Sisymbrium irio L. (Brassicaceae)
London Rocket

Description. Annuals; stems erect, 15-50 cm tall, branched throughout or above the middle, glabrous to sparsely short-appressed puberulent at base, the trichomes simple. Lower leaves 10-20 cm long, lowermost petioled, blades obovate, pinnately lobed, with 2-3 pairs of lateral lobes, the terminal lobe hastate, much larger than the proximal ones; cauline leaves gradually reduced upward, upper ones sessile, entire. Inflorescence a raceme; petals 2.5-4 mm long, pale yellow; pedicels in fruit 5-11 mm long, straight, slender, spreading to ascending; fruit a silique, 25-65 mm long, straight or slightly curved, terete, glabrous, 3-veined. Seeds usually in one series per locule, ca. 1 mm in diameter, oblong, minutely papillose. (Abrams 1944, Ball 1964, Barker 1986, Fernald 1950, Hewson 1962, Jepson 1936, Munz 1959, Rollins 1993, Wagner et al. 1990).

Similar species include hedge mustard, *Sisymbrium officinale* (L.) Scopoli, and Oriental hedge mustard, *S. orientale* L. (Rollins 1993). Both species differ from *S. irio* by having the fruiting pedicels about the same width as the silique and a denser pubescence on the stems and leaves. *Sisymbrium officinale* is distinguished by having short, appressed, erect fruiting pedicels and beaked fruits that are 8-20 mm long. *Sisymbrium orientale* has a basal rosette of leaves, pubescent ovaries and young fruits, and mature fruits that are 35-100 mm long.

Geographic distribution. All three species of *Sisymbrium* are believed to be native of Eurasia, but the original range, especially of London rocket, is apparently unclear (Ball 1964). *Sisymbrium irio* is a waif in Great Britain and has become naturalized in Australia, Hawaii, southern Africa, and much of western North America. (Arnold and de Wet 1993, Clapham et al. 1962, Hewson 1982, Rollins 1993, Wagner et al. 1990). However, it apparently is a waif elsewhere in the United States (Rollins 1993). *Sisymbrium officinale* has become naturalized throughout most of temperate North America (including Mexico) and Chile and *Sisymbrium orientale* is primarily naturalized in Arizona, California, and western Nevada (Montenegro et al. 1991, Rollins 1993).

London Rocket was first reported from southern California (Los Angeles, Riverside counties) in the early 1900s (Robbins 1940). Naturalized populations occur only on Anacapa Island (Junak et al. 1997), but on the mainland it is reported from most counties in the southern Central Valley and southwestern California (Anonymous 1998). *Sisymbrium officinale* was first reported from California ("near San Francisco") by Bolander (1870). By the beginning of the 20th Century it had been reported from several areas throughout the state (Robbins 1940). *Sisymbrium orientale* was first reported as a weed from southern California by Abrams (1944), although it may have been confused with several other species in earlier 20th Century floras (e.g., Jepson 1936, Munz 1935).

Ecological distribution. In both its native range and in naturalized areas, London rocket is reported from abandoned fields, waste places, roadsides, and orchards (Abrams 1944, Fernald 1950, Ball 1964, Hewson 1962, Munz 1959, Rollins 1993, Wagner et al. 1990).

Reproductive and vegetative biology. The breeding systems of *Sisymbrium irio*, *S. officinale*, and *S. orientale* apparently have not been studied. Like other colonizing species of mustards, however, they probably are self-compatible and their small flowers are consistent with self-

pollination (Proctor et al. 1996, Richards 1978). Seeds are presumably dispersed passively. Both seed dormancy and germination of *Sisymbrium officinale* varies, depending on soil temperature. Dormancy is broken in autumn-winter and re-induced in summer (Derkx and Karssen 1993). Seeds buried under cool conditions germinated more readily than those buried under warm temperatures; seed dormancy also can be induced by retention in warm soils previously experiencing cool conditions. Seed germination can also depend on both soluble nitrates and light, with both high nitrate and light stimulating seed germination (Hilhorst 1990a, 1990b). Lange (1969) showed that *Sisymbrium irio* recruitment was dependent, in part, on available nitrogen associated with feral mammal dung deposits.

Weed status. *Sisymbrium* species are not considered noxious weeds in agricultural or horticultural practice, at least at a global level (not listed by Holm et al. 1977), nor are any species considered noxious by the State Dept. of Food and Agriculture (Anonymous 1996). Only *Sisymbrium officinale* is listed for the United States by Lorenzi and Jeffery (1987).

Microbial and insect pathogens. No literature was found that reported microbial or insect pathogens in *Sisymbrium*.

Herbicide control. Several herbicides have been used to control *Sisymbrium* spp., including 2,4-d, imidazolinone, sulfonylurea, and triazolopyrimidine herbicides (Adkins et al. 1997, Boutsalis and Powles 1995, Stephenson and Mitchell 1993, Wolf et al. 1992, Young et al. 1992). Adkins et al. (1997) reported that they did not detect resistance to atrazine and chlorsulfuron in at least 3 collections of *S. irio* from Australia. However, Young et al (1992) found varying patterns of resistance in *S. irio* to bromoxynil, diuron, and terbutryn. Ohr et al (1996) reported effective sterilization of soil and complete control of weeds, including *Sisymbrium irio* , using methyl iodide instead of methyl bromide.

Literature Cited

Abrams, L. 1944. Illustrated flora of the Pacific states. Volume 2. Polygonaceae to Krameriaceae. Stanford University Press, Stanford, California. 635 pp.

Adkins, S., D. Wills, M. Boersma, S. Walker, G. Robinson, R. McLeod, and J. Emam. 1997. Weeds resistant to chlorsulfuron and atrazine from the north-east grain region of Australia. Weed Research. 37: 343-349.

