NATIONAL MUSEUM OF NEW ZEALAND RECORDS

Vol. 2, No. 13 Pages 145-50 19th August 1983

THE GENUS *BEDFORDIELLA* (MALLOPHAGA: PHILOPTERIDAE) AND A NOTE ON THE LICE FROM THE KERGUELEN PETREL (*PTERODROMA BREVIROSTRIS*)

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ABSTRACT

The history of the genus *Bedfordiella* is outlined. Examination of 22 lice samples from *Pterodroma brevirostris* (type host of *B. unica*) containing many specimens belonging to *Bedfordiella*, has shown that only one species should be recognised, i.e. *B. unica* Thompson, 1937. *Bedfordiella simsi* Timmermann, 1961 is placed as a junior synonym and its type host, *Pachyptila vittata vittata*, is regarded as a wrong host for lice of the genus *Bedfordiella*. The relationships of the Kerguelen Petrel based on its mallophagan parasites are discussed.

INTRODUCTION

Two species of the genus *Bedfordiella* Thompson, 1937 have been described. They are *B. unica* Thompson, 1937, so far known only from two females, and *B. simsi* Timmermann, 1961, known only from the holotype male. The study of several additional samples of *Bedfordiella*, including many male and female specimens, has led to the conclusion that only one species should be recognised, i.e. *B. unica*, and that *B. simsi* is a junior synonym.

TAXONOMY

Abbreviations: AMNZ-Auckland Institute and Museum, Auckland, New Zealand; BMNH-British Museum (Natural History), London, England; BPBM-Bernice P. Bishop Museum, Honolulu, Hawaii, USA; NMNZ-National Museum, Wellington New Zealand; NZAC-New Zealand Arthropod Collection, DSIR, Auckland, New Zealand; RLCP-R.L.C. Pilgrim Collection, housed in NMNZ; USNM-United States National Museum of Natural History, Washington, D.C., USA.

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Bedfordiella Thompson, 1937

Bedfordiella Thompson, 1937. Ann. Mag. Nat. Hist. (10), 20: 434. Type species: *B. unica* Thompson, 1937.

The genus *Bedfordiella* was based on a single female specimen collected from the Kerguelen Petrel, *Pterodroma brevirostris* (Lesson, 1931), order Procellariiformes. Hopkins & Clay (1952) were doubtful about the validity of this genus but retained it provisionally. However, Timmermann (1961, 1965), Clay & Moreby (1967) and other authors have recognised *Bedfordiella* as a distinct genus related to *Pseudonirmus* and *Philoceanus*, also parasitic on procellariiform birds. *Bedfordiella* can be identified by referring to Thompson (1937) and Timmermann (1961).

Bedfordiella unica Thompson, 1937
(Figs 1A, 1B)

Bedfordiella unica Thompson, 1937: 434, figs 1,2 (type host: *Pterodroma brevirostris* (Lesson)). Holotype ♀ in BMNH, slide B.M. 1980-40.
Hopkins & Clay, 1952: 50 (listed only).
Timmermann, 1961: 38, figs 7,9,10.
Timmermann, 1965: 126, figs 64,65; pl. VIII, fig.4.
Clay & Moreby, 1970: 218 (listed only).
Ledger, 1980: 114, fig. 135.
Pilgrim & Palma, 1982: 8 (listed only).

Bedfordiella simsi Timmermann, 1961: 39, figs 8, 11 (type host: *Pachyptila forsteri keyteli* (Mathews, 1912) = *Pachyptila vittata vittata* (Forster, 1777); *fide* Jouanin & Mougin, 1979). Holotype ♂ in BMNH. **New synonymy**.
Timmermann, 1965: 126, fig. 66; pl. IX, fig. 1.
Clay & Moreby, 1967: 160, figs 134, 142.
Clay & Moreby, 1970: 218 (listed only).
Ledger, 1980: 115.

Both sexes of *Bedfordiella unica* (the male as *B. simsi*) have been well described and figured by Thompson (1937), Timmermann (1961, 1965), and Clay & Moreby (1967). Therefore, it has been considered unnecessary to include descriptions in this paper. Photographs of the male (Fig. 1A) and the female (Fig. 1B) are given here to assist in the identification of the genus and the species.

Material examined: All samples were collected from *Pterodroma brevirostris*. The specimens listed below are all mounted on microslides; many more preserved in alcohol from the same samples are available but have not been included here. All localities are within New Zealand, unless stated otherwise.

