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Millipedes (Diplopoda) of the Kurile Islands

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Abstract The millipede fauna of the Kurile Islands is reviewed, with 11 recognizable species involved, all arranged in a catalogue-like way. A brief historical account, new faunistic records, a comparative analysis, and zoogeographical notes are given. Remarks and illustrations are provided for all species encountered, including data on the taxonomy, distribution and ecology. All species currently known from Kurile Islands are keyed.

Key words: Diplopoda, fauna, keys, distribution, Kurile Islands

Introduction

The vast majority of millipedes (Diplopoda) are saprophages; they play important roles in the processes of decomposition of plant debris and in pedogeneses. Currently this class of Myriapoda contains over 11,000 described species classified to 144 families, 16 orders and two subclasses after the new family-level classification (Shelley 2003). However, actual quantity of species is suspected to be near 80,000 (Hoffman 1980).

Millipede fauna of the Russian Far East [= territory encompasses the Magadan, Kamchatka, Amurskaya and Sakhalin (Sakhalin Island + Kurile Islands) areas as well as the Khabarovsk and Primorsky provinces] can be considered as a fairly good investigated. At present the Far East of Russia supports 66 species, 28 genera, 15 families and 5 orders. Information on Diplopoda of this territory is summarized in the faunistical review of millipedes of the Asian part of Russia (Mikhaljova 2004). According to the faunistical list of Miyosi (1959) millipede fauna of Japan contains 180 species, 57 genera, 19 families and 6 orders.

The first record of a millipede in the Kurile Islands belongs to Golovatch (1980). He reported the genus *Underwoodia* from the Kunashir Island as plotted on a map only, but he did not treat this record as conspecific with Far Eastern species *U. kurtschevae* Golovatch, 1980 due to the absence of males. Since then additional and new species were reported or described by Enghoff (1985), Mikhaljova (1988, 1990, 1995, 1996, 1998a), Golovatch *et al.* (1995), Mikhaljova & Basarukin (1995), of which latter was exclusively devoted to the insular fauna of the Russian Far East (Sakhalin Island and Kuriles). In addition, reviews of the millipede faunas of the Asian part of Russia (Mikhaljova 1993, 2004) and the Russian Far East (Mikhaljova 1998b) contain the information on the diplopods of the Kuriles.

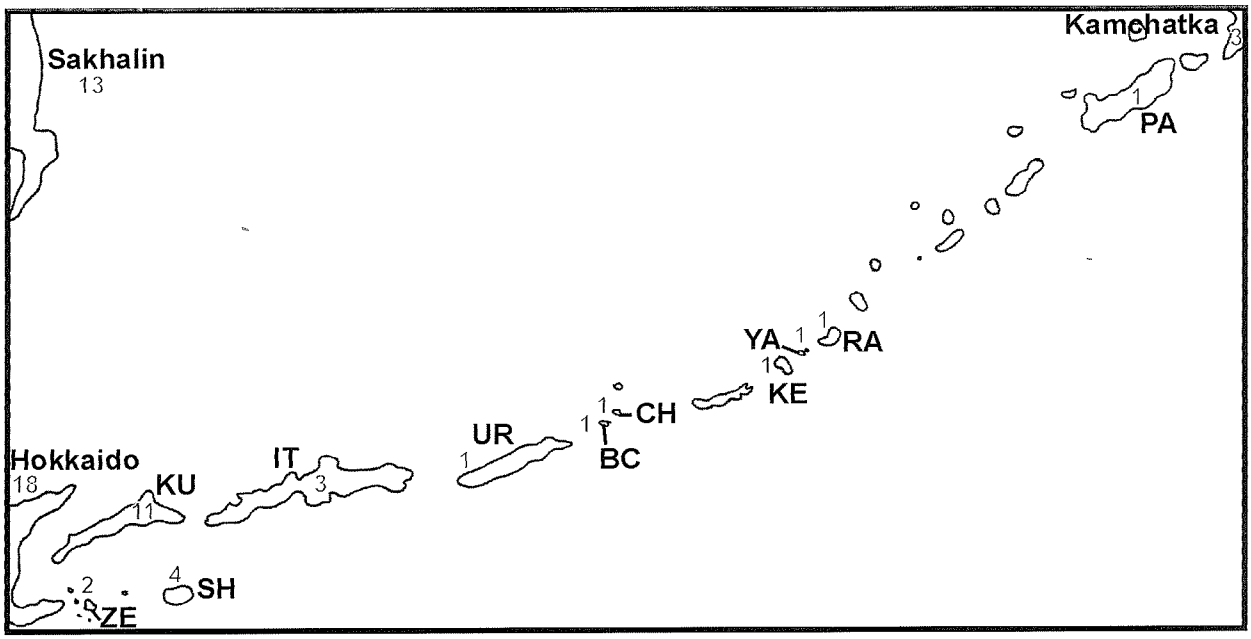
The millipede fauna of the northern part of the Kuriles is practically unknown (only one species has been reported from this territory) in contrast to fairly well investigated fauna of the Kunashir Island. Different specialists collected material in the Archipelago. Great contribution to the collection of Diplopoda of the Kurile and Sakhalin islands was made by the Russian outstanding naturalist Anatoly M. Basarukin as well as Kirill Yu. Eskov and the second author in the course of the International Kuril Island Project (IKIP) in 1994–1995 and the expedition of the second author in 1996–1997.

Materials and Methods

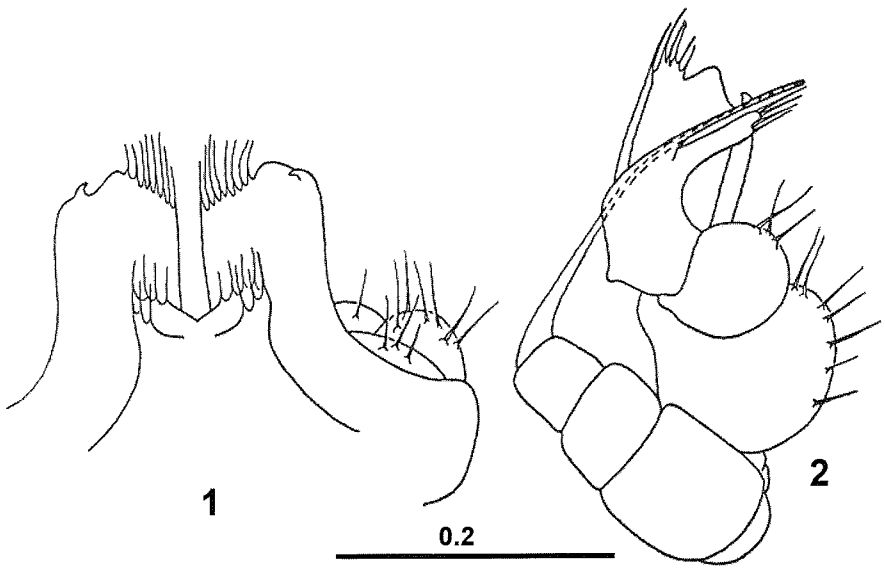
Unidentified material from the Kurile Islands deposited in the Institute of Biology and Soil Science, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok (IBSS) have been located and treated here. Examined and published samples were omitted.

Each species heading references to all published material from the Kuriles as well as original combinations are given. The list of taxa is given after the classification of Hoffman (1980).

Names of the islands have been abbreviated according to IKIP standard: ZE – Zelyonyi, SH – Shikotan, KU – Kunashir, IT – Iturup, UR– Urup, BC – Brat Chirpoev, CH – Chirpoi, KE – Ketoi, YA – Yankicha (Ushishir), RA – Rasshua, PA – Paramushir.



Map 1. Species diversity in Diplopoda within the Kurile Islands and adjacent territories. Quantity of species is written by Arabic numerals; abbreviations as in Table 1.



Figures 1–2. *Angarozonium aduncum* (Mikhaljova, 1995): 1 gonopods (front view); 2 gonopods (caudal view). Scale in mm (after Mikhaljova and Basarukin 1995).

Species surveyed

Order Polyzoniida
Family Polyzoniidae

***Angarozonium aduncum* (Mikhaljova, 1995)** [Figs 1–2]

Polyzonium aduncum Mikhaljova, 1995 in Mikhaljova & Basarukin, 1995: 90–91, 90: map 1, 91: f. 1–3.