Anonymous. 1996. Exotic pest plants of greatest ecological concern in California as of August 1996. California Exotic Pest Plant Council. 8 pp.

Anonymous. 1998. California county flora database version 2, Santa Barbara Botanic Garden and USDA National Plants Data Center, Santa Barbara and New Orleans. URL = plants.usda.gov

Arnold, T. and B. de Wet. 1993. Memoir 62. Plants of southern Africa: names and distribution. National Botanical Institute, Pretoria. 825 pp.

Ball, P.1964. *Sisymbrium* pp.264-266. In Tutin et al. (eds.) Flora Europaea. Volume 1. Lycopodiaceae to Platanaceae. Cambridge University Press, Cambridge. 464 pp.

Barker, W. 1986. Brassicaceae. pp.293-333. In Great Plains Flora Association. Flora of the Great Plains. University of Kansas, Lawrence. 1392 pp.

Bolander, H. 1870. A catalog of plants growing in the vicinity of San Francisco. A. Roman and

Co., San Francisco, California. 43 pp.
Boutsalis, P and S. Powles. 1995. Resistance of dicot weeds to acetolactate synthase (ALS)-inhibiting herbicides in Australia. Weed Research. 35:149-155.
Bouwmeester, H. and C. Karssen. 1993. Annual changes in dormancy and germination in seeds of *Sisymbrium officinale* (L.) Scop. The New Phytologist. 124:179-191.
Clapham, A., T. Tutin, and E. Warburg. 1962. Flora of the British Isles. Cambridge University Press, Cambridge. 1269 pp.
Cudney, D., S. Orloff, and C. Adams. 1993. Improving weed control with 2,4-DB amine in seedling alfalfa (*Medicago sativa*). Weed Technology. 7: 465-470.
Derkx, M. and C. Karssen. 1993. Changing sensitivity to light and nitrate but not to gibberellins regulates seasonal dormancy patterns in *Sisymbrium officinale* seeds. Plant Cell and Environrnent.16: 469-479.
Fernald, M. 1950. Gray's Manual of Botany. Eighth Edition. American Book Company, New York. 1632 pp.
Hewson, H. 1982. Brassicaceae. pp.231-357. In George et al. (eds.). Flora of Australia. Volume 8. Lecythidales to Batales. Australian Government Printing Service, Canberra. 420 pp.
Hilhorst, H. 1 990a. Dose-response analysis of factors involved in germination and secondary dormancy of seeds of *Sisymbrium officinale*. I. Phytochrome. Plant Physiology. 94: 1090-1095.
Hilhorst, H. 1990b. Dose-response analysis of factors involved in germination and secondary dormancy of seeds of *Sisymbrium officinale*. II. Nitrate. Plant Physiology. 94:1096-1102.
Holm, L., D. Plucknett, J. Pancho, and J. Herberger. 1977. The world's worst weeds: distribution and ecology. University of Hawaii, Honolulu. 609 pp.
Jepson, W. 1936. A flora of California. Volume 2. Capparidaceae to Cornaceae. University of California, Berkeley. 684 pp.
Junak, S., S. Chaney, R. Philbrick, and R. Clark. 1997. A checklist of vascular plants of Channel Islands National Park. Southwest Parks and Monuments Association, Tucson, AZ. 43 pp.
Lange, R. 1969. The “piosphere”: sheep tracks and dung patterns. Journal of Range Management. 22: 396-400.
Lorenzi, H. and L. Jeffery. 1987. Weeds of the United States and their control. Van Nostrand Comapny, New York. 355 pp.
Montenegro, C., S. Teillier, P. Arce, and V. Poblete. 1991. Introduction of plants into the mediterranean-type climate area of Chile. pp. 103-114. In Groves, R. and F. Di Castri. Biogeography of Mediterranean invasions. Cambridge University Press, Cambridge. 485 pp.
Munz, P.1935. A manual of southern California botany. Claremont Colleges, Claremont, California. 642 pp.
Munz, P.1959. A flora of California. University of California Press, Berkeley. 1681 pp.
Ohr, H., J. Sims, N. Grech, J. Becker, and M. McGiffen. 1996. Methyl iodide, an ozone-safe alternative to methyl bromide as a soil fumigant. Plant Disease. 80: 731-735.
Proctor, M., P. Yeo, and A. Lack. 1996. The Natural history of pollination. Timber Press, Portland, Oregon. 479 pp.
Richards, A. 1978. The pollination of flowers by insects. Linnean Society Symposium Series 6: 1-213. Academic Press, London.
Robbins, W. 1940. Alien plants growing without cultivation in California. Agricultural Experiment Station Bulletin 637. University of California, Berkeley. 128 pp.

Robbins, W. M. Bellue, and W. Ball. 1970. Weeds of California. Department of Agriculture, Sacramento, California. 547 pp.

Rollins, R. 1993. The Cruciferae of North America. Stanford University Press, Stanford, California. 976 pp.

Stephenson, D. and G. Mitchell. 1993. Barley grass control with herbicides in subterranean clover pasture: 1. Effect on pasture in the year of spraying. Australian Journal of Experimental Agriculture. 33: 737-741.

Wagner, W., D. Herbst, and S. Sobmer. 1990. Manual of the flowering plants of Hawaii. 1853 pp.

Wolf, T., B. Caldwell, G. McIntyre, and A. Hsiao. 1992. Effect of droplet size and herbicide concentration on absorption and translocation of 14C-2,4-D in oriental mustard (*Sisymbrium orientale*). Weed Science. 40: 568-575.

Young, R., K. Morthorpe, P. Croft, and H. Nichol. 1992. Differential tolerance of annual medics, Nungarin subterranean clover and hedge mustard to broadleaf herbicides. Australian Journal of Experimental Agriculture. 32: 49-57.