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The millipedes (Diplopoda) of the Russian Far East islands and the Kamchatka Peninsula

Elena V. Mikhaljova

Institute of Biology and Soil Science, Far Eastern Branch of the Russian Academy of Sciences, Prospekt 100-letiya Vladivostoka 159, Vladivostok 690022, Russia; e-mail: mikhaljova@biosoil.ru

Abstract

A review of the millipede fauna of the islands of the Russian Far East and Kamchatka Peninsula is presented, with 36 species involved, all arranged in a catalogue-like manner. A brief historical account, data on the distribution, a comparative analysis of the island diplopod faunas, and zoogeographical notes are given.

Keywords: Myriapoda, fauna, distribution, islands, Russia

1. Introduction

The Russian Far East includes archipelagos and islands off the western coast of the northern Pacific and the islands off the Chukotka at the border between the East Siberian and Chuckchee seas (see Map 1). The most known among them are the islands of the Primorsky Province in the Sea of Japan, Sakhalin Island, the Kurile Islands, the Wrangel, the Commander, Shantarskie islands and Karaginsky Island.

Knowledge of the millipede fauna of the islands of the Russian Far East is still incomplete. Some of the islands of the East Siberian and Bering seas, the Sea of Okhotsk have hitherto remained unexplored. However, it is possible to surmise that these islands are devoid of diplopods or that their millipede fauna is extremely poor. The Wrangel Island seems to be totally devoid of Diplopoda; at least, large long-term (within 12 years) materials on Wrangel invertebrates contain neither millipedes nor centipedes (Khruleva 1987, Stishov 2006). Only centipedes have been found in the Karaginsky Island (S. I. Golovatch pers. comm.).

The millipede faunas of the southern and south-eastern islands of the Russian Far East are nevenly well-studied. Only the diplopods of the Sakhalin Island and southern Kuriles can be considered as fairly well documented while the northern and middle Kuriles, as well as some other small islands have hitherto remained nearly or fully untouched by collecting efforts. In addition, the millipede fauna of Kamchatka requires additional investigations.

The first information concerning the diplopods of the study region came from Lohmander who, in 1933, indirectly mentioned some not more closely identified *Orinisobates* from the Kamchatka Peninsula. The first data on the millipede faunas of islands in the Russian Far East derive from the publication of Chamberlin & Wang (1953) in which *Oxidus gracilis* (C. L. Koch, 1847), a synanthropic subcosmopolitan species, was recorded from the Sakhalin Island. More or less detailed faunistic, taxonomic and ecological data on the insular millipedes of the Russian Far East, as well as Kamchatka Peninsula have only begun to appear since the 1970's (Molodova 1973, 1974, 1976, Golovatch 1976a, 1976b, 1979a, 1979b, 1980, Kurcheva 1977, Lokshina & Golovatch 1977, Mineyeva 1978, Mikhaljova 1979, 1981, 1982, 1988, 1990, 1993, 1995, 1996, 1997a, 1997b, 1998a, 1998b, 2000, 2002, 2006, 2008, Enghoff 1985, Shear 1990, Shelley 1993, 1998, Golovatch et al. 1995, Mikhaljova & Basarukin 1995, Ganin 1997, Mikhaljova & Lim 2001, Mikhaljova & Korsós 2003, Mikhaljova & Marusik 2006). As a result, all available information concerning the insular millipede faunas of the Russian Far East and Kamchatka Peninsula was summarised in a recent review of the millipede fauna of the Asian part of Russia by Mikhaljova (2004).

2. Materials and methods

Unidentified faunistic material deposited in the Institute of Biology and Soil Science, Far Eastern Branch of the Russian Academy of Sciences (IBSS), Vladivostok was treated here. In addition, material collected in August 2004 on Putyatina Island, Primorsky Province by the quantitative method (16 soil samples 25 x 25 cm each) was investigated. Species names include the literature references for the islands of the Russian Far East and Kamchatka Peninsula only.

3. Faunistic part

3.1. Order Polyzoniida

Family Polyzoniidae

***Angarozonium aduncum* (Mikhaljova, 1995)**

Polyzonium aduncum – Mikhaljova & Basarukin 1995.

Angarozonium aduncum – Shelley 1998, Mikhaljova 1998b, 2004, Mikhaljova & Marusik 2006.

Material examined (all from Russia, Kuriles, leg. Yu. M. Marusik): **Kunashir Island**: 5 km E of Yuzhno-Kurilsk, near Sukacheva Cape, 40°04.50′ N 145°51.95′ E, *Abies* forest with birch, ferns, bamboo, Gramineae, mosses, 20.VIII.1997 – 1♀; near Yuzhno-Kurilsk, 40°02.50′ N 145°51.50′ E, *Sphagnum* bog with *Carex,* some Ericaceae and dwarfish *Picea*, 31.VIII.-7.IX.1997 – 2♂, 1♀; S part, 2.5 km N of Golovnino, 43°46.01′ N 145°32.02′ E, litter and net sweeping on vegetation, 21.IX.1997 – 1♂; **Shikotan Island**: Krabozavodskoe, 43°50.10′ N 146°45.24′ E, canyon of small cape, *Abies, Taxus* & *Betula* forest with ferns, Gramineae and *Carex*, 14.IX.1997 – 1♀.

