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A preliminary evaluation of a sheep blowfly trap in the Western Cape

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ABSTRACT

An insecticide-free sheep blowfly trapping system, utilising a synthetic lure, was evaluated at 4 localities in the Western Cape. Control sites, where no suppression was practised, were identified for each locality. The blowfly population was monitored for 48 hours monthly at each of the localities. Five to 7 suppression traps at the respective localities were identified for this purpose. Three to 10 traps were set monthly for monitoring in the control areas. Trapping resulted in the suppression ($P < 0.01$) of the *Lucilia* population at Caledon, where a large area of approximately 50 km^2 was trapped. The suppression area of all the localities was ≤850 ha. At Elsenburg, blowfly numbers were low. There was a strong suggestion of a general reduction in the *Lucilia* numbers at this locality. Trapping failed to reduce *Lucilia* numbers at Tygerhoek and Langgewens. Lack of control over the influx of *Lucilia* from adjacent sheep-producing areas probably contributed to this result. The observed response at Elsenburg was probably due to its situation in a predominantly wine-growing area. Most of the blowflies recovered from the control traps during the month with the highest yield at the respective localities belonged to the genus *Lucilia.* The results obtained at Caledon and published reports suggest that large-scale trapping of *Lucilia* spp. may play a role in an integrated pest management system for blowflies.

Key words: blowfly, flystrike, trapping, woolled sheep.

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INTRODUCTION

Blowfly strikes result in an estimated annual loss of R19.8 million to the South African small stock industry[13]. The blowfly *Lucilia cuprina* is responsible for almost all primary strikes[4,9], while *L. sericata* has also been reported to be responsible for strikes on live sheep in South Africa, the United Kingdom and New Zealand[2,15,17,19]. *Chrysomyia chloropyga* is also responsible for a small percentage (about 10 %) of primary strikes[4,9]. Blowfly control relies largely on insecticides[9,10]. Strains of *L. cuprina* have demonstrated an ability to develop resistance to these chemicals[5,7,11,14,22,23]. International trade agreements increasingly strive to control harmful chemical residues in products. It was evident that pesticide residues in wool were highly variable and difficult to predict accurately in Australia[18]. It is thus almost impossible to estimate the risk of contamination of batches of wool with an acceptable degree of accuracy. Alternative means of control include the removal of breech skin folds by the Mules operation[4], the destruction of carcasses and better hygiene[6], but these practices on their own are usually not sufficient for complete blowfly control. Alternative measures therefore need to be assessed to manage this problem in an integrated manner, resulting in a more sustainable approach. An Australian-developed, insecticide-free trapping system (using a synthetic attractant) for *L. cuprina,* may benefit the South African sheep industry. This system was found to be effective in reducing blowfly populations at 2 Queensland localities[20], and the study was extended to cover 21 trials in 5 Australian states over 3 summers[21]. Suppression of the blowfly population, amounting on average to 77 %, was achieved in 62 % of these trials. No conclusion could be drawn in 24 % of the trials, owing to very low fly counts during very dry conditions.

We evaluated the effectiveness of the trapping system for the suppression of sheep blowfly numbers, as well as the selectivity of the trapping system for South African *Lucilia* spp. Preliminary findings are presented in this report.

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MATERIALS AND METHODS

Traps and locations

The commercial brand of trap used was the Lucitrap® system[16,20,21]. A synthetic attractant served as lure to entice blowflies to enter the trap. Once inside the trap, flies find it difficult to escape and die of dehydration and starvation[16]. No insecticide is required.

One trap per 100 breeding ewes was set in sheep paddocks, as prescribed by the manufacturer[16]. These traps were set before the expected rise in the blowfly population during early spring. Since usage of Lucitrap® mostly resulted in a reduction of the blowfly population (Urech *et al.*[20,21]), these areas are referred to as suppression areas. The blowfly populations in 4 suppression and neighbouring control areas (described below) were monitored monthly. For this purpose, identified suppression traps were cleaned and left open for a period of 48 h during the 1st week of every month. This method of monitoring in the suppression areas differed from that employed by Urech *et al.*[20,21], in that they employed a separate set of traps exclusively for monitoring purposes, that was only baited for a 48 h period each month. After 48 h, a contact insecticide was sprayed into these traps before the contents were recovered, and preserved in 70 % alcohol for counting. Blowflies were separated according to species[9] and counted. The blowfly species identified were *L. cuprina, L. sericata, Chrysomyia albiceps* and *C. chloropyga.* Separate sets of traps were used to monitor blowfly populations in adjacent control areas. Apart from being removed after each 48-h monitoring period, the treatment and sampling of these traps were carried out as described previously. In the study of Urech *et al.*[20,21], control areas were monitored by a permanent set of traps that were baited for a 48-h period every month.

