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## Exotic insects for leafy spurge control

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### Introduction

Leafy spurge is a noxious long-lived weed on the Great Plains of the United States and the Prairie Provinces of Canada. New infestations are continuously occurring throughout the United States with the major economic impact in the northern Great Plains. A recent study by North Dakota State University estimated the cost of leafy spurge to the economics of Montana, North Dakota, South Dakota, and Wyoming will be \$144,350,000 per year by 1995. Chemical control, which is only partially effective, is expensive and not suitable for many leafy spurge infestation sites (i.e. shelter belts, land with high water tables, and near open water). Cattle cannot use leafy spurge infested rangeland.

In its native habitat of Europe and Asia, naturally occurring enemies prevent leafy spurge from becoming a problem. Importation and use of highly host specific Eurasian insects on the northern Great Plains offers considerable potential for leafy spurge control without risk to wildlife, endangered plants, or water resources.

Twelve species of Eurasian insect biocontrol agents, which selectively attack leafy spurge, have been cleared by federal, state and Canadian agencies for release to control leafy spurge in the United States. These insects have dramatically reduced weed numbers at several experimental research sites in the United States and Canada.

The USDA/ARS Biocontrol of Weeds Research Unit in Sidney, Montana has established research sites in Montana and North Dakota to study the establishment and population dynamics of introduced flea beetles in the genus *Aphthona*. The comparatively fast developing flea beetles have stimulated interest in the biocontrol of leafy spurge and shown biological controls capabilities. Other introduced species such as *Oberea erythrocephala* and *Chamaesphecia* spp. may have an important impact on the control program,

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but it is still too early to make that judgment. All insect introductions are of species whose lives are linked to their host, leafy spurge, and will never become a problem.

## The insects

***Hyles euphorbiae***. The leafy spurge hawk moth species was first introduced into the United States in 1964. The hawk moth larvae feed on leafy spurge foliage, however an insect virus associated with the species has prevented it from reaching high population levels. It is not known whether the moth was introduced with the virus or was infected in North America. The impact on the plant from the larval foliage feeding appears to be minimal. Adult hawk moths are strong flyers and are known to cover long distances. *Hyles euphorbiae* may become widely distributed and over a period of years may impact leafy spurge in conjunction with other biocontrol agents.

***Chamaesphecia tenthrediniformis***. The larvae of this clear-wing moth bore into the roots of leafy spurge. This species was introduced in 1975 and is not thought to have established due to its high degree of specificity and the lack of the host biotype in North America (at least at sites where *C. tenthrediniformis* were released).

***Oberea erythrocephala***. This leafy spurge long horned beetle is well established in Montana. First released in 1980, it has taken approximately ten years to develop a damaging population. The best known release site is along a river in Stillwater Co., Montana. This species is thought to require a leafy spurge stem diameter of 2.5 mm or more to successfully invade a plant. Many of the leafy spurge plants in the area of the *Oberea* infestation fit this stem diameter restriction. I believe habitats producing spurge of this stem diameter are limited, but the beetle fits into an important niche for wide area leafy spurge control by a variety of introduced biocontrol agents.

***Spurgia esula***. This leafy spurge gall fly is well established in North Dakota and to a lesser extent in Montana. It is effective in reducing seed production; however, a native parasite in North Dakota builds up after the first generation in the spring and reduces the effectiveness of the biocontrol agent. Reduction in the production of leafy spurge seeds will assist the overall control program and reduce the competitive advantage of the plant. Vegetative reproduction will continue to spread the weed, at a somewhat reduced rate where *S. esula* is active.

***Aphthona flava***. First released in the United States in 1985, populations in the U.S. and Canada have multiplied at numerous sites. We are only now beginning to understand the niche requirements of this species. Where it has developed high populations, *A. flava* is a good control agent, reducing spurge to a few short stems. Many thousands of the beetles have been collected from Canada and a site near Bozeman, Montana for redistribution.

***Aphthona cyparissiae***. Released in the United States in 1986, this species has established at many sites in several states. The premier site is in Saskatchewan, Canada, located about 70 miles north and east of Plentywood, Montana. Here, *A. cyparissiae* has reduced leafy spurge from a large area and has increased in numbers and spread to all neighboring leafy spurge infestations. The figure below shows the data gathered on char-

acteristics of sites where *A. cyparissiae* has developed good colonies. Place new sites where leafy spurge average height is 50 cm or more.

***Aphthona czwalinae***. Released in 1987, it is now established in Montana and North Dakota. Because of a mix-up in identifications, a mixed population of *A. czwalinae* and *A. lacertosa* exists in eastern North Dakota. I have not seen the release sites in North Dakota and thus do not know the degree to which the two species are mixed. In the future, *A. czwalinae* and *A. lacertosa* may well occupy an extensive area of leafy spurge infestations as the plant moves eastern into the higher rainfall areas in Minnesota and Wisconsin. It is still too early to predict the best habitat for *A. czwalinae*. We may not have yet placed *A. czwalinae* where it will do best. *A. lacertosa* appears to be the more abundant species where the two occur together.

***Aphthona nigriscutis***. This flea beetle has increased in numbers and controls leafy spurge at limited sites in Canada and the United States. It is well adapted to the dryer portions on the northern Great Plains. *A. nigriscutis* has been established on sites with a variety of soil types in Montana and North Dakota (see figure below). This species prefers sites where leafy spurge plants are 30-45 cm tall and with a density in the range of 150 - 200 plants per square meter. These preferences are restrictive; however, many sites with these conditions occur on the northern Great Plains. Multiple biocontrol agents will probably be required to gain leafy spurge control from the top of the hill to bottoms of ravines.

***Aphthona lacertosa***. This black flea beetle cleared in 1993 is already well established in North Dakota and in Canada. This species seems to prefer sites where the grass can grow taller than the spurge. It may act as an important control agent where the rainfall is >400 mm.

***Dasineura nr. capitigena***. Gall fly cleared for release in the United States in 1991, this species has not been released. It is expected to reduce leafy spurge seed production in a manner similar to *S. esula*.

***Aphthona abdominalis***. Small multi-voltine flea beetles first released in 1993. It will take several years to determine if it will establish in the United States and impact leafy spurge abundance.

***Chamaesphecia hungarica***. Clear-winged moth cleared and released in 1993. It will be some years before establishment can be confirmed and impact assessed.

## Summary

The biological control of leafy spurge research program has provided the foundation on which wide area control will occur in both the United States and Canada. This research program has been conducted by The Agricultural Research Service of the U.S. Department of Agriculture and Agriculture Canada. The introduced biocontrol agents, coupled with new potential agents being tested by the ARS in France and the IIBC in Switzerland will have a major impact on leafy spurge abundance in North America. Dr. Peter Harris and I believe much of the concerns about the weediness of leafy spurge will be reduced in the next 10-15 years. We will not have eliminated leafy spurge within the

period, but the impact of biocontrol and the resultant reduction in the plants weediness will turn weed concerns to other plant problems. It would be worthwhile at this time in the research program to look in Eurasia for additional *Aphthona* species occurring in a wide range of habitats (from xeric to mesic sites and shady area). The momentum of foreign exploration and testing should be continued now with the interest in the United States and Canada. Farmers and ranchers see the potential of biological control. The support for the program has been gratifying from this group and from federal and state land managers.