MATING DISRUPTION FOR CONTROL OF THE INDIANMEAL MOTH IN A WAREHOUSE

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The Indianmeal moth *Plodia interpunctella* Hübner is a cosmopolitan pest of stored products. In warehouses, fogging systems using pyrethrins or dichlorvos are frequently used for control of Indianmeal moth, but these systems can't be used in warehouses certified in accordance with the Organic Materials Review Institute (OMRI). Typically managers with organic product use exclusion, monitor more intensively, and treat as needed using physical methods such as controlled atmospheres or cold storage. In this study we compared the use of timed release of the Indianmeal moth pheromone component (Z,E)-9,12-tetradecadienyl acetate (ZETA) with pyrethrin fogging and with Indianmeal moth prevalence in an untreated area of the same complex. In accompanying experiments we examined survivorship and rate of development of the Indianmeal moth on various types of dried beans.

Materials and Methods

Pheromone was released using the Michigan State Microsprayer. A single timed-release device was placed in the center of a square storage area with 18.3 m sides. The roof was 5.5 m high on two sides and 8.2 m high at the center. The sides of the building were built of corrugated steal, and the roof had composite shingles. The Microsprayer emitted 0.07 mg ZETA in 95% ethanol every 2.5 minutes.

The prevalence of the Indianmeal moth was monitored in the treatment area, in a warehouse used for storage of dried beans and protected with conventional pesticides, and in a breezeway where insecticides were not used. The conventional warehouse was 18.3 x 26.6 m and also had roof height of 5.5 m high on two sides and 8.2 m high at the center; we monitored in half of its length. The breezeway was a covered area of approximately 18 x 18 m, separated from warehouses on the north and south side by corrugated metal walls and doorways, and with no walls on the east and west side. In addition to the Indianmeal moth, pyralid species attracted to ZETA include the raisin moth *Ephestia figilulella* (Gregson), the tobacco moth *Ephestia elutella* (Hübner), the Mediterranean flour moth *Ephestia kuehniella* Zeller, and the almond moth *Cadra cautella* (Walker). Prevalence of these species inside and outside the storage areas was monitored using flight traps baited with red rubber septa containing ZETA.

