Scientific Name: *Acentropus niveus* Olivier, 1791

Common Name: (European) aquatic/water moth

Taxonomy: Available through ITIS

Identification: Early instar larvae of this aquatic moth species are stem boring or leaf mining caterpillars, while late instars live in shelters constructed of two or more pieces of host plant material. Larvae have no gills. The prothorax displays functional spiracles and the ventral surface exhibits biordinal crochets in horseshoe arrangements that are open mesally. Larval jaws are small and adapted for leaf-cutting (Pennak 1978; Merritt and Cummins 1984; Peckarsky et al. 1993; Johnson and Blossey 2002).

Adult females are usually brachypterous, or with shortened, non-functional wings. They have hairy second and third legs for underwater swimming, and exhibit a plastron, or an incompressible gill full of hydrofuge hairs that traps gas on the ventral surface. Winged males, flightless females, and winged females (which are rare but occur occasionally) have a short, under-developed proboscis (Munroe 1947; Dierl and Reichholf 1977; Pennak 1978; Merritt and Cummins 1984).

Size: Adult moths are 5–9 mm long, early instar larvae are 0.25 mm long, and late instar case-building larvae are 10–12 mm long right before they pupate (Johnson and Blossey 2002).

Native Range: *A. niveus* is native to Europe, where it is very widespread (Pennak 1978; Johnson and Blossey 2002).

Nonindigenous Occurrences: *A. niveus* was recorded for the first time in the Great Lakes basin in 1938 at Minetto, New York on the Oswego River, which flows into Lake Ontario (Forbes 1938). It has also been collected from other parts of the Lake Ontario drainage, Lake Ontario proper, and Lake Erie and its drainage (Judd 1947; Munroe 1947; Judd 1950).

Means of Introduction: *A. niveus* was very likely accidentally released along with European plants brought to North America, such as *Myriophyllum spicatum*, *Potamogeton crispus*, and *Trapa natans* (Mills et al. 1993).

Status: Established where recorded.

Ecology: *A. niveus* is typically found in lentic macrophyte beds where filamentous algae are scarce and there is plenty of available oxygen. Adult females depend on diffusion across their plastron to respire and larvae living in attached cases at plant tips obtain oxygen from stems, trapping it in air bubbles in their shelters. Larvae are generalist herbivorous shredders and can feed on many plant taxa in Europe or North America, including: *Lemna, Sparganium, Potamogeton, Myriophyllum, Hydrilla verticillata, Elodea canadensis, Ceratophyllum demersum, Anacharis canadensis, Trapa natans*, and various reeds (Judd 1953; Batra 1977; Marlier 1978; Pennak 1978; Merritt and Cummins

1984; Mills et al. 1993; Peckarsky et al. 1993; Brodersen 1995; Johnson and Blossey 2002).

Egg laying often occurs twice a year, resulting in *A. niveus* emergence coinciding with two peaks in the biomass of milfoil (*Myriophyllum* spp.), one of its typical host plants. The latest generation of hatched larvae typically overwinters until spring of the following year. Not all North American populations do produce two generations though, and when only one occurs, larvae usually overwinter in cocoons on macrophytes then create new feeding shelters on plants the following year (Judd 1953; Batra 1977; Painter and McCabe 1988; Johnson and Blossey 2002).

The larval stage can last around 10.5 months and larval development generally requires temperatures below 22ºC, although higher water temperatures can be tolerated for short periods of time. Larvae that are ready to pupate cut the apical tip of their host plant and spin a cocoon between this piece of plant material and the main stem. Metamorphosis and adult reproduction both occur sometime in the summer. Adult males only live one or two days solely to breed and they copulate with females at the water surface. Wingless females are mostly nocturnally active and float on the water surface until they mate. Wingless females lay 100-300 eggs on host plants, while winged females usually lay fewer than 100 (Judd 1953; Batra 1977; Pennak 1978; Buckingham and Ross 1981; Painter and McCabe 1988; Johnson and Blossey 2002).

