EVALUATION OF NATURAL ENEMIES OF BEET ARMYWORM ON ALFALFA IN NORTHERN CALIFORNIA

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ABSTRACT

Eggs and small to medium-sized larvae of beet armyworm are exploited by a complex of natural enemies in hay alfalfa fields in northern California. Field studies at Davis (Yolo Co.) during 2004 revealed that predation on sentinel egg masses ranged from 50-90%. The egg-predators included minute pirate bug, damsel bug, lygus bugs, big-eyed bugs, green-lacewing larvae, soft-winged flower beetle and convergent ladybird beetle. Three parasites were reared from larvae at Davis from 1999-2004; total parasitization ranged from 25-60%. A few larvae were infected with a nuclear polyhedrosis virus (NPV); however, no epizootic occurred from 1999-2004. These results suggest that natural enemies, primarily generalist predators, are largely responsible for maintaining beet-armyworm populations at relatively low levels in non-treated alfalfa fields in the region.

Key Words: beet armyworm, predators, parasites, pathogens

INTRODUCTION

Beet armyworm, *Spodoptera exigua* (Hübner) (Lepidoptera: Noctuidae), is an introduced pest of alfalfa in California (Campbell and Duran, 1929). Eggs are deposited in masses on the leaves, where the larvae feed and progress through five instars. Early instars feed gregariously whereas later instars feed solitarily. Pupation takes place in an earthen cell just below the soil surface. There is no known diapause in this species (Fye and Carranza, 1973). There can be several generations per year in temperate climates.

In northern California, adults of *S. exigua* are active as early as mid-May (Hogg and Gutierrez, 1980; Lange and Bronson, 1981), but larvae typically are not detected in alfalfa fields until late June or early July. Populations develop throughout the summer and well into the fall (e.g., early November). It is not known how (or if) *S. exigua* overwinters in northern California. In southern California, it apparently overwinters as a non-diapausing larva (Campbell and Duran, 1929; Trumble and Baker, 1984).

Despite the perceived economic importance of *S. exigua* on alfalfa in northern California, its natural enemies and their impact in this crop have not been assessed. The purpose of this paper is to summarize available data on these biological-control agents, with particular emphasis on those associated with eggs and small to medium-sized larvae.

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METHODS AND MATERIALS

No-choice feeding trials were conducted in the laboratory to determine egg-consumption rates of the common predators in alfalfa. Predators were collected from alfalfa fields on the U. C., Davis campus, taken to the laboratory, and confined individually with 100 eggs of *S. exigua* from a laboratory culture. Predators were held in a rearing room and the number of eggs eaten per individual was determined after 48 h.

During 204, egg predation was evaluated at various intervals from mid-July to late September in non-treated alfalfa fields on the campus. Sentinel egg masses were attached to alfalfa leaves with a metal hair clip (one egg mass per plant); sample plants were chosen systematically at 5 m intervals along a transect across the field. Egg masses (n = 40-50/trial) were observed on a regular basis for evidence of predation, retrieved after 5-7 days (just before or after hatch), and returned to the laboratory for determination of predation rate--i.e., percentage of eggs per egg mass eaten by predators.

Incidence of parasites and pathogens of small to medium-sized larvae (<1.5 cm long) was evaluated in the same alfalfa fields from 1999-2004. In a given field, apparently healthy larvae were collected either by hand or with a sweep net, taken to the laboratory and placed individually in 60 ml, capped plastic cups containing artificial diet. Larvae were held in a rearing room and observed for evidence of parasitization or nucleopolyhedrosis (NPV).

RESULTS AND DISCUSSION

Laboratory feeding trials revealed that most predators in alfalfa would feed on *S. exigua* eggs. These include minute pirate bug (*Orius tristicolor* [White]) (Heteroptera: Anthocoridae), lygus bugs (*Lygus hesperus* Knight & *L. elisus* Van Duzee) (Heteroptera: Miridae), damsel bug (*Nabis americoferus* Carayon) (Heteroptera: Nabidae), big-eyed bugs (*Geocoris punctipes* [Say], *G. pallens* Stal, & *G. atricolor* Montandon (Heteroptera: Geocoridae), soft-winged flower beetle (*Collops vittatus* [Say]) (Coleoptera: Melyridae), convergent ladybeetle (*Hippodamia convergens* Guerin) (Coleoptera: Coccinellidae) and green-lacewing larvae (*Chrysoperla carnea* [Stephens]) (Neuroptera: Chrysopidae). Predation on sentinel egg masses varied from 50-90% in a given trial. Predators typically ate all of the eggs in an exploited mass.

Small to medium-sized larvae were also exploited by parasites. Three parasitic species were recovered: *Hyposoter exiguae* (Viereck) and *Pristomerus spinator* (F.) (Hymenoptera: Ichneumonidae), both larval endoparasites; and *Chelonus insularis* Cresson (Hymenoptera: Braconidae), an egg-larval endoparasite. Total mortality attributable to parasites ranged from 25 to 60%. Infection by NPV was rarely detected.

CONCLUSION

These results suggest that natural enemies, particularly generalist predators, are responsible for maintaining beet-armyworm populations at relatively low levels in non-

treated alfalfa fields in northern California. Similar results for this pest were obtained by Eveleens et al. (1973) on cotton in the southern San Joaquin Valley and Ehler (2004) on sugarbeet in northern California. Additional evaluations of these natural enemies of *S. exigua* are planned for 2005.

REFERENCES

Campbell, R. E. and V. Duran. 1929. Notes on the sugar-beet army worm in California. Mo. Bull. Calif. Dep. Agr. 18: 267-275.

Ehler, L. E. 2004. An evaluation of some natural enemies of *Spodoptera exigua* on sugarbeet in northern California. BioControl 49: 121-135.

Eveleens, K. G., R. van den Bosch and L. E. Ehler. 1973. Secondary outbreak induction of beet armyworm by experimental insecticide applications in cotton in California. Environ. Entomol. 2: 497-503.

Fye, R. E. and R. L. Carranza. 1973. Cotton pests: overwintering of three lepidopterous species in Arizona. J. Econ. Entomol. 66: 657-659.

Hogg, D. B. and A. P. Gutierrez. 1980. A model of the flight phenology of the beet armyworm (Lepidoptera: Noctuidae) in central California. Hilgardia 48 (4): 1-36.

Lange, W. H. and L. Bronson. 1981. Insect pests of tomatoes. Annu. Rev. Entomol. 26: 345-371.

Trumble, J. T. and T. C. Baker. 1984. Flight phenology and pheromone trapping of *Spodoptera exigua* (Hübner) (Lepidoptera: Noctuidae) in southern coastal California. Environ. Entomol. 13: 1278-1282.