Seasonal Abundance of Common Phytophagous and Predaceous Insects in Kentucky Soybeans[1]

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Abstract

A 4-year study (1972–1975) was conducted to determine seasonal abundance of common phytophagous insects in Kentucky soybean fields. Populations of predaceous insects were sampled at 3 locations in 1975. Time of, and density at, peak abundance are presented for the green cloverworm *Plathypena scabra*, the bean leaf beetle *Cerotoma trifurcata*, the grape colaspis *Colaspis brunnea*, and the green stink bug *Acrosternum hilare*. The green cloverworm was the dominant defoliating species, while seed pods were attacked most frequently by the green stink bug and the bean leaf beetle. Populations of 3 prevalent groups of predators, *Orius insidiosus*, *Nabis* spp., and *Geocoris* spp., peaked at different times during the summer, with *O. insidiosus* being first and *Geocoris* last.

Introduction

Due to recent increases in soybean production in Kentucky, insect problems of this crop are receiving ever greater attention. Before an effective insect pest management program can be developed, the seasonal population dynamics of potentially important pest and beneficial species must be determined. Faunistic surveys of soybean insects in several other states have been reported (Kretzschmar 1948, Blickenstaff and Huggans 1962, Tugwell et al. 1973). These reports presented extensive lists of species, including many uncommon, and possibly transient species. Carner et al. (1974) and Shepard et al. (1974), have reported on the seasonal abundance of common insect pests and arthropod predators, respectively, in South Carolina soybean fields. To date, there have been no published reports dealing specifically with the insects of Kentucky soybeans.

Materials and Methods

Insect samples were taken at approximately 2-week intervals in variety–trial plots planted by the Department of Agronomy, University of Kentucky, during 1972–1974 using a ground cloth and plant shake method similar to that of Boyer and Dumas (1963). Analysis of variance showed only negligible differences in insect abundance among the varieties, so results were pooled across varieties. The number of samples taken varied with location depending on the number of varieties present, but in all cases 30 or more sample units per location were taken on each sampling date. Each sample unit consisted of 3 linear feet (0.91 m) of row, with 1.5 feet (0.46 m) being taken from each of 2 adjacent rows.

During 1975, all samples were taken from fields of 'Williams' variety soybeans at approximately 7- to 10-day intervals. Nine contiguous plots, each 75 × 75 feet (22.85 × 22.85 m), were established in large fields. Three ground cloth samples as described above were taken randomly from each of the 9 plots. In addition, 2 sweep net samples were taken from each of the 9 plots to provide data on those insects, such as leafhoppers, which could not be adequately sampled by the ground cloth method. Each sweep net sample consisted of 20 sweeps across the row, using a 15-inch (0.38-m) diameter sweep net. Insects in the ground cloth samples were always counted in the field, while sweep net samples were taken to the laboratory for counting. A microscope was used for counting small insects, such as leafhoppers.

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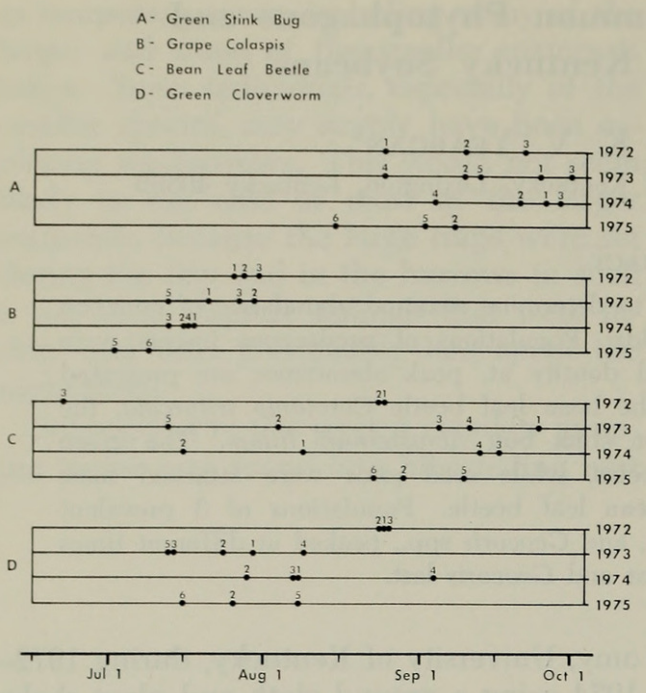

FIG. 1. Time of occurrence of peak population density of 4 species of phytophagous insects on soybeans in Kentucky. County locations are: 1, Fulton; 2, Caldwell; 3, Henderson; 4, Ohio; 5, Fayette; 6, Hardin.