Angarozonium aduncum: Shelley, 1998: 30; Mikhaljova, 1998b: 12, 11: f. 21–22, 12: map 2; Mikhaljova, 2004: 44–45, 44: f. 20–21, 45: map 2.

Comments. This detrivorous species dwells in forest litter and mosses; also it has been reported in *Sphagnum* bogs.

Distribution. The species has the insular range including southernmost Sakhalin and Kuriles (Kunashir and Shikotan islands) (Mikhaljova 2004).

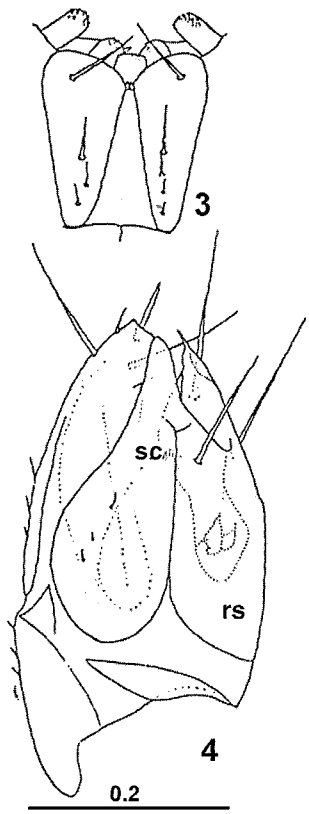
Order Julida
Family Nemasomatidae

***Orinisobates microthylax* Enghoff, 1985** [Figs 3–4]

Orinisobates microthylax: Mikhaljova, 1993: 16, 12: map 2; Mikhaljova & Basarukin, 1995: 91–92, 90: map 1; Mikhaljova, 1998b: 73, 73: map 19, 72: f. 316–317; Mikhaljova & Golovatch, 2001: 107; Mikhaljova & Korsós, 2003: 219; Mikhaljova & Marusik, 2004: 5; Mikhaljova, 2004: 94–96, 94: map 12, 95: f. 211–212.

Comments. This species mostly dwells under bark of logs. However, it occurs also in forest litter. *O. microthylax* is obligatory thelytokion species.

Distribution. The species is distributed in central and southern parts of Kamchatka Peninsula, the southern part of the Kuriles, Sakhalin Island, the southern part of Khabarovsk Province and Primorsky Province; it has also



Figures 3–4. *Orinisobates microthylax* Enghoff, 1985: 3 lamellae linguales and promentum of female gnathochilarium; 4 left vulva; rs receptaculum seminis with a pair of internal flaps; sc sclerotisations at base of receptaculum seminis. Scale in mm (after Enghoff 1985).

been recorded in Buryatia, Siberia (Mikhaljova 2004). Its occurrence in Northeast China and Hokkaido Island is very likely.

***Orinisobates soror* Enghoff, 1985** [Figs 5–10]

Orinisobates soror Enghoff, 1985: 48–49, 49: f. 44–49, 50: map (=Fig. 50); Mikhaljova, 1990: 137; Mikhaljova, 1993: 16, 12: map 2; Mikhaljova & Basarukin, 1995: 91, 90: map 1; Mikhaljova, 1998a: 7; Mikhaljova, 1998b: 72–73, 72: f. 312–315, 73: map 19; Mikhaljova, 2004: 92–94, 93: f. 205–210, 94: map 12.

Comments. This species lives mostly in lake- and seashore. Also, it was collected in gramineous meadow (Mikhaljova & Basarukin 1995).

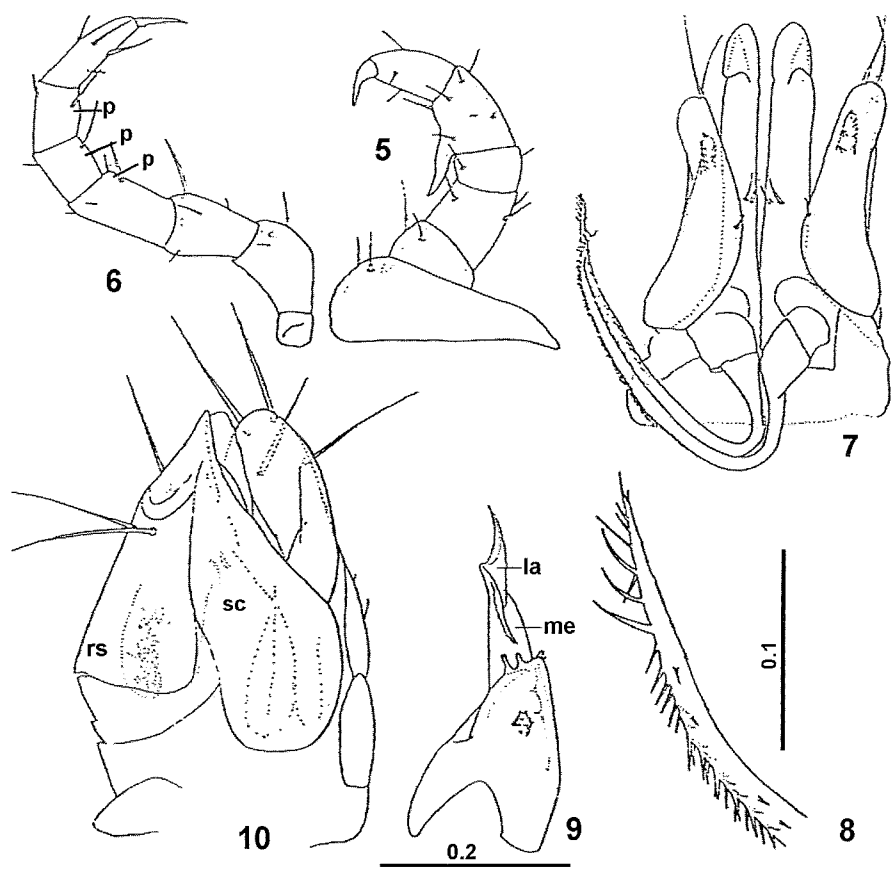
Distribution. Like some other species, this species has the insular range. It is known from the South Sakhalin Island and southern-middle Kuriles (Mikhaljova 2004).

Family Julidae

***Cylindroiulus latestriatus* (Curtis, 1845)** [Fig. 11]

Cylindroiulus latestriatus: Mikhaljova, 1998a: 6; Mikhaljova, 1998b: 61–62, 61: f. 241; Mikhaljova, 2004: 57–58, 57: f. 48, 58: map 5.

Comments. This is anthropochorous subcosmopolitan species. In the Kuriles, it has been only found sandy seashore hull near Yuzhno-Kurilsk, Kunashir Island (Mikhaljova 1998a). This record is the definitely



Figures 5–10. *Orinisobates soror* Enghoff, 1985: 5 male first right leg (front view); 6 male midbody leg; 7 anterior gonopods (caudal view); 8 distal part of flagellum; 9 right posterior gonopod (lateral view); 10 right vulva; la lateral lamella; me mesal lamella; p soft pads; rs receptaculum seminis with sperm; sc sclerotisations at base of receptaculum seminis. Scales in mm (after Enghoff 1985).

introduction through human agency.

Distribution. The species is widely distributed in Europe and introduced to the North and South America as well as the northern part of Asia. The Asian localities of *Cylindroiulus latestriatus* are rare (Altai Mts, Tomsk City, Kunashir Island) (Mikhaljova 2004).

Order Chordeumatida
Family Diplomaragnidae

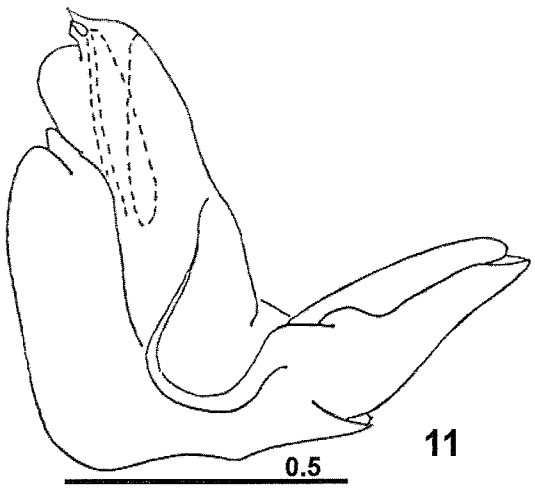


Figure 11. *Cylindroiulus latestriatus* (Curtis, 1845): gonopods (mesal view). Scale in mm (after Mikhaljova 1998b).

