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A 'penguin' chewing louse *Nesiotinus* on a Kerguelen Diving-petrel (*Pelecanoides urinatrix exsul*): an indication of a phylogenetic relationship?

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Summary

The confirmed discovery of an adult female of an as yet undescribed species of the genus *Nesiotinus* (Phthiraptera, Ischnocera, Philopteridae *sensu lato*) on a Kerguelen Diving-petrel appears to provide the first certain parasitophyletic evidence for a phylogenetic relationship between penguins (Sphenisciformes) and tubenoses (Procellariiformes). An overview of the hospital distribution of chewing lice genera parasitising penguins and tubenoses is given.

Keywords: Kerguelen Islands, parasitophyletic relationship, tubenosis.

Zusammenfassung

Ein 'Pinguin'-Federling der Gattung *Nesiotinus* vom Lummensturmvogel (*Pelecanoides urinatrix exsul*): ein Hinweis auf Verwandtschaft?

Der authentische Fund eines adulten Weibchens einer noch unbeschriebenen Art der Gattung *Nesiotinus* (Phthiraptera, Ischnocera, Philopteridae sensu lato) auf dem Lummensturmvogel der Kerguelen gibt Anlass zu der Annahme, damit auf das erste sicher erscheinende parasitophyletische Indiz für die Verwandtschaft von Pinguinen (Sphenisciformes) und Sturmvögeln (Procellariiformes) gestoßen zu sein. Es wird eine Übersicht über die hospitale Verbreitung der auf Pinguinen und Sturmvögeln bisher nachgewiesenen Federlingsgattungen gegeben.

Chewing lice (Insecta, Phthiraptera) inhabit the plumage of all recent bird species. They have established themselves on their hosts, probably since the Cretaceous Period over 100 M.Y. ago, as permanent-obligate ectoparasites in a multitude of host-specific forms. The evolutionary-historical aspect of this phenomenon is expressed in the so-called parasitophyletic correlation rules. The basic concept is contained in the Fahrenholz (or Nitzsch-Kellogg) principle (not law!) formulated by Wolfdietrich Eichler: 'The occurrence of the same, or closely related, parasites on related animal species is most convincingly explained by the theory originating with Fahrenholz and his school that the parasites in question were already parasitic on the common ancestor of these hosts' (Eichler 1941, 1990). In fact, each avian order harbours a unique suite of chewing lice genera. This phenomenon of host-parasite co-speciation is employed by the discipline of comparative parasitology, which searches for

clues to the degree of relatedness of different avian groups by studying their parasites (Timmermann 1965, Mauersberger & Mey 1993). Recent critical verifications have not only confirmed the hypothesis in some cases but have also shown its great methodological value (Demastes & Hafner 1993, Gregory 1997, Hoberg et al. 1997, Paterson & Gray 1997, Paterson et al. 1993, 1995).

In this connection, the discovery of an as yet undescribed *Nesiotinus* chewing louse species on an adult specimen of a Kerguelen Diving-petrel *Pelecanoides urinatrix exsul* trapped in mist-net on Mayes Island in the Golfe du Morbihan, Kerguelen Islands (49° 28′ S, 57° E) in October 1990 by O. Chastel (see Chastel et al. 1995) throws new light on the phylogenetic relationship between penguins and the order Procellariiformes (the tubenoses or petrels). The highly distinctive Ischnocera genus *Nesiotinus* was previously known from a single species only, *N. demersus* Kellogg, which has often, and exclusively, been recorded on the King Penguin *Aptenodytes patagonicus*. The new species, unfortunately known only from a single adult female (prep. M. 3662.) deposited at the Museum of Natural History in Rudolstadt, is only half the size of *N. demersus* and also distinctly different in a series of morphological characters, so that there can be no doubt that it is a different species (Fig. 1; description by Mey in prep.). Although this does not mean that a definite statement can be made as to whether the occurrence of *Nesiotinus* sp. on the Kerguelen Diving-petrel is the result of host-switching (secondary infestation) or of