Phytophagous species were counted during the entire study, but predaceous species were counted only during 1975. Sampling was begun when plants were in early bloom and continued until after pod maturity.

Soybean insects were sampled in the following counties during 1 or more years of this study: (1) Fulton, (2) Caldwell, (3) Henderson, (4) Ohio, (5) Fayette, (6) Hardin. The numerical designations given those counties is used consistently throughout this paper. The locations sampled each year were as follows: 1972, Locations 1, 2, 3; 1973, Locations 1, 2, 3, 4, 5; 1974, Locations 1, 2, 3, 4; and 1975, Locations 2, 5, 6.

Although quantitative data were collected on more than 20 species of insects during this study, we have chosen to present data on 4 phytophagous species and 3 predaceous genera. The phytophagous species discussed are the green cloverworm *Plathypena scabra*, the bean leaf beetle *Cerotoma trifurcata*, the grape colaspis *Colaspis brunnea*, and the green stink bug *Acrosternum hilare*. The predaceous groups discussed are damsel bugs *Nabis* spp., big-eyed bugs *Geocoris* spp. (primarily *G. puntipes*), and minute pirate bug *Orius insidiosus*. These taxa were chosen because of their consistent occurrence and relatively high numbers compared to the other taxa collected.

RESULTS AND DISCUSSION

Data collected at 3 to 5 locations each of the 4 years of this study provided 15 separate seasonal population trends for several phytophagous insect species. The time of peak abundance and mean density at peak abundance are given in Fig. 1 and Table 1, respectively, for green cloverworm, bean leaf beetle, grape colaspis, and green stink bug.

During 1973–1974, green cloverworm larval populations reached peak abundance between approximately mid-July and mid-August. The one aberrant location (#4) in 1974 may have been related to the late planting of soybeans. Population peaks of the green cloverworm in 1972 occurred several weeks later than the average for the other years. It is interesting to note that Carner et al. (1974) obtained very similar results in South Carolina. From sampling 3 locations there, they also found that green cloverworm populations peaked approximately 1 month later in 1972 than in 1973. This suggests that some geographically wide-range climatic factor may have influenced green cloverworm populations during those years.

There was considerable temporal variation in adult bean leaf beetle population peaks (Fig. 1). In the majority of cases, however, peaks occurred late in the season. Studies conducted in Illinois indicated that the bean leaf beetle, whose larvae feed on the roots of various legumes, has 2 generations per year (Kogan et al. 1974). They found that presumably overwintered adults were very scarce in soybeans after late June; first generation adults appeared in July and August while second generation adults emerged in September. If the life history of this species is similar in Kentucky, our data indicate that its peak abundance may occur either early (first generation) or late

TABLE 1.—MEAN DENSITIES PER 3-FOOT (0.91-M) OF ROW OF 4 PHYTOPHAGOUS INSECT SPECIES AT PEAK ABUNDANCE ON SOYBEANS IN KENTUCKY. MEAN VALUES ARE FOLLOWED BY ± STANDARD ERROR

		Year			
	Location[1]	1972	1973	1974	1975
Green Cloverworm (larvae)	1	12.4 ± 7.1	2.6 ± 0.3	13.9 ± 0.6	1.7 ± 0.4
	2	7.6 ± 0.1	8.5 ± 0.7	9.8 ± 0.9	1.7 ± 0.4
	3	3.4 ± 0.3	8.4 ± 0.5	10.8 ± 0.5	—
	4	—	11.5 ± 1.0	8.5 ± 0.6	—
	5	—	6.2 ± 0.5	—	7.3 ± 0.7
	6	—	—	—	6.8 ± 0.5
Bean Leaf Beetle (adults)	1	0.6 ± 0.2	1.2 ± 0.3	0.8 ± 0.2	—
	2	3.8 ± 2.3	3.2 ± 0.4	3.0 ± 0.6	1.2 ± 0.2
	3	1.5 ± 0.2	1.2 ± 0.2	0.5 ± 0.1	—
	4	—	1.6 ± 0.3	1.6 ± 0.3	—
	5	—	0.7 ± 0.2	—	0.8 ± 0.2
	6	—	—	—	2.4 ± 0.3
Grape Colaspis (adults)	1	2.4 ± 0.3	1.1 ± 0.2	1.6 ± 1.7	—
	2	0.9 ± 0.2	1.5 ± 0.2	0.5 ± 0.2	—
	3	1.4 ± 0.2	0.6 ± 0.2	1.4 ± 0.2	—
	4	—	—	0.1 ± 0.1	—
	5	—	0.9 ± 0.2	—	0.9 ± 0.2
	6	—	—	—	0.1 ± 0.1
Green Stink Bug (nymphs and adults)	1	1.2 ± 0.3	2.2 ± 0.3	1.3 ± 0.5	—
	2	0.2 ± 0.1	0.8 ± 0.2	1.2 ± 0.4	0.3 ± 0.1
	3	1.1 ± 0.3	0.5 ± 0.2	2.9 ± 0.5	—
	4	—	0.2 ± 0.1	0.1 ± 0.1	—
	5	—	1.0 ± 0.3	—	0.2 ± 0.1
	6	—	—	—	0.2 ± 0.2

