Daylight Light-Trapping: A Method for Monitoring Adult Activity of the Sugarbeet Root Maggot, *Tetanops myopaeformis* (Roder)[1]

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The sugar-beet root maggot, *Tetanops myopaeformis* (Röder), is a major pest of sugar beets throughout the beet-growing areas of the Red River Valley of Manitoba and North Dakota. Some studies have been made on the biology of the insect in North Dakota (5, 6)[3] and many studies on control of the pest (1, 2, 3 and included references) include information on its biology in Manitoba. In most of these studies adult populations have been monitored by the use of water traps (8), a method which requires frequent monitoring as the traps are often adversely affected by weather conditions, e.g. flooding by rain, filling with soil and debris by wind, and drying from the sun and wind. As a possible improvement on this trapping system a new method was tested and is reported in this paper.

In 1974, while testing light traps designed for monitoring flights of noctuids in sugar-beet fields, it was found that adults of *T. myopaeformis* were attracted to the traps in daylight. During one test of the traps, 713 adults were obtained from 2 traps in ½ hour at approximately midday during bright sunshine. By contrast, only 2 flies were taken during the entire day in the same field in a water trap. Also of interest was the fact that the light traps appeared to be selective for adults of the sugar-beet root maggot. With the exception of 3 coccinellids no other insects were captured during this ½ hour test.

The results of trapping of adults of the sugar-beet root maggot with black-light traps during daylight throughout one season are presented in this paper.

Materials and Methods

The experimental area was a field, approximately 125 x 800 m (25 acres), at Gnadenthal, Manitoba, which was planted to oats in 1975 following a crop of sugar beets in 1974. The level of the infestation by sugar-beet root maggots in 1974 was not precisely known,

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[3]Numbers in parentheses refer to literature cited.

but the owner claimed it was low and that there was no appreciable crop damage. To obtain a measure of the numbers of maggots that had overwintered, 30 emergence traps (9), each covering 0.19 m^2 (2 $ft.^2$) of soil surface were placed in a line across the field, at right angles to the former rows of sugar beets. The traps were placed in groups of 6 with 3.5 m between traps and 7 m between groups. A "Vapona"[4] strip (2 x 7 cm) was placed in each collection canister to kill trapped insects.

Five light traps were used to monitor the seasonal activity of the root maggot adults and were placed between the groups of emergence traps. The light traps were of the type recommended by the Entomological Society of America (7), modified by the addition of a canopy 75 cm in diameter. Preliminary tests in 1974 indicated that black-light blue florescent tubes (F15T8/BLB) were as attractive to the flies as was black light (F15T8/BL). As the light from the former is scarcely discernible to humans in daylight, black-light blue tubes were used to minimize the possibility of interference by curious individuals. Each trap was equipped with a DC/AC converter and a 12 volt car battery was used as a power source. The traps were operated from 5 a.m. to 7 p.m. CDT during the period June 3 to August 1 and were controlled by a timer constructed from a battery-operated clock (4). Ethyelene glycol was used in the collection container as a killing-preservative agent. Weather permitting, all traps were emptied at two- to three-day intervals from the time of installation on June 3, 1975 until the apparent cessation of fly emergence during the week ending July 29. The batteries were replaced at the same intervals.

The number and sex of flies collected from the emergence traps were recorded by date and trap location. The material collected in light traps was initially transferred to 70% alcohol and later sorted for adults of the sugar-beet root maggot. The remaining insects were sorted to order. At the beginning and end of the trapping period all the sugar beet root maggot adults that were collected were recorded as to sex. Between June 11 and July 11, 1975, when collections were large, only a sample of 100 flies from each period was sexed.