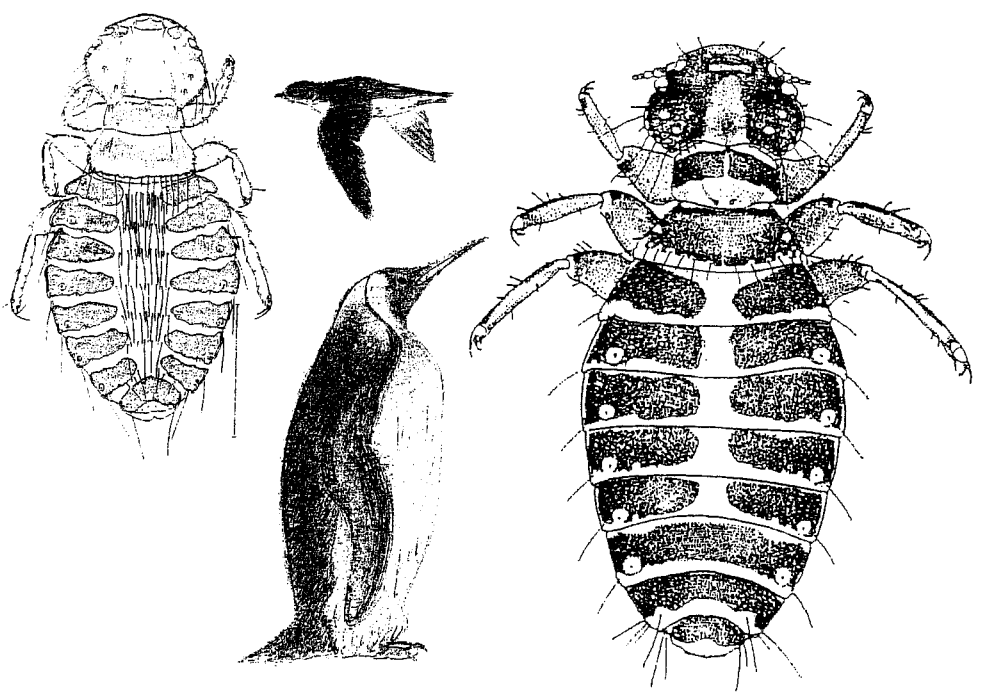

Fig. 1. The Ischnocera (both female, dorsal view) *Nesiotinus* sp. (body length 2.5 mm) from Kerguelen Diving-petrel (left) and *Nesiotinus demersus* (c. 5 mm) from King Penguin, and size of hosts shown in proportion. Drawings: E. and Franziska Mey, *N. demersus* after Kellogg (1903).

Abb. 1. Die Ischnozeren (jeweils Weibchen, dorsal) *Nesiotinus* sp. (Körperlänge 2,5 mm) vom Lummensturmtaucher (links) und *Nesiotinus demersus* (ca. 5 mm) vom Königspinguin, jeweils in proportionaler Größe. Zeichnungen: E. und Franziska Mey, *N. demersus* aus Kellogg (1903).

Table 1. The genera of chewing lice (Phthiraptera, suborders Amblycera and Ischnocera; in brackets number of species*) parasitising Penguins and Tubenoses and their occurrence on other birds.

Tab. 1. Die auf Pinguinen und Sturmvögeln lebenden Federlingsgattungen (Phthiraptera, Unterordnungen Amblycera und Ischnocera; in Klammern Anzahl ihrer Arten*) und ihr Vorkommen auf anderen Vogelgruppen.

(*Taken from/Entnommen: Clay 1967, Clay & Moreby 1967, Emerson & Price 1971, Palma 1994, Palma & Pilgrim 1983, 1984, 1987, Price & Clay 1972, Timmermann 1965).

	Sphenisciformes		**Procellariiformes**			**Other bird orders or groups**
	Spheniscidae	Diomedeidae	Procellariidae	Hydrobatidae	Pelecanoididae	
Amblycera						
Menoponidae *sensu lato*						
Longimenopon Thompson, 1948 (5)*			x	x		'–
Ancistrona Westwood, 1874 (1)			x	x		'–
Austromenopon Bedford, 1939 (c. 20)**		x	x	x	x	Charadriiformes, Phaethondidae
Ischnocera						
Philopteridae *sensu lato*						
Austrogoniodes Harrison, 1915 (10)	x					one exception'+
Cesareus von Kéler, 1952 (5)***	x					'–
Nesiotinus Kellogg, 1903 (2)	x				x	'–
Docophoroides Giglioli, 1864 (8)		x	x			'–
Saemundssonia Timmermann, 1936 (c.20)			x	x		Charadriiformes, Phaethondidae, Gruidae
Puffinoecus Eichler, 1949 (9)****			x			'–
Trabeculus Rudow, 1866 (6)			x			'–
Episbates Thompson, 1935 (1)		x				'–
Philoceanus Kellogg, 1903 (6)				x		'–
Perineus Thompson, 1936 (6)*****		x	x			'–
Pseudonirmus Mjöberg, 1910 (3)			x			'–
Naubates Bedford, 1930 (8)		?	x	?		'–
Bedfordiella Thompson, 1937 (1)			x			'–
Harrisoniella Bedford, 1929 (4)		x				'–
Paraclisis Timmermann, 1965 (6)		x	x			'–
Halipeurus Thompson, 1936 (26)						'–
Subgenera: *Halipeurus* (23)			x		x	'–

