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***Aphthona cyparissiae*, a new flea beetle for leafy spurge control in the United States**

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Aphthona cyparissiae (Koch) (Coleoptera: Chrysomelidae), a flea beetle, is one of the many *Aphthona* species which attack *Euphorbia* species in Europe and Asia. Like other *Aphthona* species, the adults of *A. cyparissiae* feed on host leaves, while the larvae feed upon the root hairs and within the roots. *A. cyparissiae* is native to Spain through central and eastern Europe to Russia. It has been recorded to feed on *Euphorbia cyprissias* L., *E. esula* L., *E. helioscopia* L., *E. pannonica* Host, *E. seguierana* Necker and *E. virgata* Waldst. and Kit. (Sommer and Maw 1982). The beetle has a single generation each year.

This insect was first evaluated as a biological control candidate for leafy spurge (*Euphorbia esula*) by G. Sommer and E. Maw at the Commonwealth Institute of Biological in Delemont, Switzerland¹ (Sommer and Maw 1982). Their research demonstrated that *A. cyparissiae* was specific to plant species belonging to the genus *Euphorbia*. This work provided the basis on which the insect was approved for release in Canada (McClay and Harris 1984) and imported into our USDA, Albany, California quarantine for additional testing.

More research was required because of the large number of nontarget native *Euphorbia* species in the United States that could become host plants for introduced leafy spurge biological control agents with broad host specificity ranges. Canada has only 8 native *Euphorbia* species, none of which are rare, whereas the United States has 113 species of *Euphorbia*² (USDA 1982), including 2 rare species that are legally protected, and 9 others that are under review for protected status (USDI 1985). The host plant specificity research at Albany enables us to detect and select among the *Euphorbia* feeding insects those species which will attack the various forms of leafy spurge but not most of the native species (Pemberton, in press). *Aphthona cyparissiae* was tested against 10 native *Euphorbia* species, selected to represent the various subgenera occurring in North America. The test plants used (Table I) included species which are weedy, ornamental, rare, sympatric with leafy spurge and those that could carry the insects around the country (bridges).

¹ The Sommer and Maw research was funded by the Canada Department of Agriculture and to a lesser degree by the United States Department of Agriculture.

² Includes the postrate subgenus *chamaesyce* species which are considered to be genus *Chamaesyce* species in some taxonomic treatments.

The measures of host plant acceptability that were studied were adult feeding, oviposition and longevity. Table II summarizes the results. In these tests, *A. cyparissiae* was restricted to species belonging to the subgenus *esula*, the group to which leafy spurge belongs. Within this subgenus, *Euphorbia incisa* Engelm., *E. robusta*, (Engelm.) Small and the control (leafy spurge) were suitable for oviposition, while the rare species *E. purpurea* (Raf.) Fernald and *E. telephiodes* (Chapm.) were not. This research allows the prediction that 9 or fewer of the perennial subgenus *esula* *Euphorbia* species native to the United States could be potential host plants of *A. cyparissiae*, if it were able to colonize the entire country. This level of risk was acceptable to the Federal Working Group on Biological Control of Weeds, which approved the beetle's release in the United States.

Table I. Native euphorbias used in host specificity testing for *Aphthona cyparissiae*.

Species	Habit	Subgenus	Sympatric with leafy spurge	Potential bridge	Endangered species	Weed	Ornamental
<i>Euphorbia heterophylla</i>	Ann.	Poinsettia	X	X		X	X
<i>E. maculata</i>	Ann.	Chamaesyce	X	X		X	
<i>E. serpyllifolia</i>	Ann.	Chamaesyce	X	X			
<i>E. robusta</i>	Peren.	Esula section <i>esula</i>	X	X			
<i>E. spatulata</i>	Ann.	Esula section <i>galarrhoei</i>	X	X			
<i>E. purpurea</i>	Peren.	Esula section not placed	X			X	
<i>E. telephioides</i>	Peren.	Esula section <i>ipeccacuahae</i>				X	
<i>E. incisa</i>	Peren.	Esula section <i>esula</i>	possibly				
<i>E. marginata</i>	Ann.	Agaloma	X	X			X
<i>E. corollata</i>	Peren.	Agaloma	X	X			X

