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# An attractant for *Austrosimulium* spp. (Diptera: Simuliidae)

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## Introduction

On the mainland of New Zealand, the family Simuliidae (blackflies) is restricted to 11 species in the genus *Austrosimulium*. At least two of these species (*A. australense* and *A. ungulatum*) are known to bite humans (Crosby 1989). Biting blackflies in New Zealand are not known to spread infectious diseases but they are a severe nuisance, especially on the West Coast of the South Island, which may detract from tourist revenue. Any means of trapping these flies to reduce their numbers in areas favoured by tourists could therefore be of significant economic value.

During a search for a sheep-strike fly bait in 1995, the volatile sulphur compounds ethane mercaptan and dimethyl sulphide were found to be attractive to blackflies. This paper reports further on the attractiveness of these two compounds to blackflies and their potential for use in baited traps.

## Materials and Methods

Two trapping series were conducted over 3 and 2 days, respectively, in regenerating forest along the banks of the Kaiwharawhara Stream, Wellington City, during March 2003. Each of the volatile compounds (1mL of either dimethyl sulphide or ethane mercapan, depending on the trial) was placed in a 10mL glass vial and this was pushed through a hole in the centre of a 220 x 220mm sticky yellow trap (Garrick trading, Auckland). A 1mm hole was drilled in the stopper of the vial. Personal observation confirmed that this allowed volatile baits to evaporate at the rate of about 0.5mL per day. Controls consisted of the sticky traps with no bait.

During the first trapping series, traps were placed at nine sites, 15 m apart along the banks of the stream. Three replicates of each of the three treatments (dimethyl sulphide, ethane mercaptan and control) were alternated at these locations over three days, giving three 3 x 3 Latin squares for analysis, taking into account effects due to site and trapping day.

In the second trapping series, only dimethyl sulphide was tested against control treatments. Fourteen traps were placed 15 m apart along the stream, alternating between the control and experimental treatments. The positions of the control and experimental treatments were switched the next day, giving seven 2 x 2 Latin squares for analysis.

All traps were left for 24 hours before counting trapped blackflies. *Austrosimulium* species were distinguished from other flies with similar body shape by examining the wing venation (CSIRO 1990).

Analyses of variance for the Latin square designs were performed on transformed data (square root of the count + 0.5) according to the method of Snedecor & Cochrane (1980).

## Results and Discussion

All blackflies trapped were female. During the first trapping series, volatile compounds attracted more flies than the control (Table 1a), but the difference in capture rate among treatments was not statistically significant (Table 2a). Dimethyl sulphide attracted marginally more flies than ethane mercaptan in the first trapping series, and when dimethyl sulphide was tested against the control in the second trapping series (Table 1b), it was found to have a highly significant effect on blackfly capture rate (Table 2b).

Volatile sulphur compounds, including those tested here, are produced during bacterial degradation of larger organic molecules (Morris *et al.* 1998), and could therefore be present in human sweat. It is known that human sweat contains attractants to blackflies (Thompson 1976a,b, Bellec & Hebrard 1984), but when non-volatile molecules found in human sweat were tested, none of them were found to be attractive (Bellec & Hebrard 1984). Thompson (1976b) was unable to isolate the attractive component, a finding consistent with the hypothesis that blackflies are attracted to the shorter, more volatile molecules in sweat, such as those tested in the present study.

Yellow is not an attractive colour for blackflies, and a greater number of individuals may be trapped if a dark colour is used (Das *et al.* 1974; Bellec & Hebrard 1984). The use of dimethyl sulphide bait or other volatile sulphur compounds in a dark-coloured trap may have potential in controlling nuisance blackflies or monitoring these species so we can better understand their ecology.

