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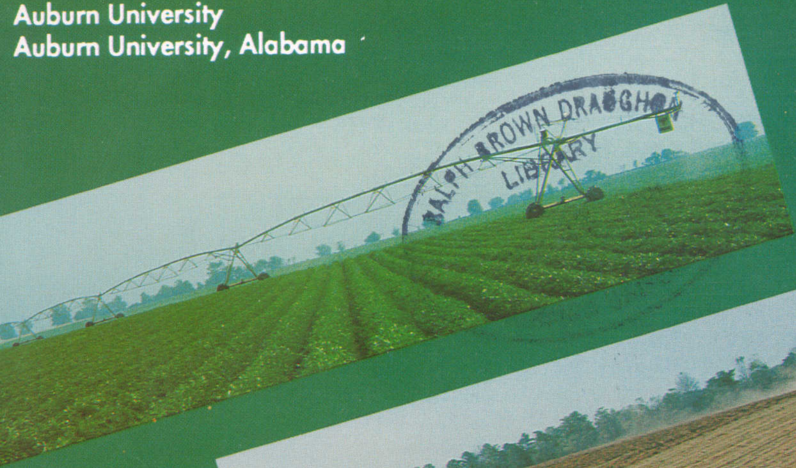
Lowell T. Frobish, Director
Auburn University
Auburn University, Alabama



Biology and Management of the Lesser Cornstalk Borer in Peanut Fields

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BIOLOGY AND MANAGEMENT OF THE LESSER CORNSTALK BORER IN PEANUT FIELDS

T.P. Mack and D.P. Davis[1]

INTRODUCTION

THE LESSER CORNSTALK BORER, *Elasmopalpus lignosellus* (Zeller) (Lepidoptera: Pyralidae), is a major insect pest of peanuts in Alabama. It is an insect in the Order Lepidoptera, and has four life stages: egg, larval, pupal, and adult. Eggs, photo 1 (page 20) are laid singly or in small groups within 1/4 inch of the soil surface under the peanut canopy. These eggs are white when they are first laid and turn red just before hatching. The adult moth 'glues' these eggs to sand particles or to the plant. Eggs also are laid on the plant, particularly when the soil is moist. Newly emerged larvae, photo 2 (page 20), crawl across the soil surface or on the plant and locate suitable host plant parts for feeding. Lesser cornstalk borer larvae molt six times, and increase in size with each molt. Larvae are easily recognized by the bluish-green bands on their bodies and by their violent wiggling when disturbed. Larvae spend most, but not all, of their time below the soil surface or inside of plant stems. Many larvae will typically construct a silken tube which is interwoven with soil particles, and is attached to the plant. Silken tubes can usually be found either attached to the plant, on the soil surface, or within the top 1/2 inch of the soil surface.

The pupae are small and brown, with few markings, photo 3 (page 20). Pupation also occurs in the soil, so most of the life cycle of this insect is spent underground.

Adults of this insect are small moths that are about 1/2 inch long, and males and females are differently colored. Males, photo 4 (page 20), are tan in color, with a dark grey stripe on interior edges of their wings. This gives males the

[1]Respectively, Associate Professor and Postdoctoral Fellow of Entomology.

appearance of having a dark stripe down the center of their backs when they are at rest, since the wings are folded over their backs. Females, photo 5 (page 20), are dark grey in color and may possess a metallic sheen. Males and females are less active in the heat of the day, although moths are easily found during the day in years with population outbreaks. Females are harder to locate than males due to their dusky coloration and their unwillingness to fly.

Population outbreaks typically occur in hot, dry weather in peanuts grown in sandy soils. These outbreaks can be either sporadic and occur only where hot and dry conditions prevail, or they can be widespread. When widespread, lesser cornstalk borer can be devastating to most peanuts in the Southeast. Studies were begun in 1982 to fully describe the biology of the insect and to develop improved methods of management. This circular describes progress made in understanding why the lesser cornstalk borer is a hot and dry weather pest, and how it can best be managed.

EFFECT OF TEMPERATURE ON FECUNDITY AND LONGEVITY OF THE LESSER CORNSTALK BORER

It is important to accurately estimate the longevity and number of eggs laid by each female lesser cornstalk borer, since all larvae develop from eggs. A good estimate of the abundance of adult moths should aid in predicting whether or not a large number of eggs, and hence larvae, will occur. Published estimates of the longevity of adult moths are quite variable, from 7 to 42 days. Estimates of the number of eggs laid per female are even more variable, ranging from 91 to 450 eggs per female. Consequently, experiments were initiated to estimate the longevity and fecundity of the lesser cornstalk borer, and the effects of temperature on these two variables *(8,10)*.

METHODS

Lesser cornstalk borers were reared on an artificial diet in the laboratory. New adults from this colony were allowed to mate, and mated female moths were placed in cylindrical paper cartons which were placed in a controlled environment chamber. Moths also were provided with a honey and water solution to aid in egg laying. Controlled environment chambers were held at one of nine constant temperatures to estimate the effects of temperature on longevity and fecundity. The number of living females and the number of eggs was recorded daily until 50 percent of the females in each container died.

