Towards better pelts from possums; mite fauna of *Trichosurus vulpecula*

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ABSTRACT

Seven possums from north Taranaki were collected in November and December 1991. They were skinned and the skin was divided into 5 parts; the fur was sliped and hydrolyzed to leave mites for counting by 10% aliquot. Fur mites (Listrophoridae) comprising 3 species made up 1005 (94%) of the 1069 adult mites counted. They appeared to remain at their favoured position on the possum after death. A *Murichirus* species of fur mite comprised 34% of the total count and was mostly confined to the shoulders of the host. *Atellana papilio* Domrow (17% of total) was confined to the posterior dorsal (rump) region and *Petrogalochirus (Austrochirus) dycei* (Domrow) Fain the most numerous mite at 45% of the total, favoured the host's anterior. All 3 species of fur mite stick their egg to the host fur. *Trichosurolaelaps crassipes* Womersley contrasted with the fur clasping mites in being rare at 6% (64/1069) of the total count and showing no preferred pelt part. *T. crassipes* and *A. papilio* are the mite species most likely to degrade pelts.

Keywords: Possum, parasitic mites, counts, fur.

INTRODUCTION

Is the pelt or fur quality of the New Zealand feral possums influenced by their parasitic mites? In a literature review, Presidente (1984) claimed that the presence of listrophorid (fur) mites was associated with alopecia (baldness), dermatitis and inflamed areas. *Trichosurolaelaps crassipes* was linked to irritation and alopecia of the lower back of a captive possum (Domrow 1979 *in* Presidente 1984). For a better insight into the influence of mites on pelt quality we need to know which mite species are parasitic on possums together with their position and abundance on the host. Presidente (1984) used the term, "rumpwear" to describe the pelt degradation of the lower back. This current work is concerned with stimulating interest in the role of parasitic mites in pelt quality.

At present there are few, if any, dried possum pelts being exported from New Zealand (S. Bracegirdle pers. comm.). Fur trappers see the possum as a valuable, abundant and renewable resource. Government officials and the news media almost invariably portray the possum as New Zealand's worst pest (Anon. 1992a; Morst 1992b; Upton 1991). This is mainly because of the recently discovered role of the possum in the spread of bovine tuberculosis and the possum's role in forest degradation. The traditionally strong farming influence in key New Zealand government legislative and scientific positions has helped to reinforce the media image of the possum as the arch despoiler of New Zealand. Work on improvements to the pelt or fur quality of possums currently receives no state funding.

This paper stems from a view that the control or management of the possum in New Zealand can most profitably be effected by the revival of the possum fur industry and an improvement in the product (pelt) quality. The financial returns to the trapper depend largely on the returns from furrier grade pelts. In the writer's experience, first grade, or furrier quality pelts, comprise less than 10% of pelts. That proportion can range from 1 to 20% depending on the time of year and locality. Top quality pelts must have top quality rump and lower back fur.

Taranaki possums regularly carry 3 species of parasitic fur mite: *Atellana papilio* Domrow, *Petrogalochirus (Austrochirus) dycei* (Domrow) Fain and a *Murichirus* sp. (see note later in this paper) and 1 mesostigmatic mite: *Trichosurolaelaps crassipes* Womersley (Clark 1991). Andrews & Ramsay (1982) reported the free living *Proctolaelaps pygmaeus* in the environs of captive possums in New Zealand. In Taranaki, *Androlaelaps hermaphrodita* with its

attendant phoretic heteromorphic deuteronymph *Acarus siro* has been collected from free ranging possums dusted with acaricide and held over a collecting tray (Clark unpublished). This method also yielded 2 specimens of *Macrocheles* sp. mite. Of lice the possum has none. Fleas are only recorded on this host in Australia (Presidente 1984). Heath (undated) listed *Murichirus* sp. and *Cheyletus* sp. as present on New Zealand possums.

The present study describes the distribution pattern and numbers of parasitic mites on 7 possums collected in November and December of 1991 to encourage research into improvement of the pelt and fur quality of feral New Zealand possums.

METHODS

The animals used in this study were either shot and immediately (within seconds) open skinned (Pracy & Kean 1969) and divided into parts, or recovered as lightly damaged, road killed carcasses and skinned. The skin was divided into 5 parts (Fig. 1): tail, belly, rump, mid-dorsal and fore (the shoulders, neck, forelimbs and head) and each part was sliped (removal of fur) individually in a sealed container at room temperature. To slipe the fur, methods were refined during this work from initially sprinkling caustic soda (NaOH) on the flesh side of the skin but later, by pouring a solution of 2N NaOH on the flesh side and spreading it with a spatula. After 4-6 hours, the skin was placed flesh side down on a flat glass surface and the belly, fore, mid-dorsal and rump regions were individually sliped and the fur was returned to its container. The container was again sealed after 300-500 ml of fresh 2N NaOH was added to digest the fur. The skin was discarded. The removal of the skin from further treatment prevents the fats and oils in the possum skin from forming a soap which hinders counting. Any soap formed from fur oils is easily dissolved with warm water during sieving. A microscope slide was used

