A PROGRESS REPORT ON THE USE OF FEMALE-BAITED TRAPS AS INDICATORS OF CODLING MOTH POPULATIONS [1]

H. F. MADSEN AND W. W. DAVIS

Research Station, Canada Department of Agriculture,
Summerland, British Columbia.

ABSTRACT

Traps containing live female codling moths, **Laspeyresia pomonella** (L.), as lures were used to indicate native codling moth populations in 2 orchards in the Kelowna area of British Columbia. In one orchard the traps captured an average of fewer than 1 male codling moth per week with the exception of 2 traps along one side of the orchard. These 2 traps caught 45 per cent of all males trapped in the orchard, and codling moth entries were found in this vicinity. A spray to control codling moth was applied to 4 outside rows of trees on this side but the remainder of the orchard was not sprayed. No fruit injured by codling moth was found in the nonsprayed portion of the orchard. In the second orchard the traps captured an average of 5 moths per week. No sprays were applied to the trees and, at harvest, 9.3 per cent of the apples were injured by codling moth. These preliminary data indicate that traps baited with female codling moths can be used to indicate levels of codling moth populations and also to indicate if chemical control is necessary.

INTRODUCTION

Developments in the field of insect sex pheromones has led to a number of practical uses for these lures. They have been employed to reduce pest populations (Guerra, Garcia and Leal 1969) and as survey tools to detect low pest populations (Dean and Roelofs 1970).

Sex traps as a lure for male codling moths, *Laspeyresia pomonella* (L.), are baited with either live female codling moths (Proverbs, Newton and Logan 1966) or extracts of the female abdomens (Butt and Hathaway 1966). They have been used to time spray applications, to assess field activity of the moths (Batiste 1970), and to provide information on the ratio of sterile to native moths in a program of control by the sterility method (Proverbs, Newton and Logan 1969). One area which has received little attention is the use of sex traps to determine population levels of codling moth and to estimate the potential fruit damage at harvest. With such information, a grower could judge whether a spray is warranted and thus base his codling moth control program on need rather than on a routine preventative schedule. The first step taken to obtain information of this nature was to install female-baited traps in locations where sprays were not applied and then attempt to correlate moth capture with the infestation at harvest. This paper reports our first study of the use of sex traps to establish a population level for the codling moth.

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MATERIALS AND METHODS

The codling moth pheromone traps used in this study were similar to those described by Proverbs, Newton and Logan (1966), and each trap contained 10 virgin females. As little data were available on how many traps should be installed to assess a codling moth population, the figure of 1 per acre was chosen based on field experience from the codling moth sterility program (Proverbs, Newton and Logan 1969) and on the availability of manpower to maintain trap records. Two orchards were used in the study; one was a grower-operated planting (Price orchard) and the other an experimental orchard (Substation) operated by the Canada Department of Agriculture. Both orchards were located at Kelowna, B.C.

The Price orchard is a mixture of young and old trees on a rectangular shaped area of approximately 15 acres. The largest planting within the orchard is a block of mature McIntosh apple trees 15 rows deep by 10 rows wide, and a block of medium sized Red Delicious trees 27 rows deep by 19 rows wide. The McIntosh trees are bordered on the north by a mixed planting of young Golden and Red Delicious trees (8 rows long by 18 rows wide) and on the south by approximately 2 acres of newly planted, nonbearing trees. The orchard is in the center of a commercial apple producing area. All the adjoining orchards are routinely sprayed for codling moth control. The area was carefully searched for abandoned trees that might provide a source of codling moths, but none were found within a mile of the Price orchard. Price

had not sprayed his orchard for codling moth control for 3 seasons, and he stated that his packinghouse records did not show codling moth damage during this three year period. A total of 15 pheromone traps were placed in the orchard so that they were uniformly distributed amongst the bearing trees.

The Substation orchard consisted of 5 acres of mature McIntosh and Spartan apple trees which had not been sprayed for codling moth control for 3 years. The per cent infestation at harvest in 1967 and 1968 was 9.7 and 26.8 respectively. In the winter of 1968-1969, temperatures dropped to a low of -32 C. which caused a high mortality of overwintering codling moth larvae. As a result, the 1969 harvest infestation was only 3.7 per cent. Five traps were placed in the orchard, distributed evenly among the trees.

The traps were collected weekly, and replaced by others containing recently emerged virgin females. Captured male codling moths were counted and recorded in the laboratory.