RESULTS

Longevity of females declined with an increase in temperature, with a longevity of about 20 days at 63°F, to a low of only 8 days at 90°F. So, adult moths would be expected to live for little more than one week in the hot, dry conditions that are characteristic of population outbreaks of the lesser cornstalk borer. The total number of eggs laid per female changed with temperature, with a low of 20 eggs laid per female at 63°F to a peak of almost 120 eggs per female laid at 88°F, figure 1. It should be noted that 88°F is a constant temperature, and temperatures in fields fluctuate. A mean of 88°F could be achieved by a maximum daily temperature of 98°F and a minimum of 78°F. This would be hotter than the 30-year average normal weather for June, July, or August in the Wiregrass, and indicates that lesser cornstalk borer moths lay the most eggs when it is hot.

The number of eggs laid per female per day also varied with temperature, figure 2. Hotter temperatures again produced a greater egg laying rate than the cooler temperatures studied, with a minimum egg laying rate of about 1.5 eggs per day at 63°F and a maximum rate of about 10 eggs per

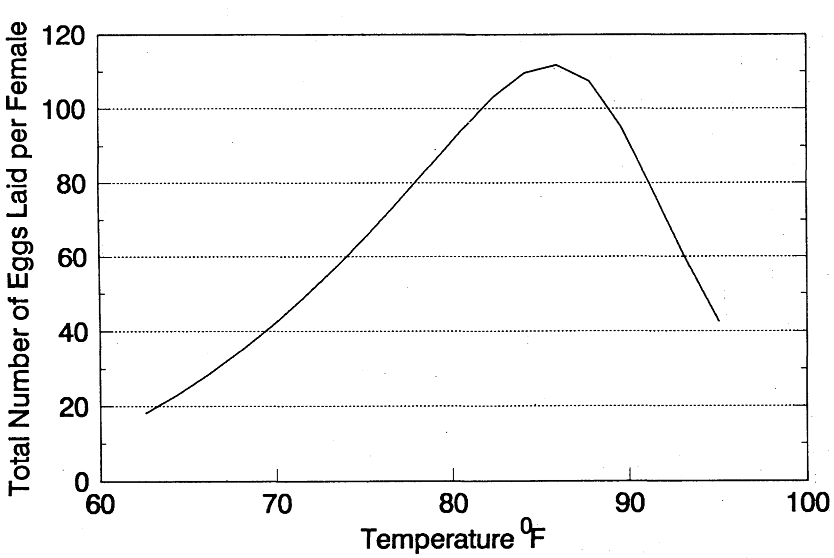

FIG. 1. Effects of temperature on the total number of eggs laid by the lesser cornstalk borer, under laboratory conditions.

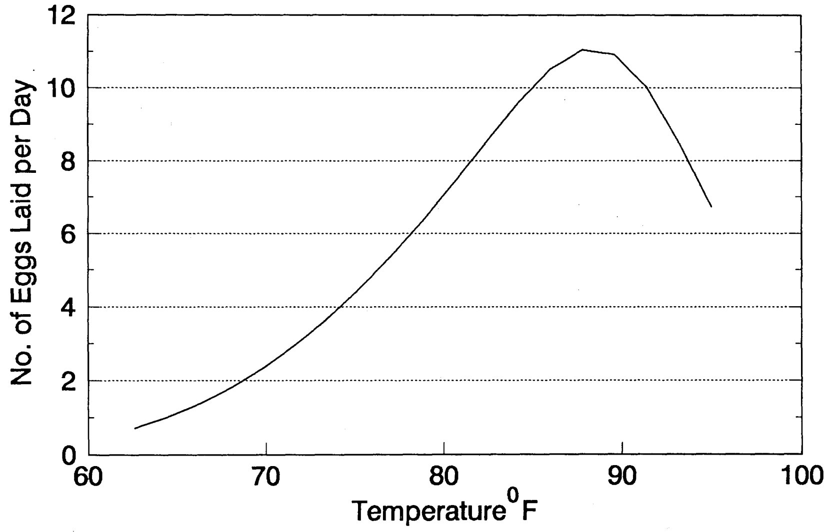

FIG. 2. Effects of temperature on the egg laying rate of females of the lesser cornstalk borer, under laboratory conditions.

day at 88°F. So, moths of the lesser cornstalk borer not only lay more eggs at a constant 88°F, they lay them at a faster rate. This should result in many eggs and larvae occurring in a short period of time in hot, dry weather.

DEVELOPMENT OF A MATHEMATICAL MODEL OF THE POPULATION DYNAMICS OF THE LESSER CORNSTALK BORER

The lesser cornstalk borer is a soil insect, so sampling for larvae is laborous and costly. Further, some plant damage occurs during sampling. Ideally, population outbreaks of this insect could be predicted so that sampling could be accurately timed and needless sampling could be avoided. Knowledge of why population outbreaks occur would allow growers to independently evaluate whether or not conditions conducive to the development of population outbreaks were present. Research was initiated to develop a mathematical model of the growth and development of the lesser cornstalk borer in conventionally tilled and planted peanut fields *(12)*.

Design of Model

A temperature- and moisture-dependent model for the population dynamics of the lesser cornstalk borer was developed. The effects of temperature on the development of larvae were evaluated in a nine-temperature laboratory study. One hundred newly hatched larvae per temperature were individually placed onto an artificial diet and reared until adulthood. The threshold temperature for development of larvae was determined to be 58°F, indicating that larvae would not grow to be adults if they were reared at or below this temperature. The accumulated number of heat units for all stages was determined from this threshold, figure 3.

