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Guest Column

J.T. Schulz and **R.B. Carlson**
Department of Entomology

BIOLOGICAL CONTROL OF INSECTS-- POTENIAL FOR NORTH DAKOTA

Control of agricultural and urban insects, as well as vectors of disease pathogens, during the post World War II period and for the following three decades was largely achieved via the use of a single control tactic, the chemical. The so-called era of the pesticide syndrome was ushered in with the insecticide, DDT; introduction of this chemical was quickly followed by the development of numerous other pesticides in a number of different synthetic organic chemical classes.

The rather spectacular control of arthropod species in relatively short periods of time was initially well received. The lengthy residual and broad spectrum activity of some of the insecticides were strong factors in their wide acceptance and use. During this period of time research on and use of non-chemical techniques was fairly minimal. The chemical became a sole tactic for insect and other pest control in many situations.

During the period of extensive reliance on the use of pesticides, many red flags have appeared which signalled the possibility that we were becoming unduly dependent on this pest control tactic and that we were not giving enough attention to the use of biological, cultural, host plant resistance and physical tactics. For example, in the insect world many species were becoming resistant to the chemicals that formerly controlled them; residues of some of these chemicals were being detected on the harvestable product even when recommended uses and rates of application were followed; groundwater and other bodies of water in some areas of world were exhibiting significantly detectable quantities of some of these chemicals; some were found to be carcinogenic or tumorigenic.

The total pest management concept recognizes the chemical pesticide as a vital tactic to be employed when needed, but also embraces the notion that chemical use, where appropriate, should be integrated with other management tactics. This will reduce our reliance on the chemical and, in some instances, reduce unnecessary introductions of pesticide chemicals into the environment.

General acceptance of the pest management concept has been translated into additional research on and use of non-

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On the Cover: An import from Italy, an insect known as *Oberea erythrocephala* is being evaluated as a possible biocontrol agent against leafy spurge. The insect is a stem borer that attacks both the upper and lower portions of the leafy spurge plant. Photo by Don Mundal.

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H.R. Lund
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EDITOR
Gary Moran

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chemical approaches to pest problems, particularly biological control. In the management of insects and other arthropods, the resurgence of both classical and more novel approaches to biocontrol is now the order of the day. Biocontrol involves the importation, conservation and encouragement of parasitoids, predators and pathogens in order to reduce and maintain pest densities below economic injury levels.

Biocontrol also now embraces some of the biologicals and chemicals which are presently classed as biorationals, and includes pheromones and growth regulators among others.

With reference to parasitoids and predators, the environment and relatively short growing season in North Dakota makes the manipulation of these biocontrol agents difficult. However, many have observed the role ladybird beetles and lacewings play in certain years in reducing aphid populations on small grains. The buildup of populations of these predators requires several years before reaching the levels that will permit them to deflate aphid populations to non-economic levels. If aphid populations decline in the ensuing years, so also will the populations of ladybird beetles and lacewings. There is a lesson in this normal sequence of events, namely that 100 percent control is not the desired objective. Prey (aphids) must be present in sufficient numbers to permit significant survival of the predators. This lesson is a general axiom for nearly all facets of biological control involving parasites and predators. There must always be sufficient numbers of the prey or susceptible host species to maintain population levels of the predators or parasitoids. This is especially important for host specific predators and parasitoids.

With the knowledge that predacious and parasitic insects do indeed comprise an important component of the natural control process, and even though this process will not, under many circumstances, provide control of pest insect species by itself, we can, by the nature of our insecticide recommendations, promote their use in such a manner to preserve as much as possible the existing natural control system. We also may find it feasible to augment the existing levels of natural control with the introduction of additional parasites/predators.

This augmentative approach provides a major basis for the current research directed to the control of the noxious weed, leafy spurge. The current multidisciplinary research effort to reduce or eliminate the impact of this weed exemplifies a multitactical approach which will, hopefully, integrate the chemical, cultural and the biological. While herbicides can be economically utilized in some spurge sites with minimal adverse impact on the environment, these chemicals cannot be used in other areas. Indigenous insects have not been able to adapt to this weed and hold it in check. Consequently exotic insects imported from other areas of the world (Italy, Austria) have been released in North Dakota during the past several years to control this weed. While some of these species have adapted to this area, others have not. Introduced species that have successfully adapted to this environment attack different sites on the spurge plant. Thus there are root feeders, leaf and stem feeders, and gall flies that may reduce seed production. Since multiple sites on the spurge plant are the favored feeding and oviposition sites for this species complex, chances are enhanced that this host will be more vulnerable to this biocontrol tactic.

Similar studies are in progress to find disease pathogens with specificity for leafy spurge that would also severely impact this host.

At this juncture we are encouraged that biocontrol techniques will ultimately play a major role in reducing the impact of this noxious weed in this state. But it is obvious the time frame for such a happening to occur is not three to five years, but more likely a decade or more.

The roles of parasitic insects, particularly the Hymenoptera (bees, wasps), are slowly being defined and their impact on selected species of the sunflower pest complex, European corn borer and other important pest species quantified. This information has already generated recommendations for more targeted use of insecticides, which minimize their adverse impact on beneficial species without a reduction in efficacy.

The role of insect pathogens as biocontrol agents is assuming greater importance in North Dakota. The extensive use of the microbial insecticide *Bacillus thuringiensis* (*B.t.*) in urban areas and in shelterbelts for control of cankerworms has been prevalent for several years. The recently implemented grasshopper management program by USDA in western North Dakota and other western sites employs the protozoan *Nosema locustae* as the control agent. Efficacy and longevity of control following use of this organism will be compared with that obtained following application of currently recommended insecticides used in rangeland grasshopper control programs.

The Department of Entomology has continued its research program begun in 1981 on the fungal pathogen *Entomophaga grylli*. This pathogen is lethal to susceptible grasshopper species and ultimately may be an efficient and effective control agent. Several pathotypes (strains) of this fungus are still under investigation in a diversity of habitats. An effective delivery system for this pathogen remains to be developed.

The resistance of the Colorado potato beetle to many of the currently recommended insecticides has necessitated cessation of their use. This resistance problem is most acute on Long Island and other potato and tomato production areas of the east. A newly developed strain of *B.t.*, San Diego, was registered for use in that region this year. This strain was evaluated for its efficacy in control of Colorado potato beetles in the Red River Valley this year.

It is readily apparent that the employment of biological control tactics either solely or in combination with other pest management tactics has assumed significantly greater importance in all sectors of pest management in the last decade. Recognition of the role biological agents play and tailoring of other tactics to exploit their action will increase as the impacts of these agents continue to be more fully known and appreciated. Concurrent with this developing philosophy, numerous private sector companies are now in a position to offer newly-researched biological organisms, particularly bacterial, fungal and viral pathogens, that will play an increasing role in the management of insect pests. Eventually, genetically engineered plant materials may contain the genes of microbial pathogens which produce substances toxic to insects. However, even this approach has limitations.

While biological control agents are generally slower acting and not as spectacular in initial evaluations of their perfor-

Agricultural Experiment Station
NORTH DAKOTA STATE UNIVERSITY
of Agriculture and Applied Science
University Station
Fargo, North Dakota 58105
Publication

H R Lund

DIRECTOR

to

RANDY COON

MORRILL
AG ECON