

The arthropod fauna of bracken (*Pteridium aquilinum*) on the Port Hills, South Island, New Zealand

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ABSTRACT

Arthropods belonging to 15 orders and 73 families were found on bracken fern (*Pteridium aquilinum*) on the Port Hills, near Christchurch. At least half of them were considered to be transients without close associations with the plant. Sminthuridae, oribatid mites and a cryptophagid beetle dominated the fauna numerically but their feeding relationships with bracken were unclear. Spiders were also abundant. Few chewing herbivores occur on bracken in New Zealand but sap-sucking Hemiptera are well represented. Few arthropods exhibited well-defined patterns of occurrence at the Port Hills sites where bracken does not die off in winter.

Keywords: *Pteridium aquilinum*; bracken; Arthropoda; New Zealand; herbivores.

INTRODUCTION

The bracken fern, *Pteridium aquilinum* (L.) Kuhn is widely distributed in the Northern and Southern Hemispheres and according to Harper (1977) may be one of the 5 commonest plants in the world. It is a morphologically variable plant with a number of distinct varieties but it is generally agreed that all belong to a single species (Page 1976). The variety *esculentum* occurs in New Zealand (Tryon 1941).

Bracken constitutes a continuing weed problem in several parts of the world (Gerson 1979). It grows in woodland and grassland, and is particularly difficult to eradicate because of its persistent, underground rhizome. The success of bracken also may be due in part to the wide range of protective, secondary plant constituents it contains (Fletcher & Kirkwood 1979). However, recent work indicates that its reputation for being particularly difficult to exploit by herbivores may not be warranted entirely. Thus it is now known that a variety of herbivorous insects occur on bracken in England (Lawton 1976), Papua New Guinea (Kirk 1977) and several parts of North America (Tempel 1981; Lawton 1982; Schreiner *et al.* 1984). No surveys of the fauna associated with bracken appear to have been made in New Zealand despite the prevalence of this fern, and indeed bracken was not mentioned by Dugdale (1975) in his overview of plant-insect associations in this country.

The composition, relative abundance and seasonality of the arthropod fauna associated with bracken fronds was examined in the present study at 2 sites on the Port Hills, near Christchurch in the South Island.

STUDY AREAS AND METHODS

Fieldwork was carried out at 2 sites about 5 km apart alongside the Summit Road on the Port Hills, overlooking Christchurch (43°36'S, 172°38'E). Bracken is common in this area and occurs in linear bands alongside the road and as more substantial 'islands' of varying size bounded by rough pasture. Site A had a northerly aspect and Site B faced north-west.

Collections were made between August 1978 and July 1979 at Site A (20 sampling days) and from October to July 1979 at Site B (15 sampling days). On each occasion the fauna was sampled by beating and shaking fronds over a sorting tray whose contents were transferred to plastic bags at frequent intervals. An attempt was made to make each collection comparable in terms of sampling effort; about 20 minutes were spent collecting in this way at each site. Individual plants were also searched for animals and signs of herbivore-induced damage, and on a few occasions fronds were removed, sealed in bags and taken to the laboratory for examination. Collections were preserved in 70% methanol

and sorted later under a low power dissecting microscope. All arthropods were identified to family and most of those which appeared to have a close association with bracken were identified to as low a taxonomic level as possible. Voucher specimens are lodged in the insect collection of the Zoology Department, University of Canterbury.

PHENOLOGY OF BRACKEN ON THE PORT HILLS

Unlike *P. aquilinum* in England, bracken does not die-off in autumn in New Zealand and most fronds remain green and upright throughout the winter. On the Port Hills, new croziers were first seen in late October (Site B) and early November (Site A). By late November-early December large numbers of new fronds were present within and adjacent to patches of old bracken fronds. The latter were browning-off in early December and by early January (Site B) or early February (Site A) the new season's growth was dominant. Croziers continued to appear at both sites until early February. In April, some browning was noticeable at the tips of pinnules and fronds had become harder and drier. No further changes were apparent in the final months of the study.

