The Parasitoid Complex of First Generation *Ostrinia Nubilalis* (Lepidoptera: Pyralidae) Larvae in Northwest Ohio

Daniel M. Pavuk
Bowling Green State University

Laura L. Hughes
Bowling Green State University

THE PARASITOID COMPLEX OF FIRST GENERATION *OSTRINIA NUBILALIS* (LEPIDOPTERA: PYRALIDAE) LARVAE IN NORTHWEST OHIO

Daniel M. Pavuk[1] and Laura L. Hughes[1]

ABSTRACT

A survey of first generation European corn borer (*Ostrinia nubilalis*) larvae was conducted during 1997 in six cornfields located in northwestern Ohio in order to determine the larval parasitoid complex utilizing this host. Collected larvae were held under constant conditions until the larvae completed development or parasitoids emerged. The following species were recorded: *Eriborus terebrans* (Hymenoptera: Ichneumonidae), *Macrocentrus grandii* (Hymenoptera: Braconidae), *Sympiesis viridula* (Hymenoptera: Eulophidae), and *Lixophaga* sp. (Diptera: Tachinidae). Levels of parasitism in the different fields ranged from 14.3 to 83.3%. Future research will include surveys of additional fields and sampling of *O. nubilalis* over the entire season in the northwest Ohio region.

The European corn borer, *Ostrinia nubilalis* (Hübner) (Lepidoptera: Pyralidae), is a widespread and significant pest of both field and sweet corn in the United States (Showers et al. 1989). Because *O. nubilalis* is not native to North America, it became the focus of a classical biological control program after it was introduced and discovered. Between 1920 and 1938, 24 parasitoid species were released in the United States from Europe and the Orient (Baker et al. 1949). In the North Central Region, the introduced parasitoids that were commonly recovered in European corn borer surveys during subsequent years were *Lydella thompsoni* (Herting) (Diptera: Tachinidae), *Macrocentrus grandii* (Goidanich) (Hymenoptera: Braconidae), and *Eriborus terebrans* (Gravenhorst) (Hymenoptera: Ichneumonidae). In Ohio, the most commonly recovered parasitoids in recent years have been *E. terebrans* and *M. grandii*. Collections of second generation larvae have been made by researchers in various parts of the state (e.g., Pavuk & Stinner 1992, Mason et al. 1994). The last comprehensive, statewide survey was performed by Mason et al. (1994); this survey focused on overwintering, second generation European corn borer larvae present in eight states, including Ohio. The parasitoids recovered were species mentioned above (Mason et al. 1994). In addition, another tachinid, *Lixophaga* sp., was found in western Ohio and western North Carolina, but was extremely uncommon (Mason et al. 1994).

We were interested in determining, in a preliminary survey within the

---

[1]Department of Biological Sciences, Bowling Green State University, Bowling Green, OH 43403-0212.

northwestern Ohio region, which parasitoids were attacking *O. nubilalis* first generation larvae. During late July and early August 1997 (28 July–6 August), we collected first generation larvae from six cornfields in Hancock, Henry, and Wood Counties. These are contiguous counties in the northwestern region of Ohio. All of the fields sampled were similar in terms of agronomic practices, with the exception of two fields (Shaffer Fields 1 and 2) that were planted using a narrow row spacing (51 cm, or 20 in). The narrow row cornfields did not appear to have substantially smaller or larger European corn borer larval populations than cornfields planted using typical row spacing (76 cm, or 30 in) (Pavuk and Hughes, personal observation). Within each field, 25 plants were dissected at each of four locations; two locations were on two edges of the field, and two locations were situated in the approximate center of the field, 25 meters apart. All of the larvae were 4th or 5th instars at the time of collection. The larvae were maintained in the laboratory under constant conditions (16 h: 8h, L:D; 25° C, and approximately 70% RH) until either parasitoids emerged or the larvae completed development. We excluded larvae that died from disease or unknown causes when calculating percent parasitism. The most common parasitoid was *Eriborus terebrans*; *Macrocentrus grandii* was the second most common species reared from the larvae (Table 1). In addition, one larva was parasitized by the eulophid *Sympiesis viridula*, and two specimens of *Lixophaga* sp. were reared from larvae. Populations of *O. nubilalis* were extremely small, especially in comparison to the previous growing season (1996) (D. M. Pavuk, personal observation). The second generation was also very small, and few larvae were collected from the same cornfields where the first generation larvae were found. No parasitoids were reared from the second generation larvae collected ($n < 10$ larvae for each field sampled).

We observed a wide range in percent parasitism of larvae collected from the six fields; total percent parasitism ranged from 14.3% to 83.3% (Table 1). The highest level of parasitism occurred in the largest field surveyed (Bennett Field 1). However, this field had an extremely small *O. nubilalis* larval population (only 6 larvae were collected), and the five larvae that were parasitized all came from an edge near a large wooded area. This may indicate that parasitoids were moving easily from the neighboring woodlot to the field edge; the woodlot may have been providing suitable refuges for the parasitoids. The use of adjacent woodlots by parasitoids of European corn borer, especially *Eriborus terebrans*, was suggested by Landis & Haas (1992) and Dyer & Landis (1997).

