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Two new species of *Neophysobates* (Acari, Oribatida, Tegeribatidae) from New Zealand

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ABSTRACT — Two new species of oribatid mites of the monotypic genus *Neophysobates* (Oribatida, Tegeribatidae) from high alpine cushion fields in the Pisa Range, South Island, New Zealand are described. *Neophysobates zealandicus* n. sp. differs from *N. monodactylus* by the presence of bothridial seta with simple stalk and clavate, rounded distally head, a short adanal lyrifissure, and thickened seta *pv*'' with attenuate tip on tarsus II. *Neophysobates incrassatus* n. sp. differs from *N. monodactylus* by the presence of bidactylous legs, three pairs of notogastral porose areas, thin rostral seta and tutorium without free tip. An identification key to the known species of *Neophysobates* is provided.

KEYWORDS — oribatid mites; Tegeribatidae; *Neophysobates*; new species; morphology; systematics; key; alpine fauna; New Zealand

INTRODUCTION

Neophysobates is a monotypic oribatid mite genus (Acari, Oribatida, Tegeribatidae), which was proposed by Luxton (1985) under the name *Paraphysobates*, with *Physobates monodactylus* Hammer, 1966 as type species. Later, Luxton (1987) proposed the replacement name (*Neophysobates*), because the name *Paraphysobates* was preoccupied (see Mahunka 1985). Apparently unaware of this action, Fujikawa (1991) proposed another replacement name – *Pseudophysobates*. As it has the same type species, *Pseudophysobates* is an objective junior synonym of *Neophysobates*, and the synonymy was first noted by Subías (2004).

Subías (2004) also included *Tegeribates montana* Engelbrecht, 1986 and *T. nuda* Engelbrecht, 1986 (both from South Africa) in *Neophysobates*. How-

ever, these species have lamellae with anterior incision, three pairs of adanal setae, and very long bothridial setae with stalk not enclosed by bothridia (also, *T. nuda* has sacculi on notogaster), therefore, the inclusion of these species in *Neophysobates* seems to be problematic and their systematic position should be investigated further.

The main generic characters of *Neophysobates* are (based on data from Luxton (1985) and including our additions): fused lamellae broadly rounded anteriorly, without anterior incision; interlamellar seta and its alveolus absent; bothridial seta clavate or fusiform, stalk enclosed in bothridium; anterior part of pteromorph at the same level as anterior notogastral margin; three or four pairs of porose areas on notogaster; ten pairs of minute notogastral setae; five or six pairs of genital setae; aggenital se-

tae present or absent; two pairs of adanal setae; legs mono- or bidactylous.

During a recent study of the oribatid mite fauna of the high alpine zone of several mountain ranges in Central Otago, South Island, New Zealand (Ermilov and Minor 2015a-c), we discovered two new species of the genus *Neophysobates*. The main goal of our paper is to describe and illustrate these taxa. Additionally, we provide an identification key for the three known species of *Neophysobates*.

MATERIALS AND METHODS

The new species were found in the high alpine zone of Central Otago mountains, at elevations ranging 1700 – 1800 m a.s.l. The area is an exposed alpine environment with low mean annual temperatures (ca. 2 degrees C) and frequent freeze-thaw cycles (Mark and Bliss 1970). The vegetation is dominated by dwarf cushion shrubs *Dracophyllum muscoides* (Ericaceae) and *Raoulia* spp. (Compositae) on crests of small (15 – 30 cm) cryogenic earth hummocks and stripes; between hummocks and stripes there is bare soil with some herbaceous plants and lichens (Mark and Bliss 1970). The collection locality and habitat for each new species are given in the respective "Material examined" sections. Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. The body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate. Notogastral width refers to the maximum width in dorsal aspect. Lengths of body setae were measured in lateral aspect. All body measurements are presented in micrometers. Formulas for leg setation are given in parentheses according to the sequence trochanter-femur-genu-tibia-tarsus (famulus included). Formulas for leg solenidia are given in square brackets according to the sequence genu-tibia-tarsus. General terminology used in this paper follows that of Grandjean (summarized by Norton and Behan-Pelletier 2009). Drawings were made with a drawing tube using a Carl Zeiss transmission light microscope "Axioskop-2 Plus".

