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AN UPDATE ON HICKORY SHUCKWORM RESEARCH

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INTRODUCTION

The hickory shuckworm, *Cydia caryana* (Fitch) (Lepidoptera: Tortricidae), has been considered one of the most important pecan pests attacking pecan by growers and entomologists in the southeastern United States. This notoriety for the hickory shuckworm originated, most likely, because of the: (1) emergence of adults over an extended period from approximately April 1 through October (Calcote & Hyder 1979 & 1980); (2) the long period of time that may need insecticide applications; (3) the difficulty of sampling and identifying this insect; and (4) the lack of validated action thresholds. The timing of an insecticide was aided greatly by the introduction of the blacklight traps for hickory shuckworm surveys and control (Tedders & Edwards 1972, 1974; Tedders et al. 1972; Strother & McVay 1978; and McVay & Ellis 1979). However, the technique of using the blacklight traps was only accepted for monitoring pest populations by a few growers which were in Alabama (McVay, Personal Communication) and research entomologists.

The recent development of the hickory shuckworm pheromone (Smith et al. 1987, McDonough 1990) provided a practical method of identifying and monitoring this pest, but action thresholds for applying insecticide applications are still lacking. The use of the hickory shuckworm pheromone has been aided greatly by the research of McVay et al. (1991). This research included trap type, effectiveness, vertical distribution (trap height), horizontal distribution (trap placement within the canopy), and cardinal direction. There have been some reports from growers and entomologists that the pheromone does not attract the male hickory shuckworm moths during the summer (June and July), but does work early in the season (April and May) and after the half-shell hardening, which occurs approximately August 15.

Additionally, some scientists have stated that there has been tremendous variation in pheromone trap catches possibly due to the lack of attraction of the shuckworm pheromone lures from different companies. Therefore, the objectives of this research study were to: (1) determine the attraction of the hickory shuckworm lures over the season with materials provided by Trece, Scentry, and the Yakima, WA, USDA-ARS laboratory, and (2) compare the hickory shuckworm pheromone trap catch trend in the same locality where we collected hickory shuckworm moths in blacklight traps in a previous 5 year study (Hall & Eikenbary, Unpublished).

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MATERIALS AND METHODS

For the experiment, the same pheromone components, E8, E10-12 acetate, were used in an abandoned pecan orchard. The pheromones were placed in Scentry wing pheromone traps and placed in a pecan orchard on the campus of Oklahoma State University. This particular orchard was ideal for testing the pheromone in that the orchard is abandoned so there has been no chemical applications or IPM practices occurring for several years. The area has native and improved pecan trees with phylloxera galls (*Phylloxera* spp.) which provide an early season habitat for hickory shuckworm development (Dinkins & Reid 1988, Eikenbary et al. 1990).

The traps were placed in the tree using a 2.5 cm X 6.09 piece of electrical conduit. A hook was fashioned from 3/8" rebar with a hole drilled in the end opposite of the hook. A piece of #12 copper wire was inserted into the hole to served as the pulley. Baling twine was placed through the copper wire loop before the hook was placed in the tree. The trap was attached to the baling twine and pulled up into place (Robert Morrison, Personal Communication. Dept of Statistics, Okla. State Univ., Stillwater, OK).

The hickory shuckworm populations were monitored from 10 July 1993 to 31 October 1993, and 1 April 1994 to 3 October 1994. During this period, 20 traps were placed in the orchard, 5 traps with each of the three pheromones (Trece, Scentry and USDA prepared) and 5 traps which had no pheromone (blanks). The traps were placed at least 25 m apart in the outer portion of the canopy, and a trap count was made every three days. The blanks were counted the day after the pheromone count was made in order not to contaminate the blanks. The concentration and purity of each of the pheromones are in table 1.

RESULTS

The data were analyzed using SAS (SAS Institute 1985). The blanks were analyzed with the three pheromone types in the first ANOVA and GLM procedure. Using the analysis in this method, significant differences in the data were noted at ($P< 0.05$). This should be the case since hickory shuckworms were not caught in the traps containing the blanks. The data were analyzed again using ANOVA and GLM without the data from the blanks included in the analysis. The analysis concluded there were no significant differences in the three pheromones. The data were also subjected to linear and quadratic analysis to determine if any differences could be detected in the three pheromones tested. No significant differences were seen between the

three pheromones by the two methods of analysis. There were significant differences detected by date and by trees ($F>0.0001$).

It should be noted that there were no independent treatments since all the traps were in the same orchard. It has been reported that traps should be at least one half mile apart to adequately evaluated the pheromones (Reid 1993).

