A TECHNIQUE FOR REARING COCCINELLID BEETLES ON DRY FOODS, AND INFLUENCE OF VARIOUS POLLENS ON THE DEVELOPMENT OF COLEOMEGILLA MACULATA LENGI TIMB. (COLEOPTERA:COCCINELLIDAE)[1]

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Abstract

A technique is described for rearing a coccinellid on a dry, particulate food. *Coleomegilla maculata lengi* Timb. (Coleoptera:Coccinellidae) was reared from first-instar larva to adult on the pollens of corn, gray birch, hemp, and hornbeam, and on the dried and powdered nymphs and adults of *Rhopalosiphum maidis* (Fitch.) (Homoptera:Aphididae).

Introduction

Coleomegilla maculata lengi Timb. was the most abundant coccinellid predator on corn in the Belleville district when two of its known prey were present—the corn leaf aphid, *Rhopalosiphum maidis* (Fitch.) (Homoptera: Aphididae), and the European corn borer, *Ostrinia nubilalis* (Hbn.) (Lepidoptera:Pyralidae). Britton (1) was the first to report that *C. maculata* eats pollen and fungus spores. Marlin (2) found that adults of this species would not eat corn pollen or pea aphids, *Macrosiphum pisi* (Harr.) (Homoptera: Aphididae), unless the pollen was offered on a piece of leaf from a corn plant in the tassel stage or the aphids were offered on alfalfa plants. The present author found corn pollen in the gut of field-collected larvae of *C. maculata* and other coccinellid species. This indicated that non-aphid foods may possibly influence the survival of predatory coccinellids. The present paper describes a technique for rearing adults and larvae of predatory coccinellids on dry foods, and also summarizes information on the development of larvae of *C. maculata* on various pollens.

Materials and Methods

The larvae used in this study were the progeny of a number of female *C. maculata* that were confined in petri dishes in the laboratory at about 22° C and 65% R.H. These females were fed various non-aphid foods to be described elsewhere (Smith, in preparation). Larvae were fed the dead nymphal stages and adults of *R. maidis*. These stages were dried at 20° C and reduced to a fine powder. Larvae were also fed pollen of the following plants: corn, *Zea mays* L.; gray birch, *Betula populifolia* Marsh.; hemp, *Cannabis sativa* L.; hornbeam, *Carpinus caroliniana* Walt.; red pine, *Pinus resinosa* Ait.; and common ragweed, *Ambrosia artemisiifolia* L. The pollens were collected, dried at approximately 20° C, cleaned by sieving, and stored in darkness at 4° C until used.

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A mated pair of *C. maculata* was reared in a cage (Fig. 1) consisting of a petri dish bottom containing a mat of filter paper, a slide with two cavities, and a perforated, disc-shaped cover grooved around its outer circumference to fit the bottom edge of the dish. The slide and cover were of plexiglass. The slide was 7.5 cm long and 2.5 cm wide and its cone-shaped cavities were each 16 mm in top diameter and 5 mm deep. Dry food was placed in one cavity and water in the other. A glass bead, 6 mm in diameter, was placed at the center of each cavity to reduce the chances of the insects becoming trapped in the food and water. The perforated cover prevented a buildup of humidity in the dish and thereby reduced the tendency of the dry food to form clumps.

Third- and fourth-instar larvae and pupae were reared in petri dishes as described for the adult except that the covers had smaller perforations. Larvae were confined individually because of frequent cannibalism. First- and second-instar larvae were reared in circular cells (Fig. 2) each 1.9 cm in diameter and 6 mm deep. The cells were formed by drilling 30 holes, six rows of 5 holes, in a piece of plexiglass 23.4 cm long and 18.4 cm wide. This perforated section was placed on a solid piece of plexiglass of the same dimensions that in turn rested on a piece of plate glass of the same dimensions, and the three sections were placed in a lidless box, 3 cm deep and enamelled white. Food was placed in one of two holes located in the floor of each cell and distilled water was placed in the other hole. The food hole was 5 mm in diameter and 6 mm deep (extended to the plate glass) and the water hole 3 mm in diameter and 4 mm deep. The top of the group of 30 cells was covered by six pieces of plate glass each 18.4 cm long and approximately 4 cm wide.

The eggs of the coccinellid were usually laid on the bottom of the petri dish cover; the incubation period was approximately 4 days. First-instar larvae were transferred to cells and given food and water within 6 hours of eclosion. During the first 2 days of life a small amount of water was deposited on the floor of the cells with a brush, but when the larvae were stronger and there was less danger of them being drowned the water holes were kept filled. Larvae being reared on the various foods were inspected at least once daily and records were kept of the duration of each stage. Larvae were transferred to clean cells or dishes after ecdysis or when appreciable amounts of frass had accumulated. The numbers of first-instar larvae started on each of the foods were as follows: 44 on powdered aphids; 214 on corn pollen; 60 on birch pollen; 94 on hemp pollen; 40 on hornbeam pollen; 50 on red pine pollen; and 30 on ragweed pollen.

