MONITORING INDIANMEAL MOTH IN THE PRESENCE OF MATING DISRUPTION

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Mating disruption has been widely adopted as a pest management technique for several lepidopteran orchard pests. For stored products protection, mating disruption offers greater worker and environmental safety and less disruption of production compared to fumigation or fogging. The Indianmeal moth shares the same primary sex pheromone component [(*Z*,*E*)-9,12-tetradecadienyl acetate, hereafter Z9,E12:14:Ac] with four other closely-related stored product pests. Studies have shown control of these pests using various mating disruption formulations, and two formulations are registered and used in the US. Possible loss of information from pheromone traps can be a barrier to wider use of mating disruption for stored products moths. Mating disruption dispenser formulations affect the mechanisms involved in achieving mating disruption, and potentially affect the success of monitoring using pheromone lures in the presence of mating disruption. A previous study[1] indicated that the lures with a higher pheromone lure are promising for monitoring the Indianmeal moth under mating disruption. The objectives of the current study were to examine the response of Indianmeal moth males to traps baited with up to 30 mg Z9,E12-14:Ac, and to examine the potential for monitoring Indianmeal moth with traps baited with 10 mg Z9,E12-14:Ac, in the presence of mating disruption with commercially registered dispensers.

Simultaneous exposure to different pheromone lure doses, with or without mating disruption

The response to pheromone loaded onto gray rubber septa was examined in a 1,000 m^3 (12 x 12 m, 7 m high). Sixteen delta traps were placed on the floor at equal distances from each other (four per wall; i.e., 2-3 m apart). Mating disruption was applied using CideTrak IMM (Trécé, Norman OK) dispensers at the highest label rate of one per 100 m^3. Males (160), 0-2 days old, were released and the room was closed. Two days later the room was opened and the traps read. The room was fumigated between tests in order to maintain independence of tests. Three tests were conducted prior to mating disruption, then three more after mating disruption dispensers were put in place. The temperature in this room during these tests was 25-35°C.

The number of males captured increased with dose up to 10 mg Z9,E12:14-Ac, but there was no significant difference between 10 and 30 mg or the number of males captured with or without mating disruption (Table 1). A second experiment, examining males captured in a 254 m^3 room in the absence of mating disruption, found significantly more males captured with 30 mg septa than with 10 mg septa (data not shown).

Sequential exposure to females and pheromone lures, with or without mating disruption

Another experiment was performed to compare male response to lures and pheromone released by females. Newly eclosed males were simultaneously released into two 76 cubic meter (2.4 x 12

m, 2.4 m high) rooms containing 4 wing traps at 3 m intervals. One room was treated with Cidetrak IMM mating disruption dispenser cut to 76% of the original length to maintain the label rate. The bait in the wing traps was changed each 2 days: first blank liners, then newly eclosed unmated females, then septa containing 1 mg Z9,E12-14:Ac, and finally 10 mg septa. These rooms were heated to 30°C continuously for several days between tests to senesce and kill uncaptured males, then the rooms were returned to the 15-27°C temperature range used for the experiments. Nine tests were performed, and the Cidetrak IMM dispenser was replaced every 3 tests. After the ninth test, the mating disruption dispenser was removed from the trailer and three more tests were performed to determine residual effects on males.

While the mating disruption dispenser was in place, significantly fewer males were captured in female-baited traps in the treated room compared to the untreated room (Table 2). Males not captured by traps baited with calling females were also not captured by 1 mg or 10 mg pheromone septa (Table 2). During these tests, males were observed approaching and contacting the mating disruption dispenser. There was no difference in the number of males captured in the two rooms after the mating disruption dispensers were removed, suggesting minimal residual effect.

Effect of age and pheromone exposure

The finding that males not captured with virgin females were not captured by pheromone lures differed from a previous study [1], so we wished to examine possible effects of male age and acclimation to pheromone. Newly-eclosed males were released into the previously-described rooms. The traps were in the same configuration and one room was treated with mating disruption. Liners and lures (females and 10 mg septa) were placed in the traps either when the males were released, or after two days.

We predicted that pre-exposure to mating disruption dispensers would result in a difference in the number of males captured in 10 mg lures between the treated and untreated rooms. There was no difference between the total number of males captured between mating disruption and non-mating disruption treatments, but there were differences due to age of males at the outset of monitoring (Table 3). When the start of monitoring was delayed, fewer males were captured overall, and a larger proportion of males were captured in female-baited traps.

Conclusions

- Indianmeal moth males approached and contacted Cidetrak IMM dispensers, suggesting that the amount of pheromone emitted by these dispensers did not repel males.
- Suppression of female location by males was quickly lost after removal of Cidetrak IMM dispensers.
- Lures containing 10-30 mg Z9,E12:14-Ac hold promise for monitoring Indianmeal moth in the presence of mating disruption.
- Response of males to monitoring lures depends on the formulation used for mating disruption.

[1]Burks CS, Brandl DG, Kuenen LPS, Reyes CC, Fisher JM. Pheromone traps for monitoring *Plodia interpunctella* (Hübner) in the presence of mating disruption. *Proc. 10th International Working Conference on Stored Product Protection, Estoril, Portugal, 2010*:79-84: Julius Kühn-Institut, Berlin

Table 1. Effect of simultaneous exposure to different pheromone lure doses on Indianmeal moth males per trap (mean ± SE, n = 12) in the absence or presence of mating disruption dispensers in a 1,000 cubic meter room

Amount Z9,E12:14-Ac (mg)	No Mating Disruption	Mating Disruption
0	0.6 ± 0.29a	1.3 ± 0.54a
1	5.8 ± 1.16b	5.4 ± 0.89b
10	10.6 ± 1.95c	12.3 ± 2.51c
30	11.0 ± 2.23c	15.1 ± 1.78c

Means in the same column followed by different letters are significantly different ($P < 0.05$). There was no significant different between the number of males captured by lures with equal pheromone load in disrupted and non-disrupted environments.

Table 2. Effect of sequential exposure to traps baited with females and different synthetic pheromone lure doses on Indianmeal moth males (mean ± SE) captured in untreated (No MD) and mating disrupted (MD) during treatment (n = 9) and after treatment (n = 3)

	While dispensers present		After dispensers removed	
Treatment	**No MD**	**MD**	**No MD**	**MD**
Blank	3.0 ± 0.83	6.1 ± 1.51	6.3 ± 2.19	7.7 ± 2.33
Female	29.5 ± 1.49	15.5 ± 2.08***	32.0 ± 2.52	30.3 ± 1.20
1 mg Z9,E12-14:Ac	1.6 ± 0.44	2.8 ± 0.45	0.7 ± 0.33	0.7 ± 0.33
10 mg Z9,E12-14:Ac	1.1 ± 0.48	2.2 ± 0.66	0	0

***Significantly fewer males ($P < 0.001$) captured in the presence of mating disruption than in its absence.

Table 3. Effect of age on Indianmeal moth male capture in traps baited with females or 10 mg pheromone in the presence or absence of mating disruption

Age at start of monitoring (days)	Lure	Males captured
0 (day of eclosion)	Females	3.9 ± 0.55a
	10 mg Z9,E12-14:Ac	29.6 ± 1.39d
2	Females	10.0 ± 2.08b
	10 mg Z9,E12-14:Ac	17.6 ± 1.15d

Means followed by different letters are significantly different ($P < 0.05$).