Polar Record 19: 618-620 (1979

SAMPLING OF TERRESTRIAL INVERTEBRATES USING STICKY-TRAPS AT MARION ISLAND

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During a brief visit to Marion Island (46°54′S 37°45′E) in the sub-Antarctic, the use of sticky-traps as a sampling method for land invertebrates was tested. Sticky-traps are plates or funnels coated with a non-drying adhesive which, like fly-paper, trap small invertebrates which touch the sticky surface. The adhesive used in this study, Tree Tanglefoot (manufactured by the Tanglefoot Company, Grand Rapids, Michigan), retained its adhesive properties when wet and when cooled to −6°C. Although the method is well known (Southwood, 1968) it has not been used as widely in the Antarctic or sub-Antarctic as methods involving extraction of animals from substrate samples using Berlese-Tullgren funnels, flotation or hand sorting techniques. This short study was aimed at testing the method and therefore not all specimens caught were fully identified. Nevertheless, the study does provide some insights into terrestrial invertebrate ecology at Marion Island, which has not been studied in any detail (Smith, 1977).

Sticky-traps were placed in eight tundra-like vegetation types between 16 and 20 April 1978. Little rain fell during this period and no gales blew. At each site, five plastic squares 10 cm × 10 cm, coated on the upper surface with the adhesive, were pegged out horizontally on the ground about 30 cm apart. The traps were visited before dawn at dusk and the trapped animals counted and removed at each visit.

The following vegetation types, which do not represent the full range of terrestrial habitats on the island, were sampled.

(1) A wet bog with little plant cover provided by the sedge *Juncus scheuchzerioides* and the grass *Agrostis magellanica*.
(2) A very wet mire dominated by the moss *Blepharidophyllum densifolium* with *Agrostis magellanica* present.
(3) A wet mire dominated by the moss *Clasmatocolea humilis* and *Agrostis magellanica*.
(4) A black-lava slope covered by the fern *Blechnum penna-marina*.
(5) A slope dominated by *Aceana adscendens* with *Blechnum penna-marina* and the moss *Dropanocladus uncinatus* present.
(6) A slope covered with *Agrostis bergiana* grass.
(7) A re-vegetated seal wallow with luxuriant growth of *Callitriche antarctica* and the grass *Poa cookii*.

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(8) A slope with low tussock vegetation comprising *Poa cookii, Agrostis magellanica, Azorello selago* and several bryophyte species.

In an investigation into mesofauna density during 1976 and 1977, five substrate cores, each 8 cm in diameter and about 10 cm deep, were taken monthly from each of the above vegetation types and the animals extracted by hand. The results for April 1977 are included here for comparison with the April 1978 sticky-trap results (Table 1).

TABLE 1. NUMBERS OF INVERTEBRATES CAPTURED IN STICKY-TRAPS AND IN HAND-SORTED CORES AT MARION ISLAND

	Numbers caught per 100 hours in sticky-traps Vegetation type								Total animal catches			
									Sticky-traps		Hand-sorted	
	1	2	3	4	5	6	7	8	no	per cent	no	per cent
Lepidoptera												
Pringleaphaga adults	0	1	1	1	0	1	5	0	7	0.11	1	0.35
Embryonopsis adults	0	0	0	0	0	0	13	1	9	0.14	0	0.00
Lepidoptera larvae	0	0	0	0	0	0	2	0	1	0.02	6	2.09
Coleoptera												
Ectemnorrhinus adults	0	0	0	0	0	0	0	1	1	0.02	10	3.48
Coleoptera larvae	0	0	1	0	0	0	3	0	3	0.05	23	8.01
Diptera												
Telmatoscopus adults	2	3	1	0	6	2	322	3	222	3.43	Undetermined	
Other small flies (2 spp)	127	117	26	15	6	11	64	9	313	4.84	Undetermined	
Hemiptera (aphids)	0	0	2	0	11	5	0	1	18	0.28	Undetermined	
Collembola (springtails)	3	7	57	39	51	42	397	98	520	8.04	Undetermined	
Araneae (spiders *Myro* sp)	0	0	0	0	0	0	0	2	2	0.03	2	0.70
Acarina (mites)	55	106	69	160	5	7	7 800	25	5 369	83.05	Undetermined	
Oligochaeta (earthworms)	0	0	0	0	0	0	0	0	0	0.00	233	81.18
Mollusca (snails and slugs)	0	0	0	0	0	0	0	0	0	0.00	12	4.18
Sampling time (hours)	88	88	88	88	88	88	64	93	—	—	—	—

The microfauna accounted for 99 per cent of all the animals caught by the sticky-traps (mites, 83 per cent; Collembola, 8 per cent; small dipteran flies, 8 per cent). Travé (1977) using a Berlese-Tullgren funnel in similar types of vegetation at Isles Kerguelen (49°21′S 70°12′E) also found high numbers of mites (59 per cent of all animals caught) and Collembola (37 per cent). Mites and, to a lesser extent, Collembola are the most common free-living land invertebrates in the Antarctic (Gressitt, 1967).

