Peanut Science (1979) 6, 106-109

Parasitism of the Lesser Cornstalk Borer, *Elasmopalpus lignosellus*, in 'Florunner' and 'Spanhoma' Peanuts by Native Hymenopterous Species in Oklahoma.[1]

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ABSTRACT

Parasitism of the lesser cornstalk borer, *Elasmopalpus lignosellus* (Zeller), by hymenopterous species in Oklahoma was compared in 'Florunner' and 'Spanhoma' peanut varieties. Of the 5 parasite species identified, the greatest incidence of parasitism in both varieties was by *Invreia* sp. There were no consistent differences in parasitic activity in *Invreia* sp. or other species related to peanut varieties from which *E. lignosellus* were collected.

Key Words: Lesser cornstalk borer, *Elasmopalpus lignosellus*, Hymenopterous parasites, Peanut insects.

The lesser cornstalk borer (LCB), *Elasmopalpus lignosellus* (Zeller), is a serious subterranean pest in nonirrigated peanut production areas of the southwestern U. S. (7, 12). The potential for heavy losses in Spanish peanuts due to LCB damage has been proven in studies by Smith and Holloway (8) and Berberet et al. (1). In conjunction with research on applied controls for LCB, naturally occurring mortality agents such as parasites and pathogens have been investigated to identify possible biological controls for this pest (3, 11). These studies were conducted primarily on Spanish peanut varieties where native parasite species seldom caused reductions of more than 10% in LCB population densities.

While making field comparisons for host resistance, Schuster et al. (6) determined rates of parasitism of LCB by hymenopterous species in several peanut varieties in Oklahoma. In these studies, parasites destroyed 12.5 - 18.7% of LCB populations in varieties such as 'Florunner' with prostrate growth characteristics compared to 0.0 - 1.6% in erect Spanish types. In the opinion of Schuster et al., higher rates of parasitism combined with intermediate levels of host resistance which they identified in runner peanuts, could prove to be important in limiting losses due to LCB.

Our primary objective was to determine if parasitism of the LCB in Florunner peanuts would consistently surpass that in 'Spanhoma' variety over a period of several years. Also to be identified were varietal preferences when exhibited by various parasite species.

[1]Journal Article 3674 of the Agric. Exp. Sta., Okla. St. Univ., Stillwater, OK. This research was supported in part by Coop. Agreement No. 216-15-97 from the USDA, SEA-CR.

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Materials and Methods

A nonirrigated field in Marshall Co., southern Oklahoma, was selected for this study because of its sandy soil and nearly 10 year history of infestation by the LCB. Florunner and Spanhoma peanuts were planted in unreplicated 0.25 ha plots with plant populations in both varieties averaging 12/m of row in 1975-76. Plants were thinned to 6/m of row in 1977-78 to encourage infestation by the LCB which, we have observed, often becomes more abundant in areas with lower plant populations. No insecticides were utilized in the research area during the 4 years of this study. PCNB (Pentachloronitrobenzene) fungicide was used to suppress soilborne diseases which may become quite prevalent with LCB damage in peanuts.

A minimum of 60 larvae and pupae were collected from each variety at weekly intervals from mid-July until October. Despite the fact that up to 500-600 plants/variety were sampled in some weeks, minimum insect numbers were collected to insure that sufficient quantities would be available for estimates of parasitism. Over 100/wk were collected per variety during periods when LCB population densities exceeded 5-6/m of row. Host larvae and pupae as well as parasite cocoons were taken by uprooting plants from 1-3 m lengths of row selected at random over each plot area. Roots, pegs, and pods were examined, after which, soil was sifted to retrieve insects which had been dislodged from plants. Estimates of population densities (#/m of row) were made during the sampling process.

Larvae were reared on a modified Vanderzant-Adkisson medium (10) in 17 x 63 mm plastic vials plugged with cotton. LCB pupae and parasite cocoons were placed in 30 ml cups with cardboard lids until adult emergence. Emergence of host and parasite adults was recorded at 2 day intervals.

We have determined in laboratory studies that a total of ca. 530 degree days (dd) above a threshold of 13°C are required for development from egg deposition to adult emergence in the LCB (unpublished data). Temperature data from a weather station located in the research area were utilized for computation of accumulated dd during each season of this study. These totals were used along with data on relative numbers of larvae and pupae collected each week to segregate members of 3 generations.

Mortality due to parasites was assigned to stages in which these agents most frequently caused host death. Accordingly, upon collection larvae were classed as small (length $\leq$ 10 mm) or large (> 10 mm) and rates of parasitism were computed for small larvae, large larvae, and pupae of each generation. Insects which did not complete development due to causes other than parasitism (mold, etc.) were not included in calculations. Parasites which emerged from field collected cocoons were included. The percentage of total parasitism attributable to each species was computed for generations and years by dividing the rate for each by total parasitism X 100. Adult parasites were identified by use of reference collections at Oklahoma State University Museum and by P. M. Marsh and E. E. Grissell Systematic Entomology Laboratory, USDA.

