Volume 24
Number 4 - Winter 1991 *Number 4 - Winter 1991*

Article 2

December 1991

New Lepidoptera-Parasitoid Associations in Weedy Corn Plantings: A Potential Alternate Host for *Ostrinia Nubilalis* (Lepidoptera: Pyralidae) Parasitoids

Daniel M. Pavuk
Ohio State University

Benjamin R. Stinner
Ohio State University

NEW LEPIDOPTERA–PARASITOID ASSOCIATIONS IN WEEDY CORN PLANTINGS: A POTENTIAL ATLERNATE HOST FOR *OSTRINIA NUBILALIS* (LEPIDOPTERA: PYRALIDAE) PARASITOIDS

Daniel M. Pavuk[1,2] & Benjamin R. Stinner[1]

ABSTRACT

Larvae of the common sooty wing, *Pholisora catullus*, and pupae of the yellow-collared scape moth, *Cisseps fulvicollis*, were collected in corn plantings containing different manipulated, indigenous weed communities to determine if these Lepidoptera had parasitoid species in common with the European corn borer, *Ostrinia nubilalis*. *Pholisora catullus* larvae were collected from lambsquarter, *Chenopodium album*, and redroot pigweed, *Amaranthus retroflexus*, whereas pupae of *C. fulvicollis* were obtained from corn. Four parasitoid species were reared from *P. catullus*: *Cotesia pholisorae*, *Oncophanes americanus* (Hymenoptera: Braconidae), *Gambrus ultimus*, and *Sinophorus albipalpus* (Hymenoptera: Ichneumonidae). Of these, *O. americanus* and *S. albipalpus* represent new host records. *Gambrus ultimus*, however, was probably parasitizing a primary parasitoid of *P. catullus*. *Itoplectis conquisitor* and *Vulgichneumon brevicinctor* (Hymenoptera: Ichneumonidae) were reared from *C. fulvicollis*; *V. brevicinctor* had not previously been associated with this host. Both species reared from *C. fulvicollis* and *Gambrus ultimus* have been reported from *O. nubilalis*.

The influence of weedy vegetation in crop plantings on phytophagous arthropods and their natural enemies has been investigated in a variety of systems (e.g. Pimentel 1961, Root 1973, Speight and Lawton 1976, Altieri and Whitcomb 1980, Horn 1981, 1987, Shelton and Edwards 1983, Barney et al. 1984, Pavuk 1990). Weedy vegetation may provide alternate prey and hosts and ameliorated microhabitats (Root 1973), as well as abundant pollen and nectar sources (van Emden 1963, 1965) for predaceous and parasitic arthropods. Thus, allowing weeds to remain along crop field borders, or in the crop itself, may augment natural control of pest arthropods by supporting populations of arthropod predators and parasitoids.

Weeds have been shown to increase the attractiveness of cornfields to the European corn borer, *Ostrinia nubilalis* (Hübner) (Lepidoptera: Pyralidae) (Showers et al. 1976, Showers et al. 1980). Adult *O. nubilalis* tend to aggregate in grassy habitats along edges of cornfields (Caffrey and Worthley 1927). Showers et al. (1976) demonstrated that areas of dense, grassy vegetation around cornfields are preferred mating habitats for *O. nubilalis*, because of the presence of water (DeRozari et al. 1977). However, the occurrence of broadleaf weeds in corn plantings has

[1]Department of Entomology, The Ohio State University, Ohio Agricultural Research and Development Center, Wooster, OH 44691.
[2]Current Address: Department of Zoology, Miami University, Oxford, OH 45056.

been observed to reduce both infestation of and damage to corn by *O. nubilalis* (Pavuk and Stinner 1991).

We initiated this study to determine if lepidopterous larvae feeding on broadleaf weeds in corn plantings serve as hosts for parasitoids of the European corn borer, *Ostrinia nubilalis*. Corn plantings containing broadleaf weeds have lower infestations of *O. nubilalis* larvae (Pavuk and Stinner 1991). Thus, we were interested in investigating parasitoid use of alternate hosts on broadleaf weeds in corn plantings as a possible mechanism leading to lower corn borer infestations.

