Cold Tolerance of Adult Parasites Attacking the Alfalfa Weevil

R.C. Berberet, A.D. Bisges, and A.A. Zarrabi Department of Entomology and Plant Pathology, Oklahoma State University Stillwater, OK 74078

Great success has been achieved in biological control of the alfalfa weevil (*Hypera postica* Gyllenhal) in northeastern and northcentral areas of the U.S. This success has resulted primarily through importation and widespread establishment of parasitic wasps that attack either the larval [*Bathyplectes curculionis* (Thomson), *B. anurus* (Thomson), and *Oomyzus incertus* (Ratzenburg)] or adult (*Microctonus aethiopoides* Loan) stage of the alfalfa weevil (Radcliffe and Flanders 1998). As a result of the effectiveness of these parasitic species, the need for application of chemical insecticides for control of alfalfa weevil has been greatly reduced. By comparison, effectiveness of parasites in regulating populations of the weevil in the Southern Great Plains has been limited. Although *B. curculionis* is the most widespread species that parasitizes weevil larvae in the Southern Great Plains, its effectiveness has not been sufficient to allow significant reductions in insecticide usage. Consequently, cultural measures such as winter grazing of alfalfa stands to reduce egg deposition and survival, and chemical insecticide applications directed at the larval stage remain important for limiting economic damage. *Bathyplectes anurus* is becoming the most prevalent parasite in localized areas where it is well-established and may contribute to improved success of biological control in the future (Berberet and Bisges 1998). The research described in this presentation is part of a series of studies conducted to identify factors that may limit the effectiveness of biological control agents for alfalfa weevil in the Southern Great Plains.

Emergence patterns and cold tolerance of adults of *B. curculionis* were studied in relation to weather conditions that are typical during fall and winter in the Southern Great Plains. Extensive field sampling was conducted from February to April with rearing and dissections of the first alfalfa weevil larvae to hatch each year to detect the first occurrence of parasitism. Laboratory studies were conducted to confirm that daylength and environmental temperatures prevailing during this time of year are conducive to termination of diapause, pupal development, and emergence of adult parasites. The level of tolerance in adults to freezing temperatures was determined through experiments in controlled temperature chambers. Results were then validated in field settings during January and February.

Experiments demonstrated that daylength and temperatures during fall and winter are suitable for termination of diapause and emergence of *B. curculionis* adults within 40-60 days after first exposure to temperatures below 5°C. Mean Julian dates for first detection of parasitism were 69 and 72 for two field sites. Weather records indicate that the adult parasites frequently encounter freezing temperatures as they begin to emerge from cocoons and search for weevil hosts in late winter. Laboratory observations indicate that >80% of these adults can survive repeated exposure to daily low temperatures ranging from 0° to -9°C. While it is clear that some B. curculionis adults do emerge during fall and winter when there may be no hosts available, this disadvantage to successful biological control is offset somewhat by the cold tolerance that allows the parasites to survive and attack the first weevil larvae to infest alfalfa each year.

References

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