NONCHEMICAL POSTHARVEST TREATMENTS/TECHNIQUES FOR CODLING MOTH ON IN SHELL WALNUTS: DISRUPTION OF MATING AND MONITORING OF ACTIVITY USING SEX PHEROMONE

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ABSTRACT

Mating disruption of a field pest (codling moth) is being tested in a stored-product situation by placing pheromone dispensers in bagged walnuts in storage at 77°F. Three series of tests have resulted in 39-100% control when a single pair of moths was present in each test bag and in 42-87% control when four pairs of moths were present in each test bag. Future tests will include field collected as well as laboratory reared moths and temperatures representative of actual shipping conditions (Oakland to Yokohama and Corpus Christi to Rotterdam).

Trapping in two walnut processing plants (Sept. 8-Dec. 5) resulted in six codling moths being trapped in the receiving area of the plant which was adjacent to a walnut orchard and no moths being trapped in the receiving area of the other plant or any of the processing and holding areas in either plant. This type of information should be valuable in demonstrating how unlikely it would be for walnuts to become reinfested during storage and processing.

OBJECTIVES

1. Determine the mating potential of codling moth in bagged walnuts stored in normal and pheromone permeated atmospheres.

2. Develop existing sex pheromone as a useful tool for controlling the codling moth by disruption of mating in postharvest walnuts.

3. Develop the existing sex pheromone as a useful tool for monitoring codling moth activity in packing and storage areas.

4. Develop alternative postharvest/quarantine detection and control strategies, based on findings in Objectives "1", "2" and "3", for codling moth causing losses on inshell walnuts.

PROCEDURE

1. Newly emerged virgin codling moth adults will be released into 25 kg or 50 lb bags of Persian walnuts. Single pairs and four pairs per bag will be used to determine mating potential in untreated and pheromone [(E,E)-8,10-dodecadien-1-ol] treated bags held in continuous darkness. Studies will be conducted at 77°F (25°C) and at the prevalent temperature under which walnuts are stored or shipped to Japan. Pheromone formulated in Shin-Etsu and/or Riocontrol dispensers will be provided by Biocontrol Ltd., Australia. Pheromone concentrations in the air space inside the
bags and storage/shipping container will be sampled and analyzed by gas chromatographic procedures.

(2) The finding from Procedure "1" will be used as the basis for developing the best methods of applying the pheromone to shipments of inshell walnuts, i.e., treatment of individual bags or placement of pheromone dispensers at various points within an enclosed space.

(3) Pheromone formulated in rubber septa and placed in sticky traps will be used for surveillance of codling moth in packing and storage areas. Strategic places in the receiving, packing and storage areas will be selected for monitoring any moth emergence from the time walnuts are received from the orchard and during storage and shipping.

(4) The results from these tests can be used as the basis for developing a surveillance and control strategy for inshell walnuts being shipped in van containers for export.

### Projected Schedules

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<tr>
<th>Time (years)</th>
<th>Mating potential (w/ and w/o pheromone)</th>
<th>Treatment of van containers</th>
<th>Surveillance tool development</th>
<th>System for control and surveillance during shipping</th>
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### RESULTS AND CONCLUSIONS

These studies could provide data needed by walnut handlers and shippers who could apply the pheromone to shipments going into export markets as one method of certifying that codling moth would not be introduced into the importing country. Alternative strategies to meet quarantine security requirements could also be developed to reduce the severity or eliminate the need for methyl bromide treatment of inshell walnuts.
Preliminary studies of mating disruption of a field pest (codling moth) in a stored-product situation (25 kg bags of walnuts in storage) at 77°F in an unlighted chamber have shown a significant reduction in mating when compared with control bags. Percent control was 100 with one pair per bag and 98 for four pairs per bag (a very high infestation level that is unlikely to occur). Percent mating was zero in treated and 12 in controls for bags with one pair and it was 2 in treated and 16 in controls for bags with four pairs per bag. When moths were contained in 2.2-liter clear plastic bags as controls with no walnuts present, percent mating was 60 for one pair and 81 for four pairs in a 16:8 (L:D) photoperiod and 29 for one pair and 36 for four pairs in continuous darkness. This indicates potential as one tool to suppress mating and reproduction in stored walnuts.

Recent tests with Shin-Etsu dispensers, resulted in 92% control with one pair and 94% control with four pairs per bag. Percent mating was 8 in treated and 14 in controls for bags with one pair and it was 6 in treated and 31 in controls for bags with four pairs per bag. Percent mating for moths in empty-plastic-bag controls was 83 for one pair and 92 for four pairs in a 16:8 (L:D) photoperiod and 52 for one pair and 46 for four pairs in continuous darkness.

Recent tests with Biocontrol dispensers had control/treated percent matings of 30/0 for one pair and 27/16 for four pairs in walnut bags. Percent matings in empty-plastic-bag controls was 73 for one pair and 81 for four pairs in a 16:8 (L:D) photoperiod and 62 for one pair and 58 for four pairs in continuous darkness.

All of the results in recent tests have shown more mating than what was obtained in preliminary testing. There was still a significant reduction in mating for bags treated with pheromone. We plan to compare our laboratory strain moths with field collected material from walnut orchards. We hypothesize that there will be a greater effect on mating disruption for field collected moths.

Air temperatures (1986) along a great circle route, Oakland to Yokohama, have been obtained from Oceanroutes Inc., Marine Weather Sciences Division. These provide data on air temperatures but not cargo temperatures. Further investigations will be made to ascertain the availability of walnut cargo temperatures or the possibility of obtaining our own temperature data for testing mating/mating disruption at representative shipping temperatures.

Trapping in two (2) walnut processing plants began on September 8. Traps were placed in the receiving, processing and holding areas - five (5) traps per plant. No codling moth were caught in one plant far removed from any walnut orchards during the period up to December 5. Six (6) codling moths were trapped in the receiving area of the second plant which was adjacent to a walnut orchard. No codling moths were trapped within the plant.