

Mating Disruption/SIR

Why So Many Mated Female Codling Moths in Disrupted Orchards?

Alan Knight
USDA-ARS, Yakima, WA

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To optimize the use of sex pheromones to manage codling moth (MD) we need to understand the various impacts this approach may have on the adult behavior and population dynamics of this pest. Previous studies have shown that female codling moths avoid surfaces treated with pheromone to lay eggs, calling by virgin females was increased in the presence of sex pheromone, males become more active in searching for females and their distribution both within the canopy and within and among orchards is affected by the presence of sex pheromone, and female movement patterns are apparently unaffected by sex pheromone. Egg predation is somewhat higher in orchards under MD that are sprayed less often with broad-spectrum insecticides and may account for an additional 10-30% reduction of the population. In 1995 I found that nearly 50% of the female codling moths were mated in a disrupted orchard during the first generation. However, this was a high pressure orchard and we know that disruption of mating is lower under higher moth pressure. Similar findings were found in 1996 and mating of females approached 100% during the second flight in a disrupted orchard. These findings led me to wonder if these mated females were older when they mated and whether this delayed mating could account for a significant population reduction. Therefore two studies were conducted to demonstrate the potential for a delay of mating and its effect on the fecundity of codling moth in apple orchards under sex pheromone-based mating disruption.

Releases were made of virgin, sterile codling moths into both MD and conventional orchards. Moths were recaptured on interception traps daily for six days. In the conventional orchards ca. 40% of the females were mated after one night and this increased to ca. 75% on the second and subsequent nights. In the MD orchards no mating occurred on the first night. On the second and third nights ca. 20% of the females were mated. On the fourth and subsequent nights ca. 45% of the moths were mated. Thus, there appeared to be a two-day delay in mating in the MD versus the conventional orchard. Laboratory bioassays were conducted with female codling moths <1-10 days old. Each female was placed in a container with two 1- 2-d-old males for one night. Her mating success, fecundity and the number of larvae produced were measured. The total number of progeny produced dropped 40% if females were not allowed to mate for two days.

A simple model has been constructed that relates the percentage of the population that mates (based on population density), the age of the females when they mate, and the seasonal effects of egg predation to characterize the population dynamics of codling moth within both MD and conventional orchards. Further research is planned to determine if delay of mating occurs with natural populations of codling moth and studies will continue to develop a population model for codling moth in MD orchards. Validation of this model will begin in 1998.