THE ARTHROPOD FAUNA

Representative of 73 families of Arthropoda were found on bracken during the course of the study (Table 1). However, a high proportion of them appeared to be transients or tourists, to use the terminology of Tempel (1983) and Moran & Southwood (1982) respectively, and were unlikely to have been feeding on the fern or using it as a predation site. Most adult Lepidoptera, Diptera and Hymenoptera (about half the species collected) probably fell into this category.

Table 1: Arthropod orders and numbers of families represented in collections from bracken on the Port Hills.

<i>Orders</i>	<i>Families</i>	<i>Orders</i>	<i>Families</i>
Diptera	18	Psocoptera	2
Hymenoptera	12	Acari	2
Araneae	9	Blattodea	1
Hemiptera	8	Phasmatodea	1
Coleoptera	7	Mantodea	1
Lepidoptera	6	Neuroptera	1
Collembola	2	Opiliones	1
Thysanoptera	2	TOTAL	73

The arthropods listed in Table 2a occurred regularly in collections and are considered to represent the core species of the community. Most abundant were Sminthuridae, a cryptophagid beetle *Myrmechoxenus atomarioides*, the spittlebug *Philaenus spumarius*, an oribatid mite *Balaghobates nudus* and 4 species of spider. The animals listed in Table 2b were taken on fewer occasions and were never common. Nevertheless, they may have a more definite relationship with bracken than those regarded as transients.

Predators (spiders, opiliones, Mantidae), sap suckers (Aphrophoridae, Cicadellidae, Aphididae, Cixiidae, Thysanoptera) and chewing herbivores (lepidopteran larvae, Phasmidae) constituted well defined feeding guilds on bracken, but the feeding relationships of Sminthuridae, Cryptophagidae, Psocoptera and Acarina were not clear. All are very small arthropods and it is possible that they feed on microflora and fine organic debris present on the fronds. Collembola and oribatid mites in general feed on decaying vegetable matter although Sminthuridae may prefer fresh plant material (Wallace & Mackerras 1970), many Cryptophagidae ingest fungi and mouldy materials (Britton 1970) while Psocoptera typically eat algae, lichens, fungal hyphae and pollen (Gillott 1980).

Because community composition at the 2 collecting sites was very similar, combined data were used for examining temporal patterns of occurrence. A total of 8-26 insect and mite species, and 3-9 spider species were taken on each sampling day (Fig. 1). Species numbers were highest in October, December and January when up to 16 transient species (winged Diptera, Lepidoptera and Hymenoptera) were found. However, no pronounced

Table 2: Arthropoda, excluding 'transients' collected from bracken on the Port Hills (a) Core taxa, (b) Less common taxa represented by at least 5 individuals.

(a) Core taxa	(b) Less common taxa
COLLEMBOLA	COLLEMBOLA
Sminthuridae	Entomobryiidae
PSOCOPTERA	PHASMATODEA
Peripsocidae <i>Ectopsocus californicus</i>	Phasmidae <i>Clitarchus</i> sp.
(Banks)	MANTODEA
Caeciliidae <i>Caecilius flavus</i> Smithers	Mantidae <i>Orthodera ministralis</i> (Fabricius)
HEMIPTERA	THYSANOPTERA
Aphrophoridae <i>Philaenus spumarius</i>	Phlaeothripidae <i>Nesothrips propinquus</i>
(L.)	(Bagnall)
COLEOPTERA	Thripidae <i>Chirothrips manicatus</i> (Haliday)
Cryptophagidae <i>Myrmechoxenus</i>	<i>Thrips obscuratus</i> (Crawford)
<i>atomarioides</i> Reitter	<i>Frankliniella occidentalis</i> (Pergande)
LEPIDOPTERA	HEMIPTERA
Cosmopterigidae <i>Pyroderces anarithma</i>	Cicadellidae <i>Scaphetus simus</i> Knight
Meyrick	Cixiidae <i>Oliarus oppositus</i> (Walker)
ACARINA	Aphididae
Ceratozetidae <i>Baloghobates nudus</i>	COLEOPTERA
Hammer	Anthicidae <i>Scraptogetus anthracinus</i> Broun
ARANEAE	Scirtidae <i>Cyphon</i> sp.
Thomisidae <i>Diaea</i> sp.	Helyridae <i>Dasytes subcyaneus</i> Broun
Pisauridae <i>Dolomedes minor</i> Koch	Curculionidae
Araneidae <i>Aranea</i> sp.	LEPIDOPTERA
Theridiidae	Geometridae <i>Sestra flexata</i> Walker
	ACARINA
	Metrioppiidae <i>Pseudoceratoppia sexsetosa</i>
	Hammer
	ARANEAE
	Thomisidae <i>Sidymella</i> sp.
	Araneidae <i>Aranea pustulosa</i> (Walckenaer)
	Tetragnathidae <i>Tetragnatha</i> sp.
	Clubionidae <i>Clubiona</i> sp.
	Salticidae
	Gnathosidae
	Lycosidae
	OPILIONES
	Phalangidae <i>Phalangium opilio</i> L.

