Flytrapping in Tasmania: effective use of traps in a cool temperate climate

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Summary

Flies were trapped on a wide range of properties throughout Tasmania using the commercially available Lucitrap®. Features contributing to variation in Lucilia cuprina catch between traps were identified. Some additional features were tested by attaching traps near or far from identified features or using traps in pairs on the same post.

One property was trapped in a regular grid rather than using selected "good" trap sites. This confirmed the guide-lines previously used to select trap sites.

In Tasmania flytraps are most effective in sites near water, exposed to the sun, but sheltered from the wind and attached to posts rather than trees. The lures must be replaced every three months and the traps must be cleaned each year.

Keywords

Flystrike, Lucitrap®,flytrap, blowfly, trap position, Tasmania

Introduction

Flystrike risk is determined by a combination of fly population, number of susceptible sheep and the suitability of the environment. Wardhaugh and Morton (1990) reported that the incidence of flystrike was related to the log density of gravid females in the area during the previous week, this factor accounting for 33% of the variation in crutch strike and 50% for body strike. As a result of the log relationship, reduction of fly numbers by 70% would be necessary to reduce flystrike by 50%. To be effective with respect to reduction of on-farm costs a much greater reduction in flystrike would be necessary and it is likely that the traps would need to capture more than 90% of the available flies. Therefore even small reductions in trap efficiency (e.g. catching only 50% of available flies) would render the traps relatively ineffective.

This paper reports a number of studies and observations on factors affecting the efficacy of Lucitrap® flytraps in Tasmania.

Methods

Fly Traps

The Lucitrap® (Urech *et al.*, 1996) consists of a white translucent or transparent bucket and a flat yellow top with multiple entrance cones, which are angled so that flies cannot easily escape. A synthetic lure designed to mimic the odours of the food source of *Lucilia cuprina* is used (Urech *et al.*, 1993). The traps and fresh lures were set out in October (most sites) or November (Bruny Island) and the lures were replaced during January or February except in some early studies (Denwood *et al.*, 1999) where not all traps had lures replaced during the fly season

Traps were fixed approximately 1.25m above the ground to trees, posts or stumps as available at each site, with at least 400m between each trap, except where traps were deliberately placed closer together in experimental studies or grid trapping.

Insects were collected from the traps at intervals of between 2 and 8 weeks and either stored at 10°C or dried in air and stored until each sample could be analysed.

Fly numbers were determined either by direct count (if less than 100 flies), counting a sub-sample from a known proportion of the total, or by weight as described by Horton *et al.* (1999).

Identification of L. cuprina

For the flies trapped in the **farm** studies reported by Denwood *et al.* (1999), *L. cuprina* was distinguished from other flies by visual observation of the colour of the fore femora and body. Flies with black legs and bright metallic green front thighs were categorised as *L. cuprina*.

For the **experimental** studies reported by Denwood *et al*. (1999) and all later studies, the *L. cuprina* were identified (Waterhouse and Paramonov, 1950) by characters on the head (hairiness of the central region of the occiput, and the degree of sclerotization of the clypeus) and the thorax (hairiness of the lateral areas of the humeral calli and notopleuron area), and the colouration of the fore femora.

Data Analysis

Fly counts were converted to the logarithm of the number of flies because of the highly skewed distribution of the numbers trapped. Multiple linear regression was used to determine the effects of multiple factors affecting each trap site while also allowing for differences between properties or parts of properties. For the controlled studies with pairs of traps, analysis of variance was used to test the effect of trap features. In some cases the total number of flies was measured without identification of any flies (usually 60-90% were green flies). In others the green flies were separated - these usually consist of 70-80% *L. cuprina* and 20-30% *Lucilia sericata*. For some studies *L. cuprina* were identified and counted.

To determine the effect of water, traps were categorised as:

- Near water: <10 m to a trough or <50 m to a dam, creek, marsh or other wet area.
- Medium distance: <200 m to a significant water source (dam or creek) that would maintain high humidity most of the time.
- Far: >200 m from any regular source of water.

Trap concentrations

Data was collected from trap sites on a range of properties in Tasmania. For the 19 properties where mass trapping was used the traps were set out to provide an even distribution across the farms, choosing sites most likely to catch large numbers of flies. This is described in detail by Horton *et al.* (2001).

The studies reported previously by Denwood *et al.* (1999) used properties with traps at the rate of 1 per 800 sheep to 1 per 300 sheep and one property (on Bruny Island) at 1 per 100 sheep. Mass trapped properties, reported by Horton *et al.* (2001), had 1 trap per 100 sheep.