Distribution: Russia, Far East: southern Sakhalin Island and Kuriles (Kunashir, Shikotan islands).

***Angarozonium amurense* (Gerstfeldt, 1859)**

Polyzonium cyathiferum – Mikhaljova 1981, 1990, 1993, Mikhaljova & Basarukin 1995, Ganin 1997.

Angarozonium amurense – Shelley 1998, Mikhaljova 1998b, 2004, Mikhaljova & Marusik 2006.

Distribution: Russia, Siberia: central part of Krasnoyarsk Province, Irkutsk and Chita areas, Buryatia, Republic of Sakha (Yakutia); Far East: southern part of Khabarovsk Province, central Kamchatka, northern and central parts of Sakhalin. North-eastern China. Northern Mongolia.

***Angarozonium bonum* (Mikhaljova, 1979)**

Polyzonium bonum – Mikhaljova 1993.

Angarozonium bonum – Mikhaljova 1998b, 2004.

Material examined: Russia, Primorsky Province: **Reineke Island:** deciduous forest, litter, 3–4.VIII.2007, leg. E. V. Mikhaljova – 5♂, 12♀, 2 juv.

Distribution: Russia, Far East: Primorsky Province, southern part of Khabarovsk Province.

Occurrences in the islands of the Primorsky Province: Popova & Reineke islands.

3.2. Order Julida

Family Blaniulidae:

***Nopoiulus kochii* (Gervais, 1847)**

Material examined: Russia, Primorsky Province: **Eleni Island:** deciduous forest, in rotten nut, 9.VIII.2000, leg. A. Laptev, I. Manin & N. Sergeyev – 1♀, 10 juv.

Distribution: Cosmopolitan species. Europe, Asia, Americas, North Africa, New Zealand.

Occurrence in the islands of the Primorsky Province: Eleni Island.

Family Nemasomatidae:

***Orinisobates microthylax* Enghoff, 1985**

Orinisobates microthylax – Enghoff 1985, 1994, Mikhaljova 1993, 1998b, 2004, Mikhaljova & Basarukin 1995, Mikhaljova & Golovatch 2001, Mikhaljova & Korsós 2003, Mikhaljova & Marusik 2004, 2006.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova): **Eleni Island:** deciduous forest, litter and rotten wood, 11–12.VIII.2000 – 2♀, 2 juv.

Distribution: Russia, Siberia: Buryatia; Far East: Kamchatka, Sakhalin, Kuriles (Kunashir, Shikotan & Iturup islands), Primorsky Province, southern part of Khabarovsk Province.

Occurrence in the islands of the Primorsky Province: Eleni Island.

***Orinisobates soror* Enghoff, 1985**

Orinisobates soror – Enghoff 1985, Mikhaljova 1990, 1993, 1998a, 1998b, 2004, 2006, Mikhaljova & Basarukin 1995, Ganin 1997, Mikhaljova & Marusik 2006.

Material examined (all from Russia, Kuriles): **Yankicha Island:** SE part of Kraternaya Bay, 47°30.64′ N, 152°48.93′ E, 14.VIII.1995, leg. Yu. M. Marusik – 1 juv.; **Anuchina Island:** 43°221′26′′ N, 146°00′35′′ E, 19.VIII.1998, leg. A. S. Lelej – 1♀.

Distribution: Russia, Far East: Sakhalin Island, Moneron Island, Kuriles (Kunashir, Shikotan, Zelyonyi, Brat Chirpoev, Yankicha, Anuchina, Rasshua Islands).

Family Mongoliulidae

***Kopidoiulus continentalis* Golovatch, 1979**

Kopidoiulus continentalis – Mikhaljova 1997a, 1998b, 2004.

Material examined: Russia, Primorsky Province: **Russky Island**: deciduous forest, 15.X.2007, leg. E. V. Mikhaljova – 1 juv.

Distribution: Russia, Far East: Primorsky Province. North-eastern China.

Occurrences in the islands of the Primorsky Province: Petrova & Russky islands.

***Skleroprotopus coreanus* (Pocock, 1895)**

Material examined: Russia, Primorsky Province: **Rikorda Island**: 200–300 m a.s.l., rotten wood, 1.VII.2007, leg. Ya. Novikov & Chernov – 1♂, 1♀.

Distribution: Russia, Far East: Primorsky Province, southern part of Khabarovsk Province, Jewish Autonomous Region, Amurskaya Area. North and South Korea.

Occurrence in the islands of the Primorsky Province: Rikorda Island.

***Ansiulus aberrans* Mikhaljova & Korsós, 2003**

Skleroprotopus schmidti – Mikhaljova 2002.

Ansiulus aberrans – Mikhaljova 2004.

Distribution: Russia, Far East: Primorsky Province. North Korea.

Occurrence in the islands of the Primorsky Province: Naumova Island.

Family Julidae:

***Cylindroiulus latestriatus* (Curtis, 1845)**

Cylindroiulus latestriatus – Mikhaljova 1998a, 1998b, 2004, Mikhaljova & Golovatch 2001, Mikhaljova & Marusik 2006.