The trapping system was used at 4 localities in the Western Cape, namely:

Caledon. An area of approximately 50 km^2 was identified for suppression. The area was situated approximately at latitude 34°16'S and longitude 19°42'E. The suppression area was situated in the foothills of the Swartberg Mountains. The topography of the site is sloping, with valleys draining in a southwesterly direction. The average annual precipitation is 420 mm, of which approximately 70 % is recorded between April and September. It is situated within the cropping-pasture regions of the Southern Cape, and the most important farming ventures are small-grain cropping as well as mutton and wool production. The area supported approximately 4000 breeding ewes, mostly Merinos. In total, 34 suppression traps were set in this area in mid-September 1997. Five of these, near to the centre of the suppression area, were used to monitor the blowfly population.

Two nearby (approximately 4 km) farms within the same agro-ecological region, supporting approximately 1000 Merino breeding ewes, were identified as the control area. The blowfly populations were monitored with 5 traps on each property. Data for this location were available from October 1997 to March 1998. As the monitoring traps in the control area were only set for the 1st time during November 1997, no data were available for the control area during October 1997.

Tygerhoek. The Tygerhoek Experimental Farm (±800 ha, 34°08'S 21°11'E, altitude 425 m) near Riviersonderend was used as the 2nd suppression area. The long-term rainfall at the locality is 429 mm, 60 % of which is expected between April and September. It is also situated in an area where small grain cropping and sheep farming for wool production are the dominant farming enterprises. The farm supported 700 Merino breeding ewes. Seven suppression traps were set during mid-September 1997 and used to monitor the blowfly population as well.

The control area was identified at a nearby property, and 3 traps were used to monitor the blowfly population monthly. This farm supported approximately 800 breeding ewes, mostly Merinos. The data for this location were available for the period October 1997 to June 1998.

Langgewens. The 3rd suppression area was the Langgewens Experimental Farm of ±500 ha (33°17'S 18°42'E, altitude 177 m), about 20 km north of Malmesbury in an area known as the Swartland. The long-term rainfall at the locality averages 395 mm. As expected with a Mediterranean type of climate, 78 % of the precipitation occurs between April and September. The locality is also situated in a typical small grain and sheep farming region, with wheat cropping as the dominant farming venture. Wool- and dual-purpose sheep-farming are also considered to be important enterprises. The farm carries approximately 600 breeding ewes, 200 Merinos and 400 SA Mutton Merinos. Six traps were considered adequate for the suppression of the blowfly population, suppression commencing at the end of August 1997. The same traps were used to monitor the blowfly population.

A nearby property was identified as the control area, and 3 traps were used to monitor the blowfly population there monthly. This property supported about 2000 Dohne Merino sheep. Data were available from October 1997 to May 1998.

Elsenburg. The 4th suppression area was the Elsenburg Experimental farm (±850 ha, 33°51'S 18°50'E, altitude 177 m), about 10 km north of Stellenbosch. The average long-term precipitation here is 606 mm. The climate is Mediterranean, with 77 % of the total rainfall being recorded from April to September. The site is situated in the horticultural area of Stellenbosch, and the dominant farming enterprise is viticulture. The major livestock enterprise is dairy production. Sheep are kept on only 2 other properties in the vicinity. The suppression area supported approximately 600 breeding ewes, about 200 Merinos, 250 SA Mutton Merinos and 150 Dormers. Six traps were regarded as adequate for the suppression of the blowfly population, starting at the end of August 1997. The same traps were used for monitoring.

One of the nearby properties where sheep were kept was identified as the control area. A flock of 250 Dohne Merino ewes were run on this property. Three traps were used for monthly monitoring of the blowfly population. Data for this location were available for the period October 1997 to June 1998.