***Sakhalineuma curvatum* (Mikhaljova, 1995)** [Figs 12–16]

Diplomaragna curvata Mikhaljova, 1995: 83–86, 84: f. 19–23; Mikhaljova & Basarukin, 1995: 94, 93: map 3; Mikhaljova, 1998b: 23, 23: f. 72–74, 19: map 5.

Sakhalineuma curvatum: Mikhaljova, 2004: 129–130, 130: f. 299–303, 126: map 17.

Comments. The species lives mainly in the litter of broad-leaved forests with bamboo undergrowth. It has been collected on vegetation and seashores.

Distribution. This species has the insular range embracing south Sakhalin and the southern Kuriles (Mikhaljova 2004).

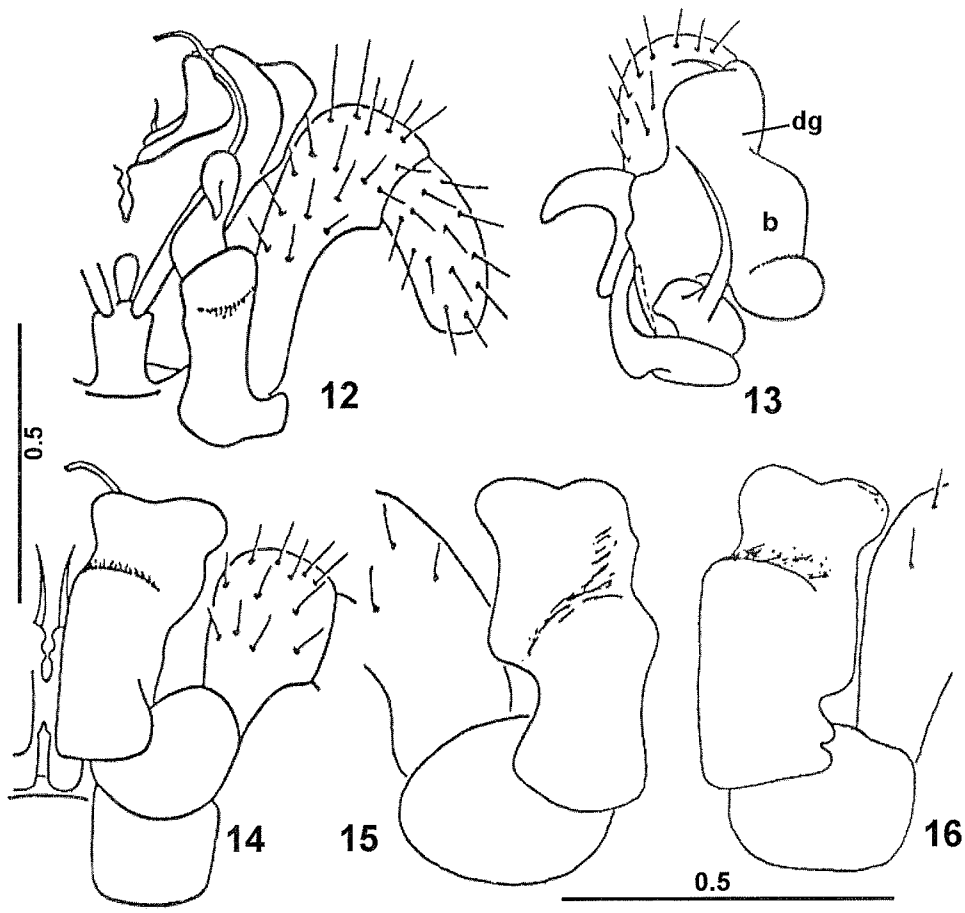
***Sakhalineuma tuberculatum* (Mikhaljova, 1995)** [Figs 17–21]

Diplomaragna tuberculata Mikhaljova, 1995: 82–83, 83: f. 13–18; Mikhaljova & Basarukin, 1995: 94, 93: map 3; Mikhaljova, 1998b: 22, 21: f. 63–68, 19: map 5.

Sakhalineuma tuberculatum: Mikhaljova, 2004: 126–128, 126: map 17, 127: f. 291–295.

Material examined. 1 ♂, 1 ♀ (IBSS), Kuriles, Paramushir Island, NE shore, environs of Severo-Kurilsk, 50°40'N, 156°06'E, 13.09.1996, leg. Marusik Yu. M.

Comments. Originally described from the southern Sakhalin Island and Kunashir Island, this species appears to be widespread here; it has not hitherto been recorded



Figures 12–16. *Sakhalineuma curvatum* (Mikhaljova, 1995): 12 gonopods (caudal view); 13 gonopods (mesal view); 14–16 gonopods (front view); b prominence of colpocoxite; dg distal groove of colpocoxite. Scales in mm (12–14 after Mikhaljova 1998b; 15–16 after Mikhaljova 1995).

in the northern part of the Kuriles. This species dwells in leafy forests as well as on seashores and lake banks.

Distribution. The range of this species is restricted to the Kuriles (Kunashir and Paramushir islands) and the southern part of Sakhalin Island (Mikhaljova 2004).

Family Caseyidae

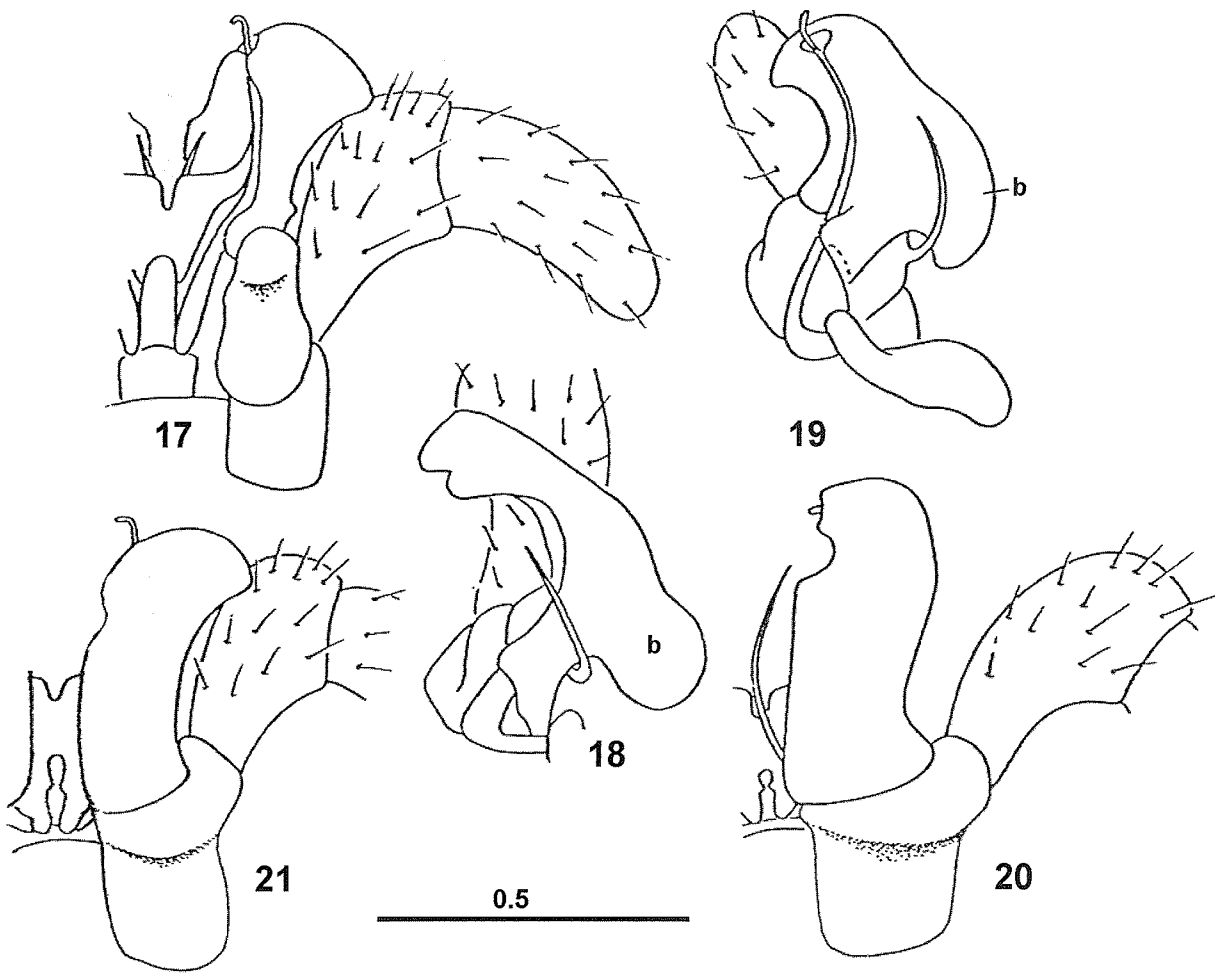
***Underwoodia kurtschevae* Golovatch, 1980** [Figs 22–34]