Neophysobates zealandicus n. sp. (Figures 1-3)

Diagnosis — Body size: 233 – 254 × 143 – 172. Rostral seta thickened, heavily barbed. Lamellar seta thin, smooth. Bothridial seta clavate, stalk simple, head rounded distally, slightly barbed. Tutorium with free, knife-like tip. Four pairs of notogastral porose areas. Six (rarely five) pairs of genital setae. Aggenital setae present. Legs monodactylous.

Description: Measurements — Body length: 241 (holotype: male), 233 – 254 (five paratypes: two females and three males); body width: 164 (holotype), 143 – 172 (five paratypes). Without sexual dimorphism.

Integument — Body color light brown to brown. Body surface smooth, but notogaster covered by cerotegumental microgranules (their diameter up to 2, well visible under high magnification in dissected specimens). Tutorium and pedotectum I partially striate.

Prodorsum — Rostrum rounded. Lamella (*lam*) covering almost all prodorsum, but pedotectum I (Pd I) partially visible in dorsal view. Rostral seta (*ro*, 10 – 12) thickened, heavily barbed. Lamellar seta (*le*, 10 – 12) setiform, thin, smooth. Bothridial seta (*bs*, 57 – 69 – including portion within bothridia) clavate. Stalk thin, smooth. Head elongated, rounded distally, slightly barbed. Tutorium (*tu*) long, of medium width, with one knife-like tooth anteriorly. Exobothridial seta and its alveolus not found.

Notogaster — Anterior margin straight. Pteromorph broadly rounded, without teeth or incisions. Hinge (*hi*) clearly developed. Dorsophragmata of medium size, fused into narrowly triangular structure. Four pairs (in all specimens) of rounded porose areas: *Aa* (8 – 12) larger than *A1* (6 – 8) and *A2*, *A3* (both 6). Ten pairs of short (4), thin, smooth notogastral setae. Lyrifissures *ia*, *im*, *ip*, *ih* and *ips* and opisthonotal gland opening (*gla*) distinct.

Gnathosoma — Subcapitulum longer than wide (61 – 65 × 49 – 57). Subcapitular setae setiform, smooth, *a* and *m* (both 8) slightly longer and thicker than *h* (6). Two pairs of thin, smooth adoral setae (*or*₁, *or*₂, 8). Axillary sacculle (*sac*) slightly elon-

FIGURE 1: *Neophysobates zealandicus* n. sp.: A – dorsal view; B – ventral view (gnathosoma and legs not illustrated); C – posterior view. Scale bar 50 μ m.

FIGURE 2: *Neophysobates zealandicus* n. sp.: A – antero-medial part of prodorsum, dorso-frontal view; B – anterior part of body, lateral view; C – subcapitulum, ventral view; D – palp; E – chelicera (Tg was damaged during dissection), left, paraxial view. Scale bar (A, B) 50 μ m, scale bar (C, E) 20 μ m, scale bar (D) 10 μ m.

FIGURE 3: *Neophysobates zealandicus* n. sp.: A – leg I, right, paraxial view; B – femur and genu of leg II, right, paraxial view; C – trochanter, femur and genu of leg III, left, antiaxial view; D – leg IV, left, antiaxial view. Scale bar 20 μ m.

TABLE 1: Leg setation and solenidia of *Neophysobates zealandicus* n. sp.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	v'	$d, (l), v''$	$(l), v', \sigma$	$(l), v', \varphi_1, \varphi_2$	$(ft), (tc), (it), (p), (u), (a), s, (pv), (pl), \varepsilon, \omega_1, \omega_2$
II	v'	$d, (l), v''$	$(l), v', \sigma$	$(l), (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s, (pv), \omega_1, \omega_2$
III	l', v'	d, ev'	l', σ	$l', (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s, (pv)$
IV	v'	d, ev'	d	$(v), \varphi$	$ft'', (tc), (p), (u), a', s, (pv)$

Roman letters refer to normal setae, Greek letters to solenidia (except ε = famulus). Single prime (') marks setae on anterior and double prime (') setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.

gated. Palp (length 41 – 45) with setation 0-2-1-3-9(+ ω). Solenidion straight. Chelicera (length 61 – 65) with two barbed setae; *cha* (20) longer than *chb* (12 – 14). Trägårdh's organ (Tg) long, tapered.