Impact of Introduction

A) Realized: In the Kawartha Lakes, which are part of the Trent Canal system that flows into Lake Ontario, introduced Eurasian watermilfoil (*M. spicatum*) populations were decimated in Lakes Buckhorn and Scugog by the 1980s. The near disappearances were likely due to grazing by *A. niveus*. In Cayuga Lake, New York, which flows into Lake Ontario, *A. niveus* was associated with declines in *M. spicatum* populations during the 1990s. These declines were probably attributable to damage of plant tips by *A. niveus* for building shelters, which seriously hampers the plants' growing ability. Densities of 6 *A. niveus* larvae per 10 tips of *M. spicatum* led to declines in this aquatic macrophyte in Cayuga Lake and the Kawartha Lakes area. Milfoil can resist 4 larvae per 10 tips but 8 larvae or more per 10 tips causes very severe impacts (Painter and McCabe 1988; Johnson et al. 1998; Johnson et al. 2000).

B) Potential: Outside the Great Lakes basin in Brownington Pond, Vermont herbivory by *A. niveus* and the weevil *Euhrychiopsis lecontei* was associated with declines in *M. spicatum*. Entire stands were pulled under water as damaged plants with reduced buoyancy pulled down nearby healthy plants (Creed et al. 1992; Creed and Sheldon 1994).

Experiments in Vermont to test the ability of *A. niveus* to act as a biocontrol agent on *M. spicatum* have indicated that *A. niveus* can significantly reduce milfoil stem length. Experimental evidence supports the fact that *A. niveus* prefers to feed on *M. spicatum* over *E. canadensis*, even though it is mostly a generalist grazer (Creed and Sheldon 1994; Gross et al. 2001).

Remarks: Some earlier authors believe that *A. niveus* is native to North America, given its wide distribution and inconspicuous appearance, which may have made it hard to identify in the past (Munroe 1947). However, most recent literature indicates that it was introduced with European plants. In North America, *A. niveus* was first recorded in 1927 from Montreal, Quebec, Canada on the St. Lawrence River (Buckingham and Ross 1981; Mills et al. 1993).

In spite of the documented strong negative effects of high densities of *A. niveus* on *M. spicatum*, this aquatic moth probably only has a weak negative effect on many host plants in general. Such macrophytes as *M. spicatum*, *T. natans*, and *P. crispus* generally experience such low costs in acting as hosts to *A. niveus* that the relationship can even be classified as commensal (Ricciardi 2001). Moreover, it is possible that herbivore damage to milfoil stems causes fragmentation and aids dispersal of some fragments that are still viable (Creed and Sheldon 1994).

Acentropus niveus is synonymous with *Acentria nivea* and *Acentria ephemerella*.

Voucher Specimens:

References:

Batra, S. W. T. 1977. Bionomics of the aquatic moth *Acentropus niveus*, a potential biological control agent for Eurasian water milfoil and *Hydrilla*. Journal of the New York Entomological Society 85(3):143-152.

Brodersen, K. P. 1995. The effect of wind exposure and filamentous algae on the distribution of surf zone macroinvertebrates in Lake Esrom, Denmark. Hydrobiologia 297:131-148.

Buckingham, G. R. and B. M. Ross. 1981. Notes on the biology and host specificity of *Acentria nivea* (=*Acentropus niveus*). Journal of Aquatic Plant Management 19:32-36.

Creed, R. P. Jr. and S. P. Sheldon. 1994. The effect of two herbivorous insect larvae on Eurasian watermilfoil. Journal of Aquatic Plant Management 32(Jan.):21-26.

Creed, R. P. Jr., S. P. Sheldon and D. M. Cheek. 1992. The effect of herbivore feeding on the buoyancy of Eurasian watermilfoil. Journal of Aquatic Plant Management 30:75-76.

