

Trapping the Indian Meal Moth

The female moth is more difficult than the male to trap consistently

The Indian meal moth is a common pest associated with stored grain and processed food materials. Adults do not feed and live for about a week to 10 days. The larval stage is the most damaging

for the food and grain industry. Larvae spin webs of silk throughout a variety of cereal food and grain products.

Proven Technique

Every pest management professional and food industry sanitarian is familiar with the pheromone trap used to capture adult males.

The pheromone for males is highly attractive, and different types of commercial traps with pheromone lures generally are used to detect and monitor Indian meal moth infestations in grain tanks, warehouses, food-processing facilities,

and retail environments.

Finding the Female

In recent years, Insects Limited, Indianapolis, IN, has commercialized an attractant to be used in a sticky trap (Moth Suppression® trap) that captures mated females before they can lay eggs. The egg-laying attractant is placed in cotton wick lures.

My graduate student, Andy Allen, initially evaluated the female attractant at

a commercial flour mill in Kansas to study the movement of Indian meal moth females. He ran two separate tests, and in both tests, the captures of females were essentially zero in traps placed inside or outside the facility.

This prompted us to evaluate the performance of the female egg laying attractant in capturing female Indian meal moths at six facilities in Manhattan, KS. Tests were done under "real-world" conditions where these traps are commonly used. Under these conditions, traps with attractants would be competing with other food odors and pheromone odors from natural Indian meal moths present.

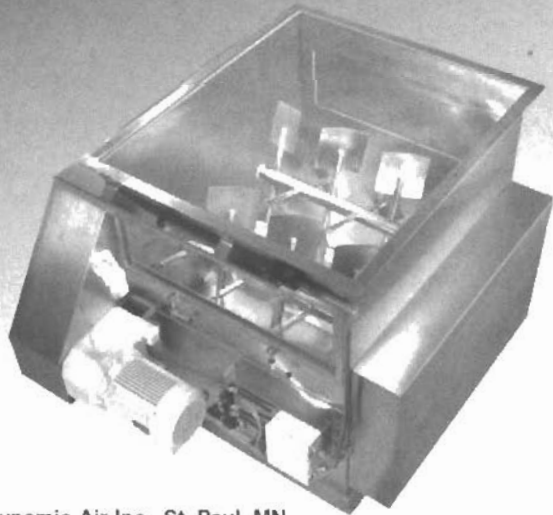
Pest Management



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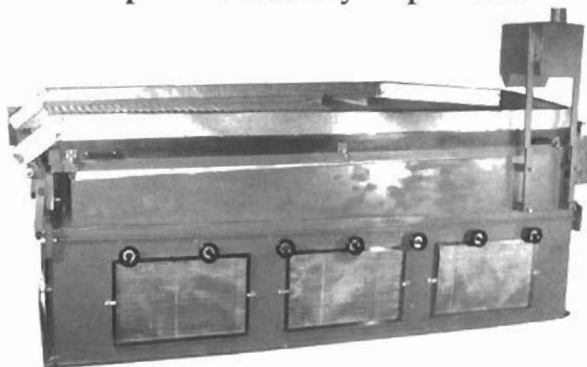
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Indian Meal Moth Food Attractant Trapping Locations

Grocery Store	185.6 m ²
Pet Store	350.6 m ²
Swine Rearing Facility	580.1 m ²
Seed Warehouse	819.9 m ²
Pilot Feed Mill	1,145.6 m ²
Ag Supply Store	1,629.8 m ²

Trapping Locations

Trapping locations were selected based on availability of cereal grain products and potential for harboring Indian meal moth populations.

The six locations included a swine rearing facility, a seed warehouse, a pet store, a grocery store, an agriculture supply store, and the Kansas State University pilot feed mill.

All locations contained whole grain and/or processed foods and feeds.

Only the pet store and the swine rearing facility had live animals and

related feeds.

All other trapping locations primarily contained food items, except for the agriculture supply store and the pet store.