**Table 1.** Numbers of blackflies trapped during (a) the first trapping series, and (b) the second trapping series. Bold font = dimethyl sulphide; italic font = ethane mercaptan; regular font = control.

| Site | Trapping day | | | |
|---|---|---|---|---|
| | **7 March** | **18 March** | **19 March** | **Site means** |
| **(a) First trapping series** | | | | |
| 1 | **3** | *3* | 0 | 2.00 |
| 2 | 1 | **7** | *2* | 3.33 |
| 3 | *4* | 0 | **1** | 1.66 |
| 4 | **0** | *2* | 0 | 0.66 |
| 5 | 1 | **0** | *0* | 0.33 |
| 6 | *2* | 4 | **8** | 4.66 |
| 7 | **0** | *0* | 0 | 0.00 |
| 8 | 0 | **21** | no data | 10.50 |
| 9 | *4* | 1 | **6** | 3.66 |
| **Day means:** | 1.66 | 3.22 | 2.13 | |

**Treatment means:**
Control = 0.78
Ethane mercaptan = 2.13
Dimethyl sulphide = 5.11

| | | | | |
|---|---|---|---|---|
| **(b) Second trapping series** | | | | |
| 1 | | **2** | 0 | 1.00 |
| 2 | | 0 | **4** | 2.00 |
| 3 | | **2** | 0 | 1.00 |
| 4 | | 0 | **0** | 0.00 |
| 5 | | **1** | 0 | 1.00 |
| 6 | | 0 | **2** | 1.00 |
| 7 | | **3** | 0 | 1.50 |
| 8 | | 0 | **3** | 1.50 |
| 9 | | **2** | 1 | 1.50 |
| 10 | | 3 | **6** | 4.50 |
| 11 | | **6** | 1 | 3.50 |
| 12 | | 0 | **1** | 0.50 |
| 13 | | **1** | 1 | 1.00 |
| 14 | | 0 | **0** | 0.00 |
| **Day means:** | | 1.43 | 1.36 | |

**Treatment means:**
Control = 0.43
Dimethyl sulphide = 2.36

**Table 2**: Analyses of variance of square root transformed data.

**(a) First trapping series**

| Sources of variation | d.f | SS | MS | F value | P value |
|---|---|---|---|---|---|
| Days | 2 | 1.76 | 0.88 | 1.22 | 0.33 |
| Sites | 8 | 6.81 | 0.85 | 1.18 | 0.38 |
| Treatment | 2 | 4.52 | 2.26 | 3.13 | 0.08 |
| Error | 13 | 9.41 | 0.72 | | |
| TOTAL | 25 | 22.50 | | | |

**(b) Second trapping series**

| Sources of variation | d.f | SS | MS | F value | P value |
|---|---|---|---|---|---|
| Days | 1 | 0.01 | 0.01 | 0.05 | 0.83 |
| Sites | 8 | 4.33 | 0.54 | 3.32 | **0.02** |
| Treatment | 1 | 2.16 | 2.16 | 13.28 | **0.002** |
| Error | 17 | 2.77 | 0.16 | | |
| TOTAL | 27 | 9.27 | 0.34 | | |

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## References

Bellec C, Hébrard G. 1984. Le comportement de recherche de l'hôte par les femelles du complexe *Simulium damnosum*. *Cahiers ORSTOM Entomo. Médicale* 22:261-270.

Crosby TK. 1989. Simuliidae (blackflies or sandflies). In: *Bulletin of the Entomological Society of New Zealand* (eds Winterbourn MJ & Gregson KLD) pp. 67-72.

CSIRO. 1991. *The Insects of Australia*, 2nd edition. Melbourne University Press, Melbourne.

Das SC, Bhuyan M, Das NG. 1984. Attraction of Simuliidae to different colors on humans – field trial. *Mosquito News* 44:79-80.

Morris MC, Woolhouse AD, Joyce MA. 1998. Volatiles present in attractants of Lucilia cuprina (Diptera, Calliphoridae). *Australian Journal of Experimental Agriculture* 38:461-468.

Snedecor GW, Cochran WG. 1980. *Statistical Methods*, 7th edition. Iowa State University Press, Ames.

Thompson BH. 1976a. Studies on the attraction of *Simulium damnosum* s.l. (Diptera: Simulidae) to its hosts. I. The relative importance of sight, exhaled breath, and smell. *Tropenmed. Parasitol.* 27:455-473.

Thompson BH. 1976b. Studies on the attraction of *Simulium damnosum* s.l. (Diptera: Simulidae) to its hosts. II. The nature of substances on the human skin responsible for attractant olfactory stimuli. *Tropenmed. Parasitol.* 27:83-90.