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LATAGOPHTHIRUS RAUSCHI, NEW GENUS AND NEW SPECIES (ANOPLURA: ECHINOPHTHIRIIDAE) FROM THE RIVER OTTER (CARNIVORA: MUSTELIDAE)[1]

By **Ke Chung Kim[2] and K. C. Emerson[3]**

Abstract: This paper presents the descriptions of a new genus and new species, *Latagophthirus rauschi*, collected from the river otter, *Lutra canadensis pacifica* Rhoads, in Coos County, Oregon. The family Echinophthiriidae is redefined, and a key to the genera is provided. The evolutionary significance of *Latagophthirus* is also discussed.

The sucking lice of the Echinophthiriidae were previously known only from marine carnivores of the order Pinnipedia. The echinophthiriids are so highly specialized that their affinities are quite obscure. The Echinophthiriidae include 4 distinct genera: *Antarctophthirus* Enderlein (6 species), *Lepidophthirus* Enderlein (2 species), *Echinophthirius* Giebel (monotypic), and *Proechinophthirus* Ewing (2 species) (Kim et al. 1974).

No anopluran has ever been found on the fissiped carnivores except for *Linognathus* on the Canidae. *Linognathus* are primarily lice of the Artiodactyla, mainly Bovidae, Giraffidae and Cervidae. The sucking louse described in this paper is the first finding of an "indigenous" species from the fissiped Carnivora.

Dr R. L. Rausch of the Arctic Health Research Center, U. S. Public Health Service made the material of this new taxon available for study. The specimens studied were collected by Mr Chris Maser of the University of Puget Sound in Tacoma, Washington, and Mr James E. Tabor of the Oregon State University, Corvallis, Oregon, from 1 male and 1 female of *Lutra canadensis pacifica* Rhoads in Coos County, Oregon. Mr Tabor has examined 11 more otters and found no lice. The senior author has made further efforts to collect more specimens from the river otter and the sea otter. Two hides of the river otter, *Lutra canadensis* (Schreber), collected in Luzerne Co., Pennsylvania, were made available for study by the Pennsylvania Game Commission. No lice were obtained from these hides. The California Department of Fish and Game provided us with 4 hides of the sea otter, *Enhydra lutris* (Linnacus), for study. Again, they harbored no lice.

In this paper the descriptions of a new genus and new species, *Latagophthirus rauschi*, are presented, and the family Echinophthiriidae is redefined. A key to the genera of the Echinophthiriidae is provided. The evolutionary significance of *Latagophthirus* is also discussed.

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LATAGOPHTHIRUS, n. gen.

Description: Anoplura without external evidence of eyes and sclerotized abdominal plates. *Head* moderately sclerotized; antennae not sexually dimorphic, 3-segmented in only known species; the 2 sensoria very small and closely associated together on terminal segment; terminal segment about as long as or slightly longer than basal segment; occipital apophysis not strongly developed. *Thorax* dorsally with strongly sclerotized phragmata; mesothoracic phragmata connected across the notum; notal pit indistinct; sternal plate absent. *Legs:* Forelegs small and weak, with unmodified tarsus and acuminate claw; mid- and hindlegs very large, stout and similar in shape and size, each with modified tibia-tarsus and blunt claws. *Abdomen* completely membranous, large and oval, without distinct tergal, sternal or paratergal plates; dorsally and ventrally densely covered with setae, pegs and scales; 6 spiracles present, each with a specialized closing apparatus and very small spiracular opening. ♀ without definite gonopods, and ♂ with genital apodeme, V-shaped pseudopenis and elongated parameres.

Type-species: *Latagophthirus rauschi*, n. sp., by monotypy.

Latagophthirus is closely related to but is distinctly different from *Antarctophthirus*, by having the 3-segmented antennae in both nymphal and imaginal stages. In *Latagophthirus* no trace of the notal pit is found on the thoracic dorsum and the occipital apophyses are not developed. The spiracular atrium is slender and tubular, as in *Antarctophthirus*, but the spiracular opening is extremely small.

The name *Latagophthirus* is derived from Gr. *latax, -agos*, f. (otter) and Gr. *phtheir*, -os, m. (louse), meaning the otter louse.