Sixty farms had between two and four traps used as monitor traps in order to estimate the fly population on that property.

Experimental studies: effect of trees

A total of 38 flytraps in 14 paddocks were positioned at various distances from single trees or groups of trees. Distances ranged from 0 m (attached to the tree) to 115 m. The trees included *Pinus spp*. (pine), *Crateus spp*. (Hawthorn) and *Eucalyptus spp*. (Gum). A further 16 traps were placed on 4 sites away from trees to monitor intra- and inter- paddock variation and the effect of concentrated Eucalyptus Oil (BP grade) as a deterrent (5 ml placed in a small open container inside the trap). All traps were about 100 m from the nearest control traps which were at least 100 m from any trees.

Experimental studies: clean and dirty traps

Some studies were carried out using pairs of traps on a single post, to compare specific differences between the traps. Some of these were on farms not previously used for mass trapping, while others were on a heavily trapped farm using the area that normally had the highest fly numbers caught.

Experimental studies: grid trapping

One property was trapped using a grid with traps every 300m over all paddocks except 'bush runs', with traps attached to free-standing temporary pickets. These traps were checked every 2-3 months and the number of flies in each trap measured.

Results

Denwood *et al*. (1999) reported a range of factors that caused 2-3 fold differences in trap efficacy. These are summarised in Table 1 and Table 2.

Table 1. Effect of trap location on the number of *L. cuprina* trapped per month.

Trap Location	% of average catch	Significance (p%)
Attached to		
Post	150	
Anything else	50	<0.1
Shelter		
None	110	
Shelter belt	230	1
Group of eucalypts	70	1
Water		
Far	80	
Medium distance	100	16
Near	140	0.3
Replacement of lures		
Lures more than 3 months old	24	
Lures replaced at 3 months	422	<0.1

Source: Denwood *et al*. (1999)

Table 2. Effect of proximity of trees on the number of L. cuprina trapped per month.

Trap Location	% of catch in open paddock	Significance (p%)
Eucalypts		
Attached to the tree	12	<0.1
At the edge of the tree canopy	72	11
10-15m from the tree	96	85
Pines		
At the edge of the tree canopy	120	50
10-15m from the tree	160	11
Hawthorns		
1-5m from the tree	59	5
Eucalyptus oil		
Oil inside trap	13	<0.1

Source: Denwood *et al*. (1999)

More precise investigations on the effect of trees (Table 2) showed that traps attached to trees contained very low numbers of flies although it was not certain whether this was due to a repellant effect of eucalypts or due to tree-living predators removing the flies. However, traps under eucalypt tree canopies appeared to be less effective than traps in the open, whereas traps near pine trees were more effective than traps in the open.

Monitor traps and type of pasture

Most of the mass-trapped farms used in this study did not have substantial areas of both native and improved pasture. However, the 60 properties with the monitor traps did differ substantially in the variety of pasture at the trap site. Table 3 compares the number of flies caught in traps on various types of pasture. Most monitor traps were on a fence adjacent to two paddocks, so multiple linear regression was used to test for multiple effects on each trap.

Traps on native pasture consistently caught less flies than traps on improved pasture. In addition traps in 'bush runs' caught no (0) or very few flies. 'Bush runs' in Tasmania are typically higher ground, rocky, with scattered trees, native pasture and little or no fertilizer use. In contrast the number of flies caught near irrigated crops was very high. This is interesting to note given that the irrigated areas were rarely pasture, so the traps were on pasture near irrigation, rather than being located within the irrigated paddocks.

Table 3. Effect of adjacent pasture type on the number of green flies trapped in monitor traps (1999/2000)

Pasture/Paddock type	Number of paddocks	% of catch compared with improved pasture	p%
Irrigation	30	150	3.8
Improved pasture	114	100	
Crop	14	97	n.s.
Rough pasture	85	76	5.3
Native pasture	56	53	<0.1
Marsh	7	53	16
Tree plantation	6	90	n.s.

Multiple linear regression of log of total flies per trap during 1999/2000. Each trap was affected by two adjacent paddock type (if identical they were counted twice).

"Rough pasture" was not native pasture, and may have been improved in the past, but had become degraded and had not been recently fertilised.

New/old traps sites and clean/dirty traps

On one property that had been trapped at only 1 trap per 300 sheep for several years, the number of traps was increased to 1 trap per 100 sheep. This was done by adding traps to a formerly untrapped part of the property and by adding additional traps in the previously trapped area. The property was relatively flat with few special features, so in the previously trapped area it was possible to add new traps midway between the old traps along fence-lines to double the number of traps in that area.

