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FINDING OF A MALE OF THE PARTHENOGENETIC SPECIES *ORINISOBATES MICROTHYLAX* ENGHOFF, 1985 (DIPLOPODA, JULIDA, NEMASOMATIDAE)

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Summary. Males of a parthenogenetic species *Orinisobates microthylax* Enghoff, 1985 has been found and described for the first time. An updated diagnosis of the genus *Orinisobates* Lohmander, 1933, as well as a diagnosis, detailed description and illustrations of the examined two males are presented. In addition, masculinized females have been identified.

Key words: taxonomy, updated diagnosis, description, Russian Far East.

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Резюме. Впервые были обнаружены самцы партеногенетического вида *Orinisobates microthylax* Enghoff, 1985. Представлен обновленный диагноз рода *Orinisobates* Lohmander, 1933, а также диагноз, подробное описание и иллюстрации двух исследованных самцов. Кроме того, были идентифицированы маскулинизированные самки.

INTRODUCTION

The genus *Orinisobates* Lohmander, 1933 is distributed in the Nearctic (3 species) and the Eastern Palearctic from eastern part of Kirgizia to Kamchatka and the Kuril Islands (5 species). The most common among the Eastern Palearctic species are *O. microthylax* and *O. sibiricus* (Gulička, 1963). The first of them is widespread in the southern and eastern parts of the Russian Far East and is only rarely recorded in Siberia (in Buryatia); the second lives in various regions of southwestern Siberia, and has been recorded in Eastern Kazakhstan and Kyrgyzstan (Enghoff, 1985; Mikhaljova, 2017). Other Asian species are distributed as follows: *O. soror* Enghoff, 1985 is common on the islands of the Russian Far East (Enghoff, 1985; Mikhaljova, 2017); *O. kasakstanus* (Lohmander, 1933) is known from near Uzbekistan-Kyrgyzstan border (Andizhan), Kyrgyzstan and Eastern Kazakhstan (Lohmander, 1933; Golovatch, 1979; Enghoff, 1985); *O. gracilis* (Verhoeff 1933) is recorded only in Northwestern China (eastern part of Tien-Shan) (Verhoeff, 1933; Enghoff, 1985; Wang & Mauriès, 1996; Golovatch & Liu, 2020).

Overview of *Orinisobates* can be found in publication of Enghoff (1985). Among the species of this genus, only *O. microthylax* is parthenogenetic, as evidenced by the reduced receptaculum seminis in females, the absence of sperm in them, and the absence of male finds (Enghoff, 1985, 1994). In addition, Enghoff (1985) found among the studied material masculinized females with more or less underdeveloped gonopods, but with normal vulvae and other typical characters of females.

Despite the abundance of collected material, no males of *O. microthylax* have been found to date (Mikhaljova, 2017). Recently, diplopod material from winter traps exhibited in the Vladivostok Botanical Garden in the winter of 2016–2017 was transferred to the collection of the Federal Scientific Center for Terrestrial Biodiversity of East Asia, Far Eastern Branch of the Russian Academy of Sciences (Vladivostok). There was found one male of *O. microthylax* among this material. The collection also includes a male of this species collected in the Sikhote-Alin Nature Reserve in 2022. In the present contribution, the male of *O. microthylax* is described for the first time, new distinctive characters of this species are added, as well as its extended diagnosis is presented.

MATERIAL AND METHODS

The sample material is stored in the Bioresource Collection of the Federal Scientific Centre of East Asia Terrestrial Biodiversity of the Far East Branch of the Russian Academy of Sciences, Vladivostok, Russia (FSCB) (reg. number 2797657). Specimens are kept in 70–75% ethanol. In the process of studying the material, the gonopods and some other parts were dissected from the specimens and mounted in glycerin as temporary micropreparations. Specimens were studied and illustrated using standard stereomicroscopic (MC-2-Zoom Digital), microscopic (Ergoval) and drawing equipment (RA-6). SEM micrographs were prepared at the Centre of Collective Use “Biotechnology and Gene Engineering” of the FSCB using a Merlin 62–15 ZEISS and a ZEISS Evo 40 scanning electron microscopes. Mounts for SEM were made through air-drying after the transfer to acetone via 96% alcohol, mounting on stubs, and coating with carbon. After the examination, SEM material was removed from stubs and returned to alcohol. SEM images were edited in Adobe Photoshop.

