

# Far Eastern Entomologist

Дальневосточный энтомолог

Journal published by Far East Branch  
of the Russian Entomological Society  
and Laboratory of Entomology, Federal  
Scientific Center of the East Asia  
Terrestrial Biodiversity, Vladivostok

Number 397: 1-8

ISSN 1026-051X

December 2019

<https://doi.org/10.25221/fee.397.1>

<http://zoobank.org/References/BA9A44F8-F437-4BF5-8209-E2D11B747D67>

## DISCOVERY OF THE FIRST LITTORAL SPECIES OF THE FAMILY TOMOCERIDAE (COLLEMBOLA)

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**Summary.** *Pogonognathellus litoralis* Kuprin et Potapov, **sp. n.** is described from Primorskii krai (Russia). It is the first species of the family Tomoceridae living on sea littoral. The new species is characterized by expanded lateral teeth on claws and enlarged unguiculus reflecting its movement on salt water film.

**Key words:** Collembola, taxonomy, new species, adaptation to littoral, Primorskii krai, Russian Far East.

**А. В. Куприн, М. Б. Потапов. Первый литоральный вид коллембол семейства Tomoceridae (Collembola) // Дальневосточный энтомолог. 2019. N 397. С. 1-8.**

**Резюме.** Из Приморского края (Россия) описан *Pogonognathellus litoralis* Kuprin et Potapov, **sp. n.** Это первый вид семейства Tomoceridae, обитающий

на морской литорали. Новый вид обладает расширенными латеральными зубцами коготка и увеличенным эмподиальным придатком, т.е. приспособлениями, отражающими адаптацию к передвижению на пленке морской воды.

## INTRODUCTION

Seventeen species of the genus *Pogonognathellus* Paclt, 1944 are known so far in the world fauna (Bellinger *et al.*, 2019; Babenko & Fjellberg, 2006). The genus is well defined by several sharp characters which were repeated and updated by Yosii (1967), Martynova (1969), Fjellberg (2007), Felderhoff *et al.*, (2010), and Wang *et al.*, (2013). The most of the species are distributed in North America (10) and Asia (5). *Pogonognathellus* appears to be not frequent in the Russian Far East and was known only due to two species *P. flavescens* (Tullberg, 1871) and *P. lividus* (Tullberg, 1876) (including its probable synonyms *T. arcticus* Schött, 1893 and *T. magadanicus* Martynova, 1977) (Martynova, 1969, 1977, Babenko & Fjellberg, 2006). The recent publications (Wang *et al.*, 2013) and our own observations (unpublished data) indicate that more species represent this genus in Eastern Asia and it is probably more common in the collembolan communities. Our recent collections revealed a new species living exclusively on sea littoral. Below we give the description of this species from this uncommon habitat for the genus and comment its possible adaptive peculiarities.

## MATERIAL AND METHODS

The type specimens are deposited in FCBV – Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of Russian Academy of Sciences, Vladivostok, Russia, MSPU – Moscow State Pedagogical University, Moscow, Russia and SMNH – Senckenberg Museum of Natural History, Görlitz, Germany. Cavity slides with Gisin's mixture and flat slides with Hoera liquid were used to mount the specimens. Figures of chaetotaxy were standardized after Wang *et al.* (2013) and Gong *et al.* (2018), notation of maxillary lamellae and elements of labial palp after Fjellberg (1998, 2007), dental spine composition after Wang *et al.* (2013). Abbreviations: A, B, C, D, E – papillae of labial palp; Abd. – abdominal segments; Ant. – antennal segments; Mac – macrosetae; Th. – thoracic segments.

