, and pygidium; scutellum intensely white, venter of body uniformly white.

Structure.—Vertex and frons densely punctulate, frontal carina lacking, middle of frons with small, glabrous boss; ocular index 5:1; ocular sinus one-half length of eye; antenna as in figure 634, reaching middle of metepisternum. Pronotum bell-shaped (figure 632), apex evenly rounded, lateral margins nearly straight; disk evenly convex, feebly impressed either side of basal lobe, shallowly microfoveolate, interspaces punctulate, lateral carina lacking; cervical sulcus well defined. Scutellum scutiform, densely pubescent. Elytra convex, one and one-fourth times as long as wide (figure 632); striae narrow, parallel, not denticulate; interstices flat with random black, denuded spots; metacoxa shallowly, indistinctly punctulate, fossula glabrous; hind leg as in figure 633; metafemur with a single, minute denticle, sometimes with two additional minute denticles; metatibia with ventral and dorsomesal carinae present, lateral and ventrolateral carinae lacking; mucro slightly longer than lateral denticle; two coronal denticles. Male abdomen with 1st sternum unmodified; 5th sternum not dimorphic; male pygidium feebly bulbous, female pygidium nearly flat, oblique; pygidial disk minutely punctate.

Male genitalia.—As in figures 635 and 636; median lobe slender. dilated toward apex; ventral valve subtriangular, apex bluntly rounded, lateral margins sinuate; internal sac lined with small denticles and short, transverse rows of fine setae; lateral lobes elongate-spatulate (figure 636), deeply cleft, densely setose on medial faces.

Size.—Body length 1.2–1.4 mm; width 0.6–0.7 mm.

Type depository.—USNM, holotype No. 50860.

Type locality.—Texas, Brazoria Co., Pearland.

Distribution.—AL, FL, LA, MI, MO, ON, TX.

Host plants.—Lythrum alatum, L. linare. Adults collected on flowers of *Rubus* sp. and *Crataegus* sp.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Although this species is smaller than *Acanthoscelides alboscutel-latus,* it superficially resembles that species in the mottled pronotum, elytra, and pygidium, the intensely white scutellum, and bulbous male pygidium. The latter character is not as pronounced in *A. tenuis* as in *A. alboscutellatus.* The distribution of the host plants suggests a wider range for this bruchid than is indicated by the known records.

Acanthoscelides tridenticulatus Bottimer

(Figures 637–642)

Acanthoscelides tridenticulatus Bottimer 1969b:1193; Kingsolver 1980b:288; Johnson and Kingsolver 1982:416; Udayagiri and Wadhi 1989:69.

Color.—Integument mostly reddish brown, thoracic sterna of some specimens black; male antenna sometimes dark brown. Vestiture mostly yellowish gray except brown on elytral spots; pronotum with two broad, bare stripes separated by evanescent median line of setae; pygidium with a pair of elongate spots.

Structure.—Vertex finely imbricate-punctate, frons with impunctate median line; ocular index 4:1; ocular sinus one-half as long as eye; antenna dimorphic (figure 640), that of female reaching elytral humerus, that of male reaching middle of metepisternum. Pronotum bell-shaped (figure 637), lateral margins sinuate; disk evenly convex, densely microfoveolate in middle of disk, lateral foveolae smaller; lateral carina ridgelike. Scutellum quadrate, densely setose, apex emarginate. Elytra together as long as wide (figure 637), moderately convex, slightly depressed around scutellum; striae narrow, parallel except 3rd and 4th approximate at base, 2nd to 6th each with blunt denticle on basal margin; interstices flat, finely imbricate; metacoxa densely punctulate in lateral one-third, sparsely punctate in medial two-thirds, fossula glabrous; hind leg as in figure 639, pecten with one long and three or four shorter denticles; metatibia arcuate at base, dilated toward apex, carinae complete except ventrolateral feeble; mucro long, slender, one-third length of basitarsus; lateral and coronal denticles acute. First sternum of male abdomen not modified; 5th sternum deeply emarginate; pygidium arcuate, that of male strongly reflexed, that of female vertical at apex; disk finely, shallowly foveolate.

Male genitalia.—As in figures 641 and 642; median lobe broad; ventral valve subtriangular, lateral margins feebly arcuate, apex broadly acute; internal sac armature consisting of mass of slender spicules at apical orifice flanked by spherical, burrlike sclerites, middle of sac with a second mass of slender spicules, a pair of hooked sclerites, a pair of thick, elongated sclerites, apex with symmetrical spiculate structure; lateral lobes broadly spatulate (figure 642), cleft to two-thirds their length.

Size.—Body length 2.3–2.7 mm; width 1.4–1.7 mm.

Type depository.—CNCI, holotype No. 10907.

Type locality.—Texas, Brownsville.

Distribution.—LA, TX.

Host plants.—Mimosa strigillosa.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species closely resembles *Acanthoscelides quadridentatus,* but the male antenna of *A. tridenticulatus* is strongly serrate and the male genitalia of the two species are radically different (compare figures 584 and 641). The 3rd elytral interstice of *A. quadridentatus* is uniformly grayish yellow for its entire length, whereas that of *A. tridenticulatus* is interrupted by two brown spots. The pygidium of female *A. quadridentatus* is grayish yellow strongly marked with brown, whereas that of *A. tridenticulatus* has a faint median stripe and is otherwise uniformly gray. Both species have been reared from the same host plant, same collection of seeds.

The male genitalia are unlike those of any other species I have seen.

Genus *Algarobius* Bridwell

Algarobius Bridwell 1946:54; Bottimer 1968c:1021,1039; Johnson 1968:1268; Kingsolver 1972b:116, 1986:110; Johnson and Kingsolver 1982:416; Borowiec 1987:105; Udayagiri and Wadhi 1989:68; Johnson and Siemens 1997a. Type species: *Bruchus prosopis* LeConte, by original designation.

Small to medium sized bruchids (2.2–5.0 mm). Two species in the United States, six in genus.

Integument red to piceous, vestiture gray with brown to black maculations.

Elongate-ovate, subfusiform. Antenna (figure 653) reaching metepisternum. Pronotum bell-shaped, convex, sometimes gibbous, lateral carina evanescent. Scutellum two times as long as wide (figure 648). Elytra evenly convex, with fine basal denticles on 3rd and 4th striae; metafemur with three subapical denticles (figure 654); mucro nearly as long as width of tibial apex; male pygidium evenly convex, female pygidium with pair of subapical sulci.

Internal sac of male genitalia with characteristic H-shaped sclerite (figure 646).

Geographic range of genus is southwestern United States to Colombia and Venezuela. All host associations are with *Prosopis* spp. (mesquite).

Taxonomy: Kingsolver 1972b, 1986.

Key to Species of U.S. *Algarobius*

1 With pair of polished sulci on pygidium (figures 645 and 652) (females).....2

Without sulci on pygidium (figures 644 and 651) (males) 3

2(1) Pygidium slightly convex, sulci centered one-third from apex (figure 645) .....***bottimeri*** Kingsolver

Pygidium strongly convex apically, sulci nearly confluent with apical margin (figure 652) ..... ***prosopis*** (LeConte)

3(1) Median lobe of genitalia with thickened frame surrounding ventral valve; internal sac armature as in figure 646. .....***bottimeri*** Kingsolver

Median lobe of genitalia with membranous frame surrounding ventral valve; internal sac armature as in figure 655. ..... ***prosopis*** (LeConte)

Algarobius bottimeri Kingsolver

(Figures 60, 643–647)

Bruchus prosopis, of authors (not LeConte): Fullaway 1913:24; Bridwell 1918:475, 1919:17, 1920a:337, 1920b:403; Swezey 1925:3; Bridwell 1929a:43; Krauss 1945:315.

Algarobius prosopis: Hinckley 1960:261.

Algarobius bottimeri Kingsolver 1972b:116; Kingsolver et al. 1977:115; Ward et al. 1977:5; Johnson and Kingsolver 1982:416; Johnson 1983c:27; Kingsolver 1986:119; Udayagiri and Wadhi 1989:68.

Color.—Integument dark red to nearly black; eyes, female pygidial sulci, and humeri black. Vestiture yellowish gray, brassy, and black; dorsal elytral pattern mottled, female more contrasting than male.

Structure.—Female pygidial sulci (figure 645) located on either side of midline about one-half of the distace from lateral margin to midline and about two-thirds of the distance from base to apex of pygidium.

Male genitalia.—As in figures 646 and 647; median lobe with apical frame thick and massive (figure 646), ventral valve short, not keeled, membrane dorsad of apical orifice with cluster of acute denticles, internal sac armature as illustrated; lateral lobes flat (figure 647), cleft about one-third their length.

Size.—Body length 2.7–4.25 mm; width 1.5–2.25 mm.

Type depository.—USNM, holotype No. 70389.

Type locality.—Texas, Bentsen State Park, Hidalgo Co.

Distribution.—NM, OK, TX, HI (introduced); Mexico.

Host plants.—Prosopis glandulosa glandulosa, P. pallida (Hawaii only), *P. reptans cinerascens, P. reptans reptans.*

Natural enemies.—Heterospilus prosopidis; Lariophagus texanus; Stenocorse bruchivora

Crawford. These parasites are listed as attacking *Algarobius prosopis* but because their distribution is given as Texas or Hawaii, the association instead is undoubtedly with *A. bottimeri.*

Immatures.—Not described.

Discussion.—Although the males of this species are externally indistinguishable from those of *Algarobius prosopis,* the two species belong to different species groups based on male genitalia and the position of the female pygidial sulcus. Females are easily differentiated in the United States by the position of the sulci (compare figures 645 and 652).

The distribution lies largely within Texas with only scattered localities in bordering states, plus Hawaii. Collections in Hawaii indicate that *A. bottimeri* attacks only seeds of *Prosopis pallida,* itself an immigrant into Hawaii. None of the Texan species of *Prosopis* are currently in Hawaii according to Fosberg (1966:134).

Records listing *Bruchus prosopis* or *Algarobius prosopis* from Hawaii prior to 1972 are almost certainly *A. bottimeri.* Bridwell (1929a:43) was the first to recognize that the Hawaiian specimens were not *A. prosopis,* but he never described the species.

Prosopis velutina and *P. glandulosa* were recently inadvertently introduced into South Africa and both *Algarobius bottimeri* and *A. prosopis* have been introduced as possible biocontrol agents. (B. Grobbelaar, personal communication, 1990; Hoffmann et al. 1993)

Algarobius prosopis (LeConte)

(Figures 61, 648–656)

Bruchus prosopis LeConte 1858:77; Horn 1873:331; Sharp 1885:475; Fall 1901:160; Schaeffer 1907:299; Cushman 1911:497,507; Zacher 1952:462.

Mylabris prosopis: Leng 1920:305.

Acanthoscelides prosopis: Blackwelder 1946:760.

Algarobius prosopis: Bridwell 1946:54; Blackwelder and Blackwelder 1948:45; Werner and Butler 1958:7; Arnett 1962:957; Bottimer 1968c:1021; Johnson 1968:1268; Kingsolver 1972b:119; Center and Johnson 1974:1101; Kingsolver 1972b:119; Smith and Ueckert 1974:61; Swier 1974:5; Pfaffenberger and Johnson 1976:31; Kingsolver et al. 1977:114; Ward et al. 1977:5; Johnson and Kingsolver 1982:416; Johnson 1983c:27; Kingsolver 1986:113; Borowiec 1987:105; Udayagiri and Wadhi 1989:69; Decelle 1990:20; Johnson and Siemens 1997a:38.

Bruchus uniformis LeConte 1858:77; Horn 1873:333; Fall 1901:160, 1910:174; Cushman 1911:508; Zacher 1952:463.

Mylabris uniformis: Kannan 1923:17; Essig 1929a:486 (*desertorum* and *prosopis* as synonyms).

Algarobius uniformis: Blackwelder and Blackwelder 1948:45; Johnson 1968:1268.

Bruchus desertorum: LeConte 1858:77; Horn 1873:328, 1894:345; Schaeffer 1907:292; Fall 1910:174; Cushman 1911:508; Zacher 1952:462.

Mylabris desertorum: Leng 1920:305

Acanthoscelides desertorum: Blackwelder 1946:759.

Algarobius desertorum: Blackwelder and Blackwelder 1948:45; Johnson 1968:1268.

Color.—Integument brownish yellow; eyes, female pygidial sulci, and humeri black. Vestiture of yellow, white, dark brown, light brown, and black fine setae in variable pattern (figures 648 and 649); venter of body mostly white with some yellow spots. Female pygdial sulci located on apical margin either side of midline.

Male genitalia.—As in figures 655 and 656. Ventral valve subtriangular, keeled; dorsal hood rounded; armature of internal sac consisting of two curved sclerites connected by a bridge; an elongate, tapered spine flanked each side by a slender,

curved spine; two tapered, crossed spines in middle of sac; and an amorphous, thinly sclerotized structure toward apex; closure valve circular; lateral lobes flat (figure 656), cleft one-half their length.

Size.—Body length 2.1–4.1 mm; width 1.0–2.2 mm.

Type depository.—MCZC (lectotypes: *desertorum,* No. 4468; *prosopis,* No. 4470; *uniformis,* No. 4471; all designated by Kingsolver 1986).

Type locality.—California, Colorado Desert *(desertorum, prosopis,* and *uniformis).*

Distribution.—AZ, CA, NM, NV, TX, UT; Mexico; South Africa, Arabian Peninsula (J. Decelle, personal communication, 1990).

Host plants.—Prosopis chilensis, P. glandulosa torreyana, P. laevigata, P. velutina, P. pubescens, P. reptans cinerascens, P. alba (introduced into Arizona). Zacher's (1952) inclusion of *Hymenaea courbaril* and *Acacia confusa* as hosts of this bruchid should be discounted.

Natural enemies.—Cerceris truncata; Charitopodinus terryi; Glyptocolastes texanus; Heterospilus prosopidis; Horismenus missouriensis, H. productus; Lariophagus texanus; Stenocorse bruchivora; Urosigalphus bruchi, U. bruchivorus, U. neobruchi; Uscana semifumipennis.

Immatures.—Kannan 1923:17 (as *Mylabris uniformis,* first instar); Pfaffenberger and Johnson 1976:31 (first instar).

Discussion.—Specimens reared from *Prosopis pubescens* (screwbean) average two-thirds the size of those reared from the straight bean *(P. glandulosa, P. torreyana,* and *P. velutina)* and are usually uniformly yellowish with little or no pattern. Male genitalia, however, are identical to those of the larger specimens. This species exhibits a wide range of intensity of color pattern with females usually, but not always, darker than males. In zones of distribution overlap in eastern New Mexico and western Texas, males must be dissected, but females can be distinguished by the position of the pygidial sulci (compare discussion of *Algarobius bottimeri*).

Teran (1967) first illustrated the male genitalia of this species.

Algarobius prosopis is the most common bruchid attacking mesquite in its range.

This species has been introduced into South Africa for possible control of *Prosopis* (B. Grobbelaar, personal communication, 1990) Scullen and Wold (1969) reported it as the prey of the hymenop-teran *Cerceris truncata* Cameron.

Kistler (1982) reported on the effects of temperature on this species.

Swier (1974) investigated the interactions of four species of bruchids attacking *Prosopis velutina* in Arizona—*Algarobius prosopis, Mimosestes amicus, Mimosestes protractus,* and *Neltumius arizonensis.* See also Kingsolver et al. (1977).

Genus *Althaeus* Bridwell

Althaeus Bridwell 1946:55; Bradley 1947:40; Arnett 1962:956–957; Bottimer 1968c:1021,1040; Johnson and Kingsolver 1982:416; Borowiec 1987:95; Kingsolver et al. 1989. Type species: *Bruchus hibisci* Olivier 1795:21, monotypic.

Bridwell separated *Althaeus* by the broad, serrate subapical denticle on the ventral margin of the metafemur (figure 660). The generic characterization is here expanded:

Head (figure 664) with frontal carina evanescent, ocular sinus one-half length of eye, antenna subserrate and moderately dimorphic (figure 665), extending to middle of metepisternum; pronotum semicircular (figure 663), convex, lateral margins arcuate, lacking lateral carina; elytral striae parallel, 3rd and 4th striae sometimes minutely denticulate basally; basitarsus of fore leg short (figure 667), subequal to 2nd segment, that of mid leg 1.5 times as long as 2nd (figure 668); metafemur not strongly swollen; mucro of metatibia short, one-fifth or less length of basitarsus (figure 660).

Apex of internal sac of male genitalia with numerous small denticles (figures 661, 670, and 676).

Althaeus is apparently closely related to *Acanthoscelides.* The character combination of elongate, serrate femoral denticle, short, broad body, ocellate elytral pubescence, and short fore tarsal segments will separate the three species included here from those species now placed in *Acanthoscelides.*

Borowiec (1987) redescribed the genus but based his description only on *Althaeus hibisci.* He failed to note the minute basal elytral tubercles, the dimorphic antennae, and the short tarsal segments.

The geographical range of *A. hibisci* lies predominantly in the Gulf Coast and Eastern Seaboard States with some scattered records in the Mississippi Valley up to Illinois. The range of *A. folkertsi* is predominantly midwestern from Oklahoma and Kansas eastward to Virginia and Maryland, where it is sympatric with *A. hibisci.* The third species, *A. steineri,* has been collected only in eastern North Carolina.

The species included in *Althaeus* apparently are obligatorily associated with species in the plant family Malvaceae.

Taxonomy: Kingsolver et al. 1989.

Key to Species of *Althaeus*

1 Legs black except tarsi reddish brown; basal four or five segments of antenna dark red, antennal club black; metatibial mucro subequal in size to lateral and coronal denticles; denticle of metafemur as in figure 675..... ***steineri*** Kingsolver

Some portion of legs usually red or reddish yellow; antenna usually yellow, sometimes dusky; metatibial mucro longer than lateral and coronal denticles; denticle of metafemur as in figures 660 and 666 2

2(1) Male genitalia with slender ventral valve, apex attenuated (figure 670); lateral lobes apically rounded (figure 671) .....***hibisci*** (Olivier)

Male genitalia with broad ventral valve, apex minutely pointed (figure 661); lateral lobes apically, obliquely truncate (figure 662) ..... ***folkertsi*** Kingsolver

Althaeus folkertsi Kingsolver

(Figures 65, 657–662)

Althaeus folkertsi Kingsolver, in Kingsolver et al. 1989:67.

Color.—Similar to *Althaeus hibisci* but generally with a more grayish appearance than yellowish; however, the variation in vestitural color in both species makes this an unreliable character. Color of legs and antennae are also variable in both species.

Structure (figures 657 and 658).—Similar to *Althaeus hibisci* but with distinctive differences in the shape of the ventral valve and lateral lobes of the male genitalia. Antenna (figure 659) slightly dimorphic.

Male genitalia.—As in figures 661 and 662; median lobe slender (figure 661) in apical one-half, broadly rounded at base; ventral valve ogival with small apical nipple; base of internal sac finely denticulate, with coarser denticles in middle of sac and 11 thornlike denticles in apical portion, each with fine spines on its enlarged base, apex of sac with ringlike, denticulate, apical band; lateral lobes (figure 662) short, broad, obliquely truncate at apex.

Size.—Body length 1.9–2.5 mm; width 1.1–1.7 mm.

Type depository.—USNM.

Type locality.—Maryland, Plummers Island (Potomac River).

Distribution.—AR, DE, DC, IL, IN, IA, KS, LA, MD, MO, MS, NJ, OH, OK, PA, TX, VA, WV.

Host plants.—Abutilon theophrasti; Hibiscus moscheutos lasiocarpos, H. militaris. Visiting records: *Amelanchier; Crategus mollis; Hibiscus; Malva; Spiraea;* swamp mallow; wafer ash.

Natural enemies.—None recorded.

Immatures.—Pfaffenberger (first larval instar) and Gibb (larva and pupa) *(In* Kingsolver et al. 1989).

Discussion.—See *Althaeus hibisci* for comparisons and distribution. Although this species breeds in seeds of *Hibiscus* and *Abutilon* and adults are found in the flowers, they also feed on pollen of several species of plants in other families.

Gibb (in Kingsolver et al. 1989) described oviposition and the biology of *Althaeus folkertsi* on *Abutilon theophrasti.*

Althaeus hibisci (Olivier)

(Figures 663–671)

Bruchus hibisci Olivier 1795:21; LeConte 1824:170; Hubbard and Schwarz 1878:660; Fall 1910:172 (in key only); Cushman 1911:503; Weiss 1919:5; Weiss and Dickerson 1919:49; Zacher 1952:162,478.

Bruchus transversus Say 1831:3.

Bruchus transvexus: Horn 1873:338 (misspelling).

Althaeus hibisci: Bridwell 1946:55; Bradley 1947:40; Arnett 1962:957; Johnson and Kingsolver 1982:416; Borowiec 1987:95; Kingsolver et al. 1989:63; Udayagiri and Wadhi 1989:69.

Color.—Body black; antenna mostly reddish yellow, sometimes with club segments partly or wholly piceous; fore legs and mid legs largely reddish yellow, sometimes with bases of femora black, hind leg (figure 666) usually basally black, apically red, extent of black infusion variable, metatibia and tarsus reddish. Vestiture of short, slender, silvery gray to yellowish-gray hairs, pattern of hairs on elytra mottled, dark spaces between patches of hair each centered on a minute golden hair; pronotum with hairs condensed into two median patches and two subbasal patches, remaining areas on disk mottled; venter of body evenly clothed with gray hairs except for prominent patches on mesepisternum, caudal end of metepisternum, and dorsal border of abdominal sterna.

Structure.—Body stout (figure 663), about 2 times as long as wide, strongly convex above. Head ovate (figure 664), eyes protuberant; vertex finely, obsoletely punctate, frons finely rugose, clypeus rugosely punctate; ocular sinus about one-half length of eye, postocular lobe nearly at right angles to side of head; antenna capitate (figure 665), segments eccentrically expanded beginning with 5th segment, terminal segment elliptical, antenna reaching middle of metepisternum. Pronotum nearly semicircular in dorsal aspect (figure 663), basal lobe prominent, disk evenly convex, microfoveolate, each foveola with a micro-seta inserted under its anterior rim, lateral margin subcarinate from posterior corner about one-third distance to anterior margin, propleuron finely punctate, cervical sulcus short, deep; prosternum short, triangular, narrow before procoxae; mesosternum narrowly trapezoidal, slightly emarginate apically; postmesocoxal sulcus narrow paralleling rim of coxal cavity. Elytra together as wide as long (figure 663); striae regular in course, free apically, originating basally from minute pits under intermittent basal bead; interstices flat, finely imbricate except in intermittent bare spots surrounding each golden seta; meta-sternum with shallow median sulcus; fore, middle, and hind tarsi as in figures 667, 668, and 669, respectively; metacoxa densely punctulate; metafemur oblong-elliptical (figure 666), denticle length equal

to tibial width at their juncture, posterior margin of denticle usually with two fine teeth; metatibia nearly straight, bent only at extreme base, gradually dilated toward apex, lateral, ventral, and dorsomedial carinae distinct and entire, ventrolateral carina obsolete apically; mucro acute, only slightly longer than lateral and coronal denticles; metatarsus including claw segment equal in length to metatibia. Abdomen of male with 1st sternum l.5 times as long as remaining four sterna combined, 1st sternum without pits but with vestiture in curved pattern on either side of midline; 5th sternum broadly emarginate to receive apex of pygidium; 1st sternum of female equal in length to remaining sterna combined, 5th sternum with caudal margin not emarginate; pygidium of male broadly obovate, evenly convex, disk sparsely microfoveolate resulting in speckled appearance, each foveola with a fine seta set in its anterior rim, vestiture patchy with vague median stripe; female pygidium similar to male's except less strongly convex.

Male genitalia.—As in figures 670 and 671; median lobe slender in apical one-half (figure 670), broadly rounded basally; ventral valve elongate, tapered to blunt apex; internal sac minutely denticulate in basal one-fifth, middle of sac with coarser denticles, apex with 12 thornlike spines, the base of each denticulate, and a ring-like, denticulate band; lateral lobes (figure 671) expanded apically, apex of each lobe rounded and setose, cleft for one-third their length.

Size.—Body length 1.5–2.5 mm; width 0.9–1.5 mm.

Type depository.—MNHP.

Type locality.—"Carol." (probably Carolina).

Distribution.—AL, AR, DC, DE, FL, GA, IL, KY, LA, MD, MI, MS, MO, NJ, NY, NC, OK, PA, SC, TN, TX, VA.

Host plants.—Abutilon theophrasti; Hibiscus aculeatus, H. moscheutos lasiocarpus, H. moscheutos moscheutos, H. moscheutos palustris. Floral records: *Crataegus; Daucus carota; Hibiscus; Kosteletzkya virginica;* mallow; marsh mallow; okra; swamp mallow; thistle.

Natural enemies.—Uscana semifumipennis.

Immatures.—Not described.

Discussion.—Weiss and Dickerson (1919) listed several localities and host plants for *Althaeus hibisci* in New Jersey, but since *A. folkertsi* is also found in New Jersey, the records could apply to either species. Their descriptions of the life stages and life history of *A. hibisci* are likewise ambiguous.

Olivier described *Bruchus hibisci* in 1795 from "Carol."— undoubtedly referring to Carolina. The type in the *Museum National d'Histoire Naturelle* in Paris is a badly rubbed and broken female specimen. Enough of the specimen remained to determine that it is probably conspecific with specimens from Canadys, SC. This locality is outside the known range of the new species *A. folkertsi,* and the red coloration of the metafemur of the *hibisci* type precludes its representing the new species *A. steineri.*

This is one of the most commonly collected bruchids in the Middle Atlantic states. It commonly develops in several species of *Hibiscus* but has been bred from seeds of *Abutilon theophrasti* (butterprint or velvetleaf), a common weed in fields and waste places.

I have been unable to discover any consistent external differences between *Althaeus hibisci* and *A. folkertsi.* Females of the two species are not distinguishable from one another at present. Only the male genitalia provide diagnostic characters. Both species are readily separated from *A. steineri* by the characters in the key.

Althaeus steineri Kingsolver

(Figures 672–677)

Althaeus steineri Kingsolver, *In* Kingsolver et al. 1989:60.

Color.—Integument black, 1st to 5th antennal segments reddish yellow, 6th to 11th

piceous, tarsi dark red to piceous, apex of metatibia sometimes piceous. Vestiture of silvery gray, slender hairs; pronotum with hairs evenly distributed on disk but with small paired patches at apical one-third and on each side of basal lobe; elytral vestiture evenly distributed but interstices with small, ocellate bare spots each centered on a setose puncture (figure 672), scutellum densely setose; pygidium with mottled pattern (figure 673), vaguely denser along midline; body beneath and legs uniformly covered with gray hairs.

Structure.—Head turbiniform, eyes protuberant, ocular sinus about one-half length of eye, postocular lobe narrow, fringed; frons broad with frontal carina obsolete, or at most a denuded median line, vertex and frons finely punctate, clypeus obscurely punctate; 6th to 10th antennal segments eccentric forming a loose, terete club, 11th conical (figure 674). Pronotum semicircular (figure 672), about 1.5 times as long as wide, lateral margins evenly arcuate, slightly flared at extreme base, disk almost evenly convex, basal lobe with short, narrow sulcus; surface with densely, evenly placed, round-bottomed foveolae, each foveola with a short, white hair emerging from beneath its anterior rim; lateral carina obsolete, margin of disk an obtuse ridge; cervical sulcus fine, extending dorsad to a point above eye; prosternum triangular, short, extending about two-thirds length of coxa; mesosternum truncate; postmesocoxal sulcus narrow, following contour of coxal cavity. Scutellum quadrate, nearly covered with white hairs. Elytra together slightly longer than wide (figure 672), margins evenly arcuate, widest at middle; striae regular in course, only slightly deflected at extreme base, 2nd to 5th striae arising from basal pits beneath marginal bead, denticulate; striae deep, lacking punctures but with regularly placed, short, curved, white setae, each set in slightly widened space in stria (probably an expanded strial puncture); all striae free apically; intervals prominently punctate, each puncture setose, surface between punctures finely to obsoletely imbricate. Fore legs with basitarsus short, mid legs with basitarsus slightly longer that those of fore legs; metacoxal face with fine, densely placed punctures, metafemur (figure 675) with ventral margin nearly straight, flat, with external fringe of fine setae giving appearance of fine carina, mesoventral margin with single, small, subapical denticle finely serrate on caudal margin; metatibia (figure 675) nearly straight except at extreme base; lateral, ventral, and dorsomedial carinae complete, latero-ventral carina ending one-half distance from base, mucro shorter than lateral denticle, three coronal denticles subequal in length to lateral denticle. Abdomen with 1st sternum subequal in length to remaining four together, 5th sternum broadly emarginate in male, evenly arcuate in female; pygidium subtriangular, integument obsoletely foveolate, hairs arranged in obscure ocellate pattern; disk more strongly arcuate in male.

Male genitalia.—As in figures 676 and 677; median lobe (figure 676) elongate, slender in apical two-thirds, base slightly expanded; ventral valve broadly ogival, apex minutely pointed, basal one-half of internal sac densely lined with blunt denticles, apical portion with about 18 spiny denticles and apical denticulate band; lateral lobes (figure 677) cleft about one-half their length, rounded, expanded and apically setose.

Size.—Body length 2.3–2.5 mm; width 1.5–1.6 mm.

Type depository.—USNM.

Type locality.—North Carolina, Dare Co., Frisco, Cape Hatteras National Seashore.

Distribution.—NC.

Host plants.—Kosteletzkya virginica.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is distinguished by the key characters—black legs, short mucro, smaller serrations on femoral denticle, and the male genitalia. The latter organs more closely resemble those

of *Althaeus folkertsi* than of *A. hibisci,* whereas the external body characters seem to more closely associate *A. folkertsi* with *A. hibisci.* This species might be confused with *Acanthoscelides alboscutellatus* (Horn) because of the black body and appendages and vaguely ocellate pattern of setae on the elytra, but the pronotum of *A. alboscu-tellatus* is subconical, and the scutellum is contrastingly pure white.

Althaeus steineri is known only from collections made on the Cape Hatteras National Seashore. Although the host is known from other localities on the mainland, the bruchid has not been collected from there.

Genus *Caryedes* Hummel

Caryedes Hummel 1827:11. Type species: *Bruchus faldermanni* Mannerheim, *In* Hummel 1827:10; see Kingsolver and Whitehead 1974:343.

Pachymera Berthold 1827:378. Latinization of "pachymere" (Latreille 1825), a vernacular name.

Pachymerus Schoenherr 1833:84. Type species: *Bruchus brasiliensis* Thunberg 1816:45, by original designation (*Bruchus faldermanni* Mannerheim listed in synonymy) (not *Pachymerus* Thunberg 1805). In describing *Pachymerus,* Schoenherr (1833) listed two groups under the genus. One was the group set out by Latreille (1825) as *Pachymere* but not formally described. The other group was later expanded into the subfamily Pachymerinae, an entirely different bruchid group. The appelation "Latreille" was used by by Gistel (1848) and Pic (1913a) to indicate to which group they were referring.

Andromisus Des Gozis 1881:cxiii. (Original spelling *Adromisus*, emended by Des Gozis 1885:125). Replacement name for *Pachymerus* Latreille: of Schoenherr, not Thunberg. Type species: *Bruchus brasiliensis* Thunberg 1816, by automatic fixation.

Pedapholus Gistel 1848:xi. Replacement name for *Pachymerus* "Latreille" of Schoenherr, not Thunberg. Type species: *Bruchus brasiliensis* Thunberg 1816, by automatic fixation.

Pedalophus (error), Bottimer 1968c:1041.

Pseudopachymerus Pic 1913a:10. Replacement name for *Pachymerus* "Latreille" of Schoenherr, not Thunberg. Type species: *Bruchus brasiliensis* Thunberg 1816, by automatic fixation.

Falsobruchus Pic 1913b:110. Type species: *Bruchus cristatus* Fahraeus 1839:122, by monotypy. Proposed as subgenus of *Pachymerus* Schoenherr.

Body broad, deep; elytra subquadrate (figures 69 and 683); vestiture dense everywhere on body. Vertex and frons densely punctulate, frontal carina prominent, length of gena between eye and base of mandible 1.5–2 times as long as width of basal antennal segment, dorsal margin of antennal cavity carinate; antenna gradually clavate. Pronotum subconical (figure 69), lateral margins incurved; disk with longitudinal median gibbosity, lateral subbasal gibbosities prominent, separated from median gibbosity by shallow sulcus; discal punctation fine, hidden by vestiture. Scutellum small, quadrate. Elytra together as long as wide (figure 69), medially depressed; striae mostly hidden by vestiture in *Caryedes helvinus,* 3rd and 4th striae laterally deflected to subbasal denticles set on rounded gibbosity; interstices flat. Pygidium subtriangular (figures 679 and 684). Metacoxal face densely, evenly punctate except fossula glabrous; metafemur strongly inflated, mesoventral margin with three to four minute spines nearly hidden in vestiture and one long and three or four short, subapical denticles; metatibia slender, curved; lateroventral, ventral, and dorsomesal carinae complete; mucro slender, curved, one-third to one-half as long as basitarsus.

Median lobe of male genitalia elongate (figure 681), fractured near apex; lateral lobes fused (figure 682), straplike, divided only at apex.

Two species in this Neotropical genus [*Caryedes incensus* (Sharp) and *C. helvinus* (Motschulsky)] were recovered from field-grown *Centrosema macrocarpa* at Ft. Pierce, FL, in April 1989. The known geographical ranges of both species do not normally extend north of southern Mexico. The description applies to these two species only. For a more complete description of the genus, see Kingsolver and Whitehead (1974:345).

The only species in Florida with similar morphological characteristics is *Mero-bruchus lysilomae* Kingsolver (figure 758), but *M. lysilomae* is more slender than either species of *Caryedes*, the genal length is less than the width of the 1st antennal segment, and the lateral margins of the pronotum are arcuate, not incurved.

Gibbobruchus mimus (Say), which has similar characteristics, has been collected at Gainesville, FL, from its preferred host plant, *Cercis canadensis*. *Gibbobruchus* is easily separated from other North American genera by the serrate lateroventral carina of the metafemur, the lateral polished spots of the 1st and 2nd abdominal segments, and the polished, heart-shaped pygidial spot of the female.

Revision: Kingsolver and Whitehead 1974.

Key to *Caryedes* of the United States

1. Vestiture dense, short, yellowish white with brown or black lateral spots (figure 69); pygidium mostly yellowish white with vague darker areas and two subapical brown or black spots (figure 679); front and middle legs yellow, hind leg yellowish white (figure 680) with vague brown banding
.....***helvinus*** (Motschulsky)

   Vestiture largely dark brown with some intermixed white patches, apical one-half of elytra with diagonal rows of white setae (figure 683); scutellum and basal dart of pronotum contrastingly white; pygidium (figure 684) yellow and white with median dark brown denuded spot, sometimes with brown subapical spots; hind leg dark brown with white setal patches (figure 685)
..... ***incensus*** (Sharp)

Caryedes helvinus (Motschulsky)

(Figures 26, 68, 69, 678–682)

Pachymerus helvinus Motschulsky 1874:244.

Pseudopachymerus helvinus: Pic 1913a:11.

Caryedes helvina: Blackwelder 1946:758.

Caryedes helvinus: Kingsolver and Whitehead 1974:376; Udayagiri and Wadhi 1989:73.

Pachymerus scabricollis Chevrolat 1877: xcviii.

Pseudopachymerus scabricollis: Pic 1913a:12.

Caryedes scabricollis: Blackwelder 1946:758.

Bruchus calderensis Sharp 1885:444.

Pseudopachymerus calderensis: Pic 1913a:10.

Caryedes calderensis: Blackwelder 1946:758.

Pseudopachymerus multimaculatus var. *binotatus* Pic 1930a:36.

Caryedes bicoloripes var. *binotata:* Blackwelder 1946:757.

Color.—Integument dark red to black, everywhere concealed by dense vestiture; head black, vertex sometimes red; antennae red except 6th to 9th segments darker red to black; pronotum, elytra, pygidium, and venter of body usually dark red; pronotum usually with linear spots on raised portions of disk; elytra with black maculae at humeri and middle of lateral margin; pygidium with two subapical spots sometimes vaguely defined. Vestiture of yellowish-gray, white, and black setae in mottled pattern on body, black setae on black integumental spots.

Structure.—Body broad (figure 69), vertex finely punctate, frontal carina fine but distinct (figure 678); ocular index 4:1; ocular sinus one-half as long as eye; antenna clavate. Pronotum subconical (figure 69), lateral margins incurved, basal lobe well defined, middle of disk gibbous, vaguely sulcate, with subbasal gibbosity either side of median gibbosity; lateral carina effaced.

Scutellum quadrate, densely pubescent. Elytra together as long as wide (figure 69), medially depressed between 7th striae, striae appearing as thin lines in dense vestiture, 2nd stria slightly divergent at base, 3rd and 4th striae ending subbasally in dentate gibbosities. Metacoxal face densely, finely punctate, densely pubescent. Hind leg as in figure 680; pecten with one long denticle and three short denticles; metatibia sinuate, apically expanded, lateral, ventral, and dorsomesal carina complete to apex, lateroventral carina aborted near base of mucro; mucro slender, three-fifths as long as basitarsus. Abdomen not modified except 5th sternum of male deeply emarginate for apex of pygidium; pygidium of male convex with subapical and lateral depressions, of female nearly flat with only subapical depressions (figure 679).

Male genitalia.—As in figures 681 and 682; median lobe slender (figure 681), similar to that of *C. incensus* except internal sac armature sparse, apex of sac with bilobed structure; lateral lobes elongate (figure 682), fused nearly to rounded apical lobes.

Size.—Body length 2.8–3.7 mm; width 1.9–2.4 mm.

Type depository.—ZMUM.

Type locality.—Venezuela, Santa Lucia.

Distribution.—FL (possibly established near Ft. Pierce); Mexico to Brazil.

Host plants.—Centrosema macrocarpa, C. pubescens.

Natural Enemies.—None recorded.

Immatures.—None described.

Discussion.— This species can hardly be confused with any other bruchid in this handbook. Salient characters are the dense yellowish-gray appearance, depressed medial two-thirds of elytra, black elytral humeri and lateral marginal maculae, pronotal color pattern, pygidial spots, and long, slender mucro.

The species apparently escaped from experimental plots near Ft. Pierce, FL, but has not been found elsewhere in the United States or Canada. The host plants are not found naturally in the United States.

Caryedes incensus (Sharp)

(Figures 683–687)

Bruchus incensus Sharp 1885:445.

Pseudopachymerus incensus: Pic 1913a:11.

Caryedes incensa: Blackwelder 1946:758.

Caryedes incensus: Kingsolver and Whitehead 1974:379; Mead 1989:2; Udayagiri and Wadhi 1989:74.

Color.—Body and appendages dark red to black; antenna with 6th to 10th segments black, remainder red. Vestiture of golden brown, black, and white setae in pattern shown in figure 683, head mostly dark brown, vertex paler dorsally; pronotum mottled with black and brown hairs, narrow median band white, scutellum and prescutellar spot usually white, sometimes yellowish; elytra largely black with brown patch at one-fourth from base, disk with ill-defined diagonal bands of intermixed brown and white hairs, 7th interstice with small but prominent white spot; pygidium variable, usually with median and subapical brown spots on white to yellowish-white background (figure 684); venter of body largely brown but with yellowish-white to white spots on mesepimeron, metepisternum, lateral angle of metacoxal face, and lateral margins of abdominal segments; hind legs with vague yellow banding.

Structure.—Head 1.6 times as long as width across eyes; ocular index 3:1; ocular sinus one-half as long as eye; antenna clavate, club segments strongly eccentric, antenna reaching middle of metepisternum; pronotum (figure 683) with median gibbosity elongate and prominent, bisected by shallow sulcus, subbasal gibbosities elongated, prominent, basal margin sharply sinuate; disk densely punctulate; lateral carina threadlike. Scutellum prominent. Elytra convex (figure 683) but with area around scutellum depressed; striae

shallow, parallel, punctures prominent, 3rd and 4th arising from minute denticles on prominent subbasal gibbosity; interstices minutely imbricate. Hind leg as in figure 685, mesoventral margin with three minute median denticles, pecten with one long and four shorter denticles; mucro one-third as long as basitarsus. Pygidium densely punctulate, apex of male distinctly reflexed.

Male genitalia.—As in figures 686 and 687; median lobe long, slender (figure 686); ventral valve ogival with apex acute; internal sac densely lined with fine denticles and one saberlike sclerite; apex of sac bilobed; lateral lobes long (figure 687), fused two-thirds their length, broadly spatulate apically.

Size.—Body length 2.7–3.3 mm; width 1.7–2.2 mm.

Type depository.—BMNH.

Type locality.—Panama, Volcan de Chiriqui.

Distribution.—FL (possibly established near Ft. Pierce); Costa Rica to Colombia.

Host plants.—*Centrosema macrocarpa* (Florida), *C. pubescens* (Costa Rica)

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Characters given in the generic discussion will separate *Caryedes incensus* from *Gibbobruchus* and *Mero-bruchus.* No other U.S. bruchid species is likely to be confused with *C. incensus.*

Genus *Gibbobruchus* Pic

Pachymerus subg. *Gibbobruchus* Pic 1913b:110. Type species: *Bruchus speculifer* Gyllenhal 1833, by subsequent designation, Bridwell 1932:105.

Pseudopachymerus subg. *Gibbobruchus:* Pic 1913a:10.

Gibbobruchus: Bridwell 1932:105; Blackwelder 1946:762; Bottimer 1968c:1022,1039; Whitehead and Kingsolver 1975a:169; Johnson and Kingsolver 1982:413; Borowiec 1987:75; Udayagiri and Wadhi 1989:81.

Small to medium sized beetles (2.3–4.7 mm). Three species in the United States.

Body subdepressed, elytra subquadrate; head with prominent or evanescent frontal carina; eye with moderately deep ocular sinus; antenna with club segments strongly serrate, not sexually dimorphic (figure 692). Pronotum bell-shaped (figure 688), lateral margins incurved, disk with median and subbasal gibbosities, median gibbosity sulcate; lateral carina evanescent or lacking. Scutellum small, quadrate, bidentate. Elytra with striae narrow (figure 688), deep, 3rd and 4th deflected laterad at base and ending in prominent gibbosity; lateral umbones prominent. Pygidium dimorphic, pubescent in male, at least partly glabrous in female; 1st and 2nd abdominal sterna with polished lateral spots. Fore leg and mid leg not modified; hind leg with femur dorsoventrally strongly swollen, ventromesal margin with one long denticle usually separated by gap from three or four distal denticles; ventrolateral margin with row of short, blunt denticles; metatibia arcuate fitting ventral margin of femur; mucro elongate, acute.

Male genitalia with median lobe moderately broad, ventral valve subtriangular; internal sac densely armed with fine spicules.

Genus ranges from United States to Brazil. All three U.S. species were placed in the *mimus* group by Whitehead and Kingsolver (1975a).

Revision: Whitehead and Kingsolver 1975a.

Key to Species of *Gibbobruchus*

1 Pygidial spot round or oval (figures 691 and 699); pecten with 1st denticle separated from the remaining by distinct gap (figures 693 and 701).....3

Pygidium with large, polished central spot (figures 691, 699, and 707) (females).....2

Pygidium with at most a small, elongate median spot (figures 690, 698, and 706) (males).....4

2(1) Pygidial spot cordate (figure 707); pecten of metafemur with denticles regularly spaced, no gap behind 1st denticle (figure 709)

..... *mimus* (Say)

Pygidial spot round or oval (figures 691 and 699); pecten with 1st denticle separated from the remaining by distinct gap (figures 693 and 701).....3

3(2) Elytra with short, V-shaped, median dark brown spot (figure 688); base of pronotal gibbosity with elongate, pale spot .....*cristicollis* (Sharp)

Elytra with elongated, velvety black, median spot (figure 696); base of pronotal gibbosity lacking elongate pale spot; basal triangle of pygidium prominent (figure 699) ..... *divaricatae* Whitehead and Kingsolver

4(1) Pygidium sparsely pubescent, convex, with short median sulcus (figure 698); basal triangle of pygidium prominent .....*divaricatae* Whitehead and Kingsolver

Pygidium densely, conspicuously pubescent.....5

5(4) Pygidium with two projecting gibbosities (figures 688 and 690).....*cristicollis* (Sharp)

Pygidium lacking gibbosities but with three glabrous, subapical spots (figure 706)

.....*mimus* (Sharp)

Gibbobruchus cristicollis (Sharp)

(Figures 688–695)

Bruchus cristicollis Sharp 1885:442.

Pseudopachymerus cristicollis: Pic 1913a:10.

Caryedes cristicollis: Blackwelder 1946:758.

Gibbobruchus cristicollis: Whitehead and Kingsolver 1975a:190; Johnson and Kingsolver 1982:413; Udayagiri and Wadhi 1989:81.

Color.—Integument reddish brown to black, in more teneral specimens yellowish brown with dark red variegation; antenna with basal segments yellowish, middle segments often infuscated; pronotum and elytra variegated red; dorsal half of metafemur red, ventral half black; female pygidium with large, oval, glabrous spot. Vestiture white, yellow, light brown, dark brown, and black; head yellow; pronotum mostly yellow but somewhat variegated, posterior slope of median gibbosity with elongate, intensely white patch; elytra variegated light brown, dark brown, yellow, and white with median V-shaped spot velvety black; male pygidium yellow except paler spots on twin gibbosities, female pygidium with brownish-yellow fringe around glabrous median spot; venter of body white except yellow and brown spots on lateral sclerites; row of small, white spots on dorsal margin of abdominal sterna; 1st, 2nd, and 3rd sterna with lateral, glabrous patches.

Structure.—Vertex densely, finely punctate, transverse sulcus shallow, frons with linear punctures, frontal carina not prominent (figure 689); ocular index 3.3:1; ocular sinus five-eighths as long as eye; antenna moderately eccentric from 4th segment, terminal segment elliptical (figure 692); antenna extended to humerus. Pronotum with strongly incurved lateral margins (figure 688); median gibbosity with four slight elevations, median sulcus shallow, subbasal gibbosities prominent, ridgelike; cervical sulcus hidden in vestiture. Scutellum quadrate, emarginate. Elytral disk depressed between 6th interstices (figure 688), slight ridge extending from humerus diagonally to middle of elytron; striae sinuate, subparallel, discal striae divergent in basal one-half, 3rd and 4th ending in denticulate basal gibbosity, interstices densely pubescent, punctulate-imbricate; metacoxal face densely punctate, setose, setae directed laterad; pecten with four to five denticles irregularly positioned, ventrolateral carina denticulate (figure 693). First sternum of male with yellow patch of fine setae, 5th sternum broadly emarginate.

Male genitalia.—As in figures 694 and 695; ventral valve semicircular (figure 694), apex produced, internal sac with linear rows of fine spicules in basal one-third, apical two-thirds lined with fine denticles; lateral lobes concave on mesal faces (figure 695), bowed, cleft two-thirds their length.

Size.—Body length 2.5–4.7 mm; width 1.5–2.8 mm.

Type depository.—BMNH.

Type locality.—Mexico, Oaxaca, Yolos.

Distribution.—TX; Mexico to Costa Rica.

Host plants.—Bauhinia lunarioides (Texas); *B. coulteri, B. divaricata, B. macranthera, B. pauletia* (extralimital).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is similar to *Gibbobruchus divaricatae* in size and form but differs in density of the male pygidial pubescence, and extent and placement of the glabrous female pygidial spot. Male genitalia offer little assistance in distinguishing the two species. From the much smaller *G. mimus,* the pygidial characters offer the easiest differentiating characters (compare figures 690, 698, and 706 for males; figures 691, 699, and 707 for females).

Gibbobruchus divaricatae Whitehead and Kingsolver

(Figures 696–703)

Gibbobruchus divaricatae Whitehead and Kingsolver 1975a:183; Johnson and Kingsolver 1982:413; Udayagiri and Wadhi 1989:81.

Color.—Integument mostly piceous with some reddish variegation; antenna pale yellow with 7th to 10th segments usually fuscous; legs dark red, tarsi yellow, profemur, mesofemur and tibia, and metatibia banded with white. Vestiture variegated black, yellowish brown, and white; head yellowish brown in broad band across transverse sulcus and median spot on vertex, frons yellowish brown with scattered white setae; pronotum yellowish brown with scattered white patches; elytra variegated yellowish brown and white, elongate median patch velvety black (figure 696); male pygidium with fine, white setae and scattered yellowish patches, conspicuous white basal triangular patch (figure 698), female pygidium with white basal patch and scattered white patches (figure 699); venter of body mostly fine, white setae, row of white patches on sides of abdomen, yellow fringes on mesopleuron and metapleuron.

