LIGHT-SOURCE TESTS FOR TRAPPING *ELDANA SACCHARINA* WALKER MOTHS

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Abstract

Thirteen sources of light were tested for use in light traps for sampling *Eldana saccharina* moths. White light proved the most attractive. Ultra-violet was not particularly attractive. Blue, green, and white fluorescent light proved more attractive than red or yellow. However, light intensity seemed more important than colour; bright or very dim sources being less attractive than moderately bright ones.

Introduction

Larvae of the sugarcane borer *Eldana saccharina* Walker are difficult to control with insecticides because of their inaccessibility. For chemical control of the adult moths, particularly for preventative control, any seasonal fluctuations of this stage must be established so that materials can be applied to coincide with seasonal peak flying times. First impressions during the years 1976-77 with light traps using the standard mercury-vapour 125 W (MB/U) lamp, suggested that this globe was a poor attractant. Results given here constitute an attempt to find a better attractant for traps.

Methods

Two outdoor cages measuring 3 x 4 x 2 m and covered with 60% shade cloth were placed 15 m apart. A water trap (Figure 1) was placed in the centre of each cage with four potted cane plants or natural host plants as refuge sites, one in each corner. Equal numbers of male and female moths one day old were released in each cage at intervals of several days. The numbers found floating in the water were counted each morning.

One cage constituted the experimental cage, in which the light source was changed after several runs, each run lasting several days. A run was considered to have ended when no moths were recorded on two successive mornings. The other cage constituted the control, in which the light source was an ordinary incandescent 60W tungsten filament globe. Control runs were the same as in the experimental cage.

The light sources tested were intended for the two types of trap shown in Figure 2. The Robinson trap (Robinson and Robinson[5]), for use with globes, is robust, and ideal for fixed permanent traps. The Pennsylvania trap (Frost[4]), for use with tubes, is light and ideal as a portable trap for in-field

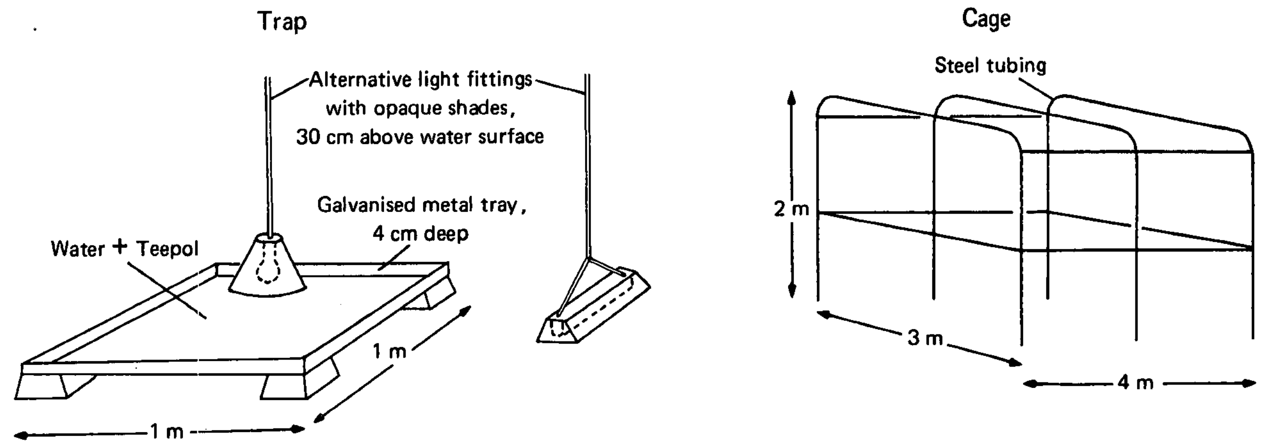

FIGURE 1 Details of light trap, and outdoor cages covered with 60% shade cloth, used in the tests.

