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A NATIVE HYMENOPTERAN PREDATOR OF *AGONOPTERIX ALSTROEMERIANA* (LEPIDOPTERA: OECOPHORIDAE) IN EAST-CENTRAL ILLINOIS

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ABSTRACT

Agonopterix alstroemeriana is a European oecophorid moth that defoliates poison hemlock (*Conium maculatum*), a noxious Eurasian weed extensively naturalized throughout temperate Australia, New Zealand, North America, and South America. Throughout western North America, and increasingly in the Midwest and Northeast, *A. alstroemeriana* has been utilized in poison hemlock eradication programs. We report, for the first time, predation on *A. alstroemeriana* by *Euodynerus foraminatus* (Hymenoptera: Eumenidae), a native solitary wasp that paralyzes these and other lepidopteran larvae and uses them to provision its nests. The presence of an effective predator may reduce the impact of *A. alstroemeriana* in biological control programs.

Agonopterix alstroemeriana (Clarke) is a European oecophorid moth that defoliates poison hemlock (*Conium maculatum*), a noxious Eurasian weed extensively naturalized throughout temperate Australia, New Zealand, North America, and South America (Holm et al. 1979). In North America, *C. maculatum* can be abundant in disturbed habitats such as unmown roadside ditches and railroad rights-of-way (Voss 1985). The whole plant is considered poisonous, laden throughout with relatively high concentrations of piperidine alkaloids and small quantities of furanocoumarins (Panter and Keeler 1989). Due to its rank odor, toxicity to livestock and humans, and invasive character, it is frequently the target of eradication programs.

The only insect herbivore that has been widely reported to feed on poison hemlock in North America is the leaf-roller, *Agonopterix alstroemeriana* (Lepidoptera: Oecophoridae) (Powell and Passoa 1991). In the northwestern and northeastern United States, and increasingly in the Midwest (Berenbaum and Harrison 1994), *A. alstromeriana* can be found defoliating poison hemlock. *A. alstroemeriana* was first reported in east-central Illinois in 1993 (Berenbaum and Harrison 1994). Because of its increasing range, *A. alstroemeriana* has become the biocontrol agent of choice for poison hemlock, and it is widely used as part of poison hemlock eradication programs in California, Montana, Nevada, and Wyoming (Johnson, G. T. [Web Page]. [Accessed 10 July 2000]; Reichenbach R. [Accessed 10 July 2000]; Stevenson, T. [Accessed 10 July 2000]). It is currently being considered for use in eradication pro-

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Table 1. Number of nests with *A. alstroemeriana* larvae and number of larvae (if known) found in each nest. In 1998, trapping began in March and ended in September. In 1999, trapping began in June and ended in September. The data reported for the year 2000 includes only April–July.

Year of collection	# nests with *A. alstroemeriana*	# *A. alstroemeriana* in nests*
1998	3	8, 12, 28
1999	0	0
2000	7	1, 3, 3, 51, 17, 12, 28

*Numbers are approximate because dead larvae often were decaying or otherwise disfigured, and were commonly broken apart when we dissected the nest.

grams in other states (Biological Control of Weeds, Inc., http://www.biocontrol.com/7j.html. [Accessed 10 July 2000]).

Although *A. alstroemeriana* is introduced, many native congeners can be found throughout its range (Hodges 1974). The possibility exists that predators of other *Agonopterix* species have shifted to preying upon *A. alstroemeriana* where it has been introduced, reducing the efficacy of biological control of poison hemlock by *A. alstroemeriana* in those areas.

MATERIALS AND METHODS

We conducted annual surveys of *A. alstroemeriana* from 1997 to 2000 on four local populations of *Conium maculatum* located in and around Urbana (Champaign County, IL); at one additional site, we set out traps for hole-nesting wasps, in order to determine rates of predation on this species. The four populations were the "yard waste" population, located in Urbana on what was previously a landfill (the site is currently used for landscape waste recycling); the "Route 150" population, located approximately 3.5 km east of the eastern city limit of Urbana on Route 150 and within the Penn Central railroad right-of-way; the "ditch" site, located approximately 0.5 km west of Lincoln Avenue along a drainage ditch that intersects Windsor Road; and the "railroad" population, located in the Penn Central right-of-way approximately 0.3 km west of Interstate 57. Each spring in mid-May, 50 plants at each site were selected haphazardly and scored for the number of *A. alstroemeriana* larvae present.

