

LATEST DEVELOPMENTS IN BIOLOGY AND CONTROL OF THE
CARROT BEETLE, *BOTHYNUS GIBBOSUS* DE GEER, A PEST
OF SUNFLOWER IN PARTS OF THE USA

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The carrot or sunflower beetle was reported to be a continuing pest of cultivated sunflower in parts of the states of Texas and Oklahoma, USA, at the Fifth International Sunflower Conference held in 1972 at Clermont-Ferrand, France by Brigham and Bottrell (5). It was earlier reported as a serious pest at the Third International Sunflower Conference held in 1968 at Crookston, Minnesota, USA, by Brigham (4). Later reports by Bottrell *et al* (1, 2, 3) indicated the insect was not controlled by available insecticides, and this was confirmed in limited trials by Rogers and Howell (7). Investigations were begun to further study the biology of the pest.

SEASONAL ADULT ACTIVITY

Carrot beetles were collected daily from a light trap equipped with a 15-watt black light bulb placed in a planting of sunflowers May 16, 1973 on the Texas Agricultural Experiment Station at Lubbock. Adult carrot beetles were counted daily, and 100 were randomly selected and sexed in the manner described by Hayes (6).

Two peaks of activity were clearly evident. In early summer, the largest number of beetles (377) was caught on June 13. The late summer high was 307 beetles caught on September 4.

Percentage of female beetles captured declined from a high of 70% in May to a low of 28% in late June, and then appeared to remain constant at about 50% for the remainder of the season. This reduction of females in the population in June may have been due to egg-laying, thereby reducing their flight activity.

LABORATORY REARING OF CARROT BEETLES

Many experimental diets were formulated and tested in attempting to devise suitable procedures for rearing carrot beetle larvae. Some of these were; soil and peat moss 6:4; soil, peat moss, cow manure 5:4:1; soil, peat moss, cornmeal 5:4:1; soil, peat moss, Grapenuts 5:4:1; soil, grass clippings, cornmeal 5:4:1; soil, grass clippings, Grapenuts 5:4:1. Amount of water used with these diets was varied. Of more than 200 larvae fed these diets, only a few reached the 2nd instar, and none developed to the 3rd instar.

A fungus was observed growing in the diet mixtures, and this may have caused the death of many larvae. Diets were subsequently autoclaved to eliminate the fungus growth, but larvae again failed to survive.

On August 2, 138 eggs were obtained from beetles which had fed on roots of sunflower seedlings in the laboratory. The eggs were placed singly in clear plastic cups containing 4 oz (114 grams) of a diet composed of soil, grass clippings, and Grapenuts in a ratio of 5:4:1 by volume. These ingredients were treated with 25 ml of a .03% solution of Roccal (germicide) in tap water, and placed in a cabinet maintained at about 25°C.

Of the 138 eggs, 97.2% hatched, and a total of 60 larvae reached the 3rd instar. Five pupae were reared in the plastic cups from the original 138 eggs, and one adult beetle (a male) emerged.

The duration of the 1st and 2nd instars was found to be about the same (2 weeks). By the fourth week, over 80% of the larvae were in the 3rd instar. The 3rd instar was of approximately 3 weeks duration, and the pupal stage about 4 weeks. The total length of the life cycle of the adult which emerged was 82 days, which corresponds very closely to two observed seasonal peaks of adult activity.

PHEROMONE RESPONSE STUDY

In August, 1973, insect traps (4 yellow steel panels coated with a non-drying adhesive) were baited with either 8 male or 8 female carrot beetles. Similar unbaited traps were used as checks. The traps, located in fallow land adjacent to a planting of sunflowers on the Texas Agricultural Experiment Station at Lubbock, were checked and rebaited daily from August 25 through September 12, 1973. Sex of trapped beetles was determined and recorded.

In a 19-day period, only 10 beetles were trapped. Although 8 of these (4 female, 4 male) were caught on male-baited traps, the numbers were not sufficient to draw valid conclusions concerning selective attraction by male beetles.

Two other pheromone experiments were conducted in Crosby County sunflower plantings, about 80 km (50 miles) east of Lubbock. A total of 141 beetles were trapped in the second study. An equal number of beetles (41) was trapped on the male and female baited traps, and

the sex ratio was approximately 1:1. The largest number of beetles (59) was caught on the unbaited traps. In the third experiment, only 2 female carrot beetles were captured on traps.

There was apparently little or no attraction among carrot beetles during late August and early September. However, there may be a much greater attraction in the spring when overwintering adults are in search of a source of food and/or mates. The low population levels also may have affected responses of the beetles present in the areas studied.

EVALUATION OF GENOTYPES FOR TOLERANCE

Fifteen hybrids and the cultivar Peredovik were planted April 30, 1973, in a replicated trial for evaluation of possible resistance of tolerance to the carrot beetle. Six weekly counts were taken of plants wilting or dead, beginning on June 6. Peredovik suffered an 8.5% loss of plants, while losses of the hybrids ranged from 1.5 to 4%. Low populations of the carrot beetle resulted in a correspondingly low mortality of sunflower plants, and valid differences in genotypes could not be determined in this study.

EVALUATION OF INSECTICIDES

As in-furrow insecticides had not been effective in controlling the carrot beetle in earlier tests, granular formulations of seven insecticides were applied by hand to the soil surface in an 8-inch band. The materials were then incorporated to a depth of 2.5 cm (1 inch) with a rake. Plants of the sunflower hybrid, HA 60 x RHA 266, were 15—20 cm (6—8 inches) in height. Insecticides applied were carbofuran 10 G, Dyfonate 10 G, diazinon 14.3 G, Dasanit 15 G, phorate 10 G, aldicarb 10 G, and paradichlorobenzene. Check plots were included in each of the four replications.

The above materials were applied on May 22 to an April 20 planting, and again on August 30 to an August 6 planting. In general, low populations of carrot beetles caused limited damage to plants in check plots as well as in treated plots, and we were not able to properly evaluate the effect of the insecticides on feeding of the carrot beetle.

EFFECT OF CARROT BEETLES ON SUNFLOWER GROWTH IN THE GREENHOUSE

An experiment was carried out to determine the effect of varying number of beetles on the growth of sunflower seedlings. The cultivar Armavirec was used in 4 replications. One-gallon cans with equal amounts of soil were planted and thinned to one seedling. When seedlings were in the 6 to 8 leaf stage, plant height was recorded, and 0, 1, 2, 3, or 4 female carrot beetles were caged per plant. After 8 days, plant height and weight of the root system was recorded.

One beetle per plant caused little reduction in height or loss of root weight. Plants infested with 2 or more beetles had a similar substantial reduction in growth rate and root weight.

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