Routine management strategies, representative of those applied in the rest of the region, were followed on the farms included in the study for the experimental period. These involved the spot treatment of strikes where appropriate, as well as preventive treatment when an increase in blowfly numbers was expected. Non-insecticidal protective agents like Vetrazin (Cyromazine, Novartis Animal Health) were sometimes used. These strategies were broadly similar in the suppression and control areas, and are unlikely to have influenced the results of this study.

It was decided to use data from the control areas to indicate the selectivity of the traps for specific blowfly species, on the assumption that the population could have been altered in the suppression areas[20,21]. The month with the highest yield at each control locality was used for this purpose, in order to assess the selectivity of the traps with the highest counts possible.

Statistical methods

The effect of suppression on the *Lucilia* populations of the respective localities was assessed in factorial analyses, incorporating the effects of the designation of the trap (located in a suppression or in a control area) and month. Months included in the analyses were October 1997 to March 1998 for Caledon, October 1997 to May 1998 for Langgewens and October 1997 to June 1998 for Tygerhoek and Elsenburg. The *Lucilia* spp. (*L. cuprina* and *L. sericata*) were pooled for these analyses. Data for the 4 localities were analysed separately, as the responses obtained appeared to differ. *Lucilia* counts for traps within months were extremely variable, ranging from 0 to 1032 (overall mean ± SD across localities = 41 ± 96). In order to normalise the distribution, the $\log_{10}$ was calculated for the *Lucilia* count +1 (to account for zero counts) yielded by individual traps before statistical analysis.

The selectivity of the traps was evaluated using 4 localities × 3 blowfly species (*L. cuprina, L. sericata, Chrysomyia* spp.) in a preliminary analysis. Only the months with the highest *Lucilia* yield in the control areas were considered. The 2 species of the genus *Lucilia* were pooled in the final analysis, resulting in a 4 × 2 factorial design.

RESULTS

Monthly *Lucilia* yield in the suppression and control areas

In Caledon there was no indication that counts in the suppression or control areas reacted differently to influences specific to the months included in the investigation. The interaction between the designation of the trap and month was thus not significant ($P > 0.05$; Fig. 1). In general, the traps used for monitoring purposes in the control area yielded higher *Lucilia* numbers than those in the suppression area (respective $\log_{10}$-transformed means and standard errors when pooled across months were 1.41 ± 0.10 *vs* 0.99 ± 0.11; respective geometric means 26 *vs* 10; $P < 0.01$).

At Tygerhoek, no significant interaction was similarly observed between the designation of the trap and month (Fig. 2). No difference in *Lucilia* numbers was observed between traps in the suppression or control areas (respective overall $\log_{10}$-transformed means and standard errors when pooled across months were 1.21 ± 0.11 *vs* 1.29 ± 0.07; respective geometric means 16 *vs* 19; $P > 0.50$). Significant ($P < 0.01$) month effects suggested peak activity during October/November 1997, and again during February/March 1998, with lower levels of activity during

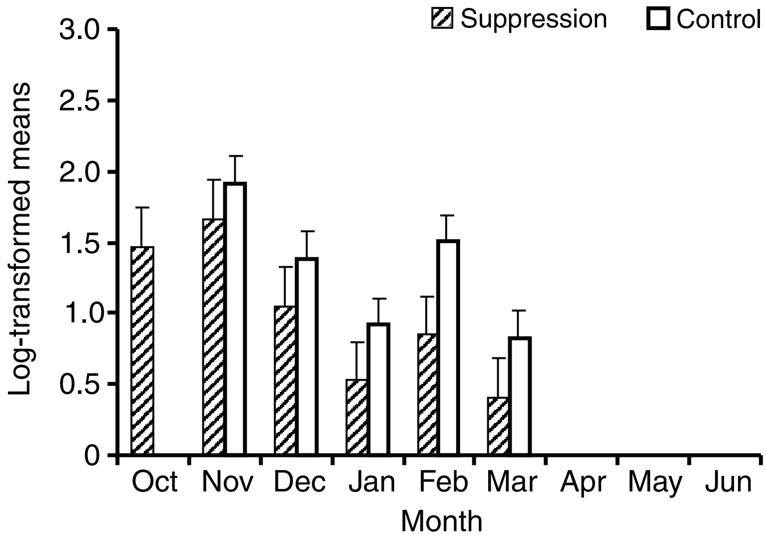

Fig. 1: **Mean log_{10}-transformed *Lucilia* counts collected over a 48-hour period in the suppression and control areas at Caledon. The vertical lines on the columns represent standard errors.**

January 1998 and during the cooler months (April to June 1998).