MATERIALS AND METHODS

The study was conducted at The Ohio Agricultural Research and Development Center, The Ohio State University, Wooster, Ohio, during 1987 and 1989. Four treatments were established: corn without weeds, corn principally with broadleaf weeds, corn principally with grassy weeds, and corn with a mixture of both weed types. For details of the experimental design, see Pavuk (1990). The weedy flora of the corn with broadleaf weeds treatment was dominated in late spring and early summer by Canada thistle, *Cirsium arvense*, dandelion, *Taraxacum officinale*, and daisy fleabane, *Erigeron strigosus*, and in later summer by lambsquarter, *Chenopodium album*, and redroot pigweed, *Amaranthus retroflexus*. Principal early season species present in the corn with grassy weeds treatment were *Muhlenbergia frondosa* and yellow nutsedge, *Cyperus esculentus*. Later, the grassy plantings became increasingly populated by foxtails (primarily giant foxtail, *Setaria faberii*), fall panicum, *Panicum dichotomiflorum*, barnyardgrass, *Echinochloa crus-galli*, and large crabgrass, *Digitaria sanguinalis*. The mixed weeds treatment contained combinations of these species.

Surveys of broadleaf weeds indicated that larvae of the common sooty wing, *Pholisora catullus* (F.) (Lepidoptera: Hesperiidae), were abundant. Larvae of this species were haphazardly collected from *C. album* and *A. retroflexus* in the broadleaf and mixed weed treatments in June, July and August of 1987 and August of 1989. Klots (1951) lists *C. album*, *Amaranthus graecizans*, and probably other Chenopodiaceae and Amaranthaceae as larval hosts of *P. catullus*. However, most larvae in the present study were collected from *C. album* rather than *A. retroflexus*. Capman (1990) indicated that he, too, seldom found *P. catullus* feeding on *A. retroflexus*. Collected larvae were placed individually in 29.5 ml clear plastic cups fitted with paper lids, and provided with fresh *C. album* or *A. retroflexus* leaves several times each week. Larvae were fed leaves of both species, regardless of which plant they were collected from, because larval development occurred equally well on either species. Larvae were held under a 16:8 (L:D) photoperiod, 25 degrees C and 70 % RH until they either completed development or adult parasitoids emerged. A total of 410 larvae were collected (177 larvae from the broadleaves treatment and 233 larvae from the mixed weeds treatment).

Pupae of the yellow-collared scape moth, *Cisseps fulvicollis* (Hübner) (Lepidoptera: Arctiidae), were observed on corn plants, and these pupae were collected from randomly-selected corn plants in the broadleaf and mixed weed treatments in 1989. No pupae of this species were found on corn plants in weedless and grassy weed plantings. Covell (1984) lists grasses, lichens and spike-rushes as larval hosts for *C. fulvicollis*; neither larvae nor pupae were observed on grassy weeds in the experimental plots. Pupae were held under the same conditions as *P. catullus* larvae, except no plant material was provided. Ten pupae were collected (6 pupae from the broadleaves treatment and 4 pupae from the mixed weeds treatment).

Table 1.—Parasitoids reared from *Pholisora catullus* larvae.

Parasitoid	Number of *P. catullus* parasitized in: Broadleaves Treatment	Mixed Weeds Treatment	Reported from: *Ostrinia nubilalis*
Braconidae			
Cotesia pholisorae	25(14.1)[a]	52(22.3)	no
Oncophanes americanus	4(2.3)[b]	0(0)	no
Ichneumonidae			
Gambrus ultimus	1(0.57)[bc]	0(0)	yes
Sinophorus albipalpus	4(2.3)[b]	3(1.3)	no

[a]Number in parentheses is the percentage of larvae parasitized.
[b]New host record.
[c]May have parasitized *Sinophorus* rather than *Pholisora*.

