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Status of screening activities for new insect and pathogen natural enemies of leafy spurge

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Leafy spurge, *Euphorbia esula* (L.) is an aggressive perennial weed that currently infests over one-half million acres in Montana alone and threatens countless more (Lacey, *et al.*, 1985). The weed's extensive underground root system, high capacity for vegetative reproduction, and prolific seed production allow it to effectively out-compete many desirable forbs and grasses (Nowierski and Harvey 1988). Leafy spurge has been found to reduce forage production, wildlife habitat, and cause extensive monetary losses to the livestock industry (Derscheid and Wrage 1972, Lacey, *et al.*, 1985, Messersmith and Lym 1983, Reilly and Kaufman 1979, Selleck 1962, and Watson 1985). Each year, leafy spurge costs the cattle industry of Montana an estimated \$1.4 million loss in forage production, plus \$2.5 million for chemical control (Lacey *et al.*, 1985).

Control of leafy spurge using conventional management approaches has not been satisfactory (Watson 1985). The plant's extensive and persistent root system enables it to survive and spread despite repeated chemical treatments and tillage operations, and it occurs where limited economic returns restrict the amount of money which can be justified for spurge control (Watson 1985). Thus, more cost-effective methods of weed management, such as biological control, are currently being developed for the management of extensive infestations of the weed on rangelands of low economic return.

In this paper, I report on the status of new insect and pathogen natural enemies of leafy spurge, currently undergoing screening by: Agriculture Canada, Regina, Saskatchewan, Canada; the USDA-ARS (Biological Control of Weeds Laboratory, Rome, Italy; Rangeland Weeds Laboratory, Bozeman, MT); and the Commonwealth Institute of Biological Control (CIBC), Delemont, Switzerland.

Funding of the screening effort has been provided by the Leafy Spurge Consortium (LSC: Agriculture Canada; Canada National Defense, Manitoba; Montana Department of Agriculture [MDA]; and North Dakota Department of Agriculture); Alberta, Canada; USDA-ARS; and USDA-APHIS-PPQ. Table 1 provides a summary of the leafy spurge insects and plant pathogens currently undergoing screening for release in Canada and the U.S.

Table 1. Natural enemies of leafy spurge currently undergoing screening by CIBC and USDA-ARS.

Species	Funding Source(s)	Completion Date
<i>Pegomya curticornis</i> - root boring fly	Alberta MDA, APHIS	1991
<i>Dasineura</i> sp. - flower gall midge	USDA-ARS	1990?
<i>Chamaesphecia crassiformia</i> - root boring moth	LSC	1992
<i>Chamaesphecia hungarica</i> - root boring moth	LSC	1989
<i>Lobesia euphorbiana</i> - leaf tying moth	Agric. Can.	?
<i>Minoa murinata</i> - defoliating moth	Agric. Can.	?
<i>Oxycesta geographica</i> - defoliating moth	LSC, USDA-ARS	1989
<i>Simyra dentosa</i> - defoliating moth	USDA-ARS	?
<i>Acyrtosiphon cyparissiae</i> - leaf aphid	Agric. Can.	1989
<i>Aphis esulae</i> - stem aphid	Agric. Can.	1989
<i>Aphthona abdominalis</i> - flea beetle	USDA-ARS	?
<i>Aphthona lacertosa</i> - flea beetle	LSC	1989
<i>Eurytoma euphorbiae</i> - seed gall wasp	LSC, USDA-ARS	1994
<i>Uromyces</i> sp. - systemic rust	USDA-ARS, LSC	?

One of the most promising early season natural enemies of leafy spurge is the root-boring fly, *Pegomya curticornis*. This insect emerges in early spring and attacks leafy spurge shoots while the night temperatures are still below freezing. Feeding from the fly larvae kills individual stems and weakens the plant (Harris 1989a). The fly failed to establish on spurge from Canadian releases in 1988, but apparently bred successfully on leafy spurge near Regina, Saskatchewan in 1989 (Harris 1989ab).

Although *P. curticornis* is approved for release in Canada, additional host plant testing will be required before approval to release in the U.S. is granted by the Technical Advisory Group (TAG), a regulatory group under the auspices of the Animal Plant Health Inspection Service (APHIS). Initial screening of this fly for release in Canada was funded by Alberta. Additional host plant testing for release of the fly in the U.S. will be conducted by CIBC, with funds provided by MDA and APHIS.