The infestation at harvest was determined by examining samples of apples for the number of codling moth entries and stings. At the Price orchard, it was not possible to obtain harvest samples in the field, and the codling moth injury was determined by examining the culls after the fruit was graded in the packinghouse. At the Substation, the harvest sample consisted of 5 boxes per tree on 20 trees selected at random from the test area

RESULTS AND DISCUSSION

Male codling moth activity as determined by sex trap catches for the two orchards is illustrated in Fig. 1. The flight periods of the moths were similar in the 2 trap locations, but more moths were captured at the Substation. A seasonal average of 82 moths per trap were captured at the Substation compared with 31 at the Price orchard. The majority of the moths at the Price orchard were recorded from 2 traps along the south end of the McIntosh block. Forty-five per cent of the total moths were captured in this portion of the orchard. The population peaked from mid-July to mid-August and, based upon previous flight data, these moths were probably second brood. The orchard had been examined for first brood entries prior to this time, but none was found. At the Substation, however, first brood entries were relatively common.

When the 2 traps in the Price orchard showed relatively high numbers of moths in mid-July the fruit throughout the orchard was carefully checked for second brood entries. Infested fruit was found only in the McIntosh trees and most of this was along the south edge of the block. The entries were found in groups which indicated activity by relatively few females. The first entries were found on 21 July, and the number of infested fruits increased through late July and early August. All infested apples observed in the field were collected and dissected. Each contained early instar larvae which was further evidence that the infestation was due to second brood activity. Because the number of entries were increasing, the grower treated the outside 4 rows of the McIntosh block along the south side with azinphosmethyl in August. No further entries were observed for the remainder of the season.

Since so many moths were captured along the south end of the McIntosh trees, it seemed likely that they originated outside the Price orchard. Almost all of the entries were found along the side which adjoined 2 acres of nonbearing, recently planted trees.

An examination of cull fruit from the Price orchard did not show any apples infested with codling moth. This does not suggest the harvest infestation was zero, as pickers often discard fruit that is obviously wormy. The data do indicate that the infestation was very low and would not have justified a routine codling moth spray. If the high counts in the 2 traps in the McIntosh trees are omitted, the total seasonal moth catch per trap in the rest of the orchard would be 17, or less than 1 moth per trap per week. By contrast, the weekly catch in the Substation orchard was 5 per trap.

At the Substation, second brood codling moth entries were evident by the end of July and fresh damage was observed throughout August. The harvest examination showed that 9.3 per cent of the apples were injured by codling moth.

Our preliminary investigations suggest that traps baited with female codling moths can be used to indicate levels of codling moth populations and whether control measures are necessary. In the Price orchard the majority of the traps caught less than one moth per week, and this population did not result in significant fruit loss. The relatively high population indicated by the traps in one section of the orchard necessitated a spray, and this was the only treatment required for pest control in the orchard. Such a program represents a considerable saving to the grower when compared with a conventional schedule.

More information is required before sex traps can be used with confidence to indicate codling moth population levels. The traps capture only males, and data are needed on female activity. It is difficult to determine whether males attracted to female-baited traps originate in the orchard where the traps are located or come from a more distant source. Proverbs (unpublished data) has shown that marked male moths can travel for a distance of 4 miles from their release site. There are indications that sex traps do not accurately reflect population levels when codling

moth numbers are high (Howell, U.S.D.A., Fruit Insects Laboratory, Yakima, Washington, personal communication). The optimum number of traps per unit area is not known nor has the best distribution of traps within an area been determined. Data thus far obtained, however, indicate that codling moth sex traps show promise for determining population levels and periods of moth activity in the field.