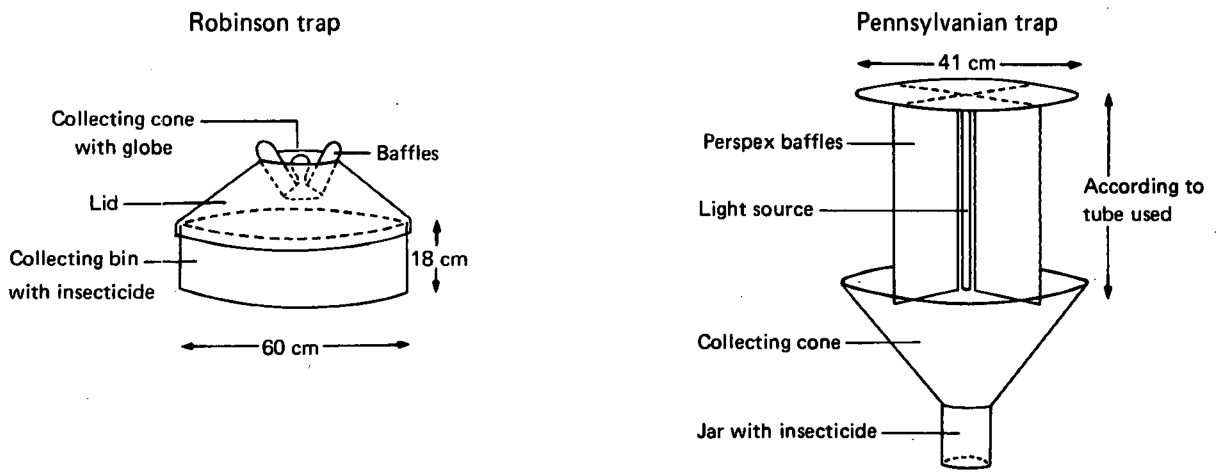

FIGURE 2 The two types of trap for which light sources were tested.

TABLE 1

Various light attractants compared with the control (a 60W incandescent globe), and the attractiveness of the opposite sex compared with the same control. Relative attractiveness is assessed in column 5 (% of control)

Experimental attractant								Control			
Description	No. of runs	Total inserted ♂	Total inserted ♀	Total caught ♂	Total caught ♀	% of control ♂	% of control ♀	Total inserted ♂	Total inserted ♀	Total caught ♂	Total caught ♀
No attractant (light switched off)	4	20	20	0	1	0	6,3	20	20	15	16
Incandescent clear globe . . . 25 W	4	40	40	22	22	115,8	137,5	40	40	19	16
Incandescent clear globe . . . 40 W	5	50	48	38	43	102,7	113,2	50	48	37	38
Incandescent clear globe . . 100 W	4	40	40	23	26	95,8	96,3	40	40	24	27
Incandescent blue globe . . . 40 W	7	70	70	19	25	38,7	45,4	70	70	49	55
Incandescent clear tube (284 mm) . 60 W	12	90	80	48	43	94,1	86,2	90	85	51	53
Fluorescent white globe (MB/U) 125 W	9	90	90	31	21	52,5	36,8	90	90	59	57
Fluorescent U.V. globe (HPW) 125 W	9	63	63	27	30	62,8	81,1	63	63	43	37
Fluorescent white tube (435 mm) . 15 W	4	26	25	14	18	127,3	112,5	26	25	11	16
Fluorescent U.V. (435 mm) . . 15 W	4	29	29	11	11	91,7	100,0	29	29	12	11
Fluorescent yellow (435 mm) . . 15 W	6	51	51	31	31	81,6	103,3	51	51	38	30
Fluorescent red (435 mm) . . . 15 W	9	80	80	18	25	34,6	56,8	80	80	52	44
Fluorescent green (435 mm) . . 15 W	10	75	75	61	63	103,4	100,0	75	75	59	63
Fluorescent blue (435 mm) . . . 15 W	11	80	80	46	41	124,3	100,0	80	80	37	41
Two females in cage over molasses . .	2	12	—	0	—	0	—	15	—	10	—
Two males in cage over molasses . . .	7	—	45	—	2	—	11,1	—	45	—	18
Four to ten males (as above)	6	—	50	—	4	—	10,5	—	50	—	38

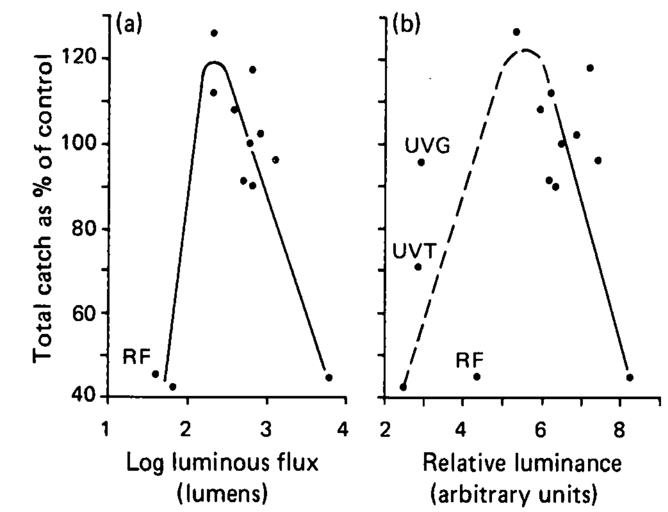

FIGURE 3 Total catch for each source expressed as percent of control, plotted against (*a*) the logarithm of the manufacturer's specified output for the source and (*b*) the luminance measured with a photographic exposure meter at 1 m from the source. RF, UVG and UVT indicate respectively: red fluorescent tube, ultra-violet globe, and ultra-violet tube.

studies. The relative intensity of each source was assessed in two ways: (a) by the manufacturer's specified luminous flux, (b) by the luminance at 1 m measured with a Gossen 'Sixtomat' exposure meter. The scale on the exposure meter was in logarithmic units graduated by the manufacturer.