More than half of the products sold at the agriculture supply store were non-food items. In the pet store, equal amounts of food and non-food products were sold.

Trapping protocol

Seven baited (with female oviposition attractant) and seven unbaited (blank) orange-colored Moth Suppression traps were paired and uniformly distributed at each facility.

Six pairs of Moth Suppression traps (each pair with one blank trap and one trap baited with female attractant) were located inside the facility, while a single trap pair was placed outside, near exterior doors or windows.

Furthermore, 10 Pherocon II traps from Trece, Inc., Enid, OK, baited with a female sex pheromone lure for capturing males, were used at each facility to confirm the presence of the Indian meal moth.

Eight of the traps were located inside



Indian meal moth. Photo courtesy of Insects Limited.

while the other two were located outside the facility.

The Moth Suppression and Pherocon II traps were placed at 0.44 to 2.81 meters above the floor, and the distance between these two trap types was less than 1.83 meters.

Trapping was conducted for two consecutive weeks at the seed warehouse, pet store, grocery store, agriculture supply store, and pilot feed mill from July 7 to July 22, 2004. In the swine facility, Moth Suppression traps were deployed from June 16 to July 1, 2004, while the Pherocon II traps were used from ►

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July 7 to July 22, 2004.

Temperatures inside the facilities ranged from 78.8 to 82.4 degrees F, and the humidity ranged from 51% to 71%. The outside temperatures and humidity levels fluctuated between 46.4 to 100.4 degrees F and 47% to 93%, respectively.

Interior wind speeds were zero for all six trapping sites, except for the swine rearing facility, which had an average wind speed of 0.46 meters per second with a standard error of plus or minus 0.15 meters per second. Average outside wind speeds ranged from 0.76 to 7.38 meters per second.

The number of male and female moths captured in baited and unbaited traps was counted. All females in traps were dissected to determine the number of spermatophores (sperm sac) in the bursa copulatrix, which is a genital chamber for sperm storage.

Presence of a spermatophore would indicate that the female had mated once. A female mating three times would have three spermatophores.

In all of the experiments, care was taken to prevent any type of cross-contamination between the lures by wearing

Indian Meal Moth Trapping Study Results

Location	Week	Females Caught (Moth Suppression)		Males Caught (Moth Suppression)		Pherocon II
		Female Lure	Blank	Female Lure	Blank	No. of Males
Swine-Rearing Facility	1	0	1	9	1	N/A
	2	0	1	1	5	N/A
Seed Warehouse	1	4	1	10	0	735
	2	0	0	1	1	125
Pet Store	1	0	0	2	0	81
	2	0	0	0	2	56
Grocery Store	1	1	0	1	0	16
	2	0	1	0	0	25
Agriculture Supply Store	1	0	0	0	0	7
	2	0	0	0	0	21
Pilot Mill	1	0	0	0	1	33
	2	0	0	1	0	38
	Total	5	4	25	10	1137

separate gloves and using forceps when handling the lures for male and female Indian meal moths.

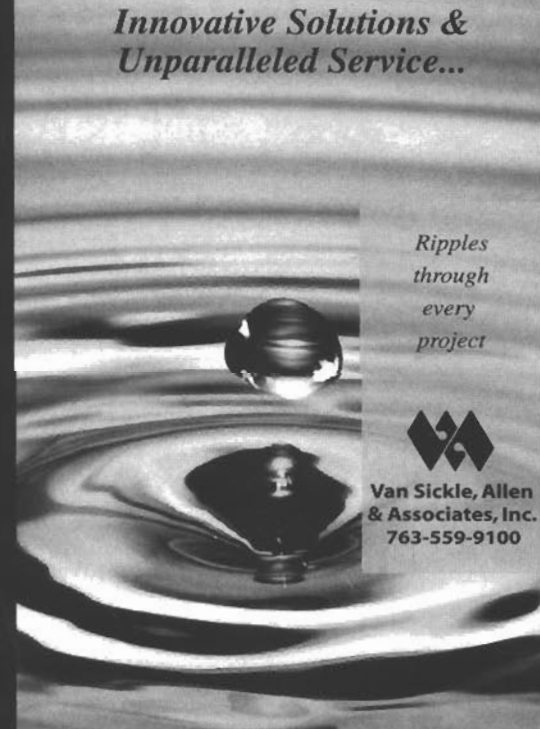
Trapping Results

Females were captured only in traps containing the female attractant in the seed warehouse and the grocery store. The