Distribution: Subcosmopolitan species.

Occurrence in the islands of the Russian Far East: Kuriles: Kunashir Island.

***Anaulaciulus golovatchi* Mikhaljova, 1982**

Anaulaciulus golovatchi – Mikhaljova 1998a, 1998b, 2004, Mikhaljova & Korsós 2003.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova): **Popova Island**: *Quercus, Tilia, Betula* & *Acer* forest, litter, 9.X.1979 – 3♀, 1 juv. **Russky Island**: deciduous forest, litter, 23.XI.2001 – 1 juv.; deciduous forest, 15.X.2007 – 1♂, 2♀, 3 juv.

Distribution: Russia, Far East: southern part of Primorsky Province. North and South Korea.

Occurrences in the islands of the Primorsky Province: Firugelma, Russky & Popova islands.

***Pacifiiulus amurensis* (Gerstfeldt, 1859)**

Pacifiiulus amurensis – Mikhaljova 1998a, 1998b, 2004.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova, except for some material from Bolshoy Pelis, Furugelma, Petrova and Stenina islands): **Popova Island**: *Quercus* forest, rotten wood and litter, 20.VIII. 1979 – 6♀, 1 juv.; *Quercus, Tilia, Betula* & *Acer* forest, litter, 9.X.1979 – 5♀, 1 juv.; **Petrova Island**: seacoast, under algae among stones, 10.VI.1979 – 1♀; seacoast, *Quercus* forest, litter, 10.VI.1979 – 3♀, 2 juv.; 18–19.VII.1981, leg. T. Romankova – 1♀; 16.VIII.1986, leg. A. S. Lelej – 1♀; **Furugelma Island**: Severnaya Bay, 29.VIII.1983, leg. T. S. Vshivkova – 1♀; **Stenina Island**: on a mushroom, 2.VI.1999, leg. P. B. Klimov – 1♂; **Bolshoy Pelis Island**: slope, litter, 26.VI.2001, leg. L. A. Prozorova – 1♂; **Eleni Island**: leaved forest, litter and rotten wood, 7-11.VIII.2000 – 1♂ (undeveloped), 2♀, 4 juv.; same locality, 4–10.VIII.2001 – 11♀, 3 juv.; **Putyatina Island**: deciduous forest, litter and upper soil layer, 11–14.VIII.2004 – 3♀; **Russky Island**: between Shigino and Ekipazhnyi villages, Podnozhie moorage, forest on seacoast, litter, 25.VII.2007 – 1♀; Canal moorage, deciduous forest, litter, 26.VII.2007 – 1♀, 2 juv.; near Voevoda bay, deciduous forest, litter. 30.VII.2007 – 2♀, 1 juv.; deciduous forest, 15.X.2007 – 3♀, 1 juv.; **Reineke Island**: deciduous forest with *Betula*, litter, 3.VIII.2007 – 2♀, 1 juv.; deciduous forest, litter, 3–4.VIII.2007 – 18♀, 11 juv.

Distribution: Russia, Far East: Primorsky Province, southern part of Khabarovsk Province, Jewish Autonomous Region, Amurskaya Area; Siberia: Republic of Altai, southern part of Krasnoyarsk Province, Republic of Khakassia, Republic of Tyva. North-eastern China.

Occurrences in the islands of the Primorsky Province: De-Livrona, Stenina, Bolshoy Pelis, Furugelma, Popova, Eleni, Putyatina, Petrova, Russky & Reineke islands.

3.3. Order Chordeumatida

Family Megalotylidae

***Megalotyla brevichaeta* Golovatch & Mikhaljova, 1978**

Material examined (all from Russia, Primorsky Province, Lazovsky Nature Reserve): **Petrova Island**: seacoast, *Quercus* forest, litter, 10.VI.1979, leg. E. V. Mikhaljova – 1♀, 1 juv.; 18–19.VII.1979, leg. T. Romankova – 2 ♂, 1♀.

Distribution: Russia, Far East: Primorsky Province.

Occurrence in the islands of the Primorsky Province: Petrova Island.

Family Diplomaragnidae

***Sakhalineuma basarukini* (Mikhaljova, 1995)**

Diplomaragna basarukini – Mikhaljova 1995, 1998b, Mikhaljova & Basarukin 1995.

Sakhalineuma basarukini – Mikhaljova 2000, 2004, Mikhaljova & Marusik 2006.

Distribution: Russia, Far East: Sakhalin Island.

***Sakhalineuma curvatum* (Mikhaljova, 1995)**

Diplomaragna curvata – Mikhaljova 1995, 1998b, Mikhaljova & Basarukin1995.

Sakhalineuma curvatum – Mikhaljova 2000, 2004, Mikhaljova & Marusik 2006.