Structure.—Vertex, frons, and basal one-half of clypeus densely microfoveolate; ocular index 3:1 (figure 697); ocular sinus 0.7 as long as eye; antenna (figure 700) eccentric from 5th segment. Pronotum bell-shaped (figure 696), apex rounded, basal margin strongly sinuate, lateral margins strongly incurved; disk with prominent, sulcate median ridge, subbasal gibbosities prominent; gibbosities densely punctate-imbricate, remainder of discal sculpture with umbilicate foveolae; lateral carina obsolete; cervical sulcus distinct. Scutellum transverse, emarginate, sparsely pubescent. Elytral length and width subequal (figure 696); disk depressed between 6th interstices; lateral margin impressed behind humerus; striae sinuate, 3rd and 4th ending at base in prominent, denticulate gibbosity; interstices variable in width, 3rd, 5th, and 7th with setose protuberances, surface finely imbricate-punctate; metacoxal face densely micro-foveolate, setae directed laterad, fossula glabrous; metafemur with ventrolateral carina denticulate (figure 701), ventromesal carina finely denticulate, pecten consisting of one large, slender denticle separated from smaller distal, serrate denticles by gap; metatibia arcuate (figure 701), mucro nearly one-half as long as basitarsus; 1st abdominal sternum with patch of fine setae in male only, 5th sternum nearly divided by broad emargination; male pygidium strongly reflexed apically (figure 698), disk feebly channeled one-third from base, apical one-half with sulcate swelling limited laterally by rugose

vertical channels, punctation of remainder of disk dense, variable in size; female pygidium with prominent, glabrous, oval or cordate swelling (figure 699), basal one-half of disk finely punctate-granulose, lateral margins of swelling rugosely punctate.

Male genitalia.—As in figures 702 and 703; median lobe slender (figure 702); ventral valve triangular; internal sac lined with masses of fine spicules and denticles of various sizes; lateral lobes flat, spatulate, bowed (figure 703).

Size.—Body length 2.6–4.1 mm; width 1.8–2.6 mm.

Type depository.—USNM holotype No. 72803.

Type locality.—Mexico, Veracruz, 10 mi east of Acayucan.

Distribution.—TX; Mexico to Honduras.

Host plants.—Bauhinia divaricata. Three other species, *Bauhina pauletia, B. pescaprae,* and *B. ungulata,* are host to this species in Mexico.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is known from the United States only at Brownsville, TX. Its distribution appears to be mainly in Mexico.

Infested seeds are almost entirely hollowed out by a single larva. The adult emerges through the side of the seed.

The key characters will separate it from the other two U.S. species.

Gibbobruchus mimus (Say)

(Figures 53, 704–711)

Bruchus mimus Say 1831:2 (LeConte edition 1883:260); Fall 1910:162; Cushman 1911:493; Pic 1913a:35.

Mylabris mimus: Leng 1920:305; Knull 1934:211.

Gibbobruchus mimus: Bridwell 1938a:74; Craighead 1950:279; Bottimer 1968c:1022,1039; Whitehead and Kingsolver 1975a:203; Johnson 1977d:304; Johnson and Kingsolver 1982:413; Udayagiri and Wadhi 1989:81.

Bruchus crataegi Fahraeus 1839:119; Pic 1913a:35.

Bruchus murinus Schoenherr 1839:132 (misspelling of *mimus,* not *murinus* Boheman 1829).

Bruchus borealis Schoenherr 1839:132 (as new name for *murinus* Schoenherr).

Pseudopachymerus crataegi: Pic 1913a:10.

Color.—Integument mostly black, dark red integumental patches on elytra, pronotum, and margins of abdomen, elytra sometimes all red; legs red except ventral margin of metafemur dark red to black, tarsi reddish yellow; antenna reddish yellow usually with some club segments dusky. Vestiture yellow, white, orange, dark brown and black; head yellow with condensed patch on vertex; pronotum mostly orange with black on gibbosities, white patches in middle of disk; scutellum orange; elytra with mottled pattern of white, orange, yellow, and black, middle of disk with V-shaped velvety black spot (figure 704); male pygidium yellow with pale basal triangle (figure 706), apex with two or three bare patches; female pygidium with large, yellow basal triangle (figure 707), white setae surrounding polished, median, cordate swelling; venter of body mostly white, mesopleura and metapleura orange and yellow.

Structure.—Vertex finely punctate-imbricate, frons and clypeus longitudinally imbricate, frontal carina prominent; ocular index 2.6:1; ocular sinus five-eighths length of eye; antenna (figure 708) moderately eccentric from 5th segment, reaching middle of metepisternum. Pronotum subtriangular (figure 704), lateral margins incurved, disk with median, sulcate ridge, subbasal gibbosities obtuse, disk densely punctulate on raised portions, foveolate on depressed portions; lateral carina obsolete; cervical sulcus hidden in vestiture. Scutellum transverse, emarginate. Elytra

(figure 704) slightly depressed on 2nd and 4th interstices, sutural interstice elevated; striae sinuate, nearly parallel, 3rd and 4th ending basally in prominent, dentate gibbosity; interstices flat, punctate-imbricate, 2nd, 4th, 6th, and 8th with tufts of setae on slight elevations; metacoxal face densely punctulate except fossula glabrous, setae directed laterad; metafemur with ventromesal carina finely dentate (figure 709), pecten of one long and three short denticles not separated by gap, ventrolateral carina feebly denticulate; metatibia arcuate, mucro acute, curved, one-fifth as long as basitarsus; male 1st sternum with ovate patch of fine, white setae, 5th sternum emarginate one-half its length; male pygidium densely pubescent (figure 706); female pygidium (figure 707) extremely finely punctulate on swelling, densely punctate in surrounding areas.

Male genitalia.—As in figures 710 and 711; similar to those of *Gibbobruchus divaricatae;* lateral lobes strongly bowed (figure 711), cleft one-half their length.

Size.—Body length 2.3–3.5 mm; width 1.4–2.1 mm.

Type depository.—Type lost *(mimus);* NHRS *(crataegi).*

Type locality.—"Indiana." *(mimus);* "Carolina America borealis" *(crataegi).*

Distribution.—AL, AR, AZ, DC, FL, GA, IA, IL, IN, KS, KY, LA, MD, MI, MO, MS, NC, NV, OH, OK, ON, PA, SC, TN, TX, VA, WI, WV; Mexico.

Host plants.—Cercis canadensis, C. occidentalis; Bauhinia lunarioides. Adults have been collected on flowers of numerous other species of plants not the larval hosts—*Fraxinus, Magnolia* sp., and *Magnolia grandiflora,* for example.

Natural enemies.—Eupelmus cyaniceps; Heterospilus bruchi, H. prosopidis; Horismenus sp.; *Stenocorse bruchivora.*

Immatures.—Pfaffenberger 1986 (larva).

Discussion.—Salient characters for this species are male pygidium almost totally pubescent, female pygidium with cordate, glabrous swelling; ventrolateral carina of metafemur edentate, pecten with one long and three short denticles; median ridge of pronotum not as high as in *Gibbobruchus divaricatae* and *G. cristicollis.*

Both *Cercis canadensis* and *C. occidentalis* are confirmed larval hosts. Four specimens were reared from *Bauhinia lunarioides (=congesta)* along with several hundred specimens of *Gibbobruchus cristicollis.*

Genus *Lithraeus* Bridwell

Lithraeus Bridwell 1952:125; Bottimer 1968c:1022; Borowiec 1987:116; Udayagiri and Wadhi 1989:83; Kingsolver 1990c:49. Type species: *Bruchus electus* Bridwell 1952, by monotypy, unnecessary new name for *Bruchus elegans* Blanchard 1851.

Small size, *Acanthoscelides*-like, 1.4–3.8 mm.

Color.—Vestiture in some species condensed into lateral stripe or spot on metepisternum, stripe sometimes extended to abdomen.

Structure.—Vertex and frons convex, some species with frontal carina; eyes prominent; ocular sinus about one-half length of eye; antenna (figure 713) not sexually dimorphic. Pronotum semicircular to subconical, disk convex. Elytra with striae regular, not distorted. Pygidium convex, not modified, metafemoral denticle minute to one-half width of metatibia; metibia lacking longitudinal carinae; mucro short, acute, length less than apical width of tibia.

Discussion.—Bridwell thought that *elegans* was a homonym of Sturm 1843, but Sturm's name is a *nomen nudum* listed in a catalog with no description and was later cited by Gemminger and Harold (1873) as a synonym of *Bruchus chinensis* Linnaeus. See Bottimer (1968c:1022) and Kingsolver (1990c:49) for discussion.

Species now assigned to the genus *Lithraeus* are generally small (1.5–3.5 mm),

and the metatibia lack carinae. Nine species are found in Chile, but several (undescribed) are known from Brazil and Argentina, including *L. atronotatus*, which has been recently introduced into Hawaii.

Lithraeus atronotatus (Pic)

(Figures 712–716)

Bruchus atronotatus Pic 1929:35; Bondar 1936:43; Krauss 1962:132, 1963:282; Davis and Krauss 1962:245; Davis 1967:344.

Acanthoscelides atronotatus: Blackwelder 1946:758; Udayagiri and Wadhi 1989:37.

Lithraeus atronotatus: De Luca 1967a:20; Kingsolver 1968:322.

Color.—Pronotal integument entirely dark red or orange with dark red median band; elytra dark red with black maculae; pygidium dark red to orange-red with dark stripes; venter of body dark red, antenna mostly black; fore legs and mid legs reddish yellow with some duskiness on femora, metafemur mostly black, metatibia reddish yellow. Vestiture variable from white to grayish yellow, elytral maculae dark brown; head white; pronotum white to grayish yellow, often condensed laterally, pronotum white or grayish yellow, maculae usually black, sometimes dark brown; pygidium grayish yellow, basal triangle prominent; venter of body gray, usually condensed into setal spots on metepisternum and dorsal margin of abdomen.

Structure.—Vertex finely punctate, sometimes granulose, frons sometimes with median impunctate line; ocular index 3:1; ocular sinus three-fifths length of eye; antennal segments (figure 713) slightly eccentric, extending to humerus. Prono-tum bell-shaped (figure 712), lateral margins gently arcuate, evenly convex with shallow basal sulcus; disk densely microfoveolate; lateral carina absent; cervical sulcus short, deep. Scutellum quadrate, emarginate. Elytra slightly longer than wide (figure 712), convex; striae deep, narrow, punctures distinct, 3rd, 4th, 5th, and sometimes 6th each ending basally in pit twice as large as a strial puncture; interstices flat, minutely imbricate; meta-coxal face densely punctulate, fossula glabrous; metafemur (figure 714) moderately slender, lacking denticles; metatibia slender, lacking carinae, mucro minute, lateral and coronal denticles lacking; abdomen not modified; male pygidium convex, apex only slightly reflexed, female pygidium medially convex, with shallow sublateral sulci.

Male genitalia.—As in figures 715 and 716; median lobe moderately broad (figure 715); ventral valve broadly triangular, apex slightly produced; internal sac lined for its full length with mixed flat, scalelike denticles and acute, thornlike denticles; closure valve circular; lateral lobes fused, straplike (figure 716), slightly expanded toward apex, set with stout apical setae.

Size.—Body length 2.2 mm; width 1.2 mm.

Type depository.—MNHP.

Type locality.—Brazil.

Distribution.—Brazil, Argentina, Paraguay; introduced into Hawaii.

Host plants.—*Schinus terebinthifolius* (aroeira, Brazil); *Lithraea brasiliensis* (Brazil) (De Luca 1967a).

Natural enemies.—*Eurytoma* sp., *Horismenus* sp., *Zatropis* sp.

Immatures.—Not described.

Discussion.—This species was released in Hawaii in 1954 and 1960 by Krauss (1963) for control of *Schinus terebinthifolius* (Christmas berry, a serious weedy rangeland pest), but it did not increase to sufficient numbers to effect control. It is occasionally recovered in collections.

Lithraeus atronotatus is easily separated from other species in Hawaii by the lack of metatibial carinae and mucro, the lack of metafemoral denticles, and the shallow, undifferentiated female pygidial sulci. The pygidial sulci of female *Algarobius bottimeri* are deep and distinctly marked and of a

different texture than that of the surrounding surface.

Genus *Meibomeus* Bridwell

Meibomeus Bridwell 1946:54; Bottimer 1968b:288, 1968c:1023; Johnson and Kingsolver 1982:413; Borowiec 1987:81. Type species: *Bruchus musculus* (Say) 1831, by original designation.

Meibomerus: Arnett 1962:957 (error).

Small beetles (1.1–2.7 mm). Three species are treated herein.

Elytra and pronotum convex; head with prominent frontal carina; eyes prominent, ocular sinus deep, nearly dividing eye; antenna elongate, serrate; pronotum bell-shaped, dorsally convex; 4th elytral stria basally abbreviated, limited by fine denticle; fore legs and mid legs normally developed, procoxae contiguous; metafemur moderately swollen, lacking external ventral carina or denticles, inner margin with one to three fine denticles before pecten, pecten with one large denticle followed by three to five obliquely inserted, fine denticles, or with subequal fine denticles only; metatibia carinate, arcuate, mucro short or absent; abdominal sterna slightly telescoped in male, perceptibly emarginate to receive apex of pygidium; pygidium flat, or slightly convex, pattern not sexually dimorphic.

Male genitalia with median lobe elongated, slender, sometimes partly fractured near apex; lateral lobes fused basally into flat, straplike structure, apex divided into two lobes.

This genus is distributed from Canada to Argentina.

The tentative record of *Meibomeus apicicornis* (Pic) reported by Kingsolver (1995a:170) was based on an aberrant specimen of *Meibomeus musculus* (Say).

Taxonomy: Kingsolver and Whitehead 1976.

Keys to species: Kingsolver and Whitehead 1976 (North American continent).

Key to Species of *Meibomeus*

1 Body and appendages black except tarsal pads yellow; vestiture evenly distributed over body ***desmoportheus*** Kingsolver and Whitehead

Body black; part or all of antennae, fore legs, mid legs, and metatarsi yellow.....2

2(1) Vestiture yellowish gray; sides of pronotum more densely pubescent than disk (figure 725); elytra with median spot of dense pubescence on 3rd and on 7th interstices; pygidium with basal triangle and median line (figure 728) ***musculus*** (Say)

Vestiture white, thinly distributed, not condensed on pronotum (figure 732) (except for spot on basal lobe), elytra, or pygidium; Florida only ..... ***surrubresus*** (Pic)

Meibomeus desmoportheus Kingsolver and Whitehead

(Figures 717–724)

Meibomeus desmoportheus Kingsolver and Whitehead 1976:12; Johnson and Kingsolver 1982:413; Udayagiri and Wadhi 1989:85.

Color.—Body and appendages black except tarsal pads yellow. Vestiture white, evenly distributed over body; scutellum intensely white.

Structure.—Vertex and frons microfo-veolate; frontal carina prominent; eyes dimorphic: ocular index 10:1 in male (figure 718), 5:1 in female (figure 719); ocular sinus two-thirds length of eye; antenna dimorphic (figure 721), reaching nearly to apex of elytra in male, to middle of elytra in female; penultimate segment 1.25 times as long as wide in male, as long as wide in female. Pronotum bell-shaped (figure 717), lateral margins slightly sinuate; disk evenly convex except for slight subbasal depressions and basal median sulcus, surface densely, finely punctate to imbricate; lateral carina effaced; cervical sulcus deep. Scutellum small, quadrate.

Elytra 1.5 times as long as wide (figure 717), convex; striae narrow, slightly impressed, 4th stria abbreviated at base; interstices flat, finely imbricate. Metacoxal face finely punctate except fossula polished; hind leg as in figure 722; metafemur with three to five prepectenal denticles, pecten with one long and four to six minute denticles; metatibia basally arcuate, apically straight, lateral, lateroventral, ventral, and dorsomesal carinae complete to apex; mucro minute, as long as lateral denticle; abdomen not modified, sexes similar, male only slightly emarginate to receive pygidial apex; pygidium nearly flat in female, slightly convex in male (figure 720).

Male genitalia.—As in figures 723 and 724; median lobe fractured near apex (figure 723); ventral valve semicircular, nearly flat in lateral aspect, apex truncate, margin setose; internal sac with paired, thread-like basal tendons, middle of sac lined with blunt denticles, apex with fine, acute denticles; lateral lobes divided (figure 724), rounded, and slightly bowed at apices.

Size.—Body length 1.9–2.7 mm; width 1.0–1.5 mm.

Type depository.—USNM, holotype No. 72811.

Type locality.—Arizona, Cochise Co., Chiricahua Mountains.

Distribution.—AZ; Mexico to Costa Rica.

Host plants.—Desmodium grahamii.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This is the only species of *Meibomeus* in the United States with the body and appendages entirely black.

Meibomeus musculus (Say)

(Figures 59, 725–731)

Bruchus musculus Say 1831:3; Horn 1873:340; Schwarz 1878:457; Hubbard and Schwarz 1878:660; Blatchley 1910:1241; Fall 1910:185; Pic 1913a:36.

Meibomeus musculus: Bridwell 1946:54; Teran 1967:313; Bottimer 1968b:288, 1968c:1022; Kingsolver and Whitehead 1976:16; Johnson and Kingsolver 1982:413; Udayagiri and Wadhi 1989:85.

Bruchus erythrocerus Riley 1871:55; Bottimer 1968b:288.

Bruchus alboguttis Motschulsky 1874:215; Kingsolver 1979a:342.

Color.—Body integument black; male antenna entirely pale yellow, female partly infuscated; male mesofemur yellow, female mesofemur partly infuscated; tarsi, fore leg, and mesotibia yellow. Vestiture grayish white, variegated, vaguely condensed on flanks of pronotum, in an irregular band across middle of elytra, sometimes with condensed spots on pronotum and on 3rd and 7th interstices of elytra; and in three basal spots on pygidium with setae diagonally oriented toward midline (figure 728).

Structure.—Vertex finely foveolate, frontal carina fine, short, nearly concealed by setae (figure 727); eyes not sexually dimorphic; ocular index 4.75:1; ocular sinus seven-eighths length of eye; antenna (figure 726) not dimorphic, reaching posterior margin of metasternum. Pronotum bell-shaped (figure 725), lateral margins incurved or slightly sinuate; disk strongly convex, lacking asperities; surface densely, finely foveolate; lateral carina obtuse or absent. Scutellum small, prominent, densely pubescent. Elytra together slightly longer than wide (figure 725); striae normal except 4th abbreviated and denticulate at one-sixth from base; interstices flat, finely imbricate. Metacoxal face finely, densely punctate except fossula polished; hind leg as in figure 729, pecten with one long denticle separated by a gap from three short, slanted denticles; metatibia arcuate at base, apical three-fourths straight; lateral, ventrolateral, ventral, and dorso-mesal carinae complete; mucro short, slender, as long as lateral denticle. Abdomen telescoped, 5th sternum deeply emarginate for pygidial apex; male pygidium more deeply reflexed at apex (figure 728).

Male genitalia.—As in figures 730 and 731; median lobe slender (figure 730), not fractured near apex; ventral valve triangular, acute; internal sac with prominent, curved, tuberculate structures on either side of apical orifice, sac lined with fine denticles in basal three-fourths, apex lined with fine, beadlike denticles; lateral lobes with broad apical emargination between rounded lobes (figure 731).

Size.—Body length 1.6–2.7 mm; width 1.0–1.6 mm.

Type depository.—Types destroyed *(musculus, erythrocerus);* ZMUM *(alboguttis).*

Type locality.—Indiana *(musculus);* "Amer. Bor." *(erythrocerus);* Alabama, Mobile *(alboguttis).*

Distribution.—AL, AR, CT, DC, DE, FL, GA, IL, IN, IA, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, ON, PA, PQ, SC, TN, TX, WI, WV, VA.

Host plants.—Desmodium canescens, D. tenuifolium, D. tortuosum, D. triflorum; Lespedeza hirta. Most specimens are collected by general sweeping of vegetation.

Natural enemies.—None recorded.

Immatures.— Not described.

Discussion.—The two species of *Meibomeus* known from the eastern part of the country are easily separated by the characters in the key. The vestiture of *Meibomeus musculus* is dense, concealing most of the surface of the elytra and pygidium, whereas that of *M. surrubresus* is sparse and short, not concealing the surface. The geographic distribution of *M. desmoportheus* does not overlap either of these two species in the United States.

Teran (1967) first illustrated the male genitalia of this species.

Meibomeus surrubresus (Pic)

(Figures 732–738)

Bruchus surrubresus Pic 1933:18.

Acanthoscelides subrubrosus: Blackwelder 1946:761 (misspelling).

Acanthoscelides surrubresus: Schoonhoven 1977:692.

Meibomeus surrubresus: Kingsolver and Whitehead 1976:20; Janzen 1980:948; Mead 1989:2; Udayagiri and Wadhi 1989:86.

Color.—Body integument and hind legs, except tarsi, black; antennae usually bright yellow, sometimes with terminal five or six segments dusky, fore legs, mid legs and metatarsi yellow. Vestiture white, inconspicuous, evenly distributed except white tuft on basal lobe of pronotum and on scutellum.

Structure.—Vertex and frons umbilicate-foveolate; frontal carina prominent (figure 733); eyes dimorphic: ocular index 10:1 in males (figure 733), 6:1 in females (figure 734); ocular sinus dimorphic: one-half length of eye in males, two-thirds length of eye in females; antenna eccentric from 5th segment (figure 735), reaching 1st abdominal segment in males, reaching metacoxal margin in females. Pronotum bell-shaped (figure 732), strongly convex, without asperities; lateral margins slightly sinuate, surface punctate-imbricate, basal lobe sulcate; lateral carina lacking; cervical sulcus distinct. Scutellum small, quadrate. Elytra together 1.2 times as long as wide (figure 732), convex, slightly depressed around scutellum; striae normal, 3rd, 4th, and 5th not reaching basal margin, 4th ending in denticle; interstices finely punctate-imbricate. Metacoxal face finely punctate except fossula polished; hind leg as in figure 736, pecten with six to seven oblique, acute denticles; metatibia arcuate in basal one-half; lateral, ventrolateral, ventral, and dorsomesal carinae complete to apex; mucro short, acute, about as long as lateral denticle. Abdomen normal except 5th sternum of male slightly emarginate for apex of pygidium; pygidium with extremely fine, lunulate punctation.

Male genitalia.—As in figures 737 and 738; median lobe not fractured (figure 737); ventral valve ogival, acute; internal sac short, with ovate bundle of spicules at extreme base, three to four prominent,

dark sclerites at middle, apex lined with fine spicules; lateral lobes rounded at apices (figure 738), with U-shaped median cleft.

Size.—Body length 1.3–2.1 mm; width 0.7–1.2 mm.

Type depository.—MNHP.

Type locality.—Costa Rica, Puntarenas Prov., Surubres.

Distribution.—FL; Mexico to Panama.

Host plants.—Aeschynomene americana.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Specimens of this species were collected in the field near Ft. Pierce, Florida. Whether it constitutes a breeding population remains to be seen. Characters given in the key will easily separate *M. surrubresus* from *M. musculus.* The distribution of *M. surrubresus* and *M. desmo-porth-eus* is sympatric in Central America but not in the United States.

Genus *Merobruchus* Bridwell

Merobruchus Bridwell 1946:54; Bradley 1947:41; Arnett 1962:955; Johnson 1967:264, 1968:1269; Bottimer 1968c:1023; Johnson 1969c:55, 1969d:676; Kingsolver 1970a:374; Janzen 1975:180, 1980:948; Johnson 1981e:999; Janzen 1982:1274; Johnson and Kingsolver 1982:418; Borowiec 1987:86; Kingsolver 1988:4; Udayagiri and Wadhi 1989:87; Johnson and Siemens 1997b. Type species: *Bruchus julianus* Horn 1894:410, monotypic.

Small to medium-sized beetles (1.8-8.8 mm).

Body dorsally subdepressed or with elytra slightly concave. Head with frontal carina usually prominent (figure 747); ocular sinus about one-half length of eye; antenna gradually clavate from segment four, individual segments ovate or elliptical (figure 739). Lateral carina of pronotum with distinct sinuation at middle in lateral aspect; cervical sulcus distinct, usually narrow; cervical boss prominent, bisetose; prosternum Y-shaped, acutely triangular between coxae, sometimes separating coxal apices. Elytron with 3rd and 4th striae usually arising from denticles on summit of basal gibbosity (except major). Pygidium of male usually strongly reflexed apically to fit sternal emargination. Fore leg and mid leg not especially modified; metafemur strongly dorsoventrally swollen; ventral margin basad of pecten carinate, lacking fine denticles; pecten with three to five denticles, basal denticle usually larger than others and separated from them by gap of varying width; metatibia usually straight in apical three-fourths but bent sharply at base, in some species slightly arcuate; tibial carinae usually complete to apex; mucro of varying length. Fifth abdominal sternum usually carinate either side of caudal emargination, often more prominent in females.

Male genitalia with ventral valve nearly as broad as apical width of median lobe; internal sac usually with wishbone-shaped median sclerite or modification thereof, sclerites characteristic for each species. Lateral lobes spatulate, arms usually bowed; ventral strut flat, not carinate.

Biology: Center and Johnson 1974; Johnson and Siemens 1997b.

Host associations: Johnson and Siemens 1997b.

Revision: Kingsolver 1988.

Keys to North American species: Kingsolver 1988.

Key to Species of *Merobruchus*

1 Elytra with 3rd, 4th, 5th, and 6th striae each with a flattened, scalelike, triangular basal denticle (figure 763); subapical metafemoral denticle large, triangular, with five to six serrations on posterior margin, large denticle longer than metatibial width at their intersection (figure 767); body length 5.2-8.8 mm
..... *major* (Fall)

Third and 4th striae each with subbasal denticle usually set on gibbosity, sometimes with denticles fused into transverse carina; subapical metafemoral denticle as in figure 743 or 755; body length 1.8-5.5 mm 2

2(1) Pygidium dark brown with uninterrupted, attenuate, median white line of setae (figures 741 and 742); lateral margins of elytra irregularly darker than middle (figure 740); body length 2.9-3.3 mm ..... *insolitus* (Sharp)

Pygidium with short basal triangle or short line of setae, or with median line not strongly differentiated 3

3(2) Pygidium nearly uniformly pale yellow with small, irregularly rounded, median spot divided by narrow median line of setae (figure 753); apical two-fifths of elytra usually clouded with dark brown (figure 752); body length 3.2-4.1 mm.....male *knulli* (White)

Pygidial and elytral patterns otherwise.....4

4(3) Pygidium with heart-shaped, median, dark brown, bare area with transverse basal band and short median dart pale yellow (figure 754); body length 3.2-4.1 mm
.....female *knulli* (White)

Pygidium uniformly pubescent with contrasting basal triangle (figure 759) or irregularly pubescent with vaguely defined basal triangle (figure 771).....5

5(4) Pygidium uniformly pubescent with contrasting basal triangle.....6

Pygidium irregularly pubescent.....7

6(5) Ventral valve of median lobe truncate or broadly emarginate (figure 761); Florida and West Indies ..... *lysilomae* Kingsolver

Ventral valve of median lobe rounded apically (figure 774); Kansas, Oklahoma, Texas, Arizona through Central America
.....*placidus* (Horn)

7(5) Third elytral interstice with elongate, median golden stripe, and short, subapical spot distinct from predominantly gray discal vestiture; basal margin of elytra with patches of golden setae; pronotal vestiture predominantly gray with golden median stripe; male genitalia as in figures 750 and 751
..... *julianus* (Horn)

Third interstice with median stripe distinct, evanescent, or absent; if present, is part of irregular, transverse golden band of short stripes or spots on lateral interstices; pronotal vestiture golden yellow or grayish yellow.....8

8(7) Pronotal vestiture dense and conspicuous, especially on lateral portions (figure 776); mesepimeron, metepisternum, metacoxal face, and 5th sternum with dense patches of golden setae; male genitalia as in figures 779 and 780
.....*terani* Kingsolver

Pronotal vestiture sparse and inconspicuous, more or less evenly distributed over disk (figure 781); mesepimeron and posterior angle of metepisternum with inconspicuous patch of yellow setae; male genitalia as in figures 784 and 785 ..... *vacillator* (Sharp)

Merobruchus insolitus (Sharp)

(Figures 740–745)

Bruchus insolitus Sharp 1885:476; Pic 1913a:29.

Acanthoscelides insolitus: Blackwelder 1946:759.

Merobruchus insolitus: Johnson 1979a:122; Janzen 1980:948; Johnson 1981a:251; Johnson and Kingsolver 1982:418; Kingsolver 1988:21; Udayagiri and Wadhi 1989:88.

Merobruchus sp.: Gibson 1972:148.

Color.—Integument dark red to black, head dark red; pronotum dark red tending toward black; elytra red except humeri and lateral margins clouded with black, usually with dark spots on 3rd interstice and apex, lateral clouding sometimes extended mesad as dark maculation; pygidium

piceous with dark red median streak; antenna reddish yellow, usually with 8th, 9th, and 10th segments dusky; fore legs and mid legs reddish yellow, hind legs dark red. Vestiture yellowish white, white, and brown; dorsal clothing mostly yellowish white to white, dark spots on dorsum brown; venter of body white, pygidium intermixed brown and white patches with median, attenuate white dart reaching nearly to apex (figures 741 and 742), sometimes "pinched" in middle but not interrupted.

Structure.—Vertex above transverse sulcus densely punctate-foveolate, frontal punctures longitudinal, frontal carina distinct; ocular index 4:1; ocular sinus one-half length of eye; antenna clavate, extending to humerus. Pronotum subconical, lateral margins nearly straight (figure 740); disk evenly convex, surface densely umbilicate-foveolate, foveolae sometimes coalescing; lateral carina ridgelike, sinuate; cervical sulcus deep. Scutellum transverse, apically emarginate; postmesal sulcus angulate. Elytral disk depressed (figure 740); striae narrow, shallow, parallel except 2nd, 3rd, and 4th slightly deflected laterad at base with 3rd and 4th ending in small, adjacent denticles on low gibbosity; strial punctures fine, elongate; metacoxal face, except fossula, densely punctate; hind leg as in figure 743; metafemur with one long and three short denticles in pecten; metatibia with four prominent carina, mucro short, angulate. Pygidium slightly convex, densely punctulate.

Male genitalia.—As in figures 744 and 745, median lobe broad at apex, ventral valve semicircular with distinct apical nipple (figure 744); internal sac with cluster of minute denticles and two thornlike denticles near base, middle of sac with three acute, subequal spines, apex partly lined with minute denticles; closure valve circular; lateral lobes flat, cleft one-half their length (figure 745), apices spatulate, mesal faces setose.

Size.—Body length 2.9-3.3 mm; width 1.0-2.0 mm.

Type depository.—BMNH.

Type locality.—Guatemala, near Guatemala City.

Distribution.—AZ, TX; Mexico to Costa Rica.

Host plants.—Pithecellobium pallens; Lysiloma microphylla thornberi. Fourteen additional hosts from Mexico southward are listed by Kingsolver (1988:35). See also Johnson and Siemens (1997b).

Natural enemies.—Chryseida spinola bennetti; Horismenus missouriensis; Urosigalphus bruchi, U. neobruchi.

Discussion.—The salient characters that mark this species are the dark red body, elytral margins clouded with black, white basal pygidial triangle elongated into evenly tapered dart, and, in the male genitalia, the apical nipple on the ventral valve, three subequal median sclerites, and the basal pair of small, thornlike sclerites.

Merobruchus julianus (Horn)

(Figures 49, 64, 74, 746–751)

Bruchus julianus Horn 1894:410; Fall 1910:186, 1912:320; Wenzel 1912:140.

Mylabris julianus: Leng 1920:304; Boeving 1927:141.

Acanthoscelides julianus: Blackwelder 1946:759.

Merobruchus julianus: Bridwell 1946:54; Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1024; Johnson 1967:264, 1968:1269; Bottimer 1969b:1187; Johnson 1969c:55, 1969d:676; Forister and Johnson 1970:84; Kingsolver 1970a:374; Johnson 1979a:122; Johnson and Kingsolver 1982:418; Borowiec 1987:86; Kingsolver 1988:11; Udayagiri and Wadhi 1989:88.

Bruchus ochreolineatus Fall 1910:186; Cushman 1911:492; Johnson 1968:1269; Johnson and Kingsolver 1982:418; Kingsolver 1988:11; Udayagiri and Wadhi 1989:88.

Bruchus ochrolineatus: Pic 1913a:38 (misspelling).

Color.—Integument dark red to black; distal antennal segments usually darker than proximal segments. Vestiture gray, coppery, brown, and yellow; head gray, lateral slopes of pronotum gray with yellow patches, disk brown with white patches and median yellow stripe, elytra with variably intermixed brown and gray, 3rd interstice with elongate stripe and subapical spot yellow, evanescent gray or yellow bands two-fifths from base and one-fifth from apex; pygidium yellow with evanescent basal triangle, disk with variable brown patches; venter of body mostly gray, three yellow patches on metepisternum and metacoxa, yellow spots sometimes evident on lateral margin of abdomen; legs gray.

Structure.—Vertex and frons densely punctulate, transverse sulcus distinct, frontal carina prominent (figure 747); ocular index 3:1; ocular sinus one-half as long as eye; antenna eccentric from 5th segment, extending to middle of metepisternum; Pronotum subconical (figure 746), lateral margins nearly straight; disk slightly depressed, posterolateral corners depressed; sculpture microfoveolate, each foveola setate beneath its anterior rim; lateral carina represented by intermittent row of denticles hidden in vestiture. Scutellum transverse, apical margin deeply emarginate. Elytra slightly depressed between 5th interstices (figure 746); striae parallel except 3rd, 4th, and 5th deflected laterad at base, 3rd and 4th each ending in basal denticle on prominent gibbosity, strial punctures foveolate, encroaching on interstitial margins; interstices finely imbricate; metacoxa densely punctulate and setose except fossula glabrous; hind leg as in figure 749; ventral face of metafemur flattened, ventromesal margin carinate, pecten with four to five denticles, the 1st denticle longer than others; metatibial carinae prominent, complete; mucro one-fourth as long as basitarsus; lateral denticle one-fourth as long as mucro. Margin of 5th abdominal sternum finely carinate in both sexes, not developed into processes; pygidium densely foveolate, crowded, coalescent, middle of disk with shallow median depression (figure 748).

Male genitalia.—As in figures 750 and 751, median lobe broad (figure 750); ventral valve nearly semicircular; internal sac lined with minute spicules and denticles, middle of sac with one large, broad-based, ogival sclerite flanked either side by tapered, elongate spine, apex of sac sparsely denticulate; closure valve circular; lateral lobes cleft three-fourths their length (figure 751), arms moderately broad, apices diagonally truncated, mesal faces setose for entire length.

Size.—Body length 3.2-5.5 mm; width 1.9-3.1 mm.

Type depository.—CASC (*julianus,* lectotype No. 285 D, 10474, by Johnson 1969d); MCZC (*ochreolineatus,* holotype No. 25057).

Type locality.—Texas, San Ignacio (lectotype) *(julianus);* Arizona, Jerome *(ochreolineatus).*

Distribution.—TX; Mexico.

Host plants.—*Acacia berlandieri, A. greggi, A. rigidula, A. roemeriana, A. wrightii; Desmanthus illinoensis* (questionable); *Mimosa borealis* (questionable); *Pithecel-lobium ebano* (all in the United States). *Acacia coulteri* and *A. juncifolia* are listed from Mexico. According to Rico-Arce (1991), the name *"ebano"* is a senior synonym of *"flexicaulis"* (Benth.) Coult.

Natural enemies.—*Eupelmus cushmani, E. cyaniceps; Stenocorse bruchivora; Urosigalphus bruchi, U. bruchivorus,* and three unidentified species of *Eurytoma.*

Immatures.—Not described.

Discussion.—Johnson (1968) designated a lectotype from Texas in the Academy of Natural Sciences in Philadelphia but later rescinded that action in favor of selection from a series of specimens in CASC from which he (1969d) designated a lectotype that corresponded to the data given in the original description. Kingsolver (1988)

erroneously listed MCZC as type depository of *M. julianus* following Johnson's 1968 paper. The bruchid types in the Academy were later transferred to the Museum of Comparative Zoology at Harvard.

Kingsolver (1988:12) included some of Bottimer's field notes in which he indicated the differences in feeding habits of *M. julianus* in two host seed pods. A larva attacking *Acacia berlandieri,* because of its size relative to that of the seed, will glue several seeds to the inside of the pod valve to provide sufficient seed material to complete its development. After eclosion, the adult then will cut through the valve to escape (Johnson 1967). Although seeds of this host normally fall to the ground when the pod dehisces, those fastened to the valve remain attached. In contrast, *M. julianus,* in attacking the larger-seeded *Acacia greggi,* does not glue the seeds to the pod valve since each larva requires only one seed to complete its development, and the adult will cut through only the seed coat, not the valve, to escape. See also Forister and Johnson (1970:84) for further description of the bionomics of *M. julianus.*

Merobruchus knulli (White)

(Figures 752–757)

Bruchus knulli White 1941:189.

Mylabris knulli: Blackwelder and Blackwelder 1948:44.

Merobruchus knulli: Bottimer 1968c:1024; Johnson 1968:1269, 1979a:123, 1981a:251; Johnson and Kingsolver 1982:418; Kingsolver 1988:18; Udayagiri and Wadhi 1989:88.

Color.—Integument reddish brown; apical one-third of elytra, especially in male, clouded with dark brown to black (figure 752); male pygidium with small, irregularly rounded spot divided by medial line of setae (figure 753); female pygidium with large, brown, cordate patch (figure 754); basal seven antennal segments yellow, terminal four dark brown. Vestiture gray, yellow, dark brown, and black; head, pronotum, and pygidium (except median spots) yellow; venter of body gray with yellow patches on metepisternum; male elytra yellow with gray spots, female elytra gray, female pygidial patch with fine brown setae.

Structure.—Vertex and frons densely punctulate with different sizes; frontal carina weak, impunctate with irregular margins; ocular index 3.5:1; ocular sinus one-half length of eye; antenna clavate, 5th to 10th segments eccentric. Pronotum subconical (figure 752), lateral margins straight; disk convex, faintly sulcate on basal lobe, posterolateral corners impressed; surface densely, irregularly foveolate-punctate, lateral carina arcuate at middle one-third; cervical sulcus deep, narrow. Scutellum transverse, emarginate. Elytra broadly depressed between 5th striae (figure 752); striae shallow, narrow, 3rd and 4th ending at base in triangular denticles on low gibbosity, 5th and 6th sometimes denticulate, interstices flat, densely imbricate; metacoxal face densely, evenly punctulate except fossula glabrous, polished. Hind leg as in figure 755; pecten with long denticle separated by small gap from three smaller, distal denticles; metatibia slightly arcuate, dilated toward apex; tibial carinae complete to apex; mucro one-sixth to one-eighth as long as basitarsus, coronal denticles three. Pygidial disk finely imbricate.

Male genitalia.—As in figures 756 and 757; median lobe broad (figure 756), apically expanded; ventral valve truncate, internal sac with large, V-shaped, skewed sclerite near base, paired cluster of fine spicules in middle of sac; lateral lobes slender (figure 757), spatulate, deeply cleft, densely, finely setose on mesal faces.

Size.—Body length 3.2-4.1 mm; width 1.9-2.6 mm.

Type depository.—OSUC.

Type locality.—Arizona, Huachuca Mountains.

Distribution.—AZ; Mexico to Honduras.

Host plants.—*Lysiloma microphylla thornberi* in the United States; *L. watsoni* and *L. acapulcensis* extralimital.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Nothing is known of the life history of this species except the host associations. It is most similar to *Merobruchus xanthopygus* from southern Mexico and Central America, but it can be distinguished from other U.S. species by its pygidial pattern and distinctive male genitalia.

Merobruchus lysilomae Kingsolver

(Figures 758–762)

Merobruchus lysilomae Kingsolver 1988:25; Kingsolver 1992b.

Color.—Integument reddish brown to dark brown, elytra mottled with dark brown spots and evanescent bands (figure 758), antenna, fore legs and mid legs, metatarsi yellowish red; pronotum often with broad, red, median stripe. Vestiture short, yellowish gray except dark brown on elytral spots and occasionally on pygidium, pronotal flanks with dense yellow clothing; pygidium with basal triangular pad of setae (figure 759).

Structure.—Vertex transversely punctate, transverse sulcus feeble, frons densely punc-tate, sometimes with triangular impunctate boss, frontal carina feeble or absent; ocular index 4:1; ocular sinus one-half as long as eye; antenna gradually clavate, segments eccentric from 5th segment, extending to humerus. Pronotum subconical (figure 758), lateral margins nearly straight, apex rounded; disk convex, basal lobe feebly sulcate, surface densely but discretely microfoveolate, each foveola with median seta, interspaces rugosely punctate; lateral carina intermittent, arched at middle; cervical sulcus deep, narrow. Scutellum transverse, broadly emarginate. Elytra together slightly longer than broad (figure 758); disk depressed, especially around scutellum; striae shallow, parallel, slightly deflected laterad at base, 3rd and 4th minutely denticulate on basal margin, strial punctures distinct; interstices flat, imbricate; metacoxal face finely, evenly punctate except fossula glabrous; hind leg as in figure 760; pecten with three or four denticles gradually decreasing in length; metatibia abruptly bent at base, gradually dilated toward apex; carinae complete except ventrolateral obsolete apically; mucro short, only slightly longer than lateral denticle, coronal denticles three. Pygidial disk finely strigose, strigae unevenly distributed; ventral emargination of 5th sternum carinate.

Male genitalia.—As in figures 761 and 762; median lobe broad (figure 761); ventral valve as broad as median lobe, apical margin shallowly emarginate; internal sac with folds near base lined with fine spicules, middle of sac with inverted Y-shaped sclerite (wishbone), and two thornlike sclerites, middle one-third of sac lined with fine denticles; apex with C-shaped closure valve; lateral lobes as in figure 762, cleft nearly to base.

Size.—Body length 2.4-3.1 mm; width 1.4-1.7 mm.

Type depository.—CNCI.

Type locality.—Florida, Royal Palm Park.

Distribution.—FL; West Indies.

Host plants.—*Acacia richei, A. simplex* (*A. simplicifolia* of authors); *Albizia lebbeck, A. polyphylla; Lysiloma latisiliqua.* In Cuba, this bruchid is known from *Lysiloma sabicu* Bentham.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Salient characters for this species are the sparse body clothing, evenly convex pronotal disk, minute basal strial denticles, and male genitalia with Y-shaped sclerite and two mesal, thornlike sclerites. It is the only species of *Mero-bruchus* in the eastern part of the United States.

Merobruchus major (Fall)

(Figures 72, 763–769)

Bruchus major Fall 1912:320; White 1941:189.

Mylabris major: Leng 1920:304.

Merobruchus major: Bradley 1946:41; Blackwelder and Blackwelder 1948:44; Johnson 1967:264; Bottimer 1968c:1023; Johnson and Kingsolver 1982:418; Kingsolver 1988:7; Udayagiri and Wadhi 1989:88.

Bruchus flexicaulis Schaeffer 1904:229 (manuscript name).

Acanthoscelides flexicaulis: U.S. Department of Agriculture 1940:36, 1942:7,24, 1944:6,24, 1945:7,24; Zacher 1952:465.

Merobruchus flexicaulis: Wheeler et al. 1950:23,37.

Acanthoscelides flexicaule: Zacher 1952:470 (lapsus).

Bruchus julianus: Schaeffer 1904:229 (misidentification); Cushman 1911:491 (misidentification).

Mylabris julianus: Boeving 1927:133 (misidentification).

Color.—Integument dark red to black; head dark red, antenna red, usually with 8th to 10th segments dusky; pronotum, elytra, abdominal sterna, and hind legs mottled; pygidium mostly uniformly dark red, occasionally with darker median spot. Vestiture white, dark brown, and yellow; vertex, frons, and median stripe of pronotum yellow, flanks of pronotum and legs mostly white; pygidium white to yellowish brown with white basal triangle (figures 765 and 766).

Structure.—Vertex finely, densely punctulate, hidden by vestiture, frons more coarsely punctate, transverse sulcus and frontal carina minutely granulose (figure 764); ocular index 3.5:1; ocular sinus one-third as long as eye; postocular lobe elongated, lunate; antennal segments eccentric from 5th segment, reaching elytral humerus. Pronotum bell-shaped (figure 763), lateral margins incurved with slight bulge at middle; disk convex, feebly sulcate but deeper on basal lobe, with subbasal gibbosities either side opposite bases of 4th interstices; lateral carina arched at middle. Scutellum transverse, broadly emarginate. Elytra broadly depressed between 5th striae (figure 763); striae narrow, parallel, slightly deflected laterad in basal one-half, bases of 4th, 5th, 6th, and sometimes 3rd armed with large, flat denticles; interstices mostly flat, minutely imbricate; metacoxal face densely punctulate in lateral one-half, less dense in proximal one-half, polished, impunctate either side of fossula; hind leg as in figure 767; pecten with four to five denticles gradually decreasing in length; basal one-fourth of metatibia arcuate, gradually dilated toward apex; lateral, ventrolateral, ventral, and dorsomesal carinae complete to apex; mucro acute, slender, one-fourth length of basitarsus, coronal denticles three. Pygidium (figures 765 and 766) broadly sulcate along midline, middle of disk with inverted V-shaped depression, punctation concealed by vestiture.

Male genitalia.—As in figures 768 and 769; median lobe broad (figure 768), ventral valve cordate, apex rounded; internal sac densely lined with fine spicules, devoid of large sclerites; lateral lobes short (figure 769), bowed, flat, cleft two-thirds their length, mesal faces densely setose.

Size.—Body length 5.2-8.8 mm; width 2.8-4.7 mm.

Type depository.—MCZC (*major,* holotype No. 25056); USNM (*flexicaulis,* lectotype No. 42446).

Type locality.—Texas, Brownsville *(major);* Texas, Esperanza Ranch *(flexicaulis).*

Distribution.—TX; Mexico.

Host plants.—Pithecellobium ebano. Both *Merobruchus major* and *Stator beali* are seed predators on this host; however, *S. beali* also attacks other species of *Pithecellobium* whereas *M. major* is an obligate predator of *P. ebano.* According to

Rico-Arce (1991), the name *"ebano"* predates *"flexicaulis"* and must be used for this species.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is the largest in this genus. It is sometimes confused with *Merobruchus julianus* but size overlaps only slightly, elytral 3rd, 4th, 5th, and 6th strial bases of *M. major* are set with prominent, flattened denticles, and male genitalia are devoid of large sclerites.

Schaeffer (1904) discussed, under the name *"julianus,"* a "gigantic *Bruchus* on *Acacia flexicaulis,* in the large seed pods of which it undoubtedly breeds." He distributed specimens under the manuscript name *"flexicaulis"* but never formally described the species. The name was first listed as a synonym of *Bruchus julianus* and subsequently as an unavailable name. According to the 1985 International Code of Zoological Nomenclature, a name may be made available if it was used as the name of a taxon prior to 1961. In 1940, the U.S. Department of Agriculture List of Intercepted Plant Pests lists *Acantho-scelides flexicaulis,* and subsequent issues used this combination (U.S. Department of Agriculture 1940, 1942, 1943, 1944, 1945). Wheeler et al. (1950), listed *Merobruchus flexicaulis* (Schaeffer), and in 1952 Zacher used *Acanthoscelides flexicaulis.* Although *flexicaulis* predates *major,* I prefer to use *major* in the interest of stability since it has been used in several taxonomic publications. Application to the International Congress should be made to suppress the name *"flexicaulis."*

Merobruchus placidus (Horn)

(Figures 770–775)

Bruchus placidus Horn 1873:341, 1894:345; Fall 1910:184; Cushman 1911:498.

Mylabris placidus: Leng 1920:306.

Acanthoscelides placidus: Blackwelder 1946:760.

Merobruchus placidus: Johnson 1967:264; Bottimer 1968c:1024; Johnson 1968:1269, 1969c:55, 1979a:123, 1981a:251; Johnson and Kingsolver 1982:418; Kingsolver 1988:27; Udayagiri and Wadhi 1989:89.

Bruchus limpidus Sharp 1885:456; Cushman 1911:498; Pic 1913a:31.

Acanthoscelides limpidus: Blackwelder 1946:760.

Merobruchus limpidus: Johnson and Kingsolver 1977:154.

Color.—Integument dark red to dark brown with some sternal areas black; antennae, fore legs, and mid legs yellowish red, hind legs dark red. Vestiture short, grayish yellow, white, and brown, the latter on elytral maculations; venter of body white; pronotal vestiture varying from nearly uniformly yellowish gray to a pattern of median and lateral lines; pattern of elytra varying from nearly unicolorous to pattern of lateral and apical dark brown maculae with elongate, yellowish spot on 3rd interstice; pygidium yellowish with variable triangular basal spot (figures 771 and 772).