Results

As determined from dd calculations and field sampling data, the LCB completed 3 generations during the period from early July to October of each year. Accurate segregation of generations was possible despite the considerable overlapping which occurred. LCB population densities increased greatly in both Florunner and Spanhoma peanuts from first through third generations (Table 1). Dramatic increases in population densities were attributable in part to dry conditions which have been reported to be favorable for survival of the LCB, (4, 12). Average rainfall for the period Aug. 1 - Sept. 30 in the years of our study was just 9.8 cm and frequently, 2 - 3 weeks passed without any precipitation being recorded. LCB numbers were generally higher in Florunner during September due perhaps to greater ground cover and availability of food afforded by plants of this variety at this time. In every year except 1976, large numbers of LCB destroyed nearly all pegs and pods in Spanhoma before damage of this severity occurred in Florunner.

Parasitism of the LCB by hymenopterous species ranged from 1.4% (first generation, Spanhoma - 1977) to 39.1% (first generation, Florunner - 1978). Rates were variable for years, generations within years, and life stages in this study (Table 1). Overall, extent of parasitism did not differ greatly between varieties and averages for the 4 years indicated that parasitism was not consistently a major cause of mortality in LCB regardless of growth characteristics of its host plant.

Relative abundance of parasites was variable with predominate species changing from year to year. For example, parasitism of small larvae by *Apanteles* sp. (Braconidae) was not observed in Florunner during 1976 and only accounted for 1.5% of total parasitism in Spanhoma. However, in 1978 this species was responsible for 38.6% and 33.1% of total parasitism in Florunner and Spanhoma, respectively (Table 2). *Bracon gelechiae* Ashmead (Braconidae) was a gregarious ectoparasite of small and large larvae in both varieties during 1976 and 1978. We recorded only one instance of parasitism in Florunner during 1977 and none by this species in either variety in 1975.

Parasites which emerged from large larvae (prepupae) after the host cocoon had been constructed included *Orgilus elasmopalpi* Muesebeck (Braconidae) and *Pristomerus spinator* (f.) (Ichneumonidae) These species appeared somewhat sporadically during this study with average percentage of total parasitism somewhat higher in Florunner than in Spanhoma (Table 2). The most abundant parasite from 1976-78 was *Invreia* sp. (Chalcididae) in both varieties. In the opinion of E. E. Grissell, this pupal parasite is a new species of *Invreia* which has not yet been described. Despite the very low incidence of this species in 1975, averages for the 4 year duration of this study showed that *Invreia* sp. was responsible for nearly 50% of total parasitism (Table 2).

Table 1. Parasitism of *Elasmopalpus lignosellus* (LCB) by hymenopterous species in 'Florunner' (F) and 'Spanhoma' (S) peanuts in Oklahoma, 1975 - 78.

Year	Generation	LCB/m of row[1/]		% Parasitism							
				Small Larvae		Large Larvae		Pupae		Total	
		F	S	F	S	F	S	F	S	F	S
1975	1	2.3	2.3	4.3	5.7	13.7	12.6	0.0	0.0	18.0	18.3
	2	2.3	5.0	1.4	5.6	11.1	18.6	1.1	0.0	13.6	24.2
	3	26.7	29.6	1.5	3.0	1.7	1.0	3.2	0.0	6.4	4.0
1976	1	1.2	1.2	0.0	0.0	1.5	13.2	2.4	3.8	3.9	17.0
	2	2.3	1.2	1.2	0.8	1.5	0.8	10.8	17.5	13.5	19.1
	3	8.1	3.5	0.0	0.0	0.0	1.8	5.4	15.7	5.4	17.5
1977	1	2.0	2.0	0.0	0.0	8.8	0.0	4.4	1.4	13.2	1.4
	2	12.5	7.5	0.0	0.6	1.6	0.6	4.3	2.9	5.9	4.1
	3	27.0	15.0	1.3	0.0	3.5	3.2	19.2	17.6	24.0	20.8
1978	1	1.2	3.5	18.7	4.8	20.4	1.2	0.0	1.7	39.1	7.7
	2	13.7	11.2	0.0	2.0	1.6	2.7	0.5	2.8	2.1	7.5
	3	50.6	27.6	2.1	2.4	1.3	1.4	9.6	8.7	13.0	12.5
Average	1	1.7	2.3	5.8	2.6	11.1	6.8	1.7	1.7	18.6	11.1
	2	7.7	6.2	0.7	2.3	4.0	5.7	4.2	5.8	8.8	13.7
	3	28.1	18.9	1.2	1.4	1.6	1.9	9.4	10.5	12.1	13.7

1/ Peak population densities, larvae + pupae.