Material examined (all from Russia, Kuriles, leg. Yu. M. Marusik): **Kunashir Island**: W part of Yuzhno-Kurilsk, 146°51.50′ E, 40°02.50′ N, coniferous forest with moss and litter along seashore, 31.VIII–7.IX.1997 – 2♂, 2♀;

Mendeleevo Airport, 145°40.98′ E, 43°57.77′ N, *Pinus pumila* separate bushes surrounded by bamboo, litter, 1.IX.1997 – 1♀, 2 juv.; 145°39.92′ E, 44°00.50′ N, near Krugly Cape, seashore vegetation, 23.IX.1997 – 1♂; 4 km SW of Yuzhno-Kurilsk, 145°49′ E, 44°02.10′ N, boggy spruce forest with Ericaceae, moss, bamboo and ferns, litter and net sweeping on vegetation, 24.IX.1997 – 2 ♂, 4♀; **Shikotan Island**: E coast, 146°47.19′ E, 43°45.80′ N, swamp along unnamed creek, moss, 16.VII.1997 – 6 ♂, 5♀; N coast of Krabovaya Bay, 146°44′ E, 43°50′ N, deciduous stand with *Carex*, 11.IX.1997 – 8 ♂, 4♀, 3 juv.; SW shore, Delfin Bay, 146°36.41′ E, 43°44.90′ N, *Sphagnum* spots in bog, 13.IX.1997 – 1♂, 1♀; same locality, bamboo, litter, 13.IX.1997 – 1♀; Krabozavodskoe, 146°45.24′ E, 43°50.10′ N, canyon of small cape, *Abies, Taxus* & *Betula* forest with ferns, Gramineae and *Carex*, 14.IX.1997 – 4♂, 4♀, 1 juv.; same locality, under stones along creek, 14.IX.1997 – 2♂; same locality, canyon slope, *Carex* and Gramineae, 15.IX.1997 – 1♂, 1♀; same locality, *Abies-Taxus* stand, litter, 15.IX.1997 – 2♂, 1♀.

Distribution: Russia, Far East: Sakhalin island, Kuriles (Shikotan, Kunashir & Iturup islands).

***Sakhalineuma globuliferum* (Mikhaljova, 1995)**

Diplomaragna globulifera – Mikhaljova 1995, 1998b, Mikhaljova & Basarukin 1995.

Sakhalineuma globuliferum – Mikhaljova 2000, 2004, Mikhaljova & Marusik 2006.

Distribution: Russia, Far East: northern Sakhalin Island.

***Sakhalineuma molodovae* Golovatch, 1976**

Sakhalineuma molodovae – Golovatch 1976a, Mikhaljova 2000, Shelley et al. 2000.

Diplomaragna molodovae – Shear 1990, Mikhaljova 1993, 1995, 1998b, 2004, Mikhaljova & Basarukin 1995, Ganin 1997, Mikhaljova & Marusik 2006.

Distribution: Russia, Far East: Sakhalin Island.

***Sakhalineuma sakhalinicum* (Mikhaljova, 1995)**

Diplomaragna sakhalinica – Mikhaljova 1995, 1998b, Mikhaljova & Basarukin 1995.

Sakhalineuma sakhalinicum – Mikhaljova 2000, 2004, Mikhaljova & Marusik 2006.

Distribution: Russia, Far East: Sakhalin Island.

***Sakhalineuma tuberculatum* (Mikhaljova, 1995)**

Diplomaragna tuberculata – Mikhaljova 1995, 1998b, Mikhaljova & Basarukin 1995.

Sakhalineuma tuberculatum – Mikhaljova 2000, 2004, Mikhaljova & Marusik 2006.

Material examined (all from Russia, Kuriles, leg.Yu. M. Marusik): **Kunashir Island**: 5 km E of Yuzhno-Kurilsk, near Sukacheva Cape, 145°52′ E, 40°04.50′ N, *Abies* forest with birch, ferns, bamboo, Gramineae, mosses, 20–30.VIII.1997 – 1♂,1♀; 145°53.70′ E, 44°05.20′ N, small creek in dark *Abies* forest with moss and *Carex*, litter, 7.IX.1997 – 7♂; 5 km E of Yuzhno-Kurilsk, near Sukacheva Cape, 145°51.95′ E, 40°04.50′ N, sweeping and litter in bamboo, 22.IX.1997 – 3♂,1♀.

Distribution: Russia, Far East: Sakhalin Island, Kuriles (Kunashir & Paramushir islands).

***Diplomaragna anuchino* Shear, 1990**

Diplomaragna yakovlevka – Mikhaljova 1997b.

Material examined: Russia, Primorsky Province: **Popova Island**: *Quercus*, *Tilia*, *Betula*, *Acer*, 9.X.1979, leg. E. V. Mikhaljova – 1♂.

Distribution: Russia, Far East: Primorsky Province.

Occurrence in the islands of the Primorsky Province: Popova Island.

***Diplomaragna terricolor* (Attems, 1899)**

Diplomaragna terricolor – Mikhaljova 1993, 1998b, 2004.

Distribution: Russia, Far East: Primorsky Province.

Occurrence in the islands of the Primorsky Province: Popova Island.

***Diplomaragna yakovlevka* Shear, 1990**

Diplomaragna yakovlevka – Shear 1990, Mikhaljova 1998b, 2004.

non *Diplomaragna yakovlevka* – Mikhaljova, 1997b.

Distribution: Russia, Far East: Primorsky Province.