Underwoodia kurtschevae: Golovatch, 1980: 199–202, 200: f. 1, 201: map (= f. 2); Mikhaljova, 1990: 137; Mikhaljova, 1993: 17–18; Shelley, 1993: 175, 172: f. 10, 175: map (= f. 12); Mikhaljova & Basarukin, 1995: 92–94, 92: f. 4–7, 93: map 2; Mikhaljova, 1998b: 40–42, 40: map 9, 39: f. 138–141; Mikhaljova & Marusik, 2004: 6; Mikhaljova, 2004: 202–205, 203: f. 505–517, 204: map 26.

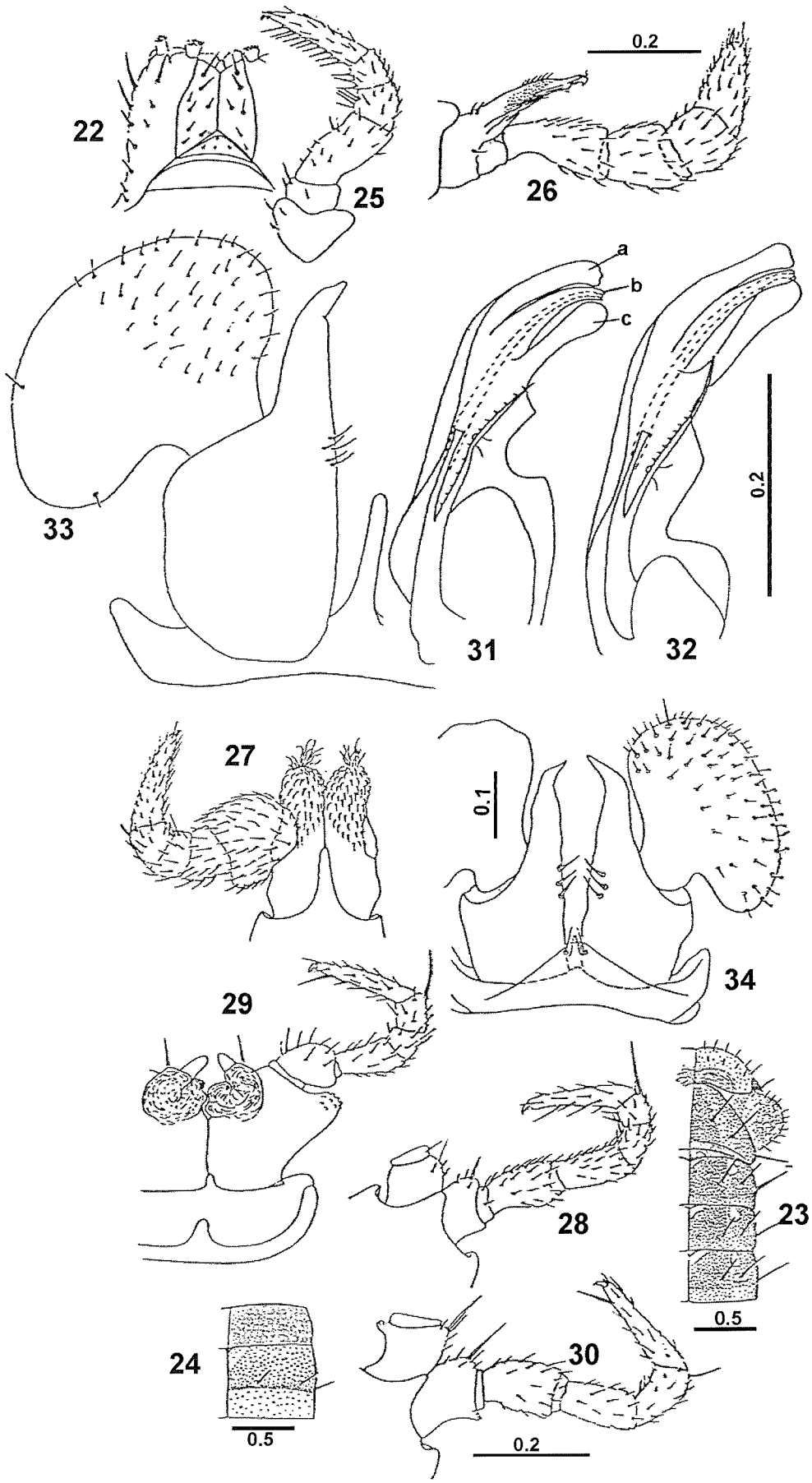
Material examined. 1 juv. (IBSS), Kuriles, Urup Island, C-SW shore Otkryty Reid S shore, 45°51'N, 149°46'E, 4–5.VIII.1995. – 1 ♀ (IBSS), Kuriles, Urup Island, NW shore Natalii B., S shore near Natalii R., 46°06'N, 150°07'E, 6.VIII.1995. – 2 ♀♀ (IBSS), Kuriles, Urup Island, NW shore Natalii Bay, C shore Obzhytaya R. valley, 46°10'N, 150°08'E, 7.VIII.1995. – 1 ♀ (IBSS), Kuriles, Ketoi Island, N part, Storozheva Cape W of Caskad Waterf., 47°22.60'N, 152°27.48'E, 15.VIII.1995. – 3 ♀♀, 1 juv. (IBSS), Kuriles, Chirpoi Island, NE Part of Peshchanaya Bay, 46°32.52'N, 150°53.90'E, 23.VIII.1995. – 2 juv. (IBSS), Kuriles, Kunashir Island, 5 km E of Yu. Kurilsk, near Sukacheva Cp., 145°51.95'E, 40°04.50'N, bamboo thicket, 21.VIII.1997. – 1 ♀ (IBSS), Kuriles, Kunashir Island, SW of Yu. Kurilsk, Lesnaya River, Kisly Ck., 44°00.72'N, 145° 46.28'E, 1.IX.1995. – 1 ♀ (IBSS), Kuriles, Shikotan Island, Krabozavodskoe Vil., 146°45.24'E, 43°50.10'N, canyon with *Abies*, *Taxus*, birch forest with ferns Gramineae and *Carex*, 14.IX.1997. – 1 juv. (IBSS), same locality, under stones along ck., 14.IX.1997; all leg. Yu. M. Marusik.

Comments. This is rather common species in the southern part of the Russian Far East. It is characterized by thelytoky with males almost absent in populations. This species has hitherto been reported from Urup Island, Ketoi Island and Chirpoi Island, all plotted on a map; corresponding materials have not been given (Mikhaljova 1998b). These samples are given above.