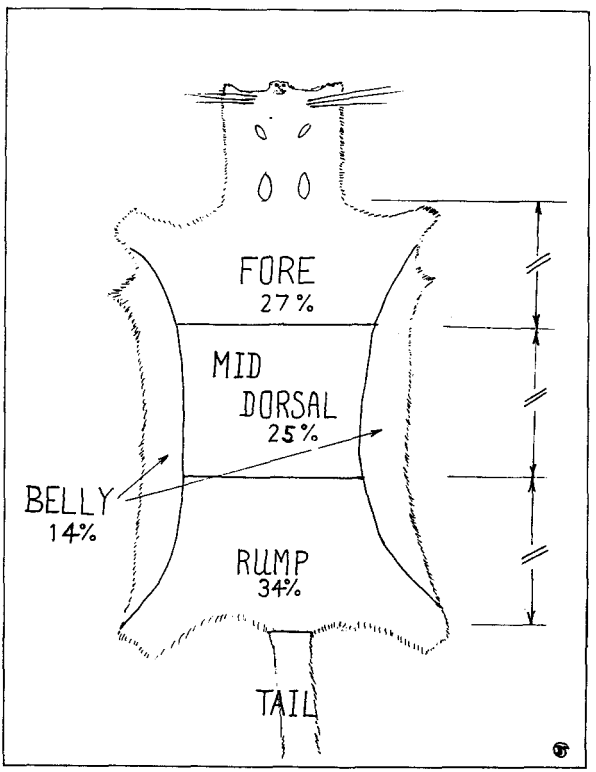

Fig. 1: The possum pelt as it was divided for analysis. Percentages of proportional total body surface each sub-area represents.

to lightly scrape the skin surface to remove all the fur and any mites adhering to the skin. The digesting fur samples were left until all fur was digested. This was signalled by a clearing of the liquid in the digestion containers. Between 1 and 3 days were needed to dissolve the fur. The fluid containing the hydrolyzed fur and mites (often with other organic matter) was then filtered through a 200 mesh/inch sieve. The retained mites were washed into a collecting dish; transferred to a 25 ml vial; neutralized with acetic acid and made up to 20 ml by adding water.

Mites were counted by taking 2 ml aliquots from the 20 ml samples and placing them on a Petri dish which had a grid of 50 squares marked on the bottom so the counting could be done 1 square at a time with a dissecting microscope. For some identifications, it was necessary to remove mites on a needle or in a Pasteur pipette to a clearing agent, (chloral hydrate, Nesbitt's solution) for inspection with a compound microscope at 100-400 X.

A recording card for the 4 common mite species was prepared so male, female, sub-adult and cast skins could be separately recorded for each species. Egg counts were made for some skin areas and notes made on the other contents of the filtrate.

Using the relative areas of belly, rump, fore and mid-dorsal, expected values for the mite counts were estimated by assuming that an even distribution constituted the expected distribution of the mite load. This expected distribution could be compared to the observed values and the null hypothesis could then be tested by use of Chi^2 for each species. The mite counts from the tail were removed from the analysis by the chi square "goodness of fit" approach. Tail counts were incomplete as not all tails were counted because of skinning problems.

Mite identification was confirmed at the Royal Institute of Natural Sciences of Belgium by A. Fain.

CAUTION: The wearing of eye protection and rubber gloves is essential with these sliping and dissolution methods if skin and eye damage is to be avoided from the caustic ("burning") action of NaOH.

RESULTS

With the exception of 1 possum ("A") which did not have *Petrogalochirus dycei* in the counted aliquot, all 7 possums had all 4 species of parasitic mite (Table 1).

The distributions seem little affected by host post-mortem interval. Although no quantitative observations were made on mites leaving the host after death, it seems that they do not migrate and "wait" at the fur tip as *Listrophorus gibbus* does on dead rabbits. Therefore, data from the freshly killed possums were combined with the data from the road-killed possums to form Table 2. Male and female possum data were combined.

Counts of the cast mite skins and pre-adult mite forms presented problems. In counts of the *Murichirus* sp. on 1 possum, there were 580 cast skins and pre-adult forms and they have been lumped together as it would have been too time consuming to turn each one over to examine the dorsal surface for the split of the cast skin. Only the adult mite counts are used for the statistical analysis.

The results of chi^2 test of uniformity of the mites over the host body in Table 2 show that the null hypothesis should be accepted for *Trichosurolaelaps crassipes* and rejected for all 3 fur mite species.