Table 2. Percentage of parasitism of *Elasmopalpus lignosellus* in 'Florunner' and 'Spanhoma' peanuts by hymenopterous species in Oklahoma, 1975 - 78.

Parasite species	Host stage 1/	% of total parasitism									
		Florunner					Spanhoma				
		'75	'76	'77	'78	Ave.	'75	'76	'77	'78	Ave.
Apanteles sp.	SL	18.8	0.0	2.2	38.6	14.9	36.7	1.5	2.3	33.1	18.4
Bracon gelechiae	SL-LL	0.0	12.4	0.7	7.1	5.0	0.0	16.2	0.0	7.6	5.9
Orgilus elasmopalpi	LL	14.8	6.9	20.4	0.6	10.7	13.1	13.3	3.0	2.9	8.1
Pristomerus spinator	LL	49.2	0.0	6.4	6.3	15.5	30.2	0.0	0.0	0.0	7.5
Invreia sp.	P	4.2	80.7	61.9	18.7	41.4	0.0	69.0	83.3	47.4	50.0
Unidentified	-	13.0	0.0	8.4	28.7	12.5	20.0	0.0	11.4	9.0	10.1

1/ Stage from which parasites most often emerge; SL = small larvae, LL = large larvae, P = pupae.

Those species which emerged from small and large LCB larvae were somewhat more abundant than the pupal parasite in the first and second generations. However, the pupal parasite accounted for over 70% of total parasitism in generation 3 (Table 3). This trend was evident in both peanut varieties indicating that the pronounced difference in plant morphology of the prostrate Florunner vs. the erect Spsnish type did not greatly influence relative abundance of parasites through the season. Unidentified parasites included primarily those which attacked host larvae and did not survive to the adult stage after leaving the host remains. Species determination of these parasite larvae and pupae was not possible. Unidentified parasites accounted for only a small percentage of the total instances of parasitism.

Table 3. Relative importance of hymenopterous species parasitizing 3 generations of *Elasmopalpus lignosellus* in Oklahoma, 1975 - 78.

Parasite Species	% of total parasitism					
	Florunner			Spanhoma		
	1	2	3 1/	1	2	3 1/
Apanteles sp.	31.0	3.9	9.1	29.9	16.4	9.9
Bracon gelechiae	3.1	10.0	2.0	15.5	3.8	3.3
Orgilus elasmopalpi	5.9	17.0	12.4	20.4	6.6	3.8
Pristomerus spinator	27.9	11.6	2.2	6.3	20.5	0.0
Invreia sp.	9.2	44.2	70.6	15.5	42.2	76.6
Unidentified	22.9	13.3	3.7	12.4	10.5	6.4

1/ Generation numbers (values in table are averages for 4 years).

Discussion

Several authors have reported that plant species upon which insects are feeding may influence incidence of parasitism by entomophagous insects (5, 9). The relationship of plant species to insect parasitism was further refined in studies by Franklin and Holdaway (2) who found that the tachinid parasite, *Lydella grisescens* Robineau-Desvoidy, is attracted primarily to a particular corn variety and secondarily to its host the European corn borer, *Ostrinia nubilalis* (Hubner). Similarly, Schuster et al. (6) proposed that plant morphology in peanuts may influence host finding and frequency of parasitization by hymenopterous species attacking the LCB leading to higher incidence of parasitism in spreading Virginia peanut varieties than in Spanish types. Our study has not confirmed this hypothesis. We have observed no consistent trend of higher rates of parasitism in Florunner vs. Spanhoma peanuts. Percent parasitism (Table 1, total) by 5 hymenopterous species in Florunner exceeded that in Spanhoma in just 6 of 12 LCB generations observed. Average % parasitism was somewhat higher in Florunner during the first generation, however, rates were slightly higher in Spanhoma for second and third generation LCB (Table 1). Species which parasitize small and large larvae were prevalent in generations 1 and 2, while most parasitism of third generation LCB in both varieties was by the pupal parasite, *Invreia* sp. (Table 3).

Johnson (3) reported that density dependence could not be demonstrated for any mortality agents of the LCB in Texas. Of the 5 parasite species identified in our study, only *Invreia* sp. appeared to respond to increasing host population densities with increased levels of parasitism. This response was similar in both varieties and there was little indication that parasitism by this or any other species was influenced by varietal characteristics of Florunner vs. Spanhoma peanuts.

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Accepted October 2, 1979