Structure.—Vertex densely, finely punctate, frons more coarsely punctate; transverse sulcus feeble; frontal carina vaguely delimited; ocular index 3:1; ocular sinus five-eighths length of eye; antenna gradually clavate, segments eccentric from 5th segment, extending to humerus. Pronotum bell-shaped (figure 770), lateral margins slightly sinuate, apex gently rounded; disk mostly convex, sulcate on median lobe, impressed on posterior corners; surface densely but irregularly foveolate, each foveola with median seta; interspaces densely punctate; lateral carina discernible only at middle of margin; cervical sulcus short, deep. Scutellum transverse, broadly emarginate. Elytra about as long as wide (figure 770), convex except depressed around scutellum; striae parallel, only slightly deflected laterad near base, 3rd and 4th ending in basal denticles on slight protuberance; striae shallow, narrow;

interstices flat, imbricate; metacoxal face discretely punctate in lateral one-half, punctures crowded at mesal one-half, fossula glabrous; hind leg as in figure 773; pecten with four denticles gradually decreasing in size; metatibia strongly bent at base, dilated toward apex, all tibial carinae complete to apex, or with ventrolateral carina abbreviated at apex; mucro short, angulate, lateral and coronal denticles minute. Fifth sterna not carinate in either sex; pygidium convex; surface minutely imbricate.

Male genitalia.—As in figures 774 and 775; median lobe broad (figure 774), ventral valve arcuate, variable in outline; armature of internal sac consisting of paired, elongate sclerites near base, middle with subtriangular sclerite, and apex with paired thornlike sclerites, sac lined with spicules and denticles of various sizes; closure valve C-shaped; lateral lobes short, broad (figure 775), cleft two-thirds their length.

Size.—Body length 1.8-2.8 mm; width 1.1-1.8 mm.

Type depository.—MCZC (*placidus*, lectotype No. 8210, by Johnson 1968); BMNH *(limpidus).*

Type locality.—"Texas" *(placidus);* Guatemala, Capetillo *(limpidus).*

Distribution.—AZ, OK, KS, TX; Mexico to Costa Rica.

Host plants.—Acacia angustissima angus-tissima, Acacia angustissima hirta, A. angustissima suffrutescens, A. angustissima texensis; Astragalus sp. The variety *A. angustissima angustissima* is found only in Mexico and Central America. Kingsolver (1988) erroneously listed *Acacia suffrutescens* as *A. suffruticosa.* See Kingsolver (1988) for additional host species of *Acacia* in Mexico and Central America.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Merobruchus placidus is the most variable and widespread species in the genus on the North American continent. This variation is reflected in the several variants in form of the male genitalia (see Kingsolver 1988). Additional and systematic collecting is needed to determine the true status of the species—whether it is a widely varying species or a cluster of closely related sibling species. Most of the host records are of *Acacia angustissima* and its varieties.

The habitus of this bruchid closely approaches that of some species of *Acanthoscelides,* but the basal strial denticles, enlarged hind leg, and form of male genitalia are diagnostic.

Merobruchus terani Kingsolver

(Figures 776–780)

Merobruchus species 4: Johnson 1979a:123.

Merobruchus terani Kingsolver 1980a:256; Janzen 1980:936,948; Johnson and Kingsolver 1982:418; Kingsolver 1988:20; Udayagiri and Wadhi 1989:90.

Color.—Integument deep red to piceous, antennae yellowish red with 7th to 10th segments dusky; fore tarsi and mid tarsi yellowish red. Vestiture yellowish orange, gray, and dark brown; head, pronotum, scutellum, and elytra orangish yellow, darker spots in pattern with dark brown setae; pygidium dense yellow; venter and pleuron of body gray except yellow patches on mesepimeron, metepisternum, and sides of 5th sternum.

Structure.—Vertex finely, densely punctate, frons more coarsely punctate; transverse sulcus well-marked; frontal carina an impunctate median line; ocular index 3.3:1; ocular sinus six-tenths as long as eye; antenna clavate, extending to humerus, 5th to 10th segments eccentric, terminal segment elliptical. Pronotum bell-shaped (figure 776), lateral margins nearly straight; disk convex but sulcate on basal lobe, slightly impressed near lateral corners; surface with densely crowded umbilicate foveolae, interspaces punctulate; lateral carina medially arcuate but obsolete

near forecoxal cavity. Scutellum transverse, broadly emarginate; cervical sulcus short, deep. Elytra as long as wide (figure 776); disk depressed between 5th striae; striae parallel, 3rd and 4th each ending at base in flat denticle on low tumescence, striae shallow but distinct; interstices flat, minutely imbricate; postmesocoxal sulcus strongly angulate; metacoxal face densely punctate except fossula glabrous; hind leg as in figure 778; pecten with one long and three short denticles.

Male genitalia.—As in figures 779 and 780; median lobe (figure 779) suddenly expanded near apex, lateral margins embracing base of ventral valve heavily sclerotized; ventral valve transverse, lunate; internal sac lined with fine denticles and setae, middle of sac with inverted Y-shaped sclerite; apex of sac denticulate; closure valve circular; lateral lobes moderately broad (figure 780), slightly bowed, apices expanded mesad, cleft three-fourths their length.

Size.—Body length 2.9-4.5 mm; width 1.9-2.5 mm.

Type depository.—USNM, holotype No. 72818.

Type locality.—Costa Rica, Guanacaste Prov., Santa Rosa N.P.

Distribution.—TX; Mexico to Costa Rica. This species was first reported from Southmost in extreme southern Texas.

Host plants.—No host records are known in the United States, but two of the host plants listed by Kingsolver (1988) from northern Mexico, *Acacia berlandieri* and *A. angustissima,* also occur in Texas. The type series was reared from *A. tenuifolia* Willd.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—*Merobruchus terani* is most similar to *M. vacillator* among the U.S. species, but the elytra of *M. terani* are nearly quadrate and the pronotal margins are concave, whereas the elytra of *M. vacillator* are longer than wide and the pronotal margins are straight or slightly bowed. Male genitalia are distinctive (compare figures 779 and 784).

Merobruchus vacillator (Sharp)

(Figures 71, 781–785)

Bruchus vacillator Sharp 1885:457; Pic 1913a:54.

Acanthoscelides vacillator: Blackwelder 1946:761.

Merobruchus vacillator: Bottimer 1968c:1024; Johnson and Kingsolver 1982:418; Kingsolver 1988:15; Udayagiri and Wadhi 1989:90.

Color.—Integument reddish brown to deep purplish red with pale reddish variegation; basal seven antennal segments reddish yellow, 8th to 11th dark red; fore legs and mid legs usually paler red than hind leg. Dorsal vestiture grayish yellow in vague pattern (figure 781), pronotum with transverse band and two spots; venter of body gray with yellow patches on metepisternum and sides of abdomen; pygidium (figure 782) yellow with median bare spot.

Structure.—Vertex finely punctate, transverse sulcus feeble, frons more coarsely punctate, frontal carina absent or intermittent; ocular index 3:1; ocular sinus six-tenths as long as eye; antenna gradually clavate, segments eccentric from 5th, extending to humerus. Pronotum bell-shaped (figure 781), lateral margins nearly straight, apex evenly rounded; disk convex, basal lobe feebly sulcate, basal margin impressed either side of basal lobe; surface densely foveolate, each foveola umbilicate and setose; lateral carina ridgelike, arched. Scutellum quadrate, emarginate, densely pubescent. Elytra slightly longer than wide (figure 781); striae parallel, 1st, 2nd, and 3rd laterally deflected toward base, 3rd and 4th each ending in basal denticle on common tumescence, striae narrow, deep; interstices flat, coarsely imbricate; metacoxal face densely, uniformly punctate except fossula glabrous; hind leg as in figure 783; pecten with one long, sharp

denticle, separated by gap from two smaller distal denticles; metatibia bent at base, slightly dilated toward apex; all carinae except ventrolateral complete to apex; mucro short, scarcely longer than lateral denticle. Female 5th sternum with carinate projections either side of anal notch, projections lacking in male; pygidial disk densely microfoveolate, each foveola bearing seta from its anterior rim.

Male genitalia.—As in figures 784 and 785; median lobe broad (figure 784), expanded at apex; ventral valve transverse, arcuate; armature of internal sac consisting of fine denticles at apical orifice, an inverted V-shaped sclerite near base of sac, two large, thornlike denticles in middle, an amorphous, sclerotized structure near apex, and fine denticles lining extreme apex; closure valve circular; lateral lobes slender (figure 785), slightly bowed, cleft nearly to base, densely setose on mesal faces.

Size.—Body length 2.7-3.3 mm; width 1.6-1.9 mm.

Type depository.—BMNH.

Type locality.—Mexico, Guanajuato.

Distribution.—TX; Mexico.

Host plants.—No records for the United States. *Lysiloma divaricatum* in Mexico.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species, like *M. terani,* is represented by one collection in southern Texas, the northern extension of a Mexico-Central American distribution. It most closely resembles *M. terani,* but in *M. terani* the elytra are quadrate, the dorsal vestiture is bright yellow, and the male genitalia are distinctive (see discussion of *M. terani*).

Genus *Mimosestes* Bridwell

Mimosestes Bridwell 1946:54; Bradley 1947:39; Blackwelder and Blackwelder 1948:45; Bottimer 1968c:1024; Johnson 1968:1269; Kingsolver and Johnson 1978; Johnson 1983b; Borowiec 1987:86; Udayagiri and Wadhi 1989:90; Johnson and Siemens 1995b. Type species: *Bruchus sallaei* Sharp 1885, by original designation (=*nubigens* Motschulsky).

Cercidiestes Bridwell 1946:55. Type species: *Bruchus ulkei* Horn 1873, by original designation.

Small to medium sized beetles (1.6–6.0 mm). Seven species.

Elongate-ovate, subfusiform. Integument dark red to black; vestiture variable according to species. Head with frons usually glabrous, impunctate frontal line expanded into Y-shaped or diamond-shaped boss above and between eyes (figure 57); ocular sinus less than one-half length of eye; posterior margin of eye protruding from side of head or merging with lateral surface of head; antenna moderately eccentric (as in figure 818), usually extending to humerus, not sexually dimorphic. Pronotum bell-shaped, dorsally convex, sometimes with slight impressions along basal margin, lateral carina varying from weakly intermittent to strong and denticulate; procoxae contiguous or narrowly separated by prosternal process; cervical sulcus usually distinct, deep. Scutellum small, usually quadrate. Elytra longer than broad, evenly convex; 3rd and 4th striae, sometimes 5th and 6th, with basal strial denticles prominent, recumbent, striae shallow but distinct. Abdomen unmodified (except *M. protractus*). Metafemur moderately swollen, channeled on ventral face, male often with setose ventral pocket; pecten composed of one long denticle followed by one to four smaller denticles (except *M. ulkei* with one spine); metatibial carina prominent, ventrolateral abbreviated near apex; mucro as long as or shorter than lateral denticle.

Male genitalia with ventral valve not articulated; membranous dorsal valve hoodlike.

Revisions: Kingsolver and Johnson 1978.

Keys: Kingsolver and Johnson 1978.

Key to U.S. Species of *Mimosestes*

1 Elytra with white, attenuated, median stripe extending from base to apex bordered by broad, lateral black stripe (figure 818); pygidium white with variable black spots either side of midline (figure 819); metafemur with single denticle (figure 820) and with shallow ventral channel; lateral carina of pronotum denticulate .....*ulkei* (Horn)

Elytra at most with evanescent maculae or stripes; pygidium variously colored but not white; metafemur with multiple denticles.....2

2(1) Posterior margin of eye merging with side of head behind eye, not protruding (figure 791); color brown to bluish gray, sometimes with reddish suffusion .. *amicus* (Horn)

Margin of eye protruding from side of head; color various 3

3(2) Pygidium with median, hourglass-shaped, dark mark (figure 813); male metafemur with shallow ventral sulcus; 2nd to 5th ventral sternites of abdomen with broad concavity (figure 814).....*protractus* (Horn)

Pygidium with vague median stripe and lateral spots or without pattern; male metafemur with deep, setose ventral sulcus; abdomen lacking ventral concavity 4

4(3) Anterolateral corner of pronotum with denticulate shoulder (figure 808); posterodorsal margin of eye subangulate (figure 807)

..... *nubigens* (Motschulsky)

Anterolateral corner of pronotum gently rounded, lacking denticles; posterolateral margin of eye not angulate (figure 802).....5

5(4) Body length 1.6–2.7 mm; pygidium uniformly yellowish brown; southwestern United States and Mexico

.....*acaciestes* Kingsolver and Johnson

Body length 2.3–4.4 mm; pygidium vaguely maculate (figure 797); Florida and Hawaii 6

6(5) Eye slightly flattened on dorsal margin (figure 802); pygidium with median stripe and two lateral white spots; one record from southern Florida (also West Indies, Mexico, Central America).....*mimosae* (Fabricius)

Eye evenly rounded dorsally (figure 796); pygidium with basal triangle of white setae and median, dark brown macula; Hawaii (also Colombia and West Indies)

..... *insularis* Kingsolver and Johnson

Mimosestes acaciestes Kingsolver and Johnson

(Figures 786–789)

Mimosestes new species: Center and Johnson 1976:196.

Mimosestes acaciestes Kingsolver and Johnson 1978:12; Johnson and Kingsolver 1982:417; Johnson 1987:348; Udayagiri and Wadhi 1989:90.

Color.—Integument mostly black with following areas red: labrum; four basal antennal segments, but in some specimens all segments red; broad stripe in center of each elytron; pygidium; legs. Vestiture uniformly yellowish brown in some specimens, usually gray and brown in indistinct pattern on elytra and pygidium, pronotum and pygidium usually with two white spots; scutellum white.

Structure.—Vertex and frons finely punctate; frontal boss broadly Y-shaped; ocular index 3:1; ocular sinus three-fifths length of eye; antenna extending to humerus; pronotal disk microfoveolate; lateral carina as denticulate ridge extending to coxal cavity. Scutellum transverse, narrowly emarginate. Basal denticles on 3rd, 4th, and 5th elytral striae (figure 786); striae nearly hidden in vestiture; metacoxal face with dense setal patch in lateral one-third; metafemoral pocket deep, pecten as in figure 787; mucro not as long as lateral denticle; apex of male 5th sternum slightly emarginate.

Male genitalia.—As in figures 788 and 789; ventral valve arcuate (figure 788), evenly rounded; dorsal valve semicircular; inter-

nal sac trilobed, densely lined with fine denticles; closure valve C-shaped; lateral lobes cleft nearly to base (figure 789), arms slender, bowed, apical margin diagonal, mesal faces densely setose.

Size.—Body length 1.6–2.7 mm; width 0.9–1.7 mm.

Type depository.—USNM, holotype No. 72778.

Type locality.—Arizona, Yavapai Co., 7 1/2 mi southeast of Camp Verde.

Distribution.—AZ, NM, TX; Mexico.

Host plants.—Acacia amentacea, A. berlandieri, A. constricta, A. neovernicosa, A. rigidula, A. vernicosa.

Natural enemies.—Eupelmus sp., *E. amicus*; *Heterospilus prosopidis; Horismenus missouriensis; Stenocorse bruchivora; Urosigalphus bruchivorus, U. neobruchi; Zatropis incertus.*

Immatures.—Not described.

Discussion.—This species can be distinguished by its small relative size, black head, vaguely maculate elytra, and host plant preference. The apical margin of the ventral valve is arcuate, unlike the tongue-like forms in other U.S. species.

Mimosestes amicus (Horn)

(Figures 27, 57, 58, 790–794)

Bruchus amicus Horn 1873:337; Riley and Howard 1892c:165; Ashmead 1894:342; Horn 1894:345; Townsend 1895:277; Cockerell 1902:379; Fall and Cockerell 1907:201; Schaeffer 1907:292; Fall 1910:164; Cushman 1911:495; Zacher 1952:47.

Acanthoscelides amicus: Blackwelder 1946:758.

Mylabris amicus: Leng 1920:305; Kannan 1923:20.

Mimosestes amicus: Muesebeck et al. 1951:467; Hinckley 1960:261; Bibby 1961:325; Peck 1963:956; De Luca 1965:67; Bottimer 1968c:1024,1039; Johnson 1968:1269, 1969c:55; Smith and Ueckert 1974:63; Swier 1974; Center and Johnson 1976:196; Pfaffenberger and Johnson 1976:34; Mitchell 1977:644; Johnson and Kingsolver 1982:417; Kistler 1982; Pfaffenberger 1985a:4; Johnson 1987:346; Udayagiri and Wadhi 1989:90; Kingsolver 1995a.

Color.—Integument reddish orange to black; basal four antennal segments red, apical segments usually black, sometimes reddish; pronotum usually black with reddish basal suffusion; elytra usually black with reddish-orange stripe, but may be all black or all reddish orange; legs black with apices of mesofemur and metafemur reddish. Vestiture white, golden, light brown, and dark brown intermixed but usually without discernible pattern, occasionally with vague white lines on pronotum, elytra, and pygidium; venter of body white.

Structure.—Vertex and frons densely micropunctulate, frons with subtriangular, granulose, frontal boss (figure 57); ocular index 2.5:1; ocular sinus one-half length of eye; eye not protruding from side of head, blending smoothly into contour of head (figure 791); pronotum bell-shaped (figure 790), lateral margins gently curved; disk evenly convex, basal lobe feebly sulcate, basal margin impressed near posterior corners; lateral carina visible as short ridge in middle of margin; cervical sulcus concealed by vestiture. Scutellum quadrate, emarginate. Elytra slightly longer than wide (figure 790), evenly convex except slightly depressed around scutellum; striae shallow, narrow, strial punctures elongate, 3rd, 4th, and 5th denticulate on basal margin, 6th sometimes denticulate; interstices flat, finely imbricate; metacoxal face densely punctate except fossula glabrous; hind leg as in figure 792; male femur with deep, setose pocket; pecten with one large denticle and two or three small denticles; metatibia with all carinae complete except ventrolateral carina apically obsolete; mucro shorter than lateral denticle; coronal denticles three. Male 5th sternum slightly emarginate; male pygidium moder-

ately reflexed at apex, female pygidium oblique; disk densely punctulate with scattered microfoveolae.

Male genitalia.—As in figures 793 and 794; median lobe broad (figure 793); dorsal valve arcuate with apex slightly produced; ventral valve liguliform, truncate; internal sac densely lined with fine spicules; middle of sac with flat, crescentic sclerite; closure valve circular; lateral lobes bowed (figure 794), cleft nearly to base, arms narrow, apices strongly expanded mesad; mesal faces setose.

Size.—Body length 2.1–3.8 mm; width 1.4–2.5 mm.

Type depository.—MCZC, lectotype No. 8208 (by Johnson 1968).

Type locality.—Texas (lectotype).

Distribution.—AZ, CA, CO, FL, HI, KS, NV, NM, TX; Mexico to Costa Rica.

Host plants.—Rearing records: *Acacia constricta, A. farnesiana, A. glauca* (Hawaii); *Leucaena leucocephala; Parkinsonia aculeata, P. florida, P. microphylla, P. texana macra, P. texana texana; Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. velutina, P. pallida, P. pubescens; Sesbania sesban* (Hawaii), *S. aegyptiaca. Prosopis julianus* records in the United States should be referred to *P. velutina* in Arizona, California, and New Mexico and to *P. glandulosa glandulosa* in Texas. Records in the literature that require verification are *Caesalpinia coriaria* and *Cassia occidentalis.* Found in flowers of *Lippia wrightii* Gray.

Natural enemies.—Cerceris truncata; Eupelmus amicus, E. cyaniceps; Hetero-spilus prosopidis; Horismenus productus; Stenocorse bruchivora; Urosigalphus bruchi, U. neobruchi; Uscana semifumipennis.

Immatures.—Kannan 1923 (egg); Pfaffenberger and Johnson 1976:34 (first larval instar).

Discussion.—Mimosestes amicus is one of the most abundant and widespread bruchids in the southwestern United States. It is easily separated from other *Mimosestes* species and from nearly all other U.S. bruchids by the character of the posterior margin of the eye merging smoothly with the side of the head. It probably breeds most successfully in seeds of *Parkinsonia* species but is abundant in *Prosopis* seeds as well. This bruchid oviposits only on green pods. Its exit holes are used by other species of bruchids for oviposition sites.

Kannan (1923) described oviposition by *M. amicus.*

Wheeler and Longino (1988) found *M. amicus* as an inquiline in galls of *Dishol-caspis cinerosa* Bassett (Cynipidae) in Texas. Scullen and Wold (1969) collected *M. amicus* as prey of the wasp *Cerceris truncata* Cameron.

Mimosestes insularis Kingsolver and Johnson

(Figures 795–800)

Mimosestes insularis Kingsolver and Johnson 1978:35; Johnson and Kingsolver 1982:418; Johnson 1987:348; Udayagiri and Wadhi 1989:92; Kingsolver 1992b.

Color.—Integument mostly reddish orange; antenna reddish, sometimes with apical seven segments brown; pygidium with median or apical dark brown maculation; legs reddish orange. Vestiture intermixed white, golden, and brown; pronotum with lateral patches and median line of white setae, usually with two small white spots on disk; elytra white with lateral patches of darker setae; pygidium with basal triangular patch of white sometimes extending as a median line to apex, dark brown integumental maculation with brown setae, marginal setae white; venter of body white.

Structure.—Vertex and frons densely punctulate, punctures crowded and coalescent; frontal boss broadly V-shaped, granulose; ocular index 3.5:1; ocular sinus three-fifths length of eye; posterior margin of eye evenly rounded (figure 796); antenna slender, extending to middle of metepisternum. Pronotum bell-shaped (figure

795), lateral margins arcuate; disk convex, feebly sulcate on meson, lightly impressed either side of meson and along basal margin, surface densely but irregularly foveolate; lateral carina ridgelike, finely denticulate; cervical sulcus deep, constricting neck of pronotum. Scutellum transverse, emarginate. Elytra slightly longer than wide (figure 795), evenly convex; striae lightly impressed, punctures distinct, 3rd, 4th, 5th, and 6th striae denticulate on basal margin; interstices flat, finely imbricate, punctate in basal one-half; metacoxal face densely punctulate, fossula glabrous; hind leg as in figure 798, pecten with one long and two or three shorter denticles; femoral pocket of male more than one-half length of femur, ventromesal margin of pocket not visible in lateral aspect; metatibial carina distinct but with ventrolateral carina extending only one-half distance to apex; mucro short, only as long as lateral denticle, coronal denticles three or four. Fifth sternum of male slightly emarginate; pygidium of both sexes oblique, male feebly reflexed at apex; discal surface finely granulose with scattered fine foveolae, densely setose.

Male genitalia.—As in figures 799 and 800; median lobe moderately slender (figure 799); dorsal valve with slight apical angulation; ventral valve liguliform, evenly rounded; internal sac densely lined with minute denticles; apical one-half with hourglass-shaped, flat sclerite; closure valve circular; lateral lobes slightly bowed (figure 800), cleft nearly to base, arms slender, expanded mesad apically.

Size.—Body length 2.3–4.4 mm; width 1.5–2.8 mm.

Type depository.—USNM, holotype No. 72779.

Type locality.—Hawaii, Oahu, Waikiki.

Distribution.—HI; West Indies, Colombia.

Host plants.—Acacia farnesiana; Prosopis glandulosa glandulosa, P. juliflora, P. pallida (last two in Hawaii).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Among the species treated in this handbook, *Merobruchus insularis* would most easily confused with *M. nubigens.* Since they both occur in Hawaii, they can easily be separated by the shape of the posterior margin of the eye—that of *M. insularis* is evenly rounded, and that of *M. nubigens* is somewhat angulate. The form of the "shoulder" of the pronotum of *M. nubigens* is protruding and denticulate, whereas that of *M. insularis* is rounded behind the cervical sulcus but not denticulate. Male genitalia are diagnostic (compare figures 799 and 810). The only other species of *Mimosestes* in Hawaii is *M. amicus,* which is readily separated by the flattened posterior margin of the eye and gray appearance.

Mimosestes insularis was most likely introduced into Hawaii from the West Indies, since both of its host plant species occur in both areas.

Mimosestes mimosae (Fabricius)

(Figures 801–805)

Only the references to original descriptions are given here. For a complete listing of synonyms and combinations, see Kingsolver and Johnson (1978:42).

Bruchus mimosae Fabricius 1781:76.

Bruchus dominicanus Jekel 1855:12.

Bruchus breweri Crotch 1867:389.

Bruchus inornatus Horn 1873:333.

Bruchus subrufus Motschulsky 1874:225.

Bruchus strigatus Motschulsky 1874:237.

Bruchus immunis Sharp 1885:474.

Bruchus innotatus Pic 1912:92 (proposed for *inornatus* Horn, not Küster 1850).

Acanthoscelides breweri: Blackwelder 1946:760.

Acanthoscelides dominicanus: Blackwelder 1946:759.

Acanthoscelides immunis: Blackwelder 1946:759.

Acanthoscelides innotatus: Bradley 1947:40.

Acanthoscelides mimosae: Blackwelder 1946:760.

Acanthoscelides strigatus: Blackwelder 1946:761.

Acanthoscelides subrufus: Blackwelder 1946:761.

Mimosestes dominicanus: Johnson and Kingsolver 1977:154.

Mimosestes immunis: Kingsolver 1975a:60.

Mimosestes innotatus: Bottimer 1968c:1024.

Mimosestes inornatus: Johnson 1968:1269.

Mimosestes mimosae: Decelle 1975:138.

Mimosestes strigatus: Johnson and Kingsolver 1977:154.

Mylabris immunis: Leng 1920:305.

Mylabris innotatus: Leng 1920:305.

Color.—Head black to red-orange, V-shaped frontal boss black; antenna varying from all red-orange to having basal four segments red-orange and apical segments dark brown. Body usually red-orange varying to dark reddish brown; thoracic sterna sometimes black; pronotum and elytra usually darker than remainder of body.

Structure.—Vertex and frons minutely imbricate-punctate; frontal boss Y-shaped, granulose; ocular index 3.2:1, ocular sinus one-half as long as eye; dorsal margin of eye arcuate, not evenly rounded (figure 802); antenna normal for genus, extending to middle of metepisternum. Pronotum bell-shaped (figure 801), lateral margins arcuate; disk convex, feebly sulcate on basal lobe, basal margin impressed; surface densely foveolate, foveolae discrete, each with anteriorly positioned seta, interspaces punctulate; lateral carina ridgelike, finely denticulate; cervical sulcus short, nearly hidden by vestiture. Scutellum, small, quadrate, bidentate. Elytra as long as wide (figure 801), convex but feebly depressed along suture; striae parallel, slightly divergent toward base, 3rd, 4th, 5th, and 6th prominently denticulate on basal margin; interstices flat, finely imbricate, distinctly foveolate in basal one-half of elytra; metacoxal face finely, discretely punctate except fossula glabrous, lateral one-fourth densely pubescent; hind leg (figure 803) with ventromesal carina denticulate, pecten with one long and two smaller denticles, male femoral pocket about one-half length of femur, ventro-mesal border of pocket visible in lateral aspect; metatibia slender, all carinae present except ventrolateral abbreviated at apex; mucro only as long as lateral denticle, coronal denticles three, none as long as lateral denticle. Fifth ventral segment of abdomen broadly, shallowly emarginate; pygidium in both sexes oblique, male slightly reflexed; disk densely, finely punctate, with scattered, small foveolae.

Male genitalia.—As in figures 804 and 805; median lobe moderately broad (figure 804); dorsal valve semicircular, membranous; ventral valve liguliform, broad, truncate; internal sac finely denticulate, middle of sac with two arcuate clusters of coarse denticles, median sclerite oblong, rectangular, apex of sac densely, finely denticulate; closure valve circular; lateral lobes strongly bowed (figure 805), cleft to base, arms narrow, only slightly expanded at apices.

Size.—Body length 2.0–4.3 mm; width 1.3–2.5 mm.

Type depository.—UZMC *(mimosae);* BMNH *(breweri, dominicanus, immunis);* MCZC *(inornatus);* ZMUM *(strigatus, subrufus).*

Type locality.—"Americae meridionalis" *(mimosae);* Santa Domingo *(dominicanus);* Azores *(breweri);* "Middle States" *(inornatus);* Colombia *(subrufus);* Mexico *(strigatus);* Panama *(immunis).*

Distribution.—FL; Mexico, West Indies, South America; introduced into Europe.

Host plants.—In Florida: *Caesalpinia coriaria.* Extralimital: *Acacia* sp., *A. cochliacantha, A. cymbispina, A. farnes-iana, A. globulifera, A. hindsii, A. macracantha, A. pennatula*; *Caesalpinia* spp., *C. coriaria, C. sclerocarpa; Ceratonia siliqua; Cordia* sp. (questionable); *Lotus* sp.

Natural enemies.—None recorded from United States. See Hetz and Johnson (1988) for extralimital parasites.

Immatures.—Not described.

Discussion.—This species is included here on the basis of a single collection at Key West, Florida. It is closely similar to *M. insularis* and *M. nubigens* in color pattern and body form. The denticulate pronotal "shoulder" and subangulate postocular lobe of *M. nubigens* will separate it from the other two species. If *M. insularis* should be collected in Florida, the key characters and male genitalia will separate it from both *M. nubigens* and *M. mimosae.*

Mimosestes nubigens (Motschulsky)

(Figures 806–811)

Bruchus nubigens Motschulsky 1874:237.

Acanthoscelides nubigens: Blackwelder 1946:760.

Mimosestes nubigens: Johnson and Kingsolver 1977:154; Kingsolver and Johnson 1978:49; Johnson and Kingsolver 1982:418; Borowiec 1987:86; Johnson 1987:348; Udayagiri and Wadhi 1989:93; Johnson and Seeno 1993.

Bruchus sallaei Sharp 1885:475; Schaeffer 1907:292; Fall 1910:169; Cushman 1911:491; Bridwell 1919:16, 1920a:337, 1920b:405, 1921b:465; Swezey 1925:3.

Bruchus sallei: Pic 1913a:47 (misspelling).

Mylabris sallei: Leng 1920:305 (misspelling).

Mylabris sallaei: Kannan 1923:22.

Acanthoscelides sallaei: Blackwelder 1946:761.

Mimosestes sallaei: Bridwell 1946:54; Blackwelder and Blackwelder 1948:45; Zacher 1952:462; Hinckley 1960:261, 1961:526; Peck 1963:956; De Luca 1965:67; Bottimer1968c:1025,1039, 1041; Kingsolver 1970a:383; Forister and Johnson 1971:232; Bottimer 1973:549; Howe 1973:575; Decelle 1975:137; Janzen 1975:157; Center and Johnson 1976:196; Pfaffenberger and Johnson 1976:36.

Color.—Integument reddish orange to black; frons often with black maculation; four basal antennal segments red, club segments black; ventral areas usually darker than pronotum and elytra. Vestiture white, yellow, and dark brown; dorsal surface with variable pattern; pronotum usually with two sublateral white spots; elytra variably mottled, usually in linear pattern, medial sublateral and apical maculae usually evident; pygidium usually with median white line of pubescence and pair of sublateral white spots, disk sometimes uniformly clothed.

Structure.—Vertex and frons imbricate-punctulate, frontal boss broadly V-shaped, granulose; ocular index 2.8:1; ocular sinus one-half as long as eye; postocular lobe subangulate (figure 807); antenna extending to humerus. Pronotum trapezoidal, lateral margins convergent to apex, constricted by cervical sulcus, anterolateral corner swollen, strongly denticulate (figure 808); disk convex, basal lobe feebly sulcate, basal margin impressed, surface of disk finely foveolate, interspaces minutely punctate; lateral carina ridgelike, denticulate; cervical sulcus short, deep. Scutellum small, transverse, bidentate. Elytra slightly longer than wide (figure 806), striae shallow, narrow, parallel, 1st to 6th slightly divergent near base, 3rd to 6th denticulate on basal margin; interstices flat, punctate-granulose; metacoxal face finely, densely punctate, fossula glabrous, lateral one-fourth of face densely pubescent; hind leg as in figure 809, femoral pocket of male about one-half length of femur, mesal margin of pocket visible in lateral aspect, ventromesal carina denticulate basad of pecten, pecten with one long and two short denticles; metatibia slender, carinae distinct except ventrolateral abbreviated near apex; mucro small, shorter than lateral denticle, coronal denticles three, all smaller than lateral denticle. Fifth ventral segment of male abdomen broadly emarginate; pygidium oblique, apex of male

slightly reflexed; discal face finely imbricate with scattered minute foveolae.

Male genitalia.—As in figures 810 and 811; median lobe broad (figure 810), dorsal valve hoodlike, apex subangulate, ventral valve broadly liguliform, truncate or slightly emarginate; internal sac lined with fine denticles in basal one-half and in apex, middle of sac with transverse, sclerotized plate; closure valve circular; lateral lobes cleft nearly to base (figure 811), arms flat, gradually expanded to apices, mesal faces densely setose.

Size.—Body length 2.2–4.1 mm; width 1.3–2.7 mm.

Type depository.—ZMUM *(nubigens);* BMNH *(sallaei).*

Type locality.—"Bresil" *(nubigens);* Mexico, Guanajuato *(sallaei).*

Distribution.—AZ, CA, FL, HI, TX; Mexico to Brazil; introduced into New Caledonia and the Philippines.

Host plants.—Rearing records: *Acacia cornigera, A. farnesiana, A. schaffneri, A. tortuosa; Lotus* sp.; *Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. pallida* (Hawaii). Records needing confirmation: *Acacia amentacea; Caesalpinia coriaria; Ceratonia siliqua; Cordia* sp.; *Gleditsia triacanthos; Prosopis chilensis, P. juliflora.* The common name "klu" is applied to *Acacia farnesiana* in Hawaii. Literature records for *Prosopis chilensis* in Hawaii should be referred to *P. pallida* (Fosberg 1966). See appendix I.

Natural enemies.—*Argiope* sp.; *Bracon* sp.; *Catolaccus* sp.; *Cephalonomia hyalini-pennis; Eupelmus bruchivorus, E. cushmani, E. cyaniceps; Eurytoma* sp., *E. tylodermatis; Heterospilus prosopidis; Horismenus bruchophagus; Lariophagus texanus; Monomorium* sp.; *Parasierola distinguenda; Pyemotes boylei; Stenocorse bruchivora; Urosigalphus bruchi, U. neobruchi; Uscana semifumipennis; Zelus renardii.*

Immatures.—Hinckley 1960 (as *M. sallaei;* egg); Pfaffenberger and Johnson 1976:36 (as *M. sallaei;* first instar).

Discussion.—This species of *Mimosestes* is easily recognizable by the unique, pronounced denticulate "shoulders" of the pronotum. Other characters are the subangulate postocular lobe of the eye and the large, transverse plate in the internal sac.

The preferred host for *M. nubigens* is probably *Acacia farnesiana* both on the mainland and in Hawaii. Large numbers of beetles emerge from samples taken anywhere within its host range. Swezey (1936) and Hinckley (1960) report rearing *M. nubigens* from both *A. farnesiana* and *Prosopis pallida* (as *Prosopis chilensis*) in Hawaii. Fosberg (1966) detailed usage of names applied to the Hawaiian species of *Prosopis* and concluded that *P. pallida,* but neither *P. chilensis* nor *P. juliflora,* is the correct name.

Kannan (1923) described oviposition of this species.

Mimosestes protractus (Horn)

(Figures 812–817)

Bruchus protractus Horn 1873:332; Sharp 1885:476; Horn 1886:xi, 1894:345; Schaeffer 1907:291; Fall 1910:169; Cushman 1911:507.

Mylabris protractus: Leng 1920:305.

Acanthoscelides protractus: Blackwelder 1946:760; Zacher 1952:465,471.

Mimosestes protractus: Johnson 1968:1270; Bottimer 1968c:1025,1039; Swier 1974; Center and Johnson 1976:196; Pfaffenberger and Johnson 1976:35; Kingsolver et al. 1977; Kingsolver and Johnson 1978:58; Johnson and Kingsolver 1982:418; Pfaffenberger 1985a:4; Udayagiri and Wadhi 1989:94.

Bruchus longiventris Sharp 1885:476; Horn 1894:345.

Mimosestes longiventris: Johnson and Kingsolver 1977:154.

Color.—Integument of head usually black, body and appendages reddish orange, elytra usually with darker lateral maculae,

pygidium with median, hourglass-shaped maculation; metafemur with dark brown maculation. Vestiture white, golden, and brown; head white; pronotum mostly white intermixed with brown and with brown lateral patches; elytra white with dark brown lateral and apical maculae (figure 812); pygidium white with median maculation dark brown constricted by white patches at midpoint; venter of body white.

Structure.—Body elongate, lateral margins subparallel. Vertex and frons densely punctulate; frontal boss broadly V-shaped, granulose; ocular index 3.2:1; ocular sinus four-tenths length of eye; antenna extending to middle of metepisternum. Pronotum bell-shaped (figure 812), lateral margins sinuate, apex evenly rounded; disk convex, impressed along basal margin; surface densely foveolate, each foveola bearing seta on anterior rim, interspaces punctulate; lateral carina ridgelike, denticulate, densely pubescent; cervical sulcus distinct, deep. Scutellum quadrate, densely setose. Elytra 1.2 times as long as wide (figure 812); moderately convex; striae shallow, sometimes evident only by a line of punctures, subparallel, 2nd to 6th divergent laterad in basal one-half, 3rd to 6th denticulate on basal margin; interstices flat, imbricate-granulose; metacoxal face evenly punctulate, fossula glabrous; hind leg as in figure 815, ventral margin of male meta-femur shallowly sulcate in basal one-fourth; pecten with one long and two small denticles; metatibial carinae present except ventrolateral evanescent in apical one-half; mucro not as long as lateral carina, three coronal denticles minute. Male 5th abdominal sternum with deep, round depression (figure 814), female 5th sternum shallowly sulcate or slightly impressed; pygidial disk densely foveolate as on pronotal disk, interspaces punctulate, sculpture nearly hidden by vestiture.

Male genitalia.—As in figures 816 and 817; median lobe slender (figure 816); dorsal valve evenly rounded; ventral valve triangular, elongate; internal sac lined with fine spicules at apical orifice, middle one-half lined with blunt denticles, apical part of sac with slender spicules; closure valve small, circular; lateral lobes divergent (figure 817), outline as figured.

Size.—Body length 2.0–3.5 mm; width 1.2–2.1 mm.

Type depository.—MCZC (*protractus*, holotype No. 8200); BMNH *(longiventris).*

Type locality.—Lower California *(protractus);* Arizona *(longiventris).*

Distribution.—AZ, CA, NV, TX, UT; Mexico.

Host plants.—Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. laevigata, P. velutina; Parkinsonia microphylla, P. texana texana. Names of *Prosopis* species have been confused in the literature. I followed Johnston (1962) in application of names, but where species or varieties overlap, especially in western Texas, literature records are unreliable.

Natural enemies.—Cerceris truncata Cameron (Scullen and Wold 1969).

Immatures.—Pfaffenberger and Johnson 1976:35 (first instar).

Discussion.—The elongate, parallel-sided form, reddish-orange appendages, and depression of the 5th sternum should easily separate this species from other North American *Mimosestes.*

This bruchid has been found as an inquiline in galls of *Disholcaspis cinerosa* (Bassett) (Cynipidae) by Wheeler and Longino (1988).

Mimosestes ulkei (Horn)

(Figures 818–822)

Bruchus ulkei Horn 1873:324; Riley and Howard 1892c:165; Fall 1910:164; Cushman 1911:494,508.

Bruchus (Cercidiestes) ulkei: Zacher 1952:463.

Cercidiestes ulkei: Bridwell 1946:55 (type species); Blackwelder and Blackwelder 1948:45; Zacher 1952:463,472; Bottimer 1968c:1021,1039; Johnson 1968:1269, 1969a:54; Center and Johnson 1976:196.

Mimosestes ulkei: Kingsolver and Johnson 1978:62; Johnson and Kingsolver 1982:413; Johnson 1987:348; Udayagiri and Wadhi 1989:94.

Mylabris ulkei: Leng 1920:305; Kannan 1923:19.

Color.—Integument reddish orange to black; head black, antenna reddish orange; elytra black; fore legs and mid legs reddish brown to orange, hind legs black, often with mesal face brown; abdomen often with orange suffusion. Vestiture white covering entire body except dark brown to black on lateral one-half of each elytron, median, wedge-shaped elytral stripe gray (figure 818), two black spots of variable size and shape on pygidium (figure 819), and a black spot on 5th sternum each side of meson.

Structure.—Vertex and frons densely punctulate; frontal boss broadly triangular, granulose; ocular index 4:1; ocular sinus eight-tenths length of eye; posterior margin of eye subangulate; antenna subserrate, extending to humerus. Pronotum bell-shaped (figure 818), strongly convex, lateral margins gently arcuate, basal lobe sulcate, basal margin impressed, apical margin evenly rounded; surface sparsely foveolate and punctulate, nearly concealed by dense vestiture; lateral carina ridgelike, denticulate, densely pubescent, forming sharp "shoulder" behind eye; cervical sulcus nearly hidden by vestiture. Scutellum quadrate, bidentate, pubescent. Elytra slightly longer than wide (figure 818); convex, subdepressed around scutellum; striae distinct in gray mesal area but difficult to distinguish within black lateral stripes, subparallel, slightly divergent toward base, 3-5 denticulate on basal margin; interstices flat, imbricate-granulose; metacoxal face densely punctulate and pubescent except fossula glabrous; hind leg as in figure 820; male with small, shallow pocket on ventral face of femur near apex of trochanter; pecten with one long, acute denticle; metatibia with all carinae present except ventrolateral abbreviated at midpoint, carinae nearly concealed by vestiture; mucro short, one-half as long as lateral denticle; three coronal denticles minute. Pygidium feebly convex, disk densely pubescent; minutely punctate with scattered foveolae.

Male genitalia.—As in figures 821 and 822; median lobe moderately slender (figure 821); dorsal valve evenly rounded, densely setose; ventral valve broadly liguliform, apex broadly angulate; internal sac lined with blunt denticles in basal one-half, with clusters of spicules in apical one-half; closure valve circular; lateral lobes with arms strongly bowed (figure 822), densely setose at apices.

Size.—Body length 2.5–4.9 mm; width 1.9–2.9 mm.

Type depository.—MCZC, holotype No. 1873.

Type locality.—Arizona.

Distribution.—AZ; Mexico.

Host plants.—Parkinsonia aculeata, P. florida, P. texana texana.

Natural enemies.—None recorded.

Immatures.—Kannan 1923 (egg).

Discussion.—This strikingly marked bruchid is probably the most easily recognized in North America. It was designated the type species of the genus *Cercidiestes* by Bridwell in 1946, but Kingsolver and Johnson (1978) moved it to *Mimosestes* based on form of male genitalia, male metafemur with ventral pocket, and head with prominent boss. This species, while not rare in collections, is less abundant than other species of *Mimosestes.*

Essig (1929a) gave the common name "retama weevil" to this bruchid after a local name for *Parkinsonia aculeata.*

Genus *Neltumius* Bridwell

Neltumius Bridwell 1946:54; Bradley 1947:35; Kingsolver 1964a:105; Bottimer 1968c:1025,1039,1041; Johnson 1968:1270; Johnson and Kingsolver 1982:416; Borowiec 1987:97; Udayagiri and Wadhi 1989:95.

Type species: *Bruchus arizonensis* Schaeffer, by monotypy.

Integument black; vestitural pattern distinctive for each species.

Frons carinate, sparsely pubescent; antenna serrate, short, extending to humerus, not dimorphic. Pronotum strongly convex, gibbous; lateral carina lacking; cervical sulcus narrow, hidden by pubescence. Elytra together slightly longer than wide; striae deep, narrow, lacking basal denticles. Pygidium dimorphic in color pattern and convexity. Metafemur with single, subapical denticle (figure 832); metatibia with mucro shorter.

Neltumius does not seem to be closely related to any of the other genera in the New World. Structure of the metatibia resembles that of Old World *Bruchidius,* but because of the close association of two of the three species with the plant genus *Prosopis,* itself highly developed in the New World, *Neltumius* is likely a relict group originating in this hemisphere. Bradley (1947) thought that *Neltumius* was a close relative of *Gibbobruchus* because of the gibbous pronotum, but other characters of *Gibbobruchus* (pecten with several denticles, strong basal elytral denticles, and form of the male genitalia) negate this association.

Revision: Kingsolver 1964a.

Key to Species of *Neltumius*

1 Metatibia uniformly gray; dorsal pattern mostly grayish white with prominent patches of dark brown and yellowish setae; pronotum with single median gibbosity near apex (figure 830); middle of 3rd elytral interstice with elongate, white spot (figure 829); humerus with fine, transverse carina ..... *gibbithorax* (Schaeffer)

Metatibia with brown band at middle of dorsal margin; dorsal pattern of strongly contrasting dark brown and gray elongated patches; 3rd interstice with two or more elongated white patches separated by dark brown spots (figures 823 and 838); humerus carinate or granulose 2

2(1) Pronotum with prominent, paired gibbosities separated by shallow mesal and transverse channels (figure 823), posterior gibbosities more prominent than anterior pair (figure 824); humerus with fine, transverse carina ..... *arizonensis* (Schaeffer)

Pronotum with gibbosities and channel only slightly developed (figures 838 and 839); humerus granulose ..... *texanus* (Schaeffer)

Neltumius arizonensis (Schaeffer)

(Figures 823–828)

Bruchus arizonensis Schaeffer 1904:229; Fall 1910:162.

Mylabris arizonensis: Leng 1920:305; Kannan 1923:21.

Neltumius arizonensis: Bridwell 1946:54; Bradley 1947:36; Bibby 1961:325 (as *griseolus*); Kingsolver 1964a:108; Bottimer 1968c:1025,1039,1041; Johnson 1968:1270; Forister 1970:68; Swier 1974; Pfaffenberger and Johnson 1976:37; Kingsolver et al. 1977:115; ohnson and Kingsolver 1982:416; Johnson 1983c:28; Udayagiri and Wadhi 1989:95.

Color.—Vestiture black, white, and reddish brown in distinctive pattern (figure 823) on pronotum and elytra; pygidial pattern dimorphic (figures 825 and 826); venter of body gray except brown spots on metepisternum, lateral margins of abdominal sterna, and on each femur and tibia.

Structure.—Head densely punctulate and pubescent, nearly concealing surface, frontal carina distinct; ocular index 5:1; ocular sinus three-fifths as long as eye. Pronotum strongly gibbous with median, longitudinal sulcus separating the two

pairs of gibbosities, sulcus broader basally (figure 823). Elytral striae deep, narrow, 6th and 7th striae connected subbasally by short, dentate carina; alternate interstices broader and more elevated, surface finely imbricate; metacoxal face densely punc-tulate, pubescent in lateral angle; ventrolateral carina of metatibia absent, the other three nearly concealed by vestiture; mucro smaller than lateral denticle, coronal denticles minute. First abdominal sternum of male with small tuft of hair; male pygidium moderately convex, strongly reflexed into sternal emargination, female pygidium convex in basal one-half, strongly swollen apically.

Male genitalia.—As in figures 827 and 828; median lobe slender (figure 827); ventral valve semicircular with small membranous area at apex; armature of internal sac consisting of two burrlike sclerites near base, a mass of spicules in radiating pattern in middle of sac, and two thornlike sclerites near apex; closure valve small, circular; lateral lobes as figured (figure 828), cleft three-fourths to base, arms bowed and setose on mesal faces.

Size.—Body length 2.5–4.0 mm; width 1.4–2.1 mm.

Type depository.—USNM, holotype No. 42285.

Type locality.—Arizona, Pinal Mountains.

Distribution.—AZ, CA, NV, TX; Mexico.

Host plants.—Prosopis velutina, P. glandulosa glandulosa, P. glandulosa torreyana. Records of *Prosopis chilensis* and *P. juliflora* are probably the result of misidentification of the plants since neither species is within the range of *N. arizo-nensis* according to Johnston (1962). Records of *Chilopsis linearis* (Cav.) Sweet and *Larrea tridentata* (Sesse and Mocino) Cov. are undoubtedly accidental.

Natural enemies.—Urosigalphus arizonensis Crawford, *U. bruchivorus* Crawford. This bruchid is also listed as the prey of *Cerceris truncata* Cameron (Hymenoptera) (Scullen and Wold 1969).

Immatures.—Kannan 1923:21 (egg, first instar); Pfaffenberger and Johnson 1976:37.

Discussion.—The pronotum of *N. arizo-nensis* is more deeply sulcate than that of *N. gibbithorax* and bears two subequal pairs of gibbosities, whereas the prominent, anteriorly placed gibbosity of *N. gibbithorax* is not sulcate. The pronotal gibbosity of *N. texanus* is much less prominent and is placed nearer the base of the pronotum than in the other two species. Pygidial patterns of the three species, size differences between *N. texanus* and the other two species, and details of male genitalia are salient characters for discrimination.

Neltumius gibbithorax (Schaeffer)

(Figures 829–837)

Bruchus gibbithorax Schaeffer 1904:230; Fall 1910:162; Pic 1913a:27.

Neltumius gibbithorax: Bradley 1947:36; Bottimer 1968c:1025,1039; Johnson 1968:1270; Kingsolver et al. 1977:115 et seq.; Johnson and Kingsolver 1982:416; Johnson 1983c:28; Udayagiri and Wadhi 1989:95.

Neltumius gibbothorax: Kingsolver 1964a:106 (misspelling).

Mylabris gibbithorax: Leng 1920:305.

