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Fecundity of the Lesser Cornstalk Borer, *Elasmopalpus lignosellus*, from Florunner and Spanhoma Peanut Cultivars.[1]

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ABSTRACT

Pupal weights and reproductive rates were compared over a 3 year period in females of the lesser cornstalk borer, *Elasmopalpus lignosellus* (Zeller), from Florunner and Spanhoma peanuts. Weights of pupae from the two cultivars were quite similar. Egg production of moths emerging from pupae collected in Florunner (mean = 297/female) was significantly lower ($p \leq 0.05$) than in Spanhoma peanuts (mean = 341/female). In both groups, fertility of eggs averaged ca. 94%.

Key Words: Lesser cornstalk borer, *Elasmopalpus lignosellus*, host resistance, reproductive rate.

The lesser cornstalk borer (LCB), *Elasmopalpus lignosellus* (Zeller), has been an important pest in spanish peanuts grown in Oklahoma since 1963 (6). Berberet et al., (1) reported that LCB infestations caused serious reductions in yields in the spanish cultivar Spanhoma. With the release of the Florunner cultivar (3), producers in Oklahoma began to plant larger acreages of runner peanuts. Little information has been published regarding the extent of infestations and losses which might be expected due to the LCB in Florunner peanuts.

Several studies have been conducted which show that Florunner and other runner cultivars have some resistance to LCB and may not be as heavily damaged as susceptible spanish cultivars (4, 5). However, influence of environmental conditions at the soil surface under the prostrate vines of runner peanuts and possible effects of resistance in these cultivars on the biology of the LCB have not been investigated. The purpose of this study was to compare pupal weights and fecundity of LCB which had completed larval development in Florunner and Spanhoma peanuts.

Materials and Methods

This research was conducted over a 3 year period from 1976-78. Florunner and Spanhoma peanuts were used as representatives of runner and spanish types commonly grown in Oklahoma. Peanuts were grown in a nonirrigated research area with a history of LCB infestation. Pupae were collected from each cultivar at weekly intervals throughout each season to provide a consistent supply of insects for laboratory studies. Collections were made by uprooting plants and sifting soil to retrieve cocoons which were then transported to the laboratory prior to removal of pupae.

Laboratory studies have been conducted which show that a total of ca. 530 degree days above a threshold of 13 C are required for completion of one LCB generation (Berberet, unpublished). Temperature data recorded at a weather station located in the research area were used in calculating degree day accumulations during this study. These data, along with relative numbers of larvae and pupae observed were used in segregating members of three generations completed by the LCB in each season.

All laboratory studies were conducted at 25 ± 2 C and 14 h photophase. These conditons were similar to those during nighttime hours in the field when LCB moths are known to oviposit (2). Pupae were removed from cocoons, weighed and placed in 30 ml cups with cardboard lids. As adults emerged, males and females were selected at random and each pair was confined in a clear plastic dish (ca. 100 mm dia. x 40 mm high) with paper toweling over the top. The toweling served as a substrate for egg deposition. Humidity was maintained at 70-80% by placing a damp sponge covered with filter paper in the bottom of each dish and moths were fed Gatoraid®. Due to time required for preparing dishes and making egg counts, all moths that emerged could not be included in studies of reproduction. A minimum of 10 pairs/cultivar were used for each generation.

At 48 h intervals paper toweling was removed from dishes and eggs were counted under a stereomicroscope. Papers were then placed in 1 L jars and, after a 1 week incubation period, infertile eggs were counted. Total numbers of fertile and infertile eggs and the percent fertility were calculated for each LCB female. Moths were placed in clean dishes with fresh paper toweling at each 48 h interval. Longevity of females was recorded.

The percentage of females which laid no fertile eggs was computed for each cultivar. Because those which did not lay eggs may have been affected as much by experimental environment as peanut cultivars, they were not included in statistical analyses relating to pupal weight, longevity, or fecundity of moths. To avoid the possibility of biasing results, care was taken to assure that sizes of moths included in analyses were representative of field populations. Weights of females included in reproduction studies were compared with those for all females collected. Weight classes were established based upon 5 mg increments from 15 to 40 mg. The percentage of all females collected which belonged in each class was calculated. By frequent comparison of these percentages and weights of moths selected for reproduction studies, samples were kept as representative as possible of field populations.

Means were calculated over the duration of the study for pupal weight, adult longevity, total eggs, and fertile eggs for females which laid fertile eggs from each cultivar. Means for weight and fecundity were computed for each generation as well. Significant differences in means for LCB from Florunner and Spanhoma cultivars were determined by use of Student's 't' tests. Linear regression lines were fitted for female weight vs. total eggs and weight vs. fertile eggs by generation and year to determine if a consistent relationship existed between these variables. The pattern of egg production (eggs/48 h interval) was calculated for each cultivar.