[1] County locations are: 1, Fulton; 2, Caldwell; 3, Henderson; 4, Ohio; 5, Fayette; 6, Hardin.

(second generation), depending on location and year (Fig. 1). Soybean pods usually are at or near maturity by September in Kentucky, and these pods occasionally are damaged by adult bean leaf beetle feeding. If economic damage occurs from that species, it probably will result from feeding of colonizing adults on young seedlings or from unusually large populations of second generation adults feeding on soybean pods.

Populations of grape colaspis invariably peaked relatively early in the growing season at all of our sampling locations (Fig. 1). Data were not included from Location 4 in 1973 and Location 2 in 1975 because that species was virtually absent in those plantings. The biology and ecology of that beetle were studied in Arkansas, where it overwintered in the larval stage with adults emerging and ovipositing from June until mid-August (Rolston and Rouse 1965). Although they found that some second brood adults emerged in late summer and early fall, our data indicate that this does not occur in Kentucky soybeans. If such a second brood emerged, it occurred well after pod maturity and after our sampling was discontinued for the season. The relatively low adult densities of this species that we found on soybeans suggest that it poses little threat to this crop in Kentucky at the present time.

Because the green stink bug feeds on the soybean pods and developing seeds rather than foliage, it is not surprising that it is most abundant late in the season (Fig. 1). This insect feeds on other host plants earlier in the year, such as dogwood, blackberry, etc., and moves to soybeans when the pods begin to develop (Underhill 1934, Miner 1966). Due to its spotty distribution pattern and piercing–sucking type feeding damage, the insect and its feeding damage

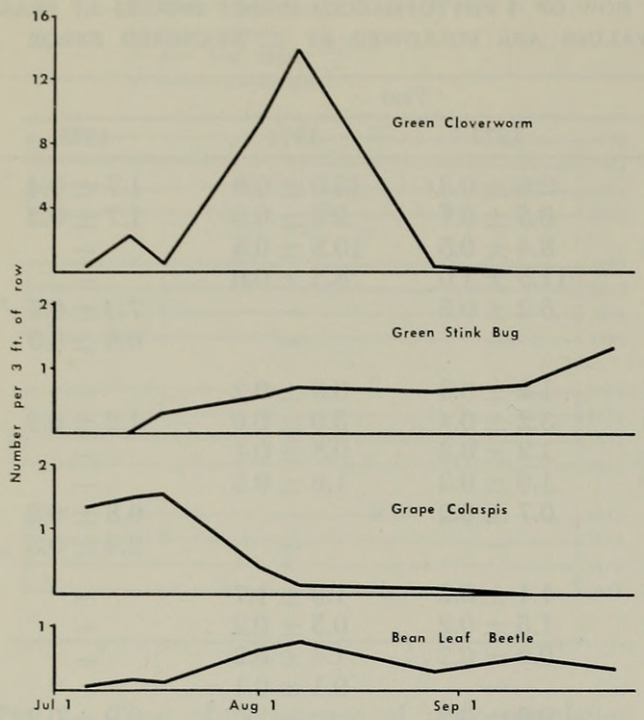

FIG. 2. Representative population trends of 4 species of phytophagous insects on soybeans in Kentucky; Fulton Co., 1974.