Color.—Vestiture of gray intermixed with orange and brown (pattern, figure 829); pygidial pattern as in figures 833 and 834; venter of body gray intermixed with orange.

Structure.—Punctation of vertex and frons nearly concealed by dense vestiture; frontal carina prominent, sometimes with pit at dorsal end; ocular index 4:1; ocular sinus three-fifths length of eye; antenna not dimorphic (figure 831). Pronotum gibbous in anterior one-half of disk (figure 830), not channeled (figure 829); vestiture dense, concealing surface; lateral carina absent; cervical sulcus concealed. Scutellum small, triangular. Elytra together as long as wide (figure 829); strial punctures elongate, striae slightly impressed; interstices

densely pubescent; 3rd, 5th, and 7th interstices wider than 4th, 6th, and 8th; humerus with transverse carina, sometimes dentate; metacoxa densely punctate, punctation concealed by dense pubescence except fossula narrowly glabrous; ventrolateral carina of metatibia absent, remaining carinae concealed by dense pubescence. First abdominal sternum of male with tuft of setae; male pygidium strongly reflexed at apex, female pygidium bulbous; punctation concealed by dense pubescence.

Male genitalia.—As in figures 835, 836, and 837; median lobe relatively broad (figure 835); ventral valve nearly semicircular, apex slightly produced and membranous; internal sac with two large, burrlike sclerites occupying basal one-third, a dense, fanlike cluster of long, slender spicules in middle of sac, and two flat, lunate sclerites in apical one-half; extreme apex of sac with sleevelike, spinous structure; lateral lobes (figure 837) relatively flat, deeply cleft, arms broad, apex with transverse, setose lobe, mesal faces of lobes densely setose.

Size.—Body length 2.6–4.2 mm; width 1.5–2.0 mm.

Type depository.—USNM, lectotype No. 42286, by Johnson 1968.

Type locality.—Arizona, Pinal Mountains (lectotype).

Distribution.—AZ, CA, NV, UT; Mexico.

Host plants.—Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. pubescens. A record of *Pluchea sericea* is probably accidental.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is easily distinguished by the rounded protuberance in the apical one-half of the pronotal disk, the body size, and the feebly patterned pygidium in both sexes. It is subequal in size to *N. arizonensis,* but larger than *N. texanus.*

Neltumius texanus (Schaeffer)

(Figures 67, 838–844)

Bruchus texanus Schaeffer 1904:231; Fall 1910:162.

Mylabris texanus: Leng 1920:305.

Neltumius texanus: Bradley 1947:36; Kingsolver 1964a:110; Bottimer 1968c:1025,1039; Johnson 1968:1270; Kingsolver et al. 1977:115; Johnson 1978:432; Johnson and Kingsolver 1982:416; Udayagiri and Wadhi 1989:95; Johnson 1995a:42.

Color.—Vestiture white and reddish brown arranged in pattern in figure 838; head with mixed reddish brown and gray; pronotum gray with paired reddish-brown spots near apex, another pair either side of white pubescent wedge on basal lobe; humeri black, elytra otherwise gray with reddish-brown maculae, 3rd interstice with alternating gray and reddish-brown elongate spots; pygidium gray with evanescent horizontal maculae (figures 840 and 841); venter of body gray with two or three reddish-brown spots on metepisternum; abdominal sterna mixed reddish brown and gray; legs faintly reddish brown with distinct brown spot on dorsal face of metatibia.

Structure.—Vertex finely punctate; frontal carina distinct, sharp; ocular index 4:1; ocular sinus one-half length of eye; antenna not dimorphic, extending past 1st abdominal segment. Pronotum bell-shaped (figure 838), strongly convex, briefly sulcate on prominent basal lobe; lateral margins feebly incurved; lateral carina lacking; cervical sulcus hidden by vestiture. Scutellum small, densely pubescent. Elytra one and one-tenth times as long as wide (figure 838), evenly convex, without asperities, humeri granulose; striae parallel, 3rd and 4th congruent basally, strial punctures deep, elongate, inconspicuous; interstices flat, minutely imbricate; metacoxal face finely, densely punctate except fossula glabrous; metafemur with single, small denticle; metatibia with lateral, ventral, and dorsomesal carinae complete to apex,

ventrolateral carina absent; mucro subequal in length to lateral denticle, apex with three minute coronal denticles. First abdominal sternum without tuft of hairs similar to those found in *N. arizonensis* and *N. gibbithorax.*

Male genitalia.—As in figures 842, 843, and 844; median lobe slender (figures 842 and 843); ventral valve triangular, apex bent ventrad; armature of internal sac consisting of rodlike cluster of fine spicules and denticles at apical orifice, apex of sac densely lined with fine denticles, middle of sac with cluster of coarse spines, a cluster of minute denticles, and a terminal cluster of coarse spines; lateral lobes with arms slender (figure 844), cleft nearly to base, apices broadly expanded and with coarse spines on ventral faces.

Size.—Body length 2.0–2.5 mm; width 1.1–1.2 mm.

Type depository.—USNM, holotype No. 42287.

Type locality.—Texas, Esperanza Ranch, Brownsville.

Distribution.—AZ, CA, TX; Mexico.

Host plants.—Condalia correllii, C. globosa globosa, C. globosa pubescens, C. hookeri hookeri, C. obovata, C. spathulata, C. warnockii kearneyana. Zanthoxylum clava-herculis is probably accidental.

Natural enemies.—Horismenus missou-riensis; Urosigalphus bruchivorus.

Immatures.—Johnson 1978 (egg).

Discussion.—This species, although obviously belonging to *Neltumius,* is distinctive in details of the male genitalia, granulate humeri, lack of setal tuft on 1st abdominal sternum, relative size, less protuberant pronotal gibbosities, and pygidial pattern. In pronotal and elytral pattern, it more closely resembles *N. arizonensis* than it does *N. gibbithorax.* The stout, thornlike processes at the apices of the lateral lobes are unique in the Bruchidae.

Johnson (1978) described the life history of this species. All host records are with *Condalia* spp., a genus in the Rhamnaceae, whereas host records of the other two species of *Neltumius* are with *Prosopis* spp. in the Mimosoideae. Johnson (1995a) recorded additional host and distributional data for *N. texanus.*

Genus *Sennius* Bridwell

Sennius Bridwell 1946:55; Bradley 1947:37,39; Blackwelder and Black-welder 1948:45; Bottimer 1968c:1025,1039,1041; Johnson 1968:1270; Center and Johnson 1973; Johnson and Kingsolver 1973:1; Johnson and Slobodchikoff 1979; Johnson and Kingsolver 1982:419; Johnson 1984a; Borowiec 1987:101; Udayagiri and Wadhi 1989:99. Type species: *Bruchus cruentatus* Horn, by original designation.

Small beetles (1.8–2.8 mm).

Vertex densely punctulate, frons with impunctate line, obtuse carina, or sharp carina; eyes protuberant; antenna eccentric from 5th segment except apical segment ovate, not sexually dimorphic, uniform in outline, except elongated in *S. whitei* (figure 904). Pronotum bell-shaped, evenly convex, without asperities; disk densely, uniformly punctulate; lateral carina obtuse or lacking; cervical sulcus narrow but distinct; prosternum triangular, procoxae contiguous. Mesepimeron reduced to triangular sclerite near elytral humerus. Scutellum quadrate, apical margin emarginate. Elytra convex, disk in some species slightly depressed, lateral margins and apex arcuate; striae regular, narrow and shallow, without basal denticles or gibbosities in U.S. species, strial punctures fine; interstices flat, subequal in width, imbricate. Fore legs and mid legs not modified; metacoxal face densely, uniformly punctulate except fossula impunctate, polished; metafemur slightly swollen, ventromesal margin with one subapical denticle, ventrolateral margin rounded, not carinate; metatibia straight with lateral, ventrolateral (most species), ventral, and dorsomesal carinae present; mucro relatively short, scarcely longer than

coronal denticles. Abdomen unmodified except male 5th sternum emarginate to receive apex of pygidium; male pygidium more strongly reflexed at apex than female, disk densely punctulate.

Male genitalia with curved sclerite on either side of apical orifice (hinge sclerites); internal sac usually armed with fine denticles, some species with clusters of coarser denticles; lateral lobes spatulate, fringed with sensitive setae.

Sennius is undoubtedly a valid genus, but separating its members from some species and species groups now placed in *Acanthoscelides* can be difficult. *Acanthoscelides* is wide-ranging in its variation and is difficult to characterize as a taxon, making its discrimination from certain other genera difficult. The senniine characters of hinge sclerites, short mucro, and single metafemoral denticle will differentiate *Sennius* from the bulk of *Acanthoscelides* species. Resemblance in color pattern of some species of *Sennius* to those in *Stator* is striking, but structural characters of *Sennius,* particularly the lack of a lateral pronotal carina, short metatibial mucro, presence of a cervical sulcus, lack of a ventrolateral carina on the metafemur, and presence of hinge sclerites separate *Sennius* species.

Irwin and Barneby (1982) revised the leguminous tribe Cassiinae—including *Cassia, Senna,* and *Chamaecrista*—and transferred to *Senna* most of the species hitherto placed in *Cassia.* Host names herein included have been updated in accordance with the 1982 paper.

Johnson and Slobodchikoff (1979) included 34 species of bruchids in their investigations of the coevolution of *Cassia (Senna)* and Bruchidae.

Revision: Johnson and Kingsolver (1973) (North America).

Key to Species of *Sennius*

Some species of ***Sennius*** vary greatly in the extent of red elytral maculation. Some species that normally are adorned with a large macula may vary to an entirely black form (for example, ***S. cruentatus, S. simulans***) whereas others are consistent in their color patterns. Because of these variables, construction of an unambiguous key to species is difficult. In questionable cases, male genitalia should be extracted and compared. Use elytral pattern outlines in conjunction with key because the red integumental color does not register well in photographs.

1 Elytra usually with distinct, red maculae, or marginal or medial stripes (figures 846, 852, and 868); legs variously colored 2

Elytra lacking red maculae or stripes, or with maculae indistinct; legs red with base of metafemur black 12

2(1) Pygidium red, or reddish brown, sometimes with darker markings; elytral maculae yellowish red, chevron shaped (figure 868); basal margin of each elytron usually black, apical one-half of elytra brown to black ..... ***lebasi*** (Fahraeus)

Pygidium black; elytral maculae of different configuration 3

3(2) Elytral maculae red, confined to basal one-half, and extending from lateral margin to 2nd stria but not reaching basal margin nor humerus (figure 902); metatibial denticle minute (figure 905); male frontal carina dis-tinct (figure 903); antenna elongated (figure 904) ..... ***whitei*** Johnson and Kingsolver

Elytral macula of different configuration 4

4(3) Elytral macula medial, extending from lateral margin toward but not reaching suture, basal margin, or apex (figures 846, 881, and 892) 5

Elytral macula elongate or confined to apical one-half (figures 852, 862, and 897) 7

5(4) Hind leg red, or red with basal one-fourth black; elytral pattern as in figure 881 ***medialis*** (Sharp) Hind leg entirely black 6

6(5) Elytral maculation as in figure 846 ..... ***abbreviatus*** (Say)

Elytral maculation as in figure 892 ..... ***obesulus*** (Sharp)

7(4)	Elytral macula confined to apical one-half (figures 892 and 897)	8
	Elytral macula elongate, extending full length of elytron (figures 852 and 862), sometimes in the form of a median stripe on each elytron	10
8(7)	Elytral macula occupying most of apical one-half (figure 897)	*simulans* (Schaeffer)
	Elytral macula confined to small subapical patch	9
9(8)	Male genitalia as in figure 899	*simulans* (Schaeffer)
	Male genitalia as in figure 894	*obesulus* (Sharp)
10(7)	Red macula extending from near humerus diagonally toward, but not reaching, suture (figure 852); legs red except in all-black form (see couplet 12); male genitalia as in figure 854; eastern United States	*cruentatus* (Horn)
	Red stripe of each elytron variable in width, sometimes evanescent, sometimes occupying entire width; elytron usually with indistinct lines of white vestiture (figure 862); Georgia and Florida	*fallax* (Boheman)
	Red stripe usually limited by black marginal and sutural borders, lacking vestitural lines; southwestern United States	11
11(10)	Dorsal vestiture yellowish gray; male genitalia as in figure 859	*discolor* (Sharp)
	Dorsal vestiture white; male genitalia as in figure 889	*morosus* (Sharp)
12(1)	Elytral vestiture in cruciform white pattern (figure 875); male genitalia as in figure 878	*leucostauros* Johnson and Kingsolver
	Elytra without pattern; male genitalia as in figure 854	melanistic form of *cruentatus* (Horn)

Sennius abbreviatus (Say)

(Figures 63, 845–850)

Bruchus abbreviatus Melsheimer 1806:30 (catalogue name).

Curculio abbreviatus Say 1824:307,308.

Bruchus abbreviatus Say 1824:307,308 [validation of name by comparing it in discussion with *Bruchus* now *Mega-cerus*] *discoidus* Say.]

Bruchus abbreviatus Horn, listed in Dohrn 1879:187 as synonum of *bivulneratus* Horn 1873.

Mylabris abbreviatus Dohrn: Leng 1920:305 (Leng erroneously attributed the name to Dohrn).

Sennius abbreviatus: Bottimer 1968c:1025; Johnson 1968:1270, 1969c:55; Johnson and Kingsolver 1973:17, 1982:419; Udayagiri and Wadhi 1989:99.

Bruchus bivulneratus Horn 1873:325; Dohrn 1879:187; Riley and Howard 1892c:165; Schaeffer 1907:293; Blatchley 1910:1237; Fall 1910:165; Cushman 1911:494; Pic 1913a:19; Zacher 1952:461.

Mylabris bivulneratus: Leng 1920:305.

Sennius bivulneratus: Bradley 1947:39; Blackwelder and Blackwelder 1948:45; De Luca 1965:68.

Color.—Integument black; basal four antennal segments reddish orange, terminal segments reddish orange to black; elytral macula reddish orange extending from lateral margin to 1st or 2nd stria, basal margin narrowly black (figure 846); legs dark brown to black. Vestiture white, gold, and brown, sparse on pronotal meson, elytra with sparse, intermixed gold and brown setae; venter of body dense white; pygidium white condensed into basal triangle, sometimes extending as thin line to apex.

Structure.—Vertex and frons densely reticulate-foveolate; frons with impunctate boss sometimes extended into brief carina; ocular index 3:1; ocular sinus two-thirds length of eye. Pronotum subconical (figure 845), apex rounded, lateral margins straight to slightly arcuate, disk evenly convex, feebly sulcate on basal lobe; lateral carina evident only at posterior corner of pronotum; cervical sulcus short, shallow. Elytra together about as long as wide (figure 845); striae parallel, deep, strial punctures ovate; interstices coarsely imbricate. Metafemur with small denticle (figure 847); metatibial carinae complete except ventrolateral evanescent toward apex,

mucro short, less than one-eighth as long as basitarsus.

Male genitalia.—As in figures 848, 849, and 850; median lobe moderately slender (figure 848), slightly expanded at apex; ventral valve semicircular, apex produced; armature of internal sac consisting of two linear clusters of setae at apical orifice, paired, crescentic hinge sclerites, a dense cluster of fine spicules and denticles, a pair of clusters of coarse, curved spines, two lateral sacs lined with fine spicules, extreme apex lined with denticles, closure valve circular; lateral lobes with arms slender (figure 850), slightly bowed, apices expanded mesad, mesal faces setose.

Size.—Body length 2.1–3.0 mm; width 1.5–2.1 mm.

Type depository.—Type destroyed *(abbreviatus);* MCZC (*bivulneratus,* lectotype No. 8194, by Johnson 1968).

Type locality.—Unknown *(abbreviatus);* "Southern and western states" *(bivulneratus).*

Distribution.—AR, DC, GA, IL, IN, KS, KY, LA, MD, MS, MO, NY, NC, OH, PA, TN, TX, VA.

Host plants.—Cassia sp.; *Senna marilandica.* Also collected in flowers of *Asclepias syriaca; Cicuta maculata; Cryptotaenia canadensis; Eupatorium* sp.; *Taenidia integerrima.* Baskin and Baskin (1977) found 22 to 91.1 percent seed predation of *S. marilandica* in Tennessee. This host also appears in literature as *Cassia marilandica.*

Natural enemies.—Horismenus sp.

Immatures.—Not described.

Discussion.—The color pattern of *Sennius abbreviatus* most closely resembles that of *S. medialis,* but the reddish-yellow legs of *S. medialis,* larger femoral denticle, and male genitalia separate them easily. Other species with partly or wholly red elytra can be separated by characters in the key and by the male genitalia.

Sennius cruentatus (Horn)

(Figures 851–855)

Bruchus cruentatus Horn 1873:325; Sharp 1885:469; Riley and Howard 1892c:165; Schaeffer 1907:294,296; Blatchley 1910:1237; Fall 1910:165; Cushman 1911:498,506; Pic 1913a:23; Zacher 1952:461.

Mylabris cruentatus: Leng 1920:305.

Acanthoscelides cruentatus: Blackwelder 1946:759.

Sennius cruentatus: Bridwell 1946:55; Bradley 1947:39; Blackwelder and Blackwelder 1948:45; Bottimer 1968c:1026,1039,1041; Johnson 1968:1270; Kingsolver 1968:319; Johnson 1969c:55; Johnson and Kingsolver 1973:38, 1982:419; Borowiec 1987:101; Udayagiri and Wadhi 1989:101.

Bruchus depressus Fall 1912:321; Pic 1913a:23.

Sennius depressus: Johnson 1968:1270; Bottimer 1968c:1026.

Bruchus nictitans Motschulsky 1874:241; Pic 1913a:37; Zacher 1952:462.

Mylabris nictitans: Leng 1920:306.

Sennius nictitans: Bottimer 1968c:1025.

Bruchus nigrinus Horn 1873:327; Schaeffer 1907:298; Blatchley 1910:1237; Fall 1910:166; Pic 1913a:37; Zacher 1952:462.

Sennius nigrinus: Bradley 1947:39; Blackwelder and Blackwelder 1948:45; Bottimer 1968c:1026; Johnson 1968:1270, 1969c:55.

Mylabris nigrinus: Leng 1920:305.

Color.—Integument mostly black; each elytron entirely black or black with a lateral, elongate, red macula sometimes extending from humerus nearly to apex but not extending mesad of fourth stria (figure 852); fore leg and mid leg usually reddish brown; hind leg reddish brown to black; antenna with basal four segments yellow, apical segments black. Vestiture white, sparse on dorsum, slightly more dense on venter.

Structure.—Vertex and frons strongly convex, densely punctulate, frontal carina evanescent, usually only an impunctate line; ocular index 3.25:1; ocular sinus one-half as long as eye; antenna not modified, extending to middle of metepisternum. Pronotum nearly semicircular (figure 851), strongly convex; basal lobe sulcate; surface densely foveolate, interspaces punctulate, lateral portions of disk more densely sculptured than middle; lateral carina ridgelike, cervical sulcus lacking. Scutellum quadrate, emarginate. Elytra together about as long as wide (figure 851); disk flattened between 5th striae; striae parallel, shallow but distinct, lacking basal denticles, interstices flat, punctate-imbricate in basal one-half, imbricate toward apex; metacoxal face densely, evenly punctate, fossula glabrous; hind leg as in figure 853; meta-femoral denticle longer than width of tibia at base; metatibial carinae, with exception of abbreviated ventrolateral carina, complete to apex; mucro shorter than lateral denticle, coronal denticles subequal to lateral denticles; abdomen not modified; pygidium convex, discal surface densely microfoveolate.

Male genitalia.—As in figures 854 and 855; median lobe slender (figure 854), apically slightly expanded; ventral valve semicircular, apex produced, truncate; armature of internal sac consisting of two small clusters of denticles at apical orifice, hinge sclerites short, remainder of internal sac sparsely lined with denticles; apex with circular closure valve; lateral lobes bowed (figure 855), cleft nearly to base, arms slender, apices expanded toward meson, mesal faces densely setose.

Size.—Body length 1.6–2.9 mm; width 1.2–2.2 mm.

Type depository.—MCZC (*cruentatus,* lectotype No. 3886, by Johnson 1968; *depressus,* lectotype No. 25051, by Johnson 1968; *nigrinus,* lectotype No. 126, by Johnson 1968); ZMUM (*nictitans,* holotype).

Type locality.—Texas (*cruentatus,* restricted by lectotype); Florida, Orlando? *(depressus);* "Am. Bor." *(nictitans);* "Middle States" *(nigrinus).*

Distribution.—AL, AR, CT, DC, FL, GA, IL, IN, IA, KS, LA, MD, MA, MN, MO, MS, NE, NJ, NY, NC, OH, OK, PA, SC, SD, TN, VA; Mexico.

Host plants.—*Chamaecrista fasciculata, C. nictitans nictitans; Parkinsonia* sp. often collected. Records in literature of *Cassia chamaecrista* and *Chamaecrista nictitans nictitans* are referable to *Chamaecrista fasciculata.* Often collected in inflorescences of other plant species and in spanish moss *(Tillandsia usneoides)* as a hibernaculum (Rosenfield 1911).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The shape of the elytral maculation will usually separate *S. cruentatus* from all the U.S. species except *S. simulans.* The maculation of *S. cruentatus* usually extends basad to the humerus, whereas the maculation of *S. simulans* is confined to the apical one-third of the each elytron. Male genitalia of the two species are similar except that the apex of the median lobe is truncate in *S. cruentatus* but acute in *S. simulans.* Little overlap occurs in the distribution of the two species, *S. cruentatus* being found east of the 100th meridian whereas *S. simulans* is known only from Arizona. The occasional totally black individual of *S. cruentatus* must be separated by male genitalia. Other *Sennius* species can be separated by color pattern and male genitalia.

Sennius discolor (Horn)

(Figures 856–860)

Bruchus discolor Horn 1873:326; Fall 1901:165; Fall and Cockerell 1907:200; Schaeffer 1907:292; Cushman 1911:506; Pic 1913a:24; Zacher 1952:462.

Sennius discolor: Bottimer 1968c:1026; Johnson 1968:1270, 1969c:54,55;

Johnson and Kingsolver 1973:43, 1982:419; Udayagiri and Wadhi 1989:102.

Mylabris discolor: Leng 1920:305.

Bruchus discopterus Fall 1910:167; Fall 1912:322; Pic 1913a:24.

Sennius discopterus: Bottimer 1968c:1027; Johnson 1968:1270.

Mylabris discopterus: Leng 1920:305.

Bruchus infirmus Sharp 1885:481.

Acanthoscelides infirmus: Blackwelder 1946:759.

Bruchus managuanus Pic 1935:66.

Acanthoscelides managuanus: Blackwelder 1946:760.

Color.—Integument mostly black but each elytron largely reddish orange with marginal, basal, and sutural borders black (figure 857); legs reddish orange, antenna reddish brown to brown, pygidium black. Dorsal vestiture of dense, intermixed white and golden setae; venter of body with dense white pubescence; pygidium white with evanescent basal triangle.

Structure.—Vertex and frons strongly convex, densely punctulate, impunctate frontal line; ocular index 3:1; ocular sinus two-thirds length of eye; pronotum subconical (figure 856), lateral margins nearly straight; disk strongly convex and densely punctulate; cervical sulcus short, deep. Scutellum quadrate, emarginate. Each elytron convex but slightly depressed around scutellum (figure 856); striae deep, narrow; interstices minutely imbricate; metafemoral denticle acute (figure 858), length equal to tibial width at base; metatibia with ventrolateral carina lacking; mucro, lateral denticle, and coronal denticles subequal in length.

Male genitalia.—As in figures 859 and 860; median lobe slender (figure 859), slightly expanded apically, dorsal valve semicircular, ventral valve subtriangular, lateral margins incurved, apex blunt; apical orifice lined with fine denticles; hinge sclerites strongly arcuate, internal sac armature consisting of two lateral rows of closely packed, elongate spicules extending two-fifths from base, middle of sac with two dense rows of minute denticles and numerous, randomly placed denticles, apex similarly armed; closure valve circular; lateral lobes bowed (figure 860), cleft nearly to base, arms slender, moderately expanded apically.

Size.—Body length 1.3–2.3 mm; width 0.8–1.6 mm.

Type depository.—ICCM (*discolor,* Ulke Collection); MCZC (*discopterus,* holotype No. 25052); BMNH *(infirmus);* MNHP *(managuanus).*

Type locality.—Texas *(discolor);* Southern California, Elsinore *(discopterus);* Guatemala *(infirmus);* Nicaragua *(managuanus).*

Distribution.—AZ, AR, CA, NM, TX; Mexico to Nicaragua.

Host plants.—*Senna lindheimeriana, S. roemeriana, S. wislizeni wislizeni;* "*Cassia* sp." Cushman (1911) reported this species from *Prosopis* sp. and *Parkinsonia* sp. but these records have not been verified by subsequent rearings.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species most closely resembles *S. morosus* among U.S. species of *Sennius.* The metafemoral denticle of *S. morosus* is usually as long as or longer than width of the tibia at base, but this is difficult to measure. Male genitalic characters are the most reliable (compare figures 859 and 889). No U.S. species other than these two has the red elytral patch covering nearly the entire surface.

Sennius fallax (Boheman)

(Figures 861–866)

Bruchus fallax Boheman 1839:59; Pic 1913a:25; Zacher 1952:462.

Acanthoscelides fallax: Blackwelder 1946:759.

Sennius fallax: Johnson and Kingsolver 1973:54, 1982:419; Udayagiri and Wadhi 1989:102.

Bruchus xanthopus Suffrian 1870:156; Pic 1913a:57.

Acanthoscelides xanthopus: Blackwelder 1946:759; Zacher 1952:465.

Sennius xanthopus: Bottimer 1961:295, 1968c:1027,1039.

Bruchus probus Sharp 1886:481; Pic 1913a:43.

Acanthoscelides probus: Blackwelder 1946:760.

Bruchus californicus Boheman 1859:114; Pic 1913a:19; Kingsolver 1979a:342.

Acanthoscelides californicus: Bottimer 1968c:1017.

Color.—Integument dark red to black, each elytron usually with some red integument varying from faintly red in basal areas to the entire elytron red to reddish orange (figure 862); head and pronotum black; antenna and legs red; pygidium dark red to black. Vestiture dense, intermixed white and brown setae on pronotum; elytra faintly striped in most specimens; pygidium with three basal white patches (figure 863); venter of body white.

Structure.—Vertex and frons densely reticulate-punctate, frons with median line; ocular index 3:1; ocular sinus one-half length of eye; antenna reaching middle of metepisternum. Pronotum bell-shaped (figure 861), lateral margins straight in basal one-half, apex evenly arcuate; disk evenly convex and densely microfoveolate; basal lobe sulcate; lateral carina not visible; cervical sulcus distinct, deep. Scutellum transverse, densely pubescent. Elytral margins convex (figure 861), striae parallel, deep, narrow, strial punctures fine; interstices flat, sparsely punctate and minutely imbricate. Metafemoral denticle minute (figure 864); ventrolateral carina of metatibia evanescent; pygidial disk foveolate-punctulate.

Male genitalia.—As in figures 865 and 866; median lobe moderately broad (figure 865); ventral valve triangular, lateral margins not arcuate, apex slightly produced; hinge sclerites massive, sinuate; middle of sac with paired clusters of fine, elongate spicules, middle of sac and lateral pockets with scattered fine denticles; closure valve circular; lateral lobes cleft nearly to base (figure 866), arms slender, apices spatulate, with mesal expansion, mesal faces setose.

Size.—Body length 1.3–2.5 mm; width 0.8–1.7 mm.

Type depository.—NHRS *(fallax, californicus);* Cuba, Havana, Academia de Ciencias de Cuba *(xanthopus);* BMNH *(probus).*

Type locality.—Jamaica *(fallax);* Cuba *(xanthopus);* Guatemala *(probus);* California *(californicus).*

Distribution.—FL, GA; Mexico to Panama, West Indies.

Host plants.—*Senna bicapsularis bicapsularis, S. biflora, S. obtusifolia, S. occidentalis.* Johnson and Kingsolver (1973) and Johnson (1977b) record eight additional hosts from Mexico and Central America.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—*Sennius fallax* is also widespread in the Neotropics and is variable in integument color. Specimens found from Mexico southward on the mainland are usually smaller with the pronotum and elytra entirely black, whereas those specimens from the West Indies and southern United States are larger with reddish-brown pronotum and elytra usually with a red stripe of varying width on each elytron. Male genitalia of the two forms are identical.

Bottimer (1961) discussed the life history of this species under the name *Sennius xanthopus.*

Sennius lebasi (Fahraeus)

(Figures 867–873)

Bruchus lebasi Fahraeus 1839:25; Pic 1913a:30.

Acanthoscelides lebasi: Blackwelder 1946:760.

Sennius lebasi: Kingsolver 1979a:342; Johnson and Kingsolver 1982; Udayagiri and Wadhi 1989:104.

Bruchus celatus Sharp 1885:499; Pic 1913a:20.

Acanthoscelides celatus: Blackwelder 1946:759.

Sennius celatus: Bottimer 1961:294, 1968c:1026,1039; Moldenke 1971:108.

Bruchus rufescens Motschulsky 1874:222; Blackwelder 1946:761.

Sennius rufescens: Kingsolver 1979a:342.

Acanthoscelides rufescens: Blackwelder 1946:761.

Color.—Body reddish yellow to black, most often dark red; head black, pronotum red to black, often with paler red median line; elytra reddish yellow to dark brown, each elytron with broad, oblique, paler band usually extending from side to side, separated from base by narrow black border extending briefly along suture, apical one-half dark brown with light brown median macula, apical border usually black (figure 868); antennae and legs red, sometimes with base of metafemur dark brown; sternal areas dark brown to black except terminal abdominal segments reddish; pygidium varying from uniformly reddish yellow to a slightly darker form with paired dark brown maculae. Vestiture inconspicuous, sparse yellow on pronotum, elytra, and abdomen, white on thoracic sterna and scutellum; pygidium yellow, vestiture condensed in basal one-half and in median stripe.

Structure.—Vertex and frons strongly convex, reticulate-punctate; frontal carina distinct; ocular index 3.25:1; ocular sinus six-tenths as long as eye; pronotum strongly convex (figure 867); disk densely foveolate-punctate; cervical sulcus narrow, deep, continuous ventrally. Scutellum quadrate, emarginate, densely pubescent. Elytral striae shallow (figure 867), relatively broad, strial punctures slightly encroaching on interstitial borders; interstices flat, finely imbricate; metafemoral denticle about one-third width of tibial base (figure 871); ventrolateral carina of metatibia lacking; pygidium shallowly micropunctate.

Male genitalia.—As in figures 872 and 873; moderately broad; ventral valve broad with lateral margins sinuate (figure 872); hinge sclerites strongly arcuate, basal one-half of internal sac densely lined with long spicules, rows of slender spines in apical one-half; closure valve circular; lateral lobes bowed (figure 873), cleft nearly to base, expanded mesad in apical one-half, mesal faces densely setose.

Size.—Body length 1.5–2.9 mm; width 0.9–1.9 mm.

Type depository.—NHRS *(lebasi);* BMNH *(celatus);* ZMUM *(rufescens).*

Type locality.—Colombia, "Carthagena" *(lebasi);* Panama, Bugaba *(celatus);* "Columbia" *(rufescens).*

Distribution.—TX; Mexico to Colombia, Brazil, Trinidad.

Host plants.—*Senna bicapsularis bicapsularis.* Six additional host plants are recorded from Mexico south (Waterworth 1986).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—The pygidium of this species is red or reddish brown, usually with darker, arcuate maculae. The elytral pattern is variable. In some specimens, the color is nearly all yellowish red; but variation ranges from that to dark brown or even black, darker specimens with a chevron-shaped transverse band across the elytra slightly above the middle. The pronotum is usually much darker than the elytra.

Bottimer (1961) briefly discussed the life history of this species in Texas under the name *Sennius celatus.* Johnson (1977b) listed host plants also under the name *Sennius rufescens.*

Sennius leucostauros Johnson and Kingsolver

(Figures 874–879)

Sennius leucostauros Johnson and Kingsolver 1973:75; Johnson 1977b:128,130; Johnson and Kingsolver 1982:419; Udayagiri and Wadhi 1989:419.

Color.—Integument black; antenna reddish brown, fore legs and mid legs reddish brown, metafemoral base black, apical one-third to one-half red. Vestiture white and dark brown; pronotum with median stripe and lateral patches white; scutellum white; elytra black, dorsal setal pattern of brief basal patches, sutural stripe, and transverse median band white, remainder of each elytron with dark brown vestiture (figure 875); pygidium with median stripe and lateral patches white (figure 876); venter of body uniformly white.

Structure.—Vertex and frons microfoveate, frons with impunctate median line; ocular index 3:1; ocular sinus three-fifths as long as eye; antenna short, extending only to humeri. Pronotum bell-shaped (figure 874), evenly convex, disk densely punctulate with scattered foveae; cervical sulcus short, deep, not continuous across pro-sternum. Scutellum transverse, apex emarginate. Elytra striae consisting of lightly impressed rows of elongate punctures at base, gradually becoming deep and narrow toward apex; interstices finely, densely imbricate. Metafemoral denticle equal to width of tibia at base (figure 877); ventrolateral carina of metatibia absent; mucro as long as lateral denticle. Pygidial disk microfoveate, foveae elliptical, crowded, sometimes coalescing.

Male genitalia.—As in figures 878 and 879; median lobe moderately broad (figure 878); ventral valve broadly triangular, lateral margins straight; hinge sclerites large, strongly curved; basal one-half of internal sac with massive cluster of elongate spicules, lateral pockets of apical one-half lined with spicules, remainder of sac with scattered spicules. Lateral lobes cleft nearly to base (figure 879), arms slender, apices slightly expanded mesad; mesal faces densely setose.

Size.—Body length 1.8–2.3 mm; width 1.1–1.7 mm.

Type depository.—USNM, holotype No. 71397.

Type locality.—Mexico, Oaxaca, Temascal.

Distribution.—TX; Mexico to Guatemala.

Host plants.—*Senna bicapsularis bicapsularis.*

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—No other U.S. species has a white, cross-shaped pattern on a black elytral integument. Johnson and King-solver (1973) placed *Sennius leucostauros* in the *abbreviatus* species group, but its appearance is more similar to *Sennius bondari* (Pic) from South America than to other members of the *abbreviatus* group.

Sennius medialis (Sharp)

(Figures 880–884)

Bruchus medialis Sharp 1885:470; Pic 1913a:34.

Acanthoscelides medialis: Blackwelder 1946:760.

Sennius medialis: Johnson and Kingsolver 1973:78; Center and Johnson 1973:670; Johnson and Kingsolver 1982:419; Udayagiri and Wadhi 1989:105.

Bruchus auctus Fall 1910:166.

Mylabris auctus: Leng 1920:305.

Sennius auctus: Johnson 1968:1270; Bottimer 1968c:1026.

Color.—Integument mostly black; elytra with broad, reddish-orange, transverse

band continuous from margin to margin and centered about one-third from base, sometimes with narrow, black, sutural stripe (figure 881); antennae usually reddish orange or reddish brown; legs red except base of each metafemur sometimes black. Vestiture yellow, dark brown, and white; pronotum mostly yellow with indistinct white basal patches. Scutellum white. Each elytron with irregular, white band along basal margin, more conspicuous on 5th and 6th interstices; black elytral portions with dark brown setae, orange band with yellow setae; pygidium and ventral areas white.

Structure.—Vertex and frons with coarse, elongate punctures, setae directed mesad, frons with broad, impunctate ridge; ocular index 3:1; ocular sinus one-half length of eye; antenna extending to humerus; pronotum nearly semicircular (figure 880), disk densely punctulate and foveolate, foveae sparse along midline; cervical sulci continuous across prosternum. Scutellum quadrate, emarginate. Elytral striae shallow, punctures deep (figure 880); interstices flat, coarsely imbricate; metafemoral denticle about two-thirds as long as width of tibial base (figure 882), sometimes serrate on distal margin; ventrolateral carina of metatibia absent, mucro and lateral denticle subequal in length. Pygidial disk densely set with shallow, round varioles.

Male genitalia.—As in figures 883 and 884; median lobe moderately broad (figure 883); ventral valve subtriangular, lateral margins slightly sinuate; hinge sclerites slender, moderately arcuate; basal one-half of sac with small, paired clusters; apical one-half with scattered rows and small clusters of minute denticles; closure valve large, circular; lateral lobes cleft three-fourths their length (figure 884), arms long, slender, apices expanded mesad, mesal faces setose.

Size.—Body length 1.6–2.4 mm; width 1.2–1.7 mm.

Type depository.—BMNH *(medialis);* MCZC (*auctus,* lectotype No. 325046, by Johnson 1968).

Type locality.—Mexico, Guanajuato *(medialis);* Santa Rita Mountains, 8,000 feet *(auctus).*

Distribution.—AZ; Mexico to Guatemala.

Host plants.—Senna hirsuta leptocarpa. Johnson and Kingsolver (1976) list also *Cassia tomentosa* (now *Senna hirsuta hirsuta*) from Mexico.

Natural enemies.—Urosigalphus bruchivorus; Horismenus missouriensis.

Immatures.—Center and Johnson 1973:670 (egg).

Discussion.—Center and Johnson (1973) described oviposition and larval feeding in *Senna hirsuta leptocarpa.* Eggs have two elongate anchoring strands at each end. Larvae develop one to a seed, devouring it almost completely, and pupation occurs inside the intact seed coat. It does not form a cocoon, and the adult does not bore through the pod valve but escapes when the valves dehisce.

This species most closely resembles *Sennius abbreviatus* among the U.S. species, but the hind legs of *S. abbreviatus* are black, not red.

Sennius morosus (Sharp)

(Figures 885–890)

Bruchus morosus Sharp 1885:467; Pic 1913a:36.

Acanthoscelides morosus: Blackwelder 1946:760.

Sennius morosus: Johnson and Kingsolver 1973:84; Center and Johnson 1976:669; Pfaffenberger and Johnson 1976:38; Johnson and Kingsolver 1982:419; Udayagiri and Wadhi 1989:105.

Bruchus discolor: Fall and Cockerell 1907:200 (not Horn 1873).

Color.—Integument mostly black, each elytron with large, subelliptical reddish-

orange macula extending from humerus nearly to apex and mesad to 2nd stria, bordered basally, laterally, and apically with black (figure 886); basal four segments of antenna yellow, apical segments brown to black; fore legs and mid legs reddish brown, metafemur red with basal one-fourth black, tibia and tarsus red. Vestiture white, sparse on dorsum, dense on sides of abdomen and on pygidium; 3rd and 5th striae with elongate, white, basal patches.

Structure.—Vertex reticulate-foveolate, foveae coarser on frons bordering broad, impunctate ridge; ocular index 2.5:1; ocular sinus three-fifths as long as eye; antenna extending to humerus. Pronotum bell-shaped (figure 885), lateral margins straight; disk convex, densely, evenly foveolate, intervals micropunctate; cervical sulcus nearly hidden by vestiture, continuous across prosternum. Scutellum quadrate, densely pubescent. Elytra convex (figure 885); strial punctures deep, round, slightly encroaching on interstitial margins in basal one-third but becoming more narrow toward apex; interstices densely, finely imbricate; 3rd, 4th, and 5th striae sometimes with small basal denticles; length of femoral denticle equal to width of tibial base, sometimes minutely serrate on distal margin (figure 888); ventrolateral carina of metatibia apparent only in basal one-fourth; mucro subequal to lateral denticle. Pygidial sculpture of intermixed foveolae and minute punctures.

Male genitalia.—As in figures 889 and 890; median lobe moderately broad (figure 889); lateral margins of ventral valve basally incurved, then angulate to apex; hinge sclerites strongly arcuate, middle of sac with elongate mass of small, flat, ovate sclerites flanked by masses of small denticles, apical one-third of sac lined with small denticles; closure valve large, circular; lateral lobes cleft four-fifths to base (figure 890), arms elongate, slender, apices expanded toward meson, setose on mesal faces.

Size.—Body length 1.3–2.7 mm; width 0.9–1.7 mm.

Type depository.—BMNH.

Type locality.—Mexico, Jalapa.

Distribution.—AZ, NM, TX; Mexico to Panama.

Host plants.—Senna bauhinioides, S. covesii, S. durangensis durangensis, S. hirsuta leptocarpa, S. obtusifolia, S. roemeriana. Senna occidentalis is reported from Mexico.

Natural enemies.—Horismenus missouriensis.

Immatures.—Pfaffenberger and Johnson 1976:38 (first larval instar); Center and Johnson 1973:669 (egg).

Discussion.—Sennius morosus is similar to *S. discolor* but can be separated from it by the larger metafemoral denticle and details of the male genitalia (compare figures 859 and 889).

Center and Johnson (1973) discussed the life history of this species in Arizona. Eggs are anchored by several strands to the substrate along the line of pod dehiscence. Larvae burrow into a seed and, after devouring the contents, move to the adjacent seed in the pod. As many as eight seeds may by eaten by a larva, but three or four are usual. Excavated seeds are glued together by the larva, and the resultant cluster of seeds remains attached to the pod valve even after the pod has dehisced. Pupation occurs within the cluster of seeds, but a cocoon is not spun. This species is apparently bivoltine, according to Center and Johnson (1976).

Sennius obesulus (Sharp)

(Figures 891–895)

Bruchus obesulus Sharp 1885:468; Pic 1913a:37.

Acanthoscelides obesulus: Blackwelder 1946:760.

Sennius obesulus: Johnson and Kingsolver 1973:88; Johnson 1977b:130; Udayagiri and Wadhi 1989:106.

Color.—Integument mostly black; each elytron with red hemispherical maculation not attaining humerus, sometimes appearing as a subapical lateral ovate spot (figure 892); basal four or five antennal segments reddish orange, apical segments dark brown to black; fore leg and middle tibia reddish brown, middle femur and hind leg black. Vestiture white, everywhere dense, sometimes concealing sculpture.

Structure.—Vertex and frons convex, densely, evenly punctate, with short median impunctate line dorsad of fronto-clypeal suture; ocular index 3:1; ocular sinus one-half length of eye; antenna short, extending to humerus, club segments not markedly eccentric. Pronotum nearly semicircular in outline, moderately convex, disk evenly punctulate, each puncture bearing short white seta; lateral pronotal carina vaguely traceable near posterior angle; cervical sulcus absent; prosternum short, triangular, procoxal apices contiguous. Scutellum rectangular, slightly wider than long, bidentate. Elytra (figure 891) together as long as wide, broadest behind humeri; slightly depressed behind scutellum; striae regular in course, shallow, strial punctures evenly spaced; interstices flat, densely punctate. Hind leg as in figure 893; tibial coronal denticles fine; lateral carina complete, ventrolateral carina extending one-half distance to apex. Pygidium apically reflexed in male; disk finely, shallowly foveolate.

Male genitalia.—As in figures 894 and 895; median lobe slender (figure 894); ventral valve ogival, lateral margins sinuate, apex acutely produced; hinge sclerites moderately long, slightly arcuate; internal sac densely lined with mixed blunt and acute denticles; lateral lobes elongate (figure 895), slender, slightly bowed, cleft about two-thirds their length.

Size.—Body length 1.7–2.6 mm; width 1.1–1.8 mm.

Type depository.—BMNH.

Type locality.—Guatemala, "near the city Capetillo."

Distribution.— AZ; Guatemala, El Salvador, Costa Rica.

Host plants.—Chamaecrista serpens wrightii.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—Inclusion of *Sennius obesulus* in this handbook is based on Johnson's record (1977b) from Arizona, Santa Cruz County, near the border with Mexico.

This species is closely similar to *Sennius simulans* (Schaeffer) (see below), differing only in the following (characters of *S. simulans* in brackets): elytral maculation red, hemispherical, not attaining humerus, sometimes appearing as a subapical, lateral, ovate spot (figure 892) red elytral spot apical, nearly spanning width of apex, occasionally only as a small red, apical spot figure 897; armature of internal sac densely lined with blunt denticles (figure 894) internal sac with fewer blunt denticles figure 899.

Further study is needed to assess the correct application of these two names. If they prove to be synonymous, *S. obesulus* has priority.

Sennius simulans (Schaeffer)

(Figures 896–900)

Bruchus simulans Schaeffer 1907:296; Fall 1910:164; Pic 1913a:50.

Mylabris simulans: Leng 1920:305.

Sennius simulans: Johnson 1968:1270; Bottimer 1968c:1027; Johnson and Kingsolver 1973:93, 1982:419; Udayagiri and Wadhi 1989:107.

Color.—Integument mostly black; each elytron with reddish-orange apical maculation bordered with black and not extending anteriad beyond middle of elytron (figure 897); basal four antennal segments yellow, apical segments black. Fore legs brown, mid legs dark brown to black, hind legs always black. Vestiture white, everywhere dense, sometimes concealing sculpture.

Structure.—Vertex punctulate, punctures separated by three diameters of a puncture, frons more coarsely punctate flanking impunctate median ridge; ocular index 3:1; ocular sinus three-fourths length of eye; antenna short, extending to humerus. Pronotum nearly semicircular (figure 896), lateral margins arcuate; disk convex; surface sculpture intermixed fine punctures and elliptical foveolae; lateral carina ridge-like; cervical sulcus absent, proster-nal sulcus complete between cervical bosses. Scutellum quadrate, apically emarginate. Elytra (figure 896) slightly depressed along suture; striae shallow, strial punctures round, variolate, encroaching on margins of interstices; interstices punctate-imbricate. Length of metafemoral denticle about two-thirds length of tibial width at base (figure 898); ventrolateral carina of metatibia obsolete in apical one-third. Pygidium densely, finely foveolate.

Male genitalia.—As in figures 899 and 900; median lobe of uniform width (figure 899); lateral margins of ventral valve nearly straight, apex narrowly produced; hinge sclerites lunate, massive; internal sac relatively short, without lateral apical pockets, sac lined with blunt denticles; lateral lobes cleft two-thirds their length (figure 900), arms slender, expanded mesad, mesal faces setose.

Size.—Body length 1.7–2.6 mm; width 1.1–1.8 mm.

Type depository.—USNM, holotype No.42339.

Type locality.—Arizona, Huachuca Mountains.

Distribution.—AZ, CA; Mexico.

Host plants.—*Chamaecrista nictitans mensalis* (as *Cassia leptadenia* in literature).

Natural enemies.—None recorded.

Immatures.—Center and Johnson 1973 (egg).

Discussion.—Adults of *S. simulans* usually can be recognized by the subapical red spot on each elytron and totally black hind legs, but see the discussion of *S. obesulus.*

Center and Johnson (1973) briefly discussed the aspects of the life history of *S. simulans.* Eggs are glued to the pod wall as usual but with anchoring strands similar to those of *Sennius morosus.* Larvae consume several seeds within a pod and pupate within the feeding cavity. Seeds are apparently not glued together as in the case of *S. morosus,* and no cocoon is formed. Pods attacked by *S. simulans* dehisce only slightly, not widely as with normal pods. Adults escape through the dehiscing gap but do not bore through the pod wall.

Sennius whitei Johnson and Kingsolver

(Figures 901–907)

Sennius whitei Johnson and Kingsolver 1973:99; Johnson and Kingsolver 1982:420; Udayagiri and Wadhi 1989:107.

Color.—Body mostly black; each elytron with subbasal, marginal, red macula extending mesad to 3rd stria, apicad to middle of elytron (figure 902); fore leg, mid leg, and basal three antennal segments reddish yellow, remaining segments black; hind legs black. Vestiture black, white, and yellow; head, lateral portions of pronotum, sutural stripe, pygidium, and venter of body white, elytral vestiture yellow from 2nd stria to margin; middle one-third of pronotum with inconspicuous black setae.

Structure.—Vertex and frons densely foveolate, foveolae discrete, tending to be elongate either side of distinct frontal carina (figure 903); ocular index 4:1; ocular sinus three-fourths length of eye; antenna (figure 904) atypical for genus, subserrate from 3rd segment, extending to middle of metepisternum. Pronotum bell-shaped (figure 901), lateral margins nearly straight; disk convex except flattened on basal lobe; surface densely set with intermixed elliptical ovarioles and fine punctures; cervical sulci connected across prosternum. Scutellum quadrate, apex

shallowly emarginate. Elytra (figure 901) depressed along suture, striae shallow, strial punctures deep, elongate, encroaching on margins of interstices, basal foveae rounded; interstices flat or slightly convex, densely, finely imbricate; metafemoral denticle minute (figure 905); metatibial carina evanescent; mucro shorter than lateral denticle. Pygidium densely, finely variolate, interspaces finely punctate.

Male genitalia.—As in figures 906 and 907; median lobe slender (figure 906); lateral margins of ventral valve sinuate, apex produced slightly; hinge sclerites elongate, moderately arcuate, internal sac lined with blunt denticles in basal one-half, with acute denticles in apical one-half, closure valve large, circular, lateral pockets absent; lateral lobes cleft about one-half their length (figure 907), apices bowed mesad, setose on mesal faces.