Lateral podosomal and epimeral regions — Genal tooth (*gt*) narrowly triangular, long, reaching rostrum. Pedotectum I large, rounded anteriorly, pedotectum II (Pd II) small, scale-like in lateral view. Epimeral setal formula: 3-1-2-2; all setae short (4), thin, smooth. Custodium (*cus*) strong, directed anteriorly to the pedotectum II. Discidium (*dis*) triangular. Circumpedal carina (*cp*) distinct.

Anogenital region — Six (rarely five) pairs of genital and one pair of aggenital (*ag*) setae minute (4). Two pairs of anal (*an*₁, *an*₂) and two pairs of adanal (*ad*₁, *ad*₂) setae slightly longer (6), thin, smooth. Lyrifissure *iad* short, about 1/7-1/8 length of anal plates, located in paraanal position.

Legs — All legs monodactylous. Formulas of leg setation and solenidia: I (1-4-3-3-18) [1-2-2], II (1-4-3-4-15) [1-1-2], III (2-2-1-3-15) [1-1-0], IV (1-2-1-2-11) [0-1-0]; homology of setae and solenidia indicated in Table 1. Seta *pv''* on tarsi II elongated, thickened, with two strong ventral spines.

Material examined — Holotype (male) and five paratypes (two females and three males): New Zealand, South Island, Central Otago, Pisa Range, 44°52'11"S, 169°10'9"E, 1797 m a.s.l., in soil and debris under *Dracophyllum muscoides* cushion plant, 18 February 2014, collected by M. Minor.

Type deposition — The holotype (alcohol) and two paratypes (alcohol) are deposited in the New Zealand National Arthropod Collection, Auckland, New Zealand; two paratypes (alcohol) are deposited in the collection of the Senckenberg Institution, Frankfurt, Germany; one paratype (alcohol) is deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Etymology — The specific name "*zealandicus*" refers to the country of origin, New Zealand.

Comparison — *Neophysobates zealandicus* n. sp. is similar to *N. monodactylus* Hammer, 1966 also from New Zealand (see Hammer 1967) in having monodactylous legs, four pairs of notogastral porose areas, thickened rostral seta, and tutorium with free knife-like tip. However, it differs from the latter by the presence of simple bothridial stalk (vs. with strong mid-length swelling), bothridial head rounded distally (vs. pointed), short adanal lyrifissure (vs. comparatively long) and seta *pv''* on tarsus II thickened, with attenuated tip (vs. short, thick, thorn-like).

Neophysobates incrassatus n. sp. (Figures 4-5)

Diagnosis — Body size: 196 – 217 × 115 – 147. Anterior margin of pteromorph and epimeral region striate. Rostral and lamellar setae thin, smooth. Bothridial seta fusiform, stalk with strong mid-length swelling. Tutorium ridge-like, curving backwards,

FIGURE 4: *Neophysobates incrassatus* n. sp.: A – dorsal view; B – ventral view (gnathosoma and legs not illustrated); C – posterior view. Scale bar 50 μ m.

FIGURE 5: *Neophysobates incrassatus* n. sp.: A – antero-medial part of prodorsum, dorso-frontal view; B – anterior part of body, lateral view; C – bothridial seta; D – right half of subcapitulum, ventral view; E – genu, tibia and tarsus of leg II, right, paraxial view. Scale bar (A, B) 50 μ m, scale bar (C-E) 20 μ m.

TABLE 2: Leg setation and solenidia of *Neophysobates incrassatus* n. sp.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	v'	$d, (l), v''$	$(l), \sigma$	$(l), v', \varphi_1, \varphi_2$	$(ft), (tc), (it), (p), (u), (a), s, (pv), (pl), \varepsilon, \omega_1, \omega_2$
II	v'	$d, (l), v''$	$(l), \sigma$	$(l), (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s, (pv), \omega_1, \omega_2$
III	l', v'	d, ev'	l', σ	$(v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s, (pv)$
IV	v'	d, ev'	d	$(v), \varphi$	$ft'', (tc), (p), (u), (a), s, (pv)$

Roman letters refer to normal setae, Greek letters to solenidia (except ε = famulus). Single prime (') marks setae on anterior and double prime (') setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.

without free tip. Three pairs of notogastral porose areas. Five pairs of genital setae. Aggenital setae absent. Legs bidactylous.