Kapiti Is., Jul. 1934, 4♂♂, 8♀♀(NMNZ); Portland, Victoria, Australia, 4 Aug. 1954, 3♂♂, 2♀♀(BMNH); Ohope Beach, 15 Aug. 1965, 5♂♂, 5♀♀ (NMNZ); Pukerua Bay, 24 Aug. 1972, 1♂, 1♀ (NMNZ); Oreti Beach, 26 Aug. 1972, 2♂♂ (NMNZ); Hokio Beach, 15 Sep. 1973, 3♂♂, 4♀♀(NMNZ); Ocean Beach, Tasmania, Australia, 11 Aug. 1974, 1♂, 1♀(BMNH); Mahuta, 9 Aug. 1975, 4♂♂, 4♀♀ (NMNZ); Greymouth, 12 Sep. 1975, 30♂♂, 30♀♀ (NMNZ, NZAC, AMNZ, RLCP, BMNH, BPBM, USNM); Greymouth, 14 Sep. 1975, 24♂♂, 20♀♀ (NMNZ, RLCP, BPBM, USNM); Stewart Is., 22 Sep. 1977, 2♀♀ (NMNZ); Paekakariki, 29 Jul. 1978, 6♂♂, 6♀♀ (NMNZ); Invercargill, 5 Aug. 1980, 4♂♂, 2♀♀ (NMNZ); Henderson, 7 Aug. 1980, 4♂♂ (NMNZ); Paraparaumu, 18 Sep. 1980, 5♂♂ 3♀♀ (NMNZ); Nelson, Aug.-Sep. 1980, 3♂♂, 3♀♀ (NZAC); Wellington, 18 Aug. 1981, 3♂♂, 2♀♀ (NMNZ); Otahuhu, 6 Sep. 1981, 5♂♂, 1♀ (NMNZ, AMNZ); Titahi Bay, 8 Sep. 1981, 6♂♂, 6♀♀(NMNZ); Tawa, Wellington, 26 Sep. 1981, 6♂♂, 9♀♀ (NMNZ); Waikanae Estuary, 26 Sep. 1981, 6♂♂, 6♀♀ (NMNZ); New Zealand, no date, 1♀ (NMNZ).

DISCUSSION

The history of the genus *Bedfordiella* shows the importance of having both sexes available when describing a new species of Mallophaga. Unitl now, the name *Bedfordiella unica* has been applied to females only. An unfortunate multiple coincidence, i.e. a sample comprising a single male, a case of extreme sexual dimorphism, and an accidental change of host, led Timmermann (1961) to believe that he had an undescribed species before him. Hence he described *B. simsi* from a male collected from *Pachyptila vittata* at Gough Island by the *Discovery* Expedition in 1927. Although he suspected that *P. vittata* may not have been the true host of *B. simsi*, it appears that he did not consider the possibility that its original host could have been *Pterodroma brevirostris*, the type host of *B. unica*. If he had considered it, he may have refrained from describing a new species. On two occasions, Timmermann (1961, 1965) examined the same female specimen of *B. unica*, as well as the only known specimen of *B. simsi*, i.e. the holotype male. Clay & Moreby (1967) included *B. simsi* (the male only) in their key to antarctic genera of Philopteridae and figured the holotype male. Ledger (1980) listed both species of *Bedfordiella* following Timmermann (1961, 1965) but without citing any material examined.

All specimens of *Bedfordiella* collected in the course of this study have been found on *Pterodroma brevirostris* only. Hundreds of lice samples collected from birds belonging to all the genera and most of the species currently accepted within the order Procellariiformes, from