Results and Discussion

Sugar beet root maggots overwinter as larvae, pupate in the spring, and begin emerging about the time the sugar beet is in the cotyledon stage. As determined by water traps, the emergence period in Manitoba has usually commenced during the second week of June (1,3), although in some years emergence has begun as early

[4]Shell Chemical Co. formulation of 2,2-Dichlorovinyl 0,0-dimethyl phoshate.

as the latter part of May, and peak emergence has occurred as early as June 9 (2). In 1975, emergence probably began about June 1 as 3 flies were obtained in the emergence cages and 50 in the light traps during the first trapping period, June 3-5. Emergence reached a peak the week of June 20-27 with 77 flies being obtained in the emergence traps. Light-trap catches peaked during the same week with approximately 20,000 flies being collected. No flies were obtained in the light traps after July 21 although some emergence continued until July 29. However, between July 7 and July 29 the combined weekly emergence from the 30 emergence traps was one or less per day. The emergence trap data, because of the relatively small number of adults involved, was more variable than the light trap data but the trends were similar with the peaks for each occurring at the same time (Figure 1). It was concluded that the light trap collections can be used to indicate the duration and peak of field emergence of the sugar-beet root maggot adults.

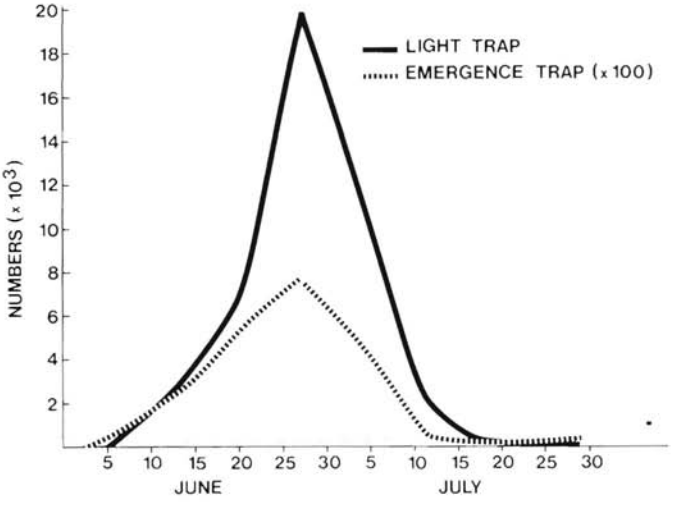

Figure 1. Comparison of numbers of adults of *Tetanops myopaeformis* collected in 30 emergence cages with the numbers collected in 5 light traps.

The specificity of the light traps for adults of the sugar-beet root maggot appears high, particularly during the main emergence period of the insect (Table 1). Throughout the season, 56% of the insects collected were adults of the sugar-beet root maggot and, in certain traps at certain times, the proportion was as high as 96%. With better placement and operation of the traps it may be possible to maintain high specificity consistantly.

Table 1.—Numbers of *Tetanops myopaeformis* and other insects collected in 5 black-light traps during June and July 1975.

Period[1]	*Tetanops myopaeformis*	Other Diptera	Lepidoptera	Coleoptera	Hemiptera Homoptera	Others[2]	Total	% *Tetanops myopaeformis*
June 3-5	50	165	0	45	2	2	264	18.9
5-13	2,789	2,450	11	661	35	54	6,000	46.5
13-20	6,616	1,696	11	545	33	67	8,968	73.8
20-27	19,693	1,660	22	597	115	165	22,252	88.5
June 27-July 1	9,473	783	13	510	58	98	10,935	86.6
4-11	1,872	2,110	31	3,296	47	48	7,404	25.3
11-17	223	3,522	62	3,405	203	61	7,476	3.0
17-24	84	1,694	74	1,917	131	48	3,948	2.1
24-28	1	1,725	64	2,725	208	110	4,833	0.0

[1]Traps emptied at approximately 10:00 a.m. at end of each period
[2]Primarily Hymenoptera and Tricoptera