Another factor that may eventually have effects on parasitism rates of *O. nubilalis* larvae is the increasing use of Bt-corn (transgenic corn in which the *Bacillus thuringiensis* toxin-producing gene has been incorporated). Hilbeck et al. (1998) found that *Chrysoperla carnea* larvae reared on *Bacillus thuringiensis*-fed *O. nubilalis* larvae had a higher mortality rate than *C. carnea* immatures that were fed *B. thuringiensis*-free prey. Parasitoids may also possibly suffer sub-lethal effects and increased mortality while developing in or on *O. nubilalis* larvae that are feeding on Bt-corn plants. Also, reduced populations of *O. nubilalis* due to the planting of Bt-corn may make it more difficult for parasitoids to locate larvae, which could adversely affect the persistence of parasitoid populations. We estimated that the amount of Bt-corn planted in the tri-county region we surveyed to be less than 5% in 1997; however, this amount is likely to increase in the next several years. It will be interesting to track the changes in parasitism of *O. nubilalis* that may occur because of increasing use of Bt-corn.

We intend to continue our studies of the parasitoids of *Ostrinia nubilalis* in northwest Ohio. More intensive collecting of *O. nubilalis* larvae may re-

Table 1. Parasitoids Reared from First Generation *Ostrinia nubilalis* Larvae, 1997.

Location & Field*	No. of Larvae	Parasitoid Species	No. of Larvae Parasitized	% Parasitism
Wood Co.; Shaffer - Field 1				
(~20 ha;51 cm row spacing;	24	*Eriborus terebrans*	7	29.2%
corn fields on N and W edges)		*Macrocentrus grandii*	3	12.5%
				Total: 41.7%
Wood Co.; Shaffer - Field 2				
(~10 ha; 51 cm row spacing;	11	*Eriborus terebrans*	4	36.4%
trees on S and W edges)		*Macrocentrus grandii*	2	18.2%
				Total: 54.6%
Hancock Co.; Welly - Field 1				
(~5 ha; 76 cm row spacing;	17	*Eriborus terebrans*	5	29.4%
woods on E and W edges)		*Macrocentrus grandii*	2	11.8%
		Sympiesis viridula	1	5.9%
		Lixophaga sp.	1	5.9%
				Total: 52.9%
Hancock Co.; Welly - Field 2				
(~20 ha;76 cm row spacing;	11	*Eriborus terebrans*	6	54.5%
woods on E edge, soybean		*Macrocentrus grandii*	2	18.2%
field on S edge)				**Total:** 72.7%
Henry Co.; Bennett - Field 1				
(~25 ha;76 cm row spacing;	6	*Eriborus terebrans*	3	50.0%
woods on S edge,wheat field		*Macrocentrus grandii*	1	16.7%
on W edge, soybean field		*Lixophaga* sp.	1	16.7%
on E edge)				**Total:** 83.3%
Henry Co.; Bennett- Field 2				
(~10 ha; 76 cm row spacing;	14	*Eriborus terebrans*	2	**Total:** 14.3%
hedgerows on E and S edges)				

*Some type of reduced tillage used in all fields, e.g., chisel plowed in the fall and field cultivated in the spring.

veal trends in parasitism and will enable us to more thoroughly elucidate the parasitoid complex of this important corn herbivore.

ACKNOWLEDGMENTS

We thank Rich Bennett, Lyle and Phil Shaffer, and Brian Welly for allowing us to collect *Ostrinia nubilalis* larvae from their cornfields. We also thank Curtis Young of Ohio State University and Alan Sundermeier, Henry County Cooperative Extension, for their assistance with this project.

LITERATURE CITED

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.

Dyer, L.E. and D.A. Landis. 1997. Influence of noncrop habitats on the distribution of *Eriborus terebrans* (Hymenoptera: Ichneumonidae) in cornfields. Environ. Entomol. 26: 924–932.

Hilbeck, A., M. Baumgartner, P.D. Fried, and F. Bigler. 1998. Effects of transgenic Bacillus thuringiensis corn-fed prey on mortality and development time of immature *Chrysoperla carnea* (Neuroptera: Chrysopidae). Environ. Entomol. 27: 480–487.

Landis, D.A. and M.J. Haas. 1992. Influence of landscape structure on abundance and within-field distribution of European corn borer (Lepidoptera: Pyralidae) larval parasitoids in Michigan. Environ. Entomol. 21:409–416.

Mason, C.E., R.F. Romig, L.E. Wendel, and L.A. Wood. 1994. Distribution and abundance of larval parasitoids of European corn borer (Lepidoptera: Pyralidae) in the East Central United States. Environ. Entomol. 23: 521–531.

Pavuk, D.M. and B.R. Stinner. 1992. Influence of weed communities in corn plantings on parasitism of *Ostrinia nubilalis* (Lepidoptera: Pyralidae) by *Eriborus terebrans* (Hymenoptera: Ichneumonidae). Biol. Control 2: 312–316.

Showers, W.B., J.F. Witkowski, C.E. Mason, D.D. Calvin, R.A. Higgins, and G.P. Dively. 1989. European corn borer development and management. North Central Regional Extension Publication No. 327.