RESULTS AND DISCUSSION

Two new parasitoid host records were noted for *P. catullus*, and one was observed for *C. fulvicollis* (Tables 1 & 2) (Krombein et al. 1979; Biological Abstracts). Although *Gambrus ultimus* (Cresson) emerged from *P. catullus*, this species was probably a hyperparasitoid which attacked a primary parasitoid of *P. catullus*, perhaps *Sinophorus albipalpus* Sanborne (R. W. Carlson, personal communication). *Gambrus ultimus* has been recorded as a primary parasitoid of *Ostrinia nubilalis* (Krombein et al. 1979), but has also been observed to be a common hyperparasitoid of *Eriborus terebrans* (Gravenhorst) (Hymenoptera: Ichneumonidae), a primary parasitoid of the corn borer (Baker et al. 1949). The presence of *P. catullus* in corn plantings could therefore lead to larger populations of *G. ultimus* and consequently greater parasitization of *O. nubilalis* as well as *E. terebrans*. In addition, *Itoplectis conquisitor* (Say) and *Vulgichneumon brevicinctor* (Say) (Ichneumonidae), parasitoids of *O. nubilalis*, were reared from *C. fulvicollis*. However, none of the parasitoids reared from *P. catullus* and *C. fulvicollis* emerged from *O. nubilalis* in the present study. *Eriborus terebrans* was the only parasitoid observed from collections of corn borer larvae from corn plantings containing broadleaves (corn with broadleaf weeds: 50 larvae collected in 1988, 67 larvae collected in 1989; corn with broadleaf and grassy weeds: 96 larvae collected in 1988, 82 larvae collected in 1989; D. M. Pavuk and B. R. Stinner, unpublished data). Baker et al. (1949) state that both *I. conquisitor* and *V. brevicinctor* parasitize corn borer larvae and that

Table 2.—Parasitoids reared from *Cisseps fulvicollis* pupae.

Parasitoid	Number of *C. fulvicollis* parasitized in: Broadleaves Treatment	Mixed Weeds Treatment	Reported from: *Ostrinia nubilalis*
Ichneumonidae			
Itoplectis conquisitor	2(33.3)[a]	0(0)	yes
Vulgichneumon brevicinctor	1(16.7)[b]	0(0)	yes

[a]Number in parentheses is the percentage of pupae parasitized.
[b]New host record.

both species emerge from pupae. However, neither species was listed as being reared from *O. nubilalis* in the Great Lakes states (Baker et al. 1949).

Differences were observed between the two treatments in terms of percent parasitism of *P. catullus* larvae. Overall parasitism of *P. catullus* was greater in the treatment containing both broadleaves and grasses (23.6%) than in the treatment with only broadleaf weeds (19.2%), although the difference was not large. Parasitism of *P. catullus* larvae by *Cotesia pholisorae* was also greater in the mixed weeds treatment than in the broadleaves only treatment (22.3% versus 14.1%). However, *Oncophanes americanus* (Weed) emerged from 2.3% of the larvae collected from the broadleaf weeds treatment, and from none collected in the mixed weeds treatment. Parasitism of *P. catullus* larvae by *Sinophorus albipalpus* was slightly greater in the broadleaf weeds treatment (2.3%) than in the mixed weeds treatment (1.3%). Comparison of parasitization of *P. catullus* collected on *Chenopodium album* and *Amaranthus retroflexus* was not possible because nearly all larvae were collected from *C. album*. Also, the number of *C. fulvicollis* pupae collected was too small to make any meaningful comparisons between treatments.

Large numbers of *C. fulvicollis* present in a corn planting could potentially harbor significant numbers of parasitoids. Hudon and Perron (1970) found that approximately 92% of large numbers *C. fulvicollis* pupae that they collected from a 45-acre cornfield were parasitized by *I. conquisitor* and *Ichneumon* sp. of the group *winkleyi*. Thus, a large *C. fulvicollis* population in a cornfield could lead to large numbers of *O. nubilalis* parasitoids, although such a large *C. fulvicollis* population could itself be damaging to the corn (Hudon and Perron 1970).

The inclusion of weeds in corn plantings to enhance natural enemy populations of *O. nubilalis* may have some potential. However, none of the parasitoids reared from *P. catullus* or *C. fulvicollis* were observed from *O. nubilalis* in the present study, although three species (two from *C. fulvicollis* and one from a primary parasitoid of *P. catullus*), have been recorded from *O. nubilalis* (Krombein et al. 1979). It is also not clear whether or not broadleaf weeds increase the abundance of *C. fulvicollis* in corn plantings, even though no pupae of this species were found on corn in grassy weed and weed-free plantings. In addition, weeds, particularly grassy species, in corn plantings can actually increase larval populations of *O. nubilalis*, because adult moths prefer such habitats (Showers et al. 1976, Showers et al. 1980). Perhaps selective management of certain weeds around cornfields could be of some benefit to parasitoids and predators of the European corn borer. More extensive research will be needed to determine if weed communities associated with corn plantings can be manipulated to augment natural control of *O. nubilalis*.