The effects of temperature on longevity and fecundity were previously determined. The effects of soil moisture on the number of eggs laid and on the behavior of small larvae were determined by Carolla *(1)*. In air-dried sand, females laid 99 percent of their eggs beneath the soil surface, where they would be less exposed to common egg predators in peanut fields, such as fire ants. However, only 15 percent of eggs laid by moths were in the soil when the soil was completely saturated with water. About 55 percent were laid on the surface of the soil and 30 percent were laid on the plant in this case, so 85 percent of the eggs would be exposed to predators. A

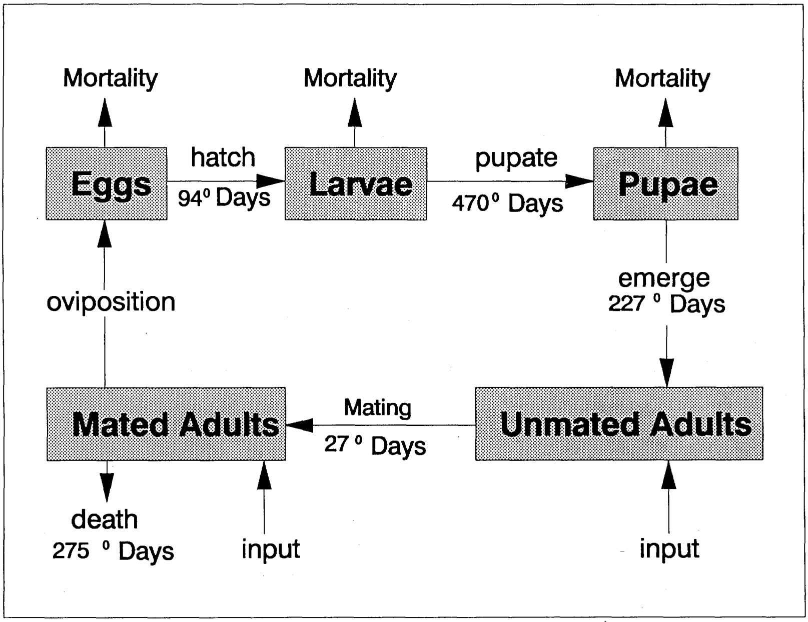

FIG. 3. Diagram of the life cycle of the lesser cornstalk borer, with the required number of accumulated heat units (°Days) required to advance to the next stage. Assumes a threshold temperature of 58°F.

similar situation exists for small larvae. In air-dried soil, 73 percent of small larvae remained underground, while only 1 percent remained underground in saturated soil. So, wet soil exposes eggs and larvae to predators, while hot, dry soil does not.

WHY ARE LESSER CORNSTALK BORERS A PEST IN HOT, DRY WEATHER?

The mathematical model that was developed for the lesser cornstalk borer attacking peanuts aids in understanding why this insect is a pest in hot, dry weather. Model simulations measured the increase in egg and larval abundance from known changes in simulated weather. The simulations show that there are several factors that contribute to the development of population outbreaks of lesser cornstalk borers in hot and dry weather.

Increased Egg Laying Rate of Females

Lesser cornstalk borer moths laid up to twice as many eggs at a two times faster rate when they were held at a constant temperature of 89°F compared with females held at 72°F. So, hot temperatures promote the laying of a large number of eggs in a short period of time.

Faster Life Cycle

Higher air temperatures caused by hot weather also cause higher soil temperatures. This increases the rate of development of the insect, so the time it takes to produce a generation is shorter. If wilting of plants occurs, soil temperatures increase beyond air temperature and generation time is even further reduced. This results in overlapping generations of eggs, larvae, pupae, and adults. Lesser cornstalk borer populations may increase exponentially at this time, with no apparent delays due to reproduction.

Decreased Egg/Larval Mortality Due to Predation

In recent laboratory studies, lesser cornstalk borers and selected beneficial insects were exposed to simulated hot, dry conditions of 86°F and less than 2 percent relative humidity *(9,13)*. No eggs, pupae, or adults of the lesser cornstalk borer were killed by these conditions, even after 24 hours exposure. In contrast, 69 percent of bigeyed bugs were killed in 24 hours and 100 percent of fire ants were killed in 10 hours. So, the lesser cornstalk borer can survive hot and dry conditions better than at least some of its common predators. Hence, more larvae should survive in the field due to reduced mortality from these predators.

EFFECTS OF HOT, DRY WEATHER ON THE LIFE CYCLE

Lesser cornstalk borers, like all insects, are cold-blooded so changes in temperature affect their growth and development rate. Model simulation results (see chart below) illustrate this by comparing the rate of development of this insect in Headland, Alabama, during the month of July in 1984, when normal weather prevailed, and 1986, when hot, dry conditions predominated and a population outbreak of lesser cornstalk borers occurred.

Life cycle	*Normal*	*Hot*
Egg	4.4 days	3.7 days
Larva	22.2 days	18.5 days
Pupa	10.7 days	8.9 days
Adult	14.3 days	11.9 days
Generation time	38.6 days	32.2 days
No. of eggs/day	6.3	9.6
Total eggs laid/female	85 eggs	110 eggs

Actual daily maximum and minimum temperatures recorded at the Wiregrass Substation, Headland, were used to calculate the number of days needed for each stage in the chart. Hot weather during the peanut growing season is almost always accompanied by drought. Drought, of course, is not good for plant growth, and wilting of plants may occur. Wilted peanut plants allow more light (and heat) to penetrate to the soil surface, which further accelerates the growth rate of the lesser cornstalk borer. For example, soil temperatures under a normal peanut canopy are typically equivalent to the air temperatures, but soil temperatures under a wilted canopy are hotter than the air temperature. Soil temperatures taken 1 inch deep under a peanut canopy have reached 118°F at the Wiregrass Substation, so the hot weather estimate of the life cycle in the chart is actually an underestimate of the rate of development.

