A Rapid Separation of Larvae of the Indian Meal Moth[1] from Rearing Medium[2]

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Laudani (1948) described a variation of the Berlese technique for separation of the larvae of the carpet beetle, *Anthrenus scrophulariae* (L.), from diet medium based on the negative phototaxis of the larvae. Because our biochemical and physiological investigations of the Indian meal moth, *Plodia interpunctella* (Hübner), often require many larvae, we attempted to modify Laudani's technique by utilizing the negative thermotaxic and phototaxic responses of Indian meal moth larvae. Larval development, adult emergence, egg production, and egg viability of insects removed by this method were not adversely affected.

MATERIALS AND METHODS

The Indian meal moth larvae were obtained from cultures maintained by the standardized procedures of Silhacek and Miller (1972). Larvae were separated from the diet medium as follows. First, 400 g of loosely packed diet containing late 4th- and early 5th- instar larvae were placed in a 20.5-cm-diam sieve (U. S. Standard 20-mesh brass wire) mounted 6 in. above the collecting pan described by Laudani (1948). A 250-w reflector IR heat lamp mounted 17 cm directly above the sieve served to gradually raise the temperature of the medium. As the temperature increased, the larvae migrated downward through the diet and fell onto the smooth stainless steel surface of the collecting pan. A 150-w projector flood-lamp mounted 43 cm behind the sieve and directed down the chute of the collecting pan induced the larvae to migrate across the pan, down the chute, and into the collecting jar. Larval collection was completed within 18 min.

The temperature of the medium during the larval collection period was measured with a digital thermometer coupled to a remote temperature probe. The diet was spread in even thickness of 25 mm in the sieve and the probe was positioned in the center of the sieve at 5, 12.5, and 24.5 mm from the upper surface of the diet. The temperature at each position was recorded in a separate test.

The percent recovery of larvae by this modified Berlese (thermal) method of collection was established by placing 200 larvae collected with vacuum tweezers on the surface of 400 g of diet in each of four 13.0×19.0×10.5-cm plastic boxes. The containers were placed in a temperature cabinet at 30±0.5°C for 2 hr while the larvae dispersed through the medium. Then the larvae were collected by using the thermal method, and the percent of larvae recovered was calculated. In addition, insects removed from diet by the thermal method (Group A) were compared with larvae carefully hand-picked from the diet with vacuum tweezers (Group B) to determine duration of developmental time of the late 4th and early 5th instar larvae, larval mortality, and percent adult emergence. Twenty larvae from each group were placed in each of 10 one-pint glass jars containing 60 g of diet medium and covered with metal lids fitted with wire brass screen for ventilation. The jars were then held for daily observation in a rearing chamber maintained at 30°C and 70% RH with a 16L:8D photoperiod. Also, the fecundity and percent hatch of eggs for females reared from larvae from Groups A and B were compared by sexing day-old

[1] *Plodia interpunctella* (Hübner) (Lepidoptera:Pyralidae).
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Table 1.—Comparison of the effects of the thermal method of collection (Group A) with the handpicked method (Group B) on 4 life history characteristics of *P. interpunctella.*

	Avg no. of days to adult emergence	% adult emergence	Avg mg eggs deposited/♀[a]	% adult emergence in F_1
Group A	20.2[b]	99.5[b]	2.2[b]	85.2[b]
Group B	20.1	97.5	2.5	80.6

[a] Each mg of eggs represents ca. 40 eggs.
[b] Means are not significantly different at the 0.05 level of confidence.

pupae from each group and placing 50 ♂ and 50 ♀ into each of 7 one-pint glass jars with screened closures. After the adults had emerged and mated, the jars were inverted each day for 3 days on black construction paper so the eggs would drop through the screen lid onto the paper. The collected eggs were sifted to remove debris and weighed. To determine the percent adult emergence in the F_1 generation of Groups A and B, 50 eggs from each group were placed in one-pint jars containing 60 g of diet medium, and maintained in the rearing chamber.

The Student's t-test was used to test for significant differences between data collected for Groups A and B.

RESULTS AND DISCUSSION

Separation of 7-day-old Indian meal moth larvae from the diet by the modified Berlese technique did not adversely affect larval development, adult emergence, egg production, and egg viability (Table 1).

During the 18-min extraction period, 96.5% of the larvae were recovered from the medium by the thermal method. After 12 min, 75% had dropped from the medium. The temperature of the medium at 3 depths during the extraction is shown in Fig. 1. Most larvae located near the upper surface probably began migrating down through the medium immediately after the heat lamp was turned on. Therefore, they were probably not exposed to temperatures excessively higher than the temperature at the surface for any period.

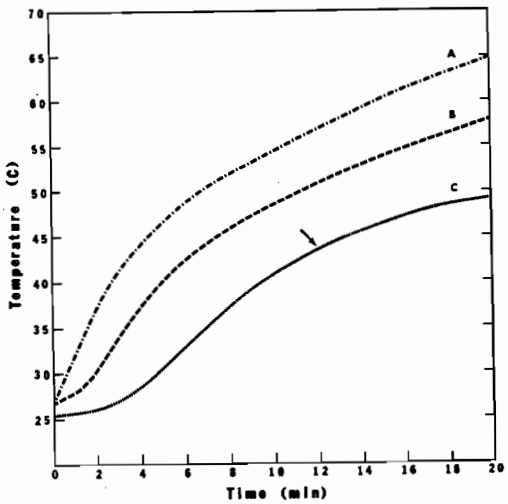

FIG. 1.—Temperature of medium 5 mm (A), 12.5 mm (B), and 24.5 mm (C), from the upper surface of the medium during larval separation. (Arrow indicates point at which 75% of the larvae had left the medium).

By using this technique, we were able to extract 1-g quantities of 7-day-old larvae uninjured and free of diet particles in 18 min compared with ca. 35 min required to collect a comparable amount from the diet by hand.

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