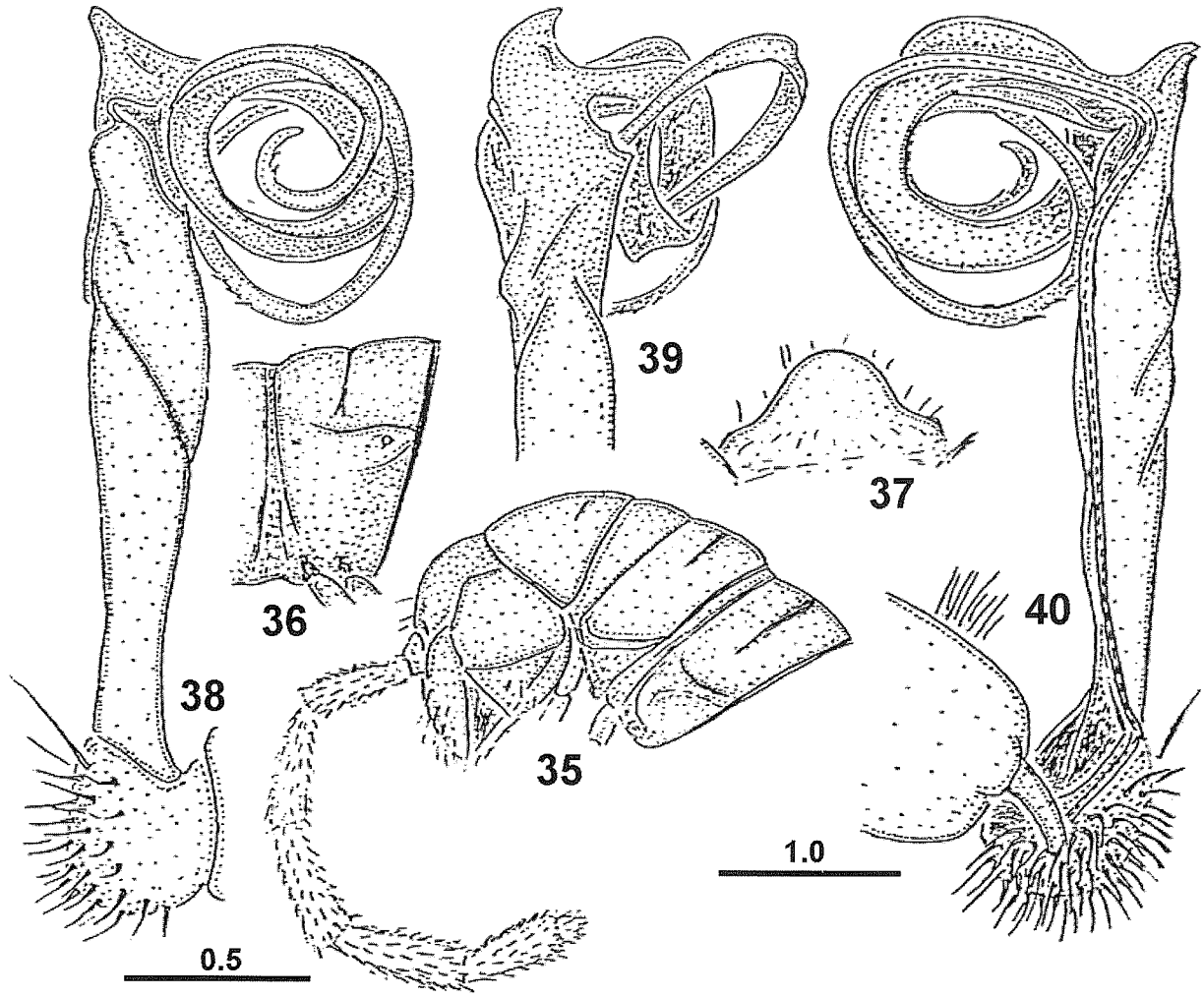
Distribution. This species is widespread in the southeastern part of the Russian Far East and reaches as far north as the central part of the Kamchatka Peninsula. The most southern locality is North Korea. In the west border of the species range coincides with Maliyi Khingan Mt. Range, in the east – with the Kurile Islands



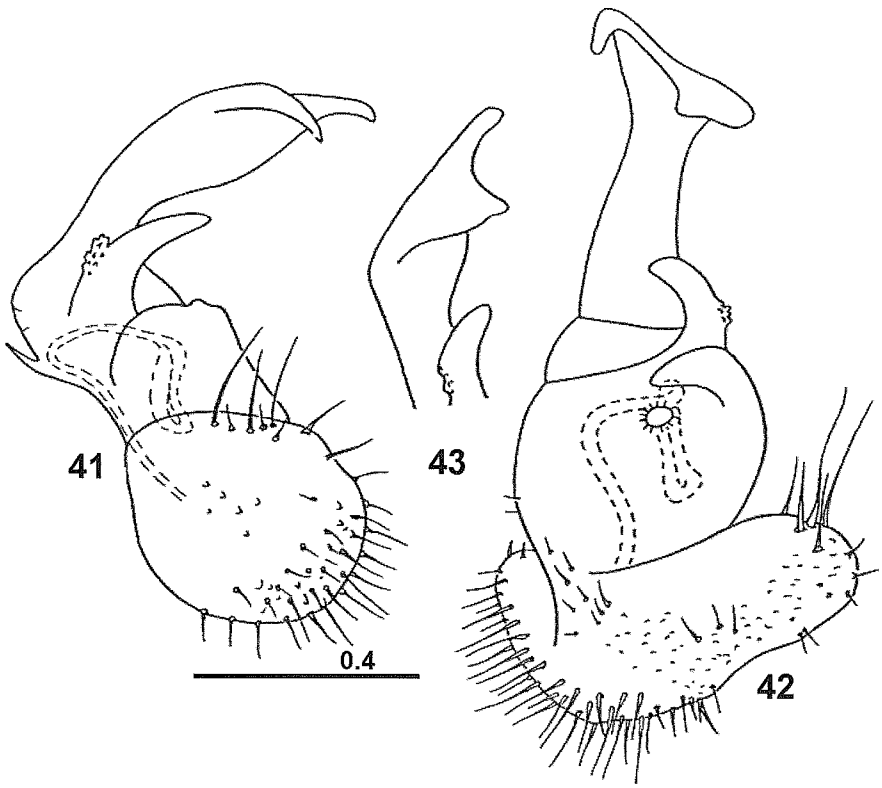
Figures 17–21. *Sakhalineuma tuberculatum* (Mikhaljova, 1995): 17 gonopods (caudal view); 18–19 gonopods (mesal view); 20–21 gonopods (front view); b prominence of colpocoxite. Scale in mm (after Mikhaljova 1998b).



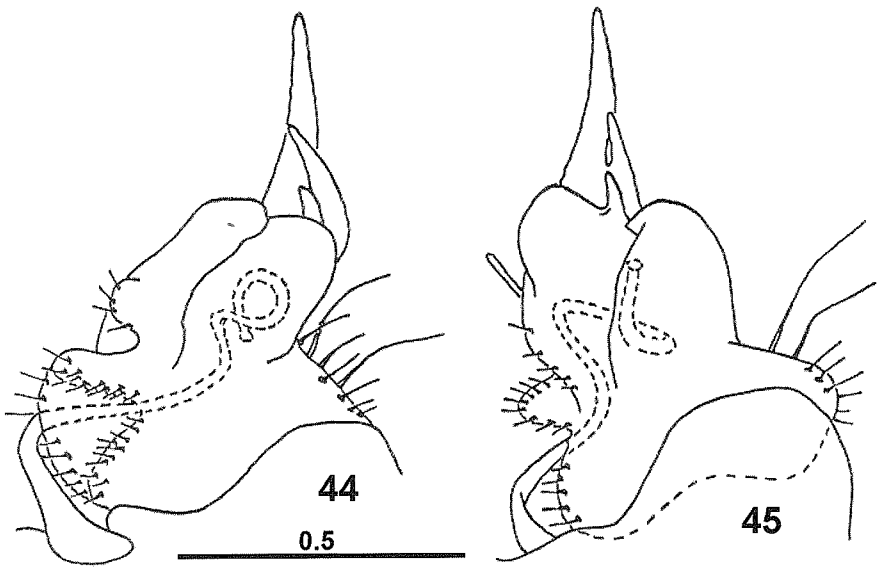
Figures 22–34. *Underwoodia kurtshchevae* Golovatch, 1980: 22 gnathochilarium; 23 fore part of male body (dorsal view); 24 male midbody segment (dorsal view); 25 male first leg; 26 male second leg; 27 male leg pair 3; 28 male leg pair 4; 29 male leg pair 10; 30 male leg pair 11; 31–32 anterior gonopods (caudal view); 33 posterior gonopod (caudal view); 34 posterior gonopods (front view); a mesal branch of colpocoxite; b lateral branch of colpocoxite; c posterior branch of colpocoxite. Scales in mm (22–30, 34 after Golovatch 1980; 31–33 after Mikhaljova and Basarukin 1995).



Figures 35–40. *Haplogonosoma implicatum* Brölemann, 1916: 35 fore part of male body; 36 male body segment 10; 37 lamina between male coxae 4; 38 gonopod (lateral view); 39 distal part of gonopod (subventral view); 40 gonopod (mesal view). Scales in mm (after Golovatch *et al.* 1995).