A “body ring formula” indicates the number of podous (including gonopod ring and apodous collum) and apodous rings before the telson in an individual. This formula is x (-y) where x = sum of podous and apodous body rings excluding telson and y = number of apodous body rings before telson.

TAXONOMIC PART

Order Julida Brandt, 1833

Family Nemasomatidae Bollman, 1893

Genus *Orinisobates* Lohmander, 1933

The main distinguishing characters of the genus: eyes present; supralabral setae 2+2; axial suture evident; pro- and metazona separated by distinct constriction; anterior part of prozona covered with a microsculpture; metazona and posterior part of prozona with longitudinal striae in ventral half; ozopores far away set off behind from suture dividing pro- and metazona; hind edge of metazona with short setae or without setae; telson without caudal dorsal process; male legs with ventral soft pads on tibia, postfemur and femur; male leg pair 1 with a spiniform tibial process and tarsus about as long as tibia; male leg pair 2 with coxal

group of pores; anal valves and subanal scale each with 2 setae; anterior gonopods with apical hooks on coxal processes and a pair of flagella at base; flagellum distal part covered with spines; telopodites of anterior gonopods 1-segmented, with a subapical group of 2–8 minute spiniform setae, several small setae near mid-length of mesal margin and 1–3 long apical setae; posterior gonopods with a groove for accomodation of flagellum; telopodite of posterior gonopod is divided into distal and basal parts by a line of finger-like processes; basal part of posterior gonopod telopodite with a group of spiniform setae; distal part of posterior gonopod telopodite with two lamellae delimiting the flagellum-conducting groove; in female receptaculum seminis with a pair of internal flaps except in *O. soror*.

