1. Thresholds,/Monitoring/Sampling
   b. Monitoring - pheromone treated orchards
      Codling moth, *Cydia pomonella* L., Apple

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Summary: Pheromone traps baited with high load red septum (10 mg of codlemone) have been adopted as a tool for monitoring codling moth in pheromone-treated orchards. Large-scale evaluation of this trap in the Howard Flat, Codling Moth Areawide Pilot (CAMP) project, indicated that traps more effectively tracked CM flight when placed in the upper third of the canopy rather than at mid-canopy. Small-plot experiments showed attractancy of high load lures lasted 3-4 weeks in the spring and 2 weeks in the summer. Analysis of release rates using mobility spectrometry indicated the reduced attractancy of the 10 mg lure was closely associated with a sharp decline in the release rate of codlemone during the second codling moth flight period. A significant reduction in the attractancy of the high load lure occurred when release rates dropped below 2.5 µg of codlemone per hour. Experimental high load lures were engineered by Consep and Trécé, but none proved as effective as the high load red septum. Based on our analysis of release rates from high load red septum, new lures with release rates of 5-10 µg per hour should be available for testing in 1996.

High load lures - Pheromone block monitoring

Experimental design: Three kinds of high load pheromone lures were compared for effectiveness in monitoring CM in pheromone treated orchards. The lures tested were the commercially available red septum loaded with 10 mg of codlemone (Trece, Inc.), a Biolure membrane (Consep, Inc.), and one-eighth of a CIDeTRAK pheromone dispenser (Trece, Inc.). The amount of codlemone in the two experimental lures was not determined. To evaluate the effect of aging on attractiveness of lures, a red septum replaced every 8 d was used as a control. The experimental design was a randomized complete block (6-8 blocks). During the spring flight of CM, the number of male moths captured in Pherocon 1CP traps baited with the different lures were recorded every 2 d. Only two of the four lures were compared in the summer (aged and new red septum), thus trap catch was recorded every 3-4 days. To minimize position effects, traps were rotated each time they were inspected. Trap bottoms were replaced after a cumulative catch of 40 moths, more often if dirty.

Attractancy of lures: The relative attractancy of the various lures during the first and second generation flights of CM are shown in Figure 1. The experimental high load lures engineered by Consep and Trece were significantly less attractive than the 10 mg red septum, capturing about a third as many moths as the red septum replaced at regular intervals throughout the first generation comparison (Fig. 1A). Attractancy of the 10 mg red septum remained as attractive as a new 10 mg red septum for about 3 weeks during the spring flight. A significant reduction in the relative attractancy of the red septum was observed during the thrid and fourth trapping periods, days 25 through 40.

Becuase only two lures were tested in the second generation and moth captures were consistently low the actual average values were used in comparing lure performances during this test period (Fig 1B). The effectiveness of the red septum declined dramatically during the second trapping

period, days 8 to 14. No moth catch was recorded after the red septum had been in the field for 3 weeks. The consistent attractancy of the 10 mg lure could only have been maintained if it was replaced weekly under these conditions. Effective use of the 10 mg red septum in commercial orchards probably will require changing lures every three weeks during the first generation CM flight and at least every two weeks during the second generation CM flight. Better lures are needed to reduce the expense and difficulty associated with maintaining consistent trap attractancy in orchards treated with CM pheromone.

Pheromone emission rates: Pheromone emission rates of field exposed 10 mg lures are currently being analyzed using ion mobility spectrometry. Lures were collected at 7-10 d intervals during both CM flights in 1994 and 1995. Preliminary analysis of 10 mg red septum collected in 1994 have indicated significant differences in emission rates of lures during the first and second generation flights of CM. In both spring and summer flights, emission rates dropped sharply during the first 10 d, from about 8 µg/hour on day 1 to 3.5 µg/hour on day 10. Emission rates continued to decline in the summer, with only 1.0 µg/hour emmitted on day 21. In contrast, emission rates above 2.5 µg/hour were maintained between day 10 and day 31 of the spring flight. The longer period of high emission of codlemone in the spring compared to the summer correlated well with the prolonged attractancy of the 10 mg red septum in the spring reported herein and in earlier studies (Gut and Brunner 1994). High summer temperatures appeared to increase the rate of pheromone emission, thus shortening the effective life of the lure. Further evaluation of pheromone emission rates and performance of high load lures should lead to the development of products that are highly attractive to CM in the spring and summer, and for a period of time that is commercially acceptable, 4 or more weeks.

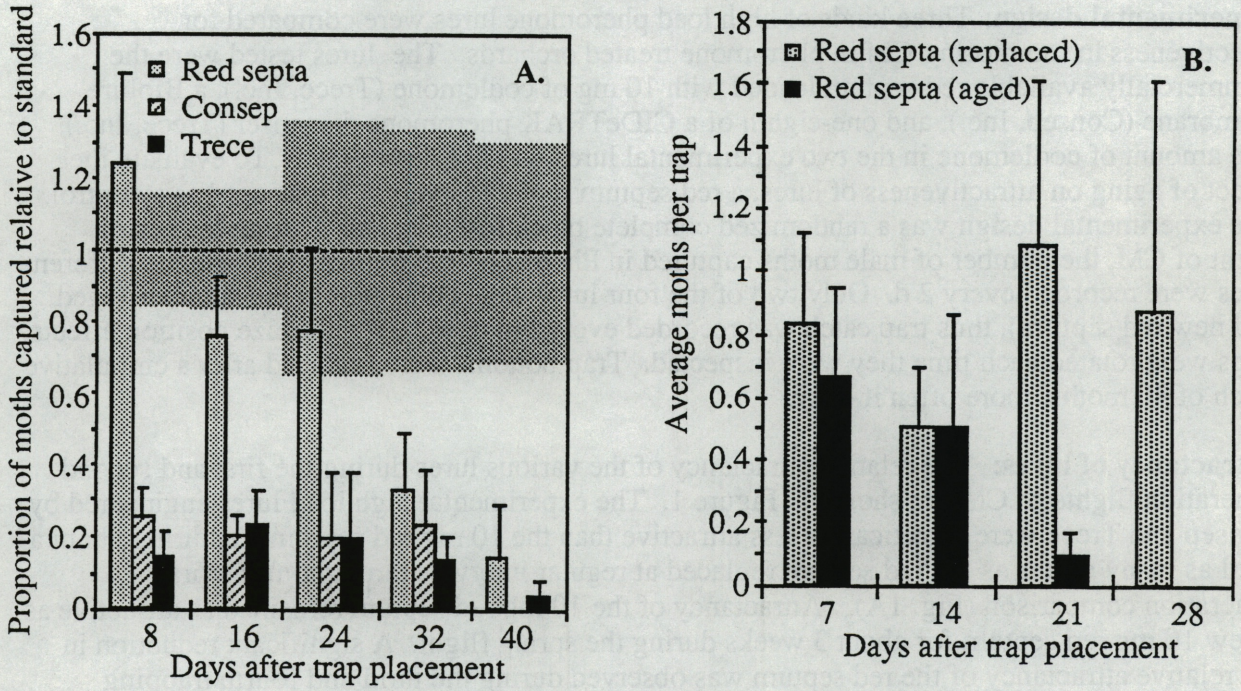

Fig 1. First (A) and second (B) generation capture of CM males in pheromone traps baited with three types of lures relative to a red septum replaced every 8 days (broken line). The shaded area indicates the standard errors for average moth capture in traps baited with the new red septum.