Size.—Body length 2.5–2.9 mm; width 1.7–1.9 mm.

Type depository.—USNM, holotype No. 71391.

Type locality.—Mexico, Nayarit, 23 mi south of Tepic.

Distribution.—AZ; Mexico.

Host plants.—Unknown.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species resembles *S. cruentatus* and was placed in the *cruen-tatus* group by Johnson and Kingsolver (1973). The red elytral spot of *S. whitei,* however, is confined to the anterior one-half (figure 902), the frontal carina is sharp and distinct (figure 903), the median lobe is more slender, lateral lobes are more shallowly cleft, and the metafemoral subapical denticle is much smaller than for *S. cruentatus.*

Nothing is known of the life history of this species.

Genus *Stator* Bridwell

Stator Bridwell 1946:55; Bradley 1947:39; Blackwelder and Blackwelder 1948:45; Johnson 1963:860; Teran 1967:308,316; Bottimer 1968c:1027,1039,1041; Johnson 1968:1270; Kingsolver 1972a:219; Johnson and Kingsolver 1973:1,5, 1976:2; Borowiec 1987:99; Johnson et al. 1989:7; Udayagiri and Wadhi 1989:108; Johnson and Siemens 1995a. Type species: *Bruchus pruininus* Horn, by original designation.

Frons carinate or with finely punctate line; antenna not dimorphic, club segments slightly eccentric, subserrate from 5th segment, terminal segment elliptical, extending to humerus; eyes protruding laterally, separated from side of head (except *Stator subaeneus*); antenna not sexually dimorphic, terminal segment ovate. Prothorax semicircular in dorsal aspect (figure 908), convex, lacking asperities; lateral margin sharply carinate, carina extending from posterolateral corner of pronotum nearly to coxal cavity; procoxae contiguous apically (except *Stator beali*); cervical sulcus absent; cervical boss bisetose. Scutellum quadrate, slightly concave; mesepi-meron reduced to triangular sclerite. Elytra subquadrate (figure 908), slightly depressed on disk; striae not distorted, subparallel, lacking basal asperities, strial punctures distinct; interstices of uniform width, flat, finely punctate-imbricate. Metacoxae entirely punctate (figure 956) or with median one-half smooth (figure 949); metafemur with ventral face channeled, ventrolateral and ventromesal margins carinate, ventromesal carina with acuminate, subapical denticle; ventrolateral carina slightly sinuate, or emarginate subapically with blunt angulation; meta-tibia gradually dilated toward apex; mucro usually short, subequal to lateral denticle; ventrolateral carina sometimes evanescent apically, lateral, ventral, and dorsomesal carina strong and complete; some species with longitudinal dorsal fossa (figure 911), coronal denticles two or three. Abdominal sterna unmodified except male 5th sternum

usually deeply emarginate; pygidium convex, lacking asperities.

Median lobe of male genitalia with one to several spines or spicules; lateral lobes deeply cleft, spatulate apically.

Biology.—Johnson 1967, 1984b.

Keys.—Johnson 1963; Johnson and Kingsolver 1976 (North America); Pfaffenberger 1981 (first larval instar); Johnson et al. 1989 (South America).

Key to Species of *Stator* of United States

1 Metacoxal face entirely punctate (figure 956) 2

Metacoxal face with most of medial one-half smooth (figure 949); lateral one-half and small patch near trochanteral fossa punctate 7

2(1) Elytra entirely red, or black with red maculae 3

Elytra entirely black 4

3(2) Vestiture of pronotum and elytra uniformly yellow; black maculation of elytra extending from margin to 5th or 6th stria; prosternum separating procoxae for entire length ..... ***beali*** Johnson

Vestiture of pronotum and elytra uniformly white; black maculation, if present, extending only to 7th stria; procoxae contiguous at apices ..... ***limbatus*** (Horn)

4(2) Eye flattened, nearly contiguous with lateral margin of head ..... ***subaeneus*** (Schaeffer)

Eye not flattened, posterior margin protruding from side of head 5

5(4) Metafemur black and red, usually with apex red, or all red 6

Metafemur entirely black ..... ***pruininus*** (Horn)

6(5) Metafemur and antenna all red ..... ***bottimeri*** Kingsolver

Metafemur and antenna partly black ..... ***vachelliae*** Bottimer

7(1) Metafemur mostly black with no more than apical one-tenth reddish; elytra with intermixed white and brown setae, without denser patches of white setae ..... ***pygidialis*** (Schaeffer)

Metafemur with apical two-tenths or more dark red; elytra with intermixed reddish-brown and brown setae, without denser patches or rows of white setae 8

8(7) Male genitalia with large, curved, saddle-shaped spine (figure 951); apex of ventral valve arcuate ..... ***sordidus*** (Horn)

Male genitalia either with large, curved spine or small, tapered spine (figures 912 and 932); apex of ventral valve emarginate 9

9(8) Male genitalia with large spine; apex of ventral valve narrowly emarginate (figure 924) ..... ***chihuahua*** Johnson and Kingsolver

Male genitalia with small, tapered spine (figure 926); ventral valve broadly emargi-nate ..... ***coconino*** Johnson and Kingsolver

Stator beali Johnson

(Figures 908–914)

Stator beali Johnson 1963:861; Bottimer 1968c:1027,1039; Johnson 1968:1270; Johnson and Kingsolver 1976:16, 1982:420; Johnson et al. 1989:9; Udayagiri and Wadhi 1989:109; Nilsson and Johnson 1993b; Fox and Mousseau 1995.

Color.—Body black except each elytron mostly red with black basal and sutural borders and lateral macula extended medially to 5th or 6th stria; antenna with basal five segments yellow or orange, apical segments orange to brown; fore leg and mid leg reddish yellow, hind leg usually black, sometimes with tibial apex dark red. Vestiture yellow, sparsely distributed on dorsum of body except pronotum with median stripe and lateral patches; scutellum white; pygidium with median basal triangle and lateral patches yellow, more prominent in female (figures 909 and 910); ventral vestiture white.

Structure.—Frontal carina usually a glabrous ridge; ocular index 3:1; ocular sinus one-half length of eye. Pronotal disk finely punctate (figure 908). Metacoxal face

uniformly punctate; ventrolateral metafemoral carina subapically sinuate (figure 911); metatibial carinae all complete, dorsal face with elongate fossa, sometimes difficult to see.

Male genitalia.—As in figures 912, 913, and 914; ventral valve triangular (figure 912); internal sac with one slender median sclerite, and one apical, helmet-shaped sclerite; lateral lobes with arms slender at base (figure 913), apices expanded toward meson, cleft two-thirds their length; spiculum gastrale as in figure 914.

Size.—Body length 2.1–2.8 mm; width 1.6–2.1 mm.

Type depository.—USNM, holotype No. 67419.

Type locality.—Texas, Cameron Co., Brownsville.

Distribution.—TX; Mexico.

Host plants.—*Pithecellobium ebano* (common name, Texas ebony).

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species closely resembles *Stator limbatus* but differs in the yellow dorsal vestiture, prosternum separating the procoxae, the lateral elytral macula reaching 5th or 6th stria, and shape of the spiculum gastrale (compare figures 914 and 934). (See *S. limbatus* discussion.)

Bridwell, in an unpublished notebook from 1936, states, "While this species resembles *Stator limbatus,* it affects only the seed of Texas ebony. Its eggs are laid upon the ripe seeds within the pod, the ovipositor being inserted between the pod and seed, and as many as 25 eggs may be deposited at one time by a female on a single seed. Each seed can furnish food for that many more larvae if it is full sized."

Nilsson and Johnson (1993b) discussed oviposition habits of *S. beali,* compared to those of *S. limbatus,* and their attempts at hybridization of these species.

Stator bottimeri Kingsolver

(Figures 915–920)

Stator bottimeri Kingsolver 1972a:225; Johnson and Kingsolver 1976:17, 1982:420; Johnson et al. 1989:9; Udayagiri and Wadhi 1989:109; Alvarez Marin and Kingsolver 1997:220.

Color.—Body black with bronzy sheen; antenna, fore leg, and mid leg reddish brown to yellow, hind leg red except trochanter black. Vestitural pattern of pronotum and elytra with black, intermixed brown and white, and white setae (figure 915); pygidial pattern of male intermixed brown and white setae with pair of slightly depressed, black, median patches (figure 916), that of female black with lateral basal white patches and scattered apical white setae (figure 917); venter of body densely white.

Structure.—Frontal carina evanescent; ocular index 4:1; ocular sinus two-thirds length of eye. Metacoxal face uniformly punctate; metafemur with ventrolateral carina sinuate (figure 918); ventrolateral carina of metatibia lacking, dorsal sulcus well-defined.

Male genitalia.—As in figures 919 and 920; ventral valve with lateral margins arcuate (figure 919), apex bluntly rounded; internal sac armed with 18–20 broad, flat, bladelike spines; lateral lobes as in figure 920.

Size.—Body length 2.1–2.2 mm; width 1.5–1.7 mm.

Type depository.—USNM, holotype No. 70396.

Type locality.—Cuba, near Santiago.

Distribution.—FL; West Indies.

Host plants.—*Acacia farnesiana, A. pinetorum.*

Natural enemies.—None recorded.

Immatures.—None described.

Discussion.—This species is most similar to *Stator subaeneus* among the U.S. species but is easily separated from it. The posterior margin of the eye is separated from the

head (partly contiguous in *S. subaeneus*), the hind leg is entirely red (entirely black in *S. subaeneus*), and armature of the internal sac is distinctive (compare figures 919 and 958).

Stator chihuahua Johnson and Kingsolver

(Figures 921–925)

Stator chihuahua Johnson and Kingsolver 1976:23; Pfaffenberger 1981:255; Johnson and Kingsolver 1982:420; Johnson et al. 1989:10; Udayagiri and Wadhi 1989:110.

Color.—Body black, legs dark red, basal five antennal segments reddish yellow, six apical segments black. Pronotum and elytra with intermixed coppery and white setae, evanescent white patch of setae at middle of each 7th interstice (figure 921); male pygidial vestiture nearly uniformly white with scattered coppery setae near apex, basal margin with three patches of white setae (figure 922); female pygidium black with lateral basal white patches (figure 923); ventral vestiture mostly white with scattered coppery setae on lateral portions of abdominal sterna.

Structure.—Vertex and frons uniformly punctulate, frontal carina absent; ocular index 4:1 in male, 2.4:1 in female; ocular sinus one-half length of eye; antenna reaching middle of metepisternum; medial one-half of metacoxal face impunctate and polished, lateral one-half punctulate; ventrolateral carina of metafemur with obtuse angle opposite subapical denticle; metatibia lacking ventrolateral carina; dorsal fossa absent.

Male genitalia.—As in figures 924 and 925; ventral valve with incurved lateral margins and emarginate apex (figure 924); internal sac armed with large, saddle-shaped median sclerite, apical sclerite absent; lateral lobes broadly spatulate (figure 925), cleft nearly to base; mesal faces finely setose.

Size.—Body length 1.6–2.2 mm; width 1.1–1.6 mm.

Type depository.—USNM, holotype No. 71402.

Type locality.—Arizona, Pima Co., Kitt Peak.

Distribution.—AZ; Mexico.

Host plants.—Acacia angustissima angustissima, A. constricta; Calliandra eriophylla, C. humilis humilis; Lysiloma microphylla thornberi; Mimosa biuncifera, M. wherryana.

Natural enemies.—Lariophagus texanus.

Immatures.—Pfaffenberger 1981:255 (first larval instar).

Discussion.—This species is similar to *Stator sordidus, S. coconino, S. pygidialis,* and *S. vachelliae,* differing principally in structures of the male genitalia.

Stator coconino Johnson and Kingsolver

(Figures 926–927)

Stator coconino Johnson and Kingsolver 1976:25, 1982:420; Johnson et al. 1989:10; Udayagiri and Wadhi 1989:109.

Color.—Similar to *Stator chihuahua* but with base of metafemur black, the 7th elytral interstice lacking a white patch, and the apical one-half of the male pygidium nearly glabrous.

Structure.—Identical to *Stator chihuahua* except for male genitalia.

Male genitalia.—Characters of the male genitalia are distinctive (figures 926 and 927); ventral valve is apically broadly emarginate, and the internal sac is armed only with a small median sclerite (figure 926); lateral lobes broadly spatulate (figure 927), mesally expanded, cleft two-thirds to base, mesal faces finely setose.

Size.—Similar to *Stator chihuahua.* Body length 2.2 mm; width 1.6 mm.

Type depository.—USNM, holotype No. 71403.

Type locality.—Arizona, Coconino Co., 8 mi north of Sedona.

Distribution.—AZ.

Host plants.—Not known.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—See discussion of *Stator chihuahua.*

Stator limbatus (Horn)

(Figures 928–934)

Bruchus limbatus Horn 1873:326; Sharp 1885:454; Horn 1894:344; Fall 1901:29,160; Schaeffer 1907:292,294,303; Fall 1910:165; Cushman 1911:498,506; Bridwell 1920b:406,409, 1920c:332, 1921a:458, 1921b:465, 1923c:262; Krauss 1944:11.

Mylabris limbatus: Leng 1920:305; Kannan 1923:25.

Acanthoscelides limbatus: Moreno and Bibby 1943:23; Blackwelder 1946:760; Zacher 1952:465,470,471.

Stator limbatus: Leech 1954:85 Swezey 1954; Leech 1959:60; Hinckley 1960:261; Bibby 1961:325; Johnson 1963:861; Bottimer 1968b:284, 1968c:1027,1039; Johnson 1967:267, 1968:1270, 1969c:55; Forister and Johnson 1970:84, 1971:231; Kingsolver 1972a:228; Johnson and Kingsolver 1976:32; Pfaffenberger and Johnson 1976:39; Mitchell 1977:645,648 (life history); Johnson and Kingsolver 1982:420; Kistler 1982:266; Stein 1983a,b; Johnson et al. 1989:8; Udayagiri and Wadhi 1989:110; Nilsson and Johnson 1993b:385; Johnson 1995b:319.

Bruchus interruptus Sharp 1885:470; Schaeffer 1907:297.

Acanthoscelides interruptus: Blackwelder 1946:759.

Bruchus cearanus Pic 1930c:12

Acanthoscelides cearanus: Blackwelder 1946:759

Stator cearanus: Kingsolver 1972a:225; Johnson and Kingsolver 1976:38, 1982:420; Johnson et al. 1989:27; Kingsolver and Silva 1991:412; Johnson 1995b:319.

Color.—Body black except each elytron usually red with black lateral macula, each macula with lobe sometimes extended toward suture as far as 7th stria, varying from all red to a pattern of small basal and apical red maculae on black background; antennal color varying from four or five basal segments yellow and remaining segments dark red, to all segments yellow; fore leg and mid legs yellow. Vestiture white, uniformly distributed over body, pygidium sometimes with evanescent basal patches.

Structure.—Frontal carina short, sometimes appearing as only an impunctate line; ocular index 3.75:1; ocular sinus one-half length of eye; antenna extending to elytral humerus. Pronotum, scutellum, and elytra as for genus (figure 928). Metacoxal face uniformly punctate; ventrolateral carina of metafemur sinuate; all four metatibial carina complete. Female pygidium more elongated than in male (figures 929 and 930).

Male genitalia.—As in figures 932, 933, and 934; ventral valve triangular (figure 932); internal sac with thornlike median sclerite and helmet-shaped, dentate apical sclerite; lateral lobes with arms slender (figure 933), apices mesally strongly expanded, cleft two-thirds to base. Spiculum gastrale as in figure 934.

Size.—Body length 1.6–2.7 mm; width 1.1–2.0 mm.

Type depository.—MCZC (*limbatus,* lectotype No. 8196; BMNH *(interruptus).*

Type locality.—Lower California *(limbatus);* Mexico and Guatemala *(interruptus).*

Distribution.—AZ, CA, TX, HI; Mexico to Ecuador. Generally distributed in the Hawaiian Islands (Stein 1983a).

Host plants.—Acacia acatlensis, A. angustissima angustissima, A. baileyana, A. berlandieri, A. confusa, A. cultriformis, A. farnesiana, A. greggi, A. koa, A. melano-xylon, A. millefolia, A. retinodes, A. richei, A. roemeriana, A. wrightii; *Albizia lebbeck, A. saponaria; Arachis hypogaea; Caesalpinia*

pulcherrima; Calliandra eriophylla, C. humilis humilis, C. humilis reticulata; Cassia fistula, C. grandis, C. javanica indochinensis, C. javanica javanica; Delonix regia(?); *Desmanthus bicornutus; Erythrina sandwicensis; Glycine max; Leucaena leucocephala, L. pulverulenta; Lysiloma microphylla thornberi; Neptunia plena; Parkinsonia aculeata, P. florida, P. micro-phylla, P. texana macra, P. texana texana; Pithecellobium brevifolium, P. dulce, P. ebano, P. pallens, P. saman, P. unguis-cati; Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. juliflora* (exp.).

Natural enemies.—Microdontomerus anthonomi; Stenocorse bruchivora; Urosigalphus bruchivorus, U. neobruchi; Uscana semifumipennis.

Immatures.—Kannan 1923 (egg and first larval instar); Pfaffenberger and Johnson 1976 (first larval instar); Pfaffenberger 1981 (first instar).

Discussion.—This species has one of the most extensive host lists among the Bruchidae. Waterworth (1986) lists 36 hosts taken from the literature.

Johnson, in his paper on bruchid guilds (1981a), places this species in his mature seed guild, in which species oviposit only on mature seeds on the plant. Mitchell (1977) reported that *Stator limbatus* entered seed pods of *Cercidium floridum* through exit holes of another bruchid, *Mimosestes amicus* (Horn).

Mitchell detailed the oviposition strategy and life history of *S. limbatus,* and Bridwell (1923c) described oviposition through open valves of the seed pod. Nilsson and Johnson (1993b) experimented with hybridization of *S. limbatus* and *S. beali.*

Among the species included in this handbook, *Stator limbatus* and *S. beali* are the only species with red elytra marked with black maculae. Other differentiating characters can be found in the key to species.

Kistler (1982) studied the effects of temperature on biological processes of *S. limbatus* in Arizona.

Essig (1929a) gave the common name "limbate weevil" to this species.

Stator pruininus (Horn)

(Figures 54, 935–939)

Bruchus pruininus Horn 1873:327; Sharp 1885:453,472; Riley and Howard 1892c:165; Fall 1901:29,160; Fall and Cockerell 1907:200; Schaeffer 1907:292–297; Fall 1910:162–166; Cushman 1911:507; Payne 1913:40; Bridwell 1918:465–471, 1919:18, 1920a:408; Swezey 1921:521; Bridwell 1923a:79, 1923b:261; Swezey 1925:3, 1936:201; Bridwell 1938a:71; Swezey 1954:80.

Bruchus (Stator) pruininus: Zacher 1952:462.

Mylabris pruininus: Leng 1920:305; Kannan 1923:25.

Bruchidius pruininus: Herford 1935:15.

Acanthoscelides pruininus: Blackwelder 1946:760.

Stator pruininus: Bridwell 1946:55; Bradley 1947:39; Zacher 1952:462,480; Hinckley 1960:261; Bibby 1961:325; Johnson 1963:862; Peck 1963:956; Bottimer 1968b:1027,1039,1041, 1968c:285; Johnson 1967:267, 1968:1270; Bottimer 1969b:1189,1191; Janzen 1969:14,19; Johnson 1969c:55; Janzen 1972:976; Kingsolver 1972a:221; Center and Johnson 1976:196; Johnson and Kingsolver 1976:44; Johnson 1979a:124, 1981c:251; Pfaffenberger 1981:264; Johnson and Kingsolver 1982:420; Kistler 1982:266; Johnson 1984b:88; Borowiec 1987:99; Luckow and John-son 1987:49; Johnson et al. 1989:10; Udayagiri and Wadhi 1989:111.

Bruchus cognatus Sharp 1885:472.

Acanthoscelides cognatus: Blackwelder 1946:759.

Bruchus piger Sharp 1885:473.

Acanthoscelides piger: Blackwelder 1946:760.

Color.—Body and appendages black except 3rd to 5th basal antennal segments, fore leg and mid leg reddish yellow. Vestiture sparse, white, and uniformly distributed over body.

Structure.—Frons with impunctate median line; ocular index 3:1; ocular sinus two-thirds length of eye; antenna extending to elytral humerus. Pronotum, scutellum, and elytra as for genus (figure 935). Metacoxal face densely, uniformly punctate; ventrolateral carina of metafemur sinuate; all four carinae of metatibia complete to apex, dorsal tibial fossa present.

Male genitalia.—As in figures 938 and 939; ventral valve obtusely angulate (figure 938); internal sac armed with many spines and sclerites of various sizes; lateral lobes broadly spatulate (figure 939), bowed, cleft three-fourths to base; mesal faces densely setose.

Size.—Body length 1.4–2.7 mm; width 0.9–2.0 mm.

Type depository.—MCZC (*pruininus,* lectotype No. 3888); BMNH *(cognatus, piger).*

Type locality.—Arizona *(pruininus);* Mexico *(cognatus, piger).*

Distribution.—AZ, CA, HI, NM, NV, OR, TX, UT; Mexico to Venezuela. The species is generally distributed throughout the Hawaiian Islands (Stein 1983a).

Host plants.—Hosts marked (exp.) are experimental host trials. *Acacia berlandieri, A. californica, A. confusa, A. constricta, A. dealbata, A. decurrens* (exp.), *A. greggi, A. koa, A. mearnsii, A. melanoxylon, A. neovernicosa, A. richei, A. rigidula, A. roemeriana, A. schotti, A. vernicosa, A. wrightii; Albizia saponaria* (exp.); *Arachis hypogaea* (exp.); *Caesalpinia pulcherrima* (exp.); *Calliandra eriophylla, C. humilis humilis, C. humilis reticulata; Cassia fistula* (exp.), *C. grandis, C. javanica indochi-nensis, C. javanica javanica; Coursetia microphylla; Desmanthus bicornutus, D. cooleyi, D. covillei, D. fruticosa, D. leptolobus, D. virgatus virgatus; Desmodium uncinatum* (exp.); *Erythrina sandwicensis; Glycine max* (exp.); *Indigofera anil, I. suffruticosa; Leucaena leucocephala; Mimosa biuncifera, M. dysocarpa, M. grahamii, M. laxiflora, M. wherryana; Neptunia plena; Olneya tesota; Parkinsonia aculeata, P. texana macra, P. texana texana; Pithecellobium ebano, P. pallens, P. saman; Prosopis glandulosa glandulosa, P. juliflora* (exp.), *P. velutina; Robinia pseudoacacia; Scaevola taccada sericea; Senna siamea* (exp.); *Sesbania emerus, S. exaltata, S. macrocarpa, S. sesban; Sophora chrysophylla.*

For Bridwell's experimental rearings in Hawaii, see Johnson and Kingsolver (1976:50–51). For other host plants from Mexico southwards, consult Johnson and Kingsolver (1976:47–51), Johnson (1984b:88), and Luckow and Johnson (1987).

Natural enemies.—Anisopteromalus calandrae; Charitopodinus swezeyi, C. teryi; Heterospilus prosopidis; Horismenus depressus, H. missouriensis; Lariophagus texanus; Pteromalus sp.; *Uscana semifumipennis;* Trichogrammatidae.

Immatures.—Bridwell 1918:470 (eggs); Kannan 1923 (egg); Pfaffenberger and Johnson 1976:40 (first instar); Pfaffenberger 1981:264 (first instar).

Discussion.—Stator pruininus is one of the most easily recognized species in the genus with its uniformly gray appearance and reddish-yellow fore legs and mid legs.

This species evidently is adaptable to a wide range of host plant situations. Johnson (1981a) placed *S. pruininus* with *S. limbatus* in his mature seed guild, a group that oviposit on seeds in partly dehiscent pods. Waterworth (1986) lists 38 host plants for *S. pruininus.*

Kistler (1982) studied the effects of temperature on *S. pruininus,* and Johnson (1967) published notes on its bionomics.Fullaway and Krauss (1945) stated that females chew holes in koa pods and ovi-

posit directly on the seeds. Stein (1983b) briefly detailed the biology of this bruchid.

Essig (1929a) gave the common name "pruinose weevil" to this species.

Stator pygidialis (Schaeffer)

(Figures 940–945)

Bruchus pygidialis Schaeffer 1907:297; Fall 1910:164,166.

Mylabris pygidialis: Leng 1920:305.

Stator pygidialis: Johnson 1967:267; Bottimer 1968c:1027,1039; Johnson 1968:1270; Bottimer 1973:545; Center and Johnson 1976:197; Johnson and Kingsolver 1976:52; Pfaffenberger and Johnson 1976:41; Johnson 1981a:251, 1981d:241; Pfaffenberger 1981:264; Johnson and Kingsolver 1982:420; Johnson et al. 1989:10; Udayagiri and Wadhi 1989:112.

Bruchus pythonicus Pic 1913a:43 (unnecessary new name for *pygidialis* Schaeffer).

Mylabris pythonicus: Leng 1920:305.

Stator pythonicus: Johnson 1963:864.

Acanthoscelides pythonicus: Johnson 1963:864.

Color.—Body black, fore leg and mid leg varying from dark red to black; hind leg usually black, sometimes dark red with base of femur black; basal three or four antennal segments dark red to black, apical segments always black. Vestiture of intermixed coppery and white setae on pronotum, elytra, and lateral areas of abdomen, remaining ventral areas sparsely white; male pygidium with three white basal patches (figure 941), apex with mixed coppery and white setae; female pygidium similar to male except with two white basal patches (figure 942).

Structure.—Vertex and frons densely punctulate, frontal carina absent; ocular index 3:1; ocular sinus three-fourths length of eye; antenna extending to middle of metepisternum; pronotum and elytra as for genus (figure 940); lateral one-half of metacoxal face finely punctate, median one-half glabrous and polished; ventrolateral carina of metatibia absent, dorsal coronal denticle nearly as long as mucro.

Male genitalia.—As in figures 944 and 945; apex of ventral valve slightly truncated (figure 944); internal sac armed with one large, saddle-shaped sclerite; lateral lobes as illustrated (figure 945).

Size.—Body length 1.9–2.7 mm; width 1.3–1.9 mm.

Type depository.—USNM, lectotype No. 42340, by Johnson 1968.

Type locality.—Arizona, Huachuca, Mountains.

Distribution.—AZ, NM, TX; Mexico to Venezuela.

Host plants.—Calliandra humilis humilis, C. humilis reticulata.

Natural enemies.—None recorded.

Immatures.—Pfaffenberger and Johnson 1976:41 (first larval instar); Pfaffenberger 1981:264 (first larval instar).

Discussion.—Johnson (1981d) investigated the bionomics of this species in Arizona. Johnson and Kingsolver (1976) placed *S. pygidialis* in the *sordidus* group of *Stator.* Characters to separate *S. pygidialis* from other *Stator* species can be found in the key.

Bottimer (1968c:1027) explained the reason for rejecting *Bruchus pythonicus* Pic as a replacement name for *pygidialis* Schaeffer. In his catalogue Pic (1913a) changed the spelling of *Kytorhinus pygidalis* Motschulsky to *pygidialis* and then transferred the name to *Bruchus,* making *Bruchus pygidialis* Schaeffer a secondary homonym. Bottimer rejected Pic's usage as an incorrect subsequent spelling thereby freeing *pygidialis* Schaeffer to become a valid name. Johnson (1963) used the name *"pythonicus"* for this species.

Stator sordidus (Horn)

(Figures 946–952)

Bruchus sordidus Horn 1873:319; Horn 1894:344; Fall 1901:29,160, 1910:162–166; Schaeffer 1907:292,294,298.

Mylabris sordidus: Leng 1920:305.

Acanthoscelides sordidus: Blackwelder 1946:761.

Stator sordidus: Johnson 1963:863; Bottimer 1968b:285, 1968c:1027,1039; Johnson 1968:1270, 1969c:55; Moldenke 1971:108; Bottimer 1973:545; Johnson and Kingsolver 1976:54; Johnson 1981a:251; Pfaffen-berger 1981:260; Johnson and Kingsolver 1982:420; Kistler 1982:266; Johnson 1984b:88; Johnson et al. 1989:24; Udayagiri and Wadhi 1989:112.

Bruchus semicolon Sharp 1885:472; Schaeffer 1907:297.

Acanthoscelides semicolon: Blackwelder 1946:761

Stator semicolon: Bottimer 1973:545.

Bruchus usticolor Sharp 1885:467.

Acanthoscelides usticolor: Blackwelder 1946:761.

Stator usticolor: Bottimer 1973:545.

Color.—Body black; fore leg, mid leg, and basal four or five antennal segments reddish yellow, hind leg mostly dark red, sometimes with base black. Vestiture of intermixed yellow-brown and coppery setae on pronotum and elytra; male pygidium mostly yellowish brown with three slightly denser basal patches (figure 947), female pygidium brown with white patch at each dorsal angle (figure 948); venter of body white but with intermixed coppery setae on sides of abdomen.

Structure.—Vertex and frons densely punctulate, frontal carina absent; ocular index 3:1; ocular sinus two-thirds length of eye; antenna extending to middle of metepisternum. Pronotum and elytra as for genus (figure 946). Metacoxal face with lateral one-half punctate, medial one-half smooth and polished; ventrolateral carina of metafemur angulate (figure 950); ventrolateral carina of metatibia complete to apex; ventrolateral carina evanescent or absent; dorsal coronal denticle nearly as long as mucro.

Male genitalia.—As in figures 951 and 952; ventral valve evenly rounded (figure 951); internal sac with large, saddle-shaped sclerite; lateral lobes as illustrated (figure 952).

Size.—Body length 1.7–3.2 mm; width 1.2–2.2 mm.

Type depository.—MCZC (*sordidus,* holotype No. 8193); BMNH *(semicolon, usticolor).*

Type locality.—Lower California *(sordidus);* Guatemala *(semicolon);* Mexico *(usticolor).*

Distribution.—AZ, TX; Mexico to Colombia.

Host plants.—Acacia wrightii; Calliandra humilis humilis. Johnson (1979a, 1984b) lists five additional hosts from Mexico and Honduras.

Natural enemies.—None recorded.

Immatures.—Pfaffenberger 1981 (first larval instar).

Discussion.—Stator sordidus is placed in the *sordidus* group with *S. chihuahua, S. coconino, S. pygidialis,* and *S. vachelliae* (Johnson and Kingsolver 1976). Characters to distinguish *S. sordidus* from others in the group may be found in the key to species.

Kistler (1982) investigated the effects of temperature on this species.

Stator subaeneus (Schaeffer)

(Figures 953–960)

Bruchus subaeneus Schaeffer 1907:298; Fall 1910:164.

Mylabris subaeneus: Leng 1920:305.

Stator subaeneus: Johnson 1963:865; Janzen 1967:351,363; Bottimer 1968c:1027,1039; Johnson 1968:1271; Janzen 1969:11; Kingsolver 1972a:224; Bottimer 1973:549; Johnson and

Kingsolver 1976:60, 1982:420; Johnson et al. 1989:9; Udayagiri and Wadhi 1989:113.

Color.—Body and hind leg black; fore leg, mid leg, and antennae reddish orange; dorsum of body with metallic sheen. Vestiture coppery, and white setae in irregular bands and patches on pronotum and elytra (figure 953), in evanescent basal patches and apical lines on pygidium (figures 954 and 955); scutellum white; venter of body sparsely white.

Structure.—Vertex and frons densely punctulate, frontal carina short but distinct; ocular index 3:1; ocular sinus one-half length of eye; dorsal and caudal margins of eye contiguous with vertex and side of head; antenna extending to middle of metepisternum; pronotum and elytra as for genus (figure 953). Metacoxal face uniformly punctulate (figure 956); ventrolateral carina of metafemur obtusely angulate (figure 957); ventrolateral carina of metatibia lacking, dorsal fossa distinct.

Male genitalia.—As in figures 958, 959, and 960; ventral valve subtriangular with arcuate lateral margins (figure 958); internal sac armed with 20-22 bladelike and thornlike sclerites (figure 959); lateral lobes as illustrated (figure 960).

Size.—Body length 2.4–2.8 mm; width 1.8–2.0 mm.

Type depository.—USNM, holotype No. 65933.

Type locality.—Texas, Brownsville.

Distribution.—TX; Mexico.

Host plants.—Acacia cornigera; A. farnesiana.

Natural enemies.—None recorded.

Immatures.—Not described.

Discussion.—This species is easily separated from other U.S. *Stator* by the eyes being contiguous with the vertex and sides of the head. The male genitalia are similar to those of *S. bottimeri* but are distinct in the size and shape of the internal sac sclerites (compare figures 919 and 959).

See discussion of *Stator sordidus.*

Stator subaeneus was reared from *Acacia farnesiana* seeds (not pods) beneath the trees (Bottimer 1973).

Stator vachelliae Bottimer

(Figures 961–967)

Stator vachelliae Bottimer 1973:546; Johnson and Kingsolver 1976:65, 1982:420; Johnson et al. 1989:9; Udayagiri and Wadhi 1989:114.

Bruchus sordidus: Schaeffer 1907:294 (misidentification).

Stator sordidus: Johnson 1963:863 (misidentification).

Color.—Body black except basal four antennal segments, fore leg and mid leg, apex of metafemur, and all of metatibia dark red to reddish orange. Vestiture dimorphic: in males yellowish brown uniformly distributed except slightly more dense on lateral portions of pronotal disk, pygidium with slightly denser median and lateral patches (figure 963); in females fine, reddish-brown setae uniformly distributed except pygidium usually with three elongate, basal patches of white setae (figure 964), these sometimes evanescent. Scutellum white in both sexes.

Structure.—Vertex and frons densely punctulate, frons with median, impunctate line; ocular index 3.5:1; ocular sinus one-half length of eye; antenna extending to middle of metepisternum; pronotum and elytra as for genus (figure 961); metacoxal face uniformly punctulate; ventrolateral carina of metafemur angulate opposite ventromesal denticle (figure 965); ventrolateral carina of metatibia absent; dorsal fossa lacking.

Male genitalia.—As in figures 966 and 967; ventral valve subtriangular with incurved lateral margins (figure 966); internal sac armed with elongate, forked sclerite; lateral lobes as illustrated (figure 967).

Size.—Body length 2.0-2.8 mm; width 1.4-1.9 mm.

Type depository.—CNCI, holotype.

Type locality.—Texas, Brownsville.

Distribution.—TX; Mexico to Venezuela.

Host plants.—Acacia farnesiana.

Natural enemies.—None recorded.

Immatures.—Pfaffenberger 1981 (larva).

Discussion.—Although *S. vachelliae* is placed in the *sordidus* group, it differs from the other four species in the group by its uniformly punctate metacoxal face and by its sexually dimorphic vestiture. Bottimer (1973) determined that females of this species oviposit on seeds on the ground but not on pods on the tree. The extensive geographical distribution is no doubt due to its association with its widespread host, *Acacia farnesiana.*

Johnson and Kingsolver (1976) reported that *S. vachelliae* was the prey of a robber fly, *Efferia argyrosoma* (Hine).

Johnson (1988a) found *S. vachelliae* in Venezuela ovipositing on *Parkinsonia aculeata* seeds mixed on the ground with its normal local host seeds of *Acacia flexuosa.* Johnson regards this as a possible example of the mechanism of host transfer.

Genus *Stylantheus* Bridwell

Stylantheus Bridwell 1946:54; Bradley 1947:40; Blackwelder and Blackwelder 1948:48; Bottimer 1968c:1028; Johnson 1968:1271, 1970:28, 1976b:254; Johnson and Kingsolver 1982:413; Borowiec 1987:93; Udayagiri and Wadhi 1989:114. Type-species: *Bruchus macrocerus* Horn 1873:343, by monotypy.

One species. Because this at present is a monotypic genus, the generic and specific diagnoses are combined. Johnson (1976b) presented a more detailed description.

Revision: Johnson 1976b.

Stylantheus macrocerus (Horn)

(Figures 13, 70, 968–975)

Bruchus macrocerus Horn 1873:342; Schaeffer 1907:305; Blatchley 1910:1238; Fall 1910:187; Carr 1920:7.

Mylabris macrocerus: Leng 1920:306.

Acanthoscelides macrocerus: Bridwell 1935:186.

Stylantheus macrocerus: Bridwell 1946:54; Bradley 1947:40; Blackwelder and Blackwelder 1948:44; Bottimer 1968c:1028; Johnson 1968:1271, 1969c:55, 1976b:254; Johnson and Kingsolver 1982:413; Udayagiri and Wadhi 1989:114.

Acanthoscelides mucrofer Bottimer 1969a:975, **New Synonymy.**

Color.—Integument everywhere black, all appendages black. Teneral specimens may be brownish black. Vestiture white, sparse on head and pronotum; elytra with short, oblong patches separated by glabrous spaces, each with central seta, giving ocellate effect (figures 13 and 968); pygidium patchy (figure 970).

Structure.—Body elongate. Vertex and frons finely punctate, punctures elongated, interspaces granulose; frontal carina absent; ocular index 4:1; ocular sinus four-fifths as long as eye; male antenna (figure 971) serrate, eccentric from 3rd segment, extending beyond elytral apices; female antenna (figure 971) not as strongly serrate, not extending beyond apices. Pronotum bell-shaped (figure 968), sides straight anteriad to cervical sulcus then abruptly constricted; disk convex, only slightly impressed on basal margin; surface densely foveolate, foveolae elliptical, setose; interspaces punctate, setose; lateral carina obsolete; cervical sulcus deep. Scutellum slightly longer than wide, emarginate. Elytra slightly longer than wide (figure 968), strongly convex; striae parallel, distinct, 2nd, 3rd, and 4th ending in transverse, denticulate basal carina; interstices flat, finely imbricate; metacoxal face finely, densely punctate, punctures crowded;

fossula glabrous; hind leg as in figures 70 and 972; pecten with three small denticles; metatibia slender, lateral, ventral, and dorsomesal carinae present; mucro elongate, curved, one-half length of basitarsus (figure 972), lateral denticle and two coronal denticles subequal. Fifth abdominal sternum of male broadly emarginate; male pygidium strongly reflexed; female pygidium vertical; discal surface irregularly punctate.

Male genitalia.—As in figures 973, 974, and 975; median lobe slender, elongated (figures 973 and 974); ventral valve narrowly triangular, apex acute; internal sac lined with minute denticles, large sclerites absent; closure valve circular; lateral lobes elongate (figure 975), arms slender, cleft three-fourths their length, apices moderately expanded, mesal faces setose.

Size.—Body length.1.7–2.2 mm; width.1.0–1.3 mm.

Type locality.—District of Columbia (*macrocerus,* lectotype); Texas, Kenedy County *(mucrofer).*

Type depository.—MCZC, lectotype No. 3897, by Johnson 1968 *(macrocerus);* CNCI *(mucrofer).*

Distribution.—AL, AR, DC, FL, GA, IL, IN, LA, MD, MS, MO, NC, NJ, OH, OK, SC, TN, TX, VA.

Host plants.—Stylosanthes biflora.

Natural enemies.—Urosigalphus bruchivorus.

Immatures.—Not described.

Discussion.—Johnson (1976b) concluded that *Stylantheus,* although closely related to *Acanthoscelides,* is a valid genus differing in its deep ocular sinus, much elongated and broadened antennae, and uniform size and shape of the pecten denticles. The single species of *Stylantheus* closely resembles *Acanthoscelides compressicornis* (Schaeffer) in the long tibial mucro and elongated antennae but differs in the ocellate elytral pattern and distinctive male genitalia.

I could find no differences between the two type specimens of *Acanthoscelides mucrofer* Bottimer and normal *Stylantheus macrocerus;* therefore, I here synonymize *A. mucrofer* with *S. macrocerus.*

Appendix I

Hawaiian Bruchidae

All but one of the 16 species of Bruchidae known to occur in the Hawaiian Islands have been accidently introduced either from the southwestern United States-Mexico region or from southeastern Asia or through commerce. The exception is a deliberate introduction of *Lithraeus atronotatus* from South America for biological control of Christmas berry (*Schinus terebinthifolius* Raddi). *L. atronotatus* is apparently well established in the southern part of the island of Hawaii, but it has had little effect in controlling its host (B. Kumashiro, personal communication, 1988).

Some of these bruchids were undoubtedly introduced in the early part of the 20th century during establishment of a cattle-feed industry using protein-rich *Prosopis* seeds. This venture died out within a few years due to the unchecked depredations of three introduced bruchids *(Algarobius bottimeri, Mimosestes nubigens,* and *Caryedon serratus)* and one stored-grain moth *(Plodia interpunctella).* Bridwell (1920a) described the effects of these four species on the industry, the bruchids being identified by him as *Bruchus prosopis* (now *Algarobius bottimeri*), *Bruchus sallaei* (now *Mimosestes nubigens*), and *Caryoborus gonagra* (now *Caryedon serratus*). The first two species primarily destroyed seeds in the field, whereas *C. serratus* began feeding in the field and continued into storage. Parasites from the southwestern U.S. were introduced in an attempt to control these bruchids, but these efforts were ineffective.

Bianchi (1940:381) listed the self-introduced parasites of the Bruchidae of the Hawaiian Islands. All of the bruchids have been transferred to other genera or synonymized since then, but most of the parasites remain in the genera in which he placed them. Six parasites were deliberately introduced.

The Hawaiian species of *Prosopis* have been variously listed as *chilensis, juliflora,* and *pallida.* Fosberg (1966) expressed the opinion that the correct name is *Prosopis pallida.* Two forma of this species occur in Hawaii—*P. pallida pallida* is spineless whereas *P. pallida armata* is spined. Wagner et al. (1990), however, list both *P. pallida* and *juliflora* and state that the first naturalized collections of *juliflora* were made in 1978 on Oahu. *Algarobius bottimeri,* the sole representative of the genus in Hawaii, is found on the mainland primarily within the borders of Texas with only a few records in adjoining states (Kingsolver 1986). It attacks seeds of *Prosopis glandulosa glandulosa* and *P. reptans cinerascens.* Yet this bruchid was somehow transported to the Islands and became the principal seed pest of another species of *Prosopis.* Fullaway (1913:25) describes the attempts to import hymen-opterous parasites to combat bruchids. The Department of Agriculture brought in from Texas consignments of bruchid-infested seeds from which *Heterospilus prosopidis* Viereck and *Uscana semifumipennis* Girault were bred and released. This is probably the source of entry of *Algarobius bottimeri* into Hawaii.

The preferred host of *Mimosestes nubigens* on the mainland and in the Islands is *Acacia farnesiana,* but it has never been found in mainland *Prosopis.* Its damage level in *Prosopis* in Hawaii apparently was never as high as that of *Algarobius.*

The preferred host of *Caryedon serratus* throughout its tropicopolitan range is *Tamarindus indica,* but its host list is extensive. The full-grown larva is too large to allow it to fit inside a seed of *Prosopis,* but Bridwell (1920b) indicates that oviposition is on ripe pods and the principal feeding occurs in seed storage. Since it spins a cocoon before pupating, *serratus* does not need the protection of an excavated seed as a pupal shell as other species do.

Bridwell's pioneering papers (1918, 1919, 1920a) were in great part reports of experi

mental transfers of species of bruchids to native and introduced hosts.

Hinckley (1960 and 1961) thoroughly covered the history of 12 of the 16 species known at that time, although several specific names have changed since his papers were published.

Key to Hawaiian Bruchidae

The following key applies only to the Hawaiian Islands.

1 Lateral pronotal margin with prominent tooth or denticle (figure 46); ventrolateral margin of metafemur with tooth or angular emargination (figure 47); elytral striae lacking basal denticles: *Bruchus* 2

Lateral pronotal margin smooth, lacking prominent tooth or denticle; metafemur variously armed; elytral striae with or without basal denticles..... 3

2(1) Ventrolateral tibial tooth long, acute, lying outside tibia when leg is closed (figure 47); pygidium with large, subapical maculae (figure 267) ..... *Bruchus pisorum* (Linnaeus)

Ventrolateral tibial tooth angular but not elongated (figure 274); pygidial maculae small (figure 275) ..... *Bruchus rufimanus* Boheman

3(1) Metatibial apex with two movable apical spurs (calcaria) (figure 43); lateral margin of pronotum with sharp carina; ventrolateral margin of metafemur carinate, sinuate; body black with transverse white bands on elytra (female) (figure 191) or with yellowish mottling (male) (figure 190) ..... *Zabrotes subfasciatus* (Boheman)

Metatibial apex without movable apical spurs but sometimes with fixed apical spines and denticles; margin of metafemur varied; color varied 4

4(3) Metafemur with one or more denticles on ventromesal margin (figures 78, 523 and 937)..... 6

Metafemur without denticles on ventromesal margin (figure 215, 714) 5

5(4) Frons with prominent median carina; strial punctures of elytra deep and rounded (figure 243); male antenna pectinate (as in figure 230), female antenna serrate (as in figure 231); red and white alternating stripes on elytra; length 3.5 mm ..... *Megacerus leucospilus* (Sharp)

Frons without median carina; strial punctures inconspicuous (figure 712); antenna not strongly modified (figure 713); body red, elytra with white patchy pattern, with lateral and apical bare spots; length 2.25 mm ..... *Lithraeus atronotatus* (Pic)

6(4) Metafemur with 9–12 denticles on mesoventral margin; metatibia strongly arcuate (figure 1); reddish brown with scattered brown spots; length 6 mm ..... *Caryedon serratus* (Olivier)

Metafemur with no more than four denticles on mesoventral margin; metatibia nearly straight (except at extreme base), or slightly arcuate 7

7(6) Scutellum elongate, nearly 2 times as long as wide (figure 643); yellowish and brown mottled; female with pair of sulci on pygidium (figure 645); length 4–4.5 mm ..... *Algarobius bottimeri* Kingsolver

Scutellum quadrate or transverse 8

8(7) Lateral margin of pronotum with distinct, shining carina; ventrolateral margin of metafemur with strong carina (figure 931), sometimes angulate or thickened; ventromesal margin with single denticle: *Stator* 9

Lateral margin of pronotum lacking distinct, shining carina; ventrolateral margin of metafemur carinate or not, ventromesal margin with one or more denticles (figures 44 and 792)..... 10

9(8) Body black with black-bordered red or orange elytra; pygidium with three indistinct white patches along basal margin; length 2.5–3.0 mm..... *Stator limbatus* (Horn)

Body and elytra uniformly black; pygidium lacking patches; length 2.25–3.0 mm ..... *Stator pruininus* (Horn)

10(8) Frons with V- or Y-shaped, bare, shining, raised boss (figure 57); male with deep cavity on ventral margin of metafemur: *Mimosestes*..... 11

Frons with strong or faint vertical median carina; male metafemur lacking ventral cavity 13

11(10) Body black with some reddish areas, vestiture entirely gray; eyes flat against side of head (figure 791) .....*Mimosestes amicus* (Horn)

Body dark red, vestiture yellowish; eyes protruding from side of head.....12

12(11) Anterolateral corner of pronotum sharply angulate and finely tuberculate on shoulder (figures 807 and 808); posterodorsal corner of eye subangulate (figure 807) .....*Mimosestes nubigens* (Motschulsky)

Anterolateral corner of pronotum rounded, not tuberculate; posterodorsal corner of eye rounded (figure 796) ..... *Mimosestes insularis* Kingsolver & Johnson

13(10) Metafemur with toothed carina on ventrolateral margin and single denticle on ventro-mesal margin (figure 310): *Callosobruchus*.....14

Metafemur without carina on ventrolateral margin but with one long and two or three shorter denticles (figure 44); terminal segment of antenna and abdomen red .....*Acanthoscelides obtectus* (Say)

14(13) Elytral striae three and four each with prominent subbasal denticles on slight gibbosity (figure 298) 15

Elytral striae extending to basal margin, lacking prominent denticles or gibbosities (figure 305); basal lobe of pronotum with glossy coating on setae.....16

15(14) Pattern of pronotum and elytra as in figure 327; pygidium in both sexes only slightly convex, nearly immaculate except for subapical, paired spots; antennae as in figures 328 and 329; lateral margins of 2nd to 4th abdominal sterna with uniform pubescence .... *Callosobruchus pulcher* Pic

Pattern of pronotum and elytra as in figure 297; pygidium in both sexes convex, male with vague patches at middle and at apex, female with more intense patches sometimes connected into paired crescents; antennae as in figures 299 and 300; lateral margins of 2nd to 4th abdominal sterna with intensely white setal patches (figure 298) ..... *Callosobruchus chinensis* (Linnaeus)

16(14) Pronotum yellowish with brown or black longitudinal lines (figure 321); elytral pattern as in figure 321; eye with narrow posterior fringe .... *Callosobruchus phaseoli* (Gyllenhal)

Pronotum dark red to black, lacking longitudinal lines (figure 305); elytral pattern variable (figures 305–307); eye with posterior margin lobed ..... *Callosobruchus maculatus* (Fabricius)

Host Associations of Hawaiian Bruchidae

This list was compiled from various sources, and plant names were updated as far as possible. Bridwell (1918) conducted a series of experimental rearings of several species of bruchids, but it is not certain that all of the plants he used now grow in Hawaii.

