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## FLIGHT ACTIVITY OF TROPICAL SOD WEBWORMS (LEPIDOPTERA: PYRALIDAE)

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Lepidopterous larvae have long been recognized as major pests of Florida turf. Among these pests, the tropical sod webworm, *Herpetogramma phaeopteralis* Guenee is considered to be most damaging. This species has a wide tropical distribution and occurs along much of the Gulf Coast of the United States (Kerr 1955). All major southern turfgrasses in Florida are subject annually to potential damage by tropical sod webworms (TSW). Widespread damage can occur on virtually all types of turf areas, but infestation levels and the resulting damage are usually greatest on high-maintenance turf areas (Reinert 1983).

Webworms have been the target of extensive chemical control programs due to their widespread damage on golf courses, private lawns, and other turf areas in Florida and other southeastern states (Reinert 1973). Numerous studies have been published on the chemical control of sod webworms in Florida. However, in spite of the economic importance of TSW, only two studies have been published on the biology of this pest. Kerr (1955) describes some of the basic biology of TSW and Reinert & Busey (1983) note the resistance of bermudagrass selections to TSW. With the exception of these two studies, little is known of the actual biology of this important pest. The objective of this study was to determine the flight activity of TSW.

Seasonal flight activity of TSW was measured with a large, walk-in black light trap. This trap measured 2 m × 2 m × 2.5 m high and was made of wood with screened sides. On the top was a 15 watt black light with funnel through which insects fell into the trap below. The trap was located on the Everglades Research and Education Center (Univ. of Florida/IFAS), Belle Glade, Florida in an area composed of mixed vegetation (grasses, weeds, trees). The trap was used only one night per week in order to prevent possible depletion of local populations of TSW around the trap. Trapping was conducted for two years from June 2001 to June 2003. After collection, adult TSW were taken to the laboratory for positive identification and sex determination. In order to determine possible seasonal differences in flight activity, samples from 3 month periods were pooled. For the purposes of this paper, winter is defined as December, January, and February, spring is March, April, and May, summer is June, July, and August, and fall is September, October, and November. These definitions correspond to seasonal definitions for the North Temperate Zone (Guralnik 1982). Mean

differences in TSW adults caught in the light trap between seasons was determined by using a Least Significant Difference (LSD) test (SAS 1996).

The distance flown by adult TSW when disturbed was determined in field tests at the Everglades Research and Education Center (EREC) during June-July, 2003, on four different days ( $n = 15$  TSW adults recorded per day). All 60 observations were conducted during afternoons when temperatures were warm and winds mild, which is representative of southern Florida weather conditions during the summer. Observations were made by a person walking across a mowed grassy area of mixed species until a TSW appearing moth flew up. The location from which the moth flew was marked by dropping a ball and the moth was visually followed until it settled. Thereafter, the moth was caught in a fine mesh net as it flew up from its new location. Wind speed and air temperature at 1.5 m high were recorded and the moth was taken to the laboratory for identification and sex determination (Kerr 1955) via microscope. A  $t$ -test (SAS 1996) was used to compare the distance flown of males versus females of TSW. Also, linear correlation of flight distance versus air temperature and wind speed was performed (SAS 1996).

An additional test was conducted to determine if adults had a preference to reside in grasses of different heights. The test was conducted at the EREC in grassy areas of mixed species. Five pairs of plots were located in various areas of the EREC. Each plot was 10 m by 10 m and located 5 m away from its paired plot and appeared similar to its paired plot i.e., plant species, shade, etc. During October, 2003, portions of the EREC were mowed on different days, leaving one plot unmowed (tall grass) and one plot mowed (short grass). Samples were taken 24 h after mowing to allow time for disturbed TSW adults to settle into plots. Each pair of plots was sampled during the afternoon and at the same time to insure that light, wind, etc. would be the same between the two adjacent plots. One random sample of grass height was measured in each plot. TSW adults were sampled in each plot in five parallel transects evenly spaced through each plot. Twenty sweeps with a sweep net (38 cm diameter) were taken per transect. Each sweep consisted of a 180° sweep with each forward step. Mean differences in grass height and TSW adults/100 sweeps between tall versus short grass plots were compared by using  $t$ -tests (SAS 1996).

TABLE 1. TROPICAL SOD WEBWORM ADULTS CAUGHT IN A BLACKLIGHT TRAP DURING 2001 TO 2003.