Description — *Measurements*. Body length: 213 (holotype: male), 196 – 217 (nine paratypes: five females and four males); body width: 143 (holotype), 115 – 147 (nine paratypes). Without sexual dimorphism.

Integument — Body color light brown to brown. Body surface smooth, except anterior margins of pteromorph (with several transverse striae) and epimeral region (with numerous longitudinal striae). Cerotegumental microgranules absent.

Prodorsum — Rostrum rounded. Lamella covering entire prodorsum; no parts of pedotectum I visible in dorsal view. Rostral (8 – 10) and lamellar (10 – 12) setae setiform, thin, smooth. Bothridial seta (49 – 57) fusiform. Stalk with strong mid-length swelling (*sw*). Head elongated, slightly or distinctly pointed, barbed. Tutorium of medium width, ridge-like, curving backwards distally, without free tip anteriorly. Exobothridial seta and its alveolus not found.

Notogaster — Anterior margin straight. Pteromorph broadly rounded, without teeth and incisions. Hinge clearly developed. Dorsophragmata of medium size, fused into narrowly triangular structure. Three pairs (in all specimens; A2 apparently absent) of rounded porose areas: Aa (8) larger than A1 and A3 (both 6). Ten pairs of short (2 – 4),

thin, smooth notogastral setae. All lyrifissures and opisthonotal gland opening distinct.

Gnathosoma — Generally, similar to *N. zealandicus* n. sp. Subcapitulum longer than wide (53 – 57 × 45). Subcapitular setae setiform, smooth, *a* and *m* (both 6) little longer and thicker than *h* (4). Two pairs of adoral setae (4) thin, smooth. Axillary sacculus elongated. Palp (34 – 36) with setation 0-2-1-3-9(+ ω). Solenidion straight. Chelicera (53 – 57) with two barbed setae; *cha* (16) longer than *chb* (10). Trägårdh's organ long, tapered.

Lateral podosomal and epimeral regions — Genal tooth narrowly triangular, long, reaching rostrum. Pedotectum I large, rounded anteriorly, pedotectum II small, scale-like in lateral view. Epimeral setal formula: 3-1-2-2; all setae short (4) thin, smooth. Custodium strong, directed anteriorly to the pedotectum II. Discidium triangular. Circumpedal carina distinct.

Anogenital region — Five pairs of genital, two pairs of anal and two pairs of adanal setae similar in length (4), thin, smooth. Aggenital seta absent. Lyrifissure *iad* long, about 1/4 length of anal plates, located in paraanal position. Ovipositor slightly elongated (52 × 41), lobe (32) distinctly longer than distal section (beyond middle fold; 20). Each of three lobes with four straight, smooth setae; $\psi_1 \approx \tau_1$ (16) longer than $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$ (12). Six pairs of coronal setae (8 – 10) straight, smooth, inserted in medial part of distal section.

Legs — Generally, similar to *N. zealandicus* n. sp.

Heterobidactylous. Formulas of leg setation and solenidia: I (1-4-2-3-18) [1-2-2], II (1-4-2-4-15) [1-1-2], III (2-2-1-2-15) [1-1-0], IV (1-2-1-2-12) [0-1-0]; homology of setae and solenidia indicated in Table 2. Seta *pv*'' on tarsi II short, thick, thorn-like, with several strong spines.

Material examined — Holotype (male) and nine paratypes (five females and four males): New Zealand, South Island, Central Otago, Pisa Range, 44°52'11''S, 169°10'9''E, 1797 m a.s.l., in soil and debris under *Raoulia* sp. cushion plant (Compositae), 18 February 2014, collected by M. Minor.

Type deposition — The holotype (alcohol) and three paratypes (alcohol) are deposited in the New Zealand National Arthropod Collection, Auckland, New Zealand; three paratypes (alcohol) are deposited in the collection of the Senckenberg Institution, Frankfurt, Germany; three paratypes (alcohol) are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Etymology — The specific name "*incrassatus*" refers to the mid-length swelling of bothridial setae.