Figures 41–43. *Epanerchodus kunashiricus* Mikhaljova, 1988: 41 gonopod (lateral view); 42 gonopod (ventral view); 43 gonopod telopodite and postfemoral process (43 cephalic and caudal distofemoral processes, according to Golovatch 1991 and Djursvoll *et al.* 2001). Scale in mm (after Mikhaljova 1988).



Figures 44–45. *Epanerchodus cuspidatus* Mikhaljova, 1996: 44 gonopod (lateral view); 45 gonopod (ventral view). Scale in mm (after Mikhaljova 1996).

(Mikhaljova 2004). Its occurrence in the adjacent territory of Hokkaido Island is very likely.

Order Polydesmida
Family Paradoxosomatidae

***Haplogonosoma implicatum* Brölemann, 1916** [Figs 35–40]

Haplogonosoma implicatum: Golovatch *et al.*, 1995: 72–79, 74: f. 1–8; Mikhaljova & Basarukin, 1995: 94; Mikhaljova, 1998b: 58–59, 58: f. 229–234 and map 14; Mikhaljova, 2004: 256–258, 257: f. 662–667, 258: map 34.

Comments. This species was originally described from Japan (Brölemann 1916). Based on material from Kunashir Island it has later been redescribed more adequately (Golovatch *et al.* 1995).

Distribution. The species has the insular range; it is known from Japan (Central Honshu Island) and Russia (the Kuriles, Kunashir Island) (Mikhaljova 2004).

Family Polydesmidae

***Epanerchodus kunashiricus* Mikhaljova, 1988** [Figs 41–43]

Epanerchodus kunashiricus Mikhaljova, 1988: 620–621, 620: figs; Mikhaljova, 1993: 30; Mikhaljova & Basarukin, 1995: 94, 95: map 4; Ganin, 1997: 133; Mikhaljova, 1998b: 44–45, 45: f. 153–155 and map 10; Mikhaljova, 2004: 220–221, 220: f. 555–557, 218: map 28.

Comments. This is a typical inhabitant of forest litter and different plant debris; also it occurs on seashores and lake banks.

Distribution. The Kuriles: Kunashir Island (Mikhaljova 2004).

***Epanerchodus cuspidatus* Mikhaljova, 1996** [Figs 44–45]

Epanerchodus cuspidatus Mikhaljova, 1996: 2–3, 3: f. 1–2; Mikhaljova, 1998b: 45–46, 45: map 10, 46: f. 156–157; Mikhaljova, 2004: 218–219, 218: map 28, 219: f. 553–554.

Comments. This species has originally been described from the environs of Yuzhno-Kurilsk, Kunashir Island, since then remains unrediscovered.

Distribution. This species seems endemic to Kunashir Island (Mikhaljova 2004).

***Uniramidesmus septimus* Mikhaljova, 1990** [Figs 46–48]

Uniramidesmus septimus Mikhaljova, 1990: 136–137, 137: f. 2; Mikhaljova, 1993: 33, 32: f. 56; Mikhaljova & Basarukin, 1995: 94–95, 95: map 4; Mikhaljova, 1998b: 50–51, 50: f. 184–185, 48: map 11; Mikhaljova, 2004: 233–235, 234: f. 585–587, 225: map 29.

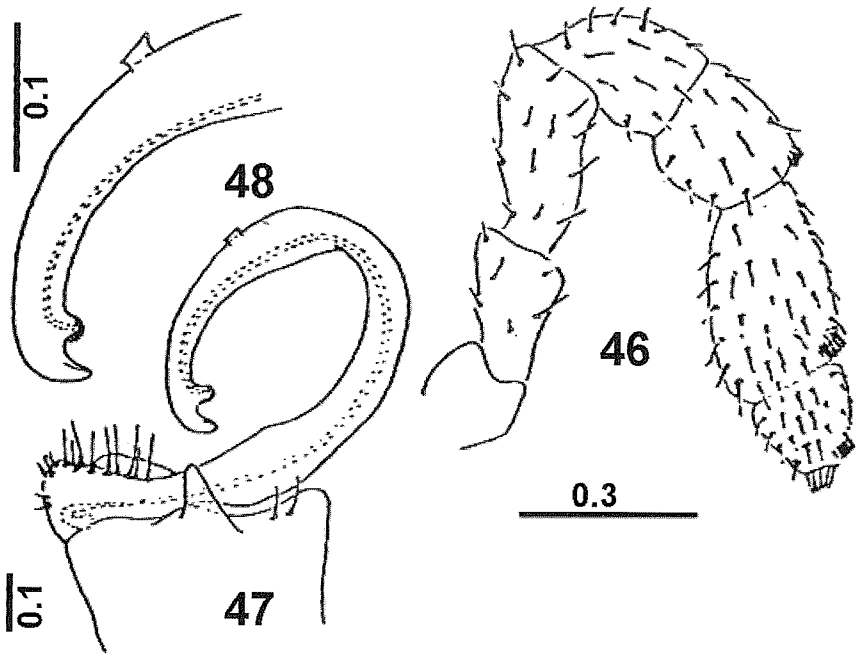
Comments. Like congeners this species inhabits the litter of coniferous, mixed and broad-leaved forests.

Distribution. Originally described from Sakhalin Island and Kunashir Island, this species appears to be widespread there; also it occurs in the southern part of Khabarovsk Province (Mikhaljova 2004), being relatively common (Ganin 1997).

Key to orders, families and species

1 (2) Head very small, elongated anteriorly into a rostrum. Body strongly flattened dorsoventrally, without paraterga. External edge of coxal process of anterior gonopods with a small unciform outgrowth (Figs 1–2) .... Order Polyzoniida Family Polyzoniidae, Genus *Angarozonium, A. aduncum*

2 (1) Head larger, more or less ovoid, devoid of a rostrum. Body more or less cylindrical, with



Figures 46–48. *Uniramidesmus septimus* Mikhaljova, 1990: 46 antenna; 47 gonopod (lateral view); 48 distal part of gonopod telopodite. Scales in mm (after Mikhaljova 1990).

or without paraterga.....3

3 (8) Telson with a pair of spinnerets. Each metatergite with 3+3 macrochaetae ..... Order Chordeumatida

4 (7) Body segments with medium-sized paraterga. Posterior gonopod bearing colpocoxite with a front prominence (b) (Figs 13, 18–19) ..... Family Diplomaragnidae
Genus *Sakhalineuma*

5 (6) Male coxa 11 with a digitiform process. Gonopods as in Figs 17–21; lateral sheath process of posterior gonopod colpocoxite tuberculiform (Figs 18–19) .... *S. tuberculatum*

6 (5) Male coxa 11 without processes. Gonopods as in Figs 12–16; lateral sheath process of posterior gonopod colpocoxite cylindrical, curved (Fig. 13) ..... *S. curvatum*

7 (4) Body segments without paraterga or bulges (Fig. 24). Gonopods, including posterior ones, different, as in Figs 31–34 ..... Family Caseyidae
Genus *Underwoodia, U. kurtschevae*

8 (3) Telson without spinnerets. Metatergites without macrochaetae or with simple setae 9

9 (16) Metatergites with paraterga. Eyes absent. Adult body with 20 segments, including telson ..... Order Polydesmida

10 (15) Paraterga well-developed, serrate at lateral margin, without peritremata. Body relatively slender; metaterga relatively flat, with three transverse rows of bosses. Gonopod coxites fused medially .....Family Polydesmidae

11 (14) Paraterga broad. Body relatively large (adults >15 mm long). Gonopods as in Figs 41–43, 44–45 ..... Genus *Epanerchodus*

12 (13) Gonopod telopodite [= Cephalic distofemoral process, using modern terminology (Golovatch 1991; Djursvoll *et al.* 2001)] without two branches apically (Figs 44–45) ..... *E. cuspidatus*

13 (12) Gonopod telopodite [= Cephalic distofemoral process, using modern terminology (Golovatch 1991; Djursvoll *et al.* 2001)] with two branches apically (Figs 41–43) ..... *E. kunashiricus*

14 (11) Paraterga narrow. Body relatively small (adults < 15 mm long). Gonopods as in Figs 47–48 .....Genus *Uniramidesmus, U. septimus*

15 (10) Paraterga relatively poorly-developed, with peritremata, non-serrate at lateral margin (Fig. 36). Body stout, metaterga strongly convex, arched, without traces of bosses. Gonopods (Figs 38–40) free from each other basally .....Family Paradoxosomatidae
Genus *Haplogonosoma, H. implicatum*

16 (9) Metatergites without paraterga, body subcylindrical. Eyes present. Adult body with more than 20 segments. ..... Order Julida

17 (18) Surface of metazonites completely striate. Gonopods as in Fig. 11 .....Family Julidae
Genus *Cylindroiulus, C. latestriatus*

18 (17) Surface of metazonites clearly striate only below ozopore level. Gonopods different ....Family Nemasomatidae
Genus *Orinisobates*

19 (20) Setae on metazonites distinctly visibly. Gonopods as in Figs 7–9.....*O. soror*

20 (19) Setae on metazonites not or hardly visible even at high magnification. Male unknown. Female receptaculum seminis reduced (Fig. 4) ....*O. microthylax*

Results and Discussion

At present, 11 species from 8 genera, 7 families and 4 orders of Diplopoda are known to occur in the Kurile Islands (see Table 1 and Map 1). Millipedes have been reported from 11 of 30 islands. Rather this pattern expresses the degree of Diplopod's fauna study. Within the Archipelago millipedes are restricted to the southern Kuriles (Shikotan-Kunashir-Iturup) and the southern part of middle Kuriles (Urup-Ushishir); only one species has been registered in Paramushir of all northern islands.

