THE INFLUENCE OF TRAP DESIGN ON THE RESPONSE OF CODLING MOTH (LEPIDOPTERA: OLETHREUTIDAE) AND FRUITTREE LEAFROLLER (LEPIDOPTERA: TORTRICIDAE) TO SYNTHETIC SEX ATTRACTANTS[1]

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ABSTRACT

Trap design influenced the attraction of male codling moths, **Laspeyresia pomonella** (L.), and male fruittree leafrollers, **Archips argyrospilus** (Walker), to synthetic sex pheromones. White or blue Sectar 1 traps captured significantly more male codling moths than Pherotrap 1, U.C. Pherotrap or Sectar 2 traps when all traps were baited with Codlemone, a synthetic sex attractant of the codling moth. Cylindrical carton and Pherotrap 1-C traps were intermediate in effectiveness.

Pherotrap 1-C and cylindrical carton traps captured significantly more male fruittree leafrollers than Sectar I traps when the traps were baited with Fruitamone, a synthetic sex attractant of the fruittree leafroller.

The results indicate that trap design is an important factor when conducting tests on the response of codling moths or fruittree leafrollers to sex attractants.

INTRODUCTION

A number of papers on the use of virgin females or synthetic sex attractants to lure male Lepidoptera to traps have been published during the past 5 years. In these papers, more attention has been given to the lure than to the trap design. Sharma *et al.* (1971) showed that the attraction of male cabbage loopers, *Trichoplusia ni* (Hub), to a synthetic sex lure was influenced by the type of trap containing the lure. Trap design is probably an important consideration when field tests are conducted on male response to sex attractants of other Lepidoptera. This paper reports the influence of trap design on the response of male codling moths, *Laspeyresia pomonella* (L.) and male fruittree leafrollers, *Archips argyrospilus* (Walker) to synthetic sex attractants.

MATERIALS AND METHODS

The codling moth experiments were conducted in a mature heavily infested 1 hectare Red Delicious apple orchard at the Research Station, Summerland, B.C. The trees were 6.1 x 6.1 m apart and the block contained 228 trees. Seven trap types, each with 5 replicates, were hung in the trees in a randomized design. There was approximately 1 trap per 6 trees and each trap was suspended 1.6 m above ground on an outside limb. Each trap was baited with a rubber cap stopper (1 x 2 cm) impregnated with 1.0 mg of Codlemone (Zoecon Corporation, Palo Alto, California) a synthetic sex attractant of the codling moth. The caps were renewed every 4 weeks.

The trap designs were as follows: A cylindrical cardboard carton with a replaceable liner similar to that described by Proverbs *et al.* (1966). Pherotrap 1 (Zoecon Corporation) an open wing trap similar to the trap designed and illustrated by Howell (1972). Pherotrap 1-C (Zoecon Corporation) had a cardboard cover to protect the exposed surface. Sectar 1, white or blue, (3M Corporation, St. Paul, Minnesota) was a rectangular trap, 9 x 15 cm which was suspended by one corner so the opening was diamond-shaped. The ends of the trap were folded up when in use. The two colors were used because there was evidence that color influenced the attraction of certain Lepidoptera to traps containing a synthetic sex attractant (Hendricks *et al.* 1972). Sectar 2 was similar to the Sectar 1 trap, but larger (13 x 22 cm). U.C. Pherotrap (Zoecon Corporation) was an aluminum trap described and illustrated by Batiste and Joos (1972).

Stikem (Michael and Pelton, Emeryville, California) was used to coat the catching surface of each trap. The traps were routinely cleaned and replaced every 6 weeks or oftener if the sticky surface was contaminated by debris or wing scales from moth accumulation. The traps were examined weekly and male codling moths were removed and recorded.

Fruittree leafroller experiments were conducted in a 0.8 hectare mature Red Delicious apple orchard at the Research Substation, Kelowna, B.C. Visual examination

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TABLE 1. Numbers of male codling moths captured in 5 traps per design baited with Codlemone.

Summerland, B.C., 1972

Trap Design	May			June				July				August				Sept.	Totals[1]
	15	22	29	5	12	19	26	10	17	24	31	7	14	21	28	4	
Sectar 1 (white)	44	25	36	65	30	26	10	18	23	116	59	78	106	30	57	50	773 a
Sectar 1 (blue)	38	20	25	52	25	22	16	4	34	133	59	62	111	23	53	49	736 a
Cylindrical carton	17	1	19	58	21	38	16	9	19	42	47	56	55	49	60	43	550 ab
Pherotrap 1-C	21	4	22	48	32	20	5	9	13	29	47	44	45	22	45	31	437 ab
Sectar 2	16	4	8	46	19	7	4	7	9	29	21	27	97	19	15	18	345 b
Pherotrap 1	22	6	1	23	12	9	2	16	12	43	38	25	39	23	33	32	335 b
U.C. Pherotrap	25	8	23	36	12	9	4	5	18	41	14	17	16	8	11	49	286 b

[1]Totals followed by the same letter are not statistically different. One tail t-test $P < 0.05$.

in May showed that the trees were heavily infested by fruittree leafrollers. The trees were 9.1 x 9.1 m apart and the block contained 126 trees. Three trap designs were evaluated, the cylindrical cardboard carton, Pherotrap 1-C and Sectar 1 white. Each trap design was replicated 5 times in a randomized design. There was approximately 1 trap per 8 trees and each trap was suspended 1.6 m above ground on an outside limb. The traps were baited with Fruitamone (Zoecon Corporation), a fruittree leafroller synthetic sex attractant. The lure consisted of plastic caps, 1.3 x 1.8 cm, filled with 25 mg of the sex attractant. The caps were not replaced during the experiment. Traps were examined weekly and leafrollers were removed and recorded.