DISCUSSION

The research completed in the past two growing seasons indicated that all three pheromones evaluated were effective in attracting the male shuckworm to the pheromone lures in the traps.

The traps were observed and moths removed and recorded every three days for the periods 26 July to 31 October 1993 and 1 April thru 3 October 1994. During these periods, the populations of hickory shuckworm fluctuated greatly most likely due to weather conditions and natural population variations. The data obtained from these portions of the growing seasons indicate that the traps are effective in attracting male hickory shuckworms if they are present in the orchard. It is very difficult to know what is actually happening with populations in the tree since there is not an effective method of sampling the trees for the hickory shuckworm.

In this particular orchard, the traps were effective in attracting males to the traps during the period of June thru July 1994 (Figure 1). It has been reported by growers and entomologists that during this period of time the traps are not effective in attracting the males. Calcote and Hyder (1979) monitored emergence of hickory shuckworm from the shucks over a 3 yr. period and found during 1976 hickory shuckworm were emerging during June and July, but during 1977 and 1978 from June thru July there was no hickory shuckworm emergence from the shucks (Figure 2). When comparing the pheromone data to the blacklight data (Hall & Eikenbary, Unpublished) for June thru July, 1994, the trap catch for the pheromone is about half of the blacklight trap catch. Blacklights attract both male and female moths whereas the pheromone trap attracts only males. Thus, there is an unequal attraction of hickory shuckworms to pheromone traps versus blacklight traps. Our data suggests the traps are an effective method of monitoring the male hickory shuckworm during this period of time. The hickory shuckworm pheromone probably attracts the male moths in proportion to the total population in an area. Therefore, when few moths are caught by the pheromone traps or blacklight traps in the summer, it is a result of few moths present in that locality. This can be alleviated somewhat by placing the pheromone traps in pecan trees that have a history of hickory shuckworm populations.

Use of the pheromone traps for determining spraying times (action threshold) for control of hickory shuckworm populations may require additional field research, but the traps do give some indication that the insect is present in an orchard. By monitoring weather data and pheromone trap catches, blacklight traps, and emergence of the hickory shuckworm from the pecan shucks for the growing season, the data may help explain the fluctuations with shuckworm populations.

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Table 1. Concentration and purity of the pheromones lure provided by the individual labs.

Pheromone	Concentration (ug/speta)	Purity
USDA HSW pheromone	50ug	99.9%
Scentry	50ug	99.9%
Trece	50ug	99.9%

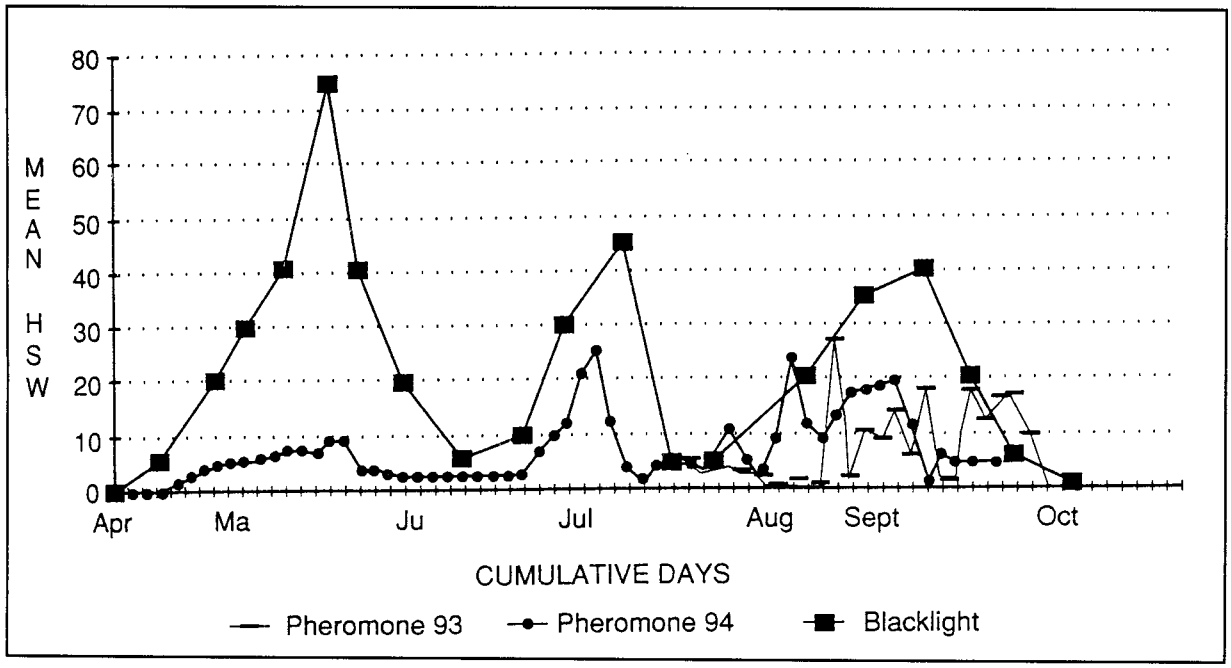

Figure 1. Mean hickory shuckworm trap catch over a 5 year period for the blacklight trap and over the 1993 and 1994 growing season for the hickory shuckworm pheromone trap.