Dierl, W. and J. Reichholf. 1977. Wing reduction in Lepidoptera as an adaptive strategy. Spixiana 1(1):27-40.

Forbes, W. T. M. 1938. *Acentropus* in America (Lepidoptera, Pyralidae). Journal of New York Entomological Science 46:338.

Gross, E. M., R. L. Johnson and N. g. Hairston Jr. 2001. Experimental evidence for changes in submersed macrophyte species composition caused by the herbivore *Acentria ephemerella* (Lepidoptera). Oecologia 127:105-114.

Johnson, R. L. and B. Blossey. 2002. Eurasian Watermilfoil. Pp. 79-90 in R. Van Driesche et al., eds. Biological Control of Invasive Plants in the Eastern United States, USDA Forest Service Publication FHTET-2002-04. 413 pp.

Johnson, R. L., E. M. Gross and N. G. Hairston Jr. 1998. Decline of the invasive submersed macrophyte *Myriophyllum spicatum* (Halorgaceae) associated with herbivory by larvae of *Acentria ephemerella* (Lepidoptera). Aquatic Ecology 31:273-282.

Johnson, R. L., P. J. Van Dusen. J. A. Toner and N. G. Hairston Jr. 2000. Eurasian watermilfoil biomass associated with insect herbivores in New York. Journal of Aquatic Plant Management 38:82-88.

Judd W. W. 1947. *Acentropus niveus* Olivier (Lepidoptera, Pyralidae) at Hamilton, Ontario. The Canadian Entomologist 79:119.

Judd W. W. 1950. *Acentropus niveus* (Oliv.) (Lepidoptera: Pyralidae) on the north shore of Lake Erie with a consideration of its distribution in North America. The Canadian Entomologist 82:250–253.

Judd, W. W. 1953. A study of the population of insects emerging as adults from the Dundas Marsh, Hamilton, Ontario, during 1948. Amerian Midland Naturalist 49(3):801-824.

Marlier, G. 1978. Aquatic insects. Naturalistes Belges 59(1-2):37-44.

Merritt, R. W. and K. W. Cummins, eds. 1984. An Introduction to the Aquatic Insects of North America 2nd ed. Kendall/Hunt Publishing Company, Dubuque, Idaho. 722 pp.

Mills, E. L., J. H. Leach, J. T. Carlton and C. L. Secor. 1993. Exotic Species in the Great Lakes: A History of Biotic Crises and Anthropogenic Introductions. Journal of Great Lakes Research 19(1):1-54.

Munroe, E. G. 1947. Further North American records of *Acentropus niveus* (Lepidoptera, Pyralidae). The Canadian Entomologist 79:120.

Painter, D. S. and K. J. McCabe. 1988. Investigation into the disappearance of Eurasian water milfoil from the Kawartha Lakes, Canada. Journal of Aquatic Plant Management 26:3-12.

Peckarsky, B. L., P. R. Fraissinet, M. A. Penton and D. J. Conklin Jr. 1993. Freshwater Macroinvertebrates of Northeastern North America. Cornell University Press, Ithaca, New York State. 442 pp.

Pennak, R. W. 1978. Fresh-water Invertebrates of the Unites States 2nd edition. John Wiley and Sons, Inc., New York, New York State. 803 pp.

Ricciardi, A. 2001. Facilitative interactions among aquatic invaders: is an “invasional meltdown” occurring in the Great Lakes? Canadian Journal of Fisheries and Aquatic Sciences 58:2513-2525.

Other Resources:

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Group: Insect - Does not fit available categories

Lake(s): Lake Erie Drainage, Lake Ontario Drainage

Genus: *Acentropus* (synonymous with *Acentria*)

Species: *niveus* (synonymous with *nivea* and *ephemerella*)

Common Name: (European) aquatic/water moth

Status: Established

Freshwater/Marine: Freshwater

Pathway: Does not fit available categories (accidental release with introduced plants)

Exotic/Transplant: Exotic