NOTE

Alternative Method for Encapsulation of Artificial Diet Used in Rearing *Ceraeochrysa cubana* (Hagen) Larvae (Neuroptera: Chrysopidae)[1]

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Rearing lacewings in the laboratory can be expensive and time consuming, especially when the diet consists of lepidopteran eggs or larvae reared as a host colony. We initially reared larvae of *Ceracochrysa cubana* (Hagen) on a diet of green peach aphids, *Myzus persicae* (Sulzer), and velvetbean caterpillar, *Anticarsia gemmatalis* Hübner, larvae. This method was successful, but required much time, space and resources. Therefore, an artificial diet for larvae was evaluated. The diet presentation method of Hagen and Tassan (1965, J. Econ. Entomol. 58: 999-1000) was used initially. This method required the addition of paraffin to the diet ingredients which were then heated to 43 to 47°C. Droplets of encapsulated diet were made by dipping a glass applicator rod into the warm mixture and gently touching it to a sheet of Parafilm® (American Can Company, Greenwich, CT). After several attempts to perfect this technique, it was decided to develop another method that involved less time and skill to encapsulate the diet.

The method used by Cate (1987, Southwest. Entomol. 12: 211-215) for rearing the parasitoids of the boll weevil, *Anthonomus grandis grandis* Boheman, was selected and modified to encapsulate the diet of Hagan and Hassan (1965) without inclusion of paraffin. A plastic plate (18 × 20 × 1 cm, UHMV Ultra High Molecular Weight, Fabricated Plastics) with holes (1 cm diam) drilled 1.5 cm apart in rows 1.5 cm apart, and a plastic plate fitted with opposing metal pegs (2.54 cm) were constructed (Fig. 1). Parafilm, cut to the size of the plates, was placed on top of the plate with holes. The plate with the pegs was pressed down on top to form the cells (5 mm). The bottom plate and formed parafilm cells were then placed on ice after which 3 to 4 drops of the diet were pipetted into each cell. In the method of Cate (1987), another piece of parafilm was placed on top and sealed with a splining tool; however, the diet often leaked from the cells. Instead of using another parafilm sheet, melted paraffin

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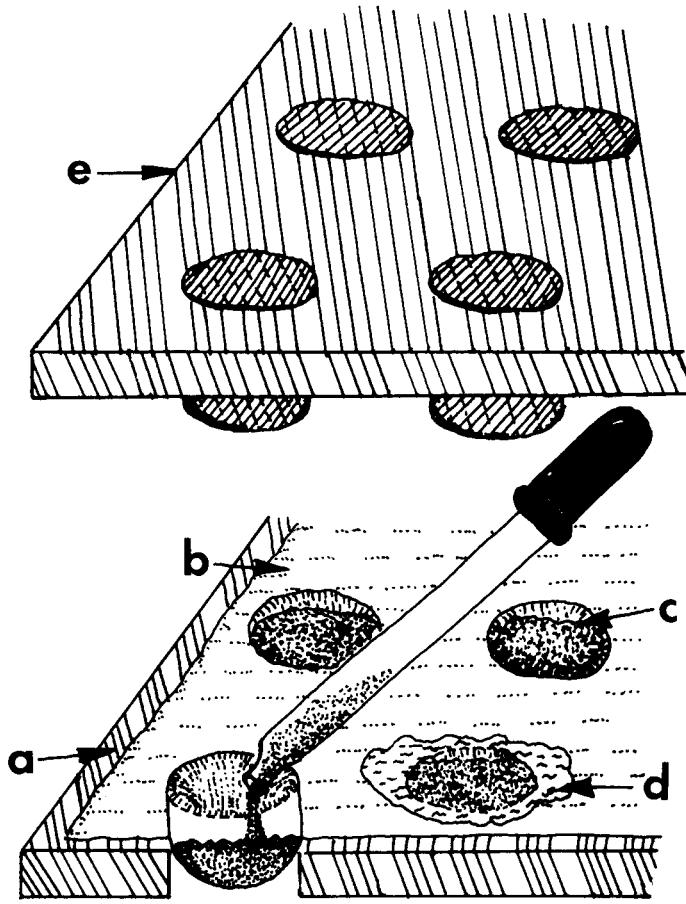

Fig. 1. Illustration of diet cell preparation: (a) bottom of plate with holes, (b) layer of parafilm, (c) parafilm cell with larval diet, (d) cell sealed with paraffin, (e) plastic plate mold with solid metal pegs used to form parafilm cells for diet.

was dripped on top of the diet in each cell until the diet was completely covered and sealed. After sealing all the cells on the plate, the parafilm sheet was removed and the cells were separated individually and stored in a refrigerator until needed.