Results

Of over 1200 LCB pupae collected in this study 618 were female. Of those which were observed for reproduction studies, 26.9% from Florunner and 23.9% from Spanhoma laid no fertile eggs. For the remainder (112/cultivar) analyses of female weights, longevity, and fecundity are given in Table 1. No significant differences ($p \leq 0.05$) were recorded for pupal weights or longevity of moths from the two peanut cultivars. Moths from Florunner produced significantly fewer eggs. However, egg fertilty was ca. 94% for both LCB populations.

Because of the consistently high rates of fertility, means for total eggs and fertile eggs were similar and only those for total eggs are presented in Table 2. Analyses of egg production for generations and years shown in this table illustrate a fairly consistent trend for greater numbers of eggs from females collected in the Spanhoma cultivar.

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Table 1. Means ± SE for size, longevity, and fecundity of adult females of *Elasmopalpus lignosellus* collected from Florunner and Spanhoma peanuts, 1976-1978.

Cultivar	No. Females/ Cultivar†	Pupal Wt. (mg)	Life Span (days)	% females without fertile eggs	Eggs/Female Total	Eggs/Female Fertile	% fertility
Florunner	154	26.8±0.4	16.2±0.5	26.9	297.0±15.5*	280.3±15.5**	94.5
Spanhoma	147	27.7±0.5	16.6±0.6	23.9	340.7±12.8*	316.1±13.6**	93.2

†Includes those which laid no fertile eggs. Other calculations include only females which laid fertile eggs SE were obtained without pooling data across cultivars.

*Means significantly different, ($p \leq 0.05$), 't' test.

**Means significantly different, ($p \leq 0.10$).

Table 2. Fecundity of *Elasmopalpus lignosellus* in Florunner and Spanhoma peanuts.

Cultivar	Generation =	Mean total eggs/female ± SE: 1	2	3	Mean for Year
			1976		
Florunner		353.1±41.4 (8)†	380.3±41.4 (20)	342.3±68.1 (10)	364.6±28.9 (38)
Spanhoma		367.5±63.7 (8)	353.4±34.2 (17)	363.7±33.5 (11)	359.7±23.1 (36)
			1977		
Florunner		287.3±46.5 (10)	281.4±37.1 (15)	169.7±40.1** (9)	253.5±24.7 (34)
Spanhoma		318.9±33.7 (19)	324.8±51.5 (8)	263.7±23.3** (15)	300.3±19.9 (42)
			1978		
Florunner		352.6±13.7 (6)	233.9±34.4* (19)	290.8±38.3 (16)	270.6±23.1* (41)
Spanhoma		415.5±41.5 (8)	410.0±17.6* (15)	283.8±43.6 (11)	370.5±22.9* (34)

†Number of observations used in computing mean and SE; includes only females which laid fertile eggs.

*Means significantly different, ($p \leq 0.05$), 't' test.

**Means significantly different, ($p \leq 0.10$).

However, numbers of eggs produced by moths from Spanhoma were significantly higher ($p \leqslant 0.05$) than in Florunner only during 1978 (Table 2).

Pupal weights and fecundity of moths varied considerably over the nine generations included in this study (Fig. 1). No consistent trend of increased egg deposition as female weight increased was evident for generations within years in LCB collected in either cultivar. For example, pupal weights of females from the first generation of 1978 were the lowest recorded over the 3 years while egg numbers were relatively high (Fig. 1). A significant ($p \leqslant 0.05$) year by generation interaction indicated that the relationship of pupal weight and fecundity changed throughout the study and overall conclusions may not be valid.

The pattern of egg deposition vs. time was quite similar for LCB in the two cultivars. Moths laid more than 80% of their eggs prior to 12 days post emergence (Fig. 2).