***Orinisobates microthylax* Enghoff, 1985**
Figs 1–17

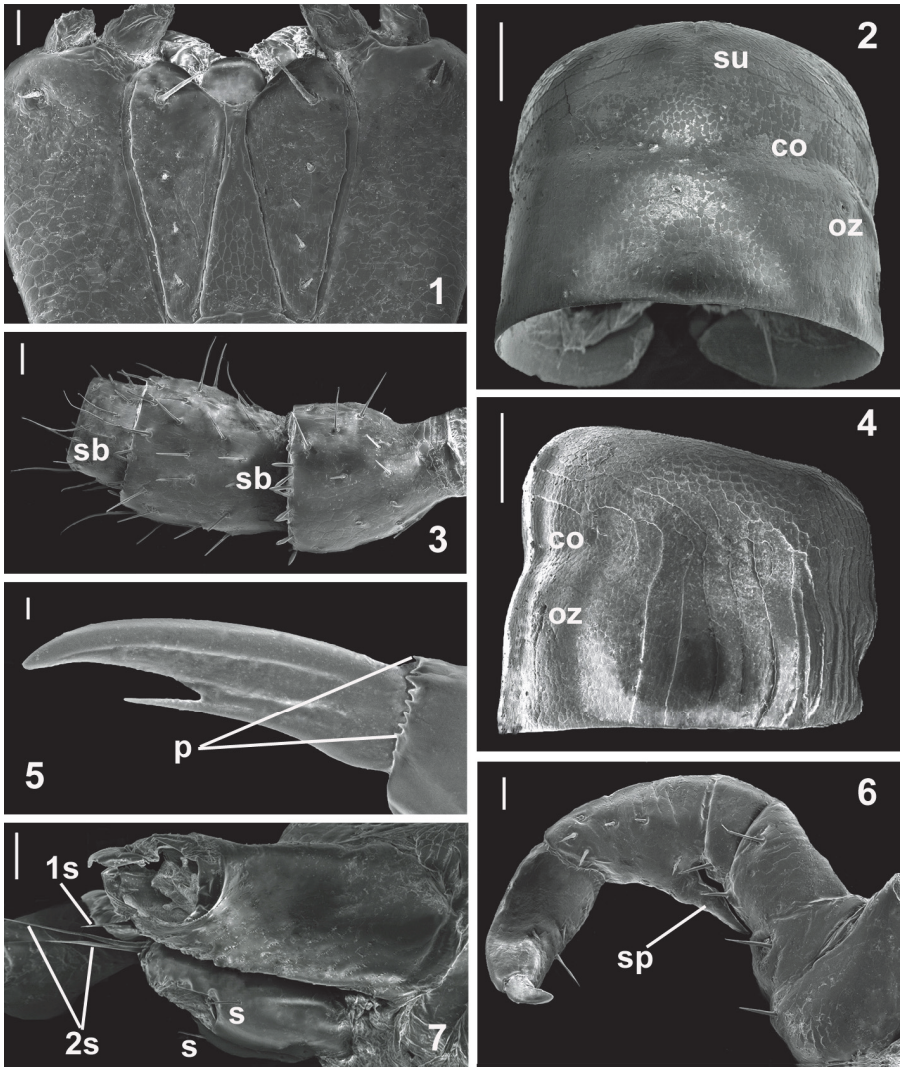
MATERIAL EXAMINED. Russia: Primorsky krai, Vladivostok, Botanical Garden, winter traps [43˚13′20″N, 131˚59′37″E], 20.XI 2016–11.III 2017, 1 ♂, 1 ♀, leg. A.A. Komisarenko, [FSCB]; Russia: Primorsky krai, Sikhote-Alin State Nature Biosphere Reserve, cordon Blagodatnoe, 7.IX 2022, 1♂, 1♀, leg. M.E. Sergeev, [FSCB]; Russia, Jewish Autonomous Region, "Bastak" Nature Reserve, block 140, section 16, "Bastak" Sector, Bastak river valley, near the house under a piece of wood, 15.VIII 2005, 4 ♀ (one of them is masculinized female), leg. L. Kapitonova, [FSCB]; Amurskaya oblast, Selemdzhinsky District, 29.VIII 2006, 1 masculinized ♀, leg. A.B. Rivkin, [FSCB].

DIAGNOSIS. According to Enghoff (1985), this species differ from congeners by very small receptaculum seminis, by the each gnathochilarial lamella lingualis with 4–5 setae in the base, except for one, by parthenogenesis. The distinguishing characters of the male are as follows. Gonopods differs from those of congeners mainly by the apical knob-shaped, almost square hook of the coxal process of anterior gonopod (vs oval or almost rectangular hook in congeners), by 2 long setae in the basal third of length of the coxal process of anterior gonopod (vs 0–2 small, short setae in congeners).

DESCRIPTION. MALE. Length in alcohol 11 mm, midbody vertical diameter 0.5 mm with 32(–1) rings (in male from Sikhote-Alin State Nature Biosphere Reserve) and respectively 12.5 mm, 0.5 mm with 46(–2) rings (in male from Vladivostok, Botanical Garden). Coloration in alcohol dark brown. Collum and several front rings marbled dark brown. Genae, anterior and posterior parts of head marbled brown, frons and vertex dark brown. Antennae and legs dark brown. Eyes black. Head with four frontal setae in a transverse row (all setae broken off). About 18–20 ommatidia (in male from Sikhote-Alin State Nature Biosphere Reserve) or about 35 ommatidia (in male from Vladivostok, Botanical Garden) on each side, arranged in subtriangular group. Mandibular stipites subrectangular in lateral view. Antennae medium length, rather slender and clavate. Antennomeres 5 and 6 with incomplete distodorsal corolla of sensilla basiconica (**sb**) (Fig. 3). Lamellae linguales of gnathochilarium each with 4 setae in the base and 1 seta in the apical part (Fig. 1); length of setae increasing towards apex of lamellae linguales. Collum at posterior margin laterally with a few striae extending from posterior to anterior margin.