Wasp nest traps were placed at our site at the University of Illinois Phillips Tract (1.6 km. N. of Route 150 on Cottonwood Rd., Champaign County, IL). Trap nests consisted of 20 by 40 by 180 mm blocks of pine with a 1 cm hole drilled lengthwise into them to a depth of 70–80 mm. The nests are designed to attract wasp species that partition natural cavities and provision their grubs with prey (Krombein 1967). Bundles of 4–6 "traps" were placed on 1.5 m metal poles in an old field overgrown with alien grasses, parsnip (*Pastinaca sativa*), blackberries (*Rubus* spp.), Canada thistle (*Cirsium arvense*), clovers (mostly *Melilotus* sp.) and other plants typical of such habitats. The site is adjacent to a prairie reconstruction and remnant dry-mesic forest. Several traps were also placed on mulberry limbs (*Morus alba*) in a neighboring fencerow.

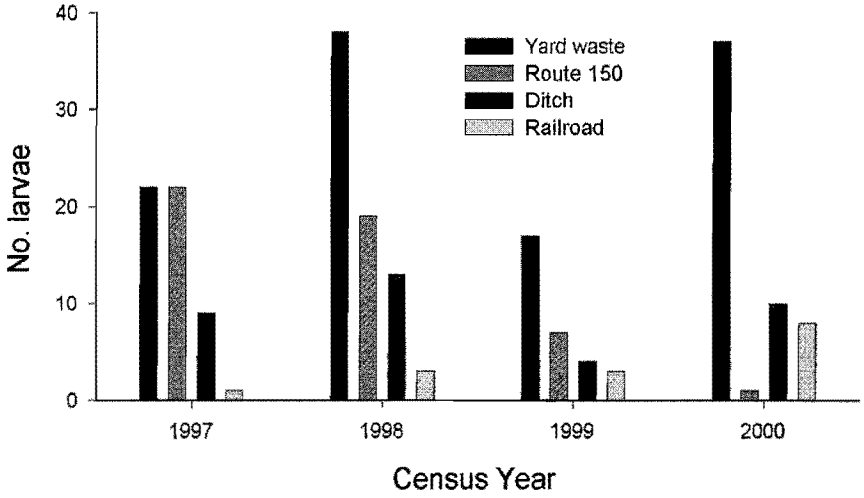

Figure 1. Number of larvae collected from a haphazard sample of 50 plants at each of four sites in Champaign County, IL from 1997 through 2000.

The bundles of trap nests were examined once weekly during the period March–September 1998, June–September 1999, and April-July 2000 for partitioned nests. Provisioned and sealed nests (nests with a thin mud seal at the entrance to the nest hole) were collected and split open in the laboratory to reveal their contents.

RESULTS

In each of the four census years, the amount of damage observed on *C. maculatum* plants in these populations was minimal, and there was no obvious increase in the insect populations over the survey period (Fig. 1). One factor that may be limiting *A. alstroemeriana* populations in central Illinois is predation.

We recovered more than 100 larvae and prepupae of *A. alstroemeriana* from wasp nest traps at our site at the University of Illinois Phillips Tract. Most nests contained from one to eight partitioned compartments of approximately 1 cm length, each separated from the next by a thin brown to white mud barrier. Typically, within each partition we found a single wasp larva and from 3 to 10 paralyzed microlepidopteran larvae or prepupae. Most compartments contained only one species of larva, as did most nests. The first nests were found partitioned in mid-May 1998, early June 1999 (trapping did not begin until June of 1999), and early May 2000. The nests collected in May 1998 and late May and early June 2000 contained large numbers of *A. alstroemeriana*; in fact, more *A. alstroemeriana* were collected in trap nests over the course of the study than any other species of Lepidoptera. In some nests *A. alstroemeriana* was found in only one compartment, and only one to a few individuals were in the nest, but in other nests the entirety of the nest was provisioned with *A. alstroemeriana*. One nest collected 7 June 2000 con-