When the traps were next checked it was clear that in the part of the farm where traps had been added between old traps the new traps caught about four times as many flies as the old traps (Table 4). This had not been set up as an experiment and there would have been some physical differences in trap sites. However, the first trap sites had been chosen as the 'best' available sites so if there were differences the added traps would be expected to be slightly inferior, whereas they actually caught many more flies. Fly species were not separated in this study.

It was possible that the first traps, which had been in place for three years, had exhausted the number of flies in the vicinity of each, although the traps were only 800 metres apart initially and 400 metres apart after the new traps were added. Another difference was that the old traps had become darker due to staining with dead flies and the chemical lure, the effect of which is to cause a brown stain on the trap's translucent plastic bucket.

Table 4. Geometric mean of flies per trap in old vs new traps

Trap Type	Nov/Dec	Jan/Feb	Mar/Apr
New traps on new trap site	106	124	306
5 year old traps on old sites	27	46	68

S.E. is 33%. For each pair of trap types, $p<0.001$ (21 old traps, 33 new traps)

N.B. These results are for the total number of flies, not the number of green flies or *L. cuprina*

In the following year, on two different properties, trap sites were paired where the sites were close together and similar in most respects. One trap in each pair was replaced with a completely new trap and the other trap in the pair was replaced with a 5 year old trap. In addition, each alternate pair of traps were both moved to a similar site roughly equidistant between other traps, while another nearby pair of traps were kept in the original position.

There was no difference between traps that had been moved to a new site and traps that were left at the old site. However, new traps caught more than 10 times as many green flies as old traps. There was no difference in the number of non-green flies caught in the traps. As a result the differences in total number of flies in each trap were not as marked as the difference in green flies. Random sampling showed that 70 to 80% of green flies in any trap were *L. cuprina*.

Table 5. Geometric mean of green flies in old vs new traps and old vs new trap sites

Property 1 (3 traps/treatment)	Old trap site	New trap site
Old trap	92	101
New trap	1295	913
Property 2 (5 traps/treatment)		
Old trap	45	82
New trap	1785	788

S.E. 63%, Analysis of variance: NS for trap sites, P<0.05 for trap type

This study was extended by comparing pairs of traps attached to the same post. Comparisons included pairs of identical traps, pairs of old and new traps and pairs of new traps of different types (translucent vs transparent plastic).

There were no significant differences between traps on a post when the traps were identical. Although anecdotal evidence had suggested that traps facing north or east would catch more flies than those facing south or west, the orientation of the trap was not related to the number of flies trapped.

Table 6. Geometric mean of green flies in clean vs dirty traps

Trap type	Number of flies per week
Clean trap	17.5
Dirty trap	2.3

S.E. 33%, P<0.001 (using Student's paired t-test)

The number of flies caught at this site was lower than in previous years due to unusually dry seasonal conditions.

Grid traps

The number of flies varied throughout the year, but some parts of the property were consistently high while other areas were consistently low with respect to the number of flies captured (Figure 1). The high fly areas were the best pasture, and areas near shelter-belts or in gullies. The low fly areas were adjacent to the 'bush run', or near patches of bush in open paddocks, or on hilltops.