Latagophthirus rauschi, n. sp. FIG. 1–7

Type data: Holotype ♂, allotype ♀, and 35 paratypes which include 2 ♂♂, 4 ♀♀ and 29 nymphs, ex *Lutra canadensis pacifica* Rhoads, 1.6 km NE of Broadbent, Coos Co., Oregon (T 29 S, R 12 W, cent. Sec. 28, elevation 15 m), 20.VII.1971, Chris Maser & James E. Tabor (Rausch 39741). These specimens were found on the head and neck of the

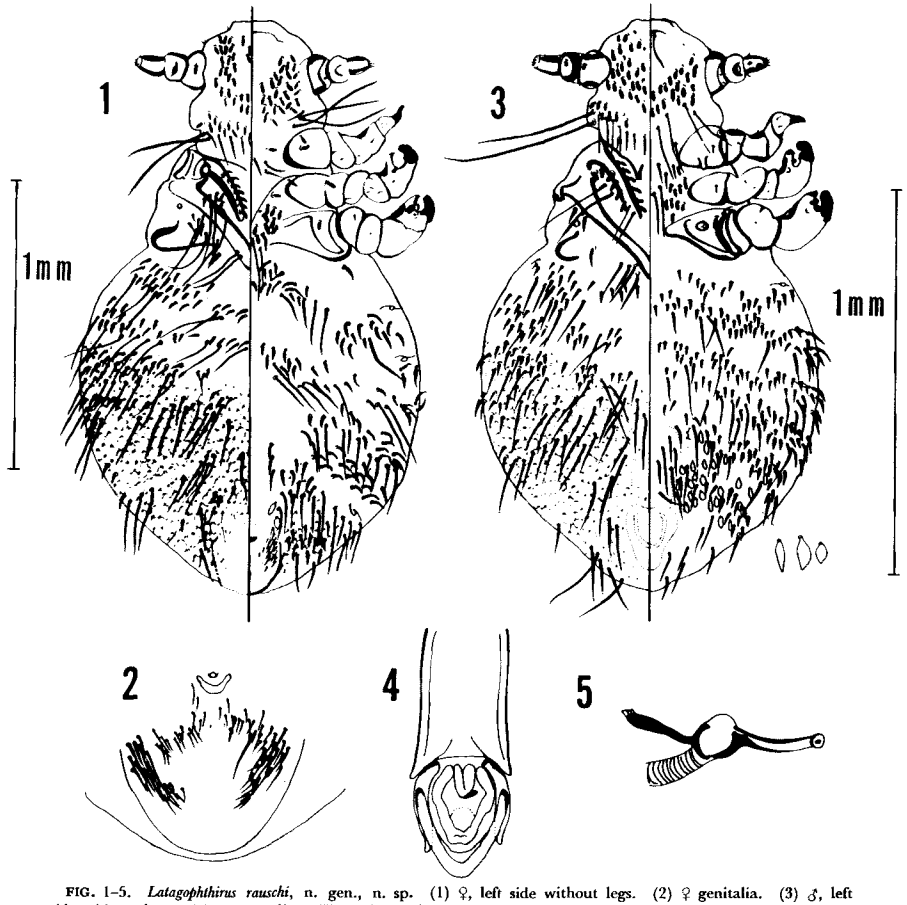

FIG. 1–5. *Latagophthirus rauschi*, n. gen., n. sp. (1) ♀, left side without legs. (2) ♀ genitalia. (3) ♂, left side without legs. (4) ♂ genitalia. (5) Abdominal spiracle.

host. Holotype and allotype and several paratypes are deposited in the collection of the National Museum of Natural History, Smithsonian Institution, and some paratypes are deposited in the collections of The Frost Entomological Museum, The Pennsylvania State University and the K. C. Emerson Entomological Museum, The Oklahoma State University, Stillwater, Oklahoma.

