A report on the testing for effectiveness of the three models of Mosquito Slayer for mosquito capture by:

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I. Introduction

In the scientific literature, standard insect traps, such as light traps are not often used in studies of mosquito populations. Mosquito-specific traps, directed at the physical, visual and air-borne cues used by mosquitoes to detect host animals, are employed.

There are increasing numbers of commercially available insect traps for use by the general public. The designs of such traps are beginning to incorporate the scientific understanding of what attracts mosquitoes. Of the traps tested over time, the two Mosquito Slayers designed by Bantix Pty Ltd incorporate such knowledge and are specifically directed at mosquitoes. If such traps are able to trap significant numbers of mosquitoes, thereby removing them from local populations, it is possible that such devices could form part of an integrated pest management approach to mosquito control.

II. Aims and scope of this test

This test seeks to answer two main questions:

i) What is the ability of the Mosquito Slayer to capture mosquitoes?

ii) What is the ability of the Mosquito Slayer to reduce the size of local mosquito populations over time in a localised area?

In addressing these two questions, the three trap models were tested and compared for their ability to capture mosquitoes in both natural and contrived situations. In addition, they were trialed to determine whether they could reduce the number of biting mosquitoes in a localised area.

III. Materials and Methods

A. The traps tested in this test.

1. Mosquito Slayer master and satellite model with carbon dioxide

This traps works by attracting mosquitoes to a light source, at which point they are blown into an aqueous solution and are killed. Attraction to the light source is facilitated by the following lures:

· carbon-dioxide gas released in pulses,
· a weak lactic acid solution (also acting as the aqueous killing solution),
· a heating element in the top and front of the unit,
· a 1-octen-3-ol (octenol) releasing strip,

· a sound-emitting unit (specifically for attracting females),
· the lights themselves, which emit wavelengths considered attractive to mosquitoes.

Carbon dioxide gas is supplied to the unit from a pressurised cylinder. The trap tested actually comprises a programmable master unit, and a satellite unit, which receives power and carbon dioxide via the master. The satellite trap can be operated up to 40 metres from the master.

2. Mosquito Slayer - Non Gas trap

This trap differs in that no carbon dioxide gas is used.

B. Insect trapping ability of the different models tested

i) Mosquito trapping efficacy

The traps were tested in a coastal suburb (Globe Derby Park) 15km north of the Central Business District of Adelaide, South Australia (34055'S, 138033'E). The suburb lies adjacent to several hectares of samphire swamp and mangrove forest and is known for seasonally high numbers of the mosquitoes Aedes camptorhynchus (Thomson) and Aedes vigilax (Skuse). Both species are aggressive biters by day and night, and are vectors of arboviruses of local importance (eg. Ross River virus).

Five trapping sites were used. These were all located on private property, near the homes of local residents. Each of the traps was tested at each site twice, with the rotation of the traps conducted in a random, albeit balanced design. This design allowed a statistical comparison of the total mosquito catch between traps, as well as site and date of trapping effects to be accounted for. Trapping was conducted from December 5th - December 22nd, 2000.

Traps were set in the late afternoon and allowed to run overnight. They were set in shaded locations near dwellings, particularly amongst vegetation. Mosquitoes are known to gather in vegetated areas to rest during the day, thereby avoiding potentially desiccating conditions.

Catches were placed in sample jars and transported to the laboratory, where they were stored in 70% ethanol. Mosquitoes were removed, counted and identified.

ii) Specificity for mosquitoes over non-target invertebrates

Invertebrates other than mosquitoes were sorted roughly by order or class before more thorough identification and counting was performed.

iii) Ability to capture other pestiferous invertebrates

Where possible, other insects of potential pest significance were identified. Of particular focus were other haematophagous Diptera such as stable fly (Muscidae), gad flies (Tabanidae) and flesh flies (Sarcophagidae).

C. Mosquito control using the Mosquito Slayer

i) Trap-down studies
To determine whether such insect traps could be used to reduce the number of mosquitoes biting in an area, such as around a dwelling, traps were operated daily over a one month period. The traps were programmed to switch on at 20.00h (30-45 minutes prior to sunset), and switch off at 08.00h (2 to 2.5 hrs after sunrise). The traps were maintained (ie trap solution reservoirs were kept full) by the residents whose properties were chosen for this study.