seasonal patterns in total species numbers were observed. Further, faunas on new and old generation fronds compared in December and January were very similar.

The temporal occurrence of some of the more abundant taxa is shown in Fig. 2. Sminthuridae occurred erratically in collections. Large numbers were found in October, December and May but few or none were seen at other times. Small numbers of *P. spumarius* were taken on all but one sampling day and mites were relatively abundant at all times after mid-October. Larvae of *Pyroderces anarithma* were most common in autumn and winter. *M. atomarioides* was taken on every sampling day but was most abundant in the late summer-early autumn collections, whereas Psocoptera exhibited a later autumn peak in abundance.

Spiders were present on bracken at all times. Peak numbers of *Dolomedes minor* were observed from January to March but no clear seasonal patterns of abundance were shown by Araneidae, Theridiidae or *Diaea* sp.

The lack of well defined seasonality in the fauna is in contrast with findings from the Northern Hemisphere, but there bracken dies off in autumn and the growing season is short.

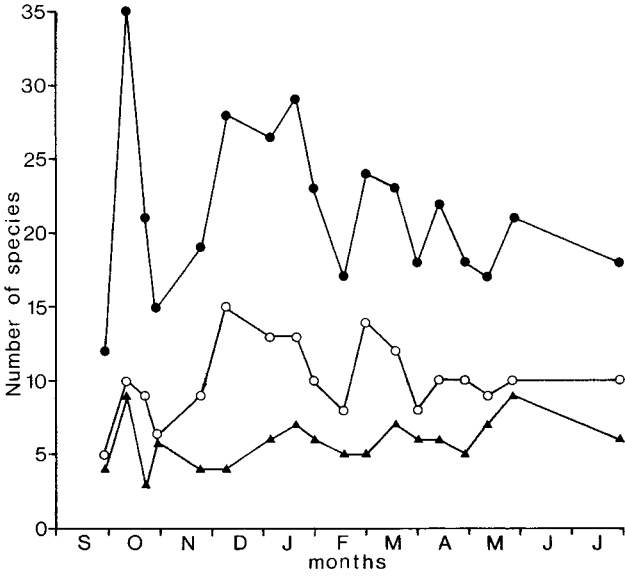


Fig. 1: Numbers of arthropod taxa present in collections taken from bracken on the Port Hills. (●) Total Arthropoda, (▲) spiders, (○) insects and mites excluding transients.