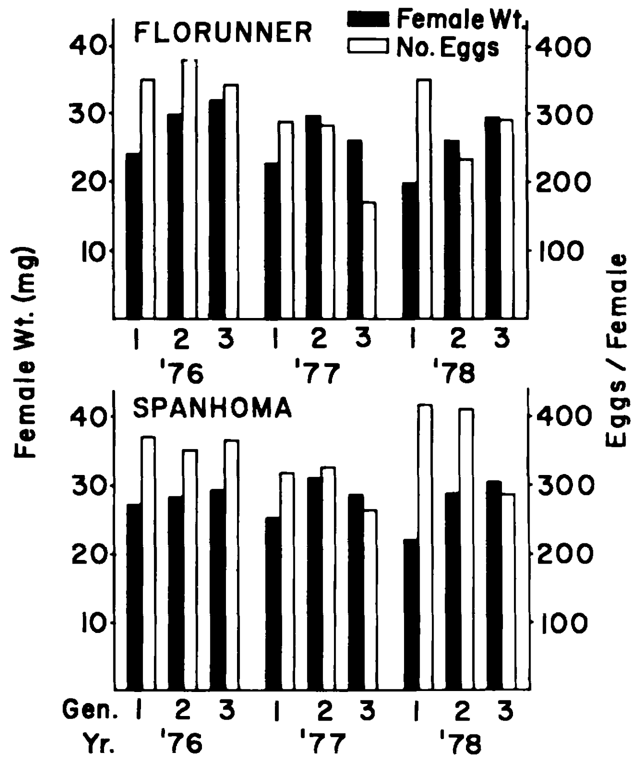

Fig. 1. Mean female weight and egg production for each generation of *Elasmopalpus lignosellus* from Florunner and Spanhoma peanuts during 1976-78.

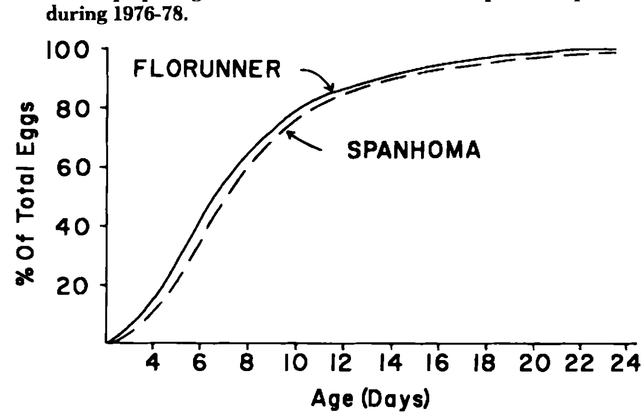

Fig. 2. Ovipositional rate of *Elasmopalpus lignosellus* from Florunner and Spanhoma peanuts.

Discussion

This study was designed to compare sizes and reproductive rates of LCB which had completed larval development in representative cultivars from two types of peanuts commonly grown in Oklahoma. Although not selected for resistance to LCB (3), Florunner peanuts have been reported to possess some resistance to this pest. Resistance has been indicated by lower ratings for larval feeding damage relative to those in a susceptible spanish cultivar (Starr) (5) and less reduction in yield relative to the spanish cultivar Comet when ca. 50% of the plants were infested in field plots (4). Studies of Berberet et al. (1) have indicated that the spanish cultivar (Spanhoma) used in our study is quite susceptible to damage and yield reduction when infested by the LCB.

Little information exists on possible effects of resistence in Florunner peanuts on development and reproduction in the LCB. Schuster et al. (4) reported that size of larvae collected in resistant virginia peanuts (e.g. Florunner) was significantly reduced relative to that in Comet, indicating possible inhibition of larval development. These authors felt that Florunner peanuts possessed some antibiosis for the LCB. Comparison of female pupal weights in our study showed a slightly lower mean for those from Florunner, however, it was not significantly different from the mean weight in Spanhoma. Life span of moths in both cultivars was somewhat longer than the ca. 10 day average reported by Leuck (2). Longevity under laboratory conditions was greater than 4-19 days as reported by Walton et al. (6) from field studies. Increased life span under laboratory conditions probably did not have an important influence on egg production, because most eggs were laid within 8-10 days of adult emergence.

Numbers of eggs/female was much higher in this study than recorded in Georgia by Leuck (2). Mean numbers were over twice as large and where Leuck found a maximum number of 314/female, we found that some moths laid over 600 eggs. However, Leuck included relatively few females in his studies and a more representative sample of LCB from Georgia would perhaps yield larger numbers of eggs/female. The relationship of female weight and egg production changed with each insect generation. It seemed evident in this study that size of moths was not an important factor in determination of reproductive capacity. Apparently, moths which were only 20-25 mg in weight had sufficient nutrient reserves to lay virtually the same quantity of eggs as those which were 35-40 mg in weight.

The only evidence gained in this study of possible antibiosis for LCB in Florunner peanuts was related to eggs produced/female. Significantly lower means for total and fertile eggs for the 3 year period suggested that some aspects of environment or nutrient sources in Florunner were perhaps less suitable for larval development than those in Spanhoma peanuts (Table 1). While this study could not be used to predict reproductive rates of the LCB in other peanut cultivars, it does show clearly the egglaying potential of this pest and tends to support contentions that Florunner peanuts possess some resistance for the LCB.

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