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Two new insects (*Dasineura capitigena* and *Aphthona flava*) for leafy spurge control in United States¹

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During the past year we have completed the host plant specificity testing, obtained governmental clearances for importation, and have begun releases of two new insects for the biological control of leafy spurge (*Euphorbia esula* complex).

Aphthona flava (Coleoptera: Chrysomelidae), a flea beetle, is one of the many *Aphthona* species which attack *Euphorbia* species in Europe. Like the other *Aphthona* species, the adults of *A. flava* feed on the leaves of their host plants, while the larvae feed on the root hairs and within the roots (Maw 1981). This insect was first evaluated as a biological control candidate for leafy spurge by G. Sommer and E. Maw at the Commonwealth Institute of Biological Control in Delemont, Switzerland¹. This research demonstrated that the beetle was specific to species belonging to the genus *Euphorbia* (Sommer and Maw 1982) and provided the basis on which the insect was released in Canada and imported to our laboratory in Albany, California for additional testing. Additional tests were required due to the large number of non-target testing. Additional tests were required due to the large number of non-target native *Euphorbia* species in the United States, which could become hosts of the biological control agents. Canada has only eight native *Euphorbia* species, none of which are rare, whereas the United States has 113 species of *Euphorbia* and *Chamaesyce* species (USDA 1982) including 9 rare and endangered species (USDI, FWS 1980, 1983). Selective testing enables us to predict what the host plant range, within the *Euphorbia* and *Chamaesyce* groups, of an insect could become if it was released into the United States. Our goal is to select among the genus level specialists, insect species which will attack the various forms of leafy spurge, but not most native species (Pemberton, in press). This approach appears to be quite possible, since many of the insects tested have the desired level of host plant specificity.

Aphthona flava was tested against 12 native *Euphorbia* species selected to represent the various subgenera occurring in North America. Native test plants also included species which are sympatric with leafy spurge, widespread species which could potentially carry the biological control agents around the country and onto rare species (i.e., bridging

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species), species which have ornamental or weedy characteristics, and lastly two species which are rare and closely related to leafy spurge.

Of these, *A. flava* was only able to complete its life cycle on some subgenus *Esula* species (4 of the 6 tested). The *Esula* subgenus contains 21 species of which 11 are perennials, a condition thought to be necessary in a host plant of this univoltine root-feeder. These 11 perennial species include two rare species (*Euphorbia purpurea* and *E. telephiodes*) which were tested, but also failed to support the full life cycle of *A. flava*. This host specificity testing allows the prediction that not more than 9 subgenus *Esula* species (countrywide) may become host plants for this flea beetle (Pemberton and Johnson, 1984). This level of risks was acceptable to the Federal Working Group on Biological Control of Weeds, which approved the beetle's release in the United States.

Releases of *A. flava* began in mid-July 1985 and continued through August in and near Bozeman, Montana by Norm Rees (USDA-ARS, Bozeman) and myself (RWP) and in Glacier National Park by Maura Longden and Dave Lange (National Park Service, Glacier). These *A. flava* were collected in northern Italy from *Euphorbia esula* by P. Pecora and then held in the USDA Albany quarantine to observe normal feeding, mating, and oviposition on leafy spurge before being released. Since *A. flava* has successfully overwintered at Canadian release sites in Saskatchewan and Alberta (McClay and Harris 1984), we are optimistic that it will establish in the United States. We hope that *A. flava* will, through its root-feeding, reduce the ability of leafy spurge to absorb water, thereby inducing stress and reduced vigor. *A. flava* is the first of several *Aphthona* species under study by Albany to be cleared and released in the United States. A second species, *A. cyparissiae*, may be ready for use in 1986.

Dasineura capitigena (Bremi) (*Bayeria capitigena*) is a gall midge (Diptera: Cecidomyiidae) which attacks the meristematic shoot tips of leafy spurge. It is widely distributed in Europe where it uses eight species of *Euphorbia* as host plants. This insect is multivoltine and is thought to have as many as five generations per season in northern Italy (Pecora 1983). Shoots which are galled usually fail to produce flowers and seed.

D. capitigena was studied as a biological control candidate and demonstrated to be host specific to the genus *Euphorbia* by Pasquale Pecora of the USDA's Rome Biological Control of Weeds Laboratory (Pecora 1983). This research allowed us to bring the midge into our quarantine laboratory for testing against 12 representative native *Euphorbia* species. Its predicted host range was found to be similar to that of *Aphthona flava*, in that it is restricted to subgenus *Esula* species. It also failed to use the rare subgenus *Esula* species *E. telephiodes* and *E. purpurea*. Unlike *A. flava*, it can use (in laboratory testing) annual species of the subgenus *Esula*. From our tests we predict that should *D. capitigena* become established throughout the United States (an unlikely event) it could potentially utilize 19 or fewer subgenus *Esula Euphorbia* species (Pemberton and Johnson 1984b). This level of risks was acceptable to the Federal Working Group of Biological Control who approved release.

The first releases of this midge in North America were made during a two-week period in June 1985 in Bozeman and Clyde Park, Montana, with Norm Reese and Noa Poritz, and in Glacier National Park, Montana, with the help of Dave Lange and Maura Longden. The released *D. capitigena* originated from parent material collected from *Eu-*

phorbia esula in northern Italy by P. Pecora. The extreme dryness of the season caused most of the eggs to desiccate before they were able to hatch. A few galls were found, indicating the midge's ability to use Montana leafy spurge in the field. Whether sufficient numbers of galls were formed to allow establishment and what the ability of the insect to over winter is, are unknown. We will release more midges next season (1986) and hope for less severe weather conditions. Through the use of *D. capitigena*, we hope to reduce the reproduction and spread of leafy spurge.

Another *Dasinuera* species (*D. capsulae*) has been under study by Pasquale Pecora in Rome. It galls the individual flowers within the inflorescences of leafy spurge plants. We expect to begin research in Albany on this midge during the next year (1986).

These insects and the others previously established in the United States by the USDA (*Hyles euphorbiae* and *Oberea erythrocephala*) will hopefully combine to produce sufficient stress to control leafy spurge. Despite the recognition that biological control of leafy spurge is a difficult proposition, we are optimistic in this undertaking because of the number of highly specialized insects likely to be available to us.

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