Predicting Pecan Nut Casebearer Activity in Southeast Kansas (1984)

William R. Reid

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William Reid, Research Horticulturist

The pecan nut casebearer (PNC) causes significant damage to nuts of pecan trees in SE Kansas. Management of this insect pest is an important part of any successful pecan operation. Efficient and economical control procedures rely upon knowledge of the casebearer's biology and how it interacts with the environment and the biology of its host, the pecan. This knowledge can be used to predict the behavior of the PNC in order to accurately apply control measures.

Life History

The pecan nut casebearer, *Acrobasis nuxvorella,* overwinters as partially grown larvae in small, tightly woven cocoons called hibernacula. This stage of the insect can be found on pecan stems at the base of buds. Larvae within hibernacula become active when bud growth begins in spring. They feed on buds for a short time, then tunnel into emerging shoots, where they pupate. Wilting of newly formed shoots is the characteristic sign of damage.

The adults that emerge from pupal cases are small, grey moths with a distinctive ridge of dark scales across the forewings. These moths emerge in early June, during pecan nut set. Females lay small greenish-white eggs on the blossom end of the nut, usually near the calyx. One or two eggs are laid per nut cluster.

AGRICULTURAL EXPERIMENT STATION
Kansas State University, Manhattan
John O. Dunbar, Director

Figure 1. Cluster of pecans damaged by first-generation PNC feeding.

Immediately after hatching, first-generation larvae leave nut clusters to feed on adjacent buds. A few days later, larvae return to nut clusters and attack young nutlets, usually entering them at the base. Damaged nuts are held onto the stem with fine white threads spun by the casebearer. The webbing and conspicuous frass deposits found at the base of young nuts are easily recognizable signs of PNC damage (Figure 1).

In completing its development, a single first-generation larvae may destroy all of the nuts in a cluster. Fully grown larvae are about one-half inch long and have greenish bodies with yellowish-brown heads. These larvae will pupate inside the last nut they feed upon.

Second-generation moths appear in July and also lay eggs on pecan nuts. Larval feeding on nuts at this time poses a lesser threat to the crop. Pecan nuts are larger and a single casebearer requires fewer nuts to complete its development. Larvae of a third generation feed mostly on nut shucks, doing little damage before spinning hibernacula in which they overwinter.

Damage Levels In Kansas

First-generation PNC larvae have the greatest potential to damage Kansas pecan crops. A native pecan grove near Chetopa, not treated with insecticides, was monitored to determine the amount of damage due to

Table 1. Nut-cluster damage due to first-generation PNC feeding in Chetopa, KS.

Year	No. Nut Clusters Monitored	% Damaged Nut Clusters
1979	125	17.5
1980	125	7.5
1981	200	13.0
1982	200	20.5
1983	200	6.0

PNC feeding. Damage ranged from 6 to 20.5% nut loss, depending on the year (Table 1).

The Pest Management Approach

Integrated pest management is a strategy for controlling pests utilizing ecological concepts. Pest populations are managed so that economic injury to the crop does not occur. With a high-value crop such as pecans, the tolerance for insect injury is very low. For the pecan grower, pest management means becoming more aware of the ecology of his pecan grove. The grower's eyes are his most important pest management tools. Frequent and regular scouting tours through the grove are necessary in order to make notes on tree and nut development, as well as insect activity. With knowledge of insect behavior, the pecan grower can make intelligent decisions as to the need and timing of insecticide application.

Theory Of PNC Prediction

Pecan nut casebearers, like all insects, are cold-blooded animals whose development is temperature dependent. Insects grow and develop only above a certain minimum threshold temperature. As temperatures increase above the threshold, the rate of development increases until an optimum is reached.

The influence of temperature on PNC development can be measured with the concept of the Degree Days (DD). A degree day is a measurement of the amount of biologically-stimulating heat accumulated on a specific day. DDs are calculated by subtracting the threshold temperature (38F for PNC) from the daily average temperature. By summing DDs over time, the total can be related to specific events in the life cycle of the PNC.

Degree-day theory, as developed by Texas entomologists, predicts that after 1521 DDs have accumulated, 10% of the adult first-generation PNC moths should have emerged. The first significant nut entry by

Table 2 Predicted and actual dates of events in the life cycle of the PNC.

| Event | Method | Predicted and Actual Dates | | |
		1981	1982	1983
Start date	calendar-based model	4/5	4/5	4/5
	budbreak-based model	3/20	3/23	4/16
10% adult emergence of PNC	calendar-based model	6/3	6/7	6/13
	budbreak-based model	5/24	6/2	6/15
	observation	NA	5/26	6/5
1st signif. nut entry by PNC	calendar-based model	6/11	6/17	6/21
	budbreak-based model	6/3	6/11	6/24
	observation	6/11	6/14	6/24

PNC should occur when 1831 DDs have accumulated. An insecticide should be applied at that time to prevent economic injury.

PNC Prediction In Kansas

Testing the ability of DD theory to predict PNC activity in SE Kansas involved careful insect and tree monitoring and recording daily temperatures. Information on the activity of PNC was collected through the use of black light moth traps and the observation of first significant nut entry by PNC on 200 nut clusters (i.e. when 2% of nut clusters are damaged).

Two possible start dates for DD accumulation were tested. The first date, 10 days before 50% pecan tree budbreak, was based on pecan tree development and varied with the year. Using this method to initiate DD accumulation will be termed the 'budbreak-based model.' The second date, April 5, was calculated from the average number of frost-free days per year. Using this date to start DD accumulation will be termed the 'calendar-based model.'

Table 2 compares the predicted and actual dates of 10% PNC moth emergence and first significant nut entry. Ten percent moth emergence occurred more than one week (range of 7 to 12 days) before the predicted date, using either start date. Therefore, DD theory would be of little use to Kansas pecan growers, if the prediction of this event were important for timing population control measures.

The more important date, that of first significant injury, was more accurately predicted by DD theory. Using April 5 as the start date in every year proved to be somewhat better than starting DD accumulation 10 days before budbreak. This calendar-based model accurately predicted first significant nut entry in 1981,

was 3 days late in 1982, and 3 days early in 1983. Even with this margin of error, the predictive accuracy is much better than reliance on calendar-based spray schedules.

The year 1983 provided the best example of the usefulness of the DD model. PNC activity was delayed in 1983 by an unusually late spring. If a pecan grower had applied an insecticide using the spray-schedule method (spray date 6/10), he would have been a full 2 weeks early and would have wasted both time and money. By using the DD method, he would have sprayed 3 days early but still would have received good control due to the residual effect of the insecticide.

Grower Management Of PNC

Kansas pecan growers should develop their own PNC pest management program, by frequent scouting and the calculation of DDs.

The program begins with the proper installation of a maximum-minimum thermometer in the pecan grove. Accurate recordings of daily maximum and minimum temperatures are needed to calculate the average temperature and then DDs. In SE Kansas, temperature records and DD accumulation should be started on April 5.

Starting in June, growers should carefully inspect the tips of young nuts in at least 200 clusters for PNC eggs and/or damage. Visual inspection and a DD prediction should be used together to determine the proper time for PNC control. Accurate timing will result in the need for only one insecticide application to control first-generation PNC.

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