Like other animals and plants (cf. Pietsch *et al.* 2003) the highest species diversity is recorded in Kunashir Island. Actually the millipede fauna of this island incorporates all species known from the Archipelago. This pattern contrasts the faunas of other invertebrate groups.

Majority of regional species (63.6% of the total number of species) have insular ranges. The distribution areas of three species (27.3%) cover both continental territories and islands. Thus, *Underwoodia kurtschevae* are widely distributed in the Far East of Russia; also it has been reported in North Korea. *Orinisobates microthylax* has the large range covering East Siberia and the Russian Far East. Such pattern probably being accounted for by parthenogenesis characteristic of these species. *Uniramidesmus septimus* is known from the Kuriles, Sakhalin Island and Khabarovsk Province, Far East of Russia.

Orinisobates soror and *Underwoodia kurtschevae* are the most widespread species in the Archipelago, they have been reported from 6–7 islands within the South Kuriles and the southern part of the middle Kuriles.

Synantropic *Cylindroiulus latestriatus* is not the natural component of the fauna. This species has definitely been introduced to Kunashir Island through human agency. It was collected in the semi-natural habitat (Mikhaljova 1998a). *Cylindroiulus latestriatus* is widespread in Europe, introduced into North and South America as well as the Asian part of Russia (Mikhaljova 2004).

Generally, the fauna of Diplopoda of the Kuriles is sufficiently original. The number of species endemic to Sakhlin-Kurile Islands attains 36.4% of the region's total species diversity. *Epanerchodus cuspidatus* and *E. kunashiricus* are endemic to the Kuriles, all accounting 18.2% of all regional species, and all found in Kunashir Island. Of 8 millipede genera currently known from the Kuriles, only *Sakhalineuma* (12.5%) occurs in Sakhalin Island and Kuriles.

As a result, 37.5% of genera (including endemic *Sakhalineuma*) and 45.5% of species are distributed in

Table 1. A list of Diplopoda of the Kurile Islands.

Order, family, species	ZE	SH	KU	IT	UR	BC	CH	KE	YA	RA	PA	other territories
Polyzoniida												
Polyzoniidae												
Angarozonium aduncum (Mikhaljova, 1995)		*	*									SA
Julida												
Nemasomatidae												
Orinisobates microthylax Enghoff, 1985		*	*	*+								ES, KA, SA, PP, KH
Orinisobates soror Enghoff, 1985	*	*	*			*			*	*		SA
Julidae												
Cylindroiulus latestriatus (Curtis, 1845)			*									EU, NSA, NA
Chordeumatida												
Diplomaragnidae												
Sakhalineuma curvatum (Mikhaljova, 1995)			*	*								SA
Sakhalineuma tuberculatum (Mikhaljova, 1995)			*								*	SA
Caseyidae												
Underwoodia kurtschevae Golovatch, 1980	*	*	*	*	*		*	*				PP, KH, MKHR SA, KA, NK
Polydesmida												
Paradoxosomatidae												
Haplogonosoma implicatum Brölemann, 1916			*									HI
Polydesmidae												
Epanerchodus kunashiricus Mikhaljova, 1988			*									
Epanerchodus cuspidatus Mikhaljova, 1996			*									
Uniramidesmus septimus Mikhaljova, 1990			*									KH, SA
Total	2	4	11	3	1	1	1	1	1	1	1	

ZE – Zelyonyi, SH – Shikotan, KU – Kunashir, IT – Iturup, UR– Urup, BC – Brat Chirpoev, CH – Chirpoi, KE – Ketoi, YA – Yankicha (Ushishir), RA – Rasshua, PA – Paramushir.

PP – Primorsky Province, KH – Khabarovsk Province, MKHR – Malyi Khingan Mt. Range, SA – Sakhalin Island, KA – Kamchatka Peninsula, ES – East Siberia, NK – North Korea, HI – Honshu Island, EU – Europe, NSA – North and South America, NA – northern part of Asia.

+ – *Orinisobates microthylax* has been reported under the bark of a log introduced as firewood from both southern Sakhalin Island and Primorsky Province (Mikhaljova, 1993).

Table 2. A list of Diplopoda of the Kuriles and adjacent territories (Hokkaido Island, Sakhalin Island and Kamchatka Peninsula).

Order, family, species	Hokkaido	Sakhalin	Kamchatka	Kuriles
Polyzoniida				
Polyzoniidae				
Angarozonium aduncum (Mikhaljova, 1995)		*		*
Angarozonium amurense (Gerstfeldt, 1859)		*	*	
Julida				
Nemasomatidae				
Orinisobates microthylax Enghoff, 1985		*	*	*
Orinisobates soror Enghoff, 1985		*		*
Mongoliulidae				
Kopidoiulus longus Shinohara, 1963	*			
Julidae				
Cylindroiulus latestriatus (Curtis, 1845)				*
Japanopachyiulus niponicus Miyosi, 1957	*			
Amblyiulus lobatus (Verhoeff, 1937)	*			
Pseudonemasomatidae				
Pseudonemasoma femorotuberculata Enghoff, 1991	*			
Chordeumatida				
Diplomaragnidae				
Sakhalineuma basarukini (Mikhaljova, 1995)		*		
Sakhalineuma curvatum (Mikhaljova, 1995)		*		*
Sakhalineuma globuliferum (Mikhaljova, 1995)		*		
Sakhalineuma molodovae Golovatch, 1976		*		
Sakhalineuma sakhalinicum (Mikhaljova, 1995)		*		
Sakhalineuma tuberculatum (Mikhaljova, 1995)		*		*
Diplomaragna gracilipes (Verhoeff, 1914)	*			
Diplomaragna tsurusakii Shear, 1990	*			
Maritimosoma hokkaidense (Verhoeff, 1939)	*			
Conotylidae				
Japanosoma scabrum Verhoeff, 1914	*			
Yasudatyla yasudai Shear & Tsurusaki, 1995	*			
Yasudatyla shariensis Shear & Tsurusaki, 1995	*			
Yasudatyla hidakaensis Shear & Tsurusaki, 1995	*			
Caseyidae				
Underwoodia kurtschevae Golovatch, 1980		*	*	*
Polydesmida				
Xystodesmidae				
Levizonus montanus (Takakuwa, 1941)	*			
Levizonus takakuwai (Verhoeff, 1941)	*			
Paradoxosomatidae				
Oxidus gracilis (C.L. Koch, 1847)	*	*+		
Haplogonosoma implicatum Brölemann, 1916				*
Polydesmidae				
Epanerchodus cuspidatus Mikhaljova, 1996				*
Epanerchodus fontium Verhoeff, 1940	*			
Epanerchodus furculiger Verhoeff, 1937	*			
Epanerchodus gracilis Takakuwa, 1954	*			
Epanerchodus kunashiricus Mikhaljova, 1988				*
Epanerchodus orientalis (Attems, 1901)	*			
Uniramidesmus septimus Mikhaljova, 1990		*		*
Total	18	13	3	11

+– *Oxidus gracilis* has hitherto been reported from Sakhalin Island only after the sample collected by Takakuwa in 1933 (Chamberlin & Wang, 1953). Unfortunately, the more detailed locality has not been indicated; most likely it is an anthropogeneous habitat.

the Palaearchaearctic Subregion of the Palaearctic Region (zoogeographical subdivisions adopted here is those of Semenov-Tian-Shansky in 1936). Thus, the center of species diversity for the prolific *Epanerchodus* is Japan and Korea. Only two endemic species are known from the Kuriles. The genus *Haplogonosoma* shows connections with the faunas of East and Southeast Asia.