Refer to the main body of this handbook for illustrations and for further information and to the bibliography for complete citations.

Acanthoscelides obtectus.—Origin in the Neotropics but now cosmopolitan. Primary hosts are various species of *Phaseolus,* but records of other legume genera are known. First reported by Bridwell (1918), but specimens were collected by Van Dine in 1904 (specimen label data).

Algarobius bottimeri.—Mainland distribution is almost entirely within Texas. Primary host in Texas is *Prosopis glandulosa.* Hawaiian host is *Prosopis pallida.* First reported by Fullaway (1913) as *Bruchus prosopis.*

Bruchus pisorum.—Origin in Old World, but species is cosmopolitan. Primary host is *Pisum sativum.* First reported by Bridwell (1918) but probably not established in Hawaii.

Bruchus rufimanus.—Origin in Old World but nearly cosmopolitan. Primary host is *Vicia faba.* First reported by Bridwell

(1918) but probably not established in Hawaii.

Callosobruchus chinensis.—Origin in Asia or Africa but now cosmopolitan. Primary hosts are in genera *Phaseolus* and *Vigna,* but host range is broad. First reported by Swezey (1912).

Callosobruchus maculatus.—Generally same as *C. chinensis.* Many hosts have been reported. First detected by Bridwell (1918).

Callosobruchus phaseoli.—Origin probably in Asia but now tropicopolitan. Primary host *Lablab purpureus,* but other hosts are recorded. First reported by Bridwell (1918), but specimens were collected by Swezey in 1908 (specimen label data).

Callosobruchus pulcher.—Hosts: *Cajanus, Cicer, Phaseolus,* and *Pisum* in native Philippine Islands. In Hawaii, first collected by Krauss in 1965 at Haiku, Maui; subsequently reared from *Cajanus cajan* at Ewa by Funisaki (1973), and collected at light at Manoa.

Caryedon serratus.—Tropicopolitan species with Asian or African origin. Primary host probably *Tamarindus indica* but in Hawaii attacks *Acacia farnesiana, Bauhinia tomen-tosa, Caesalpinia pulcherrima, Cassia fistula, Cassia grandis,* and *Prosopis pallida* as well as *Tamarindus.* First reported by Fullaway (1913) and Swezey (1912) as *Caryoborus gonagra.*

Lithraeus atronotatus.—Native host in Brazil is *Schinus terebinthifolius.* Introduced into Hawaii to control the same plant. First released in 1954 by Krauss (1963) but successful control not evident.

Megacerus leucospilus.—Native to Texas through Central America in *Ipomoea pes-caprae.* Found in *I. carnea fistulosa, I. pes-caprae, I. tuberculata, and Merremia aegyptia* in Hawaii. Described as *Mega-cerus alternatus* by Bridwell (1929b).

Mimosestes amicus.—Native from southwestern United States to Costa Rica in species of *Acacia, Cercidium, Parkinsonia,* and *Prosopis.* In Hawaii, it attacks *Acacia farnesiana, Leucaena glauca, Prosopis pallida,* and *Sesbania sesban.* First reported by Swezey (1925).

Mimosestes insularis.—Distribution West Indies, Colombia, and Hawaii. In the West Indies, attacks *Acacia farnesiana* and *Prosopis juliflora.* In Hawaii, attacks *Prosopis pallida.* Described in 1978 by Kingsolver and Johnson from Hawaii and West Indies.

Mimosestes nubigens.—Native to United States south to Brazil. Primary host probably *Acacia farnesiana* and perhaps other species of *Acacia.* Hawaiian hosts are *Acacia farnesiana* and *Prosopis pallida.* First reported by Bridwell (1919). Listed by him and subsequent authors as *Bruchus* or *Mimosestes sallaei.*

Stator limbatus.—Native to United States south to Panama in *Acacia* spp., *Cercidium* spp., *Lysiloma* spp., and *Pithecellobium* spp. In Hawaii, it attacks *Acacia confusa, A. koa, Albizia lebbeck, Leucaena glauca, Pithecellobium dulce,* and *Samanea saman.* First reported by Bridwell (1920b) on collections made in 1919.

Stator pruininus.—Native to United States south to Venezuela in *Acacia* spp., *Mimosa* spp., *Pithecellobium* spp., and others. In Hawaii, it attacks *Acacia confusa, A. koa, Albizia saponaria, Cassia nodosa, Desman-thus virgatus, Erythrina sandwicensis, Indigofera anil, I. suffruticosa, Leucaena leucocephala,* and *Sesbania sesban.* First reported by Bridwell (1918) from collections made in 1917 on *L. leucocephala* and *S. sesban.*

Zabrotes subfasciatus.—Probably native to Central America but now tropicopolitan. Breeds principally in *Phaseolus* but also in *Vigna* spp., *Vicia faba, Lablab purpureus, Cajanus cajan,* and *Cicer arietinum.* Bridwell (1918) reared it from *Phaseolus vulgaris, P. lunatus, P. articulatus, P. acutifolius, Vigna unguiculatus, Cajanus cajan, Glycine max, Cicer arietinum,* and *Pisum sativum.* First observations by Cowan but reported by Bridwell (1918) as *Spermophagus pectoralis.*

Appendix II

Synonymical List of the Bruchidae of the United States and Canada

Names are arranged in alphabetical order. Full references and dates for each name can be found in the main text, or in the bibliography.

Extant Species

***Abutiloneus* Bridwell**

Abutiloneus idoneus Bridwell

Abutiloneus flavicornis: Kingsolver

Acanthoscelides flavicornis: Blackwelder

Althaeus idoneus: De Luca

Bruchus (Abutiloneus) idoneus: Zacher

Bruchus flavicornis Sharp

***Acanthoscelides* Schilsky**

Acanthocelides (sic) Schilsky

Acanthoscelides aequalis (Sharp)

Acanthoscelides aequalis: Moreno and Bibby

Bruchus aequalis Sharp

Mylabris aequalis: Leng

Acanthoscelides alboscutellatus (Horn)

Acanthoselides abutilonis: Kingsolver

Acanthoscelides alboscutellatus: Bottimer

Acanthoscelides conspersus: Kingsolver

Bruchus abutilonis Motschulsky

Bruchus albiscutellaris: Ashmead (error)

Bruchus alboscutellaris: Zacher (error)

Bruchus alboscutellatus Horn

Bruchus conspersus Motschulsky

Mylabris alboscutellatus: Leng

Acanthoscelides atomus (Fall)

Abutiloneus atomus: Bradley

Acanthoscelides atomus: Bottimer

Bruchus atomus Fall

Mylabris atomus: Leng

Acanthoscelides aureolus (Horn) (complex)

Acanthoscelides aureolus: Blackwelder

Acanthoscelides pauperculus: Bottimer

Bruchus aureolus Horn

Bruchus fraterculus: Fall (not Horn)

Bruchus pulicarius: Motschulsky

Bruchus pauperculus: Schaeffer (not LeConte)

Bruchus rufus: Motschulsky

Mylabris aureolus: Leng

Mylabris pauperculus: Leng (not LeConte)

Acanthoscelides baboquivari Johnson

Acanthoscelides bisignatus (Horn)

Acanthoscelides bisignatus: Glick

Bruchus bisignatus Horn

Mylabris bisignatus: Leng

Acanthoscelides biustulus (Fall)

Acanthoscelides biustulus: Johnson

Bruchus biustulus Fall

Mylabris biustulus: Leng

Acanthoscelides calvus (Horn)

Acanthoscelides calvus: Bridwell

Bruchus calvus Horn

Mylabris calvus: Leng

Acanthoscelides chiricahuae (Fall)

Acanthoscelides chiricahuae: Johnson

Bruchus chiracahuae: Pic (error)

Bruchus chiricahuae Fall

Mylabris chiricahuae: Leng

*Acanthoscelides compressicornis (*Schaeffer)

Acanthoscelides compressicornis: Muesebeck et al.

Acanthoscelides subserripes: Johnson

Bruchus compressicornis Schaeffer

Bruchus subserripes Fall

Mylabris compressicornis: Leng

Acanthoscelides comstocki Johnson

Acanthoscelides daleae Johnson

Acanthoscelides desmanthi Johnson

Acanthoscelides distinguendus (Horn)

Acanthoscelides distinguendus: Bissell

Bruchus distinguendus Horn

Mylabris distinguendus: Leng

Acanthoscelides flavescens (Fahraeus)

Acanthoscelides flavescens: Blackwelder

Acanthoscelides ochraceicolor: Wolcott

Bruchus flavescens Fahraeus
Bruchus ochraceus Schaeffer
Bruchus ochraceicolor Pic
Mylabris ochraceicolor: Leng

Acanthoscelides floridae (Horn)
Acanthoscelides floridae: Brett
Bruchus floridae Horn
Mylabris floridae: Leng

Acanthoscelides fraterculus (Horn)
Acanthoscelides fraterculus: Trelease and Trelease
Bruchus aureolus: Fall (misident.)
Bruchus fraterculus Horn
Mylabris fraterculus: Leng

Acanthoscelides fumatus (Schaeffer)
Acanthoscelides fumatus: Bottimer
Acanthoscelides fumatus: Johnson
Bruchus fumatus Schaeffer
Mylabris fumatus: Leng

Acanthoscelides griseolus (Fall)
Acanthoscelides griseolus: Bridwell
Acanthoscelides kiotoensis: Morimoto
Bruchus griseolus Fall
Bruchidius kiotoensis: Chujo
Bruchus kiotoensis Pic
Bruchus kiotensis: Udayagiri and Wadhi
Mylabris griseolus: Leng

Acanthoscelides helianthemum Bottimer
Bruchus compressicornis: Blatchley

Acanthoscelides herissantitus Johnson

Acanthoscelides inquisitus (Fall)
Acanthoscelides inquisitus: Johnson
Bruchus inquisitus Fall
Mylabris inquisitus: Leng

Acanthoscelides kingsolveri Johnson

Acanthoscelides lobatus (Fall)
Acanthoscelides lobatus: Johnson
Bruchus lobatus Fall
Mylabris lobatus: Leng

Acanthoscelides longistilus (Horn)
Acanthoscelides longistilus: Bridwell
Acanthoscelides sp. near longistylus: Glick
Bruchus longistilus Horn
Bruchus longistylus: Ulke (error)
Mylabris longistilus: Leng

Acanthoscelides macrophthalmus (Schaeffer)
Acanthoscelides macrophthalmus: Johnson
Bruchus macrophthalmus Schaeffer
Mylabris macrophthalmus: Leng

Acanthoscelides margaretae Johnson

Acanthoscelides mixtus (Horn)
Acanthoscelides mixtus: Johnson
Bruchus mixtus Horn
Mylabris mixtus: Leng

Acanthoscelides modestus (Sharp)
Acanthoscelides atrocephalus: Blackwelder
Acanthoscelides modestus: Blackwelder
Bruchus atrocephalus Pic
Bruchus modestus Sharp

Acanthoscelides mundulus (Sharp)
Acanthoscelides mundulus: Blackwelder
Bruchus mundulus Sharp

Acanthoscelides napensis Johnson

Acanthoscelides obrienorum Johnson

Acanthoscelides obsoletus (Say)
Acanthoscelides obsoletus: Yip
Bruchus distinguendus: Horn (in part)(error)
Bruchus obscurus: Fitch (error)
Bruchus obsoletus Say
Mylabris obsoletus: Leng

Acanthoscelides obtectus (Say)
Acanthoscelides obtectus: Skaife
Bruchidius (Acanthoscelides) obtectus: Reitter
Bruchus acanthocnemus Jekel
Bruchus breweri Crotch
Bruchus fabae Fitch (not Motschulsky)
Bruchus fabi Rathvon
Bruchus gilvipes Motschulsky
Bruchus irresectus Fahraeus
Bruchus leguminarius: Gyllenhal
Bruchus leguminarius var. melanocephalus Blackwelder (error)
Bruchus melanocephalus Fahraeus (misidentification)
Bruchus mimosae: Gemminger and Harold (not Fabricius)
Bruchus obsoletus: of authors (not Say)
Bruchus obtectus Say
Bruchus pallidipes Fahraeus
Bruchus subellipticus Wollaston

Bruchus tetricus Gyllenhal
Bruchus varicornis Motschulsky
Laria obtecta: Bedel
Mylabris irresecta: Baudi
Mylabris obtectus: Leng
Spermophagus incretus Motschulsky

Acanthoscelides oregonensis Johnson

Acanthoscelides pallidipennis (Motschulsky)
Acanthoscelides collusus: Johnson
Acanthoscelides pallidipennis: Kingsolver
Acanthoscelides perplexus: Johnson
Acanthoscelides tarnawski Borowiec
Bruchus collusus Fall
Bruchus pallidipennis Motschulsky
Bruchus perplexus Fall
Mylabris collusus: Leng
Mylabris pallidipennis: Leng
Mylabris perplexus: Leng

Acanthoscelides pauperculus (LeConte)
Acanthoscelides pauperculus: Bottimer
Bruchus pauperculus LeConte
Bruchus pulicarius Motschulsky
Bruchus rufus Motschulsky
Bruchus simplex Motschulsky
Mylabris pauperculus: Leng
Mylabris pulicarius: Leng
Mylabris simplex: Leng

Acanthoscelides pectoralis (Horn)
Acanthoscelides pectoralis: Bradley
Bruchus pectoralis Horn
Mylabris pectoralis: Leng

Acanthoscelides pedicularius (Sharp)
Acanthoscelides pedicularius: Blackwelder
Acanthoscelides pulloides: Johnson
Bruchus pedicularis Sharp
Bruchus pulloides Fall
Mylabris pulloides: Leng

Acanthoscelides perforatus (Horn)
Acanthoscelides perforatus: Bradley
Bruchus perforatus Horn
Mylabris perforatus: Leng

Acanthoscelides prosopoides (Schaeffer)
Acanthoscelides prosopoides: Johnson
Bruchus prosopoides Schaeffer
Mylabris prosopoides: Leng

Acanthoscelides pullus (Fall)
Acanthoscelides brunneostictus: Johnson
Acanthoscelides pullus: Bridwell
Bruchus brunneostictus Fall
Bruchus pullus Fall
Mylabris brunneostictus: Leng
Mylabris pullus: Leng

Acanthoscelides pusillimus (Sharp)
Acanthoscelides pusillimus: Chujo
Acanthoscelides sp. 20: Johnson
Bruchidius pusillimus: Zacher
Bruchus pusillimus Sharp

Acanthoscelides quadridentatus (Schaeffer)
Acanthoscelides quadridentatum: Moreno and Bibby
Acanthoscelides quadridentatus: Zacher
Bruchus quadridentatus Schaeffer
Mylabris quadridentatus: Leng

Acanthoscelides rufovittatus (Schaeffer)
Acanthoscelides rufovittatus: Johnson
Bruchus rufovittatus Schaeffer
Mylabris rufovittatus: Leng

Acanthoscelides schaefferi (Pic)
Acanthoscelides rufescens: Johnson
Acanthoscelides schaefferi: Bottimer
Bruchus rufescens Schaeffer (preocc.)
Bruchus schaefferi Pic
Mylabris schaefferi: Leng

Acanthoscelides schrankiae (Horn)
Acanthoscelides schrankiae: Bissell
Bruchus schrankiae Horn
Mylabris schrankiae: Leng

Acanthoscelides seminulum (Horn)
Abutiloneus seminulum: Bradley
Acanthoscelides seminulum: Bottimer
Bruchus seminulum Horn
Bruchus seminulus: Pic (missp.)
Megacerus seminulum: Zacher (error)
Mylabris seminulum: Leng

Acanthoscelides speciosus (Schaeffer)
Acanthoscelides mexicanus: Johnson (not Sharp)
Acanthoscelides speciosus: Johnson
Bruchus speciosus Schaeffer
Mylabris speciosus: Leng

Acanthoscelides stylifer (Sharp)
Acanthoscelides pugiunculus: Johnson
Acanthoscelides stylifer: Blackwelder
Bruchus pugiunculus Fall
Bruchus pygionculus: Pic (error)
Bruchus stylifer Sharp
Mylabris pugiunculus: Leng
Acanthoscelides subaequalis Johnson
Acanthoscelides submuticus (Sharp)
Acanthoscelides exiguus: De Luca
Acanthoscelides horni: Caffrey
Acanthoscelides submuticus: Glick
Bruchus exiguus Horn
Bruchus horni Pic
Bruchus submuticus Sharp
Mylabris exiguus: Leng
Mylabris horni: Leng
Acanthoscelides tenuis Bottimer
Bruchus tenuis: Blackwelder
Acanthoscelides tridenticulatus Bottimer

***Algarobius* Bridwell**

Algarobius bottimeri Kingsolver
Algarobius prosopis: Hinckley
Bruchus prosopis: of authors (not LeConte)
Algarobius prosopis (LeConte)
Acanthoscelides desertorum: Blackwelder
Acanthoscelides prosopis: Blackwelder
Algarobius desertorum: Blackwelder and Blackwelder
Algarobius prosopis: Bridwell
Algarobius uniformis: Blackwelder and Blackwelder
Bruchus desertorum LeConte
Bruchus prosopis LeConte
Bruchus uniformis LeConte
Mylabris desertorum: Leng
Mylabris prosopis: Leng
Mylabris uniformis: Kannan

***Althaeus* Bridwell**

Althaeus folkertsi Kingsolver
Althaeus hibisci (Olivier)
Althaeus hibisci: Bridwell
Bruchus hibisci Olivier
Bruchus transversus Say
Bruchus transvexus: Horn (error)
Althaeus steineri Kingsolver

***Amblycerus* Thunberg**

Anthotribus Gistel
Spermophagus, of authors
Amblycerus eustrophoides (Schaeffer)
Amblycerus eustrophoides: Johnson
Spermophagus eustrophoides Schaeffer
Amblycerus ireriae Romero, Johnson and Kingsolver
Amblycerus nigromarginatus (Motschulsky)
Amblycerus nigromarginatus: Bridwell
Spermophagus nigromarginatus Motschulsky
Amblycerus obscurus (Sharp)
Amblycerus obscurus: Bridwell
Spermophagus obscurus Sharp
Amblycerus robiniae (Fabricius)
Amblycerus robiniae: Bridwell
Bruchus robiniae Fabricius
Chrysomela gleditsiae Castiglioni
Spermophagus hoffmanseggi or hoffmannseggi, of authors
Spermophagus robiniae: Gyllenhal
Amblycerus schwarzi Kingsolver
Amblycerus vitis (Schaeffer)
Amblycerus vitis: Bottimer
Spermophagus vitis Schaeffer

***Borowiecius* Anton**

Borowiecius ademptus (Sharp)
Bruchus ademptus Sharp
Borowiecius ademptus: Anton
Callosobruchus ademptus: Chujo

***Bruchidius* Schilsky**

Sparteus Bridwell
Spermophagus: Arnett (not Schoenherr)
Bruchidius cisti (Fabricius)
Bruchidius cisti: Southgate
Bruchidius unicolor: Bottimer
Bruchidius unicolor var. debilis: Schilsky
Bruchidius villosus var. pubescens: Luk'yanovich and Ter-Minassian
Bruchus ater Curtis
Bruchus ater var. pubescens: Jacquet
Bruchus autumnalis Motschulsky
Bruchus canus Germar

Bruchus cisti Fabricius
Bruchus debilis Gyllenhal
Bruchus nugax Motschulsky
Bruchus pulverulentus Motschulsky
Bruchus rostratus Motschulsky
Bruchus tibiellus Stephens
Bruchus unicolor Olivier
Bruchus villosus var. pubescens: Pic
Mylabris villosa var. pubescens: Baudi
Spermophagus cisti: Schilsky

Bruchidius villosus (Fabricius)
Bruchidius ater: Southgate
Bruchidius villosus: Zacher
Bruchus ater Marsham
Bruchus cisti sensu Paykull (not Fabricius)
Bruchus fasciatus, of authors (not Olivier)
Bruchus villosus Fabricius
Mylabris villosus: Baudi
Sparteus villosus: Bridwell
Spermophagus fasciatus (Olivier) of Arnett

Bruchus brachialis Fahraeus
Bruchus brachialis Fahraeus
Bruchus pallidicornis Mulsant and Rey
Laria brachialis: Bedel
Mylabris brachialis: Baudi

***Bruchus* Linnaeus**

Acanthobruchus Ramos
Bruchoides Ramos
Laria Scopoli (of authors)
Mylabris Müller (of authors)

Bruchus pisorum (Linnaeus)
Bruchus fabae Brulle
Bruchus intermedius Motschulsky
Bruchus lunarius Rey
Bruchus pisi Linnaeus
Bruchus pisorum: Abeille
Bruchus pisorum var. unifasciatus Rey
Bruchus sparsus Fabricius
Dermestes pisorum Linnaeus
Laria salicis Scopoli
Mylabris cruciger Geoffroy
Mylabris pisorum: Baudi
Mylabris pisorum: Leng

Bruchus rufimanus Boheman
Bruchus fabae Motschulsky
Bruchus granarius: of authors (not Linnaeus)
Bruchus rufimanus var. diversipubens Pic
Bruchus rufimanus var. velutinus Mulsant and Rey
Bruchus rufimanus var. rufimanus Luk'yanovich and Ter-Minassian
Laria rufimana: Chittenden
Mylabris rufimana: Baudi
Mylabris rufimanus: Leng
Mylabris rufimana var. velutina: Baudi

***Callosobruchus* Pic**

Bruchus (Callosobruchus) Pic

Callosobruchus chinensis (Linnaeus)
Bruchus biguttatus Fabricius
Bruchus biguttellus Schoenherr
Bruchus bistriatus Fabricius
Bruchus bistriotus: Bridwell (error)
Bruchus (Callosobruchus) chinensis: Pic
Bruchus (Callosobruchus) chinensis: Zacher
Bruchus chinensis: Cushman
Bruchus elegans: Sturm, Gemminger and Harold
Bruchus pectinicornis Linnaeus
Bruchus rufobrunneus: Wollaston
Bruchus rufus De Geer
Bruchus scutellaris Fabricius
Callosobruchus chinensis: Bridwell
Curculio chinensis Linnaeus
Mylabris chinensis: Harold
Pachymerus chinensis: Schilsky

Callosobruchus maculatus (Fabricius)
Acanthoscelides sinuatus: Blackwelder
Bruchus ambiguus Gyllenhal
Bruchus arachidis Fahraeus
Bruchus litteratus Schoenherr
Bruchus maculatus Fabricius
Bruchus ornatus Boheman
Bruchus quadrimaculatus Fabricius
Bruchus sinuatus Fahraeus
Bruchus (Acanthoscelides) trabuti Caillol
Bruchus vicinus Gyllenhal
Callosobruchus maculatus: Bridwell
Callosobruchus ornatus: Hoffmann
Callosobruchus quadrimaculatus: Shomar
Callosobruchus sinuatus: Zacher

Laria quadrimaculata: Bedel

Mylabris quadrimaculatus: Baudi

Pachymerus ornatus: Schilsky

Pachymerus quadrimaculatus: Schilsky

Callosobruchus phaseoli (Gyllenhal)

Bruchus conicicollis Fairmaire

Bruchus figuratus Gyllenhal

Bruchus phaseoli Gyllenhal

Callosobruchus phaseoli: Herford

Mylabris phaseoli: Baudi

Pachymerus phaseoli: Schilsky

Callosobruchus pulcher (Pic)

Callosobruchus albocallosus (Pic) (misident.)

Caryedes Hummel

Adromisus Des Gozis

Andromisus Des Gozis

Falsobruchus Pic

Pachymera Berthold

Pachymere Latreille

Pachymerus Schoenherr

Pedalophus Bottimer

Pedapholus Gistel

Pseudopachymerus Pic

Caryedes helvinus (Motschulsky)

Bruchus calderensis Sharp

Caryedes bicoloripes var. binotata: Blackwelder

Caryedes calderensis: Blackwelder

Caryedes helvina: Blackwelder

Caryedes helvinus: Kingsolver and Whitehead

Caryedes scabricollis: Blackwelder

Pachymerus helvinus Motschulsky

Pachymerus scabricollis Chevrolat

Pseudopachymerus calderensis: Pic

Pseudopachymerus helvinus: Pic

Pseudopachymerus multimaculatus var. binotatus Pic

Pseudopachymerus scabricollis: Pic

Caryedes incensus (Sharp)

Bruchus incensus Sharp

Caryedes incensa: Blackwelder

Caryedes incensus: Kingsolver and Whitehead

Pseudopachymerus incensus: Pic

Caryedon Schoenherr

Caryedon serratus (Olivier)

Bruchus fuscus Bedel, and authors

Bruchus gonagra Fabricius

Bruchus serratus Olivier

Caryedon gonagra: Herford

Caryedon serratus: Schoenherr

Caryoborus gonagra: (Fabricius) Swezey

Caryoborus gonagra: Gyllenhal

Pachymerus acaciae Lepesme

Pachymerus gonagra: Pic

Pachymerus gonager: Chujo

Pachymerus longus Pic

Pachymerus sibutensis Pic

Caryobruchus Bridwell

Caryobruchus gleditsiae (Linnaeus)

Bruchus arthriticus Fabricius

Bruchus fuscus Goeze

Bruchus gleditsiae: Linnaeus

Caryoborus arthriticus: Schoenherr

Caryobruchus arthriticus: Zacher

Caryobruchus gleditsiae: Bridwell

Dermestes gleditsiae: Johansson and Linnaeus

Pachymerus gleditsiae: Pic

Gibbobruchus Pic

Gibbobruchus: Bridwell

Pachymerus subg. Gibbobruchus Pic

Pseudopachymerus subg. Gibbobruchus Pic

Gibbobruchus cristicollis (Sharp)

Bruchus cristicollis Sharp

Caryedes cristicollis: Blackwelder

Gibbobruchus cristicollis: Whitehead and Kingsolver

Pseudopachymerus cristicollis: Pic

Gibbobruchus divaricatae Whitehead and Kingsolver

Gibbobruchus mimus (Say)

Bruchus borealis Schoenherr

Bruchus crataegi Fahraeus

Bruchus mimus Say

Bruchus murinus Schoenherr (error)

Gibbobruchus mimus: Bridwell

Mylabris mimus: Leng

Pseudopachymerus crataegi: Pic

***Kytorhinus Fischer* von Waldheim**

Cytorhinus Agassiz

Kytorhinus Fischer von Waldheim

Kytorhinus Motschulsky

Kytorhynus Motschulsky

Kytorrhinus Baudi

Pygobruchus Sharp

Kytorhinus prolixus (Fall)

Kytorhinus prolixus: Bridwell

Kytorrhinus prolixus: Teran

Mylabris (Bruchus) prolixus Fall

***Lithraeus* Bridwell**

Lithraeus atronotatus (Pic)

Acanthoscelides atronotatus: Blackwelder

Bruchus atronotatus Pic

Lithraeus atronotatus: De Luca

***Megacerus* Fahraeus**

Pachybruchus Pic

Serratibruchus Teran and Kingsolver

Megacerus coryphae (Olivier)

Bruchus coryphae Olivier

Bruchus (Pachybruchus) coryphae: Pic

Megacerus coryphae: Bridwell

Megacerus (Pachybruchus) coryphae: Teran and Kingsolver

Mylabris coryphae: Leng

Megacerus cubiculus (Casey)

Bruchus cubiculus Casey

Megacerus cubiculus: Bottimer

Megacerus (Megacerus) cubiculus: Teran and Kingsolver

Mylabris impiger var. cubiculus: Leng

Megacerus cubicus (Motschulsky)

Bruchus cubicus: Sharp

Bruchus (Pachybruchus) cubicus: Pic

Bruchus leucosomus Sharp

Bruchus (Pachybruchus) leucosomus: Pic

Kytorhinus cubicus Motschulsky

Megacerus cubicus: Blackwelder

Megacerus (Megacerus) cubicus: Teran and Kingsolver

Megacerus leucosomus: Blackwelder

Mylabris leucosomus: Leng

Megacerus discoidus (Say)

Bruchus (Pachybruchus) discoideus: Pic

Bruchus discoidens: Dury

Bruchus discoideus: Melsheimer and authors

Bruchus discoidus Say

Kytorhinus discoidii: Motschulsky

Megacerus discoideus: Bridwell

Megacerus discoidus: Bottimer

Mylabris discoideus: Leng

Megacerus impiger (Horn)

Bruchus impiger Horn

Bruchus (Pachybruchus) impiger: Pic

Bruchus ramicornis Boheman (not Erichson)

Megacerus eugenie Bottimer

Megacerus impiger: Bridwell

Megacerus (Megacerus) impiger: Teran and Kingsolver

Megacerus ramicornis: Blackwelder

Mylabris impiger: Leng

Megacerus leucospilus (Sharp)

Bruchus (Pachybruchus) coryphae var. lineatipennis Pic

Bruchus leucospilus Sharp

Bruchus (Pachybruchus) leucospilus: Pic

Megacerus alternatus Bridwell

Megacerus leucorpilus: Bridwell (error)

Megacerus leucospilus: Bridwell

Megacerus maculiventris (Fahraeus)

Acanthoscelides mactatus: Blackwelder

Bruchus impiger var.: Sharp

Bruchus kytorrhinensis Pic

Bruchus (Pachybruchus) kytorrhinensis: Pic

Bruchus (Pachybruchus) maculiventris: Pic

Bruchus mactatus Pic

Bruchus maculiventris Fahraeus

Bruchus serratifemur Schaeffer

Bruchus (Pachybruchus) triangularifer Pic

Bruchus (Pachybruchus) triangulifer var. multisparsus Pic

Kytorrhinus quadratus Motschulsky

Megacerus kytorrhinensis: Blackwelder

Megacerus maculiventris: Blackwelder

Megacerus (Serratibruchus) maculiventris: Teran and Kingsolver

Mylabris serratifemur: Leng

Pachybruchus triangulifer: Pic

Pachybruchus triangulifer var. multisparsus: Pic

Megacerus ripiphorus (Fahraeus)

Acanthoscelides ripiphorus: Blackwelder

Bruchus ripiphorus Fahraeus

Megacerus ripiphorus: Teran and Kingsolver

Megacerus (Megacerus) ripiphorus: Teran and Kingsolver

Megacerus wheelocki: Bottimer

Mylabris wheelocki Blatchley

Megacerus schaefferianus Bridwell

Bruchus crenatus Schaeffer

Megacerus crenatus: Johnson

Megacerus schaefferianus Bridwell

Megacerus (Serratibruchus) schaefferianus: Teran and Kingsolver

***Meibomeus* Bridwell**

Meibomerus: Arnett (error)

Meibomeus desmoportheus Kingsolver and Whitehead

Meibomeus musculus (Say)

Bruchus alboguttis Motschulsky

Bruchus erythrocerus Riley

Bruchus musculus Say

Meibomeus musculus: Bridwell

Meibomeus surrubresus (Pic)

Acanthoscelides subrubrosus: Blackwelder (error)

Acanthoscelides surrubresus: Schoonhoven (error)

Bruchus surrubresus Pic

Meibomeus surrubresus: Kingsolver and Whitehead

***Merobruchus* Bridwell**

Merobruchus insolitus (Sharp)

Acanthoscelides insolitus: Blackwelder

Bruchus insolitus Sharp

Merobruchus insolitus: Mumford

Merobruchus sp.: Gibson

Merobruchus julianus (Horn)

Acanthoscelides julianus: Blackwelder

Bruchus julianus Horn

Bruchus ochreolineatus Fall

Bruchus ochrolineatus: Pic (error)

Merobruchus julianus: Bridwell

Mylabris julianus: Leng

Merobruchus knulli (White)

Bruchus knulli White

Merobruchus knulli: Johnson

Mylabris knulli: Blackwelder and Blackwelder

Merobruchus lysilomae Kingsolver

Merobruchus major (Fall)

Acanthoscelides flexicaule: Zacher

Acanthoscelides flexicaulis: U.S. Department of Agriculture

Bruchus flexicaulis Schaeffer

Bruchus julianus: Schaeffer (error)

Bruchus major Fall

Merobruchus flexicaulis: Wheeler et al.

Merobruchus major: Bradley

Mylabris major: Leng

Mylabris julianus: Boeving

*Merobruchus placidus (*Horn)

Acanthoscelides limpidus: Blackwelder

Acanthoscelides placidus: Blackwelder

Bruchus limpidus Sharp

Bruchus placidus Horn

Merobruchus limpidus: Johnson and Kingsolver

Merobruchus placidus: Johnson

Mylabris placidus: Leng

Merobruchus terani Kingsolver

Merobruchus sp. 4: Johnson

*Merobruchus vacillator (*Sharp)

Acanthoscelides vacillator: Blackwelder

Bruchus vacillator Sharp

Merobruchus vacillator: Bottimer

***Mimosestes* Bridwell**

Cercidiestes Bridwell

Mimosestes acaciestes Kingsolver and Johnson

Mimosestes new species: Center and Johnson

Mimosestes amicus (Horn)

Acanthoscelides amicus: Blackwelder

Bruchus amicus Horn

Mimosestes amicus: Muesebeck et al.

Mylabris amicus: Leng

Mimosestes insularis Kingsolver and Johnson

Mimosestes mimosae (Fabricius)
Acanthoscelides breweri: Blackwelder
Acanthoscelides dominicanus: Blackwelder
Acanthoscelides immunis: Blackwelder
Acanthoscelides innotatus: Bradley
Acanthoscelides mimosae: Blackwelder
Acanthoscelides strigatus: Blackwelder
Acanthoscelides subrufus: Blackwelder
Bruchus breweri Crotch
Bruchus dominicanus Jekel
Bruchus immunis Sharp
Bruchus innotatus Pic
Bruchus inornatus Horn
Bruchus mimosae Fabricius
Bruchus strigatus Motschulsky
Bruchus subrufus Motschulsky
Mimosestes dominicanus: Johnson and Kingsolver
Mimosestes mimosae: Decelle
Mimosestes immunis: Kingsolver
Mimosestes innotatus: Bottimer
Mimosestes inornatus: Johnson
Mimosestes strigatus: Johnson and Kingsolver
Mylabris immunis: Leng
Mylabris innotatus: Leng
Mimosestes nubigens (Motschulsky)
Acanthoscelides nubigens: Blackwelder
Acanthoscelides sallaei: Blackwelder
Bruchus nubigens Motschulsky
Bruchus sallaei Sharp
Bruchus sallei: Pic
Mimosestes nubigens: Johnson and Kingsolver
Mimosestes sallaei: Bridwell
Mylabris sallaei: Kannan
Mylabris sallei: Leng (error)
Mimosestes protractus (Horn)
Acanthoscelides protractus: Blackwelder
Bruchus longiventris Sharp
Bruchus protractus Horn
Mimosestes longiventris: Johnson and Kingsolver
Mimosestes protractus: Johnson
Mylabris protractus: Leng
Mimosestes ulkei (Horn)
Bruchus ulkei Horn
Bruchus (Cercidiestes) ulkei: Zacher
Cercidiestes ulkei: Bridwell
Mimosestes ulkei: Kingsolver and Johnson
Mylabris ulkei: Leng

Neltumius Bridwell

Neltumius arizonensis (Schaeffer)
Bruchus arizonensis Schaeffer
Mylabris arizonensis: Leng
Neltumius arizonensis: Bridwell
Neltumius gibbithorax (Schaeffer)
Bruchus gibbithorax Schaeffer
Mylabris gibbithorax: Leng
Neltumius gibbithorax: Bradley
Neltumius gibbothorax: Kingsolver (error)
Neltumius texanus (Schaeffer)
Bruchus texanus Schaeffer
Mylabris texanus: Leng
Neltumius texanus: Bradley

Sennius Bridwell

*Sennius abbreviatus (*Say)
Bruchus abbreviatus Horn (validation)
Bruchus abbreviatus Melsheimer (catalog name)
Bruchus abbreviatus Say
Bruchus bivulneratus Horn
Curculio abbreviatus Say
Mylabris abbreviatus Dohrn: Leng (error)
Mylabris bivulneratus: Leng
Sennius abbreviatus: Bottimer
Sennius bivulneratus: Bradley
Sennius cruentatus (Horn)
Acanthoscelides cruentatus: Blackwelder
Bruchus cruentatus Horn
Bruchus depressus Fall
Bruchus nictitans Motschulsky
Bruchus nigrinus Horn
Mylabris cruentatus: Leng
Mylabris nictitans: Leng
Mylabris nigrinus: Leng
Sennius cruentatus: Bridwell
Sennius depressus: Johnson
Sennius nictitans: Bottimer
Sennius nigrinus: Bradley

Sennius discolor (Horn)
Acanthoscelides infirmus: Blackwelder
Acanthoscelides managuanus: Blackwelder
Bruchus discolor Horn
Bruchus discopterus Fall
Bruchus infirmus Sharp
Bruchus managuanus Pic
Mylabris discolor: Leng
Mylabris discopterus: Leng
Sennius discolor: Bottimer
Sennius discopterus: Johnson
Sennius fallax (Boheman)
Acanthoscelides californicus: Bottimer
Acanthoscelides fallax: Blackwelder
Acanthoscelides probus: Blackwelder
Acanthoscelides xanthopus: Blackwelder
Bruchus californicus Boheman
Bruchus fallax Boheman
Bruchus probus Sharp
Bruchus xanthopus Suffrian
Sennius fallax: Johnson and Kingsolver
Sennius xanthopus: Bottimer
Sennius lebasi (Fahraeus)
Acanthoscelides celatus: Blackwelder
Acanthoscelides lebasi: Blackwelder
Acanthoscelides rufescens: Blackwelder
Bruchus celatus Sharp
Bruchus lebasi Fahraeus
Bruchus rufescens Motschulsky
Sennius celatus: Bottimer
Sennius lebasi: Kingsolver
Sennius rufescens: Kingsolver
Sennius leucostauros Johnson and Kingsolver
Sennius medialis (Sharp)
Acanthoscelides medialis: Blackwelder
Bruchus auctus Fall
Bruchus medialis Sharp
Mylabris auctus: Leng
Sennius auctus: Johnson
Sennius medialis: Johnson and Kingsolver
Sennius morosus (Sharp)
Acanthoscelides morosus: Blackwelder
Bruchus discolor: Fall and Cockerell (not Horn)
Bruchus morosus Sharp
Sennius morosus: Johnson and Kingsolver
Sennius obesulus (Sharp)
Acanthoscelides obesulus: Blackwelder
Bruchus obesulus Sharp
Sennius obesulus: Johnson and Kingsolver
Sennius simulans (Schaeffer)
Bruchus simulans Schaeffer
Mylabris simulans: Leng
Sennius simulans: Johnson
Sennius whitei Johnson and Kingsolver

Stator Bridwell

Stator beali Johnson
Stator bottimeri Kingsolver
Str chihuahua Johnson and Kingsolver
Stator coconino Johnson and Kingsolver
Stator limbatus (Horn)
Acanthoscelides cearanus: Blackwelder
Acanthoscelides interruptus: Blackwelder
Acanthoscelides limbatus: Moreno and Bibby
Bruchus cearanus Pic
Bruchus interruptus Sharp
Bruchus limbatus Horn
Mylabris limbatus: Leng
Stator cearanus: Kingsolver
Stator limbatus: Leech
Stator pruininus (Horn)
Acanthoscelides cognatus: Blackwelder
Acanthoscelides piger: Blackwelder
Acanthoscelides pruininus: Blackwelder
Bruchidius pruininus: Herford
Bruchus cognatus Sharp
Bruchus piger Sharp
Bruchus pruininus Horn
Bruchus (Stator) pruininus: Zacher
Mylabris pruininus: Leng
Stator pruininus: Bridwell
Stator pygidialis (Schaeffer)
Acanthoscelides pythonicus: Johnson
Bruchus pygidialis Schaeffer
Bruchus pythonicus Pic
Mylabris pygidialis: Leng
Mylabris pythonicus: Leng
Stator pygidialis: Johnson
Stator pythonicus: Johnson

Stator sordidus (Horn)
Acanthoscelides semicolon: Blackwelder
Acanthoscelides sordidus: Blackwelder
Acanthoscelides usticolor: Blackwelder
Bruchus semicolon Sharp
Bruchus sordidus Horn
Bruchus usticolor Sharp
Mylabris sordidus: Leng
Stator semicolon: Bottimer
Stator sordidus: Johnson
Stator usticolor: Bottimer
Stator subaeneus (Schaeffer)
Bruchus subaeneus Schaeffer
Mylabris subaeneus: Leng
Stator subaeneus: Johnson
Stator vachelliae Bottimer
Bruchus sordidus: Johnson (misident.)
Stator sordidus: Johnson (misident.)

Stylantheus Bridwell

Stylantheus macrocerus (Horn)
Acanthoscelides macrocerus: Bridwell
Acanthoscelides mucrofer Bottimer
Bruchus macrocerus Horn
Mylabris macrocerus: Leng
Stylantheus macrocerus: Bridwell

Zabrotes Horn

Zabrotes amplissimus Kingsolver
Zabrotes arenarius (Wolcott)
Bruchus arenarius Wolcott
Megacerus arenarius: Bradley (error)
Mylabris arenarius: Leng
Zabrotes arenarius: Bottimer
Zabrotes bexarensis Kingsolver
Zabrotes sp.1, Johnson
Zabrotes chandleri Kingsolver
Zabrotes chavesi Kingsolver
Zabrotes vandykei Kingsolver
Zabrotes cruciger Horn
Spermophagus cruciger: Pic
Zabrotes cruciatus: Kingsolver (error)
Zabrotes cynthiae Kingsolver
Zabrotes densus Horn
Spermophagus densus: Pic
Zabrotes eldenensis Kingsolver
Zabrotes eldenae: Kingsolver (error)
Zabrotes humboldti Kingsolver
Zabrotes obliteratus Horn
Spermophagus obliteratus: Pic
Zabrotes planifrons Horn
Spermophagus planifrons: Pic
Zabrotes spectabilis Horn
Spermophagus spectabilis: Pic
Zabrotes stephani Kingsolver
Zabrotes subfasciatus (Boheman)
Amblycerus semifasciatus: Blackwelder
Bruchus cingulatus Suffrian
Bruchus leucogaster Sharp
Bruchus nesapius Fahraeus
Spermophagus basicornis Pic
Spermophagus dorsopictus Lepesme
Spermophagus minusculus Pic (error)
Spermophagus musculus Boheman
Spermophagus pectoralis: Back and Duckett
Spermophagus (Zabrotes) pectoralis: Sharp
Spermophagus semicinctus Horn
Spermophagus semifasciatus Boheman
Spermophagus subfasciatus Boheman
Zabrotes obtectus: Kingsolver (error)
Zabrotes pectoralis: Blackwelder
Zabrotes semicinctus: Bottimer
Zabrotes semifasciatus: Bottimer
Zabrotes subfasciatus: Zacher
Zabrotes subnitens Horn
Spermophagus subnitens: Pic
Zabrotes sylvestris Romero and Johnson
Zabrotes victoriensis Kingsolver

Fossil Species

The geologic formation in which fossil specimens were found is included.

Bruchus Linnaeus
aboriginalis Wickham 1914:482. Florissant.
anilis Scudder 1876:82. White River.
antaeus Wickham 1917:470. Florissant.
bowditchi Wickham 1912:30. Florissant.
carpophiloides Wickham 1914:482. Florissant.
dormescens Wickham 1913a:297. Florissant.
exhumatus Wickham 1912:29. Florissant.

henshawi Wickham 1912:28. Florissant.

osborni Wickham 1912:32. Florissant.

succinctus Wickham 1913b:19. Florissant.

Oligobruchus Kingsolver

florissantensis (Wickham) 1912:30. Florissant.

haywardi Wickham 1912:30. Florissant.

primoticus Wickham 1914:480. Florissant.

scudderi Wickham 1912:31. Florissant.

submersus Wickham 1914:481. Florissant.

wilsoni Wickham 1913b:19. Florissant.

Spermophagus Schoenherr

pluto Wickham 1914:480. Florissant.

vivificatus Scudder 1876:82. White River.

Appendix III

Hosts of Bruchidae of the United States and Canada, by Bruchid

Records marked with (?) are questionable although they may have been listed in the literature. For more extensive host associations, especially for Latin America, see the many papers by Johnson and his students (including Center and Johnson 1973, 1974, 1976; Forister and Johnson 1970, 1971; Johnson and Kistler 1987; Johnson and Siemans 1995a,b, 1997a,b; Nilsson and Johnson, 1990, 1993a,b).

For author names of host plants, see appendix IV.

Abutiloneus idoneus Bridwell

Abutilon abutiloides, A. berlandieri; Allowissadula holosericea

Acanthoscelides aequalis (Sharp)

Abutilon berlandieri; Allowissadula holosericea, A. lozani

Acanthoscelides alboscutellatus (Horn)

Daucus carota (floral record); *Glycyrrhiza lepidota; Ludwigia alternifolia, L. palustris*

Acanthoscelides atomus (Fall)

Hudsonia ericoides (floral record); *Lechea racemulosa, L. tenuifolia*

Acanthoscelides aureolus (Horn) complex

Astragalus allochrous, A. amphioxys, A. asymmetricus, A. bisulcatus, A. calycosus, A. crotalariae, A. douglasii, A. drummondii, A. fucatus, A. grayi, A. humistratus, A. lancearius, A. lentiginosus, A. mollissimus mollissimus, A. oxyphysus, A. pattersonii, A. praelongus, A. lonchocarpus, A. pterocarpus, A. racemosus, A. thurberi, A. trichopodus antisellii, A. trichopodus phoxus, A. trichopodus trichopodus, A. wootoni; Glycyrrhiza lepidota; Lotus purshianus, L. scoparius; Oxytropis lambertii, O. sericea

Acanthoscelides baboquivari Johnson

Indigofera platycarpa, I. sphaerocarpa

Acanthoscelides bisignatus (Horn)

Baptisia sp.; *Desmanthus* sp., *D. illinoensis, D. leptolobus, D. velutinus, D. virgatus virgatus*

Acanthoscelides biustulus (Fall)

Desmodium spp., *D. batocaulon, D. cinerascens, D. grahamii, D. neomexicanus*

Acanthoscelides calvus (Horn)

Aronia sp. (floral); *Helianthemum canadense*

Acanthoscelides chiricahuae (Fall)

Mimosa biuncifera, M. borealis, M. dysocarpa, M. grahamii, M. laxiflora, M. wherryana; Acacia greggi

Acanthoscelides compressicornis (Schaeffer)

Desmanthus sp., *D. cooleyi, D. covillei, D. illinoensis, D. leptolobus, D. leptophyllus, D. obtusus, D. subulatus, D. velutinus, D. virgatus acuminatus, D. virgatus depressus, D. virgatus glandulosus, D. virgatus virgatus; Hoffmanseggia densiflora, H. drepanocarpa, H. glauca, H. tenella; Mimosa dysocarpa, M. grahamii*

Acanthoscelides comstocki Johnson

Eysenhardtia texana

Acanthoscelides daleae Johnson

Dalea sp.; *Psorothamnus fremontii, P. schotti, P. spinosa*

Acanthoscelides desmanthi Johnson

Desmanthus sp., *D. bicornutus, D. covillei, D. leptophyllus, D. subulatus, D. virgatus depressus, D. virgatus virgatus*

Acanthoscelides distinguendus (Horn)

Mimosa strigillosa; Rhynchosia americana, R. difformis, R. erecta, R. galactoides, R. intermedia, R. latifolia, R. tomentosa; Tephrosia virginiana

Acanthoscelides flavescens (Fahraeus)

Abutilon hypoleucum; Eriosema violaceum; Galactia striata; Rhynchosia longeracemosa, R. minima; Vicia sp.