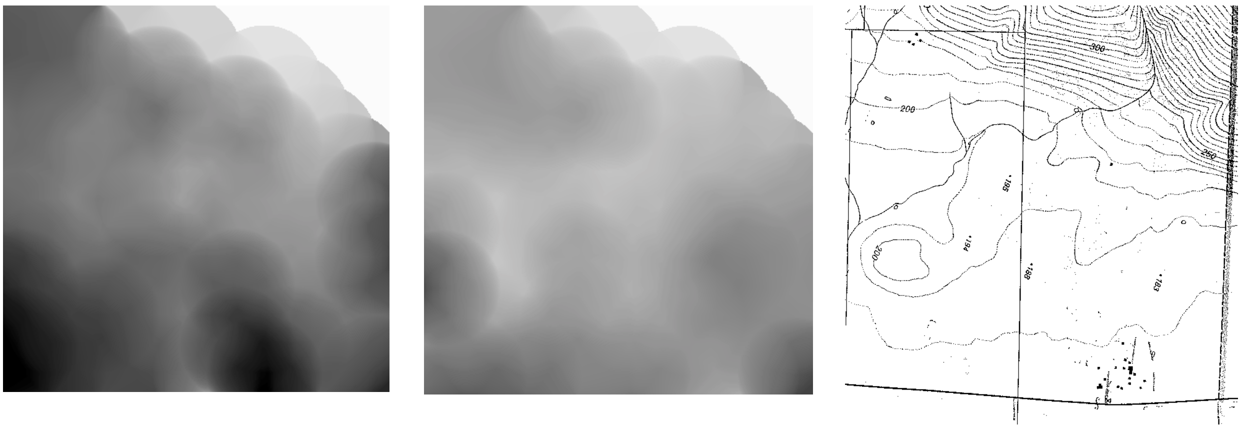

Figure 1. The farm area trapped, with the intensity of shading indicating the number of flies trapped. Oct 1999-Jan 2000 (left), Jan 2000 - Mar 2000 (centre), contours (right).

Discussion

Some differences between traps reflect real differences in the number of flies in the area. Differences in pasture type led to high numbers of flies on improved pasture, low numbers on native pasture and negligible flies on bush runs. Other factors include irrigation, which dramatically increases the numbers of flies, and the number of sheep present and hence available for strike.

Most Tasmanian wool producers agreed that flystrike was less of a problem on native pasture compared with improved pasture (Horton and Champion, 2001). Therefore the lower numbers of flies in traps on native pasture is consistent with farmer experience of a lower incidence of flystrike, rather than a difference in trap function in these areas.

Furthermore, project participants reported that flystrike was rarely observed on sheep in bush runs. These sheep are usually monitored less closely due to greater difficulty in accessing these areas, but if they suffered increased flystrike this would be noticed as increased deaths or strike found at shearing and this was not generally observed. Both flytrap catches and flystrike reporting are consistent with low numbers of flies in these bush areas.

When traps are used they should be concentrated where there are high fly populations to ensure the greatest possible number of flies trapped. However, some traps will need to be placed in areas where the number trapped will be lower to avoid having large untrapped areas where flies would be able to survive. Therefore there needs to be a compromise between having most traps in preferred areas and having a reasonable coverage of the total sheep grazing areas. However, areas where flystrike rarely or never occurs can be left untrapped.

For maximum efficiency, traps should be positioned near natural features, such as the presence of water or shelter from the wind. In contrast traps attached to trees appear to catch less flies, although some flies are certainly taken from these traps by predators such as ants and spiders. However, if predation prevents the user from estimating their efficacy then they will not be as satisfactory as traps attached to treated posts where predation is minimal.

In some cases the 'ideal' trap position cannot be used because cattle or rams may damage traps in unprotected positions.

Differences in flies caught due to the attractiveness of the trap to flies are important because they may result in traps which fail to catch all of the flies within a trap's vicinity.

An important factor in reducing fly numbers in the vicinity of traps is maintaining the attractiveness of the trap to flies. Failure to replace lures at three-monthly intervals will leave the traps relatively ineffective. However, a danger for the manager is that the traps will still catch some flies so it will not be obvious to the operator that the traps are not sufficiently attractive.

Furthermore, traps that are not cleaned annually will also fail to catch as many flies as clean traps. This is a potentially serious problem because the user will assume that the reason fly numbers in the traps are declining is that the traps are effective and the fly population has been reduced. Reports from early users of flytraps had suggested that the number of flies declined over several years while the traps were in use. The results obtained in this study suggest that the traps may simply have become less efficient.

To increase the efficiency of traps they should be cleaned at the start of each fly season. While cleaning will increase the cost of using traps, not cleaning them may render them ineffective in reducing fly numbers. Therefore producers need to understand the importance of maintaining traps at maximum efficiency.

If flytraps are to have a useful effect by reducing flystrike or by reducing the need for preventive chemical treatment they must be able to reduce the fly population by at least 90%. Therefore any features that reduce trap efficacy by as much as 50% will be unsatisfactory. Simple changes in position to seek sites favoured by the flies will cause two to three-fold differences in trap effectiveness so trap users will need good guide-lines. Traps used in warmer climates than ours may need different positions for optimum use.

Some of the factors reported here, such as the need to replace lures regularly and keep traps clean, cause a dramatic reduction in the number of flies trapped. However, these changes are not obvious to the operator, since the trap still smells of the lure and catches some flies.

Unless trap users are rigorous in ensuring very high efficiency of their traps their use will result in a false sense of security. Although flies will be trapped, this will not provide a substantial reduction in flystrike and the number of flies trapped will not give a true indication of the number of active flies.

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