Season	Mean <sup>a</sup>	SD	Range	% Female
Fall	70.5 a	125.8	3-476	69.5
Summer	16.6 b	23.0	1-99	59.6
Spring	13.2 b	42.5	0-205	65.3
Winter	9.8 b	23.3	0-110	66.7

<sup>a</sup>Means followed by the same letter are not significantly different ( $\alpha = 0.05$ ) based on the LSD test (SAS 1996).

Tropical sod webworm adults were active throughout the year in southern Florida (Table 1). Fewest adults were caught in the winter probably due to lower populations and/or cooler temperatures restricting flight at night into the light trap. Kerr (1955) noted that TSW adults became inactive at 14°C, which is within the range of night temperatures which may occur in southern Florida during the winter. Though not significantly different, more adults were caught during the spring and summer than during the winter. However, the fall clearly was the season of greatest adult catches, being more than winter, spring, and summer catches combined. Kerr (1955) reported that one of the largest outbreaks of TSW in Florida history occurred during the fall of 1953. He also noted the peak of adult emergence was in October and November in northern Florida. Reinert (1983) noted that TSW populations are present throughout the year in Florida, but most damage is incurred in late summer and fall. Our data are consistent with these earlier observations that although TSW populations are present year round, most damage is expected in the fall.

In the flight distance study, the sex ratio of males to female adults closely approximated 1/1 on each of the four days with the total number of males versus females being 30 to 30. The exact 1 to 1 sex ratio in total adults studied occurred by chance since adults were sexed only after being caught. A *t*-test showed that there was no significant difference ( $t = -0.52$ , 58 *df*,  $P = 0.61$ ) between sexes in distance flown during the four days. Hence, data from the two sexes were pooled and an adult TSW irrespective of sex was shown to fly an average distance of  $1.7 \text{ m} \pm 1.1 \text{ SD}$  during our tests. The average temperature during the flight tests ranged from 31.2 to 37.6°C/day. No significant correlation ( $r = 0.20$ ,  $P > 0.05$ ) was found between temperature and flight distance as expected since all temperatures were very warm for flight activity with only a small temperature range in the observations. Wind speed (km/h) was more variable than temperature, ranging from an average 0.1 km/h on a very calm day to 1.6 km/h on a slightly windy day. A significant positive correlation ( $r = 0.40$ ,  $P < 0.05$ ) was found between wind speed and flight distance, which simply reflects adults being carried farther when flying under windier conditions. Kerr (1955) reported that TSW flight was relatively weak during the day and disturbed moths

settled quickly, but data were not provided. Our data are essentially in agreement with Kerr's earlier observations.

In the study to measure if grass height influenced adult residence, the height of the grass in the unmowed plots averaged  $14.6 \text{ cm} \pm 2.1 \text{ SD}$  versus  $7.2 \text{ cm} \pm 0.8 \text{ SD}$  in the mowed plots. These means were significantly different ( $t = 6.1$ , 8 *df*,  $P < 0.05$ ) as expected. The number of adult TSW caught in sweep net samples averaged  $16.2 \pm 10.1 \text{ SD}$  in the unmowed plots versus  $0.2 \pm 0.4 \text{ SD}$  in mowed plots. Again, these means were significantly different ( $t = 3.6$ , 8 *df*,  $P < 0.05$ ). These latter data show that TSW were 81 times more likely to reside in tall grass versus short grass during daylight hours. Kerr (1955) noted that TSW adults rested in shrubbery around lawns during the day. Similarly, Reinert (1982) noted that TSW adults hide in tall grass, but like Kerr (1955), data were not supplied for the field observations. Our data corroborate these earlier studies showing that adult TSW have a high preference to reside in taller grass than adjacent shorter grass during daylight hours. In turf, sanitation involves practices to avoid introducing insects or mites into noninfested sites, as well as cleanup of debris that serves as hiding or overwintering sites for pests (Potter 1998). Our data suggest that reduction of taller vegetation such as grass and shrubs adjacent to turf and/or insecticidal treatment of taller vegetation adjacent to turf may be useful in reducing TSW infestations.

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#### SUMMARY

Flight activity of tropical sod webworms occurred throughout the year in southern Florida with most flight activity in the fall. Adults flew short distances when disturbed during the day and showed a high preference to reside in tall grass versus short grass during the day.

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