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Sympatric cryptic species in New Zealand Onychophora

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INTRODUCTION

In the study of evolution it is important to distinguish between morphologic change and speciation (Larson, 1989). The traditions of taxonomy, set as they are

These two species cannot be distinguished by colour or size as these traits show


35°S -
Russel
Kawau
Waiwawa
Kaueranga
Forthbranch
Lake Tikitapu
b

portion was frozen at −80° for genetic analysis. Protein extraction and electrophoresis

1830 genotypes). Geographic sample sizes ranged from one to nine (Table 1). At most sites, loci were monomorphic, with the exceptions of Waiwawa, Kakaho, Balls Clearing, Norsewood and Rangataiki where polymorphic loci were common. At Waiwawa, both *P. suteri* and *P. novaezealandiae* were collected (in the same log) and their taxonomic difference is reflected in the allozyme data. At the remaining sites where all peripatus had 15 pairs of legs it was apparent that distinct multi-locus

TABLE 1. Allele frequencies within populations of *Peripatoides novaezealandiae* and *P. suteri* for 17

[redacted]

TABLE 1. Continued

[redacted]

Aata											
A	–	–	–	–	–	–	–	–	–	–	–
B	1	1	1	1	1	1	1	1	1	1	1
C	–	–	–	–	–	–	–	–	–	–	–
D	–	–	–	–	–	–	–	–	–	–	–
Aatc									(2/3)		
A	–	–	–	–	–	–	–	–	–	–	–
B	–	–	–	–	–	–	–	–	–	–	–
C	–	–	–	–	–	–	–	–	–	–	–
D	1	1	1	1	1	1	1	–	0.333	1	1
E	–	–	–	–	–	–	–	1	0.667	–	–
Acon											
A	1	1	1	1	1	1	–	–	–	–	–
B	–	–	–	–	–	–	1	1	1	1	1
C	–	–	–	–	–	–	–	–	–	–	–
Ak											
A	–	–	–	–	–	–	–	–	–	1	1
B	1	1	1	1	1	1	1	1	1	–	–
Aldol											(1/3)
A	1	1	1	1	1	1	1	1	1	–	0.333
B	–	–	–	–	–	–	–	–	–	1	0.667
alphaGpd											
A	1	1	1	1	1	1	1	1	1	1	1
B	–	–	–	–	–	–	–	–	–	–	–
Enol											
A	1	1	1	1	1	1	1	1	1	1	1
B	–	–	–	–	–	–	–	–	–	–	–
C											

TABLE 2. *Continued*

	Rang1	Hutch	Ball2	Otar	Waio	Akat	Cart	Pahi	Mill	Bides	Nors2	Mohi	Ouer	Bide	Rang2	Tiki	Monc
Lake Rotokare (16)	1.260	1.260	1.244	2.579	2.343	2.377	2.713	2.512	2.595	1.385	1.739	1.640	1.563	1.727	1.640	1.625	1.632
Dawson falls (16)	1.224	1.224	1.208	2.817	2.530	2.575	2.817	2.732	2.833	1.463	1.844	1.735	1.654	1.765	1.735	1.720	1.727

