

# The Potential for Biological Control of Leafy Spurge

R. B. CARLSON AND L. J. LITTLEFIELD

The use of insects or plant pathogens to control certain weeds has been demonstrated to be effective. When embarking on a weed control effort using insects or disease-causing organisms, some specific criteria must be met, and there are no guarantees of success. Manipulation of plant and animal communities in nature is a difficult undertaking at best. The risks of failure are high but the potential economic return, when a program is successful, warrants vigorous efforts toward achieving biological control solutions to persistent noxious weed problems.

## Potential for Biological Control

Leafy spurge — as a candidate weed for biological control — has some features that generate optimism about the potential for success and other features that generate pessimism. On the optimistic side, leafy spurge is not a serious problem in its native habitat in Europe, which suggests that environmental factors must be holding it in check. This is in direct contrast with the extremely successful establishment and spread of the plant in the undisturbed grazing lands of the Great Plains. This success in the U.S. over a wide range of habitats would seem to rule against physical features of the environment as being the limiting factors in Europe. The biological factors — insects, diseases and perhaps competitive plants — are the most likely reasons that leafy spurge is not a problem in its native habitats. Searching for and importing biological control agents from the native habitats and releasing these agents on stands of leafy spurge in this country therefore would seem promising.

On the pessimistic side, leafy spurge is a very hardy and versatile plant that can reproduce and spread by both vegetative growth and seed dispersal. Simple destruction of the topgrowth, whether by physical, chemical or biological means, will not effectively stop the spread of the plant unless the destruction is continuous over several years. The latex produced by the plant probably is a defensive mechanism for inhibition of insect feeding by all species except those specifically adapted to overcome this defense. The growth habits of the spurge plant present another point of difficulty. It is

one of the first plant species to emerge in the spring, and considerable growth can occur before the weather in the Northern Great Plains is conducive to most insect activity. The young growth, a stage that is most susceptible to severe insect damage in most plant species, may be effectively protected from insect attack by the weather. However, root and seedling diseases during cool, early periods of plant growth in spring and early summer are common. There is the potential for control by pathogenic microorganism early in the year.

On balance, the positive potentials for biological control of leafy spurge appear to outweigh the negative advantages with which the plants are endowed. This is especially true when one considers the magnitude of the problem and the limitations of chemical control from an economic perspective.

## Native Insects

Previous surveys in Canada and current surveys in North Dakota have failed to reveal any insects which are host-specific on leafy spurge. This is not unusual when dealing with an imported plant species. However, the lack of significant feeding by general plant feeders, such as some grasshoppers, indicates that potential insect control agents must possess specific adaptations for overcoming the plant's defense mechanism. It also indicates that native insects will not provide much assistance for any imported control agent in producing significant reduction in leafy spurge densities. Conversely, the low levels of native insect activity would provide minimal competition for imported species, which may increase the probability of their successful establishment.

## Pathways to Leafy Spurge Control

There are three ways in which insects and pathogenic microorganisms may contribute individually or jointly to control of leafy spurge. The first and most obvious would be insects eating some portion of the plant. A second means would be insect transmission of disease organisms which would destroy or debilitate the plant. Transmission of disease organisms would be similar as we see in crops and other desirable plant species. Either of these modes would require an insect species that was host specific on, or at least exhibited a strong preference for, leafy spurge. The second mode also would require a host specific pathogen. A third mode is the direct attack

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*Carlson is professor, Department of Entomology, and Littlefield is professor, Department of Plant Pathology.*

on the plant by pathogenic microorganisms, such as fungi, bacteria, nematodes or viruses not dependent on insects for transmission.

### Finding the Organisms

Efforts at biological control of certain weeds have been in progress in the United States at least since 1950. These efforts have included establishment of systems and facilities for locating and screening potentially useful biological control agents in the United States as well as in native foreign habitats.

Over 50 insect species have been identified as feeding on leafy spurge in Europe. Perhaps two-thirds of the species are considered candidates for further screening prior to importation. Screening is necessary to evaluate the insect's potential for inflicting damage to the weed and to insure that they will not attack desirable plant species. Much of the preliminary insect screening is being done in U.S. Department of Agriculture facilities in Rome, Italy. Species deemed worthy of further consideration are brought into the quarantine facilities at Albany, California for further testing. Similarly, collections of two different rust fungi on leafy spurge have been obtained from eastern Europe. They are being tested for host specificity and virulence at the USDA quarantine facilities at Frederick, Maryland. Initial collections of insects or diseases must be increased to have sufficient numbers for release to provide a viable nucleus. Only after this final testing and increase is an insect or disease species approved for release to scientists wishing to test its potential in field situations in problem spurge areas. Canada has similar testing and quarantine facilities, and Canadian scientists also are actively involved in the search for biological control agents for leafy spurge.

To date, three insect species have been released in the U.S. and Canada. Although establishment of some insects has been achieved, no promise of weed control has been noted. The release efforts to date have been minimal considering the number of insect species that have been identified on spurge in Europe.

### Future Efforts

Probably no one insect or pathogen will control leafy spurge, so future work will need to identify a complex of compatible agents to effect control. This complex should simulate the insect and microbial population and species diversity observed throughout the natural range of the weed species. Increasing the efforts to obtain the candidate organisms is necessary in the search for biological answers to the spurge problem. However, any biological control effort should realistically be viewed as a long term program — 10 to 20 years — and any successful control which may be achieved on a shorter term would be considered a bonus.

Currently NDSU scientists are obtaining base-line data on the leafy spurge plant and its associated insect population and microbial pathogens. This is necessary to understand the habitat into which biological control organisms may be released. As soon as insect species and pathogenic microbes become available from the quarantine facilities, they will be released and studied in detail as to their effectiveness and viability. Additional increases in insect and pathogen numbers will be attempted so that effective species, when found, can be released over a wide range of the spurge problem areas. The search for exotic plant pathogens on leafy spurge in Europe was begun by USDA only in 1982. Any release into the USA of pathogens obtained from that exploration will be years away. A domestic pathogenic fungus, *alternaria* sp, that can debilitate and even kill the above-ground portions of leafy spurge has been isolated in North Dakota (\*). The *alternaria* fungus is being studied in greater detail to determine its potential as a biocontrol agent. Biological control research is expensive and time consuming and is of real value only if maintained over many years.

\*Krupinsky, J. M. and R. J. Lorenz. 1983. An *Alternaria* sp. on leafy spurge (*Euphorbia escula*). Weed Sci. 31:86-88.