Description: ♂ (FIG. 2–5): Total body length 1.50 mm ($\bar{X}$, n = 3). *Head* about as wide as or wider than long: anterior margin heavily sclerotized; postantennal and posterolateral angles not developed, but lateral margin strongly convex; occiput lightly sclerotized, with weakly sclerotized apophyses; dorsum anteriorly with numerous peg-like setae mixed with weak normal setae and posteriorly with 2 long lateral principal setae, pegs and normal setae of various sizes; venter with 2–3 diagonal rows of pegs and 4 long setae on each side. Antennae short and 3-segmented; each segment heavily sclerotized; basal and 2nd segments each with 1 distinct peg-like seta, terminal segment slightly longer than basal segment, with 2 small sensoria and 6–8 peg organs. *Thorax* about as long as head, with many setae of various lengths and shapes both dorsally and ventrally, but without scales; prothoracic phragma long but not reaching mesothoracic phragma; mesothoracic phragmata continuous across notum; notal pit indistinct; metathoracic phragma poorly developed; pronotal area with 2 diagonal rows of pegs and long setae; mesothoracic spiracle very small, anteriorly with 22 spiniform setae; no sternal plate; sternum with pegs and setae. *Legs:* Forelegs small and weak with unmodified tarsus and acuminate claw; mid- and hindlegs very large, stout and similar in shape, each with modified tibio-tarsus, tibial thumbs and blunt claws; forecoxa with subapical spur; mid- and hindcoxae each with a seta. *Abdomen* large and oval, without distinct tergites, sternites and paratergites; 6 spiracular openings present on segments 3 to 8; dorsally with irregularly arranged rows of setae of various sizes and shapes including pegs and scales, and particularly in the posterior 1/2 with dense scales; venter with irregularly arranged rows of setae of various sizes and shapes, and the posterior 1/3 with scattered scales; scales variable in size and shape but usually pointed at apex; anal segment not prolonged. *Genitalia* (FIG. 4): Basal apodeme short and broad; parameres short and slender, with pointed apex; pseudopenis V-shaped and rounded at apex; endomere heavily sclerotized and posteriorly flattened; aedeagus sclerotized.

♀ (FIG. 1): Total body length 1.99 mm ($\bar{X}$, n = 4). Head, thorax, legs and abdomen as in ♂ except for usual sexual dimorphism. Forecoxa without subapical spur. *Genitalia* (FIG. 2) without distinct genital plate, gonopods and spermatheca; genital area elevated; genital opening surrounded by numerous setae; no special genital setae present.

NYMPH 1: Unknown.

NYMPH 2: (FIG. 7): Total body length 1.04 mm ($\bar{X}$, n=8), range 0.974–1.14 mm. *Head* about as long as wide; labroclypeal area sclerotized; post-antennal and posterolateral angles not developed; anterior 1/2 of head with pegs and weak normal setae, and posterior head with long setae mixed with a row of pegs. Antennae 3-segmented; terminal segment slightly longer than basal segment, with 2 small sensoria; basal and 2nd segments each dorsally with a peg. *Thorax* dorsally with sclerotized phragmata; all phragmata connected; mesothoracic phragmata separated medially; pronotum with 5 or more pegs and normal setae, and mesonotum and metanotum each with 2 pegs. *Legs* as in adult. *Abdomen* short and oval, with no indication of tergites, sternites or paratergites; spiracles indistinct; dorsally with setae, pegs and scales; venter with almost no scales.

NYMPH 3: (FIG. 6): Total body length 1.30 mm ($\bar{X}$, n=11), range 1.18–1.62 mm. Body with setae, pegs and scales, denser than in nymph 2. Head, thorax and abdomen same as in nymph 2, unless mentioned otherwise. *Head* ventrally with 35 or 40 pegs and 6–8 long setae. *Thorax* with larger number of pegs and setae. *Abdomen* almost circular and densely covered with normal setae, pegs and scales; ventrally with scattered scales in addition to pegs and setae; female nymphs with 2 converging rows of variously-sized "sex setae."

Remarks: This species is named after Dr R. L. Rausch for his contribution to Arctic parasitology.