These hot, dry conditions not only have an impact on the life cycle of the lesser cornstalk borer, but on beneficial insects that feed on the lesser cornstalk borer. Some of the beneficial insects appear to be more susceptible to dying from these harsh conditions than the lesser cornstalk borer.

The lesser cornstalk borer outbreak of 1990 is an example of this phenomenon. Earwig, fire ant, and ground beetle populations declined in research fields before lesser cornstalk borer populations increased. Earwigs, photo 6 (page 20), are voracious predators that are nocturnal. They readily eat all sizes of lesser cornstalk borer larvae in lab tests. Earwigs reportedly need free moisture to reproduce, so the hot, dry weather, which is conducive to population outbreaks of the lesser cornstalk borer, is not good for earwigs. In fact, declines in earwig populations were observed in 1986 and in 1990, which were years in which lesser cornstalk borer outbreaks occurred. Ground beetles, photo 7 (page 20), are also ravenous predators that feed on lesser cornstalk borers. The immatures of ground beetles are black, and look like caterpillars except for their hardened bodies and an absence of fleshy legs on their abdomens. Fire ants, photo 8 (page 20), will seemingly eat anything, including lesser cornstalk borers. Fire ant foraging is depressed by hot, dry weather, so the number of prey taken per day declines. The activity of these three important predators in peanuts appears to be reduced in hot, dry weather.

SEASONAL ABUNDANCE OF EGGS, LARVAE, PUPAE, AND ADULTS OF THE LESSER CORNSTALK BORER

No published studies documented the abundance of eggs, larvae, pupae, and adults in peanut fields, even though this insect is considered to be a key pest of peanuts. Studies were initiated in 1982 to determine the abundance of all life stages of the lesser cornstalk borer in peanut fields, to provide a better understanding of how large populations develop *(11)*.

METHODS

Experiments were conducted from 1982 to 1986 in conventionally tilled and planted Florunner peanuts at Headland, Alabama Insect populations were monitored weekly through each growing season. The number of eggs, larvae, and pupae of the lesser cornstalk borer was determined by collecting 10 randomly chosen 18-inch-long by 12-inch-wide by 1-inch-deep soil samples within rows and by floating out these life stages from the soil in a saturated salt solution. The number of larvae and pupae was also estimated by the weekly sieving in the field of 10 randomly chosen 36-inch-long, by 12-inch-wide by 1-inch-deep soil samples within rows. An 8- or 10-mesh sieve was used for all sieving. Adult moths were monitored in two ways. Ten mesh cages that were 36 inch by 36 inch by 36 inch and that were placed over a row of peanuts were used to estimate the number of new adults in the field. These cages captured only newly emerged adults since older adults were removed from the cages when they were placed over each section of row. This method provided a means to estimate the number of new and fecund moths that were present in a field.

Adult abundance also was estimated by the use of flush samples, photo 9 (page 21). Flushing occurred in the early morning, when there was little wind. Adult moths were disturbed from their resting places by vigorously agitating foliage with a meter stick. Shape and coloration, as well as flight patterns, of adults of the lesser cornstalk borer were distinctive; adults of the lesser cornstalk borer could easily be distinguished from other moths in the field.

RESULTS

Only one or two generations of lesser cornstalk borers occurred during years when low densities of lesser cornstalk borer larvae were found. This contrasts sharply with population growth of this insect during an outbreak year, where the number of eggs, larvae, pupae, and adults per meter increased exponentially with time. This is an important difference, because it means that there are not just more lesser cornstalk borers during an outbreak, but that the entire population is behaving differently than in a non-outbreak year. Further, the slopes for the exponential increase of eggs, larvae, and adults are similar, so estimating the abundance of one of these life stages, such as adults, allows one to calculate the abundance of the other stages. It was recently demonstrated that the abundance of larvae sampled per meter by soil sieving in week '*i+l*' is linearly related to the number of adults flushed per meter in week ' *i* '.

The equation is:

$$Y= (-0.\ 30 \pm 0.27) + (12.66 \pm 0.88) *X,$$

where Y=the mean number of larvae per meter in week '*i+l*' from soil sieving and X=the mean number of adults per meter in week '*i*' from flushing. From this equation, 91 percent in the variation in larval density in week '*i+l*' can be explained from adult abundance estimates from flushing in week '*i*', figure 4. This equation could be a significant addition to