Comparison — *Neophysobates incrassatus* n. sp. is similar to *N. monodactylus* in having bothridial seta with a mid-length swelling in medial part of the stalk and in having five pairs of genital setae. However, it differs from the latter by the presence of bidactylous legs (vs. monodactylous), three pairs of notogastral porose areas (vs. four), rostral setae thin, similar to lamellar setae in thickness (vs. thicker than lamellar setae), and tutorium without free tip (vs. with knife-like tip). The three known species of *Neophysobates* can be distinguished by the key presented below.

Key to known species *Neophysobates*

1. Legs bidactylous; three pairs of notogastral porose areas; rostral seta thin, similar to lamellar seta in thickness; tutorium ridge-like, without free tip; body size: 196 – 217 × 115 – 147.....*N. incrassatus* n. sp.
— Legs monodactylous; four pairs of notogastral porose areas; rostral seta distinctly thicker than lamellar seta; tutorium with free knife-like tip 2

2. Bothridial seta simple, without mid-length swelling, head rounded distally; adanal lyrifissure short, about 1/7-1/8 length of anal plate; leg seta *pv*'' on tarsi II elongated, thickened, with attenuate tip; body size: 233 – 254 × 143 – 172.....*N. zealandicus* n. sp.
— Bothridial seta with strong mid-length swelling, head pointed distally; adanal lyrifissure long, about 1/4 length of anal plate; leg seta *pv*'' on tarsi II short, thick, thorn-like; body length: 230*N. monodactylus* (Hammer, 1966).

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REFERENCES

- Engelbrecht C.M. 1986 — New oribatid taxa and distribution records predominantly from southern Africa (Acari: Oribatei: Oribatelloidea) — *Navors. Nas. Mus., Bloemfontein*, 5(9): 169-250.
- Ermilov S.G., Minor M.A. 2015a — The oribatid mite genus *Macrogena* (Acari, Oribatida, Ceratozetidae), with description of two new species from New Zealand — *ZooKeys*, 506: 13-26.
- Ermilov S.G., Minor M.A. 2015b — The genus *Scapheremaeus* (Acari, Oribatida, Cymbaeremaeidae) in the oribatid mite fauna of New Zealand, with description of two new species — *ZooKeys*, 508: 69-83.
- Ermilov S.G., Minor M.A. 2015c — Two new species of *Dicrotegeus* (Acari, Oribatida, Cerocephidae) from New Zealand — *Syst. Appl. Acarol.* (In Press).
- Fujikawa T. 1991 — List of oribatid families and genera of the World — *Edaphologia*, 46: 1-132.
- Hammer M. 1966 — Investigations on the oribatid fauna of New Zealand. Part I — *Det Kong. Dansk. Vidensk. Selsk. Biol. Skr.*, 15(2): 1-108.

- Luxton M. 1985 — Cryptostigmata (Arachnida: Acari) – a concise review — *Fauna of New Zealand*, 7: 1-116.
- Luxton M. 1987 — Genera of the family Tegeribatidae Grandjean, 1954 (Acari: Cryptostigmata) — *New Zealand J. Zool.*, 14: 141-142.
[doi:10.1080/03014223.1987.10422693](https://doi.org/10.1080/03014223.1987.10422693)
- Mahunka S. 1985 — Oribatids from Africa (Acari: Oribatida) II — *Folia Ent. Hung.*, 46(1): 73-113.
- Mark A.F., Bliss L.C. 1970 — The high-alpine vegetation of Central Otago, New Zealand — *New Zeal. J. Bot.*, 8: 381-451.
- Norton R.A., Behan-Pelletier V.M. 2009 — Oribatida. Chapter 15. In: G.W. Krantz and D.E. Walter (eds.). *A Manual of Acarology* — Texas Tech Univ. Press, Lubbock, 430-564.

- Subías L.S. 2004 — Listado sistemático, sinonímico y biogeográfico de los ácaros oribátidos (Acariformes: Oribatida) del mundo (excepto fósiles) — *Graellsia*, 60 (número extraordinario): 3-305. Online version accessed in March 2015, 587 pp.

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