Results

Comparisons were made over a period of two years and the results are summarized in Table 1. Most light sources were tested at least twice, as far as possible at different times of year. Insect activity, and hence trap catches, are largely governed by temperature, wind and rain. Therefore the light sources in Table 1 cannot be directly compared because they were of necessity tested under different weather conditions. Instead, comparisons have been made by means of the catches expressed as proportions of the controls which were run at the same time.

Incandescent white light appears to be very attractive, and the lower the wattage the better. In general it attracted more females than males. Since females can provide better information about the state of a population than males (for example their mass, fecundity, whether mated or unmated), this is an advantage. Ultra-violet light, so successful for noctuid and sphingid moths and some other groups, was not particularly attractive to this pyralid. Field trials (unpublished) with this type of light have confirmed this observation. Among the fluorescent sources, blue and green light were more attractive than red or yellow, but the most successful was white strip light.

The relationships between the total catch expressed as percent of control, and the two measures of light-source intensity, are shown in Figures 3a and 3b. Both measures of intensity are for the spectrum visible to the human eye, which would not correspond to the spectrum visible to the insect. For example many insects are sensitive to ultra-violet light, while most are insensitive to deep red (Wigglesworth[7]).

Only a small proportion of the radiant energy emitted by ultra-violet lamps is visible to human beings so manufacturers do not specify the luminous (visible) flux for such sources. Consequently there are no readings in Figure 3a for the U.V. globe or tube. However, measures of light intensity for these two sources were obtained with the exposure meter and are plotted in Figure 3b. It is apparent that the exposure meter was relatively insensitive to U.V. wavelengths compared with the insect. For example, for an increase in measured light intensity of only 0,1 unit there is an increase in catch from 70% to 95% of control. This small difference in measured light intensity corresponds to a difference in rated power of 110 W, which suggests that much of the radiant energy from the UV lamps was not registered by the exposure meter. In Figure 3b the measured intensity of the red fluorescent tube is rather high compared with both the catch, and with the manufacturer's specified output shown in Figure 3a, which suggests that the exposure meter was also over-sensitive to red light.

In general, although there is some evidence in Figure 3 that the insect is more sensitive to short than to long wavelength light, the intensity of a source is more important than its colour in attracting the moth. Sources with specified outputs of 200-700 lumens appear to be optimum.

Pheromone traps have sometimes been used with Lepidoptera to sample one sex or the other. Table 1 shows that neither sex of *E. saccharina* attracted the other in any meaningful quantity. The traps used for these tests consisted of a small cage containing the bait sex, set either over a tray of molasses or inside a slightly larger cage having the mesh smeared with 'Formex' ant-trapping compound. The failure of these tests was almost certainly because the pheromone releasing behaviour was suppressed in the small cages. It is now known that the male moth ascends into the canopy of the host plant where it goes through a flapping routine with the abdominal pencil hairs extended, during which it releases a pheromone. Whether or not the female also emits a pheromone is not clear but it does not undertake any such obvious activity as the male.

Discussion

In practice a balance must be struck between the repellency of too intense a source and the need to attract moths from as far afield as possible. Bowden and Morris[3] have calculated the effective radius of the MB/U mercury-vapour lamp and the changes in its radius with moon-phase. The effect of moonlight on insect catches has been extensively documented by, for example, Siddorn and Brown[6], Bowden[1] and Bowden and Church[2]. However, in the literature there appears to be no mention of the effect of competition between trap lights and surrounding lights. This is an important consideration when siting a grid of permanent traps in the South African cane belt, throughout which there are many lights. Power sources for traps are nearly always located near other lights. A trap near other lights might benefit from their combined attraction from a wider area, or it might suffer from competition with them. The first instance suggests that for *E. saccharina* a dim trap source might catch the moths attracted to the surrounding lights, but in the second instance a bright trap source would be needed to overcome the effects of the other lights.

In the absence of any data on this subject, 100W (1200 lumens) incandescent globes have been chosen for a grid of fixed permanent Robinson traps spread through the Natal cane belt. This globe has almost the same attractiveness at close quarters as a 60W (670 lumens) globe, but would have a rather wider collecting radius. Its radius is undoubtedly wider than that of the 25W or 40W (200 and 380 lumens) incandescent globes. For in-field behaviour studies with Pennsylvania traps, 60W (600 lumens) incandescent tubes have been used extensively. Lately, the fluorescent white, green and blue sources (respectively 500, 850 and 200 lumens) have also been employed for this purpose although they have the disadvantage of requiring ballast.

Re-equipping Robinson traps, which comprise the present grid, with fluorescent white strip-lights, has been considered, but rejected for two reasons. Firstly, these lamps, with their associated perspex baffles, are fragile and vulnerable to wind and rain. Secondly, the catches would not be comparable with existing data accumulated with the 100W incandescent globes.

Acknowledgements

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