## DESCRIPTION OF NEW SPECIES

### ***Pogonognathellus litoralis* Kuprin et Potapov, sp. n.**

<http://zoobank.org/NomenclaturalActs/D0309B84-9E7C-4771-BBC9-711C538455B6>

Figs 1–12

TYPE MATERIAL. Holotype – female (on slide), **Russia**: Primorskii krai, Vladivostok, Russkii Island, Vyatlina Bay, stony littoral, floatation, 26.VIII 2018, coll. A. Kuprin & Yu. Shveenkova (FCBV). Paratypes: Primorskii krai: same data as holotype, 1 female (on slide), 5 specimens (in alcohol) (FCBV); Lazovsky District, near Sokolovka, Sokolovskaya Bay, shingly beach, floatation, 20.IX 2011,

20 specimens (on slide), coll. M. Potapov, Y. Bu & Ch.-W. Huang (10 specimens in MSPU, 10 specimens in SMNH).

OTHER MATERIAL. **Russia:** Primorskii krai, Vladivostok, Russkii Island, Malyi Dzhigit Bay, stony littoral, floatation, 26.VIII 2018, 10 juv. (in alcohol), coll. A. Kuprin & Yu. Shveenkov (FCBV); Vladivostok, De-Fries Peninsula, Uglovoy Bay, stony littoral, floatation, 04.VI 2019, 2 specimens (in alcohol), coll. A. Kuprin (FCBV); Fokino, Rudneva Bay, littoral (sand/algae), floatation, 07.VII 2018, 5 specimens (in alcohol), coll. A. Kuprin (FCBV).

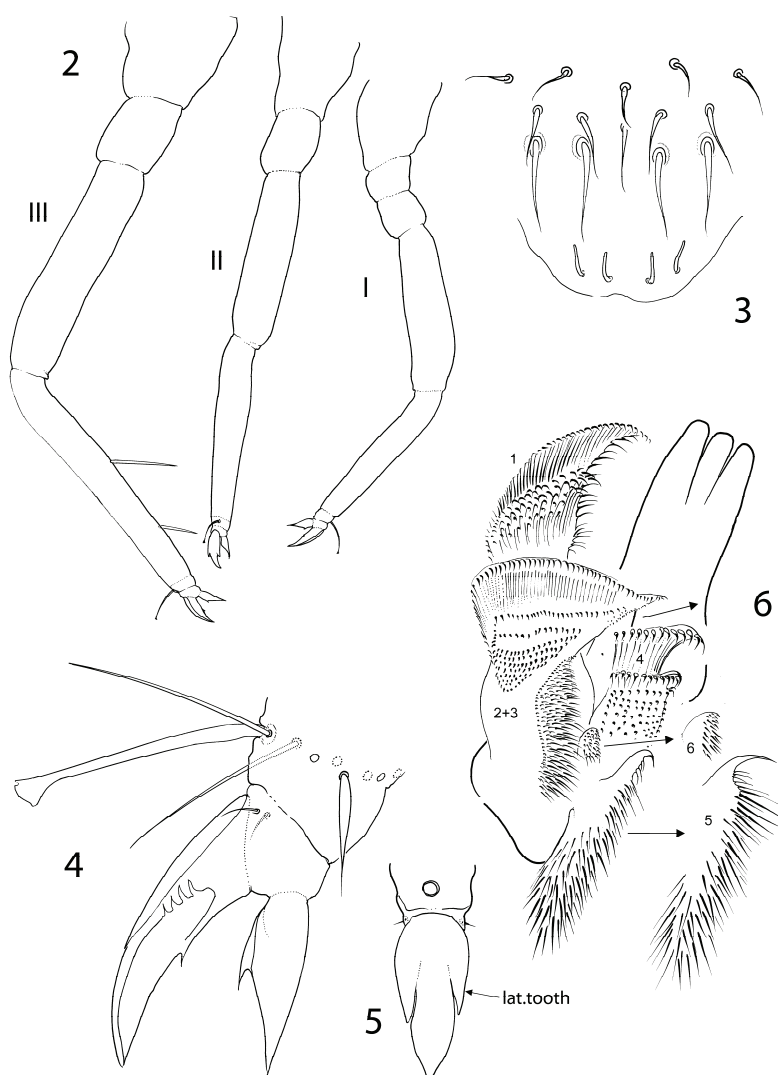


Fig. 1. Appearance of *Pogonognathellus littoralis* Kuprin et Potapov, sp. n.

DESCRIPTION. Female body size up to 3 mm. In alcohol body and head grey, proximal part of legs paler, tibiotarsi, antennae and distal part of furca with bluish pigmentation (Fig. 1). Eye spots black. In Hoera liquid on slides body greenish.

Head. Antennae as about 0.7–0.8 body length. Ratio Ant.I : Ant.II : Ant.III+IV as 1.0 : 1.4–1.7 : 9.0–10.0. Ant. I, II and basal part of Ant. III with scales. 6+6 ocelli. Labrum 4/554 and 4 back-curved spines, all setae smooth (Fig. 3). Maxillary outer lobe with 4 sublobal hairs and trifurcate palp. Maxillary head with expanded ciliate lamellae and beard-like proximal projection as common for the genus (Fig. 6). Lamella 1 rather broad, with field of numerous strong denticles and distal row of cilia, lamella 2 with distal row of cilia and many irregular rows in more proximal part, lamella 5 with long beard-like ciliate projection; lamella 6 reduced. Lamellae 2 and 3 close together and look fused to a single mass (as "2+3" in figure). Labial palp as common for the family: all papillae present, A, B, C, D, E with 0, 5, 0, 4, 7 guards, hypostomal setae H pointed, h1 as thick as H, h2 shorter and thinner. Arrangement of guards associated with papilla B complex: guard a1 set on papilla B, guards b1 and b4 set together on separate papilla, guards b2 and b3 also set on papilla detached from papilla B (as on Fig. 69 in Fjellberg, 1998). Basolateral, proximal and basomedial fields of labial palp with numerous setae; as about in *P. flavescens* (Fig: 93B in Fjellberg, 2007).

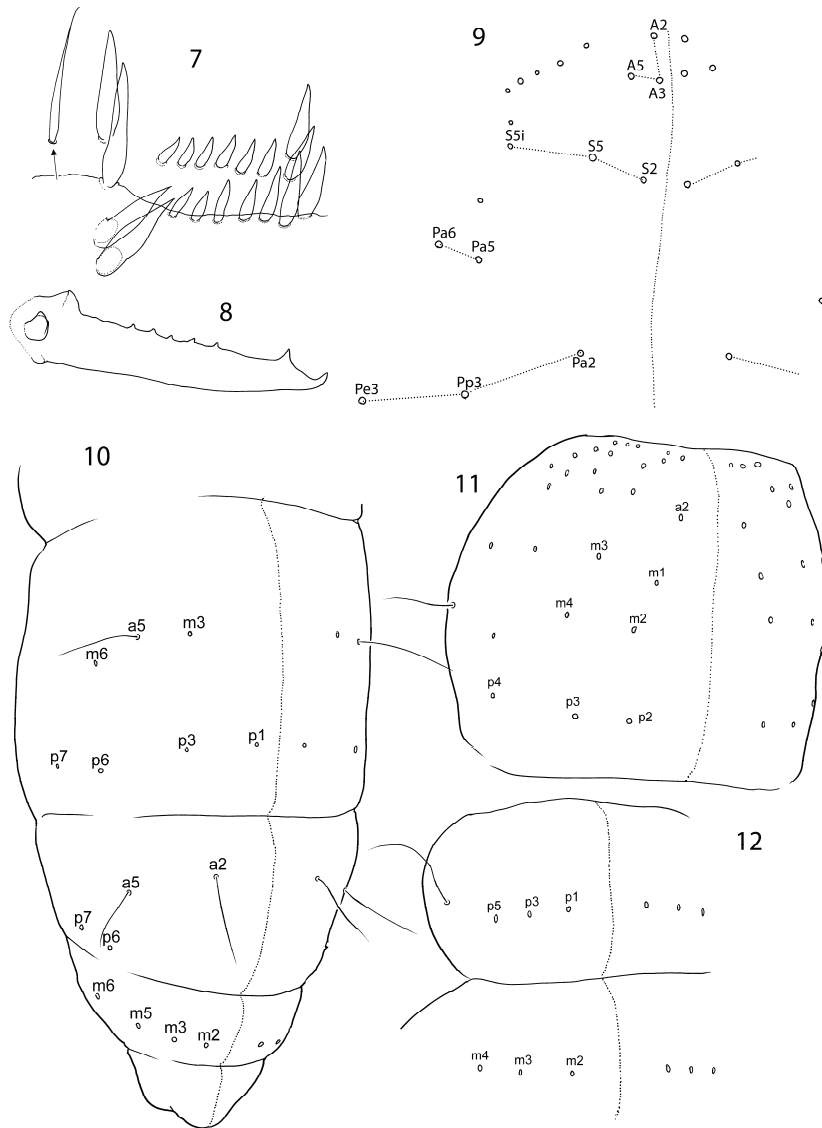
Dorsal chaetotaxy. Dorsal side of head with 2+4 anterior Mac (A2, A3, A5), 3+3 interocular Mac (S2, S5, S5i), 2+2 postocular Mac (Pa5, Pa6), and 2+2 posterior Mac (Pa2, Pp3, Pe3) (Fig. 9). Tergal macrosetae of body as in Figs 10–12. Anterior Mac on Abd.IV absent. Abd. III with 2+2 anterior and 4+4 posterior Mac.



Figs. 2–6. *Pogonognathellus litoralis* Kuprin et Potapov, sp. n. 2 – spiny inner setae on legs; 3 – labrum; 4, 5 – hind claw, lateral (4) and outer (5) views; 6 – maxillary head, maxillary claw shown separately. lat.tooth – lateral tooth, I, II, III – fore, mid and hind legs respectively.

Legs. Trochanteral organ reduced to 1+1 setae. Tibiotarsi of Leg III with 2 spiny inner setae, general formula for all legs 0-0-2 (Fig. 2). Tenent hair apically spatulate, longer (1.05–1.20) than inner edge and shorter than outer edge of Claw (Fig. 4). Claws with one distinct inner tooth, and often with indistinct second one on all legs. Pair of lateral teeth (pseudonychia) large, longer than half of outer side of

Claw, attached and partly fused with outer edge of Claw (Figs 4, 5). Unguiculus enlarged, with big inner tooth, 0.8-0.9 as long as inner edge of Claw and almost as wide (ca. 0.9) as Claw width in its middle part.



Figs. 7–12. *Pogonognathellus litoralis* Kuprin et Potapov, sp. n. 7 – spines on dens; 8 – mucro; 9 – macrosetae of head (A, S, Pa, Pp, Pe – macrosetae); 10–12 – macrosetae on dorsum (a – anterior chaeta, m – medial chaeta, p – posterior chaeta): 10 – Abd.III-V, 11 – Th.II (the second bothriotricha not shown), 12 – Th. III-Abd.I.

Abdominal appendages. Ventral tube with numerous setae in anterior, posterior and latero-distal groups, covered by scales on anterior and posterior sides. Retinaculum with 4+4 teeth and a seta, without scales. Manubrium with 8–11 large setae on each of lateral sides, with numerous scales on anterior sides and few ones along inner part of setaceous stripes on posterior side. Distal part of posterior side of manubrium with numerous setae of different size, among the largest ones 0-2+0-2 straight. Manubrium : dens : mucro as 3.5–4.2 : 4.7–4.8 : 1. Basal part of dens with one large spine swollen in proximal part and often slightly curved, set on papilla, with numerous large setae, of which 1–2 straight. Medial part with 7–8 spines of which 2 distal distinctly larger (Fig. 7). Dental spine formula I/ 5-6, II (with 2–4 small spines in juvenile specimens of 1.5–2.0 mm). Spines simple. Basal spines much larger than two distal large spines. Mucro with 5–8 intermediate teeth (3–4 in juvenile specimens of 1.5–2.0 mm) (Fig. 8).

REMARKS. The new species sharply differs by several characters. Enlarged unguiculus is remarkable: it is as wide as claw and almost as long as its inner edge. In all representatives of the family unguiculus distinctly thinner and at least 1.5 times shorter than inner edge. Lateral teeth are not detached from outer edge of claw that has been also unknown in the non-cave species of the family so far. For the genus, the presence of only one large basal spine on dens is shared only with *P. elongatus* (Maynard, 1951), *P. dubius* (Christiansen, 1964) and *P. magnibrunneus* Park, Bernard et Moulton, 2011, all are distributed in North America and differ from *P. litoralis* sp. n. by several significant features. Besides, the basal spine distinctly larger than distal spines in the new species (vs. subequal in other species of the genus). Presence of only one distinct inner tooth on claw is also unknown. In reference to the species groups, *P. litoralis* sp. n. is more close to “longicornis” clade (Felderhoff *et al.*, 2010) by 2+4 frontal macrosetae and presence of posterior macrosetae on head, absence of anterior macrosetae on Abd.IV, presence of seta on retinaculum and subequal short intermediate spines on dens. In these characters, *P. litoralis* sp. n. resembles two species from NE China, namely *P. mai* Wang, Yu et Zhang, 2013 and *P. heterochrosatus* Wang, Yu et Zhang, 2013 which also close to “longicornis” clade while all three species differ from the clade by less number of spiny inner setae on tibiotarsi (0,0,2 instead 4+,4+,4+).

Lateral teeth integrated to outer edge of claw and enlarged unguiculus of the new species probably indicate close contact of legs to salt water on littoral where this species occurs. According to Christiansen (1965, 1988) foot complex of cave *Pseudosinella* Schäffer, 1897 (Entomobryomorpha) undergoes complicated morphological changes if contacting water surface. Two tendencies, expansion of outer edge of claw and attenuation of unguiculus, concern the new species. The former tendency is well seen in *Pogonognathellus litoralis* sp. n. while its expanded unguiculus are hard to explain in terms of K. Christiansen. In Tomoceridae, *Tritomurus veles* Lukić, Houssin et Deharveng, 2010 (Croatia, cave) and *T. falcifer* Cassagnau, 1958 (France, cave), contrary to *P. litoralis* sp. n., well agree with scheme of K. Christiansen by having very slender claw and unguiculus reflecting penetrating to thin film of water

in hydropetric sites (Lukić *et al.*, 2010). The elongated claw as a troglomorphic character in Collembola is well discussed by Vargovitsh (2019). Foot complex position “C” (in Fig. 4C in Christiansen, 1965) assumes contact of both claw and unguiculus along their longest region and can possibly elucidate morphology of unguiculus in the new species. In littoral forms, the expanded unguiculus often occurs (Strenzke, 1955) that call for comprehensive explanations as it was presented by K. Christiansen for cave species. Maxillary head of *P. litoralis* sp. n. does not undergo expected significant modifications which are widely known in other littoral Collembola (genera *Archisotoma* Linnaniemi, 1912 and *Halisotoma* Bagnall, 1949). Beard-like ciliate projection of lamella 5 looks longer (Fig. 6) than in other species of the genus while other lamellae are like as common. Tomoceridae are hydrophylic group and are already armed with factually “littoral” fringed lamellae (Fjellberg, 2007) and are possibly preadapted to liquid food of damp habitats.

**DISTRIBUTION AND ECOLOGY.** The new species is recorded along western coast of Japanese Sea in four distant localities of southern areas of Primorskii krai. It was not found by us in appropriate sites of more northern areas (Terney and Olga). *P. litoralis* sp. n. is a typical inhabitant of shingly organically enriched littoral of stony inlets, frequent in shingle mixtured with rotten wrack. The species was absent in litter of coastal forests nearby.

**ETHYMOLOGY.** New species is named after ecological preference.

#### ACKNOWLEDGEMENTS

We would like to express our sincere thanks to Drs Vasily Alpatov, Birgit Balkenhol, Yun Bu, Huang Chen-Wang, Arkady Lelej, Juergen Schulz, Yulia Shveenkova, Willi Xylander, Yi Dae-Am for kind assistance in field or provide favorable conditions for laboratory work. The authors are grateful to the management and staff of the Lazovsky Nature Reserve (Primorskii krai) who provided the collecting permit and help during our field work.

The study was supported by Chinese-Russia Research Cooperative Program of RFBR (project No. 11-04-91179-GFENa) for M. Potapov and (project No. 18-54-53032 GFENa) for A. Kuprin. The research was carried out within the framework of the State Task of the Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far East Branch of the Russian Academy of Sciences (AAAA-A17-117062710084-7) and Center for Problems of Ecology and Productivity of Forests, Russian Academy of Sciences (AAAA-A18-118052400130-7).

#### REFERENCES

- Babenko, A. & Fjellberg, A. 2006. *Collembola septentrionale. A catalogue of springtails of the Arctic regions*. KMK Scientific Press Ltd, Moscow. 190 pp.
- Bellinger, P.F., Christiansen, K.A. & Janssens, F. 2019. *Checklist of the Collembola of the World*. Available from: <http://www.collembola.org>. (Accessed: 26 October 2019).

- Christiansen, K. 1965. Behavior and Form in the Evolution of Cave Collembola. *Evolution*, 19(4): 529–537.
- Christiansen, K. 1988. *Pseudosinella* revised (Collembola, Entomobryinae). *International Journal of Speleology*, 17: 1–29.
- Felderhoff, K.L., Bernard, E.C. & Moulton, J.K. 2010. Survey of *Pogonognathellus* Börner (Collembola: Tomoceridae) in the Southern Appalachians based on morphological and molecular data. *Annals of the Entomological Society of America*, 103(4): 472–491. DOI: <https://doi.org/10.1603/AN09105>
- Fjellberg, A. 1998. The Collembola of Fennoscandia and Denmark. Part. I: Poduromorpha. *Fauna Entomologica Scandinavica*, 35: 1–183.
- Fjellberg, A. 2007. The Collembola of Fennoscandia and Denmark. Part II: Entomobryomorpha and Symphyleona. *Fauna Entomologica Scandinavica*, 42: 1–264.
- Gong, X., Qin, C. & Yu, D. 2018. Two new species of *Tomocerus ocreatus* group with a single large distal dental spine (Collembola, Tomoceridae). *Zootaxa*, 4514(2): 273–282. DOI: <https://doi.org/10.11646/zootaxa.4514.2.10>.
- Lukić, L., Houssin, C. & Deharveng, L. 2010. A new relictual and highly troglomorphic species of Tomoceridae (Collembola) from a deep Croatian cave. *ZooKeys*, 69: 1–16. DOI: <https://doi.org/10.3897/zookeys.69.739>
- Martynova, E.F. 1969. Springtails of the family Tomoceridae (Collembola) from the fauna of the USSR. *Entomologicheskoe Obozrenie*, 48(2): 299–314. [In Russian]
- Martynova, E.F. 1977. Springtails of the family Tomoceridae (Collembola) from the fauna of the Far East of USSR. P. 3–16. In: *Entomofauna of Far East*. Vladivostok. (*Proceeding of Institute of Biology and Soil Science*, 46(149): 3–16). [In Russian]
- Strenzke, K. 1955. Thalassobionte und thalassophile Collembola. In: Grimpe, G., Wagler, E., Remane, A. (Eds.). *Die Tierwelt der Nord- und Ostsee*. Akademische Verlagsgesellschaft, Leipzig. 52 pp.
- Vargovitsh, R.S. 2019. Cave water walker: an extremely troglomorphic Troglaphorura gladiator gen. et sp. nov. (Collembola, Onychiuridae) from Snezhnaya Cave in the Caucasus. *Zootaxa*, 4619(2): 267–284. DOI: <https://doi.org/10.11646/zootaxa.4514.2.10>.
- Wang, T., Yu, D. & Zhang, F. 2013. Two new species of *Pogonognathellus* (Collembola: Tomoceridae) from China, with a discussion of East Asian species. *Journal of Natural History*, 47: 1243–1255. DOI: <https://doi.org/10.1080/00222933.2012.752541>
- Yosii, R. 1967. Studies on the collembolan family Tomoceridae, with special reference to Japanese forms. *Contributions from the Biological Laboratory, Kyoto University*, 20: 1–54.