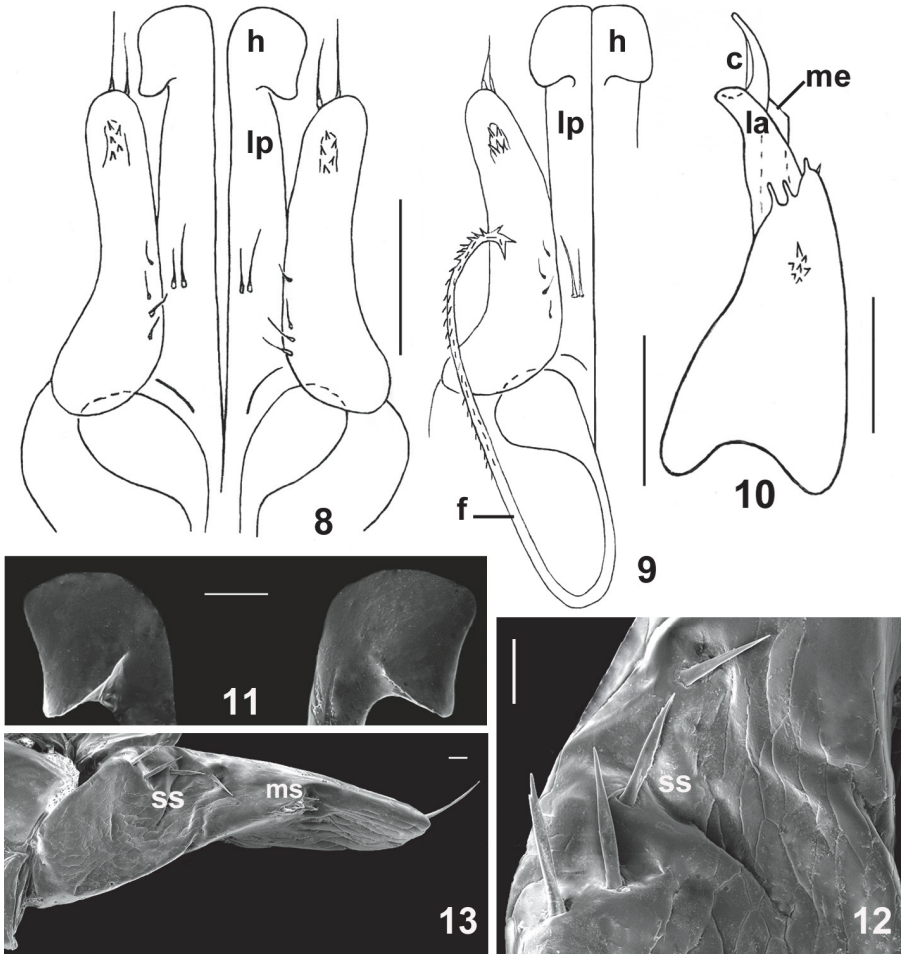
Body rings circular (Fig. 2). Axial suture (**su**) poorly visible. Pro- and metazona separated by distinct constriction. Ozopores (**oz**) small, lying behind constriction (**co**) dividing pro- and metazona. Anterior part of prozona with scaly microsculpture. Metazonital setae absent. Limbus absent. Metazona and posterior part of prozona covered with longitudinal striae in ventral half (Fig. 4). Caudal dorsal projection of preanal ring absent. Subanal scale with 2 setae at hind margin. Male from Sikhote-Alin State Nature Biosphere Reserve: posterior marginal setae of preanal ring and setae of anal valves broken off, except for one at ventral

edge of preanal ring. Male from Vladivostok, Botanical Garden: posterior marginal setae of preanal ring broken off, except for one at lateral edge of preanal ring; left anal valve with 2 setae, setae of right anal valve broken off.



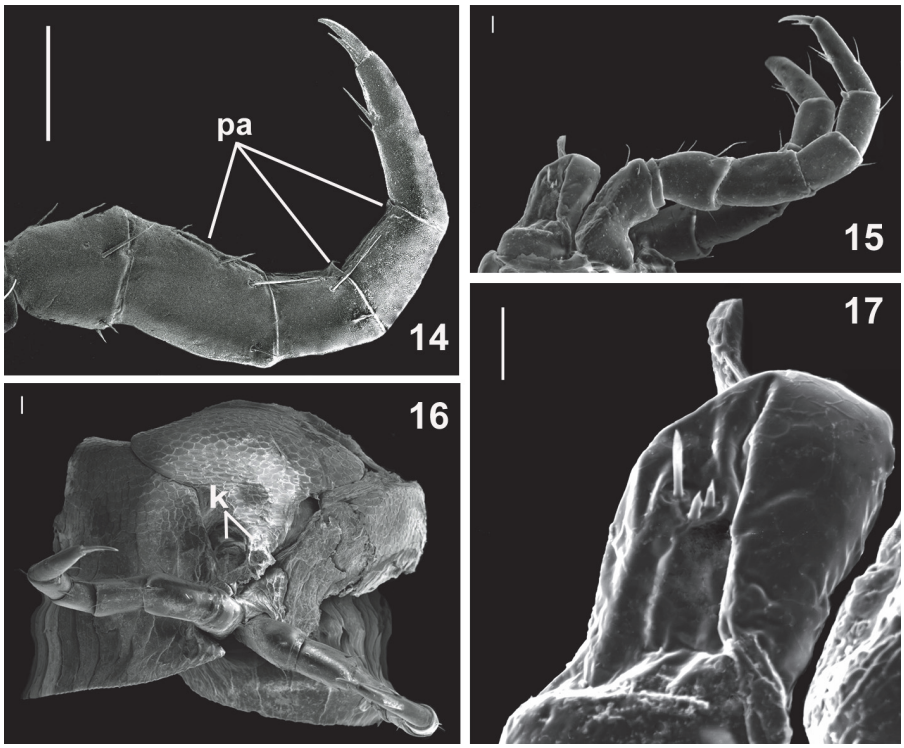
Figs 1–7. *Orinisobates microthylax* Enghoff, 1985, male from Sikhote-Alin State Nature Biosphere Reserve (1, 2), male from Vladivostok, Botanical Garden (3, 4, 5, 6, 7): 1 – distal part of gnathochilarium, ventral view; 2 – body ring 9, dorsal view; 3 – distal part of antenna; 4 – body ring 6, lateral view; 5 – claw 7; 6 – leg 1, posterior view; 7 – penis, posterior view, slightly turned to the left. Abbreviations: **co** – constriction; **oz** – ozopore; **p** – protrusions; **s** – median seta; **1s** – one apical seta; **2s** – two apical setae; **sb** – sensilla basiconica; **sp** – spinelike process; **su** – axial suture. Scale bars: 2 μm (Fig. 5), 20 μm (Figs 1, 3, 6, 7), 100 μm (Figs 2, 4).

Legs short and slender. Claw at base with a setiform accessory claw ventrally, reaching to almost mid-length, mid-length or slightly more mid-length of claw. Claws of pregonopodal legs with short accessory claws; leg pair 7 with small protrusions (**p**) in apical part of tarsus (Fig. 5). Transversely ridged, small soft ventral pads (**pa**) present on femur, postfemur and tibia of legs posterior to leg pair 2 (Fig 14). Leg pair 1 slightly shorter and more powerful



Figs 8–13. *Orinisobates microthylax* Enghoff, 1985, male from Sikhote-Alin State Nature Biosphere Reserve (9, 10), male from Vladivostok, Botanical Garden (8, 11, 12, 13): 8 – anterior gonopods, posterior view; 9 – anterior gonopods, posterior view; 10 – posterior gonopod, lateral view; 11 – apical hooks of gonopod coxal processes, posterior view; 12 – part near mid-length of mesal edge of anterior gonopod telopodite; 13 – anterior gonopod telopodite. Abbreviations: **c** – concavity; **f** – flagellum; **h** – apical hook; **la** – lateral lamella; **lp** – coxal process; **me** – mesal lamella; **ms** – minute spinelike setae; **ss** – small setae. Scale bars: 0.1 mm (Figs 8, 9, 10), 10 μm (Figs 12, 13), 20 μm (Fig. 11).

than the other legs; tibia 1 with long slender, spinelike process (**sp**) (Fig. 6). Penis short, double. According to Lohmander (1933) and Enghoff (1985), the penis of *Orinisobates* has two setae (apical and median setae) on each lobe. But the penis of above male from the Vladivostok, Botanical Garden has only one apical seta (**1s**) on the right lobe, as well as two apical setae (**2s**) and two median setae (**s**) on the left lobe (Fig. 7). This is probably not the norm, but an anomaly of the seta arrangement. Interesting, because in the few males found in parthenogenetic populations of *Nemasoma varicorne* the number of setae on the penis is variable, possibly a result of lacking stabilising selection on the presumably ”useless” males (Enghoff, 1976) (personal message from H. Enghoff).



Figs 14–17. *Orinisobates microthylax* Enghoff, 1985, male from Vladivostok, Botanical Garden (14), masculinized female from Jewish Autonomous Region, “Bastak” Nature Reserve (16), masculinized female from Amurskaya oblast (15, 17): 14 – leg 7 without coxa and trochanter; 15 – ring 7, anterior view; 16 – ring 7, ventral view; 17 – undeveloped anterior gonopod. Abbreviations: **k** – knobs; **pa** – ventral pads. Scale bars: 20 μm (Figs 15, 16, 17), 100 μm (Fig. 14).

Gonopods partly protruding. Anterior gonopods: coxae with long, slender processes (**lp**) located parallel to each other (Figs 8, 9). Each coxal process with a knob-shaped, almost square apical hook (**h**) and 2 long setae in the basal third of length. The hooks (**h**) extending well (in male from Vladivostok, Botanical Garden) or not extending much (in male from Sikhote-Alin State Nature Biosphere Reserve) laterad of coxal processes proper (Figs 8, 9, 11).

Coxa with slender flagellum (**f**) of medium length, caudally covered with cuticular conical spikes; some of the apex spines longer than others (Fig. 9). Anterior gonopods telopodites 1-segmented, about 2/3 the length coxal processes, each with 2 long apical setae (Figs 8, 9, 13; fig. 13: the second seta broken off) and 4 small setae (**ss**) near mid-length of mesal edge as well as 5 subapical minute spinelike setae (**ms**) with entire margins (Figs 12, 13). Posterior gonopods with 2–3 fingerlike processes (Fig. 10). Mesal (**me**) and lateral (**la**) lamellae about the same size; extreme apex directed distad; extreme distal part with a subapical, lateral/anterior concavity (**c**).

FEMALE. Length in alcohol from 12 mm to 17 mm, midbody vertical diameter from 0.6 mm to 0.8 mm with 34(–2), 35(–2), 35(–2) (from Jewish Autonomous Region, "Bastak" Nature Reserve), 43(–1) (from Sikhote-Alin State Nature Biosphere Reserve), 47(–1) (from Vladivostok, Botanical Garden) rings. Coloration dark brown in large individuals and light brown (this may be due to bleaching) in small (probably young) females. Mandibular stipites oval in lateral view.

The masculinized female was found among the material from Amurskaya oblast. Its length 15 mm, midbody vertical diameter 0.8–0.9 mm with 35(–1) rings. Coloration in alcohol light brown (this may be due to bleaching). The female has one leg 8 on the ring 7 transformed into an undeveloped anterior gonopod with the rudiments of coxal process and telopodite (Figs 15, 17). The second leg of these leg-pairs is a normal walking leg. In addition, this female has normal vulvae; leg 1 is devoid of process on the tibia.

Another smaller masculinized female was found among the specimens from Jewish Autonomous Region, "Bastak" Nature Reserve. Length of this female in alcohol about 10 mm, midbody vertical diameter 0.5 mm, 37(–3) rings. Coloration in alcohol light brown (this may be to bleaching). The vulvar cleft is formed; vulvae present. Ring 7 with two unsegmented knobs (**k**) arranged sequentially one after the other (Fig. 16).

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