Seasonal Abundance of Lepidopterous Larvae in Commercial Cabbage Fields[1]

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ABSTRACT

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From 8 to 18 commercial cabbage fields in upstate New York were sampled weekly from 1978 through 1980. Peak populations of lepidopterous larvae fluctuated markedly during the 3-year period, and these fluctuations could not be attributed solely to the use of insecticides. In all 3 years, larvae of imported cabbageworm and diamondback moth were detected earlier than cabbage looper, and initial infestation was not a direct function of planting date. At harvest, cabbage looper was always the most abundant species. This indicates the need for sampling individual fields for treatment decisions.

The major lepidopterous pests on cabbage in the United States are imported cabbageworm (ICW), *Pieris rapae* (L.), diamondback moth (DB), *Plutella xylostella* (L.), and cabbage looper (CL), *Trichoplusia ni* (Hübner). Ecological studies of these major pests were made by Harcourt (1963) in Ontario, Canada, Oatman and Platner (1969) in southern California, and Weires and Chiang (1973) in Minnesota. The population dynamics of adult cabbage looper was studied by Chalfant et al. (1974) in Florida, Georgia, and South Carolina.

These studies are of limited use for a cabbage pest management program in New York because of our different cropping periods and pest dynamics. Unlike the southeastern states, CL is not present in New York in the early part of the growing season, although it can be a serious threat to late-planted cabbage. Before mass immigration of CL into New York, the other two pest species predominate.

In New York, cabbage grown for sauerkraut is treated less with insecticides than is storage cabbage, which results in less disruption of pest populations. Hence, this study was undertaken to investigate the seasonal abundance of these lepidopterous pests in the two leading sauerkraut-producing counties in New York. This information will help in the development of an integrated pest management program for cabbage in our area.

Materials and Methods

Larval populations were monitored weekly throughout three seasons (1978 through 1980) in commercial sauerkraut cabbage fields (Ontario and Yates Counties, N.Y.). Fields ranged in size from ca. 2.5 to 12 ha. Sampling sites were chosen along a straight line into and out of each field, forming an inverted V. In 1978, counts were obtained from 11 fields by randomly sampling 8 to 10 sites per field, with five plants per site. In 1979 and 1980, counts were obtained from 8 and 18 fields, respectively, utilizing a similar sampling scheme.

Results and Discussion

In all 3 years, ICW and DB larvae occurred earlier in the season than CL larvae (Table 1). In 1978, ICW was present ca. 3 weeks earlier than DB larvae. Fifty percent of the fields were infested with ICW and DB by 7 and 27 June, respectively. Cabbage loopers did not appear until 6 July, and 50% of the fields were infested ca. 2 weeks later. In 1979 DB and ICW were both first present the week of 14 June, but 50% infestation for ICW occurred 2 weeks later than that of DB. CL appeared early in 1979, but half of the sampled fields were not infested until more than 1 month later. In 1980, DB and ICW again appeared within the same week, and 2 weeks later ca. 50% of the fields were infested by the two species. Cabbage loopers initially appeared late in 1980 and were not present in half the fields until 1 August.

Median planting dates were 1, 22, and 20 May for 1978, 1979, and 1980, respectively. Despite similar planting dates in 1979 and 1980, the dissimilar patterns of larval infestations indicate that the differences in first occurrence of the insects are not a direct function of planting date. Termination of diapause, immigration, presence of alternate hosts, or a combination of these factors, may be more important than planting date.

The peak population levels of the lepidopterous species fluctuated markedly during the 3 test years (Table 2). During 1978, the mean DB population reached a peak almost twice that of CL, whereas the ICW populations were nearly half that of CL. In 1979, populations were low, relative to the other years, and mean peak populations for the three species averaged 1.0 to 1.5 per plant. In 1980 peak populations were again high. The mean ICW population was almost twice that of CL, which was nearly double that of the DB population.

Although insecticides had an important impact on determining levels of peak infestation, these levels could not be attributed solely to their use since, for example, similar insecticides and numbers of sprays were used in 1979 and 1980 with large differences in pest populations. Other factors known to influence these pest levels are parasitism (Oatman and Platner 1969), weather (Harcourt 1963), and variety (Radcliffe and Chapman 1966).

The time at which 50% of the fields were harvested during the study was similar: 13, 7, and 19 September for 1978, 1979, and 1980, respectively, and species

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Table 1.—Date[a] of initial larval infestation in commercial sauerkraut cabbage fields, Ontario and Yates Counties, N.Y.

Species	1978		1979		1980	
	Date of initial infestation	50% of fields initially infested[b]	Date of initial infestation	50% of fields initially infested[b]	Date of initial infestation	50% of fields initially infested[b]
DB	6/21–7/19	6/27	6/14–7/23	6/20	6/26–7/27	7/8
ICW	5/30–7/12	6/7	6/14–7/10	7/5	6/26–7/15	7/9
CL	7/6–8/15	7/19	6/24–8/8	7/26	7/10–8/13	8/1

[a] Month/day.
[b] Time at which at least one larva of the particular species was found in 50% of sampled fields.

Table 2.—Peak populations of larvae and number of sprays used in commercial sauerkraut cabbage fields, Ontario and Yates Counties, N.Y.

Species	1978		1979		1980	
	Mean	Range	Mean	Range	Mean	Range
DB[a]	9.5	0.6–24.4	1.0	0.2–2.5	2.7	0.1–16.6
ICW[a]	2.9	0.8–7.6	1.5	0.4–2.7	10.3	0.5–49.6
CL[a]	5.1	0.4–10.0	1.1	0.3–3.4	5.3	0.4–16.3
No. of sprays[b]	3.8	2–5	2.9	1–4	2.8	1–5

[a] Highest number of larvae per plant found in an individual field.
[b] Applied specifically against lepidoptera.

Table 3.—Mean composition and abundance of larvae at harvest in commercial sauerkraut cabbage fields, Ontario and Yates Counties, N.Y.

Species	1978		1979		1980	
	% Composition	No./plant	% Composition	No./plant	% Composition	No./plant
DB	43.5	2.0	22.1	0.3	22.1	0.9
ICW	11.6	0.4	17.4	0.2	12.2	0.3
CL	44.9	2.5	60.5	1.0	65.7	3.2

composition at harvest for CL, DB, and ICW was consistent over the 3 years (Table 3). Cabbage loopers constituted 44.9% of the total larval population in 1978, and 60.5 and 65.7% in 1979 and 1980, respectively. The species composition can be a result of selective effectiveness of available insecticides (Eckenrode et al. 1981), competitive displacement, or a more favorable environment for CL.

CL is the most difficult to control (Eckenrode et al. 1981) and is the most abundant species at harvest, thus becoming a serious threat to the quality of cabbage at that time. However, because ICW and DB predominate earlier in the season, action thresholds, which take into account this shift in species composition (as well as the pests' different rate of foliage consumption), should be developed. These thresholds, however, will be dependent upon the availability of effective insecticides.

The variation in time of first occurrence between seasons, and especially between fields in any one season, indicates the need for sampling individual fields rather than basing treatment decisions on representative fields. This is especially evident since first occurrence of any of these insects may vary by 45 days between individual fields (Table 1). This same variation applies with peak population levels (Table 2). Because of this and the number of relatively small, widely spaced fields, an efficient sampling scheme is needed for an integrated pest management system for cabbage grown in New York.

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