ACKNOWLEDGMENTS

We thank D. A. McCartney and J. P. Reed for field assistance, J. Shuey for identifying *Pholisora catullus*, and P. M. Marsh and R. W. Carlson, Taxonomic Services Unit, Systematic Entomology Laboratory, USDA-ARS, BARC, Beltsville, Maryland, for identifying the Braconidae and Ichneumonidae, respectively. The manuscript was greatly improved by comments from F. F. Purrington, D. J. Horn, C. E. Williams and two anonymous reviewers. M. B. Pavuk typed the manuscript. Salaries and research support were provided by state and federal funds appropriated to The Ohio Agricultural Research and Development Center, The Ohio State University. This is manuscript number 50-91.

LITERATURE CITED

Altieri, M. A. and W. H. Whitcomb. 1980. Weed manipulation for insect pest management in corn. Environ. Manag. 4:1-7.

Baker, W. A., W. G. Bradley, and C. A. Clark. 1949. Biological control of the European corn borer in the United States. USDA Technical Bulletin 983.

Barney, R. J., W. O. Lamp, E. J. Armbrust and G. Kapusta. 1984. Insect predator community and its response to weed management in spring-planted alfalfa. Prot. Ecol. 6:23-33.

Biological Abstracts. 1926-1991. Biosis, Philadelphia, PA.

Caffrey, D. J. and L. H. Worthley. 1927. A progress report on the investigations of the European corn borer. USDA Departmental Bull. 1476.

Capman, W. C. 1990. Natural history of the common sooty wing skipper, *Pholisora catullus* (Lepidoptera: Hesperiidae), in central Illinois. Great Lakes Entomol. 23:151-157.

Covell, C. V., Jr. 1984. A field guide to the moths of eastern North America. Houghton Mifflin Co. 496 p.

DeRozari, M. B., W. B. Showers and R. H. Shaw. 1977. Environment and the sexual activity of the European corn borer. Environ. Entomol. 6:657-665.

Horn, D. J. 1981. Effect of weedy backgrounds on colonization of collards by green peach aphid, *Myzus persicae*, and its major predators. Environ. Entomol. 10:285-289.

______. 1987. Vegetational background and parasitism of larval diamond-back moth on collards. Entomol. Exp. Appl. 43:300-303.

Hudon, M. and J. P. Perron. 1970. First record of *Cisseps fulvicollis* (Lepidoptera: Amatidae) as a economic destructive insect on grain corn in Canada. Can. Ent. 102:1052-1054.

Klots, A. B. 1951. A field guide to butterflies of North America, east of the Great Plains. Houghton-Mifflin Co., Boston.

Krombein, K. V., P. D. Hurd, Jr., D. R. Smith and B. D. Burks. 1979. Catalog of Hymenoptera in America North of Mexico. Smithsonian Institution Press. Washington. D. C.

Pavuk, D. M. 1990. Influence of vegetational diversity in *Zea mays* plantings on phytophagous, predaceous and parasitic arthropods. Ph.D. Diss. The Ohio State University. 170 p.

Pavuk, D. M. and B. R. Stinner. 1991. Influence of weeds in corn plantings on population densities of and damage by second-generation *Ostrinia nubilalis* (Hübner) (Lepidoptera: Pyralidae) larvae. Environ. Entomol. 20:276-281.

Pimentel, D. 1961. Species diversity and insect population outbreaks. Ann. Entomol. Soc. Amer. 54:76-86.

Root, R. B. 1973. Organization of a plant arthropod association in simple and diverse habitats: the fauna of collards (*Brassica oleracea*). Ecol. Monogr. 43:94-125.

Shelton, M. D. and C. R. Edwards. 1983. Effects of weeds on the diversity and abundance of insects in soybeans. Environ. Entomol. 12:296-298.

Showers, W. B., G. L. Reed, J. F. Robinson and M. B. DeRozari. 1976. Flight and sexual activity of the European corn borer. Environ. Entomol. 5:1099-1104.

Showers, W. B., E. C. Berry and L. Von Kaster. 1980. Management of second-generation European corn borer by controlling moths outside the corn field. J. Econ. Entomol. 73:88-91.

Speight, M. R. and J. H. Lawton. 1976. The influence of weedcover on the mortality imposed on artificial prey by predatory ground beetles in cereal fields. Oecologia. 23:211-223.

Van Emden, H. F. 1963. Observations on the effects of flowers on the activity of parasitic Hymenoptera. Entomol. Mon. Mag. 98:265-270.

______. 1965. Observations on the effects of flowers on the distribution of the cabbage aphid (*Brevicoryne brassicae*) on an adjacent crop. J. Appl. Ecol. 2:171-196.