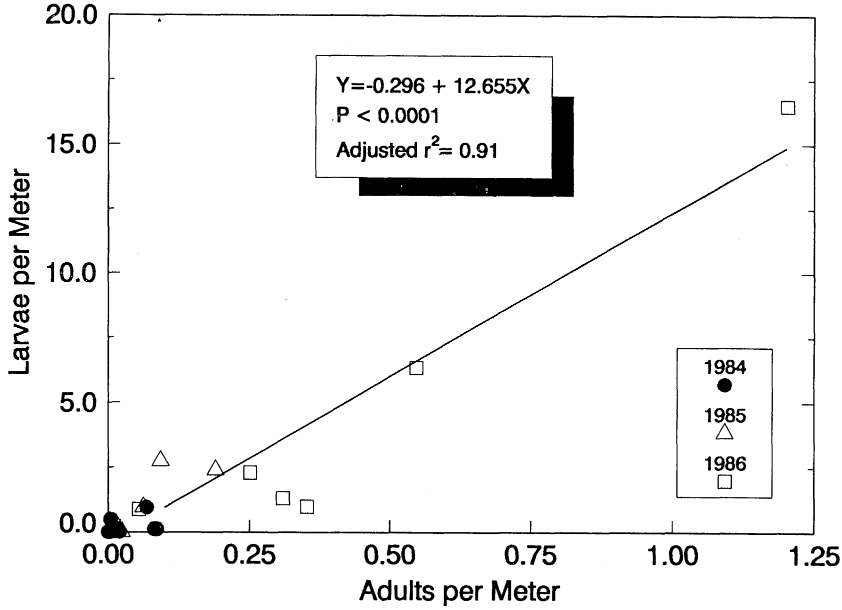

FIG. 4. Regression of the mean number of larvae per meter found by soil sieving versus the mean number of adults found by flushing for 1984 to 1986. The number of larvae plotted is for the week after flushing.

management of the lesser cornstalk borer, because the use of adult flush counts allows for the prediction of damaging larval populations before they occur.

LESSER CORNSTALK BORER DAMAGE TO PEANUTS

The larval stage is the damaging stage of this insect. Smaller larvae feed on vegetative buds, pegs, leaves, and on plant stems at or near the ground level. Older larvae feed on the stem and taproot at the root crown, photo 10 (page 21), or on pegs and pods, photo 11 (page 21). This usually occurs later in the season, such as the 1990 outbreak. Larval damage to peanut pods has been linked to increased levels of aflatoxin caused by *Aspergillus flavus* fungus, so it is important to prevent larvae from damaging pods. A study was initiated to determine the effects of lesser cornstalk borer larval feeding at different peanut plant ages on peanut growth and yield *(14)*.

METHODS

Florunner peanut plants were infested in a greenhouse at each of five plant ages with one of five densities of larvae. Plant ages ranged from just prior to blossoming to plants that were about one week from harvest. Larval densities ranged from none to eight larvae per plant. Larvae were reared on an artificial diet in the laboratory, and were placed at the base of each plant at the appropriate time. Plants were monitored daily for emergence of lesser cornstalk borer moths. Emerging adults were destroyed to prevent reinfestation. Both infested and uninfested plants were allowed to grow until harvest, when plant growth variables such as pod dry weight, number of damaged pegs, etc. were measured.

RESULTS

Lesser cornstalk borers significantly decreased peanut yield. Uninjured pod, seed, and root dry weight per plant decreased linearly with an increase in larval damage. Pod dry weight declined by 5.8 percent per larva, and root dry weight decreased by 4.7 percent per larva. This means that two larvae feeding on a plant would cause an 11.6 percent pod dry weight reduction and a 9.4 percent decline in root dry weight, compared with uninfested plants. Obviously, few larvae can be tolerated before economic losses occur. Undamaged pod dry weight is a good indicator of yield, and the decline in root dry weight means that larval feeding on plant stems decreased the flow of sugars to the root system.

CHARACTERIZATION OF LESSER CORNSTALK BORER DAMAGE TO THE ROOT CROWN REGION OF PEANUT PLANTS

Researchers working with Spanish peanuts have reported that root crown injury is important due to the concentration of small flower buds at the base of the plant. This study was done to verify that larval feeding damaged nutrient-conducting tissues of Florunner peanut plant stems *(17)*. The number, size, and distribution of larval feeding sites on peanut root crowns was determined in a greenhouse study. Methods used were similar to those used in the previous study, except that plants were harvested and examined for larval injury immediately after the emergence of lesser cornstalk borer adults from the soil.

RESULTS

Larvae fed on the phloem tissue in the root crown, which carries sugars to the root system, photo 12 (page 21). The average percent injury to the phloem in the root crown area was 16.8 percent. This data supports the hypothesis that damage to the root crown should decrease the flow of sugars to the peanut root system, and reduce root growth. This is significant since this type of damage is most likely when it is hot and dry, which is when a peanut plant has an acute need for more healthy roots. So, larval injury to the root crown should increase water stress at a time when the plant has a critical need for water. This type of injury may also increase the incidence of white mold, *Sclerotium rolfsii*, since the periderm, or 'skin', of the root crown acts as a deterrent to fungal invasion and larval injury to the root crown destroys periderm.

INSECTICIDES FOR MANAGEMENT OF THE LESSER CORNSTALK BORER

The only current method of managing lesser cornstalk borer populations is through the use of a granular insecticide, preferably applied in a 12- to 18-inch band. If applied early, these insecticides do not need to be activated by rainfall, since larvae emerging from eggs crawl across the soil surface to the plant. Rainfall or irrigation should improve the performance of granular insecticides by leaching additional insecticide out of the granules.

The same hot and dry conditions that are conducive to lesser cornstalk borer population outbreaks are trouble for granular insecticides, because insecticide degradation is enhanced in hot, dry weather. For example, phorate[2] was inactivated in air dry sand in one published study, and the degradation of chlorpyrifos[3], aldicarb[4], and terbufos[5] increased with temperature in other published studies. No insecticides in these field trials have provided season-long control under the hot, dry conditions conducive to lesser cornstalk borer outbreaks. Several field tests were done evaluating the length of effectiveness of a number of granular insecticides against the lesser cornstalk borer in peanuts, and evaluating the rates and timing of chlorpyrifos applications *(15)*, which documented the survival of newly hatched larvae of the lesser cornstalk borer exposed to the insecticide-treated soil.