A second fly species is currently undergoing screening by USDA-ARS. As the name implies, larvae of the flower gall midge, *Dasineura* sp. form galls in the flower-producing region of leafy spurge. The fly appears to be part of a species complex (Gagne 1989). Additional taxonomic studies and screening tests may be necessary before approval to release the fly in Canada and the U.S. is granted by TAG.

Six moth species are also being considered for release against leafy spurge in the U.S. These include: two root-boring moths, *Chamaesphecia crassiformia* and *Chamaesphecia hungarica*; one leaf-tying moth, *Lobesia euphorbiana*, and three defoliating moths, *Minoa murinata*, *Oxycesta geographica*, and *Simyra dentosa*.

Larvae of *C. crassiformia* and *C. hungarica* mine the root system of leafy spurge. Screening of these two insects by CIBC is expected to be completed by 1992 and 1989, respectively via funding by the LSC.

Larvae of the leaf-tying moth, *L. euphoriana* tie the terminal leaves of leafy spurge together and feed within. This insect was approved for release in Canada, and success-

fully reared in a field cage in Regina. However, the insect has yet to establish in the field (Harris 1989a).

Funding for the initial screening of this insect was provided by Agriculture Canada. Additional host specificity testing will be required before approval to release this insect against leafy spurge in the U.S. is granted. Preliminary results suggest that the moth's host range may be too broad to justify release of the insect in the U.S. at present.

The defoliating moth, *Minoa murinata* was screened by Agriculture Canada and first released in 1988, however establishment has not yet been observed in the field (Harris 1989a). Canadian provinces targeted for release in 1989 included Saskatchewan, Manitoba, Ontario, and British Columbia. Additional host specificity testing possibly will be required before approval for release in the U.S. is granted.

The second defoliating moth or webworm, *Oxycesta geographica* is currently undergoing screening by CIBC. Host specificity testing, funded by the LSC and USDA-ARS is scheduled to be completed in 1989. Larvae of this insect form a web on the leafy spurge plant and feed on the foliage within.

The third defoliating moth, *Simyra dentosa* is currently being screened by USDA-ARS. Larvae of the moth feed on leaves of leafy spurge. The time frame for completion of the host specificity testing of this insect has yet to be determined.

Two aphid species, *Acyrtosiphon cyparissiae* and *Aphis esulae*, are currently being screened by CIBC via funds provided by Agriculture Canada. *A. cyparissiae* feeds on the leaves of leafy spurge, while *A. esulae* feeds on the stems. Host specificity testing for both aphid species is scheduled to be completed in 1989.

To date the flea beetle, *Aphthona nigriscutis*, screened by Agriculture Canada, has been the only insect to demonstrate the ability to affect leafy spurge density. Since the beetles release in 1983, spurge biomass (near the original release sites) at a number of locations in Canada has declined and grass biomass has increased (Sturko pers. comm. 1989). Approval for release of this insect in the U.S. was granted by TAG in 1989, and numerous releases were made in the U.S. by USDA-ARS, USDA-APHIS, and University personnel.

Two additional flea beetles are currently being screened for release against leafy spurge in the U.S. and Canada. These include *Aphthona abdominalis* and *Aphthona lacertosa*. Adults of the flea beetles feed on the foliage, while the larvae feed on the roots.

A. abdominalis is currently being screened by USDA-ARS, however a timetable for completion of the screening has not yet been determined. CIBC is conducting the host specificity testing of *A. lacertosa*, via funding provided by the LSC. It is anticipated that the screening of this insect will be completed in 1989.

The seed gall wasp, *Eurytoma euphorbiae*, screened initially by CIBC, is currently undergoing host specificity testing by USDA-ARS. Screening of this insect is scheduled to be completed in 1994. Funding for the screening effort has been provided by the LSC and USDA.

The systemic rust, *Uromyces* sp. is a promising and extremely host specific complex of rust species that have good potential for damaging leafy spurge in North America. This complex of fungi typically causes premature shoot death in leafy spurge and effectively shuts down seed production in infected shoots. Initial biological research on *Uromyces* sp. was conducted by the Institute fur Phytomedizin, Zurich, Switzerland via funds from the USDA-ARS. Additional taxonomic studies and host specificity testing will be necessary before approval to release this rust(s) in North America is granted. Taxonomic studies and screening tests are currently being conducted by CIBC via funds provided by the LSC.

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