Occurrence in the islands of the Primorsky Province: Popova Island.

***Maritimosoma antis* Mikhaljova, 2008**

Maritimosoma antis – Mikhaljova 2008.

Distribution: Russia, Far East: Primorsky Province.

Occurrence in the islands of the Province: Putyatina Island.

Family Hoffmaneumatidae

***Hoffmaneuma exiguum* Golovatch, 1978**

Hoffmaneuma exiguum – Mikhaljova 1998a, 1998b, 2004.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova): **Eleni Island**: deciduous forest, 13.VIII.2000 – 1 juv.; **Russky Island**: deciduous forest, litter, 23.XI.2001 – 2♂, 1♀; same locality, 15.X.2007 – 1♂.

Distribution: Russia, Far East: Primorsky Province. North Korea.

Occurrences in the islands of the Primorsky Province: Popova, Eleni & Russky islands.

Family Caseyidae

***Underwoodia kurtschevae* Golovatch, 1980**

Underwoodia kurtschevae – Golovatch 1980, Mikhaljova 1990, 1993, 1998b, 2004, 2006, Shelley 1993, Mikhaljova & Basarukin 1995, Mikhaljova & Marusik 2004, 2006.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova): **Putyatina Island**: deciduous forest, litter, 8.VIII.2004 – 3♀; **Reineke Island**: deciduous forest with *Betula*, litter, 3.VII.2007 – 2 juv.; deciduous forest, litter, 3–4.VIII.2007 – 3♀.

Distribution: Russia, Far East: Primorsky Province, southern part of Khabarovsk Province, Amurskaya Area, Jewish Autonomous Region, Sakhalin, Moneron Island, Kuriles (Zeljonyi, Shikotan, Kunashir, Iturup, Urup, Chirpoi & Ketoi islands), Kamchatka Peninsula. North Korea.

Occurrences in the islands of the Primorsky Province: Putyatina & Reineke islands.

3.4. Order Polydesmida

Family Xystodesmidae

***Levizonus thaumasius* Attems, 1898**

Levizonus orientalis – Lokhsina & Golovatch 1977.

Levizonus thaumasius – Golovatch 1979a, Mikhaljova 1998b, 2004.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova): **Popova Island**: *Quercus* forest, litter, 19.VIII.1979 – 1♀; **Eleni Island**: seacoast, edge of a forest, in soil, 4.VIII.2001 – 1♀; same locality, pitfall trap, 7.VIII.2001 – 1♂; **Russky Island**: leaved forest, litter, 23.XI.2001 – 1♂, 1♀(dead); Podnozhie moorage, near Rynda bay and Rynda village, deciduous forest, litter, 25.VII.2007 – 2♂, 1♀; near Voevoda bay, deciduous forest, litter, 30.VII.2007 – 1♂, 1♀; **Putyatina Island**: deciduous forest, litter and upper soil layer, 10–15.VIII.2004 – 2♂, 3♀, 20 juv.; deciduous forest, 10–20 cm soil depth, 14.VIII.2004 – 2 juv.

Disrtibution: Russia, Far East: Primorsky Province.

Occurrences in the islands of the Primorsky Province: Popova, Eleni, Russky & Putyatina islands.

Family Paradoxosomatidae

***Oxidus gracilis* (C. L. Koch, 1847)**

Oxidus gracilis – Chamberlin & Wang 1953.

Distribution: Subcosmopolitan species.

Occurrence in the islands of the Russian Far East: Sakhalin Island.

***Haplogonosoma implicatum* Brölemann, 1916**

Haplogonosoma implicatum – Golovatch et al. 1995, Mikhaljova & Basarukin 1995, Mikhaljova 1998b, 2004, Mikhaljova & Marusik 2006.

Material examined: Russia, Kuriles: **Kunashir Island**: near a hot spring, on grass, sweeping on vegetation, 27.VII.1997, leg. R. Todd – 1 ♂.

Distribution: Russia, Far East: Kuriles (Kunashir Island). Japan (Honshu Island).

***Sichotanus eurygaster* (Attems, 1898)**

Sichotanus eurygaster – Mikhaljova 1982, 1998b, 2004.

Sichotanus popowi – Golovatch 1976b.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova, except for material from Naumova Island): **Popova Island**: *Quercus* forest, 19–20.VIII.1979 – 7 juv.; *Quercus, Tilia, Betula* & *Acer* forest, litter, 9.X.1979 – 1♂; **Eleni Island**: VIII.2000 – 1 juv.; **Naumova Island**: seacoast, shrubbery and grass, 18.IX.2001, leg. L. A. Prozorova – 1♂; **Putyatina Island**: deciduous forest, litter, 14.VIII.2004 – 4 juv.; **Russky Island**: deciduous forest, litter, 4.VI.2007 – 2♀; Podnozhie moorage, near Rynda bay and Rynda village, deciduous forest, litter, 25.VII.2007 – 1♀.

Distribution: Russia, Far East: Primorsky Province, southern part of Khabarovsk Province & Jewish Autonomous Region. Korea. North-eastern China.

