Collecting insects at lights: a test of four types of lamp

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Abstract

In a native bush collecting site, a 160 watt "blended" (mercury-tungsten) lamp attracted twice as many insects as an 8 watt "black-light" fluorescent tube, which in turn attracted twice as many as either an 8 watt white fluorescent tube or a kerosene pressure lantern. The pressure lantern attracted proportionately the most diverse assortment of insects and the "black-light" the least.

INTRODUCTION

Light traps are used widely both for survey and control of agricultural pests and for attracting insects for collecting. Since small fluorescent "black-light" tubes became available in the U.S.A., in about 1950, they have become accepted there as the most effective lamps for light traps, at least for applied entomology (Glick & Hollingsworth 1954; Hartsock *et al.* 1966; Hendricks *et al.* 1975). Recently, small fluorescent and black light tubes with their associated power supply fitting became available in New Zealand. Such lamps can be run from a battery and hence are very convenient for field use. We present here the results of a test of these and two other lamps frequently used by New Zealand entomologists.

EXPERIMENTAL PROCEDURE

The four lamps tested were:

1 Kerosene pressure lantern. A Coleman type 242E, rated at 300 candlepower. There were difficulties in keeping this functioning properly during the test. The light produced by this type of lamp has a broad spectrum mostly in the infrared with some visible and negligible ultraviolet.

2 Blended mercury-tungsten lamp. A G.E.C. type MBFT/V, 230 volt, 160 watt high-pressure mercury discharge lamp incorporating a tungsten filament which acts as a ballast to the arc and adds to the visible light output. The spectral composition of the light from such lamps includes the visible and infrared produced by the incandescent tungsten filament, plus the characteristic mercury lines in the ultraviolet and visible produced by the discharge lamp. The whole pattern is modified by colour correction phosphors which are normally chosen by the manufacturer to maximise the visible light output and give the desired colour balance. The lamp used was of a superseded type; those in current production are less attractive to insects as they have a new colour correction phosphor which reduces the long wavelength ultraviolet output (Hill 1977).

3 Fluorescent tube. A Philips TL8W/33 8 watt lamp, 30 cm long, giving a "cool white" light with spectral distribution mainly in the visible region with some ultraviolet. This was run from a "minilite" 12 volt fitting (TCT 451) modified to take 2 6-volt dry cell batteries.

4 Black-light. A Sylvania F8T5/BLB 8 watt fluorescent tube which emits only long wavelength ultraviolet light. This was run from the same type of fitting and batteries as 3.

These lamps were tested in February 1978 at St. Arnaud, Lake Rotoiti, altitude 600 m, near the Nelson Lakes National Park. The 4 trap sites were each at the edge of a clearing in native bush (mainly manuka and beech). They were chosen to facilitate servicing in rotation, while being far enough apart (30 m) to minimize interference between the lights (Baker & Sadovy 1978 found that moths were attracted to a light trap from no

Table 1. Analysis of variance of transformed nightly catches.

Source of variation	Degrees of freedom	Mean Square ($\times 10^6$)	F
Night	3	4904.4	67.0 ($P < .001$)
Trap Position	3	557.2	7.62 ($P < .025$)
Type of Lamp	3	3035.5	41.5 ($P < .001$)
Error: Nonadditivity	1	1.39	0.016 n.s.
Remainder	5	87.52	

Table 2. Mean nightly catches (untransformed; means followed by the same letter are not significantly different by Duncan's test, based on transformed data).

Blended lamp	Black-light	Pressure Lantern	Fluorescent Lamp
326a	188b	85.5c	71.3c

more than 3 m). Traps were operated simultaneously for 2 hours from dusk on 4 consecutive nights. Each trap consisted of a 1.1 × 1.0 m white synthetic sheet (which fluoresced under ultraviolet light) laid on the ground, with the lamp set up in the middle or (in the case of the blended lamp) suspended about 40 cm above it. The traps were visited in rotation at 15 minute intervals and any insects on the sheet collected and later sorted to Order and counted. Each night the lamps were reassigned among the trap positions in a predetermined Latin Square layout. This permitted an analysis of variance to separate the effects of the lamps, trap positions, and the 4 trapping nights. This analysis was done on the total nightly catches for each trap, transformed (to $1/\sqrt{n}$) to correct non-additivity and heterogeneity of variance. The lamps were also compared by calculating the percentages made up by each Order of insects in the total catch for each lamp, summed over all 4 nights.