The *Lucilia* population at the Langgewens locality declined from a log_{10} transformed mean (±SE) of 2.09 ± 0.16 (geometric mean = 123) during October 1997 to 0.13 ± 0.16 (geometric mean = 1) during May 1998 (Fig. 3). Responses to the respective months in the suppression and control areas were largely similar (P for the interaction = 0.20). Overall, the traps in the suppression areas yielded slightly higher *Lucilia* numbers than those in the control areas (respective log_{10} transformed means and standard errors were 0.92 ± 0.06 *vs* 0.67 ± 0.09; respective geometric means 8 *vs* 5; $P < 0.05$).

At Elsenburg, *Lucilia* numbers were substantially lower than at the other localities (Fig. 4 compared with Figs 1, 2 and 3). Given that the figures are on a log_{10} scale, it is evident that the differences will be further accentuated on a normal scale. The designation of the trap interacted with month ($P = 0.02$), although blowfly counts were generally lower in the suppression area than in the control area. The only significant difference was, however, during November 1997 (respective log_{10}-transformed means and standard errors 1.20 ± 0.16 *vs* 0.13 ± 0.12; respective geometric means 16 *vs* 1; $P < 0.01$). It is probably also important to note that the counts for the respective months did not differ ($P < 0.05$) from zero in many cases.

Selectivity of the traps

The November 1997 trapping yielded the highest blowfly numbers at all control localities, except for the Langgewens control, where the highest yield was recorded during October 1997. In the absence of a significant ($P < 0.05$) locality × species interaction, log_{10}-transformed mean (±SE) fly counts across localities are presented to indicate the species distribution. Counts for *L. cuprina* (1.70 ± 0.16; geometric mean = 50 flies per trap) exceeded ($P < 0.01$) that of *L. sericata* (0.88 ± 0.16; geometric mean = 8 flies per trap). Even fewer flies of the genus *Chrysomyia* were found in the traps (0.46 ± 0.16; geometric mean = 3 flies per trap). This mean fly count differed ($P < 0.01$) from that of *L. cuprina,* and also tended to differ ($P < 0.10$) from that of *L. sericata.*

Counts for flies of the genus *Lucilia* were pooled for the final analysis, and compared to counts for *Chrysomyia* spp. within localities (Table 1). It is evident that *Lucilia* spp. were more ($P < 0.05$) likely to be trapped than *Chrysomyia* spp., irrespective of the locality. The difference only approached significance at the Tygerhoek locality ($P < 0.10$), but a fairly large absolute difference nevertheless prevailed.

DISCUSSION

Monthly *Lucilia* yield in the suppression and control areas

Large-scale trapping appeared to be effective in controlling the *Lucilia* population at Caledon. A similar tendency was observed at Elsenburg, notwithstanding very low levels of activity. The *Lucilia* population at Tygerhoek and Langgewens did not decline relative to the population in the corresponding control areas. Trapping of *L. cuprina* over large areas was effective in reducing blowfly populations in Australia[20,21], comparable to the responses obtained at Caledon and Elsenburg. The lack of response to trapping at Tygerhoek and Langgewens is possibly due to the fact that a relatively small area was trapped. It was hypothetically impossible to control the influx of *Lucilia* from adjacent sheep-producing areas. Although *Lucilia* spp. were reported not to migrate over long distances, as indicated by DNA typing[8], the suppression area was probably too small for effective control at these localities. An explanation is required for the level of success at Elsenburg, where a relatively small area was trapped as well. Since this locality is surrounded by vineyards, it was probably too isolated from other sheep-producing areas to be affected by an influx of *Lucilia* from neighbouring areas. The low overall levels of *Lucilia* activity at Elsenburg could also be regarded as evidence of its isolation, since particularly *L. cuprina* has evolved to be largely dependent on the presence of live sheep for the completion of its life cycle[9]. It has been demonstrated that flies hatched from carcasses, for instance, made a very small contribution to the *L. cuprina* population[3].