TIMING OF AN INSECTICIDE APPLICATION

Correct timing of an insecticide application is critical for management of lesser cornstalk borer larvae. If larvae are present, effective control is needed from blossoming time until

[2]Trade name Thimet®.
[3]Trade name Lorsban®.
[4]Trade name Temik®.
[5]Trade name Counter®.

just prior to harvest, or about 50 to 60 days. It is important to protect the root crown from damage at blossoming time because of the concentration of flower buds in the root crown, the flow of sugars through the root crown to the root system, and the potential for fungal invasion, if the root crown is damaged. It also is important to protect the pods from damage later in the season since damaged pods may contain more aflatoxin. *However, no insecticides have remained effective for this long in hot and dry weather in the Auburn tests.* Tests indicate recommended granular insecticides should be applied when most larvae are small to medium-sized and before significant damage to pegs, pods, and the root crown has occurred. Insecticides applied after this damage has occurred may kill larvae, but economic damage will have already been done. Also, it is difficult to kill larvae when they are in the pods, since this is several inches below the soil surface and most granular insecticides need a great deal of moisture to be moved to that depth. Therefore, it is important to monitor fields carefully when conditions are favorable for the development of a population outbreak, and to not delay in applying an insecticide when scouting indicates that a treatment is necessary.

METHODS

Treatments were applied at planting or at early pegging with a single-row, small-plot applicator. Soil samples were taken from under the peanut canopy within randomly selected rows of each plot biweekly throughout the growing season. Thus, the insecticide was exposed to exactly the same environmental conditions as a normal insecticide application. Soil samples were returned to the laboratory and air-dried. Small larvae of the lesser cornstalk borer were placed in clear plastic cups partially filled with a subsample of the soil, and larvae were supplied with a sorghum seedling as a food source. Cups were kept in a controlled environment chamber to minimize effects of temperature and humidity on larval feeding and hence exposure to the insecticides during each test. Mortality of larvae was determined at 72 hours.

RESULTS

Chlorpyrifos, applied at pegging at 2.0 pounds active ingredient per acre, was effective for 42 days in 1986, 102 days in 1987, 19 days in 1988, and 53 days in 1989. Chlorpyrifos, parathion, and fonofos[6] were all effective against lesser cornstalk borer larvae, with chlorpyrifos and fonofos being consistently effective. Chlorpyrifos reduced survival of larvae longer than any other insecticide tested. Further, plots treated with chlorpyrifos have yielded significantly more peanuts than any other treatment in 3 of 4 years of field tests, from 1986 to 1990.

PREDICTING POPULATION OUTBREAKS

A method for estimating when lesser cornstalk borer population outbreaks occur was recently developed and field tested. The concept, called LCB Days, is based upon the effects of hot, dry weather on the life cycle of the lesser cornstalk borer and its natural enemies. The model assumes that a certain number of hot, dry days are required for peanut plants to wilt, natural enemy populations to decline, and lesser cornstalk borer populations to develop at a faster rate. The concept was developed from 3 years of data collected at the Wiregrass Substation, Headland. Conventionally tilled and planted Florunner peanuts were used in the study.

Validation studies also were conducted at the Wiregrass Substation in 1989 and 1990. LCB Days are defined as: LCB Days = X-Y, where X = the number of hot, dry days since planting, and Y = number of normal, wet days since planting. A hot, dry day is a day with less than 0.1 inch of rain and where the daily maximum temperature exceeds 95°F. A normal, wet day is a day where the daily maximum temperature does not exceed 95°F and where more than 0.1 inch of rain occurs. For example, assume that it is 50 days after planting and there have been 15 hot and dry days (X), 12 normal and wet days (Y), and 23 days that were neither hot and dry nor normal and wet. There would be +3 LCB Days (=15-12) accumulated at this time.

The usefulness of this concept can be seen daily by comparing the cumulative LCB Days for 1989 and 1990 in Headland, figure 5. Lesser cornstalk borers were rarely found in 1989, due to frequent rainfall and hot (greater than 95°F) weather. This contrasts with 1990, which was a year with a severe outbreak of lesser cornstalk borers.

EVALUATING POTENTIAL FOR A POPULATION OUTBREAK

There are several criteria that should be used in evaluating the potential for outbreaks of lesser cornstalk borers.

[6]Trade name Dyfonate®.