Occurrences in the islands of the Primorsky Province: Popova, Eleni, Naumova, Putyatina & Russky island.

***Cawjeekelia koreana* (Golovatch, 1980)**

Cawjeekelia koreana - Mikhaljova 1998b, 2004.

Material examined (all from Russia, Primorsky Province): **Furugelma Island**: 1.VII.1997, leg. T. S. Vshivkova – 1♂; **Rikorda Island**: 200–300 m a.s.l., rotten wood, 1.VII.2007, leg. Ya. Novikov & Chernov – 1♂, 1♀.

Distribution: Russia, Far East: Amurskaya Area & Primorsky Province. North Korea.

Occurrences in the islands of the Primorsky Province: Furugelma & Rikorda islands.

Family Polydesmidae

***Epanerchodus cuspidatus* Mikhaljova, 1996**

Epanerchodus cuspidatus – Mikhaljova 1996, 1998b, 2004, Mikhaljova & Marusik 2006.

Epanerchodus kunashiricus – Mikhaljova & Basarukin 1995.

Distribution: Russia, Far East: Kuriles (Kunashir Island).

***Epanerchodus koreanus* Verhoeff, 1937**

Epanerchodus koreanus – Mikhaljova & Lim 2001, Mikhaljova 2004.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova): **Eleni Island**: deciduous forest, litter, 9.VIII.2000 1♂; same locality, 4–9.VIII.2001 – 4♂, 3 juv.; **Russky Island**: deciduous forest, litter, 23.XI.2001 – 1♀(dead); same locality, 15.X.2007 – 1♂, 1♀; deciduous forest, litter, 4.VI.2007 – 1♀; between Shigino and Ekipazhnyi villages, Podnozhie moorage, forest on seacoast, litter, 25.VII.2007 – 2♂, 4 juv.; Kanal moorage, deciduous forest, litter, 26.VII.2007 – 1♂.

Distribution: Russia, Far East: Primorsky Province. North and South Korea. Southern Japan.

Occurrences in the islands of the Primorsky Province: Eleni & Russky islands.

***Epanerchodus kunashiricus* Mikhaljova, 1988**

Epanerchodus kunashiricus – Mikhaljova 1988, 1993, 1998b, 2004, Mikhaljova & Basarukin 1995, Ganin 1997, Mikhaljova & Marusik 2006.

non *Epanerchodus kunashiricus* – Mikhaljova & Basarukin 1995.

Material examined (all from Russia, Kuriles, leg. Yu. M. Marusik): **Kunashir Island**: 5 km E of Yuzhno-Kurilsk, near Sukacheva Cape, 145°51.95′ E, 40°04.50′ N, *Abies* forest with birch, ferns, bamboo, Gramineae and mosses, litter, 20–30.VIII.1997 – 2♂, 1♀, 1 juv.; same locality, sweeping and litter in bamboo, 22.IX.1997 – 3 juv.; NW shore, Rudnoye village, Severyanka River, 146°00.29′ E, 44°20.54′ N, 25–27.VIII.1997 – 1♂, 1♀; same locality, *Taxus* forest on slope with rare birch, litter with some grass, 26.VIII.1997 – 4♀; same locality, meadow on seashore slope, 26.VIII.1997 – 1♀; NW shore, 300 m S of Zalivnoi, 146°03′ E, 44°25.13′ N, meadow on shore, 27.VIII.1997 – 1♀; NW shore, 1 km E of Tyatina River mouth, 146°10.34′ E, 44°16.32′ N, *Abies* with *Populus* and birch, litter, 28–29.VIII.1997 – 1♀, 4 juv.; km 27 of Yuzhno-Kurilsk – Golovnino way, mixed forest with bamboo, 1.IX.1997 – 1♂, 1♀.

Distribution: Russia, Far East: Kuriles (Kunashir Island).

***Epanerchodus polymorphus* Mikhaljova & Golovatch, 1981**

Epanerchodus polymorphus – Mikhaljova 1998b, 2004.

Material examined (all from Russia, Primorsky Province, leg. E.V. Mikhaljova, except for some material from Bolshoy Pelis and Russky islands): **Petrova Island**: seacoast, *Quercus* forest, litter, 10.VI.1979 – 1♂; **Eleni Island**: deciduous forest, litter and rotten wood, 7–31.VIII.2000 – 1♂, 23♀,16 juv.; deciduous forest, litter, 6–8.VIII.2001 – 6♀, 5 juv.; seacoast, among leaf and stones, 6.VIII.2001 – 2♀, 6 juv.; **Bolshoy Pelis Island**: slope, litter, 26.VI.2001, leg. L.A. Prozorova – 1♂, 1♀; **Putyatina Island**: deciduous forest, litter and upper soil layer, 8-15.VIII.2004 – 2♂, 22♀, 6 juv.; same locality, 3.IX.2004 – 2♀; **Russky Island**: forest spring, 8.VI.1978, leg. T.S. Vshivkova – 1♂; Podnozhie moorage, between Shigino and Ekipazhnyi villages, forest on seacoast, litter, 25.VII.2007 – 1♀, 1 juv.; Podnozhie moorage, near Rynda bay and Rynda village, deciduous forest, litter, 25.VII.2007 – 5♀, 5 juv.; near Voevoda bay, deciduous forest, litter, 30.VII.2007 – 1♂, 2♀; **Reineke Island**: deciduous forest with *Betula*, on stones and trunks of trees, 3.VII.2007 – 1♀, 7 juv.; deciduous forest, litter, 3–4.VIII.2007 – 1 juv.