The clumping is most marked for *Atellana papilio* on the rump and the *Murichirus* sp. on the fore part. The count of 1069 mites represented 10% of the mite total. Thus there were an estimated 10,690 mites of 4 species on 7 possums. *Petrogalochirus dycei* was the most abundant at 43%, with *Murichirus* sp. at 34%, and *A. papilio* made at 17%, while the rarest species, *T. crassipes* made up 6% of the total.

DISCUSSION

Since completing this intensive study of the 7 pelts, another 20 pelts have been examined in similar detail at other times of the year (Clark unpublished). The conclusions resulting from the small sample in the present study are supported by data from those 20 pelts.

Table 1: The distribution and abundance of mites on 7 possums.

	T. crassipes				*A. papilio*				*P. dycei*				*Murichirus* sp.			
	M	F	PA	EX	M	F	PA	EX	M	F	PA	EX	M	F	PA	EX
possum No 6: male, red-brown, 2.4 Kg Adult, skin divided fresh 20.xi.91 moulting:																
Belly	0	1	0	0	0	0	0	0	22	11	3	3	0	0	0	0
Rump	5	9	0	0	10	43	10	12	15	1	0	0	0	0	0	0
							62 eggs									
Tail	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0
Mid-dorsal	2	5	0	1	4	0	2	0	24	29	0	3	1	1	6	1
							27 eggs									
fore	0	0	0	0	0	0	0	0	29	20	3	0	39	24	76	10
possum No A: Found dead, skinned 24 hrs after death: moulting pelt, 8.xi.91, sub-adult male:																
Belly	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Rump	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	0
tail							no mites recorded									
mid-dorsal							no mites recorded									
fore	1	1	0	0	0	0	0	0	0	0	0	0	11	3	5	8
possum JMC 285: Dead on road, Lepperton, grey, moulting male, 2.4 kg: 11.xi.91.																
Belly	0	4	0	0	0	0	0	0	0	1	0	0	2	0	3	0
rump	2	2	0	0	6	7	10	9	1	0	2	0	0	0	4	0
Tail							not counted									
Mid-dorsal	0	2	0	0	0	0	1	0	3	3	3	0	0	1	2	0
fore	0	1	0	0	0	0	0	0	9	11	10	0	5	2	8	0
possum JMC 284: female juvenile, 0.9 kg dead on Mangorei Rd. moulting 9.xi.91:																
Belly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rump	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Tail							One oribatid									
Mid-dorsal	1	5	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Fore	1	8	0	0	0	1	1	0	13	9	3	0	0	1	0	0
possum JMC 283: Road killed. 2.8 kg male skinned cold. moulting 9.xi.91, Mangorei Rd.																
Belly	0	2	0	0	0	0	1	0	4	7	5	0	11	2	22	0
Rump	1	0	0	0	35	64	195	20	11	9	1	0	0	1	1	0
Tail							No counts for the tail									
Mid-dorsal	0	2	0	0	12	12	6	8	20	32	25	19	10	17	43	31
Fore	0	5	0	0	0	0	2	0	10	9	0	0	116	126	580	(NY + EX)
possum JMC 286: Female, Shot and immediately skinned. furrier pelt, fat, pouch young c. 150 g. 2.xii.91																
Belly	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Rump	0	0	0	0	2	5	9	9	0	2	0	1	0	0	0	0
Tail							nothing found on tail digest.									
Mid-dorsal	0	1	0	0	0	0	0	0	20	25	30	7	0	0	0	0
Fore	0	0	0	0	0	0	0	0	34	57	121	10	0	3	4	0
possum JMC 287: Juvenile Male. Shot; skinned immediately and skin divided. 9.xii.91.																
Belly	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rump	1	2	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Tail	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mid-dorsal	0	0	0	0	0	0	0	0	1	7	7	1	0	0	0	0
Fore	0	0	0	0	0	0	0	0	3	4	3	12	0	0	4	2

M = male mite, F = female mite, PA = pre-adult mite, EX = moult skin.

Table 2: The number of adult mites from possums.

	Dermanyssidae				Fur Clasping Species													
	T. crassipes				*A. papilio*				*P. dycei*				*Murichirus* sp.				Totals*	
Pelt Part	OBS	χ^2	$\bar{x}$	S.D	OBS	χ^2	$\bar{x}$	S.D	OBS	χ^2	$\bar{x}$	S.D	OBS	χ^2	$\bar{x}$	S.D	OBS	Chi^2
Belly	9	1	1.3	1.4	0	26	0	0	46	5.1	6.6	12	16	24	2.4	4.8	62	43
Rump	22	0	3	5.1	154	131	25	37	40	86	5.7	8	1	123	0.1	0.4	195	62
Mid-Dorsal	18	2	3.6	2.7	30	5.6	4.3	8.8	164	22	23	25	30	40	4.3	10	224	2.9
Fore	15	0.2	2.4	3.4	1	48	0.1	0.4	208	57	30	31	315	480	47	89	524	236
Totals	64	3.2			185	210			458	670			362	667			1003	344

$Chi^2 = 16.2$ (3 d.f.); $P < 0.001$.
OBS = observed sum of counts from 7 possums.
* = Fur clasping species only.