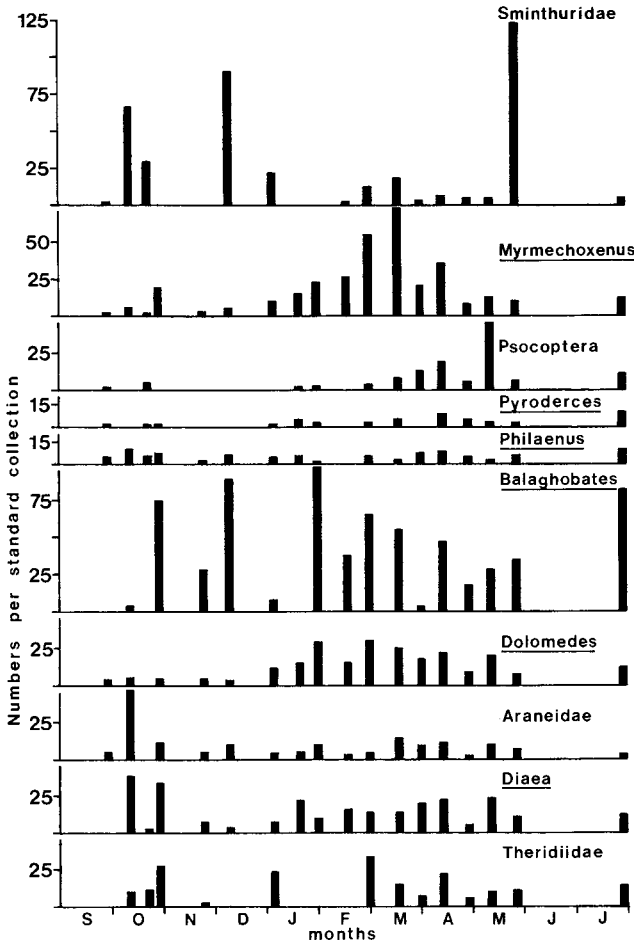


Fig. 2: Temporal patterns of abundance of 10 arthropod taxa on Port Hills bracken.

DISCUSSION

Most studies on the faunal associates of bracken have focussed primarily on herbivorous species but it is clear from this work and that of Tempel (1983) that arthropods other than herbivores also occur on the fern and indeed may be very common. Members of all 4 non-herbivore groups recognised by Tempel (1983) (predators, parasites, ants and transients) occur on the plant in New Zealand and a 5th, less easily defined group of small, apparently saprophagous-herbivorous species was well represented. Predatory arachnids (spiders and opiliones) were some of the largest and most abundant members of the Port Hills bracken community but ants which can be attracted to foliar nectaries of the fern (Lawton 1976; Tempel 1983) were seen on few occasions. The parasitic wasps recorded were considered to be transients.

The dominant herbivores on bracken in New Zealand appear to be sap-sucking hemipterans (Aphrophoridae, Cicadellidae, Ricaniidae, Cixiidae, Dictyopharidae and Aphididae) which congregate on the pinnae. Of these, *P. spumarius* is an introduced species and one of the few polyphagous insects found on bracken in the British Isles (Lawton 1976). Nymphs of *Scolypopa australis* (Walker) (Ricaniidae) were common in collections I made in summer at several North Island localities and previously have been reported as eating bracken by Scott (1976). On the other hand I did not find the long headed bracken hopper *Thanatodicta tillyardi* Myers (Dictyopharidae) which has been recorded on bracken by Miller (1971) and Deitz & Helmore (1979).

Although larvae of only 2 lepidopteran species were found in the Port Hills study, caterpillars of 2 tortricids, *Cnephasia* sp. (*jactatana* (Walker) or *incessana* (Walker)) and *Epiphyas postvittana* (Walker) were seen on bracken at Kaikoura and Mangawai Heads, respectively. The former eats dead or dying tissue (J. Dugdale pers. comm.) whereas the latter is polyphagous and its chewing activity caused more obvious damage to pinnae than any other insect I observed.

Notable absentees from the New Zealand bracken fauna are larval sawflies (Hymenoptera: Tenthredinidae) and mining and gall forming Diptera (Anthomyiidae, Cecidomyiidae) which are characteristic, monophagous herbivores on *P. aquilinum* in the British Isles, Europe and parts of North America (Lawton 1976; Brown & McGavin 1982; Tempel 1981). Further, rachis-mining Coleoptera and gall-forming *Drosophila* species which cause extensive damage to bracken in Papua New Guinea (Kirk 1977) were not observed in New Zealand.

The presence of vacant niches may reflect the paucity of potential colonists, but a contributing factor may be the extreme physical toughness of New Zealand bracken. In this respect it contrasts markedly with the much softer variety in, for example England (personal observations) where there is a more varied fauna of herbivores (Rigby & Lawton 1981). The existence of vacant niches for whatever reason, and the generally low density of arthropod populations observed in New Zealand is in accord with Lawton's (1982) view that arthropod communities on bracken like phytophagous insect communities in general, are not saturated with species or obviously structured by interspecific competition.

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