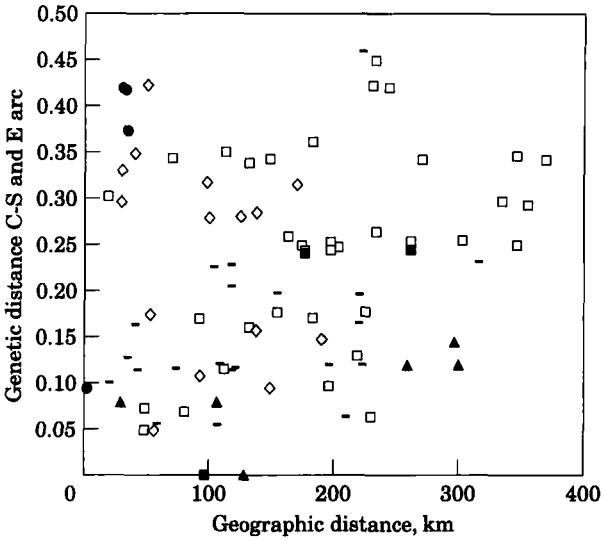
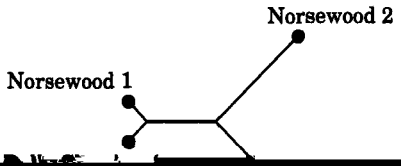
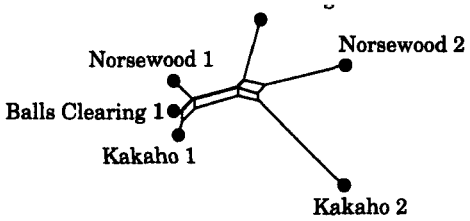
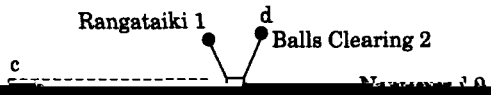


Figure 3. Plot of Cavalli-Sforza and Edwards' (1967) arc distance against minimum geographic distance (km) for populations within each of six clades indicated by Neighbour-Joining analysis of genetic distances (Fig. 2) (▲) clade a; (□) clade b; (●) clade c; (■) clade d; (◇) clade e;

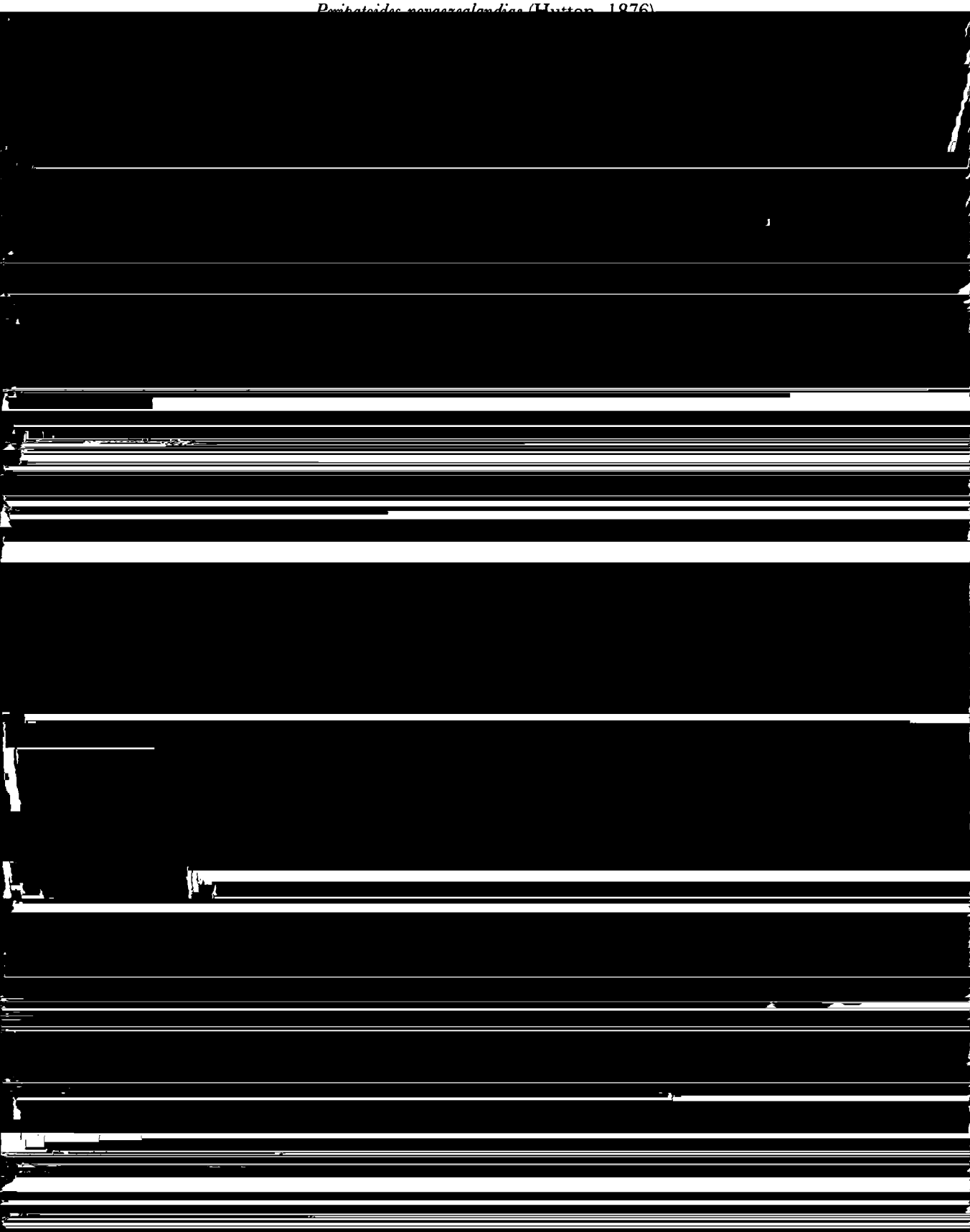
suteri. Five genetic groupings therefore exist within *P. novaezealandiae* in the North Island. In all instances genetic distance among clades is high. Furthermore, most clades include at least one population that is sympatric with a distinct genotype.


Norsewood 2
Norsewood 1


Norsewood 1
Norsewood 2
Balls Clearing 1
Kakaho 1
Kakaho 2


Rangataiki 1
d
Balls Clearing 2
c

Peripatoides novaezealandiae (Hutton, 1876)



Material. Holotype Hutchinson Reserve.

Distribution. Local, Hutchinson and Balls Clearing Reserves, Hawkes Bay. Possibly also Rangataiki where sympatric with *P. morgani* sp. nov.

Peripatoides aurorbis sp. nov.

Etymology. Latin *aurum* gold, *orbis* round or circular; a reference to the bright yellow genital opening.

Diagnosis. As for *P. novaezealandiae.* Locally identifiable by bright yellow genital opening, but this character has also been observed rarely in specimens of other species from other areas (e.g. one specimen at Lake Tikitapu). Sympatric with *P. sympatrica* sp. nov. at Kakaho from which it is distinct at 10 loci: *Aat-a, Aat-c, Acon, Ak, Aldol, Enol, Fdp, Hk, Mpi, 6Pgd,* and yellow rather than grey genital opening. Sympatric with *P. suteri* at Waiwawa from which it is distinct at 14 loci: *Aat-a, Aat-c, Ak, Aldol, alphaGpd, Enol, Gapd, Hk, Mdh, Mpi, Pgam, Pgk, Pk, 6Pgd*) (Table 1) and 15 rather than 16 pairs of legs (Tables 1, 3). Represented by clade b in the present analysis (Table 2, Figure 2).

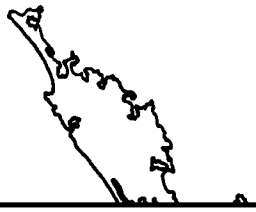
Material. Holotype Kawau Island.

Distribution. Central and mid-northern North Island, Kakaho, Waiwawa, Kawau Island.

Peripatoides sympatrica sp. nov.

Etymology. Occurs in sympatry with at least three other species

challenge to ecological and evolutionary theory. How and why do some species remain apparently morphologically and ecologically identical in sympatry? One approach to this problem is to assume that the species have only recently become sympatric and are therefore presumably in the process of evolving distinguishing characteristics or becoming extinct (Bruno *et al.* 1996). However, the number and



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