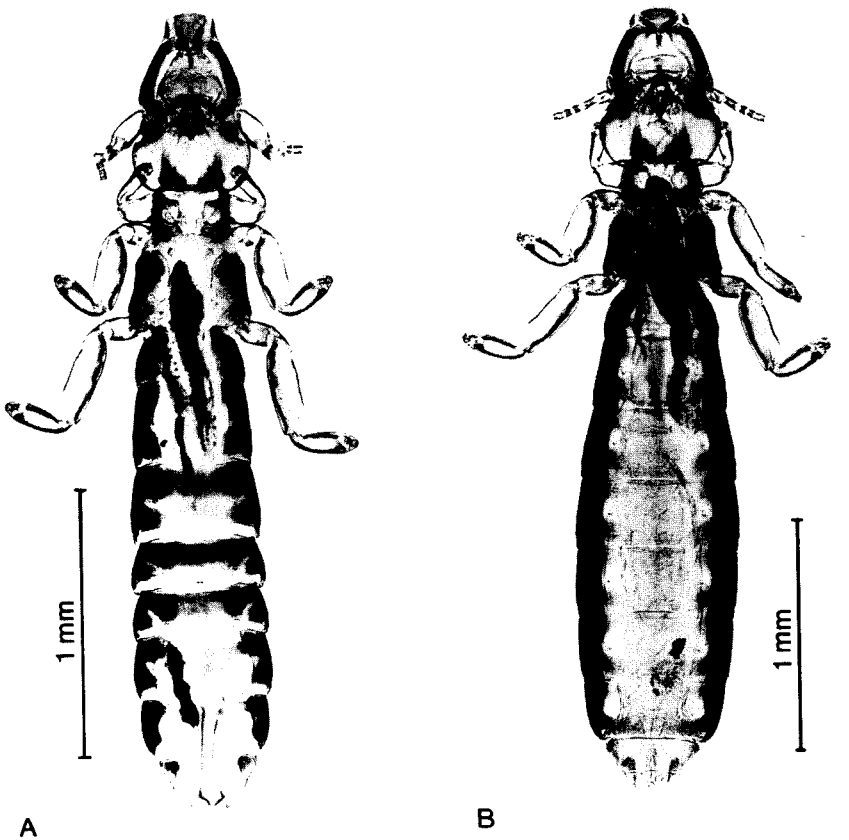

Fig. 1. *Bedfordiella unica* Thompson, 1937. A, male (Oreti Beach, N.Z.); B, female (Pukerua Bay, N.Z.). Both from *Pterodroma brevirostris*.

many different localities around the world, have been examined without finding any other host for *Bedfordiella*. Among these samples there were many from all the species of *Pachyptila* including *Pachyptila vittata*, the type host of *B. simsi*.

There are two feasible answers to the question of how the louse described as *B. simsi* was found on or associated with a specimen of *Pachyptila vittata* from Gough Island. Firstly, by natural straggling: both *Pterodroma brevirostris* and *Pachyptila vittata* breed on Gough Island, nesting in the ground (Watson, 1975). The sharing of a breeding locality gives ample opportunity for the accidental transfer of lice from one host species to another, particularly among ground nesting species. On the Snares Islands, Horning, Palma & Pilgrim (1980) reported 14 species of lice suspected of being stragglers, all associated with seabirds, including *Pachyptila vittata vittata*. The male *B. simsi* may have transferred to its type host in this way. Secondly, by an accidental contamination due to human agency: this could have occurred by placing the type host of *B. simsi* together with a specimen of *Pterodroma brevirostris*, or in a container which had previously held the latter.

Our specimens of *Bedfordiella unica* show insignificant morphological variations only, and

a small size range; the measurements of body length, head length and head width from both holotypes given in their original descriptions, all fall within the ranges given in Table 1. All our females fit all descriptions and figures given under the name *B. unica* in the synonymy. As well, all our males fit descriptions and figures published as *B. simsi*. Dr T. Clay has compared some of our specimens against the holotype male of *B. simsi* and the female *B. unica* published by Timmermann (1961, 1965) without finding any means to distinguish them.

We conclude that *Pterodroma brevirostris* is the only regular host known for *B. unica*, that the holotype male of *B. simsi* is conspecific with the many males of *B. unica* examined, and that the original host for the holotype of *B. simsi* was most likely a specimen of *Pterodroma brevirostris*.

LICE FOUND ON *PTERODROMA BREVIROSTRIS*, AND ITS MALLOPHAGAN RELATIONSHIPS WITH OTHER PETRELS

Most species and genera of feather lice are restricted to one or a few related bird taxa. This distribution is interpreted as the result of lice and host evolving together from an early stage in the evolution of the class Aves (see Clay, 1957). Consequently, lice are often considered when the relationships of their hosts are discussed (Clay, 1951).

Pterodroma brevirostris is host to five species of Mallophaga belonging to five genera, three of them in the family Menoponidae and two in the Philopteridae. Among the menoponid genera, i.e. *Ancistrona*, *Longimenopon* and *Austromenopon*, only the latter can be found on most of the birds searched for lice. The other two had been collected on very few occasions: from a total of more than 40 Kerguelen Petrels examined, only two had two specimens of *Ancistrona* each and none had *Longimenopon*; Timmermann (1957, 1965) reported two species of *Longimenopon* parasitic on *Pterodroma brevirostris*. Both *Ancistrona* and *Longimenopon* need a systematic revision before any specific name can be applied to the material available. Specimens of *Austromenopon* are referred to *A. popellus* (Piaget, 1890) *sensu lato*; this is parasitic on many different *Pterodroma* as well as on all four *Procellaria* species (Pilgrim & Palma, 1982). Although the population of *A. popellus* from *Pterodroma brevirostris* shows a slight variation from the remainder, at present it is not possible to distinguish it clearly as a different taxon.