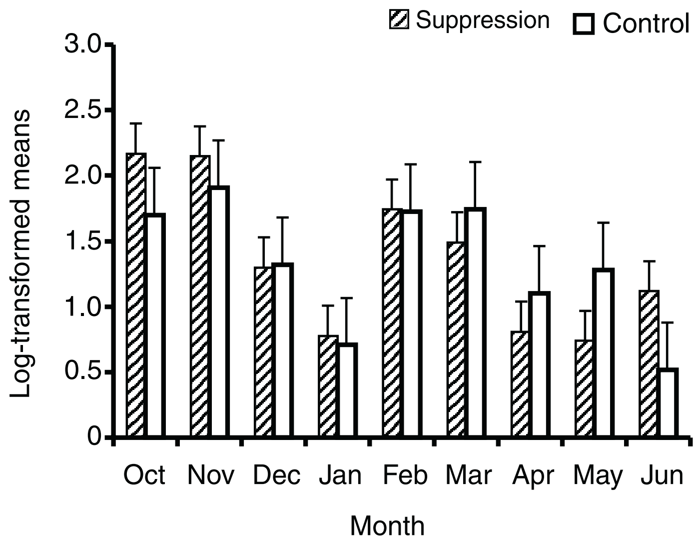

Fig. 2: **Mean log_{10}-transformed *Lucilia* counts collected over a 48-hour period in the suppression and control areas at Tygerhoek. The vertical lines on the columns represent standard errors.**

Table 1: **Log_{10}-transformed means** (standard errors) **for the distribution of the 2 genera of blowflies recovered from traps used for monitoring in the control areas during the month with the highest *Lucilia* yield (October 1997 for Langgewens, November 1997 for the other localities).**

Locality[a]	*Lucilia* spp.			*Chrysomyia* spp.		
	Mean (SE)	10[b]	Range	Mean (SE)	10[b]	Range
Caledon	1.92 (0.19)	83	4–471	0.41 (0.19)	3	0–5
Tygerhoek	1.91 (0.35)	82	6–630	1.05 (0.35)	11	0–97
Langgewens	2.06 (0.35)	115	34–429	0.39 (0.35)	3	0–14
Elsenburg	1.20 (0.35)	16	4–29	0.00 (0.35)	1	0

Means for *Lucilia* and *Chrysomyia* counts differed ($P < 0.05$) within rows for Caledon, Langgewens and Elsenburg. A similar tendency ($P < 0.10$) was found at Tygerhoek.
[a]Based on the mean yield of 10 traps at Caledon and 3 traps at the other locations.
[b]The geometric mean, depicted by the antilog of the mean.

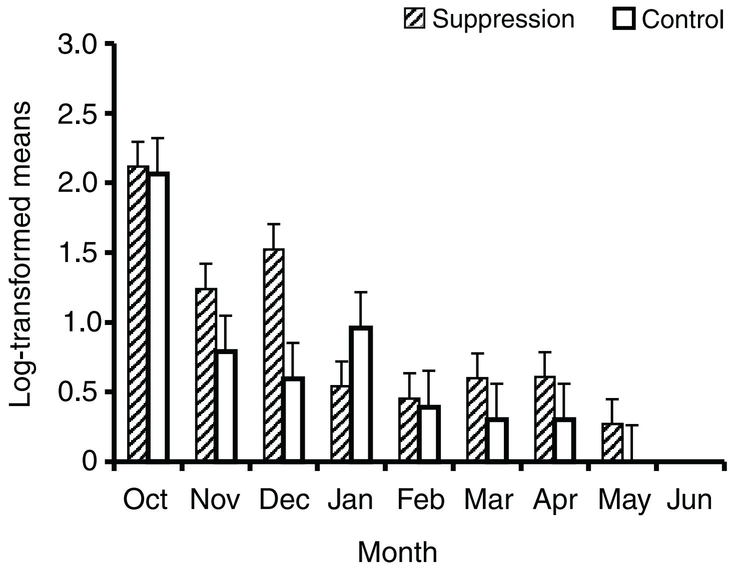

Fig. 3: **Mean log_{10}-transformed *Lucilia* counts collected over a 48-hour period in the suppression and control areas at Langgewens. The vertical lines on the columns represent standard errors.**

The procedure of using existing suppression traps for monitoring in the suppression area differed from the protocol used by Urech *et al.*[20,21]. It was subsequently brought to our attention that the chemicals used to manufacture the attractant adsorb to the surfaces of the container with continuous use (R Urech, Animal Research Institute, Department of Primary Industries, Queensland, Australia, pers. comm., 1999). This results in these traps becoming a larger source of the odour typical to the attractant. These traps thus probably had a stronger luring effect on the insects in the vicinity than traps in the control areas, which were exposed to the chemicals only once a month for 48-hours. The results of this investigation (and possibly the slightly higher overall *Lucilia* counts in the Langgewens suppression area in comparison with the control area) probably reflect this effect.