To ensure larvae would accept the diet presentation, first through third instar *C. cubana* were reared on the diet and compared with larvae reared on *A. gemmatalis* larvae. Although first instars were successful in penetrating the parafilm, they were reared on green peach aphids due to dietary needs of *C. cubana* (Dean and Schuster, 1995, Environ. Entomol. 24: 1562-1568). Sixty *C. cubana* larvae were fed green peach aphids the first week following eclosion. Then 30 larvae were fed pieces of *A. gemmatalis* larvae until pupation, and 30 were fed artificial diet. Lacewing larvae were reared individually in 5-cm diam plastic Petri dishes. The times to pupation were compared using TTEST (SAS Institute, 1988, PC SAS version 6.04, Cary, NC). All of

the larvae under both diet regimens survived to pupation. The average developmental time of lacewing larvae reared on artificial diet supplemented with aphids was 17.3 ± 0.1 (SE) days and was statistically similar (t = –1.47 d.f. = 43.8, P > 0.15) to the developmental time of larvae reared on *A. gemmatalis* larvae and aphids (17.7 ± 0.2 days).

The fecundity of adult *C. cubana* females fed either *A. gemmatalis* or artificial diet as larvae also was compared. A total of 16 *C. cubana* larvae were fed green peach aphids the first week following eclosion. Then 8 larvae were fed pieces of *A. gemmatalis* larvae until pupation, and 8 were fed artificial diet following the above procedure. The emerging adults were placed in screened 1-pint paper Fonda cans (Gainesville Paper, Gainesville, FL), one female and one male adult per can, which were lined with paper for ovipositional purposes. The number of eggs deposited was determined three times weekly for 17 to 19 days. The total number of eggs laid per female and the number eggs laid per day per female were compared using TTEST (SAS Institute). The total number of eggs per female reared on artificial diet supplemented with aphids (287 ± 27 (SE)) was statistically similar (t = 1.76 d.f. = 12, P = 0.10) to the total number of eggs per female reared on *A. gemmatalis* larvae and aphids (206 ± 37). Adults from larvae fed the artificial diet deposited more eggs per day (16 ± 1) than adults from larvae fed *A. gemmatalis* larvae (12 ± 2) (t = 2.26 d.f. = 14, P = 0.04).

Another factor in searching for an alternative diet method was the rearing of insects as a supplemental food source, such as *A. gemmatalis* larvae and the green peach aphid. Maintaining an *A. gemmatalis* colony was time and space consuming and required special containers and grids for the larvae, special diet for the larvae, plexiglass cages for the adults, adult diet and supplies and a controlled environment room. Approximately 100 *A. gemmatalis* larvae were needed for feeding 40 lacewing larvae until pupation. The time needed for *A. gemmatalis* larvae to reach the desired stage was approximately 2.5 wks and took approximately 5 h of cumulative labor. The diet to rear the *A. gemmatalis* larvae cost approximately $488 for 12 months to maintain a colony. Green peach aphids were reared on eggplant (*Solanum melongena* L. var. *esculentum* Nees var. "Black Beauty") and required little maintenance.

The diet cell method described here was simple, did not require special skills and, for laboratory means, was quick to prepare. The entire process from preparing the diet to separating the individual cells took 1 h or less to fabricate 40 cells. The cost of the diet and materials is approximately $170 a year.

Comparing cost, time and practicality, the cell method was more advantageous than the wholly natural food method for rearing *C. cubana* larvae. This method of diet presentation is recommended for laboratories or businesses with limited space or time to maintain additional insect colonies.

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