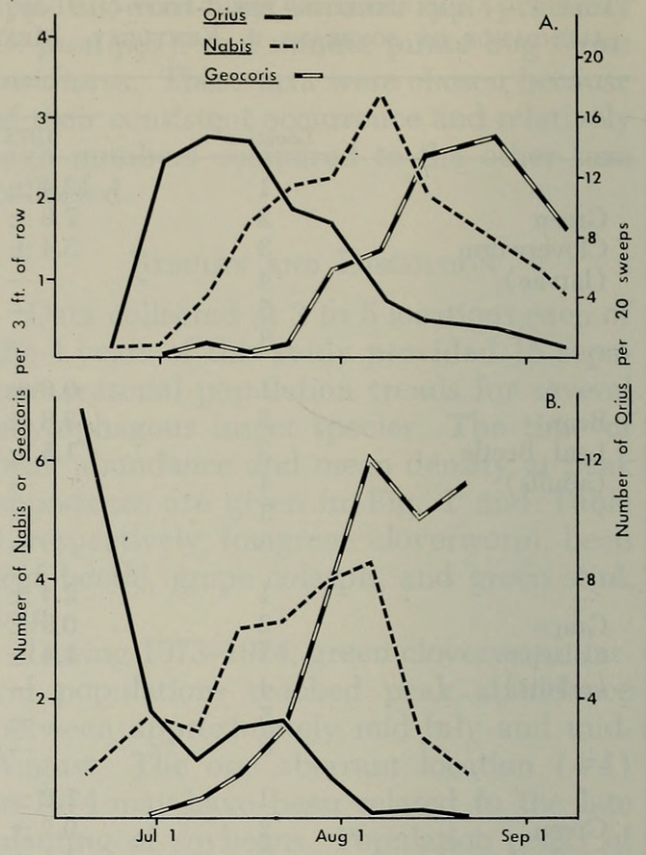

FIG. 3. Seasonal abundance of 3 species of predaceous insects on soybeans in Kentucky, 1975. A. Fayette Co. B. Hardin Co.

may go unnoticed during the growing season. Heavy stink bug feeding can, however, result in shriveled or otherwise deformed beans.

Representative seasonal population trends (Location 1, 1974) for green cloverworm, bean leaf beetle, grape colaspis, and green stink bug are given in Fig. 2. This illustrates the rates of population increase and decrease for these species.

In addition to the species discussed above, we collected population data on more than a dozen other phytophagous insect species, a few of which deserve mention. Based on our 1975 sweep net samples, the potato leafhopper *Empoasca fabae* was most abundant during the early part of the growing season. This was the most common leafhopper collected, reaching densities that gave mean estimates of more than 2 per sweep. In the same samples, all other leafhoppers combined did not exceed a mean of 1 per sweep. Very few aphids or spider mites were encountered.

Certain pests found in other parts of the country, such as the Mexican bean beetle *Epilachna varivestis*, were collected only in low numbers at our sampling locations. While other species of Lepidoptera were collected on soybeans, none were nearly as abundant nor as consistently present as the green cloverworm.

Among the beneficial insects collected, 3 groups of hemipteran predators were most prevalent. These were minute pirate bugs, damsel bugs, and big-eyed bugs, primarily *G. punctipes*. The population peaks of those 3 groups did not occur synchronously (Fig. 3). The earliest of the 3 was *O. insidiosus*, commonly found in association with large populations of thrips (*S. variabilis*) in 1975. Populations of *Nabis* spp. peaked near midseason at the time when green cloverworm populations usually were highest. Any predator–prey association between damsel bugs and green cloverworms remains to be shown, but their population synchrony invites further study. The last of these 3 predator groups to appear in

Kentucky soybeans were the big-eyed bugs. At the Fayette County location, *Geocoris* spp. populations peaked in late August and began to decline in early September (Fig. 3A). At the Hardin County location, however, their populations apparently were still increasing when the mature soybean plants lost their leaves in late August (Fig. 3B). Numbers of those predators collected at the Caldwell County location in 1975 were too low for analysis.

A comparison of our data with those published from other states, indicates that Kentucky soybean insect populations are more similar to those of the Midwest than to those of the Deep South. The bean leaf beetle, the potato leafhopper, and *S. variabilis* were the most abundant soybean insects reported from Arkansas, Minnesota, and Missouri, respectively (Blickenstaff and Huggans 1962, Kretzschmar 1948, Tugwell et al. 1973). In all those states, the green cloverworm was reported as the most abundant lepidopteran pest, as in the present study. In South Carolina, however, the green cloverworm was but one of several lepidopteran species that commonly attacked soybeans (Carner et al. 1974).

Of the pest species we collected, the green cloverworm appears to be the dominant soybean defoliator, while the seed pods are attacked by stink bugs and, occasionally, bean leaf beetles. It appears, therefore, that soybean insect pest management research in Kentucky should be directed primarily toward these species.

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