The number of flies collected in each of the traps throughout the season was similar, and averaged 8,160 (Table 2). The variation in percentage of *T. myopaeformis* in the collections was thus due almost entirely to variations in the numbers of other insects taken, which in turn was due to the trap location and time of year. The field used for these studies was bordered on both sides by windbreaks composed predominantly of elm trees with a dense undergrowth of caragana. General insect activity in and around these hedge rows is thought responsible for the large number of miscellaneous species caught in traps 1 and 5 which were adjacent to the west and east windbreaks, respectively. For example, 5,754 and 8,586 diptera other than *T. myopaeformis* were collected in traps 1 and 5, whereas the combined totals for traps 2, 3 and 4 was only 1,465. The species composition of some of the catches suggests that mass migrations of some insects were involved and that light played no part in the catch obtained. During the period July 4-7 approximately 2,400 Hydrophilidae were collected in trap 1 and none in any other traps. If a hedge row effect was involved specimens would have been expected in trap 5 and if the light was the attractant then some would have been expected in other traps. It is assumed that a mass movement of these insects occurred along the western hedge row and those collected represented only those which actually hit the trap. Similarly, 1,231 other Diptera were collected in trap 5 during the period June 6-8 while the greatest number collected in any other trap was 173. In general the number of Lepidoptera increased during the latter part of the trapping period. This is attributed to the shorter day lengths and the fact that the trap lights were then operating closer to the periods of dawn and dusk when some nocturnal moths were becoming active. The hedge rows, which probably harboured many of the nocturnal insects, further accentuated the dawn-dusk effect by casting shadows.

The attraction range of the light traps is not known. However, the fact that there was no essential difference in the numbers of flies collected in traps 1 and 5 suggests that the range was less than 13.5m, the distance these traps were from the edge of the field. The density of flies in the field was 7.37 ± 0.97/emergence trap which approximated $40/m^2$ or 4 million for the field. The light traps caught 40,801 flies or approximately 1% of the total population. On an area basis this represented all the flies which emerged within an 8 m radius of each trap.

The sex ratio of the 184 flies caught in the emergence traps was 1.28:1 males to females. A chi square test on this data showed this ratio to be significantly different from 1:1, the ratio of sexes reported by Ure (10) in laboratory experiments. Males tended to

Table 2.—Number of insects of various groups collected in each of 5 light traps during the flight period of *Tetanops myopaeformis*.

Trap No.	*Tetanops myopaeformis*	Other Diptera	Lepidoptera	Coleoptera	Hemiptera Homoptera	Others[1]	Total	% *Tetanops myopaeformis*
1	7,787	5,754	92	8,634	444	189	22,906	34.0
2	8,726	458	6	228	29	10	9,481	92.0
3	8,092	452	15	448	45	28	9,085	89.1
4	7,538	555	7	413	49	13	8,602	87.6
5	8,658	8,586	168	3,983	265	416	22,006	39.3

[1]Primarily Hymenoptera and Tricoptera

emerge before females: prior to June 24 the ratio of males to females was 2.2:1 whereas after June 24 it was 0.8:1. (The data collected after July 7 was not included in these calculations as the average emergence of 1 fly or less per day was considered too low to be meaningful.) The larvae and pupae of females are therefore exposed to possible field mortality for a longer period than males. This may explain the lower proportion of females found in the field as opposed to laboratory cultures. The sex ratio of flies obtained in the light traps differed considerably from that obtained in the emergence traps. During the first period of light trapping commencing June 3 a ratio of 11.5 males to 1 female was obtained. This ratio dropped with each successive period until June 16 when a 2:1 ratio was obtained and remained relatively constant until July 9. After July 9 the ratio was variable, dropping to 1:1 in some trapping periods. The overall ratio of males to females caught in the light traps was 2.2:1. The reason for this low female ratio in the light traps could simply be caused by a greater attractancy of the light for males or it could be an actual reflection of the numbers of each sex present in the field at any given time. As the adults emerge in a field which does not contain sugar-beet plants, the females must leave to search for suitable host plants before ovipositing. Many *T. myopaeformis* were observed mating in the field in which they emerged and it is possible that many males do not leave, resulting in a high male to female ratio in the trapping area.

Summary

Ultraviolet light traps operated during daylight hours were good devices for monitoring the activity and relative population levels of adults of the sugar-beet root maggot. The light trap collections gave a positive correlation with field emergence although the proportion of males to females was higher in the light traps than in the emergence traps. The content of the light traps averaged 56% *Tetanops myopaeformis* adults but the data indicated that this could be increased to about 90% by better placement and operation of the traps.

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Abstract

A large number of adults of the sugar-beet root maggot, *Tetanops myopaeformis* was collected, during daylight, in light traps with ultraviolet florescent tubes as a point source of light. The apparent attraction was relatively specific for this species, since few other insects were collected. Population trends were similar to those observed with emergence cages, indicating that the light trap may be a useful tool in monitoring emergence and periods of activity of the fly.