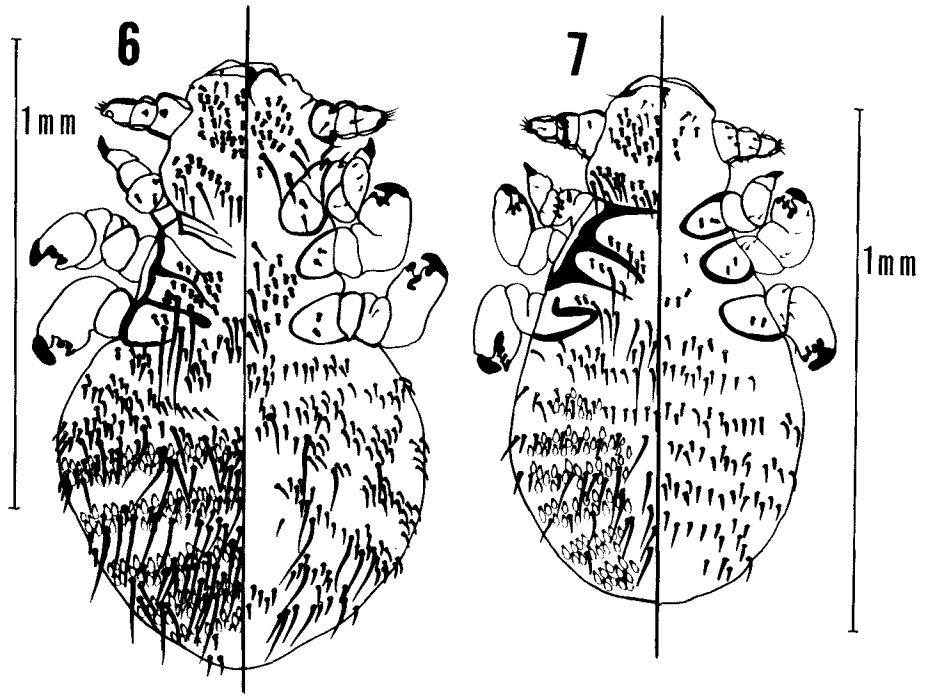

FIG. 6–7. *Latagophthirus rauschi*, n. gen., n. sp. (6) Nymph 3. (7) Nymph 2.

Family ECHINOPHTHIRIIDAE

Description: Large Anoplura; body thickly beset with various setae, spiniform setae, scales and pegs, in addition to regular setae. *Head* with no external eyes and long setae; antennae 3-, 4- or 5-segmented; occipital apophyses elongated, either divided or entire. *Thorax* with well developed phragmata; mesothoracic phragma connected across dorsum, usually enclosing notal pit; no sternal plate present. *Legs:* Mid- and hindlegs large and similar in size and shape, with blunt claw; tibital thumb elaborate, with several short, blade- or peg-like apical setae;

forelegs small and slender, with acuminate claw except in *Echinophthirius* which has large forelegs similar to midlegs. *Abdomen* completely membranous or leathery, with no sclerotized plates and usually with various types of setae including pegs and scales; 6 spiracles, small and of distinctive type, each with a long, slender atrial chamber and a long chitinous rod. *Genitalia:* ♂ with large basal apodeme and well developed parameres; pseudopenis U- or V-shaped or apically open. ♀ with no gonopods and no genital lobe; genital plate poorly developed; no distinct spermatheca present; vagina surrounded by thick patches of long setae.

Type-genus: *Echinophthirius* Giebel, 1871.
[Type-species: *E. horridus* (Olfers)].

Key to genera of Echinophthiriidae

1. Antennae 3-segmented; on *Lutra* (river otter).....
.....**Latagophthirus** Kim & Emerson
Antennae 4- or 5-segmented; on Pinnipedia (marine carnivores) 2
2. Forelegs small and slender, with acuminate claw, completely different from other legs.....3
Legs all of same size and shape, with stout claw; on phocine Phocidae (various seals).....
.....**Echinophthirius** Giebel
3. Abdomen without scales; ♀ with genital setae horizontally arranged; ♂ pseudopenis U-shaped; antennae 4-segmented; on *Callorhinus*, *Arctocephalus* (fur seals) and occasionally *Eumetopias* (sea lions).....
.....**Proechinophthirus** Ewing
Abdomen with scales and pegs in addition to regular setae; ♂ pseudopenis V-shaped or not fused apically.....4
4. Body moderately slender; head longer than wide; adult antennae 5-segmented; thorax narrowly connected to abdomen; ♀ with patches of genital setae convergently arranged; ♂ pseudopenis V-shaped; on a wide range of Pinnipedia.....**Antarctophthirus** Enderlein
Body wide and compact; head wider than long; adult antennae 4-segmented; thorax broadly connected to abdomen; ♀ with patches of genital setae divergently arranged; ♂ pseudopenis not fused apically; on *Mirounga* (elephant seals) and *Monachus* (monk seals)...
.....**Lepidophthirus** Enderlein