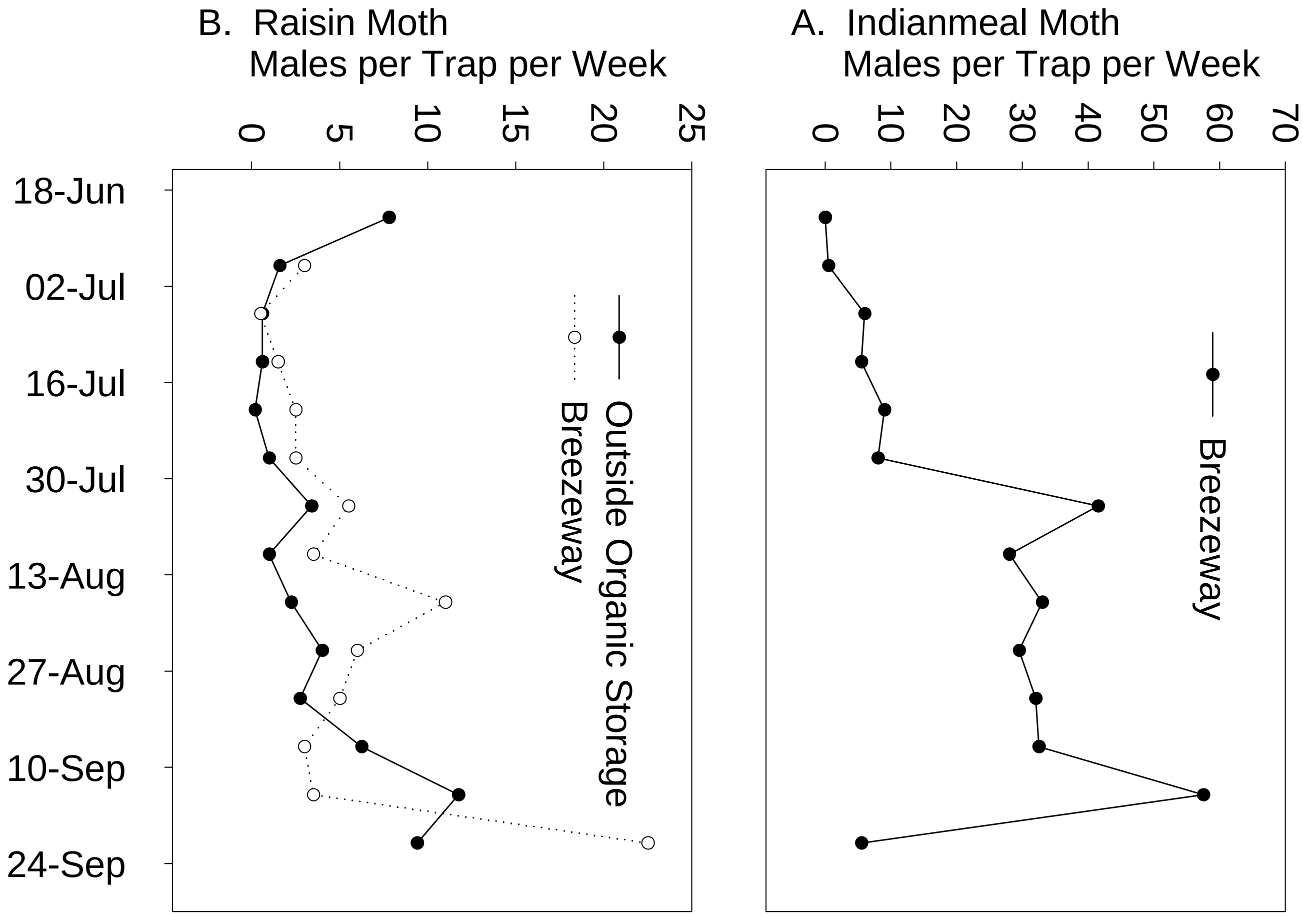
In addition to flight traps, oviposition was monitored using plastic containers containing laboratory bran diet, and mating was monitored using unmated females. A laboratory experiment examined survival of Indianmeal moth larvae on dried beans including black-eye peas, garbanzos, large lima beans, and dark red kidney beans. Moisture contents of these beans were 11-12%, as measured by our cooperator, with the exceptions of 6% moisture content in the Garbanzos and one batch of lima beans with 17% moisture content. Larvae were placed on 50 g of intact or broken beans in a 4 x 4 x 5.5 cm glass jar with a mesh top, and emergence was monitored on a regular basis.

Results and Discussion

The season totals for all pheromone-baited flight traps included 625 Indianmeal moth, 376 raisin moth, 23 tobacco moth, 5 Mediterranean flour moth, and 1 almond moth. Two hundred and thirty-five raisin moths were captured outside the organic storage, one raisin moth in the conventional storage, and the remainder in the breezeway. Seasonal prevalence of the Indianmeal moth and the raisin moth are compared in the accompanying figure. Most of the tobacco moths were captured in the breezeway, and most of the Mediterranean flour moths were captured outside the organic storage. The bran diet used for the oviposition trap is used in our laboratory to rear raisin moth, but no raisin moth larvae were recovered from the oviposition traps in the breezeway, suggesting that wild raisin moths will not oviposit in that media expect in a no-choice situation.

Flight trap and oviposition trap data indicated an infestation in the organic storage at the time that the mating disruption was initiated. Infested bags of dark red kidney beans were found and removed, and the number of moths captured in flight traps was subsequently similar between the organic and conventional storage. After the initial 2 weeks no moths were captured in oviposition traps in the organic storage, although a few moths emerged from oviposition in conventional storage at the same time as oviposition trap emergence peaked in the breezeway. Virgin females were consistently mated in the breezeway, but not in the conventional or organic storage.

Compared to bran diet, Indianmeal moth larvae developed poorly on all dried bean varieties. Generally larvae developed better on broken beans than on whole beans, and 5-day-old larvae developed more successfully than neonates placed on dried beans. Survival on neonates on broken beans ranged from 7 to 25%, compared to 87% for larvae placed on bran diet. The mean time for development from neonate to eclosion was 48 to 78 days for the broken dried beans, compared to 23 days for the bran diet.



A. Indianmeal Moth
Males per Trap per Week
0
10
20
30
40
50
60
70
Breezeway
B. Raisin Moth
Males per Trap per Week
0
5
10
15
20
25
Outside Organic Storage
Breezeway
18-Jun
02-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep