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Imported insect establishment for leafy spurge (*Euphorbia esula*) control

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Abstract:

Leafy spurge is a noxious perennial weed of Eurasian origin. It is a major rangeland problem on the northern Great Plains of the United States and in the prairie provinces of Canada. Because it is an introduced plant, leafy spurge has no native natural enemies. Twelve host specific insect species have been imported from Europe to the United States for leafy spurge control. Due to the limited stand of leafy spurge and closely related species in western Europe and Eurasia, there is limited habitat information for the introduced species. Biological control may eliminate much of the concerns about the weediness of leafy spurge 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 plant's weediness will turn weed concerns to other plant problems.

Nomenclature:

Leafy spurge, *Euphorbia esula* L. #¹ EPHEs; Cypress spurge, *Euphorbia cyparissias* # EPHCY.

Additional index words:

Aphthona, biological control of weeds, weeds, herbivory.

¹ Letters following this symbol are a WSSA-approved computer code from *Composite List of Weeds*, Revised 1989. Available from WSSA, 1508 West University Ave., Champaign, IL 61821-3133.

Introduction

Leafy spurge is a noxious perennial weed in the Great Plains region of the United States and in the prairie provinces of Canada. It is a nonnative plant and was not known in the United States until 1827 (Thompson et. al., 1990). Because it is an introduced plant, leafy spurge has no native natural enemies. The plant is primarily found in non-tilled agricultural land (pasture, rangeland, hayland and idle cropland), but it is also found along roadsides, river banks, flood plains, ridges and mountain slopes (Bangsund, et. al., 1991). This noxious weed restricts native plant growth and is not eaten by cattle unless it is given to them in weedy hay or if no other forage is available (Rees and Spencer, 1991). Leafy spurge also produces a toxic latex. This latex causes scours and blisters in cattle, and in large amounts, death. In humans, it causes dermatitis and blisters, and overexposure may lead to blindness. For these reasons, leafy spurge is a serious problem to farmers and ranchers. The greatest infestations are located in Montana, North Dakota, South Dakota and Wyoming. The total negative economic impacts in these four states could reach over \$144 million annually by 1995 (Bangsund, et. al., 1991). This noxious weed costs infested states millions of dollars each year in lost grazing, farming, and recreational pursuits. Due to the cost of herbicides and the threat they pose to the environment, an urgent need has developed to find alternative control methods.

Some insect species within the area of origin of leafy spurge have co-evolved with the plant so as to become dependent on leafy spurge for food and shelter (Rees and Spencer, 1991). This inter-relationship between plant and predator has facilitated the selection of biotic organisms as biocontrol agents for leafy spurge. In Europe, there are 105 native *Euphorbia* species in the subgenus *Esula*, the group to which leafy spurge belongs. In North America, there are only 21 native species in this subgenus (Pemberton, 1985). This disparity in numbers provides the framework for biological control, namely, the importation from Europe of biotic agents which have evolved the ability to use leafy spurge as a host. In many cases, the evolved specialization has resulted in host specificity; feeding limited to only one, or a few closely related species (Rees and Spencer, 1991).

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 control's capabilities. Other introduced species such as *Oberea erythrocephala* and *Chamaesphecia* spp. may have an important impact on the control program, 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 *not transfer to other plant species*.

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 been a factor in preventing this species from reaching high population levels. It is not known whether the moth was introduced with the virus or became 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 bores 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 80 mm or more to successfully invade a plant. Many of the leafy spurge plants in the area of the *Oberea* infestations 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

The leafy spurge gall fly is well established in North Dakota and to a lesser extent in other states. It is effective in reducing seed production. 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 beginning to understand the niche requirements of

this species. *A. flava* is a good control agent where it has developed high populations, reducing spurge to a few short stems. Many thousands of the beetles have been collected for re-distribution from Canada and a site near Bozeman, Montana. Native flea beetle species in the genus *Aphthona* (Coleoptera: Chrysomelidae) are recorded from North America but not recorded from leafy spurge. The genus is cosmopolitan in distribution, although the Nearctic fauna is depauperate. Numerous species are found in Europe and Asia feeding on leafy spurge and cypress spurge (*Euphorbia cyparissiae* L.). Adult flea beetles feed on leafy spurge leaves and bracts, while the larvae feed on the root hairs and larger roots.

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, U.S.A. Here, *A. cyparissiae* has reduced a leafy spurge infestation covering several hundred acres. The insects have increased in numbers and spread to neighboring leafy spurge infestations.

Aphthona czwalinae

Released in 1987, it is now established in Montana and North Dakota. Because of a confusion in identifications, a mixed population of *A. czwalinae* and *A. lacertosa* exists in eastern North Dakota. 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 released it where it will do best.

Aphthona nigriscutis

This flea beetle has increased in numbers and controls leafy spurge at 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. 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 similar manner to *S. esula*.

Aphthona abdominalis

Small multivoltine 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 US 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 (Agriculture Agri-Foods Canada) 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 plant's 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 with the program 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 as well as from federal and state land managers.

Literature cited

1. Bangsund, Dean A. and Larry Leistriz. 1991. [Economic impact of leafy spurge in Montana, South Dakota, and Wyoming](#). Agric. Econ. Report 275, Dept. of Agric. Econ. NDSU, Fargo, ND.
2. Pemberton, R. W. 1985. [Native plant considerations in the biological control of leafy spurge](#). In Delfosse, E. S. (ed.), Proc. VI, Int. Symp. Biol. Contr. Weeds, Vancouver, Canada 365-90.
3. Rees, N. and Neal R. Spencer. 1990. The biological control of leafy spurge. in Lynn James ed. Proceeding of the National Noxious Rangeland Weed Conference.
4. Thompson, F., J. A. Leitch, and F. L. Leistriz. 1990. Economic impact of leafy spurge in North Dakota. Agric. Econ. Report 257, Dept. of Agric. Econ. NDSU, Fargo, ND.