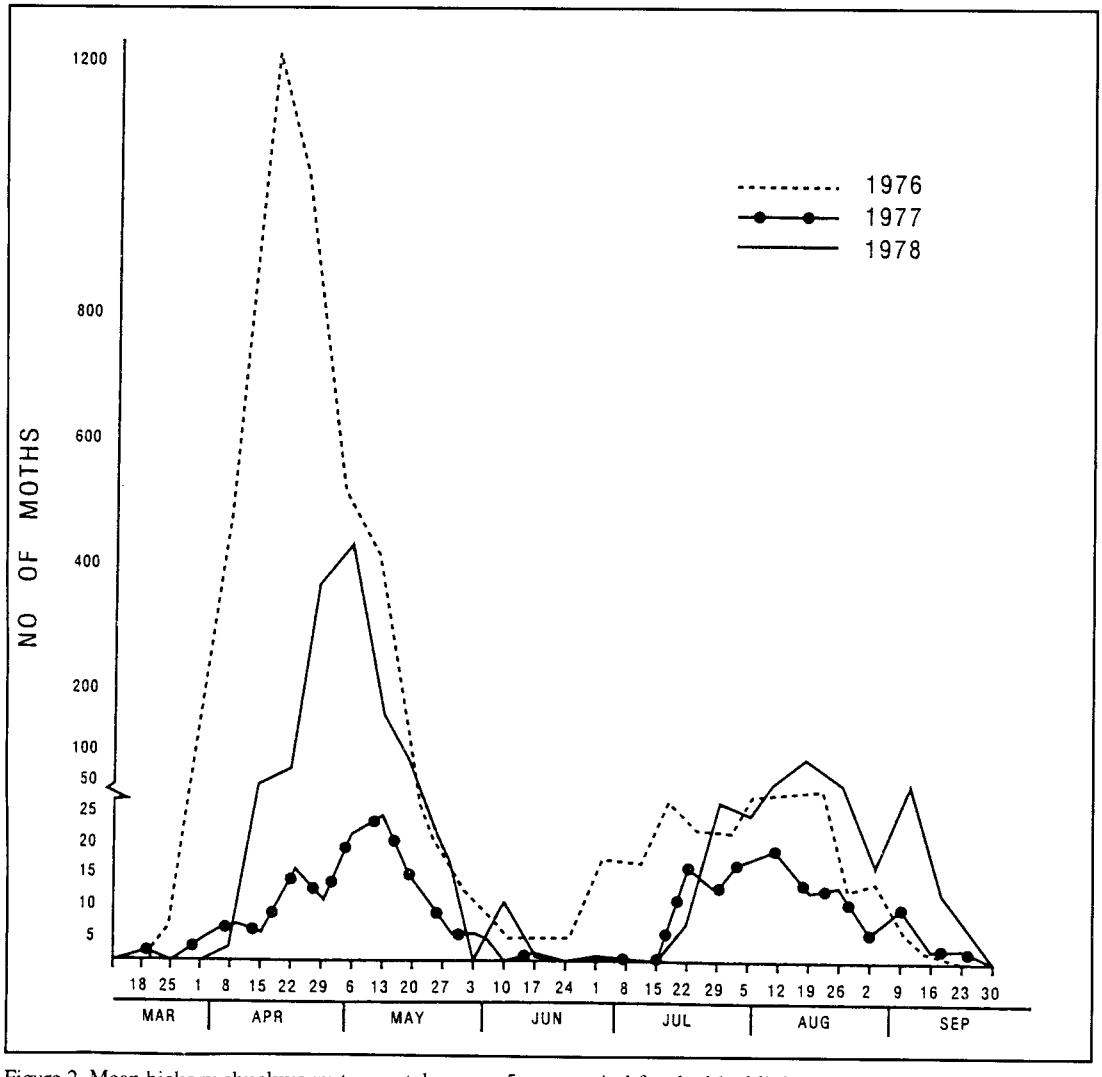

Figure 2. Mean hickory shuckworm trap catch over a 5 year period for the blacklight trap and over the 1993 and 1994 growing season for the hickory shuckworm pheromone trap.