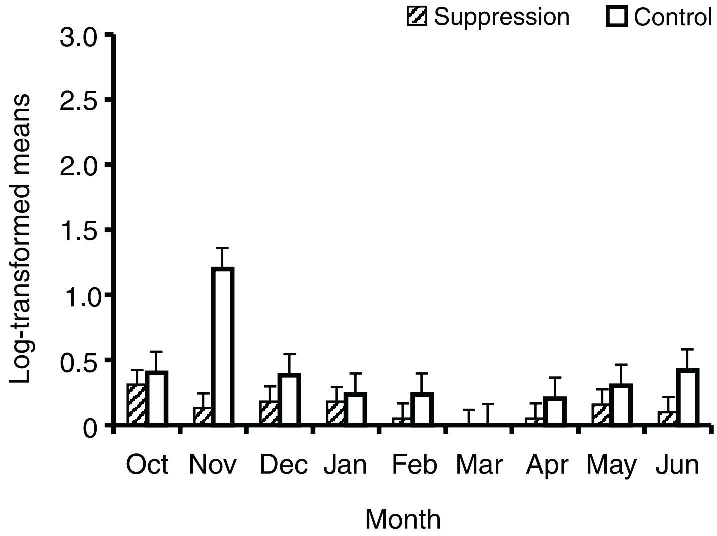

Fig. 4: **Mean log_{10}-transformed *Lucilia* counts collected over a 48-hour period in the suppression and control areas at Elsenburg. The vertical lines on the columns represent standard errors.**

Selectivity of the traps

The synthetic attractant employed in the Lucitrap® system appeared to be highly effective for trapping *Lucilia* spp., and particularly *L. cuprina,* at all the localities. Notable numbers of *L. sericata* were also trapped at all localities. The efficacy of the synthetic lure to attract this species has not been assessed (R Urech, Animal Research Institute, Department of Primary Industries, Queensland, Australia, pers. comm., 1999). This species has, however, been reported to be responsible for strikes on live sheep in South Africa, the United Kingdom and New Zealand[2,15,17,19]. The importance of *L. sericata* as a primary strike blowfly was, however, small compared to that of *L. cuprina* where both species were present[2]. The species distribution of the natural blowfly population was not investigated at any of the localities. It is thus impossible to relate the yield from the traps to the natural blowfly population. Leipoldt[12] found that *L. sericata* accounted for 58 % of Calliphoridae trapped when using a liver-dung-Na_2S attractant in the central, summer rainfall parts of South Africa. *L. cuprina* constituted only a small percentage (11.5 %) of Calliphoridae trapped. A similar result was reported when using sheep offal-Na_2S bait in bin traps[2]. Behaviour involving host location and oviposition appears to be similar for the 2 species[1].

CONCLUSIONS

Large-scale trapping appeared to be effective in reducing *Lucilia* populations when large areas were trapped[20,21]. In our study, it also seemed to be effective when applied to isolated sheep-breeding operations. The biology of the *Lucilia* spp. appears to make control by large-scale trapping a viable proposition[1]. Large-scale trapping may be of value as part of an integrated blowfly management strategy in the sheep-producing areas of South Africa, as is envisaged in Australia[20,21]. The results from the present study were inconclusive as far as the response of *Lucilia* populations to trapping was concerned, possibly owing to factors mentioned in the discussion. The effect of a reduction in blowfly numbers associated with suppression of the blowfly population using the Lucitrap® system on flystrike and the necessity of pesticide application has also not yet been studied. It is emphasised that industry will gain from a reduced reliance on chemicals, as the risk of contamination is difficult to predict[18]. It appears that the Lucitrap® system[16] could be used to great effect for trapping *Lucilia* spp, which may be of value when monitoring blowfly populations for strategic decision-making is considered. The application of the present findings to practical sheep husbandry and animal health therefore warrants further study.

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