The flightless Lepidoptera *Pringleaphaga marioni* and *Embryonopsis halticella* were uncommon although they were apparently more efficiently sampled by sticky-traps than by hand-sorting cores (Table 1). These insects have cryptic coloration and are difficult to see in vegetation. Burrowing invertebrates (earthworms and insect larvae) and those which walk or creep (beetles *Ectemnorrhinus similis*, snails, slugs and possibly spiders) appear to be more efficiently sampled by hand-sorted cores than by the sticky-traps.

Although the sticky-traps can provide only relative, and not absolute, measures of invertebrate density, the results obtained for different habitats are comparable. The re-vegetated seal wallow (Type 7) was the most productive habitat for nearly all of the invertebrates sampled. The vegetation of the wet bogs and mires (Types 1, 2 and 3), although short, supported relatively large populations of small flies and mites. Mites, Collembola and small flies were not always abundant in the same vegetation.

Sticky-traps catch only active animals, although some may be blown onto the traps by wind (Southwood, 1968). This allows the identification of periods of maximum activity in the animals sampled. Table 2 compares catches made in daylight with those made at night during a period of relatively uniform weather. A Chi-squared test was used to identify significant deviations of capture rates from the expected rates. The Lepidopteran *Embryonopsis halticella*, the fly *Telmatoscopus albipunctatus*, other small flies and Collembola were all caught in significantly greater numbers during the day than at night. Another Lepidopteran *Pringleaphaga marioni*, beetle larvae, aphids and mites appeared to be equally active by day or night.

Sticky-traps are suggested as a complementary sampling method to those normally used in the Antarctic and sub-Antarctic. They allow an initial, rapid assay of aerial or surface active invertebrate populations to be made and more accurate sampling methods can be used later where most profitable. The identification of the active periods of free-living invertebrates in the field is an attractive feature of this method. Apart from diurnal activity patterns, the effects of environmental changes on invertebrate activity can also be studied using sticky-traps. Since sticky-traps

TABLE 2. DIURNAL VARIATIONS IN THE NUMBERS OF INVERTEBRATES CAPTURED BY STICKY-TRAPS

	Numbers caught			Expected			
	Daylight	Night	Total	Daylight	Night	λ^2	Remarks
Lepidoptera							
Pringleaphaga adults	2	5	7	3	4	0.58	
Embryonopsis adults	7	2	9	3	6	8.00*	More active by day
Lepidoptera larvae	1	0	1	—	—	—	Sample too small
Coleoptera							
Ectemnorrhinus adults	1	0	1	—	—	—	Sample too small
Coleoptera larvae	2	1	3	1	2	1.50	
Diptera							
Telmatoscopus adults**	12	4	16	6	10	9.60*	More active by day
Other small flies (2 spp.)**	207	69	276	107	169	152.63*	More active by day
Hemiptera (aphids)**	11	7	18	7	11	3.74	
Colembolla (springtails)**	178	88	266	103	163	89.12	More active by day
Araneae (spiders, *Myro* sp.)**	1	1	2	—	—	—	Sample too small
Acarina (mites)**	152	225	377	146	231	0.402	
Sample time (hours)	34.4	54.2	88.6				

* $P < 0.01$
** No data from vegetation type 7 for these animals.

involve simple, inexpensive apparatus requiring no power supply, a large number of sites can be sampled simultaneously within a short period. This is particularly relevant in the Antarctic and sub-Antarctic where visits to new regions are often very brief and bad weather frequently restricts field work.

Some of the disadvantages of sticky-traps need to be mentioned, although these are discussed by Southwood (1968). The adhesive used on the traps contaminates trapped animals and therefore prevents accurate determinations of biomass, calorific and chemical composition, and often causes damage to delicate specimens. It is impossible to measure absolute densities of invertebrates using this method, since all the animals from any discrete area are not trapped. Birds or other large animals may prey on trapped animals, and this factor must be considered when positioning traps.

Acknowledgements

I thank J.-F. Voisin and Professor P. Dreux of the Laboratoire de Zoologie, Ecole Normale Supériere, Paris, for identifying insects. Biological research at Marion Island is sponsored by the South African Scientific Committee for Antarctic Research and supported financially and logistically by the South African Department of Transport.

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THE YAKUTIA GAS PROJECT

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The Soviet Union is one of the world's major exporters of gas. Both eastern and western Europe are destined to become major purchasers of this gas. By 1980 the USSR will be exporting 30 to 33 billion cubic metres a year to eastern Europe and at least 25 million cubic metres to western

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