PARASITIZATION OF FALL ARMYWORM LARVAE ON VOLUNTEER CORN, BERMUDAGRASS, AND PARAGRASS

T. R. ASHLEY, C. S. BARFIELD[1], V. H. WADDILL[2], AND E. R. MITCHELL
Insect Attractants, Behavior, and Basic Biology Research Laboratory
Agricultural Research Service, USDA Gainesville, FL 32604 USA

ABSTRACT

Fall armyworm larvae, *Spodoptera frugiperda* (J. E. Smith), were collected from volunteer corn at Homestead, FL from April through August and from Bermudagrass, *Cynondon dactylon* (L.), and paragrass, *Brachiarie mutica* (L.), in August and September at Belle Glade, FL. *Chelonus insularis* Cresson, *Temelucha* sp., and *Apanteles marginiventris* (Cresson) parasitized 44, 11, and 5% of all larvae collected, respectively. The principal parasite in volunteer corn was *C. insularis* and *A. marginiventris* was primarily found in Bermudagrass. Larvae collected from corn were the most frequently attacked with 78 and 72% of the 3rd and 4th instars parasitized, respectively. Larval abundance and parasitization rates in corn were greatest during the months of June and July.

RESUMEN

Se colectaron las larvas de *Sodoptera frugiperda* (J. E. Smith) de maiz voluntario en Homestead, FL. desde Abril hasta Agosto y de pasto de Bermuda, *Cynodon dactylon* (L.) y de *Brachiarie mutica* (L.) en agosto y septiembre en Belle Glade, FL. *Chelonus insularis* Cresson, *Temelucha* sp., y *Apanteles marginiventris* (Cresson) parasitaron 44, 11, y 5% de todas las larvas colectadas, respectivamente. El parasito principal de *S. frugiperda* en el maiz fue *C. insularis*; *A. marginiventris* fue encontrado en *S. frugiperda* primariamente en pasto de Bermuda. Las larvas colectadas del maiz fueron atacadas mas frequentamente, con 78 y 72% de las larvas del tercer y del cuarto instar respectivamente parasitadas. La abundancia de larvas y los porcentages del parasitismo de *S. frugiperda* en maiz fueron máximos en los meses de Junio y Julio.

The fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith), is a polyphagous, mobile pest that annually attacks corn and other crops, especially gramineous species, throughout the southeastern United States. Fall armyworm populations can be found during the entire year in South Florida and Texas; it is commonly believed that this pest migrates from these areas into uninfested regions farther north each spring (Mitchell 1979).

Physical environment, available host plants, and natural mortality factors may act singly or in combination to explain the annual distribution patterns and densities of FAW populations (Barfield and Stimac 1981). Natural mortality inflicted on FAW larvae by parasites in both agricultural and wild host-plant communities is believed to play a substantial role in density

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[1]Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611 USA.
[2]Agricultural Research and Education Center, University of Florida, Homestead, FL 33030 USA.

regulation (Barfield et al. 1980). Studies analyzing larval populations in southern Florida have been restricted to cultivated corn (Ashley et al. 1980, 1982). The study described here was conducted to identify parasites attacking FAW larvae on volunteer corn, Bermudagrass, *Cynondon dactylon* (L.) and paragrass, *Brachiarie mutica,* (L.). Each of these plant species constitutes a potentially significant host for FAW populations and associated parasites throughout much of the year in South Florida.

Material and Methods

FAW larvae were collected weekly from volunteer corn, commencing in April 1979 and continuing through August 1979. The corn plants were located within a 5 m radius of FAW pheromone traps. The sampling procedure consisted of harvesting several corn plants near each trap. Fall armyworm larvae were removed from the plants in the laboratory and placed into individual 30-ml plastic cups containing diet. The head capsule width of each larva was recorded when it was placed initially in the cup. Larvae were held in these cups until each larva's fate was determined. Collections in Bermudagrass occurred on 21 August 1979 and 17 September 1979 and in Paragrass on 17 September 1979 in Belle Glade, FL; all collections were made with sweep nets. Both grasses were growing adjacent to sugarcane fields and no pheromone traps were present in the collecting areas.