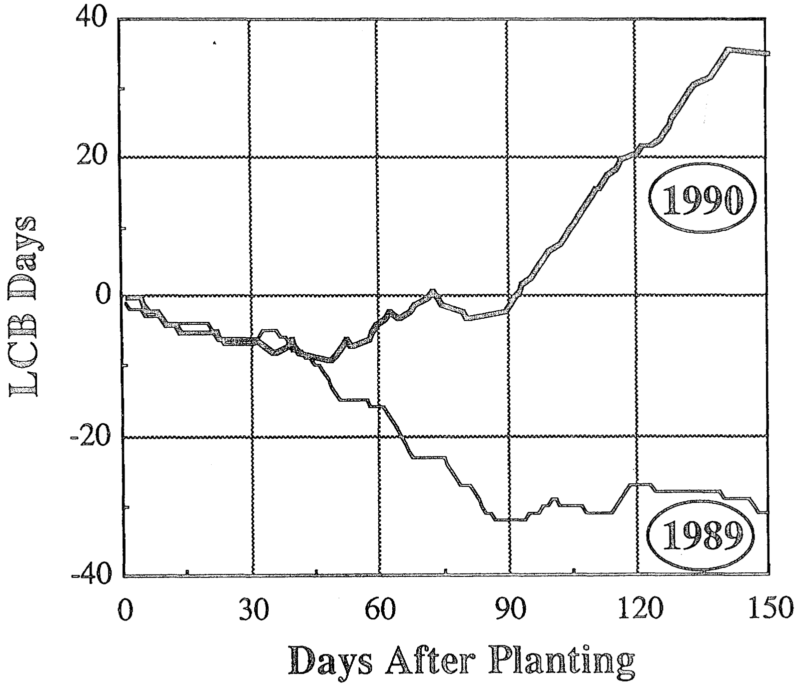

FIG. 5. Comparison of the number of LCB Days for 1989 and 1990 at the Wiregrass Substation, Headland.

Soil Type

Deep sands and sandy soils with low moisture holding capacities are probably more prone to produce wilted plants. This, of course, can be greatly altered by the typical rainfall pattern. Some fields, due to rainfall patterns, are drier than others, and these fields also would be more prone to producing wilted plants. Also a well-drained field such as one on a small hilltop or on a slope might be much drier than others. Many plants wilt for a short time each afternoon, such as from 2:00 to 5:00 p.m. Wilt occurring at 9:00 to 10:00 a.m. is not normal, and should be considered a potential trouble sign.

Planting Date

Planting on or before mid-May has been shown to reduce the abundance of lesser cornstalk borers in a 2-year experiment at the Wiregrass Substation *(16)*. Experiments were done in 1986 and 1987 in conventionally tilled and planted peanuts. Mid-May planting dates were used for one treatment in each year, and early June planting dates were used as the other treatment. Insects were monitored with pitfall traps weekly throughout both growing seasons.

About 1.9 times more lesser cornstalk borer larvae were captured in traps from late-planted peanuts in both years. Peanuts planted at this time also yielded less than those planted in mid-May. The month of May in Alabama typically has fewer hot (greater than 95°F) days than June or July, so planting at normal planting time allows plants to establish and grow an adequate root system before hot, dry weather occurs.

LCB Days

Keep a graph or table handy with a running total of the number of LCB Days that have accumulated since planting. Greater than zero LCB Days at 30 or more days after planting should be cause for immediate scouting.

Closing of Plant Canopy

Peanuts are usually planted in 36-inch single rows in Alabama, and the canopy usually closes within 2 months after planting. Growers should be aware of the typical canopy closing date for their fields, and scout fields that close very late or do not close at all. Fields that do not close can be a problem field for lesser cornstalk borers, because the canopy never completely shades the soil. This means that moisture losses from evaporation are greater than in a field with a closed canopy, so an open canopy field is more prone to wilting than a closed canopy field.

Natural Enemies

A healthy peanut field should have some beneficial insects in it, such as earwigs, ground beetles, and fire ants. Earwigs and ground beetles are nocturnal, and are difficult to sample during the day. Ants usually forage early in the morning, with foraging activity declining during the heat of the day. Populations of these and other beneficial insects can be depressed by hot and dry weather, as previously discussed. An absence of beneficial insects is an indication that, if lesser cornstalk borers invaded, few predators would be available to eat them. Therefore, the absence of beneficial insects, especially in hot and dry weather, should be cause for concern.

Presence of Adults

Field experiments have shown that lesser cornstalk borer population outbreaks are characterized by an exponential increase in the number of larvae and adults. Larvae are difficult to sample for due to their subterranean habit. The adults are not difficult to find, if they are identified accurately. The abundance of adults may be estimated by flushing adults from at least 100 feet of a representative row in a field. Adults are flushed from the plants by brushing the plants with a stick and disturbing the moths. The presence of a large number of moths, such as one per 3 feet of row, also should be cause for concern. Adults can be identified by their distinctive size, shape, coloration, and flight patterns. For example, no other moths that are the same size and coloration as male lesser cornstalk borers occur in peanuts. There are other tan moths that are the same size as male lesser cornstalk borers, but none of these have a dark grey stripe on their back. Likewise, no other moths that are the same shape as adult lesser cornstalk borers and that are also dark grey with a metallic sheen are known to occur in peanut fields.

If one to several of the preceding criteria indicate that the potential exists for a population outbreak of lesser cornstalk borers, fields should be scouted for the presence of larvae. Current Cooperative Extension Service recommendations should also be consulted to determine if scouting indicates that treatment is needed.

CONCLUSIONS

Several factors contribute to the lesser cornstalk borer being a pest in hot, dry weather in peanuts grown in sandy soils. Increased daily maximum temperatures and extended periods of drought increase the rate of development of this insect, and are harmful to many predators of insects in peanuts. Wilting of peanut plants accelerates rate of development by allowing more sunlight to reach the soil surface, resulting in higher soil temperatures. Several criteria can be used to evaluate the potential for a damaging outbreak of this insect, figure 6. If one to several of these criteria indicate that a potentially damaging population of larvae may be present, fields should be scouted for the presence of larvae. No insecticides have provided season-long control of the lesser cornstalk borer under the hot, dry conditions conducive to population outbreaks of this insect, so having an insecticide in place prior to significant increases in abundance is required to protect the crop from larval damage.