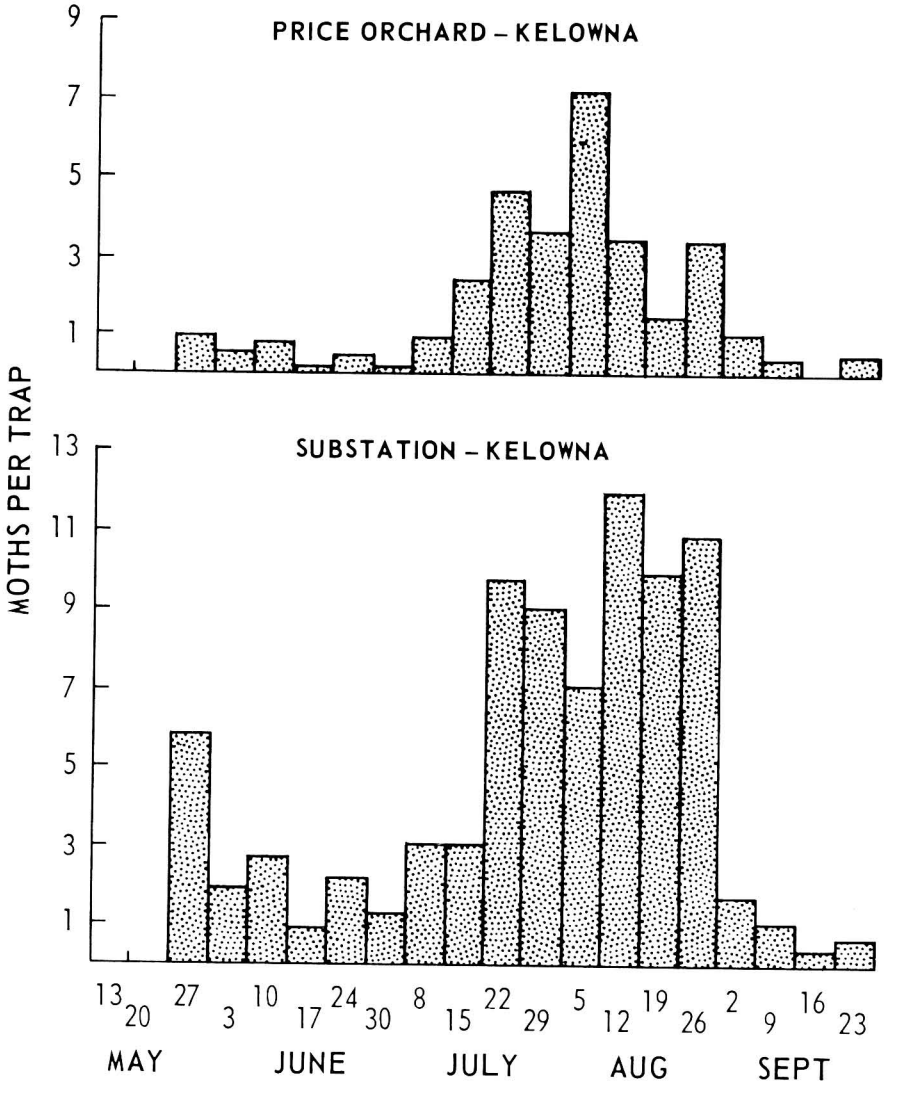

Fig. 1. Male codling moths captured in female-baited traps at the Price and Substation orchards, Kelowna, B.C. 1970.

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TOXICITY OF INSECTICIDES TO TWO STRAINS OF *HYLEMYA PLATURA* (MEIG.) (ANTHOMYIDAE: DIPTERA)[1]

D. G. FINLAYSON AND C. J. CAMPBELL

ABSTRACT

Using the topical-application and impregnated-paper methods baseline toxicity data were obtained for male and female flies of a susceptible and a cyclodiene-insecticide resistant strain of the seed-corn maggot, **Hylemya platura** (Meig.). As shown by topical application the resistance factor with dieldrin for male and female flies was 337.8 and 342.7 respectively. However, the LC_{50} by exposure to dieldrin-impregnated papers could not be obtained for the resistant strain at the concentrations tested. There was no cross-resistance to six other insecticides: two from each of the major groups of organocarbamate, organochlorine, and organophosphorous insecticides. Both methods are useful for determining the toxicity of insecticides and offer ways for agriculturists to determine if spray practices have failed or were faulty, or if resistance is developing within a species.

INTRODUCTION

Infested onions were collected at Victoria, British Columbia in August, 1964 to establish a colony of onion maggots (*Hylemya antiqua* (Meig.)) resistant to cyclodiene insecticides. These collections yielded two species of flies: one was the onion fly; the other, somewhat smaller, was identified by the late Dr. J.G.T. Chilcott, of the Entomology Research Institute, Ottawa, as the seed-corn maggot, (*Hylemya platura* (Meig.) = *Hylemya cilicrura* (Rond.)). The onion seed had been treated with aldrin, which suggested that the smaller flies might also be resistant to the cyclodiene group of the organochlorine insecticides.

In 1961 Begg reported resistance of this type in two closely related species of root maggots, *H. cilicrura* and *H. liturata* which feed on flue-cured tobacco in southwestern Ontario. Laboratory tests at Chatham, Ontario (Harris *et al.*, 1962) with field-collected adults and comparison with laboratory-reared flies of the Chatham susceptible strain of *H. platura*, indicated that the field-collected flies were resistant to dieldrin but susceptible to diazinon. Although it was reported by Miller and McClanahan (1960) that the ratio of *H. platura* to *H. liturata* averaged 9:1 in 1958, by 1961 *H. liturata* had become the dominant species (Harris *et al.*, 1962). Attempts by Telford and Brown (1964) to compare the degree of dieldrin resistance in the two species with laboratory-reared flies proved unsuccessful. Not only were they unable to rear *H. liturata* but *H. platura* reared from collections made at Delhi proved to be as susceptible as the Chatham strain. *H. liturata* field-collected from St. Thomas and Delhi were highly resistant.

Preliminary tests (Finlayson and Noble, 1964)

[1] Contribution No. 221 Research Station, Research Branch, Canada Agriculture, 6660 N.W. Marine Drive, Vancouver 8, British Columbia.