Distribution: Russia, Far East: Primorsky Province. North Korea.

Occurrences in the islands of the Primorsky Province: Petrova, Eleni, Bolshoy Pelis, Putyatina, Russky, Reineke & Popova islands.

***Uniramidesmus aberrans* Mikhaljova, 1979**

Uniramidesmus aberrans – Mikhaljova 1998b, 2004.

Material examined (all from Russia, Primorsky Province, leg. E. V. Mikhaljova): **Popova Island**: *Quercus, Tilia, Betula & Acer* forest, litter, 9.X.1979 – 3♂, 2♀; **Russky Island**: deciduous forest, 15.X.2007 – 4♂, 1♀.

Distribution: Russia, Far East: Primorsky Province, southernmost of Khabarovsk Province.

Occurrences in the islands of the Primorsky Province: Popova & Russky islands.

***Uniramidesmus septimus* Mikhaljova, 1990**

Uniramidesmus septimus – Mikhaljova 1990, 1993, 1998b, 2004, 2006, Mikhaljova & Basarukin 1995, Mikhaljova & Marusik 2006.

Material examined (all from Russia, Kuriles): **Kunashir Island**: 5–7 km N of Lagunnoe Lake, 9.VIII.1988, leg. A. M. Basarukin – 1♀, 5 juv.; Krugly Cape, 145°39.38′ E, 44°00.28′ N, 2.IX.1997, leg. Yu. M. Marusik – 1♂; **Shikotan Island**: N coast of Krabovaya Bay, 146°44′ E, 43°50′ N, deciduous stand with *Carex*, 11.IX.1997, leg. Yu. M. Marusik – 1♀.

Distribution: Russia, Far East: southern part of Khabarovsk Province, Sakhalin island, Moneron Island, Kuriles (Shikotan & Kunashir islands).

4. Discussion

Millipedes form a constant and, in a number of places, relatively abundant component of soil macrofauna (= mesofauna, according to the terminology of the Russian school of soil zoology), inhabiting insular forests and other biotopes within the south-eastern part of the Russian Far East. Thus, the proportion of diplopods in different forest and bush stands ranges from 0.2 % to 6.3 % on Sakhalin (Molodova 1973), up to 13 % in the Furugelma Island, Primorsky Province (Mineyeva 1978). Millipede abundance does not exceed 100 individuals per m^2 in the islands of the Primorsky Province. Thus, the number recorded in the *Quercus* forest on the Furugelma Island is 50 ind. m^{-2} (Mineyeva 1978), versus 72 ind. m^{-2} in the broad-leaved forest on Putyatuna Island. The abundance of diplopods on Sakhalin Island is more modest, ranging from 0.3 ind. m^{-2} in an *Alnus* forest to 27.9 ind. m^{-2} in an *Abies* forest, and from 5.6 ind. m^{-2} in a *Pinus pumila* undergrowth to 13.6 ind. m^{-2} in a bamboo undergrowth (Molodova 1973).

At present, 36 species from 22 genera, 12 families and four orders of Diplopoda are known to occur in the islands of the Russian Far East (Table 1 and Map 1). This is 52.9 % of the total number of millipede species inhabiting in the entire Russian Far East. Altogether, 16.1 % of all millipede species occurring in the entire Russian Far East show insular ranges. Continental species amount to 47.1 %. The bulk of millipede diversity is recorded in the islands of the Primorsky Province in the Sea of Japan.

Generally, the fauna of Diplopoda of the islands in the Russian Far East is fairly original. At the species level, the endemism amounts to 27.8 % of the total number of millipede species occurring there. In addition, these islands support several synanthropic, often

subcosmopolitan species, such as *Nopoiulus kochii*, *Cylindroiulus latestriatus*, and *Oxidus gracilis*. They are not natural elements in the fauna, but have become introduced to the Far East of Russia through human agency. They amount to 8.3 % of the fauna. Over half of the species (55.6 %) show faunal connections with East and Southeast Asia while 8.3 % of the species demonstrate connections with the Siberian fauna.

At the generic level, endemism amounts to 4.5 %. Trans-Beringian connections are evident only at the generic level. They amount to 9.1 % of the total. As many as 13.6 % of the genera demonstrate connections with the Siberian fauna, 59.2 % with East and Southeast Asia, and 13.6 % are elements introduced to the Far East of Russia through human agency.

The millipede fauna of the small continental islands off the Primorsky Province, which have been formed as a result of sea-land fluctuations, appears to be an organic part of the fauna of the adjacent continental part. There are no millipedes of any taxonomic rank that are endemic to any of the Primorsky Province's islands. In addition, these islands are devoid of any species with only insular distributions.