Table 1. (continue)
Tab. 1. (Fortsetzung)

	Sphenisciformes	Procellariiformes				Other bird orders or groups
	Spheniscidae	Diomedeidae	Procellariidae	Hydrobatidae	Pelecanoididae	
Synnautes Thompson, 1936 (2)				x		–
Anamias Timmermann, 1965 (1)				x		–
Pelmatocerandra Enderlein, 1908 (3)					x	–

*Near related with *Actornithophilus* Ferris, occurring in numberous species on Charadriiformes. Dubious are records of *Clypeodon* Timmerman, 1954 on some Procellariidae.
**Including *Procellariphaga* Eichler, 1949 which represented a species group maybe in generic rank. Arguments against this opinion see Clay & Moreby (1967).
***Close related to *Austrogoniodes*. Sometimes used as synonym of *Austrogoniodes*.
****Sometimes referred to as subgenus of *Saemundssonia* (see Mey 1989 and Palma 1994).
*****Near related with *Haffneria* Timmermann, 1966 occurring on Stercorariidae (and stragglers ? on Laridae) only.
'+ *Austrogoniodes metoecus* Clay on an Australian Musk Duck *Biziura lobata* is an example of secondary infestation or host switching (see Mauersberger & Mey 1993)

much older phylogenetic origin, it can be deduced from the overall biological situation that the chewing louse in question is host specific. This individual thus provides us with the first parasitophyletic indication of a relationship between penguins and tubenoses, which has in general already been regarded as more than likely by the ornithological community (Carboneras 1992, Martinez 1992, Sibley & Ahlquist 1990). The presence of the Cestoda (tapeworm) genus *Tetrabothrius* in penguins and tubenoses, as well as in whales, appears to be irrelevant in this context since it can be explained by ecological factors. As far as is known, in addition to *Nesiotinus,* penguins are host to only two other Ischnocera genera (closely related to each other), which are, with one exception (see Table 1), restricted to penguins, namely *Austrogoniodes* and *Cesareus.* Tubenoses by contrast are infested by three Amblycera and 13 Ischnocera genera, of which (e.g.) *Longimenopon* and *Ancistrona* of the former and *Docophoroides* and *Episbates* of the latter are highly characteristic (Table 1). However, on the four diving-petrel species, which are traditionally regarded as forming the family Pelecanoididae within the Procellariiformes (Carboneras 1992), this diversity appeared until now to have been reduced to just *Austromenopon, Halipeurus,* and *Pelmatocerandra,* the last being restricted to the family. The even closer relationship postulated between penguins and divers Gaviidae (Sibley & Ahlquist 1990) is so far completely unsupported by the mallophagological evidence. The only Ischnocera genus known from the divers, *Craspedonirmus,* is not closely related to either penguin nor tubenose chewing lice.

The many gaps remaining in our current parasitophyletic knowledge will only be closed by more intensive collecting activity (paired with a good deal of luck).

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References

Carboneras, C. (1992): Order Procellariiformes. In: del Hoyo, J., Elliott, A. & Sargatal, J. (Eds.): Handbook of the Birds of the World, Vol. 1: 198–278. Barcelona.

Chastel, O., Weimerskirch, H. & Jouventin, P. (1995): Body condition and seabird reproductive performance: a study of three petrel species. Ecology 76: 2240–2246.

Clay, T. (1967): Mallophaga (biting lice) and Anoplura (sucking lice). Part I: *Austrogoniodes* (Mallophaga) parasitic on penguins (Sphenisciformes). Antarctic Res. Ser. 10 (Entomol. Antarctica): 149–155.

Clay, T. & Moreby, C. (1967): Mallophaga (biting lice) and Anoplura (sucking lice). Part II: Keys and Locality of Mallophaga and Anoplura. Antarctic Res. Ser. 10 (Entomol. Antarctica): 157–196.