RESULTS AND DISCUSSION

The white or blue Sectar 1 trap captured significantly more moths than Sectar 2, Pherotrap 1 or the U.C. Pherotrap (Table 1). Cylindrical carton and Pherotrap 1-C traps were intermediate in effectiveness.

An important consideration when deciding what trap design to use is trap maintenance. The cylindrical carton trap was easy to handle because dirty traps required only a change of the liner. The Pherotraps collected a considerable amount of debris (fallen leaves, fruit etc.) and required more frequent cleaning. The covered Pherotrap was far easier to maintain that the open Pherotrap but became contaminated more quickly than the cylindrical carton. Sectar 1 traps, because of their small

TABLE 2. Numbers of male fruittree leafrollers captured in 5 traps per design baited with Fruitamone. Kelowna, B.C., 1972.

Trap Design	June 12-22	June 22-29	June 29-July 6	July 6-13	Totals[1]
Cylindrical carton	19	93	195	31	338 a
Pherotrap 1-C	20	96	177	21	314 a
Sectar 1 (white)	7	14	91	0	112 b

[1]Totals followed by the same letter are not statistically different. One tail t-test, $P < 0.05$.

size, were difficult to handle when moths were removed and recorded. When moth captures were high, the traps soon filled with wing scales and had to be replaced. Both Pherotraps and cylindrical cartons were re-used after cleaning, but it was necessary to replace the Sectar 1 traps with new traps 3 to 4 times during the season. Sectar 2 traps and the U.C. Pherotraps were relatively free from contamination and required only routine maintenance.

The choice of which trap design to use with a codling moth sex attractant is difficult to determine. If maximum capture is desired, the Sectar 1 trap would be the design of choice. If maintenance is also considered, the cylindrical carton would probably be the best trap design for field use.

Although Sectar 1 traps were among the most efficient traps for male codling moths, they captured significantly fewer male fruittree leafrollers than either the Pherotrap 1-C or the cylindrical carton (Table 2). For field studies on fruittree leafroller response to synthetic attractants, the cylindrical carton or Pherotrap 1-C would be the preferred trap design.

The results of the study indicate that attraction of male codling moths and fruittree leafrollers to synthetic sex attractants is influenced by trap type, and the response is different for the 2 species. Trap design may be as important as the synthetic attractant when studies are made on the response of other species of Lepidoptera to these lures.

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THE OCCURRENCE AND CONTROL OF THE BRUCE SPANWORM IN THE OKANAGAN VALLEY, 1972

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ABSTRACT

A minor outbreak of the Bruce spanworm, **Operophtera bruceata** (Hulst), occurred in fruit orchards of the Okanagan Valley in 1972. The heaviest infestations were limited to orchards where prebloom sprays for the fruittree leafroller, **Archips argyrospilus** (Walker), were neglected for two or more seasons. Prebloom applications of azinphosmethyl, diazinon or endosulfan at tight cluster bud to pink bud stage on apple gave good control. Apple, pear, cherry, apricot and plum were attacked.

INTRODUCTION

The Bruce spanworm, *Operophtera bruceata* (Hulst), occurs in the southern parts of Canada from Newfoundland to British Columbia and across the northern U.S.A. Brown (1962) described the developmental stages, life history, and mode of dispersal and listed a wide range of host plants amongst spp. of: *Populus*, *Acer*, *Salix*, *Betula*, *Alnus*, *Prunus*, *Malus*, *Rosa*, *Ribes*, *Lonicera*, and *Amelanchier alnifolia* Nutt.

In British Columbia, Treherne (1921) stated that the larvae may cause surface injury to young apple fruitlets but indicated that it was less important than other species of lepidopterous larvae that regularly injure apple fruits. Eastham and Ruhmann (1932) noted that the Bruce spanworm had become a troublesome pest in apple orchards and that, in cases of heavy infestations, trees were kept defoliated until the end of May when larval development is completed. Twinn (1934, 1935, 1936) reported unusually heavy infestations in various parts of the Okanagan Valley. Control recommendations for the Bruce spanworm were a regular feature on the annual fruit tree pest spray calendars for British Columbia fruit growing districts from 1928 to 1943. Later, control recommendations were dropped from the spray calendars, and Neilson (1957) stated that the Bruce spanworm had not been a serious pest for the past 20 years. Downing *et al.* (1956) listed the Bruce spanworm as a sporadic pest of apple. None of the above articles mentioned infestations of fruit species other than apple.

During the past decade research has resulted in significant reductions in the amounts of pesticides required for control of major pest species, particularly on apple (Arrand and Downing, 1970), and in the future novel approaches to pest control, such as the sterile male release technique for codling moth control (Proverbs, 1971), may result in even further reductions. Concern has been expressed (Madsen, 1969) about possible increases in abundance of minor or secondary pests that in the past generally have been suppressed by control measures for major pests. Therefore, the opportunity to observe a minor outbreak of the Bruce spanworm in 1972 was of particular interest. In addition it

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