PHOTO 1. Eggs of the lesser cornstalk borer.

PHOTO 2. Larva. Note the blue stripes in the body.

PHOTO 3. Pupa.

PHOTO 4. Adult male. Note the dark band and the tan coloration.

PHOTO 5. Adult female.

PHOTO 6. The striped earwig, which is a common beneficial insect in some peanut fields.

PHOTO 7. One of several species of ground beetle found in peanut fields is *Calosoma sayi*, which is the most abundant.

PHOTO 8. Imported fire ants are important generalists predators in peanut fields.

PHOTO 9. Flushing lesser cornstalk borer adults from peanuts, using a stick to dislodge adults from plants. One sample was considered to be completed when 200 to 600 linear feet of row were flushed, depending upon the year.

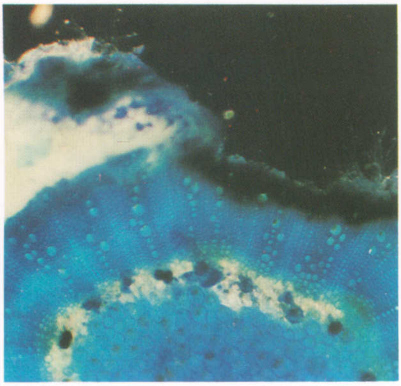

PHOTO 10. Plant with lesser cornstalk borer feeding injury to the root crown.

PHOTO 11. Pod damage from lesser cornstalk borer larvae.

PHOTO 12. Cross section of a peanut plant stem in the region of the root crown, showing damage to the periderm and phloem tissues.

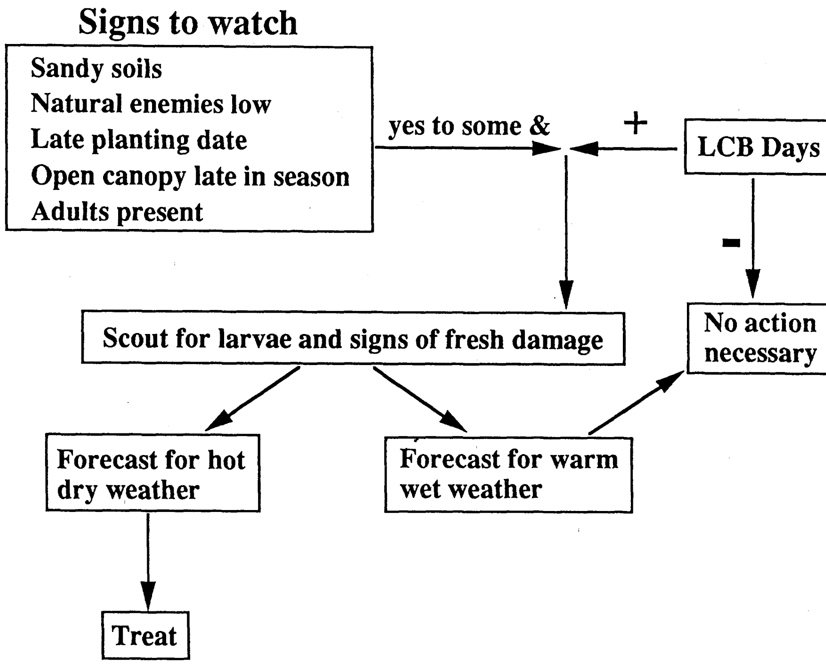

FIG. 6. Summary of how to evaluate the potential for a lesser cornstalk borer population outbreak.

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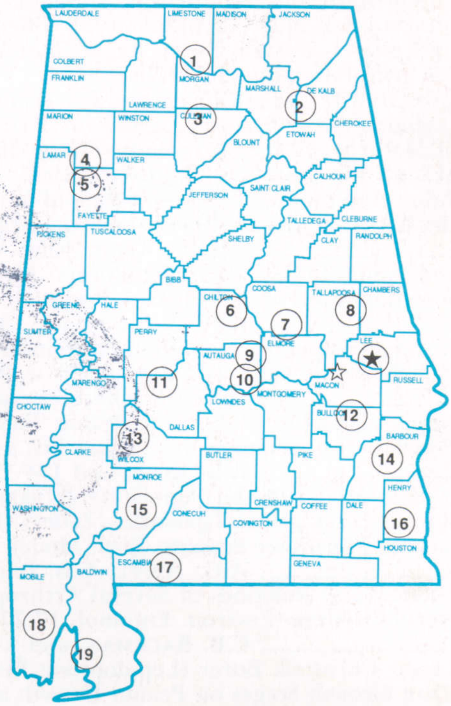

Research Unit Identification

⊛ Main Agricultural Experiment Station, Auburn.

☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Forestry Unit, Autauga County.
10. Prattville Experiment Field, Prattville.
11. Black Belt Substation, Marion Junction.
12. The Turnipseed-Ikenberry Place, Union Springs.
13. Lower Coastal Plain Substation, Camden.
14. Forestry Unit, Barbour County.
15. Monroeville Experiment Field, Monroeville.
16. Wiregrass Substation, Headland.
17. Brewton Experiment Field, Brewton.
18. Ornamental Horticulture Substation, Spring Hill.
19. Gulf Coast Substation, Fairhope.