Orinisobates, Underwoodia and subfamily Polyzoniinae demonstrate faunal connections between the Kuriles and North America (Mikhaljova 2004).

The genera *Uniramidesmus* and *Sakhalineuma* are endemic to the Asian part of Russia. *Uniramidesmus* with its nine species is more abundantly represented in the southern part of the Russian Far East. Only one species occurs in East Siberia. The genus *Sakhalineuma* is confined to Sakhalin Island and the Kuriles; it is the peripheral member of the family Diplomaragnidae, of which the presumed origin centre lies in Central Asia according to Shear (1990).

Table 2 shows a list of the diplopods encountered in territories adjacent to the Kuriles (Hokkaido Island, Sakhalin Island, and Kamchatka Peninsula). The highest species diversity is observed in Hokkaido Island. However, a single species common for Hokkaido Island and the Kuriles has not hitherto been found. In contrast, regional faunas of some other groups of animals contain common species. The only species (*Haplogonosoma implicatum*) is common for the Kuriles and Japan. This species has been recorded in the southern Kuriles and Central Honshu Island. At the generic level only 25% of all regional genera (*Haplogonosoma* and *Epanerchodus*) appear to be shared by the Kurile Islands and Japan.

The Kamchatka Peninsula supports only three species, which are most widespread in Siberia and the Russian Far East. Two species and two genera are common for the Kurile Islands and the Kamchatka Peninsula.

The millipede fauna of Sakhalin Island is most close to the Kurile fauna as compared with the other adjacent territories. It contains seven common species. At the generic level 62.5% of the total number of Kurile genera are distributed in both Sakhalin and Kurile Islands.

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References

BRÖLEMANN, H.W., 1916. Essai de classification des polydesmiens (Myriapodes). *Ann. Soc. Ent. Fr.* 84, 523–608.

CHAMBERLIN, R.V. AND WANG, Y.M., 1953. Records of millipeds (Diplopoda) from Japan and other Oriental areas, with description of new genera and species. *Amer. Mus. Novit.* 1621, 1–13.

GANIN, G.N., 1997. *Soil animals of the Ussuri region.* Vladivostok & Khabarovsk: Dalnauka Publ. (In Russian.)

GOLOVATCH, S.I., 1980. New forms of Diplopoda from the Soviet Far East and their zoogeographical relationships. *Zool. Zhurnal* 59 (2), 199–207. (In Russian.)

GOLOVATCH, S.I., 1991. The millipede family Polydesmidae in Southeast Asia, with notes on phylogeny (Diplopoda: Polydesmida). *Steenstrupia* 17 (4), 141–159.

GOLOVATCH, S.I., MIKHALJOVA, E.V. AND TANABE, T., 1995. Review of the East Asian millipede genus *Haplogonosoma* Brölemann, 1916 (Diplopoda Polydesmida Paradoxosomatidae). *Proc. Japan. Soc. Syst. Zool.* 53, 71–80.

DJURSVOLL, P., GOLOVATCH, S.I., JOHANSON, K.A. AND MEIDELL, B., 2001 (for 2000). Phylogenetic relationship within Polydesmus sensu lato (Diplopoda: Polydesmidae). *In*: J. WYTWER J. AND S. I. GOLOVATCH, eds. Progress in studies on Myriapoda and Onychophora. *Fragmenta Faunistica, PAN* 43 (Suppl.), 37–59.

ENGHOFF, H., 1985. The millipede family Nemasomatidae with the description of a new genus and a revision of Orinisobates (Diplopoda, Julida). *Entom. Scand.* 16, 27–67.

HOFFMAN, R.L. 1980 (for 1979). *Classification of the Diplopoda.* Mus. hist. nat. Genève, 237 pp.

MIKHALJOVA, E.V., 1988. New millipedes (Diplopoda) from the Kurile Islands. *Zool. Zhurnal* 67 (4), 620–621. (In Russian.)

MIKHALJOVA, E.V., 1990. On the fauna of Diplopoda of the USSR Far East. *Zool. Zhurnal* 69 (5), 134–138. (In Russian.)

MIKHALJOVA, E.V., 1993. The millipedes (Diplopoda) of Siberia and the Far East of Russia. *Arthropoda Selecta* 2 (2), 3–36.

MIKHALJOVA, E.V., 1995. The millipede genus Diplomaragna Attems, 1907, on the Sakhalin and Kurile islands (Diplopoda Chordeumatida Diplomaragnidae). *Arthropoda Selecta*, 4 (3/4), 79–87.

MIKHALJOVA, E.V., 1996. A new species of the genus Epanerchodus (Diplopoda, Polydesmidae) from Kuril Islands. *Far Eastern Entomologist* 29, 1–4.

MIKHALJOVA, E.V., 1998a. New and little-known millipedes (Diplopoda) from the Russian Far East. *Far Eastern Entomologist* 60, 1–8.

MIKHALJOVA, E.V., 1998b. The millipedes of the Far East of Russia (Diplopoda). *Arthropoda Selecta* 7 (1), 1–77.

MIKHALJOVA, E.V., 2004. *The millipedes (Diplopoda) of the Asian part of Russia.* Sofia-Moscow: Pensoft Publ.

MIKHALJOVA, E.V. AND BASARUKIN, A.M., 1995. The millipedes (Diplopoda) of the Sakhalin and Kurile Islands. *Arthropoda Selecta* 4 (3/4), 89–96.

MIKHALJOVA, E.V. AND GOLOVATCH, S.I., 2001 (for 2000). A review of the millipede fauna of Siberia (Diplopoda). *Arthropoda Selecta* 9 (2), 103–118.

MIKHALJOVA, E.V. AND KORSÓS Z., 2003. Millipedes (Diplopoda) from Korea, the Russian Far East, and China in the collection of the Hungarian Natural History Museum. *Acta Zoologica Hungarica* 49 (3), 215–242.

MIKHALJOVA, E.V. AND MARUSIK, Y.M., 2004. New data on taxonomy and fauna of the millipedes from the Russian Far East, Siberia and Mongolia (Diplopoda). *Far Eastern Entomologist* 133, 1–12.

MIYOSI, Y., 1959. *Über japanische Diplopoden.* Osaka: Arachnological Society of East Asia.

PIETSCH, T. W., BOGATOV, V. V., AMAOKA, K., ZHURAVLEV, Y. N., BARKALOV, V. Y., GAGE, S., TAKAHASHI, H., LELEJ, A. S., STOROZHENKO, S. Y., MINAKAWA, N., BENNETT, D. J., ANDERSON, T. R., ÔHARA, M., PROZOROVA, L. A., KUWAHARA, Y., KHOLIN, S. K., YABE, M., STEVENSON, D. E. AND MACDONALD, E. L., 2003. Biodiversity and biogeography of the islands of the Kuril Archipelago. *Journal of Biogeography* 30 (9), 1297–1310.

SHEAR, W.A., 1990. On the Central and East Asian milliped family Diplomaragnidae (Diplopoda, Chordeumatida, Diplomaragnoidea). *Amer. Mus. Novit.* 2977, 1–40.

SEMENOV-TIAN-SHANSKY, A.P., 1936. Limits and zoogeographical subdivisions of the Palaearctic in terrestrial animals based on the geographical distribution of Coleoptera. *Trudy Zoologicheskogo instituta AN SSSR* 2 (2–3), 1-16. (In Russian.)

SHELLEY, R.M., 1993. The milliped genus *Underwoodia* (Chordeumatida: Caseyidae). *Can. J. Zool.* 71, 168–176.

SHELLEY, R.M., 1998 (for 1997). The milliped family Polyzoniidae in North America, with a classification of the global fauna (Diplopoda Polyzoniida). *Arthropoda Selecta* 6 (3/4), 3–34.

SHELLEY, R.M., 2003 (for 2002). A revised, annotated, family-level classification of the Diplopoda. *Arthropoda Selecta* 11 (3), 187–207.