Two methods were used to calculate percent parasitization. The first method utilized all FAW larvae in a particular category regardless of their size or age. The second method used only larvae with head capsule widths within the range of head capsule widths parasitized by a particular parasite. The latter method eliminated larvae that were too large or old (as indicated by head capsule widths) for parasitization by a particular parasite. Thus, a more precise determination of the parasite's impact on larvae that it can successfully parasitize can be made.

Results and Discussion

Numbers of FAW larvae collected from corn, Bermudagrass and Paragrass were 1453, 162, and 33 and parasitization rates were 66, 54, and 22%, respectively. Parasitization levels for all FAW larvae regardless of host plant indicated that *Chelonus insularis* Cresson had a rate 4 times greater than the next most prevalent parasite *Temelucha* sp. (Table 1). *Apanteles marginiventris* (Cresson) was the third most abundant parasite followed by the tachinids and the remaining hymenopterous parasites, *Rogas laphygmae* Viereck, *Meteorus autographae* Muesebeck, and *Ophion* sp. Each parasite species emerged from larvae having a particular range of head capsule widths (Table 1) and these head capsule widths were indicative of both larval age and size. Percentages for parasitization were also calculated based on the number of available larvae. A larva was considered available for parasitization if its head capsule width was within the range of head capsule widths parasitized by a particular parasite. Slight increases in parasitization levels for most of the parasites occurred when this method was used with the most dramatic increase occurring in *Ophion* sp. Discounting time of collection, parasitization rates for *C. insularis* and *Temelucha* sp. were substantially higher in corn than in either of the 2 grasses. *Apanteles*

TABLE 1. PERCENT PARASITIZATION BASED ON TOTAL AND AVAILABLE FALL ARMYWORM LARVAE ON 3 DIFFERENT HOST PLANTS, AND MEAN RANGE (MINIMUM-MAXIMUM) VALUES OF HEAD CAPSULE WIDTHS OF LARVAE PARASITIZED BY EACH PARASITE.

Parasite	Percent parasitization					Head capsule widths (mm)	
	Total larvae	Available larvae[1]	Corn	Bermuda-grass	Para-grass	Mean (±SE)	Range (min-max)
Chelonus insularis	44	48	49	4	0	1.2±0.1	0.3 - 1.8
Temelucha sp.	11	12	12	0	0	1.1±0.1	0.4 - 1.7
Apanteles marginiventris	5	6	<1	40	0	0.8±0.3	0.4 - 1.5
Meteorus autographae	<1	<1	<1	3	12	1.4±0.2	0.6 - 1.8
Rogas laphygmae	1	1	<1	7	0	0.9±0.1	0.4 - 1.6
Ophion sp.	<1	4	<1	0	3	2.5±0.2	1.8 - 3.0
Tachinids	3	3	3	0	6	2.0±0.1	0.9 - 3.1

[1]The number of larvae having head capsule widths within the range of head capsule widths parasitized by a parasite.

TABLE 2. NUMBER AND PERCENT PARASITIZED LARVAE FOR EACH FALL ARMYWORM INSTAR AND MEAN HEAD CAPSULE WIDTHS (HCW) FOR PARASITIZED LARVAE BY PLANT SPECIES AND MONTH (HOMESTEAD, FLORIDA—1979).