swine rearing facility (two females), seed warehouse (one female), and the grocery store (one female) all captured female moths in blank traps. The number of spermatophores in these females ranged from zero to two.

A total of 1,181 male and female moths were captured throughout the experi-

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ment. In the swine rearing facility, pet store, agriculture supply store, and pilot feed mill no females were captured in the Moth Suppression trap with the female attractant.

In the five facilities sampled, the captures of males in the sex pheromone traps during the first week ranged from 7 to 735 moths per store and during the second week ranged from 21 to 125 moths per store.

Overall Conclusions

Nine female moths were captured in the six Kansas facilities. However, four of the nine females captured were found in blank traps. All captured females had mated, except for two, which were captured in the unbaited traps.

Casual observations during the two weeks of study indicated that the pet store, agriculture supply store, and grocery store facilities were relatively clean, and the swine rearing facility, seed warehouse,

Blank traps captured two females that had not mated. All the moths in the Moth Suppression® traps had mated at least once. Therefore, the female attractant is valuable in trapping females before they have had a chance to lay their eggs.

and the pilot feed mill were not clean based on product accumulation on floors, equipment, and ledges within the facilities.

To our knowledge, correlating trap captures to cleanliness would be a difficult task, because an index to determine cleanliness or degree of sanitation has yet to be developed. Furthermore, cleanliness varies over time within the same facility.

Of the nine total females captured in the six facilities, seven female moths contained spermatophores, an indication that they had mated.

The two females that had not mated were captured in blank traps, and all females in the Moth Suppression traps had mated at least once. Therefore, the female attractant is valuable in trapping females before they have had a chance

to lay their eggs.

The increased capture of males in the traps with the female attractant in the first test and at the six facilities is difficult to explain. We suspect that the female attractant may have been contaminated with traces of the female sex pheromone in the manufacturing facility, or the few females captured initially may have produced the sex pheromone to attract males to the trap.

While the Moth Suppression traps

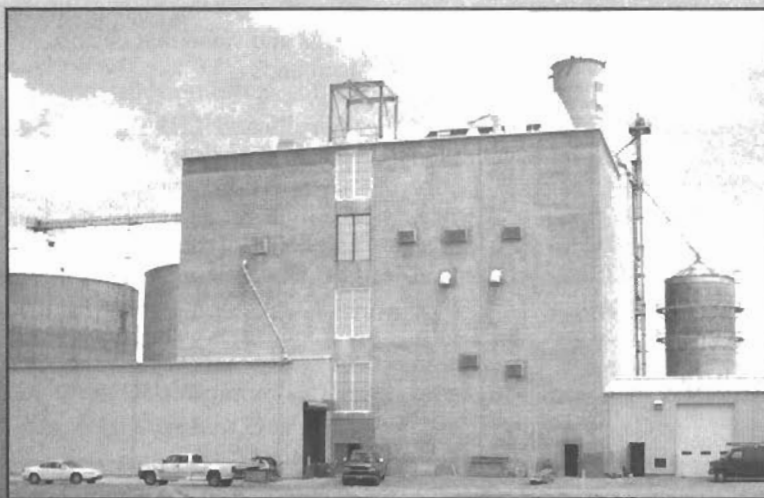
with the female attractant did outperform the blank traps, the facility's cleanliness, trap location, and temperature may have played a big part in the experiment's results.

Bhadriraju Subramanyam (Subi) is a professor in the Department of Grain Science and Industry at Kansas State University, Manhattan. He can be reached at 785-532-4092 or sbhadrir@ksu.edu.

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