The number of mosquitoes in the area was assayed every two weeks using human-biting catch and by EVS traps. Mosquito populations were assayed both at the site where the trap was operating, and at a control site, approximately 500 metres away. Human biting catch was conducted for 10 minutes immediately after sunset at the treatment site, then for 10 minutes at the control site. This was done by aspirating biting mosquitoes from the lower limbs and body, depositing the catch into a collection cup, then counting and identifying specimens in the laboratory. EVS traps were set at the treatment and control sites approximately 30 minutes before sunset and were retrieved the following morning. The traps were tested in this manner:

Mosquito Slayer Master and Satellite trap with carbon dioxide

Test location - adjacent to horse stables behind house at 107 Globe Derby Drive, Globe Derby Park. Master and satellite traps were set 10 metres apart amongst general large inorganic refuse (old sheet metal, play equipment etc.) and a small copse of Eucalypt trees with understorey next to the stables. An EVS trap was set every two weeks at the same location as the Mosquito Slayer. Human biting catch was conducted 10 metres downwind of the location.

The trap was operated from December 31, 2000 to February 5, 2001.

Control location - at 93 Globe Derby Drive, Globe Derby Park. This site is approximately 500 metres east of 107 Globe Derby Drive. A straight line joining the two locations lies roughly perpendicular to the south-westerly winds common there. Major mosquito breeding sites are thought to be approximately 1 km upwind of the treatment and control sites.

Mosquito Slayer Non Gas Trap

Test location - near the main house at Buckland Park Estate, near Port Gawler, South Australia, approximately 34 km north of the Adelaide Central Business District. An EVS trap set every two weeks at the same site as the Mosquito Slayer. Biting catch was performed 10 metres from the trap.

The trap was operated from January 1, 2001 to January 31, 2001.

Control location - 500 metres to the north, also on Buckland Park estate, in a copse of Eucalypt trees.

ii) Close system mosquito trapping efficiency

To determine the ability of the traps to capture a known number of mosquitoes in a given time, a closed system containing female mosquitoes and a test trap was established. The closed system consisted of a screen-house; namely a 3.8m wide x 3.8m wide x 2.1m high tent with a poly-vinyl floor and roof, but with only insect-proof mesh for walls. This was located in a backyard in suburban Adelaide, on a partially shaded lawn.

100 adult female Ae.vigilax mosquitoes, captured by EVS trap, were introduced into the screen house the day before a trap was trialed. Mosquitoes were provided with humid refugia in the form of a large potted plant in one corner of the screen-house. 15% sucrose solution dispensed by a cotton wick from a reservoir was also provided.

The two traps were tested in the closed system for three nights each. The number of mosquitoes captured in the traps was counted and replaced in the screen house to ensure a constant number of 100 Ae.vigilax mosquitoes at all times.

IV. Results

A. Mosquito trapping efficacy

The Mosquito Slayer Master and Satellite traps with carbon dioxide displayed the greatest mosquito capturing efficacy by catching an average of over 100 mosquitoes per night. The Mosquito Slayer Non Gas trap was also successful in mosquito capture. Both traps captured less than one male mosquito per night. In terms of the percentage of the catch comprised of males, this was less than 1% for the Mosquito Slayer Master and Satellite trap. Respective mosquito numbers in the Mosquito Slayer Master and Satellite traps were counted separately on six occasions. In general, the Master trap caught slightly more than the Satellite, although there was no statistically significant difference between them. Aedes vigilax was the most common mosquito captured. Given the proximity of trapping locations to coastal samphire and mangrove swamp, this was expected. Aedes camptorhynchus, Aedes notoscriptus, and various Culex species were also captured.

B. Specificity for mosquitoes over non-target invertebrates

Both traps captured less than 250 other invertebrates on average per night. When the number of other invertebrates is compared against the number of mosquitoes captured per night, it is clear that the Mosquito Slayer Master and Satellite traps have the greatest specificity for mosquitoes. A mean ratio of nearly 0.8:1 (mosquitoes : non-mosquitoes) was obtained for this trap.

C. Trap-down studies

The Mosquito Slayer Master and Satellite traps were promising in effectively reducing the numbers of biting mosquitoes. Mosquito numbers at the treatment and control sites were similar prior to the operation of the trap. Following the installation of the trap, the numbers of mosquitoes captured at the site using the Mosquito Slayer Master and Satellite traps were less than half the number that were caught at the control site (no trap). The human biting catch results were also promising, as the number of biting mosquitoes at the treatment site (using Mosquito Slayer Master and Satellite traps) was always lower than at the control site (no trap).