The first release of *A. cyparissiae* in the United States was made in Fremont County, Wyoming during July 1986 by J. Littlefield (University of Wyoming, Laramie), L. Baker (Fremont County Weed and Pest District) and myself (RWP). Subsequent releases were made during August in Crook County, Wyoming, by J. Littlefield and in Barnes County, North Dakota by R. Carlson and D. Mundal (University of North Dakota, Fargo). The beetles that were released were collected in Austria from *Euphorbia cyparissias* by P. Pecora and L. Fornasari (USDA, Biological Control of Weeds Laboratory, Rome, Italy). These beetles were then screened in our Albany quarantine prior to release. This entailed setting up pairs of adult beetles on bouquets of leafy spurge shoots. Each pair was observed for normal leaf feeding and egg laying before being shipped for field release. Con-

firmation of the identity of *A. cyparissiae* was made by M. Biondi (Institute of Zoology, Rome, Italy) and R. White (USDA, Smithsonian National Museum, Washington, D. C.).

Table II. Summary of *Aphthona cyparissiae* host plant specificity testing on native North American *Euphorbia* species, Albany 1985.

Test Plant Species	Subgenus	% of plants with adult feeding	% of plants supporting oviposition	% of adults living 1 mo. or longer
<i>Euphorbia esula</i> (Control)	Esula	100	100	75
<i>Euphorbia incisa</i>	Esula.	100	100	60
<i>Euphorbia robusta</i>	Esula	80	80	70
<i>Euphorbia purpurea</i>	Esula	60	0	10
<i>Euphorbia telephioides</i>	Esula	40	0	0
<i>Euphorbia spatulata</i>	Esula	10	0	0
<i>Euphorbia maculata</i>	Chamaesyce	0	0	0
<i>Euphorbia serpyllifolia</i>	Chamaesyce	0	0	0
<i>Euphorbia corollata</i>	Agaloma	0	0	0
<i>Euphorbia marginata</i>	Agaloma	0	0	0
<i>Euphorbia heterophylla</i>	Poinsettia	0	0	0

Since *A. cyparissiae* has successfully overwintered in Saskatchewan, Canada (McClay and Harris 1984), it appears to have sufficient cold tolerance to establish in the United States. Through its root feeding, this beetle could limit the ability of the plants to absorb water, inducing water stress and reduced vigor. *A. cyparissiae* is the second *Aphthona* species to be released in the United States. The first, *A. flava* Guill., was first released in 1985 (Pemberton and Johnson 1986) and again this summer. In Europe, *A. cyparissiae* has a more northern distribution than *A. flava* (Sommer and Maw. 1982), which suggests that it may do better in colder areas. *A. cyparissiae* may also do better than *A. flava* on drier sites (suggested by data from Maw 1981). A third species, *Aphthona czwalinae* Koch, has been under study in Albany and may be cleared for release in 1987. It appears to prefer moister sites than either *A. flava* or *A. cyparissiae* (interpreted from data in Maw 1981). The introduction of a complex of *Aphthona* species should increase our chances of controlling leafy spurge in the diverse habitat it infests.

The *Aphthona* species have been selected for use because they damage the absorptive roots of leafy spurge. Additional insects, that attack other parts of the plant, have also been introduced. *Oberea erythrocephala* (Schrank) (Cerambycidae) which bores the stems and larger roots, and *Hyles euphorbia* (L.), which eats the leaves and flowers, have been established in Montana (Rees *et al.* 1986). A gall midge, *Dasineura (Bayeria) capitigena* (Bremi), that attacks the growing shoots, was first released in 1985 and again this year 1986 (Pemberton and Johnson 1986). Other gall midges and leaf feeding Lepidoptera are under study.

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