tained 51 larval and prepupal *A. alstroemeriana*. This was not unusual as other nests collected in 1998 and 2000 contained as many as 28 *A. alstroemeriana*, and no other species of larvae. In several of these nests we found large wasp larvae surrounded by dead, emaciated *A. alstroemeriana*. In May and June of 1998, one of each of the nests found to contain *A. alstroemeriana* was collected in the early morning (ca. 0800 h), at which time the female wasp partitioning the nest had not yet left the nest to begin foraging. These females were identified by Richard Cowan (Western Michigan University) as *Euodynerus foraminatus* (Saussure) (Hymenoptera: Eumenidae). It appears that this wasp was also responsible for the other nests collected because, in three years of collecting trap nests and attempting to capture adult wasps partitioning the nests, no other wasp species was collected or observed making nests with mud-partitioned cells, each with a single wasp larva and multiple lepidopteran larvae. In fact, the only other wasp species observed or collected that used the trap nests made a very different nest without partitions and provided its larvae with tree crickets, which were not identified to species. The nest entrance for this species was sealed with dry grass fibers. Nests of this wasp species were collected only in 1998.

Despite the abundance of *A. alstroemeriana* found in nests of *E. foraminatus*, relatively few poison hemlock plants were found growing nearby. The closest plants were more than 50 m away along a roadside. Very few *A. alstroemeriana* leaf rolls have been observed at this site to date. The extraordinary efficiency with which *E. foraminatus* found and captured *A. alstroemeriana* suggests a specialized hunting mode. Consistent with this suggestion is the fact that *Agonopterix clemensella* (Chambers), a native congener, was found in two nests. Also discovered in wasp traps were other leaf-rolling lepidopterans, including *Dichomeris flavocostella* (Clemens) (Gelechiidae), *Sparganothis* sp. (Tortricidae), and fewer than 10 individuals of other unidentified lepidopteran larvae.

Surprisingly, we found no *Depressaria pastinacella* (Oecophoridae) larvae in the trap nests despite the relative abundance of *D. pastinacella* larvae in the field where the traps were located, and despite a report by D. Cowan (WMU) of finding *D. pastinacella* in trap nests in Michigan (pers. comm.).

Because more *A. alstroemeriana* were found in trap nests partitioned by *E. foraminatus* than any other microlepidopteran, the nesting behavior of *E. foraminatus* has important implications for poison hemlock eradication programs and *A. alstroemeriana* populations in the Midwest.

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LITERATURE CITED

Berenbaum, M. R. and T. L. Harrison. 1994. *Agonopterix alstroemeriana* (Oecophoridae) and other lepidopteran associates of poison hemlock (*Conium maculatum*) in east central Illinois. Great Lakes Entomol. 27: 1–5.

Biological Control of Weeds, Inc. [Web Page]. http://www.bio-control.com/7j.html. [Accessed 10 July 2000].

Hodges, R. W. 1974. Gelechioidea Oecophoridae, pp. 15–42. *In:* R. B. Dominick, D.C. Ferguson, J. G. Franclemont, R. W. Hodges and E. G. Munroe (eds.), The moths of America north of Mexico. Fascicle 6: 2. E. W. Classey, London.

Holm, L., J. V. Pancho, J. P. Herberger and D. L. Plucknett. 1979. A geographical atlas of world weeds. John Wiley and Sons, New York.

Johnson, G. T. [Web Page]. http://128.174.5.51/denix/Public/Library/PRO97/noxweeds.html. [Accessed 10 July 2000].

Krombein, K. V. 1967. Trap-nesting wasps and bees: Life histories, nests, and associates. Smithsonian Press, Washington, D. C.

Panter, K. E. and R. F. Keeler. 1989. Piperidine alkaloids of poison hemlock (*Conium maculatum*), pp. 109–132. *In*: P. R. Cheeke (ed.), Toxicants of plant origin, vol.1. Alkaloids. CRC Press, Boca Raton.

Powell, J. A. and S. Passoa. 1991. Rapid colonization of the western United States by the Palearctic moth, *Agonopterix alstroemeriana* (Oecophoridae). J. Lepid. Soc. 45: 234–236.

Reichenbach R. [Web Page]. http://www.uwyo.edu/ag/psisci/newsletter/arts/Vol1_3/hemlock.htm. [Accessed 10 July 2000].

Stevenson, T., [Web Page]. http://www.extension.unr.edu/Weeds/Biolcontrol.html. [Accessed 10 July 2000].

Voss, E. G. 1985. Michigan flora—Part II. Dicots (Saururaceae-Cornaceae). Cranbrook Institute of Science and University of Michigan Herbarium, Ann Arbor, MI.