The different fur mite species are not distributed evenly over the pelt.

The presence of the large numbers of *A. papilio* eggs and their attachment membranes in the rump fur indicate that the mites start their life on the host at the site where the adults live. This was also true for *P. dycei* and *Murichirus* sp.

On the other hand, there was an absence of the eggs and larva of the dermanyssid *T. crassipes*. It appeared only as adults in the aliquot counts though protonymphs and deutonymphs were collected from further uncounted aliquots. Larvae or possibly protonymphs can be born, rather than hatching from eggs (Clark unpublished).

Further sampling may reveal what interaction one mite species has on another. In that regard the possum provides a rich area for parasitology research. Heath (1978) did not point out the possibility of one species of parasite influencing another in a brief discussion on fluctuation in populations of ectoparasite, mentioning only the influences of host physiology, parasite physiology and climate. The collection of whole skins and the area by area digestion methods used here offer a methodological option for research to build up a picture of mite population dynamics and relate it to host moult, sex, season and the status of other parasites.

It is curious that the unidentified *Murichirus* species recorded in this work should appear as common on possums in Taranaki and yet be both undescribed and not be mentioned in the published literature on possum mites in New Zealand (Presidente 1984; Bowie & Bennett 1983). The method described by Bowie & Bennett (1983) may have failed to detect this *Murichirus* species as it occurs at the anterior of the possum, and they may have had no knowledge of its predilection site.

It is tempting to attribute the "rump wear" (Presidente 1984) in possums to *A. papilio*, as it is clearly the only mite in this work which prefers that site. However, vegetable matter, especially the small spines from the large New Zealand tree ferns commonly occurred in the fur filtrates. These could be an irritant in possums fur. There is only circumstantial evidence to implicate *A. papilio* in the development of "rump wear" in possums. *Trichosurolaelaps crassipes* has recently been demonstrated to be haematophagus (Clark unpublished) but the extent to which this mite feeds on the rump is unknown.

We need quantitative measurements on the effects of the different mite species on pelt quality. If they prove to be a major cause of pelt defects, oral application of an acaricide as part of pre-trapping or poisoning pre-feeding program may be an effective method to improve pelt quality. Attempts at "management" of the feral possum populations in New Zealand have simply been synonymous with killing them. This paper outlines one potential role for the entomologist to play in the control and use of the possum.

ADDENDUM

Taxonomy of fur mites (Listrophoridae: Atopomelinae) from Taranaki possums.

Petrogalochirus sp.: Recently, the writer has isolated 7 adult males of a species of *Petrogalochirus* from 2 sub-adult male possums collected in Taranaki. More work is needed to establish if they are a new species or an undescribed form of *P. dycei*. *Murichirus* sp.: A. Fain (pers. comm.) regards the species counted in this work as undescribed at 25th Jan. 1992. It is close to *M. ornatus* Fain and *M. moschati* Domrow and most similar to the former. Domrow (pers. comm.) has examined the Taranaki *Murichirus* sp. material and considers that the species is conspecific with a species of *Murichirus* collected from *Psuedochirus* ringtail possum in Australia. (Domrow, R., 1993: Acari Astigmata (excluding feather mites) parasitic on Australian vertebrates; An annotated checklist, key and bibliography. *Invertebrate taxonomy 6*: 1459-1606). It seems probable from this study, that *Trichosurus vulpecula* is the main host for the species.

Voucher specimens of species mentioned here are held at the National Arthropod Collection in Mount Albert Auckland, The Belgium Royal Institute for Natural Sciences and the Queensland Museum, Brisbane. The author retains the bulk material.

ACKNOWLEDGMENTS

S. Bracegirdle of the Inglewood possum factory provided information on Taranaki

Fig. 2: Different species of possum parasitic mites occupied different parts of the pelt. They are shown here in their favoured positions
Shoulder—female *Murichirus* sp.
Back—Male Dyce's fur mite *P. dycei.*
Rump—Male *A. papilio*
Body—Female *T. crassipes*. This mite did not have a clumped distribution on the host.

possums. A. Fain and R. Domrow gave generic identity to the *Murichirus* mite. R. Watt and S. Kerr loaned microscope and sieve. Allen Heath criticized a chaotic draft. I thank them all.

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