Acanthoscelides floridae (Horn)

Amorpha fruticosa fruticosa

Acanthoscelides fraterculus (Horn)

Abrus precatorius, Astragalus bisulcatus, A. cibarius, A. crassicarpus crassicarpus, A. crassicarpus paysonii, A. drummondii, A. falcatus, A. hyalinus, A. missouriensis, A. mollissimus bigelovii, A. mollissimus mollissimus, A. pattersonii, A. pectinatus, A. pterocarpus, A. racemosus, A. utahensis; Glycyrrhiza lepidota; Hedysarum boreale; Lotus crassifolius, L. mearnsii, L. rigidus, L. scoparius

Acanthoscelides fumatus (Schaeffer)

Rhynchosia texana

Acanthoscelides griseolus (Fall)

Sesbania emerus, S. exaltata

Acanthoscelides helianthemum Bottimer

Helianthemum corymbosum

Acanthoscelides herissantitus Johnson

Herissantia crispa; Malvastrum bicuspidatum

Acanthoscelides inquisitus (Fall)

Unknown

Acanthoscelides kingsolveri Johnson

Indigofera lindheimeriana, I. sphaerocarpa, I. suffruticosa

Acanthoscelides lobatus (Fall)

Astragalus humistratus, A. lentiginosus, A. mollissimus bigelovii, A. mollissimus marcidus, A. mollissimus mollissimus, A. troglodytus

Acanthoscelides longistilus (Horn)

Desmodium illinoense; Lespedeza capitata, L. frutescens, L. hirta, L. intermedia, L. texana, L. virginica

Acanthoscelides macrophthalmus (Schaeffer)

Leucaena leucocephala, L. pulverulenta, L. retusa

Acanthoscelides margaretae Johnson

Astragalus pycnostachys

Acanthoscelides mixtus (Horn)

Astragalus allochrous, A. lentiginosus, A. praelongus, A. lonchocarpus, A. sabulonum, A. thurberi, A. wootoni; Eysenhardtia texana

Acanthoscelides modestus (Sharp)

Aeschynomene histrix incana, A. indica. In other species of Aeschynomene in Mexico and Central America

Acanthoscelides mundulus (Sharp)

Nissolia schottii, N. wislizenii

Acanthoscelides napensis Johnson

Malacothrix incana, M. saxatilis implicata (all floral records)

Acanthoscelides obrienorum Johnson

Senna armata, S. polyantha, S. wislizenii wislizenii

Acanthoscelides obsoletus (Say)

Tephrosia ambigua, T. spicata, T. virginiana

Acanthoscelides obtectus (Say)

Albizia sp.; *Cajanus cajan; Cicer arietinum; Daucus carota* (floral); *Dolichos melanophthalmus* (doubtful); *Glycine max; Lablab purpureus; Lens culinaris; Lathyrus sativus; Lupinus albus; Phaseolus acutifolius latifolius, P. coccineus, P. lunatus, P. ritensis, P. vulgaris; Pisum sativum arvense; Sesbania aegyptiaca, S. sesban; Vicia faba; Vigna aconitifolia, V. radiata radiata, V. subterranea, V. umbellata, V. unguiculata sesquipedalis, V. unguiculata unguiculata; Zea mays (doubtful)*

Acanhoscelides oregonensis Johnson

Dalea ornata

Acanthoscelides pallidipennis (Motschulsky)

Amorpha californica, A. canescens, A. fruticosa fruticosa; Astragalus sp.; *Dalea* sp.; *Desmanthus virgatus acuminatus, D. virgatus virgatus; Errazurizia rotundata; Glycyrrhiza* sp.; *Lotus* sp.; *Parryella filifolia*

Acanthoscelides pauperculus (LeConte)

Trifolium obtusiflorum

Acanthoscelides pectoralis (Horn)

Desmanthus sp., D. leptolobus, D. obtusus, D. reticulatus, D. velutinus, D. virgatus virgatus

Acanthoscelides pedicularius (Sharp)

Dalea carnea albida

Acanthoscelides perforatus (Horn)

Astragalus canadensis

Acanthoscelides prosopoides (Schaeffer)

Condalia lycioides; Ziziphus obtusifolia

Acanthoscelides pullus (Fall)

Astragalus allochrous, A. asymmetricus, A. bolanderi, A. crotalariae, A. douglasii, A. lentiginosus, A. oxyphysus, A. praelongus, A. thurberi, A. trichopodus antisellii, A. trichopodus phoxus, A. wootoni

Acanthoscelides pusillimus (Sharp)

Dalea spp., Dalea scandens paucifolia; Trifolium pratense **(**Trifolium records are suspect)

Acanthoscelides quadridentatus (Schaeffer)

Mimosa pigra, Mimosa pigra berlandieri, M. strigillosa

Acanthoscelides rufovittatus (Schaeffer)

Galactia wrightii; Tephrosia cinerea, T. purpurea, T. thurberi

Acanthoscelides schaefferi (Pic)

Unknown

Acanthoscelides schrankiae (Horn)

Acacia amentacea; Desmanthus virgatus acuminatus; Mimosa borealis; Schrankia microphylla, S. nuttallii, S. roemeriana, S. uncinata

Acanthoscelides seminulum (Horn)

Dalea aurea, D. candida, D. enneandra, D. feayi, D. frutescens, D. stanfieldii, D. tenuis

Acanthoscelides speciosus (Schaeffer)

Mimosa biuncifera, M. malacophylla, M. wherryana

Acanthoscelides stylifer (Sharp)

Desmodium sp. *D. grahamii*

Acanthoscelides subaequalis Johnson

Abutilon abutiloides, A. berlandieri, A. incanum, A. trisulcatum

Acanthoscelides submuticus (Sharp)

Amorpha californica, A. fruticosa angustifolia, A. fruticosa fruticosa, A. fruticosa occidentalis

Acanthoscelides tenuis Bottimer

Lythrum alatum, L. lineare

Acanthoscelides tridenticulatus Bottimer

Mimosa strigillosa

Algarobius bottimeri Kingsolver

Prosopis glandulosa glandulosa, P. pallida, P. reptans reptans, P. reptans cinerascens

Algarobius prosopis (LeConte)

Prosopis alba (introduced), *P. chilensis, P. glandulosa torreyana, P. laevigata, P. pubescens, P. reptans cinerascens, P. velutina*

Althaeus folkertsi Kingsolver

Abutilon theophrasti; Hibiscus militaris, H. moscheutos lasiocarpus

Althaeus hibisci (Olivier)

Abutilon theophrasti; Daucus carota (floral record); *Hibiscus aculeatus, H. moscheutos moscheutos, H. moscheutos lasiocarpus, H. moscheutos palustris; Kosteletzkya virginica*

Althaeus steineri Kingsolver

Kosteletzkya virginica

Amblycerus eustrophoides (Schaeffer)

Drypetes lateriflora

Amblycerus ireriae Romero, Johnson, and Kingsolver

Host unknown

Amblycerus nigromarginatus (Motschulsky)

Senna corymbosa. Outside the United States: *Senna alata, S. bicapsularis bicapsularis, S. occidentalis, S. splendida, S. uniflora; Caesalpinia* spp.; *Cassia* spp.

Amblycerus obscurus (Sharp)

U.S. host unknown. Associated with *Senna alata, S. bicapsularis bicapsularis, S. hirsuta leptocarpa, S. obtusifolia, S. pendula advena, S. pendula ovalifolia,* and *S. uniflora* south of the Rio Grande

Amblycerus robiniae (Fabricius)

Acacia farnesiana(?); *Gleditsia aquatica, G. triacanthos; Robinia pseudoacacia* (probable misidentification); *Tillandsia usneoides* (hibernaculum)

Amblycerus schwarzi Kingsolver

U.S.A.: *Hippomane mancinella.* West Indies: *Guettarda* sp.; *Hippomane mancinella; Tectona grandis; Terminalia catappa; Ricinis communis*

Amblycerus vitis (Schaeffer)

Vitis arizonica

Borowiecius ademptus (Sharp)

Pueraria montana lobata

Bruchidius cisti (Fabricius)

Cynoglossum sp.; *Onobrychis viciifolia; Spartium junceum*

Bruchidius villosus (Fabricius)

Cytisus scoparius; Laburnum alpinum, L. anagyroides; Petteria ramentacea; Spartium junceum

Bruchus brachialis Fahraeus

Daucus carota (floral record); Lathyrus sativus; Vicia benghalensis, V. caroliniana, V. cracca, V. grandiflora, V. pannonica, V. sativa nigra, V. sativa sativa, V. sepium, V. villosa dasycarpa, V. villosa villosa

Bruchus pisorum (Linnaeus)

Lathyrus sativus; Pisum elatius, P. sativum arvense; Vicia faba(?), Vicia sp.; *Vigna radiata radiata*

Bruchus rufimanus Boheman

Vicia faba, V. sativa sativa

Callosobruchus chinensis (Linnaeus)

Cajanus cajan; Cicer arietinum; Cyamopsis tetragonoloba; Glycine max; Lablab purpureus; Lathyrus sativus; Lens culinaris; Nelumbo nucifera; Phaseolus lunatus, P. vulgaris; Pisum sativum arvense; Psophocarpus tetragonolobus; Vicia faba; Vigna

aconitifolia, V. angularis, V. mungo, V. radiata radiata, V. unguiculata unguiculata

Callosobruchus maculatus (Fabricius)

ßCajanus cajan; Cicer arietinum; Glycine max; Lablab purpureus; Lathyrus aphaca, L. clymenum, L. sativus; Lens culinaris; Phaseolus acutifolius, P. lunatus, P. vulgaris; Pisum sativum arvense; Vicia faba, V. lutea, V. sativa sativa; Vigna mungo, V. radiata radiata, V. unguiculata unguiculata

Callosobruchus phaseoli (Gyllenhal)

Cajanus cajan; Cicer arietinum; Crotalaria spectabilis; Lablab purpureus; Phaseolus lunatus, P. vulgaris; Pisum sativum arvense; Sesbania sp.; *Vicia faba; Vigna angularis, V. radiata radiata*

Callosobruchus pulcher Pic

Cajanus cajan; Cicer arietinum; Phaseolus vulgaris; Vigna angularis

Caryedes helvinus (Motschulsky)

Centrosema macrocarpa, C. pubescens

Caryedes incensus (Sharp)

Centrosema macrocarpa, C. pubescens

Caryedon serratus (Olivier)

Acacia farnesiana, A. seyal, A. spirocarpa, A. tortilis; Adenanthera pavonina; Arachis hypogaea; Bauhinia malabarica, B. monandra, B. racemosa, B. reticulata, B. rufescens, B. thonningi, B. tomentosa; Caesalpinia pulcherrima; Cajanus cajan; Cassia afrofistula, C. arereh, C. fistula, C. grandis, C. javanica javanica, C. javanica indochinensis, C. sieberiana; Phaseolus vulgaris; Prosopis glandulosa glandulosa, P. pallida; Senna obtusifolia; Tamarindus indica

Caryobruchus gleditsiae (Linnaeus)

Cocothrinax argentata, C. martii; Livingstona chinensis; Phoenix sylvestris; Sabal etoni, S. glaucescens, S. mauritiaeformis, S. mexicana, S. minor, S. palmetto, S. parviflora, S. uresana, S. yapa; Serenoa repens; Tillandsia usneoides (hibernaculum); *Washingtonia filifera*

Gibbobruchus cristicollis (Sharp)

Bauhinia lunarioides (Texas), *B. coulteri* (Mexico), *B. divaricata, B. macranthera, B. pauletia* (Mexico)

Gibbobruchus divaricatae Whitehead and Kingsolver

Bauhinia divaricata (Texas), *B. pauletia, B. pescaprae, B. ungulata* (Mexico)

Gibbobruchus mimus (Say)

Bauhinia lunarioides; Cercis canadensis, C. occidentalis; Fraxinus sp. (floral); *Magnolia* sp. (floral), *M. grandiflora* (floral record)

Kytorhinus prolixus (Fall)

Hedysarum boreale, H. alpinum americanum

Lithraeus atronotatus (Pic)

Lithraea brasiliensis; Schinus terebinthifolius

Megacerus coryphae (Olivier)

Ipomoea pes-caprae, I. sagittata

Megacerus cubiculus (Casey)

Baccharis sarothroides (floral record); *Convolvulus* sp.; *Ipomoea batatas, I. lacunosa, I. purpurea, I. trifida; Merremia quinquefolia; Senecio salignus* (floral record)

Megacerus cubicus (Motschulsky)

Ipomoea sp. Extralimital: *Argyreia nervosa; Calystegia sepium;*, *Ipomoea arborescens, I. carnea fistulosa, I. crassicaulis, I. hederifolia, I. leptophylla, I. meyeri, I. nil.*

Megacerus discoidus (Say)

Calystegia sepium, C. sepium repens, C. macounii; Convolvulus arvensis; Ipomoea leptophylla, I. pandurata, I. tiliacea; Hibiscus sp. and *Daucus carota* are floral records

Megacerus impiger (Horn)

Calystegia atriplicifolia, C. occidentalis fulcrata, C. occidentalis occidentalis, C. longipes, C. macrostegia arida, C. macrostegia cyclostegia, C. macrostegia macrostegia, C. malacophylla deltoidea, C. malacophylla malacophylla, C. malacophylla pedicellata, C. piersonii, C. purpurata, C. soldanella, C. subacaulis, C. stebbensii; Convolvulus arvensis; Ipomoea sp.

Megacerus leucospilus (Sharp)

Ipomoea biloba(?), *I. cairica, I. carnea fistulosa, I. crassicaulis, I. leptophylla, I. pes-caprae; Merremia aegyptia* (Hawaii)

Megacerus maculiventris (Fahraeus)

Ipomoea aristolochiaefolia, I. marginisepala, I. nil, I. pes-caprae, I. purpurea, I. rubriflora (all extralimital)

Megacerus ripiphorus (Fahraeus)

Ipomoea alba

Megacerus schaefferianus Bridwell

Ipomoea longifolia

Meibomeus desmoportheus Kingsolver and Whitehead

Desmodium grahamii

Meibomeus musculus (Say)

Desmodium canescens, D. tenuifolium, D. tortuosum, D. triflorum; Lespedeza hirta

Meibomeus surrubresus (Pic)

Aeschynomene americana

Merobruchus insolitus (Sharp)

Lysiloma microphylla thornberi; Pithecellobium pallens

Merobruchus julianus (Horn)

Acacia berlandieri, A. coulteri (extralimital), *A. greggi, A. juncifolia, A. rigidula, A. roemeriana, A. wrightii; Desmanthus illinoensis* (questionable); *Mimosa borealis* (questionable); *Pithecellobium ebano*

Merobruchus knulli (White)

Lysiloma microphylla thornberi; L. acapulcensis and *L. watsoni* (extralimital)

Merobruchus lysilomae Kingsolver

Acacia richei, A. simplicifolia; Albizia lebbeck, A. polyphylla; Lysiloma latisiliqua, L. sabicu (extralimital)

Merobruchus major (Fall)

Pithecellobium ebano

Merobruchus placidus (Horn)

Acacia angustissima angustissima, A. angustissima hirta, A. angustissima suffrutescens, A. angustissima texensis; Astragalus sp.

Merobruchus terani Kingsolver

Host in United States unknown; Acacia *spp. south of Rio Grande*

Merobruchus vacillator (Sharp)

Host in United States unknown; Lysiloma divaricatum *in Mexico*

Mimosestes acaciestes Kingsolver and Johnson

Acacia amentacea, A. berlandieri, A. constricta, A. neovernicosa, A. rigidula, A. vernicosa

Mimosestes amicus (Horn)

Acacia constricta, A. farnesiana, A. glauca; Leucaena leucocephala; Parkinsonia aculeata, P. florida, P. microphylla, P. texana macra, P. texana texana; Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. pallida, P. pubescens, P. velutina; Sesbania aegyptiaca, S. sesban; Lippia wrightii (floral record)

Mimosestes insularis Kingsolver and Johnson

Acacia farnesiana; Prosopis glandulosa glandulosa, P. juliflora, P. pallida

Mimosestes mimosae (Fabricius)

Florida: *Caesalpinia coriaria.* Extralimital: *Acacia* sp., *A. cochliacantha, A. cymbispina, A. farnesiana, A. globulifera, A. hindsii, A. macracantha, A. pennatula; Caesalpinia* spp. *C. coriaria, C. sclerocarpa; Ceratonia siliqua; Cordia* sp. (questionable); *Lotus* sp.

Mimosestes nubigens (Motschulsky)

Rearing records: *Acacia cornigera, A. farnesiana, A. schaffneri, A. tortuosa; Prosopis pallida* (Hawaii). Records needing confirmation: *Acacia amentacea; Caesalpinia coriaria; Ceratonia siliqua; Cordia* sp.; *Gleditsia triacanthos; Lotus* sp.; *Prosopis chilensis, P. glandulosa glandulosa, P. glandulosa torreyana, P. juliflora*

Mimosestes protractus (Horn)

Parkinsonia microphylla, P. texana texana; Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. laevigata, P. velutina

Mimosestes ulkei (Horn)

Parkinsonia aculeata, P. florida, P. texana texana

Neltumius arizonensis (Schaeffer)

Chilopsis linearis (floral record); *Larrea tridentata* (floral record); *Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. velutina*

Neltumius gibbithorax (Schaeffer)

Pluchea sericea (probably floral); *Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. pubescens*

Neltumius texanus (Schaeffer)

Condalia correllii, C. globosa globosa, C. globosa pubescens, C. hookeri hookeri, C. obovata, C. spathulata, C. warnockii kearneyana; Zanthoxylum clava-herculis (floral record)

Sennius abbreviatus (Say)

Cassia sp.; *Senna marilandica.* Floral records: *Asclepias syriaca; Cicuta maculata; Cryptotaenia canadensis; Eupatorium* sp.; *Taenidia integerrima*

Sennius cruentatus (Horn)

Chamaecrista fasciculata, C. nictitans nictitans; Parkinsonia sp.; *Tillandsia usneoides* (hibernaculum)

Sennius discolor (Horn)

"*Cassia* sp."; *Parkinsonia* sp.(?); *Prosopis* sp.(?); *Senna lindheimeriana, S. roemeriana, S. wislizenii wislizenii*

Sennius fallax (Boheman)

Senna bicapsularis bicapsularis, S. biflora, S. obtusifolia, S. occidentalis

Sennius lebasi (Fahraeus)

Senna bicapsularis bicapsularis

Sennius leucostauros Johnson and Kingsolver

Senna bicapsularis bicapsularis

Sennius medialis (Sharp)

Senna hirsuta leptocarpa, S. hirsuta hirsuta (Mexico)

Sennius morosus (Sharp)

Senna bauhinioides, S. covesii, S. durangensis durangensis, S. hirsuta leptocarpa, S. occidentalis (extralimital), *S. obtusifolia, S. roemeriana*

Sennius obesulus (Sharp)

Chamaecrista serpens wrightii

Sennius simulans (Schaeffer)

Chamaecrista nictitans mensalis

Sennius whitei Johnson and Kingsolver

Host plant unknown

Stator beali Johnson

Pithecellobium ebano

Stator bottimeri Kingsolver

Acacia farnesiana, A. pinetorum

Stator chihuahua Johnson and Kingsolver

Acacia angustissima angustissima, A. constricta; Calliandra eriophylla, C. humilis humilis; Lysiloma microphylla thornberi; Mimosa biuncifera, M. wherryana

Stator coconino Johnson and Kingsolver

Host plant unknown

Stator limbatus (Horn)

Acacia acatlensis, A. angustissima angustissima, A. baileyana, A. berlandieri, A. confusa, A. cultriformis, A. farnesiana, A. greggi, A. koa, A. melanoxylon, A. millefolia, A. retinodes, A. richei, A. roemeriana, A. wrightii; Albizia lebbeck, A. saponaria; Arachis hypogaea (exp.) *Calliandra eriophylla, C. humilis humilis, C. humilis reticulata; Cassia fistula, C. grandis, C. javanica indochinensis, C. javanica javanica; Caesalpinia pulcherrima; Delonix regia*(?); *Desmanthus bicornutus; Erythrina sandwicensis; Glycine max; Leucaena leucocephala, L. pulverulenta; Lysiloma microphylla thornberi; Neptunia plena; Parkinsonia aculeata, P. florida, P. microphylla, P. texana macra, P. texana texana; Pithecellobium brevifolium, P. dulce, P. ebano, P. pallens, P. saman, P. unguis-cati; Prosopis glandulosa glandulosa, P. glandulosa torreyana, P. juliflora*

Stator pruininus (Horn)

Acacia berlandieri, A. californica, A. confusa, A. constricta, A. dealbata, A. decurrens, A. greggi, A. koa, A. mearnsii, A. melanoxylon, A. neovernicosa, A. richei, A. rigidula, A. roemeriana, A. schotti, A. vernicosa, A. wrightii; Albizia saponaria; Arachis hypogeae; Caesalpinia pulcherrima; Calliandra eriophylla, C. humilis humilis, C. humilis reticulata; Cassia fistula, C. grandis, C. javanica indochinensis, C. javanica javanica; Coursetia microphylla; Desmanthus bicornutus, D. cooleyi, D. covillei, D. fruticosa, D. leptolobus, D. virgatus virgatus; Desmodium uncinatum; Erythrina sandwicensis; Glycine max; Indigofera anil, I. suffruticosa; Leucaena leucocephala; Mimosa biuncifera, M. dysocarpa, M. grahamii, M. laxiflora, M. wherryana; Neptunia plena; Olneya tesota; Parkinsonia aculeata, P. texana macra, P. texana texana; Pithecellobium ebano, P. pallens, P. saman; Prosopis glandulosa glandulosa, P. juliflora, P. velutina; Robinia pseudoacacia; Scaevola taccada sericea; Senna siamea; Sesbania emerus, S. exaltata, S. macrocarpa, S. sesban; Sophora chrysophylla

Stator pygidialis (Schaeffer)

Calliandra humilis humilis, C. humilis reticulata

Stator sordidus (Horn)

Acacia wrightii; Calliandra humilis humilis

Stator subaeneus (Schaeffer)

Acacia cornigera, A. farnesiana

Stator vachelliae Bottimer

Acacia farnesiana

Stylantheus macrocerus (Horn)

Stylosanthes biflora

Zabrotes amplissimus Kingsolver

Phaseolus ritensis

Zabrotes arenarius (Wolcott)

Chamaecrista fasciculata (sweep record)

Zabrotes bexarensis Kingsolver

Vicia sp., *Vicia leavenworthii*

Zabrotes chandleri Kingsolver

Host plant unknown

Zabrotes chavesi *Kingsolver*

Senna hirsuta leptocarpa, S. spectabilis *(Venezuela)*

Zabrotes cruciger Horn

Host plant unknown

Zabrotes cynthiae Kingsolver

Host plant unknown. *Asclepias sp.* (floral record); *Cupressus macnabiana* (floral record); *Eremocarpus* sp. (sweep record); *Lotus* sp. (floral record); *Quercus* sp. (floral record)

Zabrotes densus Horn

Host plant unknown

Zabrotes eldenensis Kingsolver

Host plant unknown

Zabrotes humboldtae Kingsolver

Host plant unknown

Zabrotes obliteratus Horn

Rhynchosia sp.

Zabrotes planifrons Horn

Chamaecrista nictitans mensalis

Zabrotes spectabilis Horn

Senna bauhinioides, S. covesii, S. durangensis durangensis, S. lindheimeriana, S. roemeriana

Zabrotes stephani Kingsolver

Host plant unknown

Zabrotes subfasciatus (Boheman)

Cajanus cajan; Cicer arietinum; Dipogon lignosus; Glycine max; Lablab purpureus; Phaseolus acutifolius, P. angularis angularis, P. coccineus, P. lunatus, P. vulgaris; Pisum sativum arvense (experimental); *Vicia faba; Vigna angularis, V. mungo, V. subterranea, V. unguiculata unguiculata*

Zabrotes subnitens Horn

Host plant unknown

Zabrotes sylvestris *Romero and Johnson*

Phaseolus vulgaris

Zabrotes victoriensis Kingsolver

Type specimen collected on Zanthoxylum clava-herculis, but this is an unlikely host plant.

Appendix IV

Hosts of Bruchidae of the United States and Canada, by Host Plant

Host names were updated according to the National List of Scientific Plant Names (U.S. Department of Agriculture 1982). Other sources of plant names consulted were Burkart (1952), Irwin and Barneby (1982), Isely (1973, 1975, 1990), Shetler and Skog (1978), Terrell et al. (1986), and Wiersema et al. (1990). Extralimital host plants are included for the cosmopolitan Bruchidae in the genera *Acanthoscelides, Bruchidius, Bruchus, Callosobruchus, Careydon,* and *Zabrotes.* For author names of bruchid species, see appendix III.

Anacardiaceae

Lithraea brasiliensis March.
- *Lithraeus atronotatus*

Schinus terebinthifolius Raddi
- *Lithraeus atronotatus*

Asclepediaceae

Asclepias sp.
- *Zabrotes cynthiae* (floral record)

Asclepias syriaca Linnaeus
- *Sennius abbreviatus* (floral record)

Apiaceae

Cicuta maculata Linnaeus
- *Sennius abbreviatus* (floral record)

Cryptotaenia canadensis (Linnaeus) DC.
- *Sennius abbreviatus* (floral record)

Bignoniaceae

Chilopsis linearis (Cav.) Sweet
- *Neltumius arizonensis* (floral record)

Boraginaceae

Cynoglossum sp.
- *Bruchidius cisti*

Bromeliaceae

Tillandsia usneoides (Linnaeus) Linnaeus (hibernaculum)
- *Amblycerus robiniae; Caryobruchus gleditsiae; Sennius cruentatus*

Cistaceae

Helianthemum canadense (Linnaeus) Michx.
- *Acanthoscelides calvus*

Helianthemum corymbosum Michx.
- *Acanthoscelides helianthemum*

Hudsonia ericoides Linnaeus
- *Acanthoscelides atomus* (floral record)

Combretaceae

Terminalia catappa Linnaeus
- *Amblycerus schwarzi* (extralimital)

Commelinaceae

Lechea racemulosa Michx.
- *Acanthoscelides atomus*

Lechea tenuifolia Michx
- *Acanthoscelides atomus*

Compositae

Baccharis sarothroides Gray
- *Megacerus cubiculus* (floral record)

Eupatorium sp.
- *Sennius abbreviatus* (floral record)

Malacothrix incana (Nutt.) Torr. and Gray
- *Acanthoscelides napensis* (sweep record)

Malacothrix saxatilis implicata (Eastw.) Hall
- *Acanthoscelides napensis* (sweep record)

Pluchea sericea (Nutt.) Coville
- *Neltumius gibbithorax* (floral record)

Senecio salignus DC.
- Megacerus cubiculus (floral record)

Convolvulaceae

Argyreia nervosa (Burm.) Bojer
- *Megacerus cubicus* (extralimital)

Calystegia atriplicifolia H. Hallier
- *Megacerus impiger*

Calystegia longipes (S. Wats.) Brumm.
- *Megacerus impiger*

Calystegia macounii (Greene) Brumm.
- *Megacerus discoidus*

Calystegia macrostegia arida (Greene) Brumm.
- *Megacerus impiger*

Calystegia macrostegia macrostegia (Greene) Brumm.
- *Megacerus impiger*

Calystegia macrostegia cyclostegia (House) Brumm.
Megacerus impiger
Calystegia malacophylla deltoidea (Greene)
Megacerus impiger
Calystegia malacophylla malacophylla (Greene) Munz
Megacerus impiger
Calystegia malacophylla pedicellata (Jeps.) Munz
Megacerus impiger
Calystegia occidentalis fulcrata (Gray) Brumm.
Megacerus impiger
Calystegia occidentalis occidentalis (Gray) Brumm.
Megacerus impiger
Calystegia piersonii (Abrams) Brumm.
Megacerus impiger
Calystegia purpurata (Greene) Brumm
Megacerus impiger
Calystegia sepium (Linnaeus) R. Brown
Megacerus cubicus (extralimital), M. discoidus
Calystegia sepium repens (Linnaeus) Gray
Megacerus discoidus
Calystegia soldanella (Linnaeus) R. Brown
Megacerus impiger
Calystegia stebbensii Brumm.
Megacerus impiger
Calystegia subacaulis Hook. and Arn.
Megacerus impiger
Convolvulus sp.
Megacerus cubiculus
Convolvulus arvensis Linnaeus
Megacerus discoidus, M. impiger
Ipomoea sp.
Megacerus cubicus, M. impiger
Ipomoea alba Linnaeus
Megacerus ripiphorus
Ipomoea arborescens (Sweet) Don.
Megacerus cubicus (Mexico)
Ipomoea aristolochiaefolia (H.B.K.) G. Don
Megacerus maculiventris (extralimital)
Ipomoea batatas (Linnaeus) Lam.
Megacerus cubiculus
Ipomoea biloba Forsk.
Megacerus leucospilus (questionable)
Ipomoea cairica (Linnaeus) Sweet
Megacerus leucospilus
Ipomoea carnea fistulosa K. Martin
Megacerus cubicus (extralimital), *Megacerus leucospilus*
Ipomoea crassicaulis (Benth.) B. Robins.
Megacerus cubicus (extralimital), *M. leucospilus*
Ipomoea hederifolia Linnaeus
Megacerus cubicus (extralimital)
Ipomoea lacunosa Linnaeus
Megacerus cubiculus
Ipomoea leptophylla J. Torrey
Megacerus cubicus (extralimital), *M. discoidus, M. leucospilus*
Ipomoea longifolia Benth.
Megacerus schaefferianus
Ipomoea marginisepala O'Donnell
Megacerus maculiventris
Ipomoea meyeri (Sprengler) Dow
Megacerus cubicus (extralimital)
Ipomoea nil (Linnaeus) *Roth*
Megacerus cubicus (extralimital), *M. maculiventris* (extralimital)
Ipomoea pandurata (Linnaeus) G. Meyer
Megacerus discoidus
Ipomoea pes-caprae (Linnaeus) *R. Brown.*
Megacerus coryphae, M. leucospilus, M. maculiventris (extralimital)
Ipomoea purpurea (Linnaeus) Roth
Megacerus cubiculus, M. maculiventris (extralimital)
Ipomoea rubriflora O'Donnell
Megacerus maculiventris
Ipomoea sagittata Poir.
Megacerus coryphae
Ipomoea tiliacea (Willd.) Choisy
Megacerus discoidus
Ipomoea trifida (H.B.K.) G. Don
Megacerus cubiculus
Merremia aegyptia Linnaeus
Megacerus leucospilus
Merremia quinquefolia Linnaeus
Megacerus cubiculus

Cupressaceae

Cupressus macnabiana MacMurray

Zabrotes cynthiae (floral record)

Ehretiaceae

Cordia sp.

Mimosestes mimosae (questionable), *M. nubigens*

Euphorbiaceae

Drypetes lateriflora (Swartz) Krug and Urban

Amblycerus eustrophoides

Eremocarpus sp.

Zabrotes cynthiae (sweep record)

Hippomane mancinella Linnaeus

Amblycerus schwarzi

Ricinis communis Linnaeus

Amblycerus schwarzi (extralimital)

Fagaceae

Quercus sp.

Zabrotes cynthiae (floral record)

Goodeniaceae

Scaevola taccada sericea (Vahl) H. St. John

Stator pruininus

Graminae

Zea mays Linnaeus

Acanthoscelides obtectus

Leguminosae

Abrus precatorius Linnaeus

Acanthoscelides fraterculus

Acacia spp.

Merobruchus terani (extralimital); *Mimosestes mimosae* (extralimital)

Acacia acatlensis Benth.

Stator limbatus

Acacia amentacea DC.

Acanthoscelides schrankiae; Mimosestes acaciestes, M. nubigens

Acacia angustissima angustissima (Mill.) Kuntze

Merobruchus placidus; Stator chihuahua, S. limbatus

Acacia angustissima hirta (Nutt.) B. Rob.

Merobruchus placidus

Acacia angustissima suffrutescens (Rose) Isely

Merobruchus placidus

Acacia angustissima texensis (Torr. and Gray) Isely

Merobruchus placidus

Acacia baileyana F. Mueller

Stator limbatus

Acacia berlandieri Benth.

Merobruchus julianus; Mimosestes acaciestes; Stator limbatus, S. pruininus

Acacia californica T.S. Brand.

Stator pruininus

Acacia cochliacantha Humb. and Bonpl. ex Willd.

Mimosestes mimosae

Acacia confusa Merr.

Stator limbatus, S. pruininus

Acacia constricta Benth.

Mimosestes acaciestes, M. amicus; Stator chihuahua, S. pruininus

Acacia cornigera (Linnaeus) Willd.

Mimosestes nubigens; Stator subaeneus

Acacia coulteri Benth.

Merobruchus julianus

Acacia cultriformis A. Cunningham ex G. Don

Stator limbatus

Acacia cymbispina Sprague and Riley

Mimosestes mimosae

Acacia dealbata Link

Stator pruininus

Acacia decurrens Willd.

Stator pruininus (experimental)

Acacia farnesiana (Linnaeus) Willd.

Amblycerus robiniae (questionable); *Caryedon serratus; Mimosestes amicus, M. insularis, M. mimosae, M. nubigens; Stator bottimeri, S. limbatus, S. subaeneus, S. vachelliae*

Acacia glauca (Linnaeus) Moench

Mimosestes amicus

Acacia globulifera Safford

Mimosestes mimosae

Acacia greggi Gray

Acanthoscelides chiricahuae; Merobruchus julianus; Stator limbatus, S. pruininus

Acacia hindsii Benth.

Mimosestes mimosae

Acacia juncifolia Benth.
Merobruchus julianus
Acacia koa Gray
Stator limbatus, S. pruininus
Acacia macracantha Humb. and Bonpl.
Mimosestes mimosae
Acacia mearnsii Willd.
Stator pruininus
Acacia melanoxylon R. Brown
Stator limbatus, S. pruininus
Acacia millefolia S. Watson
Stator limbatus
Acacia neovernicosa Isely
Mimosestes acaciestes; Stator pruininus
Acacia pennatula (Schlect. and Cam.) Benth.
Mimosestes mimosae
Acacia pinetorum F.J. Hermann
Stator bottimeri
Acacia retinodes Schlect.
Stator limbatus
Acacia richei Gray
Merobruchus lysilomae; Stator limbatus, S. pruininus
Acacia rigidula Benth.
Merobruchus julianus; Mimosestes acaciestes; Stator pruininus
Acacia roemeriana Scheele
Merobruchus julianus; Stator limbatus, S. pruininus
Acacia schaffneri (S. Wats.) F.J. Herm.
Mimosestes nubigens
Acacia schotti Torr.
Stator pruininus
Acacia seyal Delile
Caryedon serratus
Acacia simplicifolia (Linnaeus) Druce
Merobruchus lysilomae
Acacia spirocarpa Hochst. ex A. Rich.
Caryedon serratus
Acacia tortilis (Forsskal) Hayne
Caryedon serratus
Acacia tortuosa (Linnaeus) Willd.
Mimosestes nubigens
Acacia vernicosa Standley
Mimosestes acaciestes; Stator pruininus
Acacia wrightii Benth.
Merobruchus julianus; Stator limbatus, S. pruininus, S. sordidus
Adenanthera pavonina Linnaeus
Caryedon serratus
Aeschynomene spp.
Acanthoscelides modestus
Aeschynomene americana Linnaeus
Meibomeus surrubresus
Aeschynomene histrix incana (Vogel) Benth.
Acanthoscelides modestus
Aeschynomene indica Linnaeus
Acanthoscelides modestus
Albizia sp.
Acanthoscelides obtectus
Albizia lebbeck (Linnaeus) Benth.
Merobruchus lysilomae; Stator limbatus
Albizia polyphylla Fourn.
Merobruchus lysilomae
Albizia saponaria (Lour.) Blume
Stator limbatus, S. pruininus
Amorpha californica Nuttall
Acanthoscelides pallidipennis, A. submuticus
Amorpha canescens Pursh.
Acanthoscelides pallidipennis
Amorpha fruticosa fruticosa Linnaeus
Acanthoscelides floridae, A. pallidipennis, A. submuticus
Amorpha fruticosa angustifolia Pursh.
Acanthoscelides submuticus
Amorpha fruticosa occidentalis (Abrams) Kearn. and Peebl.
Acanthoscelides submuticus
Arachis hypogaea Linnaeus
Caryedon serratus; Stator limbatus, S. pruininus (experimental)
Astragalus sp.
Acanthoscelides pallidipennis; Merobruchus placidus
Astragalus allochrous Gray
Acanthoscelides aureolus complex, *A. mixtus, A. pullus*
Astragalus amphioxys Gray
Acanthoscelides aureolus complex
Astragalus asymmetricus Sheldon
Acanthoscelides aureolus complex, *A. pu*llus

Astragalus bisulcatus (Hook.) Gray

Acanthoscelides aureolus complex, *A. fraterculus*

Astragalus bolanderi Gray

Acanthoscelides pullus

Astragalus calycosus J. Torr.

Acanthoscelides aureolus complex

Astragalus canadensis Linnaeus

Acanthoscelides perforatus

Astragalus cibarius Sheldon

Acanthoscelides fraterculus

Astragalus crassicarpus crassicarpus Nuttall

Acanthoscelides fraterculus

Astragalus crassicarpus paysonii (E.H. Kelso) Barneby

Acanthoscelides fraterculus

Astragalus crotalariae (Benth.) Gray

Acanthoscelides aureolus complex, *A. pullus*

Astragalus douglasii (Torr. and Gray) Gray

Acanthoscelides aureolus complex, *A. pullus*

Astragalus drummondii Douglas ex Hook

Acanthoscelides aureolus complex, *A. fraterculus*

Astragalus falcatus Lam.

Acanthoscelides fraterculus

Astragalus fucatus Barneby

Acanthoscelides aureolus complex

Astragalus grayi Parry ex S. Wats.

Acanthoscelides aureolus complex

Astragalus humistratus Gray

Acanthoscelides aureolus complex, *A. lobatus*

Astragalus hyalinus M.E. Jones

Acanthoscelides fraterculus

Astragalus lancearius Gray

Acanthoscelides aureolus complex

Astragalus lentiginosus Douglas ex. Hook.

Acanthoscelides aureolus complex, *A. lobatus, A. mixtus, A. pullus*

Astragalus lonchocarpus Barneby

Acanthoscelides aureolus complex, *A. mixtus*

Astragalus missouriensis Nuttall

Acanthoscelides fraterculus

Astragalus mollissimus bigelovii (Gray) Barneby

Acanthoscelides fraterculus, A. lobatus

Astragalus mollissimus marcidus (Greene ex Rydb.) Barneby

Acanthoscelides lobatus

Astragalus mollissimus mollissimus Torrey

Acanthoscelides aureolus complex, *A. fraterculus, A. lobatus*

Astragalus oxyphysus Gray

Acanthoscelides aureolus complex, *A. pullus*

Astragalus pattersonii Gray

Acanthoscelides aureolus complex, *A. fraterculus*

Astragalus pectinatus (Hook.) Dougl. ex G. Don

Acanthoscelides fraterculus

Astragalus praelongus Sheldon

Acanthoscelides aureolus complex, *A. mixtus, A. pullus*

Astragalus pterocarpus S. Wats.

Acanthoscelides aureolus complex, *A. fraterculus*

Astragalus pycnostachys Gray

Acanthoscelides margaretae

Astragalus racemosus Pursh.

Acanthoscelides aureolus complex, *A. fraterculus*

Astragalus sabulonum Gray

Acanthoscelides mixtus

Astragalus thurberi Gray

Acanthoscelides aureolus complex, *A. mixtus, A. pullus*

Astragalus trichopodus antisellii (Gray) Jeps.

Acanthoscelides aureolus complex, *A. pullus*

Astragalus trichopodus phoxus (M.E. Jones) Barneby

Acanthoscelides aureolus complex, *A. pullus*

Astragalus trichopodus trichopodus (Nutt.) Gray

Acanthoscelides aureolus complex

Astragalus troglodytus S. Wats.

Acanthoscelides lobatus

Astragalus utahensis (Torr.) Torr. and Gray

Acanthoscelides fraterculus

Astragalus wootoni Sheldon

Acanthoscelides aureolus complex, *A. mixtus, A. pullus*

Baptisia sp.

Acanthoscelides bisignatus

Bauhinia coulteri MacBr. (Mex.)

Gibbobruchus cristicollis

Bauhinia divaricata Linnaeus
Gibbobruchus cristicollis, G. divaricatae
Bauhinia lunarioides Gray ex Wats.
Gibbobruchus cristicollis, G. mimus
Bauhinia macranthera Oliver
Gibbobruchus cristicollis
Bauhinia malabarica Roxb.
Caryedon serratus
Bauhinia monandra Kurz
Caryedon serratus
Bauhinia pauletia Pers.
Gibbobruchus cristicollis, G. divaricatae
Bauhinia pes-caprae Cav.
Gibbobruchus divaricatae
Bauhinia racemosa Lam.
Caryedon serratus
Bauhinia reticulata (DC.) Hochst.
Caryedon serratus
Bauhinia rufescens Lam.
Caryedon serratus
Bauhinia thonningi (Schum.) Milne-Redh.
Caryedon serratus
Bauhinia tomentosa Linnaeus
Caryedon serratus
Bauhinia ungulata Linnaeus
Gibbobruchus divaricatae
Caesalpinia spp.
Amblycerus nigromarginatus
Caesalpinia coriaria (Jacq.) Willd.
Mimosestes mimosae, M. nubigens
Caesalpinia pulcherrima (Linnaeus) Swartz
Caryedon serratus; Stator limbatus, S. pruininus (experimental)
Caesalpinia sclerocarpa Standley
Mimosestes mimosae (extralimital)
Cajanus cajan (Linnaeus) Huth
Acanthoscelides obtectus; Callosobruchus chinensis, C. maculatus, C. phaseoli, C. pulcher; Caryedon serratus; Zabrotes subfasciatus
Calliandra eriophylla Benth.
Stator chihuahua, S. limbatus, S. pruininus
Calliandra humilis humilis Benth.
Stator chihuahua, S. limbatus, S. pruininus, S. pygidialis, S. sordidus
Calliandra humilis reticulata (Gray) L. Benson
Stator limbatus, S. pruininus, S. pygidialis
Cassia spp.
Amblycerus nigromarginatus; Sennius abbreviatus, S. discolor
Cassia afrofistula Brenan
Caryedon serratus
Cassia arereh Delile
Caryedon serratus
Cassia fistula Linnaeus
Caryedon serratus; Stator limbatus, S. pruininus (experimental)
Cassia grandis Linnaeus
Caryedon serratus; Stator limbatus, S. pruininus
Cassia javanica indochinensis (Irwin and Barn.)
Caryedon serratus; Stator limbatus, S. pruininus
Cassia javanica javanica Linnaeus
Caryedon serratus; Stator limbatus, S. pruininus
Cassia sieberiana DC.
Caryedon serratus
Centrosema macrocarpa Benth.
Caryedes helvinus, C. incensus
Centrosema pubescens Benth.
Caryedes helvinus, C. incensus
Ceratonia siliqua Linnaeus
Mimosestes mimosae, M. nubigens
Cercidium spp. See *Parkinsonia*
Cercis canadensis Linnaeus
Gibbobruchus mimus
Cercis occidentalis Torr. ex Gray
Gibbobruchus mimus
Chamaecrista fasciculata (Michx.) Irwin and Barn.
Sennius cruentatus; Zabrotes arenarius
Chamaecrista nictitans mensalis (Greene) Irwin and Barn.
Sennius simulans; Zabrotes planifrons
Chamaecrista nictitans nictitans (Linnaeus) Irwin and Barn.
Sennius cruentatus
Chamaecrista serpens wrightii Irwin and Barn.
Sennius obesulus

Cicer arietinum Linnaeus

Acanthoscelides obtectus; Callosobruchus chinensis, C. maculatus, C. phaseoli, C. pulcher; Zabrotes subfasciatus

Coursetia microphylla Gray

Stator pruininus

Crotalaria spectabilis Roth.

Callosobruchus phaseoli

Cyamopsis tetragonoloba (Linnaeus) Taubert

Callosobruchus chinensis

Cytisus scoparius (Linnaeus) Link

Bruchidius villosus

Dalea spp.

Acanthoscelides daleae, A. pallidipennis, A. pusillimus

Dalea aurea Nutt. and Pursh.

Acanthoscelides seminulum

Dalea candida Willd.

Acanthoscelides seminulum

Dalea carnea albida (Torr. and Gray) Barn.

Acanthoscelides pedicularius

Dalea enneandra Nutt.

Acanthoscelides seminulum

Dalea feayi (Chapm.) Barn.

Acanthoscelides seminulum

Dalea frutescens Gray

Acanthoscelides seminulum

Dalea ornata (Dougl. and Hook.) A. Eat. and Wright

Acanthoscelides oregonensis

Dalea scandens paucifolia (Coult.) Barneby

Acanthoscelides pusillimus

Dalea stanfieldii (Small) Shinners

Acanthoscelides seminulum

Dalea tenuis (Coultr.) Shinn.

Acanthoscelides seminulum

Delonix regia (Bojer and Hook.) Raf.

Stator limbatus (questionable)

Desmanthus sp.

Acanthoscelides bisignatus, A. compressicornis, A. desmanthi, A. pectoralis

Desmanthus bicornutus S. Watson

Acanthoscelides desmanthi; Stator limbatus, S. pruininus

Desmanthus cooleyi (A. Eaton) Trel.

Acanthoscelides compressicornis; Stator pruininus

Desmanthus covillei (Britt. and Rose) Wigg. ex B. Turner

Acanthoscelides compressicornis, A. desmanthi; Stator pruininus

Desmanthus illinoensis (Michx.) MacMil. ex B. Robin. and Fern.

Acanthoscelides bisignatus, A. compressicornis; Merobruchus julianus (questionable)

Desmanthus fruticosa N.E. Rosa

Stator pruininus

Desmanthus leptolobus Torr. and Gray

Acanthoscelides bisignatus, A. compressicornis, A. pectoralis; Stator pruininus

Desmanthus leptophyllus H.B.K.

Acanthoscelides compressicornis, A. desmanthi

Desmanthus obtusus S. Wats.

Acanthoscelides compressicornis, A. pectoralis

Desmanthus reticulatus Benth.

Acanthoscelides pectoralis

Desmanthus subulatus (Britt. and Rose)

Acanthoscelides compressicornis, A. desmanthi

Desmanthus velutinus Scheele

Acanthoscelides bisignatus, A. compressicornis, A. pectoralis

Desmanthus virgatus acuminatus (Benth.) Isely

Acanthoscelides compressicornis, A. pallidipennis, A. schrankiae

Desmanthus virgatus depressus (Humb. and Bonpl. ex Willd.) B. Turner

Acanthoscelides compressicornis, A. desmanthi

Desmanthus virgatus glandulosa B. Turner

Acanthoscelides compressicornis

Desmanthus virgatus virgatus (Linnaeus) Willd.

Acanthoscelides bisignatus, A. compressicornis, A. desmanthi, A. pallidipennis, A. pectoralis; Stator pruininus

Desmodium spp.

Acanthoscelides biustulus, A. stylifer

Desmodium batocaulon Gray

Acanthoscelides biustulus

Desmodium canescens (Linnaeus) DC.

Meibomeus musculus

Desmodium cinerascens Gray
Acanthoscelides biustulus
Desmodium grahamii Gray
Acanthoscelides biustulus, A. stylifer; Meibomeus desmoportheus
Desmodium illinoense Gray
Acanthoscelides longistilus
Desmodium neomexicanus Gray
Acanthoscelides biustulus
Desmodium tenuifolium Torr. and Gray
Meibomeus musculus
Desmodium tortuosum DC. ex G. Don
Meibomeus musculus
Desmodium triflorum (Linnaeus) DC.
Meibomeus musculus
Desmodium uncinatum (Jacq.) DC.
Stator pruininus (experimental)
Dipogon lignosus (Linnaeus) Verde.
Zabrotes subfasciatus
Dolichos melanophthalmus DC.
Acanthoscelides obtectus
Eriosema violaceum (Aublet) G. Don
Acanthoscelides flavescens (extralimital)
Errazurizia rotundata (Wooton) Barn.
Acanthoscelides pallidipennis
Erythrina sandwicensis Deg.
Stator limbatus, S. pruininus
Eysenhardtia texana Scheele
Acanthoscelides comstocki, A. mixtus
Galactia striata (Jacq.) Urban
Acanthoscelides flavescens
Galactia wrightii Gray
Acanthoscelides rufovittatus
Gleditsia aquatica Marsh.
Amblycerus robiniae
Gleditsia triacanthos Linnaeus
Amblycerus robiniae; Mimosestes nubigens
Glycine max (Linnaeus)
Acanthoscelides obtectus; Callosobruchus chinensis, C. maculatus; Stator limbatus, S. pruininus (exp.); *Zabrotes subfasciatus*
Glycyrrhiza sp.
Acanthoscelides pallidipennis
Glycyrrhiza lepidota Pursh.
Acanthoscelides alboscutellatus, A. aureolus complex, *A. fraterculus*
Hedysarum alpinum americanum Michx.
Kytorhinus prolixus
Hedysarum boreale Nutt.
Acanthoscelides fraterculus; Kytorhinus prolixus
Hoffmanseggia densiflora Bentham ex Gray
Acanthoscelides compressicornis
Hoffmanseggia drepanocarpa Gray
Acanthoscelides compressicornis
Hoffmanseggia glauca (Ortega) Eifert
Acanthoscelides compressicornis
Hoffmanseggia tenella Thorp and Williams
Acanthoscelides compressicornis
Indigofera anil Linnaeus (exp.)
Stator pruininus
Indigofera lindheimeriana Scheele
Acanthoscelides kingsolveri
Indigofera platycarpa Rose
Acanthoscelides baboquivari
Indigofera sphaerocarpa Gray
Acanthoscelides baboquivari, A. kingsolveri
Indigofera suffruticosa Miller
Acanthoscelides kingsolveri; Stator pruininus
Lablab purpureus (Linnaeus) Sweet
Acanthoscelides obtectus; Callosobruchus chinensis, C. maculatus, C. phaseoli; Zabrotes subfasciatus
Laburnum alpinum Brecht. and Presl.
Bruchidius villosus
Laburnum anagyroides Medik.
Bruchidius villosus
Lathyrus aphaca Linnaeus
Callosobruchus maculatus
Lathyrus clymenum Linnaeus
Callosobruchus maculatus
Lathyrus sativus Linnaeus
Acanthoscelides obtectus; Bruchus brachialis, B. pisorum; Callosobruchus chinensis, C. maculatus
Lens culinaris Medik.
Acanthoscelides obtectus; Callosobruchus chinensis, C. maculatus
Lespedeza capitata Michx.
Acanthoscelides longistilus
Lespedeza frutescens (Linnaeus) Elliott
Acanthoscelides longistilus

Lespedeza hirta (Linnaeus) Hornem.