Note on evolution of Echinophthiriidae

The lice of the Echinophthiriidae are exclusively parasitic on aquatic carnivores, namely Pinnipedia and aquatic Mustelidae. They are highly specialized and have unique morphological traits which are not found in other groups of Anoplura. Morphological adaptation is striking in spiracles, setae and abdomen. The spiracular structure is highly modified with an elongated atrial tube and a sophisticated closing apparatus, and the abdomen is completely membranous and covered with various types of setae; namely, normal setae, spiniform setae, pegs and scales (Kim 1971). This morphological uniqueness must be an evolutionary manifestation of the continuous selection and adaptation by the sucking lice of the aquatic carnivores to 2 contrasting environments.

The Echinophthiriidae are quite host-specific. *Proechinophthirus* is found exclusively on the Arctocephalinae (fur seals), and *Echinophthirius* is exclusively parasitic upon the phocine Phocidae. *Lepidophthirus* is found on the monachine Phocidae. *Antarctophthirus* is the most diverse genus and includes 6 known species from a wide range of pinniped hosts (Kim et al. 1974). *Latagophthirus* is so far known from *Lutra canadensis*, the only mustelid known to harbor sucking lice.

Because of the behavior of pinnipeds, louse transmission is rather difficult between 2 host species. There is very little opportunity for 2 seals or 2 different pinniped species to come in contact at sea (Kim 1974). On land, pinnipeds occupy their distinct territory for each species and aggregate exclusively in their territory, although occasional interspecies contacts are possible.

These facts on morphological traits, host specificity and louse transmission strongly suggest that the echinophthiriids must have evolved with the pinnipeds and aquatic fissipeds, after the ancestral carnivores ventured into aquatic habitats. Unquestionably, this biological specialization is the result of adaptation to the aquatic environment by the Echinophthiriidae, as the sucking lice are essentially terrestrial insects.

Hopkins (1949) defined primary infestations as those which date back at least from the period when the group of hosts diverged from the ancestral stock. In primary infestations almost every member of a given group of mammal is infested with lice closely related to those found on other members of the group. Secondary infestations, according to Hopkins, comprise those infestations originating after divergence of a host group from its parent stock. Hopkins also discussed at length the concept of secondary absence. This refers to instances whereby in a given group of hosts the distribution of parasites which at some time in the past was widespread is now discontinuous, resulting from extinction of the parasite throughout some or a majority of its host range.

Although Hopkins speculated that the lack of "indigenous" lice on land carnivores represents a secondary absence of what was once a primary infestation in the Carnivora, there has been no previous corroborative evidence to support his view.

In view of the difficulty of louse transmissions among different host species and the unlikelihood of contact between pinnipeds and terrestrial mammalian hosts, the forerunners of the Echinophthiriidae can be presumed to have originated on the fissiped ancestors of seals before they adopted a marine life. The finding of a new echinophthiriid louse on an aquatic fissiped carnivore lends support to the thesis that the Echinophthiriidae are the highly specialized descendants of a group of ancient primary parasites of the Carnivora, and that the absence of this group on land fissipeds is a case of secondary absence.

Linognathus, which are occasionally found on the Canidae, are primary parasites of the Artiodactyla. Of 48 known species of *Linognathus*, only 4 species are found on the Canidae, and thus the occurrence of *Linognathus* on the Canidae must also be considered secondary and rather recent.

Proechinophthirus is the most generalized taxon among 12 species of the Echinophthiriidae. This louse lacks typical scales, although spiniform setae and pegs are present. *Proechinophthirus*, as exemplified by *P. fluctus*, differs from other echinophthiriids by inhabiting the fur and underfur, essentially equivalent to a terrestrial environment. The generalized morphology and specific habitat preference strongly suggest that *Proechinophthirus* may be the most primitive group of the known echinophthiriids. Furthermore, the fur seals are considered the more primitive otariid seals (Kim et al. 1974).

Latagophthirus has 3-segmented antennae, which is unique among echinophthiriids, and lacks a distinct notal pit. Although many morphological features are similar to those of *Antarctophthirus*, it is uncertain at this time whether *Latagophthirus* is a descendent of *Proechinophthirus-Antarctophthirus* stock or of entirely different lineage with convergent morphological similarities.

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