RESULTS AND DISCUSSION

Analysis of variance of the nightly trap catches (Table 1) shows that there was significant variation from all 3 factors – particularly the type of lamp and the night of trapping (reflecting varying weather conditions), and to a lesser extent from the trap position. The first is of most interest here; it confirms that even when other factors are allowed for, the type of lamp used has a considerable influence on the number of insects attracted. The extent of the difference in this particular trial is shown by the mean catches obtained (Table 2). The blended light attracted significantly more insects than the black-light, which in turn attracted significantly more than either the pressure lantern or the fluorescent lamp. It must be kept in mind that the blended light is rated at 160 watts and requires mains power or a generator, whereas the black-light and fluorescent lamps both use 8 watts and run on batteries, and the presssure lantern uses only a little kerosene. Hence when working away from mains power, the necessity to carry a generator weighs heavily against the use of the blended lamp. In terms of insects caught per watt of power required (or per kg of equipment carried), the low-powered lamps are more efficient; the blended lamp required 20 times more power than the black-light but attracted only twice as many insects.

The proportions of the total catch of each lamp made up by 7 Orders of insects are shown in Fig. 1. These proportions vary somewhat between the lamps, but there is a basic pattern, reflecting perhaps the fact that all traps were sampling essentially the same population of insects. What differences there are seem to be correlated with the spectral composition of the lights, ranging from the black-light which produces only ultraviolet light and caught the narrowest range of insects, to the pressure lantern which produces negligible ultraviolet and caught proportionately the widest range of insects. The highest proportion of Diptera was caught by the pressure lantern, Trichoptera by the

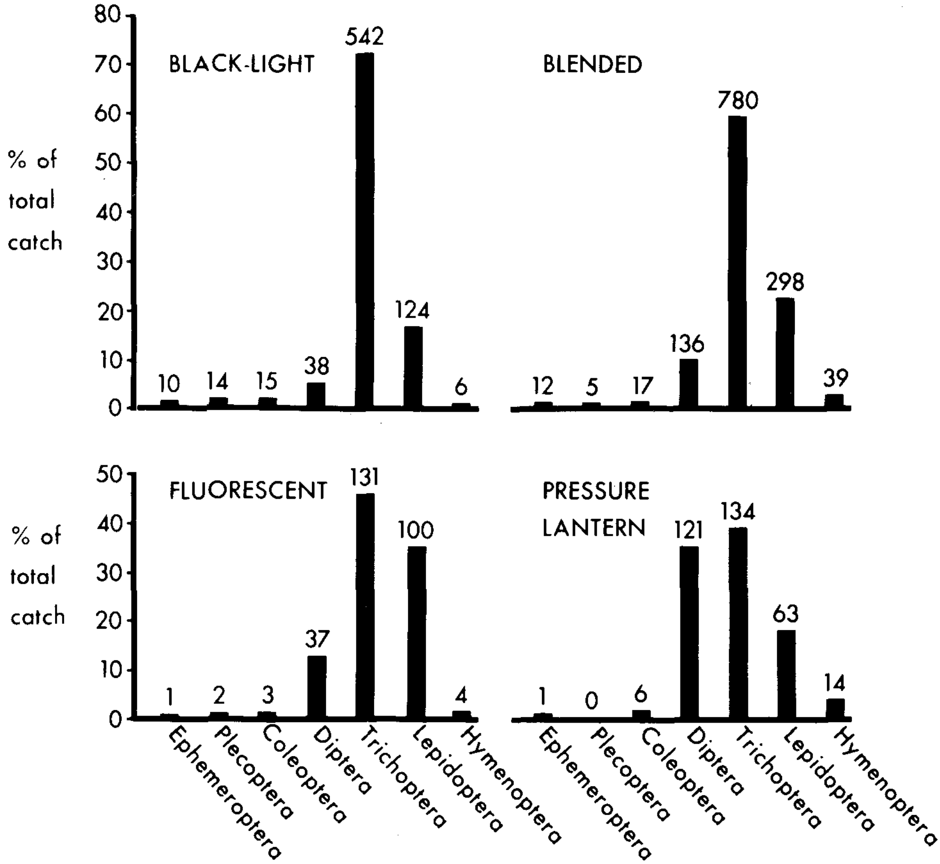

Fig. 1 Percentages of seven Orders in the total catches at 4 lamps. The actual numbers caught are given above each column.

black-light, and Lepidoptera by the fluorescent light, although in each case the highest absolute numbers were caught by the more powerful blended light. Few Ephemeroptera, Plecoptera, Coleoptera, or Hymenoptera were caught by any of the traps. The remainder of the catches, making up an average of 1.3%, comprised an assortment of Megaloptera, Hemiptera, Orthoptera, Psocoptera, Neuroptera, and Arachnida.

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