Acanthoscelides longistilus; Meibomeus musculus

Lespedeza intermedia (S. Wats.) Britt.

Acanthoscelides longistilus

Lespedeza texana Britt.

Acanthoscelides longistilus

Lespedeza virginica (Linnaeus) Britt.

Acanthoscelides longistilus

Leucaena leucocephala (Lam.) de Wit

Acanthoscelides macrophthalmus; Mimosestes amicus; Stator limbatus, S. pruininus

Leucaena pulverulenta (Schlect.) Benth.

Acanthoscelides macrophthalmus; Stator limbatus

Leucaena retusa Benth.

Acanthoscelides macrophthalmus

Lotus sp.

Acanthoscelides pallidipennis; Mimosestes mimosae, M. nubigens; Zabrotes cynthiae (floral record)

Lotus crassifolius (Benth.) Greene

Acanthoscelides fraterculus

Lotus mearnsii Britt.

Acanthoscelides fraterculus

Lotus purshianus Clements and Clements

Acanthoscelides aureolus complex

Lotus rigidus (Benth.) Greene

Acanthoscelides fraterculus

Lotus scoparius (Nutt.) Ottleya

Acanthoscelides aureolus complex, *A. fraterculus*

Lupinus albus Linnaeus

Acanthoscelides obtectus (doubtful)

Lysiloma acapulcensis Benth.

Merobruchus knulli (extralimital)

Lysiloma divaricatum (Jacq.) J.F. Macbr.

Merobruchus vacillator

Lysiloma latisiliqua (Linnaeus) Benth.

Merobruchus lysilomae

Lysiloma pulverulenta (Schl.) Benth.

Stator limbatus

Lysiloma microphylla thornberi (Britt. and Rose) Isely

Merobruchus insolitus, M. knulli; Stator chihuahua, S. limbatus

Lysiloma sabicu Benth.

Merobruchus lysilomae (extralimital)

Lysiloma watsoni Rose

Merobruchus knulli (extralimital)

Mimosa biuncifera Benth.

Acanthoscelides chiricahuae, A. speciosus; Stator chihuahua, S. pruininus

Mimosa borealis Gray

Acanthoscelides chiricahuae, A. schrankiae; Merobruchus julianus (questionable)

Mimosa dysocarpa Benth.

Acanthoscelides chiricahuae, A. compressicornis; Stator pruininus

Mimosa grahamii Gray

Acanthoscelides chiricahuae, A. compressicornis; Stator pruininus

Mimosa laxiflora Benth.

Acanthoscelides chiricahuae; Stator pruininus

Mimosa malacophylla Gray

Acanthoscelides speciosus

Mimosa pigra Linnaeus

Acanthoscelides quadridentatus

Mimosa pigra berlandieri (Gray) B.L. Turner

Acanthoscelides quadridentatus

Mimosa strigillosa Torr. and Gray

Acanthoscelides distinguendus, A. quadridentatus, A. tridenticulatus

Mimosa wherryana (N.L. Britt.) Standl.

Acanthoscelides chiricahuae, A. speciosus; Stator chihuahua, S. pruininus

Neptunia plena (Linnaeus) Benth.

Stator limbatus, S. pruininus

Nissolia schottii (Torr.) Gray

Acanthoscelides mundulus

Nissolia wislizenii Gray

Acanthoscelides mundulus

Olneya tesota Gray

Stator pruininus

Onobrychis viciifolia Scop.

Bruchidius cisti

Oxytropis lambertii Pursh.

Acanthoscelides aureolus complex

Oxytropis sericea Nutt.

Acanthoscelides aureolus complex

NOTE: Placement of plant species in *Parkinsonia* follows Isely (1975), but these species may be found in botanical literature under *Cercidium.*

Parkinsonia sp.

Sennius cruentatus, S. discolor (questionable)

Parkinsonia aculeata Linnaeus

Mimosestes amicus, M. ulkei; Stator limbatus, S. pruininus

Parkinsonia florida (Benth.) S. Wats.

Mimosestes amicus, M. ulkei; Stator limbatus

Parkinsonia microphylla Torr.

Mimosestes amicus, M. protractus; Stator limbatus

Parkinsonia texana macra (I. Johnston) Isely

Mimosestes amicus; Stator limbatus, S. pruininus

Parkinsonia texana texana (Gray) S. Wats.

Mimosestes amicus, M. protractus, M. ulkei; Stator limbatus, S. pruininus

Parryella filifolia Torr. and Gray

Acanthoscelides pallidipennis

Petteria ramentacea (Seiden) Presl.

Bruchidius villosus

Phaseolus acutifolius Gray

Callosobruchus maculatus; Zabrotes subfasciatus

Phaseolus acutifolius latifolius G.F. Freeman

Acanthoscelides obtectus

Phaseolus angularis angularis (Willd.) Wight

Zabrotes subfasciatus

Phaseolus coccineus Linnaeus

Acanthoscelides obtectus; Zabrotes subfasciatus

Phaseolus lunatus Linnaeus

Acanthoscelides obtectus; Callosobrchus chinensis, C. maculatus, C. phaseoli; Zabrotes subfasciatus

Phaseolus ritensis M.E. Jones

Acanthoscelides obtectus; Zabrotes amplissimus

Phaseolus vulgaris Linnaeus

Acanthoscelides obtectus; Callosobruchus chinensis, C. maculatus, C. phaseoli, C. pulcher; Caryedon serratus; Zabrotes subfasciatus, Z. sylvestris

Pisum elatius Steven ex M. Bieb.

Bruchus pisorum

Pisum sativum arvense Linnaeus

Acanthoscelides obtectus; Bruchus pisorum; Callosobruchus chinensis, C. maculatus, C. phaseoli; Zabrotes subfasciatus (experimental)

Pithecellobium brevifolium Benth.

Stator limbatus

Pithecellobium dulce (Roxb.) Benth.

Stator limbatus

Pithecellobium ebano (Berl.) Barn. and Grimes

Merobruchus julianus, M. major; Stator beali, S. limbatus, S. pruininus

Pithecellobium pallens (Bentham) Standl.

Merobruchus insolitus; Stator limbatus, S. pruininus

Pithecellobium saman (Jacq.) Benth.

Stator limbatus, S. pruininus

Pithecellobium unguis-cati (Linnaeus) Benth.

Stator limbatus

Prosopis sp.

Sennius discolor (questionable)

Prosopis alba Griseb. (introduced from Argentina into Arizona)

Algarobius prosopis

Prosopis chilensis (Molina) Stuntz

Algarobius prosopis; Mimosestes nubigens

Prosopis glandulosa glandulosa Torr.

Algarobius bottimeri; Mimosestes amicus, M. insularis, M. nubigens, M. protractus; Neltumius arizonensis, N. gibbithorax; Stator limbatus, S. pruininus

Prosopis glandulosa torreyana (L. Benson) M. Johnston

Algarobius prosopis; Mimosestes amicus, M. nubigens, M. protractus; Neltumius arizonensis, N. gibbithorax; Stator limbatus

Prosopis juliflora (Sw.) DC.

Stator limbatus, S. pruininus (exp.); *Mimosestes insularis* (Hawaii only), *M. nubigens*

Prosopis laevigata (Hum. and Bonpl. ex Willd.) M. Johnston

Algarobius prosopis; Mimosestes protractus

Prosopis pallida (Humb. and Bonpl. ex Willd.) H.B.K. (Hawaii only)

Algarobius bottimeri; Caryedon serratus; Mimosestes amicus, M. insularis, M. nubigens

Prosopis pubescens Benth.

Algarobius prosopis; Mimosestes amicus; Neltumius gibbithorax

Prosopis reptans reptans Benth.

Algarobius bottimeri

Prosopis reptans cinerascens (Gray) Burk.

Algarobius bottimeri, A. prosopis

Prosopis velutina Wooton

Algarobius prosopis; Mimosestes amicus, M. protractus; Neltumius arizonensis; Stator pruininus

Psophocarpus tetragonolobus (Linnaeus) DC.

Callosobruchus chinensis

Psorothamnus fremontii (Torr. ex Gray) Barn.

Acanthoscelides daleae

Psorothamnus schotti (Torr.) Barn.

Acanthoscelides daleae

Psorothamnus spinosa (Gray) Barn.

Acanthoscelides daleae

Pueraria montana lobata (Willd.) Maes. and Almeida

Borowiecius ademptus

Rhynchosia sp.

Zabrotes obliteratus

Rhynchosia americana (Mill.) Metz

Acanthoscelides distinguendus

Rhynchosia difformis (Elliott) DC.

Acanthoscelides distinguendus

Rhynchosia erecta (Walter) DC.

Acanthoscelides distinguendus

Rhynchosia galactoides Endl. ex Walp.

Acanthoscelides distinguendus

Rhynchosia intermedia (Torrey and Gray) Small

Acanthoscelides distinguendus

Rhynchosia latifolia Nutt. ex Torr. and Gray

Acanthoscelides distinguendus

Rhynchosia longeracemosa (Mart. and Gal.)

Acanthoscelides flavescens

Rhynchosia minima (Linnaeus) DC.

Acanthoscelides flavescens

Rhynchosia texana Torr. and Gray

Acanthoscelides fumatus

Rhynchosia tomentosa (Linnaeus) Hook and Arn.

Acanthoscelides distinguendus

Robinia pseudoacacia Linnaeus

Amblycerus robiniae (misidentification?); *Stator pruininus* (questionable)

Schrankia microphylla (Dryand.) F. Macbride

Acanthoscelides schrankiae

Schrankia nuttallii (DC.) Standl.

Acanthoscelides schrankiae

Schrankia roemeriana (Scheele) Blank.

Acanthoscelides schrankiae

Schrankia uncinata Willd.

Acanthoscelides schrankiae

Senna alata (Linnaeus) Irwin and Barn.

Amblycerus nigromarginatus, A. obscurus (both extralimital)

Senna armata S. Wats.

Acanthoscelides obrienorum

Senna bauhinioides Gray

Sennius morosus; Zabrotes spectabilis

Senna bicapsularis bicapsularis Linnaeus

Amblycerus nigromarginatus, A. obscurus (both extralimital); *Sennius fallax, S. lebasi, S. leucostauros*

Senna biflora Linnaeus

Sennius fallax

Senna corymbosa (Lamk.) Irwin and Barn.

Amblycerus nigromarginatus

Senna covesii (Gray) Irwin and Barn.

Sennius morosus; Zabrotes spectabilis

Senna durangensis durangensis (Rose) Irwin and Barn.

Sennius morosus; Zabrotes spectabilis

Senna hirsuta hirsuta Linnaeus

Sennius medialis

Senna hirsuta leptocarpa (Benth.) Irwin and Barn.

Amblycerus obscurus (extralimital); *Sennius medialis, S. morosus; Zabrotes chavesi*

Senna lindheimeriana (Scheele) Irwin and Barn.

Sennius discolor; Zabrotes spectabilis

Senna marilandica (Linnaeus) Irwin and Barn.

Sennius abbreviatus

Senna obtusifolia (Linnaeus) Irwin and Barn.

Amblycerus obscurus (extralimital); *Caryedon serratus; Sennius fallax, S. morosus*

Senna occidentalis (Linnaeus) Irwin and Barn.

Amblycerus nigromarginatus; Sennius fallax, S. morosus (extralimital)

Senna pendula advena (Willd.)

Amblycerus obscurus (extralimital)

Senna pundula ovalifolia (Willd.)

Amblycerus obscurus (extralimital)

Senna polyantha (Moc. and Sesse) Irwin and Barn.

Acanthoscelides obrienorum

Senna roemeriana (Scheele) Irwin and Barn.

Sennius discolor, S. morosus; Zabrotes spectabilis

Senna siamea (Lam.) Irwin and Barn.

Stator pruininus (exp.)

Senna spectabilis (DC.)

Zabrotes chavesi

Senna uniflora (Spreng.) Irwin and Barn.

Amblycerus nigromarginatus, A. obscurus (both extralimital)

Senna wislizenii wislizenii (Gray) Irwin and Barn.

Acanthoscelides obrienorum; Sennius discolor

Sesbania sp.

Callosobruchus phaseoli

Sesbania aegyptiaca Pers.

Acanthoscelides obtectus; Mimosestes amicus

Sesbania emerus (Aublet) Urban

Acanthoscelides griseolus; Stator pruininus

Sesbania exaltata (Roxb.) Rydb.

Acanthoscelides griseolus; Stator pruininus

Sesbania macrocarpa Muhlenberg

Stator pruininus

Sesbania sesban (Linnaeus) Merr.

Acanthoscelides obtectus (experimental); *Mimosestes amicus; Stator pruininus*

Sophora chrysophylla (Salisb.) Seem.

Stator pruininus

Spartium junceum Linnaeus

Bruchidius cisti, B. villosus

Stylosanthes biflora (Linnaeus) B.S.P.

Stylantheus macrocerus

Tamarindus indica Linnaeus

Caryedon serratus

Tephrosia ambigua (M.A. Curt.) Chapm.

Acanthoscelides obsoletus

Tephrosia cinerea (Linnaeus) Pers.

Acanthoscelides rufovittatus

Tephrosia purpurea (Linnaeus) Pers.

Acanthoscelides rufovittatus

Tephrosia spicata (Walt.) Torr. and Gray

Acanthoscelides obsoletus

Tephrosia thurberi (Rydb.) C.E. Wood

Acanthoscelides rufovittatus

Tephrosia virginiana (Linnaeus) Pers.

Acanthoscelides distinguendus (misidentification), *A. obsoletus*

Trifolium obtusiflorum Hook.

Acanthoscelides pauperculus

Trifolium pratense Linnaeus

Acanthoscelides pusillimus (suspect)

Vicia sp.

Acanthoscelides flavescens; Bruchus pisorum; Zabrotes bexarensis

Vicia benghalensis Linnaeus

Bruchus brachialis

Vicia caroliniana Walt.

Bruchus brachialis

Vicia cracca Linnaeus

Bruchus brachialis

Vicia faba Linnaeus

Acanthoscelides obtectus; Bruchus pisorum (misidentification?), *B. rufimanus; Callosobruchus chinensis, C. maculatus, C. phaseoli; Zabrotes subfasciatus*

Vicia grandiflora Scop.

Bruchus brachialis

Vicia leavenworthii Torr. and Gray

Zabrotes bexarensis

Vicia lutea Linnaeus

Callosobruchus maculatus

Vicia pannonica Creantz

Bruchus brachialis

Vicia sativa nigra Linnaeus

Bruchus brachialis

Vicia sativa sativa Linnaeus

Bruchus brachialis, B. rufimanus; Callosobruchus maculatus

Vicia sepium Linnaeus

Bruchus brachialis

Vicia villosa dasycarpa Ten.

Bruchus brachialis

Vicia villosa villosa Roth

Bruchus brachialis

Vigna aconitifolia (Jacq.) Marechal

Acanthoscelides obtectus; Callosobruchus chinensis

Vigna angularis (Willd.) Ohwi and Ohashi

Callosobruchus chinensis, C. phaeseoli, C. pulcher; Zabrotes subfasciatus

Vigna mungo (Linnaeus) Hepper

Callosobruchus chinensis, C. maculatus; Zabrotes subfasciatus

Vigna radiata radiata (Linnaeus) Wilcz.

Acanthoscelides obtectus; Bruchus pisorum; Callosobruchus chinensis, C. maculatus, C. phaseoli

Vigna subterranea (Linnaeus) Verdc.

Acanthoscelides obtectus; Zabrotes subfasciatus

Vigna umbellata (Thunb.) Ohwi and Ohashi

Acanthoscelides obtectus

Vigna unguiculata sesquipedalis (Linnaeus) Verdc.

Acanthoscelides obtectus; Zabrotes subfasciatus

Vigna unguiculata unguiculata (Linnaeus) Walker

Acanthoscelides obtectus; Callosobruchus chinensis, C. maculatus; Zabrotes subfasciatus

Lythraceae

Lythrum alatum Pursh.

Acanthoscelides tenuis

Lythrum lineare Linnaeus

Acanthoscelides tenuis

Magnoliaceae

Magnolia sp.

Gibbobruchus mimus (floral record)

Magnolia grandiflora Linnaeus

Gibbobruchus mimus (floral record)

Malvaceae

Abutilon abutiloides (Jacq.) Garcke ex Britt. and P. Wilson

Abutiloneus idoneus; Acanthoscelides subaequalis

Abutilon berlandieri Gray

Abutiloneus idoneus; Acanthoscelides aequalis, A. subaequalis

Abutilon hypoleucum Gray

Acanthoscelides flavescens

Abutilon incanum (Link) Sweet

Acanthoscelides subaequalis

Abutilon theophrasti Medikus

Althaeus folkertsi, A. hibisci

Abutilon trisulcatum Gray

Acanthoscelides subaequalis

Allowissadula holosericea (Scheele) Bates

Acanthoscelides aequalis; Abutiloneus idoneus

Allowissadula lozanii (Rose) Bates

Acanthoscelides aequalis

Herissantia crispa (Linnaeus) Brizicky

Acanthoscelides herissantitus

Hibiscus sp.

Megacerus discoidus (floral record)

Hibiscus aculeatus Walt.

Althaeus hibisci

Hibiscus militaris Cav.

Althaeus folkertsi

Hibiscus moscheutos lasiocarpus Cav.

Althaeus folkertsi, A. hibisci

Hibiscus moscheutos moscheutos Linnaeus

Althaeus hibisci

Hibiscus moscheutos palustris (Linnaeus)

Althaeus hibisci

Kosteletzkya virginica (Linnaeus) K. Presl. ex Gray

Althaeus hibisci, A. steineri

Malvastrum bicuspidatum (S. Wats.) Rose

Acanthoscelides herissantitus

Nelumbonaceae

Nelumbo nucifera Gaertne

Callosobruchus chinensis

Oleaceae

Fraxinus sp.

Gibbobruchus mimus

Onagraceae

Ludwigia alternifolia Linnaeus
Acanthoscelides alboscutellatus

Ludwigia palustris (Linnaeus) Ell.
Acanthoscelides alboscutellatus

Palmae

Coccothrinax argentata (Jacq.) L.H. Bailey
Caryobruchus gleditsiae

Coccothrinax martii Becc.
Caryobruchus gleditsiae

Livingstona chinensis (Jacq.) R. Brown ex Mart.
Caryobruchus gleditsiae

Phoenix sylvestris Roxb.
Caryobruchus gleditsiae

Sabal etoni Swingle ex Nost
Caryobruchus gleditsiae

Sabal glaucescens Lodd. ex H. Moore
Caryobruchus gleditsiae

Sabal mauritiaeformis (H. Karsten) Griseb and Wendl.
Caryobruchus gleditsiae

Sabal mexicana Mart.
Caryobruchus gleditsiae

Sabal minor (Jacq.) Pers.
Caryobruchus gleditsiae

Sabal palmetto (Walter) Lodd. ex Schultes
Caryobruchus gleditsiae

Sabal parviflora Becc.
Caryobruchus gleditsiae

Sabal uresana Trel.
Caryobruchus gleditsiae

Sabal yapa C. Wright ex Becc.
Caryobruchus gleditsiae

Serenoa repens (W. Bartram) Small
Caryobruchus gleditsiae

Washingtonia filifera (Linden ex Andre) H. Wendl.
Caryobruchus gleditsiae

Rhamnaceae

Condalia correllii M. Johnston
Neltumius texanus

Condalia globosa globosa I. Johnst.
Neltumius texanus

Condalia globosa pubescens I. Johnst.
Neltumius texanus

Condalia hookeri hookeri M.C. Johnst.
Neltumius texanus

Condalia lycioides (Gray) Weberb.
Acanthoscelides prosopoides

Condalia obovata Hooker
Neltumius texanus

Condalia spathulata Gray
Neltumius texanus

Condalia warnockii kearneyana M. Johnst.
Neltumius texanus

Ziziphus obtusifolia (Hook. ex Torr. and Gray) Gray
Acanthoscelides prosopoides

Rosaceae

Aronia sp.
Acanthoscelides calvus (floral record)

Rubiaceae

Guettarda sp.
Amblycerus schwarzi (extralimital)

Rutaceae

Zanthoxylum clava-herculis Linnaeus
Neltumius texanus (likely floral record); *Zabrotes victoriensis* (likely floral record)

Umbelliferae

Daucus carota Linnaeus (floral records)
Acanthoscelides alboscutellatus, A. obtectus; Althaeus hibisci; Bruchus brachialis; Megacerus discoidus

Taenidia integerrima (Linnaeus) Drude
Sennius abbreviatus (floral record)

Verbenaceae

Lippia wrightii Gray
Mimosestes amicus (floral record)

Tectona grandis Linnaeus
Amblycerus schwarzi (extralimital)

Vitaceae

Vitis arizonica Engelm.
Amblycerus vitis

Zygophyllaceae

Larrea tridentata (Sesse and Mocino) Cov.
Neltumius arizonensis (floral record)

Appendix V

Natural Enemies of Bruchidae of the United States and Canada

The following is a list of predators and parasitoids of the Bruchidae of the United States and Canada. The majority of natural enemies are Hymenoptera. For the cosmopolitan bruchids, however, predators and parasitoids from other areas of the world are included and marked as "extralimital" (EX). It must be remembered that many of these parasitoids were reared from seed pods and that insects of other taxa may have also invaded the pods and were the source of the parasitoids.

Principal references consulted were Bonet et al. 1987; Bridwell 1918; Burks 1954, 1971; Cushman 1911; De Luca 1962, 1965, 1970, 1977, 1980; Hetz and Johnson 1988; Hinckley 1961; Krombein et al. 1979; Peck 1963; Pierce 1908; Steffan 1981; Stein 1983b; and Zacher 1930. Names have been checked for accuracy by members of Systematic Entomology Laboratory Hymenoptera Unit.

Anisopteromalus calandrae (Howard) (Pteromalidae)

Bruchus brachialis, B. pisorum; Callosobruchus chinensis, C. maculatus, C. phaseoli; Stator pruininus; Zabrotes subfasciatus

Anisopteromalus pratti (Crawford) (Pteromalidae)

Callosobruchus maculatus

Aprostocetus aethiops (Zetterstedt) (EX) (Eulophidae)

Bruchus pisorum

Aprostocetus claviger Thomson (EX) (Eulophidae)

Bruchus pisorum

Argiope sp. (Araneae)

Mimosestes nubigens

Bracon sp. (Braconidae)

Acanthoscelides flavescens; Amblycerus robiniae; Caryedon serratus; Mimosestes nubigens

Bracon bruchivorus Muesebeck (Braconidae)

Acanthoscelides sp.

Bracon kirkpatricki (Wilkinson) (Braconidae)

Caryedon serratus

Bracon mellitor Say (Braconidae)

Acanthoscelides fraterculus

Bruchobius laticeps (Ashmead) (Pteromalidae)

Acanthoscelides obtectus; Bruchus pisorum; Callosobruchus maculatus

Bruchocida orientalis Crawford (EX) (Eupelmidae)

Bruchus pisorum, B. rufimanus; Callosobruchus chinensis; Zabrotes subfasciatus

Bruchocida vuilleti Crawford (EX) (Eupelmidae)

Callosobruchus maculatus

Catolaccus sp. (Pteromalidae)

Acanthoscelides floridae, A. longistilus; Mimosestes nubigens

Catolaccus hunteri Crawford (Pteromalidae)

Acanthoscelides bisignatus, A. compressicornis

Cephalonomia gallicola (Ashmead) (Bethylidae)

Callosobruchus maculatus

Cephalonomia hyalinipennis Ashmead (Bethylidae)

Mimosestes nubigens

Cerceris truncata Cameron (Sphecidae)

Algarobius prosopis; Mimosestes amicus, M. protractus; Neltumius arizonensis

Chaetostricta mukerjii Mani (Trichogrammatidae)

Callosobruchus maculatus

Charitopodinus swezeyi (Fullaway and Krauss) (Encyrtidae)

Bruchus rufimanus; Stator pruininus; Zabrotes subfasciatus

Charitopodinus terryi Bridwell (Encyrtidae)

Algarobius prosopis; Bruchus rufimanus; Stator pruininus; Zabrotes subfasciatus

Choetospila elegans Westwood (Pteromalidae)

Bruchus rufimanus; Callosobruchus chinensis, C. maculatus; Zabrotes subfasciatus

Chremylus elaphus Haliday (Braconidae)

Bruchus rufimanus

Chryseida spinola bennetti Burks (Eurytomidae)

Acanthoscelides obtectus; Merobruchus insolitus

Dibrachys cavus (Walker) (Pteromalidae)

Bruchus brachialis

Dinarmus sp. (Pteromalidae)

Megacerus discoidus

Dinarmus acutus (Thomson) (Pteromalidae)

Acanthoscelides alboscutellatus; Bruchidius cisti, B. villosus; Bruchus brachialis, B. rufimanus

Dinarmus colemani Crawford (EX) (Pteromalidae)

Callosobruchus chinensis

Dinarmus laticeps (Ashmead) (Pteromalidae)

Acanthoscelides obtectus; Bruchus pisorum, B. rufimanus; Callosobruchus chinensis, C. maculatus; Zabrotes subfasciatus

Dinarmus magnus Rohwer (EX) (Pteromalidae)

Bruchus pisorum, B. rufimanus

Dinarmus vagabundus (Timberlake) (Pteromalidae)

Callosobruchus chinensis, C. maculatus; Zabrotes subfasciatus

Entedon sp. (Eulophidae)

Caryedon serratus; Zabrotes subfasciatus

Eupelmus sp. (Eupelmidae)

Acanthoscelides aureolus complex, *A. chiricahuae, A. mixtus, A. obrienorum, A. quadridentatus; Mimosestes acaciestes*

Eupelmus amicus Girault (Eupelmidae)

Acanthoscelides alboscutellatus, A. floridae, Bruchus brachialis, B. pisorum; Mimosestes acaciestes, M. amicus

Eupelmus brevicauda (Crawford) (Eupelmidae)

Acanthoscelides submuticus

Eupelmus bruchivorus (Crawford) (Eupelmidae)

Acanthoscelides submuticus; Mimosestes nubigens

Eupelmus cushmani (Crawford) (Eupelmidae)

Acanthoscelides flavescens, A. obtectus, A. prosopoides; Merobruchus julianus; Mimosestes nubigens

Eupelmus cyaniceps Ashmead (Eupelmidae)

Acanthoscelides bisignatus, A. compressicornis, A. flavescens, A. obtectus, A. submuticus; Amblycerus robiniae; Bruchus brachialis; Gibbobruchus mimus; Merobruchus julianus; Mimosestes amicus, M. nubigens

Eupelmus inyoensis Girault (Eupelmidae)

Acanthoscelides floridae, A. submuticus

Eupelmus swezeyi Ashmead (Eupelmidae)

Caryedon serratus

Eurytoma sp. (Eurytomidae)

Acanthoscelides flavescens, A. fraterculus, A. submuticus; Amblycerus robiniae; Bruchus pisorum; Lithraeus atronotatus; Merobruchus julianus; Mimosestes nubigens

Eurytoma obtusa Bugbee (Eurytomidae)

Bruchus brachialis

Eurytoma tylodermatis Ashmead (Eurytomidae)

Acanthoscelides submuticus; Amblycerus robiniae; Bruchus brachialis; Mimosestes nubigens

Eurytoma wachtli Mayr (EX) (Eurytomidae)

Bruchus rufimanus

Gastrancistrus undulatus Ratzeburg (EX) (Pteromalidae)

Bruchus pisorum

Glyptocolastes texanus Ashmead (Braconidae)

Algarobius prosopis

Habrolepoidea tarsalis Girault (Encyrtidae)

Bruchus brachialis

Heterospilus bruchi Viereck (Braconidae)

Acanthoscelides quadridentatus; Amblycerus robiniae; Gibbobruchus mimus

Heterospilus prosopidis Viereck (Braconidae)

Acanthoscelides bisignatus, A. compressicornis, A. daleae, A. flavescens, A. quadridentatus, A. submuticus; Algarobius bottimeri, A. prosopis; Amblycerus robiniae; Callosobruchus chinensis, C. maculatus, C. phaseoli; Caryedon serratus; Gibbobruchus mimus; Mimosestes acaciestes, M. amicus, M. nubigens; Stator pruininus; Zabrotes subfasciatus

Heterospilus spermophagi Ashmead (Ichneumonidae)

Amblycerus robiniae

Horismenus sp. (Eulophidae)

Gibbobruchus mimus; Lithraeus atronotatus; Sennius abbreviatus

Horismenus bruchophagus Burks (Eulophidae)

Mimosestes nubigens

Horismenus depressus Gahan (Eulophidae)

Stator pruininus

Horismenus missouriensis Ashmead (Eulophidae)

Acanthoscelides aureolus complex, *A. chiricahuae, A. floridae, A. pallidipennis, A. subaequalis, A. submuticus; Algarobius prosopis; Amblycerus robiniae; Merobruchus insolitus; Mimosestes acaciestes; Neltumius texanus; Sennius medialis, S. morosus; Stator pruininus*

Horismenus productus (Ashmead) (Eulophidae)

Acanthoscelides mundulus, A. pallidipennis, A. submuticus; Algarobius prosopis; Mimosestes amicus

Laelius utilis Cockerell (Bethylidae)

Bruchus brachialis

Lariophagus distinguendus (Foerster) (Pteromalidae)

Bruchus brachialis, B. rufimanus; Callosobruchus chinensis, C. maculatus

Lariophagus texanus Crawford (Pteromalidae)

Algarobius bottimeri, A. prosopis; Callosobruchus maculatus; Mimosestes nubigens; Stator chihuahua, S. pruininus

Macroneura vesicularis (Retzius) (Eupelmidae)

Bruchus brachialis

Microdontomerus anthonomi Crawford (Torymidae)

Acanthoscelides aureolus complex, *A. mixtus, A. submuticus; Bruchus brachialis, B. pisorum; Stator limbatus*

Monomorium sp. (Formicidae)

Mimosestes nubigens

Oedaule magnus Rohwer (Pteromalidae)

Callosobruchus maculatus

Oedaule stringifrons Waterson (Pteromalidae)

Caryedon serratus

Parasierola distinguenda Kieffer (Bethylidae)

Acanthoscelides quadridentatus; Mimosestes nubigens

Parasierola emigrata Rohwer (Bethylidae)

Caryedon serratus

Phanerotoma sp. (Braconidae)

Acanthoscelides quadridentatus

Pseudocatolaccus bruchocida Risbec (EX) (Pteromalidae)

Zabrotes subfasciatus

Pteromalus sp. (Pteromalidae)

Acanthoscelides fraterculus; Bruchus brachialis; Callosobruchus chinensis; Stator pruininus

Pteromalus leguminis Gahan (Pteromalidae)

Bruchus pisorum

Pteromalus micans Nees (Pteromalidae)

Bruchus pisorum

Pteromalus piercei (Crawford) (Pteromalidae)

Acanthoscelides bisignatus, A. compressicornis

Pteromalus schwenkei Roomi, Khan, and Khan (EX) (Pteromalidae)

Callosobruchus chinensis

Pteromalus sequester Walker (EX) (Pteromalidae)

Bruchidius cisti, B. villosus; Bruchus pisorum (both European)

Pyemotes boylei Krczal (Acarina)

Mimosestes nubigens

Pyemotes tritici Lagrèze-Fossat and Montanè (Acarina)

Bruchidius cisti; Bruchus rufimanus; Callosobruchus chinensis

Pyemotes ventricosus Newport (Acarina)

Acanthoscelides obtectus; Bruchus pisorum, B. rufimanus; Callosobruchus chinensis, C. maculatus; Zabrotes subfasciatus

Sclerodermus immigrans Bridwell (Bethylidae)

Caryedon serratus

Senegalella acythopoensis Auriv. (Torymidae)

Callosobruchus maculatus

Staphylinus nigrellus Horn (Coleoptera)

Bruchus pisorum

Stenocorse bruchivora (Crawford) (Braconidae)

Acanthoscelides obrienorum, A. quadridentatus, A. submuticus; Algarobius bottimeri, A. prosopis; Callosobruchus chinensis; Caryedon serratus; Gibbobruchus mimus; Merobruchus julianus; Mimosestes acaciestes, M. amicus, M. nubigens; Stator limbatus

Systasis encyrtoides Walker (EX) (Pteromalidae)

Bruchus pisorum

Tetrastichus sp. (Eulophidae)

Acanthoscelides longistilus; Zabrotes subfasciatus

Tetrastichus bruchivorus Gahan (Eulophidae)

Bruchus brachialis

Tetrastichus bruchophagi Gahan (Eulophidae)

Bruchus brachialis

Tetrastichus claviger Thomson (Eulophidae)

Bruchus pisorum

Tetrastichus nerio Walker (Eulophidae)

Bruchus pisorum

Torymus atheatus Grissell (Torymidae)

Acanthoscelides obtectus

Torymus persicariae Mayr (EX) (Torymidae)

Bruchidius villosus (questionable record)

Triaspis sp. (Braconidae)

Bruchidius villosus

Triaspis forbesii (Dalla Torre) (Braconidae)

Bruchus rufimanus

Triaspis gibberosus (Szépligeti) (EX) (Braconidae)

Bruchus pisorum, B. rufimanus

Triaspis luteipes Thomson (Braconidae)

Bruchus rufimanus

Triaspis pallipes Nees (Braconidae)

Bruchus rufimanus

Triaspis similis (Szépligeti) (EX) (Braconidae)

Bruchus rufimanus

Triaspis stictostiba Martin (Braconidae)

Bruchus rufimanus

Triaspis thoracica (Curtis) (Braconidae)

Bruchus brachialis, B. pisorum, B. rufimanus; Zabrotes subfasciatus

Trichogramma sp. (Trichogrammatidae)

Bruchidius villosus

Trichogrammatidae

Stator pruininus

Trichomalopsis leguminis Gahan (Pteromalidae)

Bruchus pisorum

Urosigalphus sp. (Braconidae)

Amblycerus vitis

Urosigalphus arizonensis Crawford (Braconidae)

Neltumius arizonensis

Urosigalphus bruchi Crawford (Braconidae)

Acanthoscelides quadridentatus; Algarobius prosopis; Amblycerus robiniae; Callo-so- bruchus chinensis; Caryedon serratus; Merobruchus insolitus, M. julianus; Mimosestes amicus, M. nubigens

Urosigalphus bruchivorus Crawford (Braconidae)

Acanthoscelides chiricahuae, A. mundulus; Algarobius prosopis; Merobruchus julianus; Mimosestes acaciestes; Neltumius arizonensis, N. texanus; Sennius medialis; Stator limbatus; Stylantheus macrocerus

Urosigalphus neobruchi Gibson (Braconidae)

Acanthoscelides mundulus, A. prosopoides, A. quadridentatus; Algarobius prosopis; Amblycerus robiniae; Merobruchus insolitus; Mimosestes acaciestes, M. amicus, M. nubigens; Stator limbatus

Uscana caryedoni Viggiani (EX) (Trichogrammatidae)

Caryedon serratus

Uscana lariophaga Stephen (EX) (Trichogrammatidae)

Callosobruchus maculatus

Uscana marilandica Girault (Trichogrammatidae)

Callosobruchus maculatus

Uscana mukerjii (Mani) (EX) (Trichogrammatidae)

Callosobruchus chinensis, C. maculatus; Zabrotes subfasciatus

Uscana semifumipennis Girault (Trichogrammatidae)

Acanthoscelides alboscutellatus, A. obtectus; Algarobius prosopis; Althaeus hibisci; Bruchidius cisti; Bruchus pisorum; Callosobruchus chinensis, C. maculatus, C. phaseoli; Caryedon serratus; Megacerus discoidus; Mimosestes amicus, M. nubigens; Stator limbatus, S. pruininus; Zabrotes subfasciatus

Uscana senex (Grese) (Trichogrammatidae)

Bruchidius cisti; Bruchus pisorum; Callosobruchus maculatus

Zatropis sp. (Pteromalidae)

Lithraeus atronotatus

Zatropis incertus (Ashmead) (Pteromalidae)

Abutiloneus idoneus; Acanthoscelides chiricahuae, A. longistilus, A. subaequalis, A. submuticus; Bruchus brachialis; Mimosestes acaciestes

Zatropis orontas (Walker) (Pteromalidae)

Acanthoscelides submuticus

Zelus renardii Kolenati (Hemiptera)

Bruchus rufimanus; Mimosestes nubigens

Glossary of Morphological Terms

Some definitions modified from Nichols and Schuh (1989).

Acicular: Needle-shaped.

Acuminate: Tapering to a sharp point.

Angulate: Meeting at an angle, as two margins

Anterad: Toward the head.

Anterior: In front; toward the head.

Anterolateral: Located anteriorly and to the side.

Anteroventral: Toward the front on ventral side of body.

Antescutellar: Located immediately in front of the scutellum.

Apex: The end of a part farthest from the base; tip.

Arcuate: Arched; curved like a bow.

Armature: Various chitinous spines, denticles, or spicules in internal sac of male genitalia.

Articulation: Point where two moveable parts abut; joint.

Asperity: Surface roughening into small elevations.

Attenuate: Gradually tapering toward apex.

Basal lobe: The broad, antescutellar lobe of the posterior margin of the pronotal disk.

Basal denticle: A toothlike structure at the base of an elytral stria.

Base: The end of a body part or segment that is attached to another part; for instance, the margin of the pronotum adjacent to the base of the elytra.

Bidentate: Bearing two teeth or denticles.

Bifid: Divided into two parts; forked.

Bifurcate: Separated into two branches.

Boss: Elevated, glabrous raised area, usually on frons.

Calcar: A movable spur, usually at apex of tibia (plural, calcaria).

Cardo: Segment of the maxilla that articulates with the head.

Carina: Keel; elevated ridge.

Caudad: Toward the posterior end of the body.

Caudal: Pertaining to the posterior end of the body.

Cephalad: Toward the head end of the body.

Cervical boss: A low tubercle bearing two setiferous punctures on the anterolateral angle of the pronotum.

Cervical sulcus: A vertical sulcus paralleling the anterolateral margin of the pronotum in many bruchids.

Closure valve: Valvular structure at the end of the internal sac of male genitalia that controls passage of seminal fluid.

Clypeolabral suture: A transverse, impressed line between the clypeus and the labrum.

Clypeus: Sclerite situated between the frons and the labrum on the front of the head.

Compressed: Flattened laterally.

Condyle: A process that forms a point of articulation of a movable part.

Contiguous: Touching along a common border.

Convergent: Approaching the same point.

Coronal denticles: The crownlike cluster of denticles at the apex of the tibia in many bruchids.

Crescentic: In the shape of a crescent.

Cristate: Having a prominent carina or ridge on the dorsal surface.

Cuneate: Elongate triangular shape.

Cuspidate: Pointed, acuminate, coming to a sharp point.

Cuticle: The epidermis covering the entire body of an insect.

Dentate: Toothed or with toothlike projections.

Denticle: A small, often acute, tooth.

Denticulate: Set with small teeth or denticles.

Depressed: Flattened, as if pressed down.

Dilated: Widened; expanded.

Dimorphic: Different in form or color; in Bruchidae usually applied to sexual differences.

Disk: The central dorsal surface of a body part; for example: pronotum, pygidium.

Distal: Toward the free end of a body part.

Dorsad: Toward the upper part or side of a body or body part.

Dorsolateral: On the dorsal side of a lateral face of a body or body part.

Dorsomeson: The middle line of the dorsal part of a body or body part.

Dorsum: The upper surface of a body or body part.

Elytron: The hard or leathery forewing of a beetle modified to cover the hind, or flight, wings and meeting on the midline in repose (plural, elytra).

Elytral: Pertaining to the elytra.

Emarginate: Having an obtuse, rounded, or quadrate notch cut from a margin.

Emargination: A notched or cut-out place on a margin.

Epimeron: The caudal sclerite of a thoracic pleuron.

Episternum: The anteriad sclerite of a thoracic pleuron.

Evanescent: Vague; obsolete; nearly disappearing.

Femur: The third segment of an insect leg; the thigh.

Flabellate: Fanlike; having long, flat or terete processes that fold together.

Footstalk: The basal sclerite of the maxilla.

Fossa: A pit or deep sulcus.

Fossula: A suture on the metacoxal face extending laterad from the fossa of the trochanter.

Fovea: An integumental depression with nearly flat bottom and vertical sides.

Foveola: A small fovea.

Frons: Area of the head between the eyes limited posteriorly by the vertex and anteriorly by the clypeus.

Frontoclypeal suture: Transverse impressed line between the frons and the clypeus.

Fusiform: Spindle-shaped; broad in middle and tapered at each end.

Galea: The outer lobe of the maxilla, usually having two segments.

Gena: Cheek; side of head below the eye.

Gibbosity: A hump or protuberance from a body surface.

Glabrous: Smooth; without vestiture or surface structures.

Granulose: Grainy; covered with minute, grainlike structures.

Gula: Median sclerite on ventral side of head.

Gular suture: Impressed line between the gena and the gula.

Habitus: General form and appearance.

Host: Organism upon which another organism feeds.

Humerus: The shoulder or anterolateral angle of a beetle elytron.

Hypognathous: With the head hanging vertically.

Hypomeron: The concave lateral face of the pronotum below bounded dorsally by the lateral carina and ventrally by the prosternum.

Imbricate: Appearing like fish scales or shingles.

Incrassate: Thickened; in bruchids applied to the enlarged, laterally compressed metafemur.

Impressed: Having shallow depressed areas.

Internal sac: The invaginated intromittent sac attached at the distal end of the me-

dian lobe, which is everted during copulation.

Integument: The outer skin of the body; cuticle.

Interstice: Linear strip of integument between striae, such as the elytral interstices.

Interval: Space between surface structures or punctures.

Labium: The ventral lip of the mouthparts.

Labrum: The dorsal lip of the mouthparts.

Lageniform: Bottle-shaped with narrow neck.

Lateral: Toward the side; away from the midline.

Ligula: Middle lobe of the maxillae.

Liguliform: Tongue-shaped or straplike.

Lobed: Having a rounded projection or protuberance.

Maculate: Marked with spots of different color than the background.

Mandibles: Dorsal pair of jaws in mouthparts, principally for biting.

Maxillae: Ventral pair of jaws in the mouthparts; used to taste and to masticate food.

Median: In or at the middle.

Mesad: Toward the median line of the body.

Mesocoxa: The basal segment of the middle leg.

Mesopleuron: Lateral surface of the mesothorax.

Mesosternum: Ventral median sclerite of the mesothorax.

Metafemur: The third segment of the hind leg.

Metapleuron: Lateral surface of the metathorax.

Metasternum: Ventral median sclerite of the metathorax.

Metatibia: The fourth segment of the hind leg.

Metepisternal sulcus: Angulate groove on the face of the metepisternum.

Metepisternum: The episternum of the metathorax.

Microtrichia: Fine, cuticular setae.

Mola: Roughened grinding surface of median face of the mandible.

Monophagous: Feeding on or in only one host.

Mucro: Sharp, pointed process; in bruchids, the fixed terminal spine of the metatibia extending from the ventral margin.

Notum: Dorsal part of a segment.

Oblique: Set at or cut off at an angle.

Obsolete: Faintly marked or nearly effaced surface feature.

Obtuse: Blunt or rounded apical margin of a structure.

Occipital foramen: Opening in the caudal part of the head leading into the prothorax and through which pass the digestive and nervous systems.

Occiput: The posterior part of the epicranium between the cranium and the anterior border of the pronotum.

Ocular index: Greatest width across eyes divided by least width between eyes.

Ocular sinus: Emargination of the eye.

Ogival: Shaped like a double-curved gothic arch (from ogee).

Opisthognathous: Dependant position of head but directed caudad and resting on the procoxae.

Ovipositor: Tubular or valvular structure at the end of the female's abdomen through which and by which eggs are placed.

Palp, palpus: Jointed appendage of labium or maxilla.

Parasutural sulcus: Sulci paralleling the metathoracic pleurosternal suture. That on the metepisternum extends from the metepisternal sulcus; that on the metasternum is an extension of the postmesocoxal sulcus.

Pecten: Subapical denticle or row of denticles on the ventromesal margin of the metafemur.

Pectinate: Comblike, especially when applied to antenna.

Pedicel: Second segment of the antenna.

Piceous: Pitchy black with reddish highlights.

Pleuron: The lateral region of the thorax or abdomen.

Pleurosternal: Pertaining to the area of the thorax surrounding the coxal bases.

Posterior: Toward the hind end of the body.

Postmesocoxal sulcus: Groove or impressed line on metasternum, usually following contour of mesocoxal cavity, sometimes angulate or lobed.

Postocular lobe: Lobe attached to posterior margin of the eye separating it from the side of the head.

Prementum: Ventral region of head to which labium is attached.

Procoxa: First segment of the prothoracic leg.

Pronotum: Dorsal sclerite of the prothorax.

Prostheca: A setose sclerite in the mesal margin of the mandible in bruchids.

Protuberance: Any elevation above a surface.

Proximal: The part of an appendage nearest the body; toward the base of a part.

Pubescent: Clothed with short, closely set setae.

Punctate: Set with impressed points or punctures.

Punctulate: Set with extremely fine punctures as if pierced with a needle.

Puncture: See "Punctate."

Pygidium: The tergum of the last visible segment of the abdomen, morphologically the seventh segment.

Quadrate: Four-sided, usually with right angles.

Recurved: Bowed or bent backward, downward, or outward.

Reflexed: With apex of a body part turned, bent, or reflected backward.

Reniform: Kidney-shaped.

Sclerite: Any part of the body wall bounded by sutures.

Scutellum: Triangular or quadrate sclerite set between bases of the elytra and the posterior margin of the pronotum.

Sensillum ampullaceum: Conical sensory peg sunk in a pit in the body wall. (In larvae.)

Sensillum basiconicum: Thin-walled, peg-shaped sensillum with minute pores; a basiconic peg. (In larvae.)

Sensillum chaeticum: Spinelike or bristle-like sensory organ. (In larvae.)

Sensillum placodeum: Olfactory sensillum in the form of a flat plate. (In larvae.)

Sensillum trichodeum: Hairlike projection of the cuticle articulated with the body wall by a membranous socket. (In larvae.)

Sensory peg: A thin-walled, peg-shaped sensillum with minute pores; a basiconic peg. (In larvae.)

Serrate: Sawlike; having a series of acute teeth or angulations along a margin.

Seta: Hair-like projection of the cuticule set in a basal cuticular ring.

Setiferous, setose: Set with setae.

Sinuate: Wavy or undulating, as a margin.

Sinus: A curved break in an otherwise straight line; a deep indentation in a margin.

Spicule: A minute, pointed spine.

Spinule: A small spine.

Spur: A spinelike, movable appendage; in bruchids, located at the apex of the metatibia in certain groups such as the Amblycerinae.

Sternite: Any subdivision of a sternum.

Sternum: The ventral sclerite in a segment.

Stipes: The footstalk of the maxilla that bears the movable appendages.

Stria: Longitudinal impressed line, usually of punctures, on disk of elytra; striae are separated by interstices.

Striate: Marked with parallel, impressed lines (for example, elytral striae).

Stridulate: To produce sound by rubbing one part of the body against another.

Subapical: Located just anteriad of the apex of a body part.

Subbasal gibbosity: An elevation of the integument near the base of the elytron usually bearing on its summit one or two denticles marking bases of the elytral striae.

Subequal: Approximately equal in size or length.

Submentum: Basal sclerite of the insect labium.

Subparallel: Approximately parallel.

Sulcus: Shallow or deep furrow or groove.

Suture: Line of juncture of two sclerites.

Tarsus: Foot; the jointed appendage attached to the end of the tibia.

Tentorium: Internal skeleton of the head.

Terete: Circular in cross-section.

Tergite: A subdivision of a tergal sclerite.

Tergum: A dorsal sclerite of a body segment.

Tibia: Fourth segment of a leg.

Transverse: Wider than long (when referring to a body part).

Transverse sulcus: Vague depression on the front of the head at the dorsal limits of the eyes marking the boundary between vertex and frons.

Trochanter: Segment of the leg between the coxa and the femur.

Trochantin: A basal sclerite articulating between the coxa and the anterior part of the coxal cavity in the fore and mid legs in some bruchids.

Truncate: Cut off squarely at the apex.

Tubercle: Small, pimplelike protuberance of the body wall.

Umbilicate: Having a central depression resembling a navel.

Umbo: A knob or boss (plural, umbones).

Valvular: Valve-like or having the functions of a valve.

Venter: The underside of the body.

Ventral: Pertaining to the underside of the body.

Ventromesal: Ventral side of the body toward the midline.

Vertex: The top of the head between the occiput, the eyes, and the frons.

Vestiture: Hair, scales, or setae covering the integument of the body.

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