Demastes, J. W. & Hafner, M. S. (1993): Cospeciation of Pocket Gophers (*Geomys*) and their chewing lice (*Geomydoecus*). J. Mamm. 74, 521–530.

Eichler, W. (1941): Wirtsspezifität und stammesgeschichtliche Gleichläufigkeit (Fahrenholzsche Regel) bei Parasiten im allgemeinen und bei Mallophagen im besonderen. Zool. Anz. 132: 254–262.

Eichler, W. (1990): Koevolutionsaspekte des Parasitismus aus neuer Sicht. Rudolstädter nat.hist. Schr. 3: 19–31.

Emerson, K. C. & Price, R. D. (1971): A new species of *Pelmatocerandra* from a Diving Petrel (Mallophaga: Philopteridae). Proc. Entomol. Soc. Washington 73: 211–213.

Gregory, R. D. (1997): Comparative studies of host-parasite communities. In: Clayton, D. H. & Moore, J. (Eds.): Host-Parasite Evolution General Principles and Avian Models: 198–211. Oxford.

Hoberg, E. P., Brooks, D. R. & Siegel-Causey, D. (1997): Host-parasite co-speciation: history, principles, and prospects. In: Clayton, D. H. & Moore, J. (Eds.): Host-Parasite Evolution General Principles and Avian Models: 212–235. Oxford.

Kellogg, V. L. (1903): Two new genera of Mallophaga. Biol. Bull. Boston 5: 85–91.

Mauersberger, G. & Mey, E. (1993): Mallophagen und Vogelsystem – Beitrag zur Diskussion der "Parasitophyletik". Mitt. Zool. Mus. Berl. 69, Suppl.: Ann. Ornithol. 17: 3–30.

Martinez, I. (1992): Order Sphenisciformes. In: del Hoyo, J., Elliott, A. & Sargatal, J. (Eds.): Handbook of the Birds of the World, Vol. 1: 140–160. Barcelona.

Mey, E. (1989): Ein neuer Sturmvogelfederling (Insecta, Phthiraptera) aus dem Südatlantik. Rudolstädter nat.hist. Schr. 2: 51–56.

Palma, R. L. (1994): New synonymies in the lice (Insecta: Phthiraptera) infesting albatrosses and petrels (Procellariiformes). N. Zealand Entomologist 17: 64–69.

Palma, R. L. & Pilgrim, R. L. C. (1983): The genus *Bedfordiella* (Mallophaga: Philopteridae) and a note on the lice from the Kerguelen Petrel (*Pterodroma brevirostris*). Nat. Mus. N. Zealand Rec. 2: 145–150.

Palma, R. L. & Pilgrim, R. L. C. (1984): A revision of the genus *Harrisoniella* (Mallophaga: Philopteridae). N. Zealand J. Zool. 11: 145–166.

Palma, R. L. & Pilgrim, R. L. C. (1987): A revision of the genus *Perineus* (Phthiraptera: Philopteridae). N. Zealand J. Zool. 14: 563–586.

Paterson, A. M., Gray, R. D. & Wallis, G. P. (1993): Parasites, Petrels and Penguins: does Louse Presence Reflect Seabird Phylogeny? Int. J. Parasitol. 23: 515–526.

Paterson, A. M., Gray, R. D. & Wallis, G. P. (1995): Of Lice and Men: The Return of the 'Comparative Parasitology' Debate. Parasitol. Today 11: 158–160.

Paterson, A. M. & Gray, R. D. (1997): Host-parasite co-speciation, host switching, and missing the boat. In: Clayton, D. H. & Moore, J. (Eds.): Host-Parasite Evolution General Principles and Avian Models: 236–250. Oxford.

Price, R. D. & Clay, Th. (1972): A review of the genus *Austromenopon* (Mallophaga: Menoponidae) from the Procellariiformes. Ann. Entomol. Soc. Am. 65: 457–504.

Sibley, C. G. & Ahlquist, J. E. (1990): Phylogeny and classification of birds. A study in Molecular Evolution. New Haven.

Timmermann, G. (1965): Die Federlingsfauna der Sturmvögel und die Phylogenese des procellariiformen Vogelstammes. Abh. Verh. Naturwiss. Ver. Hamburg N. F. 7: Suppl., 250 pp. + 12 Taf.

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