Plant Month (1979)	Instar 1 (0.3-0.4)	2 (0.5-0.6)	3 (0.7-0.9)	4 (1.0-1.6)	5 (1.7-2.2)	6 (2.3-3.0)	Total-Mean %	Mean HCW (±SE) mm Parasitized	Nonparasitized
Corn									
Apr.	—	—	1-100	35-51	8-0	6-17	53-38	1.5±0.1	1.9±0.1
May	7-57	24-50	89-74	345-74	48-27	39-13	552-65	1.2±0.1	1.6±0.1
Jun.	5-100	33-73	103-78	323-77	31-19	11-9	506-72	1.1±0.1	1.4±0.1
Jul.	0	10-90	45-91	62-75	27-56	27-41	271-73	1.3±0.1	1.7±0.7
Aug.	0	2-0	14-64	35-26	7-0	5-0	63-29	1.1±0.8	1.5±0.1
Sep.	0	1-100	4-75	2-100	1-0	0	8-75	0.8±0.1	1.5±0.8
Total-Mean %	12-75	70-66	256-78	902-72	122-28	91-20	1453-66		
Bermudagrass									
Aug.	0	1-100	6-67	6-50	1-0	1-0	15-53	1.0±0.1	1.3±0.2
Sep.	15-40	17-59	69-68	38-40	5-20	3-0	147-54	0.9±0.1	2.0±0.1
Total-Mean %	15-40	18-61	75-68	44-41	6-17	4-0	162-54		
Paragrass									
Aug.	0	0	0	6-17	5-60	22-14	33-22	2.0±0.2	2.3±0.1

[1]The values in parentheses below each instar are the head capsule ranges (mm) used to estimate that instar. The value preceding each hyphen in the body of the table is the number of larvae collected and the value following the hyphen is the percentage of those larvae that were parasitized.

marginiventris and *M. autographae* parasitized the highest proportion of hosts in Bermudagrass and paragrass, respectively. FAW larvae parasitized by *A. marginiventris* had the smallest mean and range for head capsule widths indicating that this parasite species permitted the least amount of host development prior to the host's destruction. *Ophion* sp. attacked larvae with the largest head capsule widths. The tachinids parasitized hosts having the greatest range of head capsule widths which suggests that these flies are less influenced by host size and age compared to the hymenopterous parasites.

Parasitization levels and FAW abundance were highest in corn during the months of June and July (Table 2). The first 4 FAW instars in both corn and Bermudagrass were the most heavily parasitized with substantial reductions in parasitization occurring in the 5th and 6th instars. The decrease in head capsule widths for parasitized and nonparasitized larvae in corn from April through September may indicate a gradual shift in the age distribution of the larval populations. The mean head capsule width for parasitized larvae was always smaller than for nonparasitized larvae. This condition probably resulted because the hymenopterous parasites, except *Ophion* sp., normally destroy FAW larvae in either the 4th or 5th instar.

The principal parasite on corn was *C. insularis*, and *A. marginiventris* was the principal parasite on Bermudagrass. The differences between parasites on these 2 hosts may reflect a host plant preference or perhaps a change in abundance due to time since collections from Bermudagrass were only made during the last 2 months of the corn collecting period. FAW larval abundance and parasitization rates were highest in corn during the months of May, June, and July. The least amount of host development appeared to occur in larvae parasitized by *A. marginiventris* since these larvae had the smallest head capsule widths prior to their destruction.

References Cited

ASHLEY, T. R., E. R. MITCHELL, N. C. LEPPLA, AND E. E. GRISSEL. 1980. Parasites attacking fall armyworm larvae, *Spodoptera frugiperda*, in late planted field corn. Florida Ent. 63: 136-42.

———, V. H. WADDILL, E. R. MITCHELL, AND J. RYE. 1982. Impact of native parasites on the fall armyworm, *Spodoptera frugiperda*, in South Florida and the release of the exotic parasite, *Eiphosoma vitticole*. Environ. Ent. 11: 833-7.

BARFIELD, C. S., J. L. STIMAC, AND M. A. KELLER. 1980. State-of-the-art for predicting damaging infestations of fall armyworm. Florida Ent. 63: 364-75.

———, AND J. L. STIMAC. 1981. Understanding the dynamics of polyphagous, highly mobile insects. Pages 43-6 *in* T. Kommedahl, ed. Proc. Int. Cong. Plant Protection, Washington, DC. Vol. 1. Burgess Publishing Co.

MITCHELL, E. R. 1979. Migration by *Spodoptera exigua* and *S. frugiperda*, North American style. Pages 386-93 *in* R. L. Rabb and G. E. Kennedy, eds. Movement of Highly Mobile Insects. North Carolina State University.