Table 1. Measurements of *Bedfordiella unica* (mm)

Specimens	Head width	Head length	Total body length
35 ♂♂	0.445 (0.43–0.46)	0.721 (0.69–0.76)	3.017 (2.90–3.10)
♂ holotype of *B. "simsi"* (from Timmerman, 1961)	0.45	0.72	3.03
35 ♀♀	0.521 (0.51–0.55)	0.725 (0.68–0.75)	3.408 (3.34–3.53)
♀ holotype (from Thompson, 1937)	0.54	0.72	3.46
additional ♀ (from Timmermann, 1961)	0.50	0.72	3.38

The philopterid species are *Bedfordiella unica*, fully discussed in this paper, and *Saemundssonia pterodromae* Timmermann, 1959. Both can be found regularly, and usually in great numbers. *Saemundssonia pterodromae* is also frequent and abundant on the Blue Petrel, *Halobaena caerulea* (Gmelin, 1789).

Pterodroma brevirostris is also notable for some important "absences". Negative lice records are usually regarded as being of very little value when discussing host relationships because further collecting can make them "positive", rendering any previous conclusion meaningless. This notwithstanding, the evidence from more than 40 specimens of *Pterodroma brevirostris* suggests that the philopterid genera *Halipeurus*, *Naubates* and *Trabeculus* do not occur on this petrel. These genera have been found on all other *Pterodroma* species for which a comparable number of lice collections have been made; furthermore they are collected frequently and in large quantities.

The following analysis of host relationships can be made from the lice found on *Pterodroma brevirostris*:

1. The genera *Ancistrona* and *Longimenopon* give, at present, no indication of which petrel species can be regarded as related to the Kerguelen Petrel.
2. *Austromenopon popellus* shows affinities between the Kerguelen Petrel and many other species of *Pterodroma*, as well as between this genus and *Procellaria*.

3. *Saemundssonia pterodromae* is a very distinct species with no clear affinites. Timmermann (1965) placed it in the "occidentalis" group of species; this is questionable but, if it proves to be correct, it will relate the Kerguelen Petrel to the genera *Fulmarus*, *Thalassoica*, *Pagodroma* and *Daption*, rather than to *Pterodroma*. The occurrence of *S. pterodromae* on *Halobaena caerulea* can be interpreted either as clear evidence of a relationship between the Blue and Kerguelen Petrels, or as the result of a successful secondary infestation between two unrelated petrels which have several breeding localities in common (Watson, 1975). There are few other records of *Saemundssonia* from *Pterodroma* petrels, and the species are so different from *S. pterodromae* that no relationships between their hosts and *Pterodroma brevirostris* can be deduced.
4. The monotypic genus *Bedfordiella* is found only on the Kerguelen Petrel. Therefore it gives no indication of relationships between its host and any other *Pterodroma* petrel.

It is possible that the species of *Bedfordiella* occupies an ecological niche similar to those of the "missing" species of *Halipeurus* and *Naubates*; comparable considerations may be applied to *Saemundssonia* and the "missing" species of *Trabeculus*. However, this is speculative because little is known about the ecological requirements of these lice.

The louse fauna of *Pterodroma brevirostris* suggests that it be regarded as a very distinct species with the genus, perhaps in a group of its own. Timmermann (1965) placed it as a "species *incertae sedis*" together with *Pterodroma aterrima*, the latter without any record of Mallophaga; although he did not have many samples from the Kerguelen Petrel, he pointed out the special position of this bird. Jouanin & Mougin (1979) grouped *Pterodroma brevirostris* with *P. ultima*, *P. mollis* "and perhaps *P. inexpectata*" in a superspecies. The evidence from the Mallophaga known from these petrels does not fit such grouping (Pilgrim & Palma, 1982). Harper (1973) also considered *P. brevirostris* to be very distinct, both osteologically and behaviourally, from *P. mollis*. Imber (pers. comm.), in his current study of the anatomy and biology of several *Pterodroma* species, considers *Pterodroma brevirostris* to be an atypical member of the genus.

There still remain some species of *Pterodroma* with only one or no species of louse known from them: they are *P. solandri*, *P. ultima*, *P. hasitata*, *P. cahow*, *P. aterrima* and *P. baraui*. Future collecting is needed to ascertain any possible relationships with *P. brevirostris* based on their mallophagan parasites.

ACKNOWLEDGMENTS

We thank Dr T. Clay and Mr C.H.C. Lyal, London, for information related to BMNH holdings of *Bedfordiella*, and for the loan of some of the specimens studied. We acknowledge the vital cooperation of many bird collectors, especially beach patrollers, who provided most of the material examined.

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