Results and Discussion

Adults that subsequently mated and produced fertile eggs developed from larvae reared on the powdered aphid and on all the pollens used except those of ragweed and red pine. First-instar larvae lived up to 2 days on ragweed pollen but did not increase in size or molt. There was no indication that this pollen was ingested. The pollen of red pine, though ingested, was not adequate for complete growth. On this food the durations of the first two

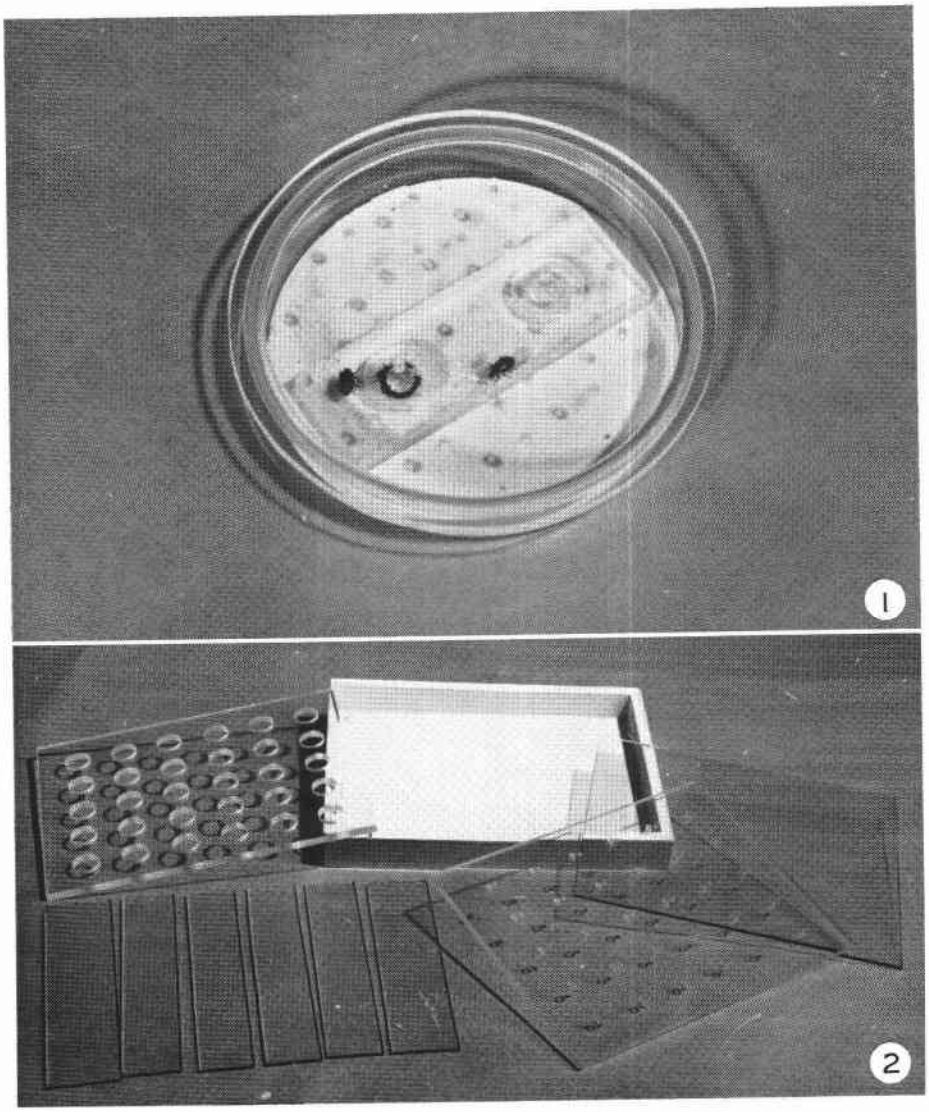

FIG. 1. Cage used to rear adults and third- and fourth-instar larvae.
FIG. 2. Parts forming the cells in which first- and second-instar larvae were reared.

larval instars were prolonged to 9 days for the first instar and to more than 8 days for the second. The normal durations of these stages are about 4 and 3 days respectively. There was no growth beyond the third instar on the pollen of red pine. Possibly pine pollen has inadequate protein content for normal growth: Nielsen, Grömmer, and Lunden (3) found that pollen of *Pinus montana* Mill. contained only 13% protein whereas other pollens studied, including corn, contained about 25% protein. No differences attributable to food were observed in the time required for the development of *C. maculata* from the first-instar larva to the adult stage on the powdered aphid and on the pollens of corn, birch, hemp, and hornbeam. The mean duration of this period for larvae reared on the powdered aphid and on these pollens was 23.86 ± 1.58 days. Survival to the adult stage of larvae reared on powdered aphids was 66% and did not differ significantly from survival on either birch pollen or hornbeam pollen. Survival of larvae reared on both corn pollen and on hemp pollen was significantly lower (chi-square, $P < .01$) than on powdered aphids.

If the food is nutritionally adequate the chief requirement for the growth of larvae of *C. maculata* on dry foods is that the particle size be sufficiently small to be ingested by the first-instar larva. It is not necessary that the food be offered with a closely associated plant, and it is not of primary importance that the food be one that the predator has previously experienced. *C. maculata* probably rarely, if ever, encounters powdered aphids or the pollens of birch, hornbeam, and hemp in the field. The first two pollens occur before the larvae of *C. maculata* are present and hemp pollen is so scarce locally that it is probably never encountered. Corn pollen is probably a factor in the survival of *C. maculata* as it is eaten by all stages and supports the growth of the larvae. The importance of corn pollen and other non-aphid foods in the survival of coccinellids will depend on the quality, quantity, and palatability of each in relation to the quality, quantity, and palatability of the animal foods present.

References

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