The Mosquito Slayer Non Gas trap did not appear to be successful in reducing mosquito numbers substantially. While it could be argued that mosquito numbers did not increase as sharply at the treatment site compared with the control site. The human catch data reveals little difference between the treatment and control sites after a month of operation. However, as mosquito numbers in the entire area appeared to have risen over the test period, it may be interpreted that the Mosquito Slayer Non Gas Traps prevented an even larger increase in human biting catch.

D. Closed system mosquito trapping efficiency

The screen house functioned well in retaining the mosquitoes placed in it, and provided a suitable environment for mosquito host-seeking. The latter was evidenced by aggressive human-biting when the screen house was entered to service the traps within.

Although it was an artificially enclosed environment, the screen house was outdoors, and so was subject to local weather conditions. Temperature varied from 24oC to 31.6oC and relative humidity from 22% - 38% over the nights that testing took place. Overall, weather conditions were warm and dry, with very little wind.

Both models of traps captured Ae.vigilax mosquitoes from within the screen-house. The Mosquito Slayer Master and Satellite traps were the most successful at this, capturing a mean of

24.5 (+10.5) and 30.5 (+14.5) out of 100 Ae.vigilax per night respectively. The Mosquito Slayer Non Gas trap was not as impressive in this regard, only capturing a mean of 1.5 (+1.5) out of 100 mosquitoes per night.

V. Discussion

A. Comparison of the different models

The Mosquito Slayer Master and Satellite traps were clearly the most efficacious for mosquito capture. Miniature light traps baited with carbon dioxide (such as the EVS) have been reported as capturing up to 260,000 mosquitoes per night (C Johansen, Queensland Health, pers. comm.) and are renowned for their efficacy. It is therefore of interest that the Mosquito Slayer Master and Satellite trap performed better than the EVS trap in a comparison test.

In terms of catching female mosquitoes, the Mosquito Slayer Master and Satellite trap was clearly the most specific for females as opposed to males. This suggests that the technology in the Mosquito Slayer Master and Satellite traps used to specifically attract females, ie the sound emitting units, was successful. This may be related to the mosquito species locally available, and the trap may catch males of other species in greater numbers.

Specificity for mosquitoes relative to other invertebrates is a desirable quality in any purpose-built mosquito trap. Similarly, avoiding the capture of potentially beneficial or otherwise benign invertebrates should be a priority of any environmentally-conscious trap manufacturer. With this in mind, it should be pointed out that the Mosquito Slayers have less impact on the non-mosquito fauna than other traps tested over time.

In a comparison between the Master and the Satellite of the Mosquito Slayer, no detectable difference in mosquito numbers was detected. This demonstrates that both traps are of equal value.

B. Usefulness of the traps for mosquito nuisance reduction

Of the traps tested over time, only the Mosquito Slayer Master and Satellite traps appeared to cause some significant reduction in mosquito numbers. This was evident from lower EVS trap results and consistently lower human biting catch at the site where this trap was operated. The Mosquito Slayer Non Gas trap did not effectively reduce mosquito numbers in this instance. However, they may be more effective in other situations.

It is likely that if the Mosquito Slayer Master and Satellite traps were tested in a different situation, such as a relatively closed-in urban garden with an Aedes notoscriptus problem (domestic container and tree-hole breeding species), then even more convincing results may be obtained. Major Ae.notoscriptus problems may arise from as few as 100 mosquitoes in a backyard. The data presented in this report suggests that such a problem would be well within the abilities of the Mosquito Slayer Gas trap to control.

In terms of the different traps tested over time, it is clear that the Mosquito Slayer with carbon-dioxide is the most efficacious mosquito trap.

For the purposes of mosquito control, Mosquito Slayer with carbon dioxide represents the best option from the traps tested over time. However, effective control of very large numbers of mosquitoes migrating at high rates into an area cannot be expected of such a device.

These traps provide an inexpensive alternative or augmentation to existing control programs in small, well-defined areas.

An earlier version of the Mosquito Slayer was the Megacatch. The Megacatch site provides full details of the technology used in this scientifically tested unit. The Mosquito Slayer has enhancements such as a new light spectrum, sound emissions and the removal of the gas regulator which reduces the overall costs.