A list of diplopods of the Primorsky Province's islands includes 21 species from 18 genera, 12 families and four orders. Most of the species that populate these islands can be attributed to the Manchurian distribution pattern, which includes the Primorsky Province, the southern part of the Khabarovsk Province, the Amurskaya Area, north-eastern China, and Korea. Only three parthenogenetic species (*Orinisobates microthylax, Pacifiiulus amurensis* and *Underwoodia kurtschevae*) show wider distributions; both *O. microthylax* and *P. amurensis* are also known from Siberia while *O. microthylax* and *U. kurtschevae* also from Kamchatka. Such a pattern can probably be accounted for by the parthenogenetic characteristic of these species.

The millipede faunas of the islands off the Primorsky Province differ strongly from those of the large archipelagos, such as Sakhalin and the Kuriles. Only two parthenogenetic species (*Orinisobates microthylax* and *Underwoodia kurtschevae*) are common.

Only one species, *Epanerchodus koreanus*, is common for the islands off the Primorsky Province and Japan. Two widespread species, *O. microthylax* and *U. kurtschevae,* are common for the islands off the Primorsky Province and Kamchatka.

Both Sakhalin and the Kurile Islands are characterised by a sufficiently high degree of the millipede originality. Their faunas contain ten species (58.8 % of the total number of species occurring there) and one genus (*Sakhalineuma*) which are endemic. These species, plus *Haplogonosoma implicatum*, which is known from Kunashir Island and Honshu Island, Japan, belong to a complex of species with insular distributions. According to Semenov-Tian-Shansky (1936), nine species are confined to the Palaearchaearctic Subregion of the Palaearctic Region (Palaearchaearctic Subregion includes eight provinces: Manchurian, Korean, Japanese, Inland-Chinese, South-Chinese, Yunnan, Tibet, Himalaya). Only three species, *Angarozonium amurense*, *Orinisobates microthylax* and *Underwoodia kurtschevae* (17.6 %), are known beyond the Palaearchaearctic. The former species is widespread in the Asian part of Russia, including one of the northernmost records of Diplopoda in the Holarctic, being also known from north-eastern China and northern Mongolia.

Seven species are common for Sakhalin and the Kuriles. Only three of them, *Orinisobates microthylax, Underwoodia kurtschevae* and *Uniramidesmus septimus*, are known to occur also outside Sakhalin and the Kuriles.

Tab. 1 Diplopoda occurring on the islands of the Russian Far East and in the Kamchatka Peninsula.

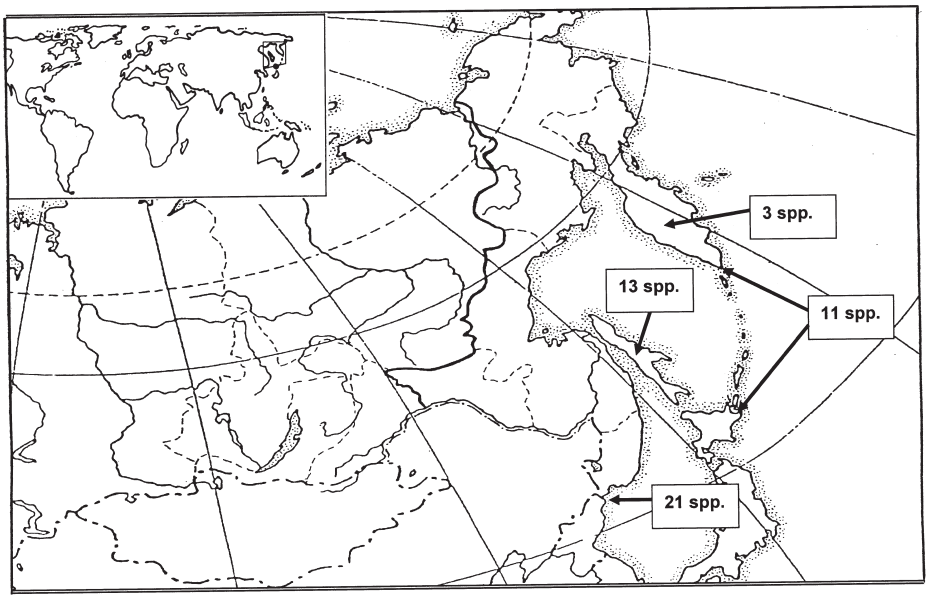
Taxa	Islands off the Primorsky Province	Moneron Island	Sakhalin Island	Kurile Islands	Kamchatka Peninsula	Other territories
Polyzoniida						
Angarozonium aduncum			+	+		
Angarozonium amurense			+		+	si, kh, j, nch, nm
Angarozonium bonum	+					
Julida						
Nopoiulus kochii	+					subcosmopolitan
Orinisobates microthylax	+		+	+	+	si, kh, pk, aa, j
Orinisobates soror		+	+	+		
Kopidoiulus continentalis	+					pk, nch
Ansiulus aberrans	+					pk, nk
Skleroprotopus coreanus	+					pk, j, aa, kh, nk, sk
Cylindroiulus latestriatus				+		subcosmopolitan
Anaulaciulus golovatchi	+					pk, nk, sk
Pacifiiulus amurensis	+					si, pk, kh, aa, j, nch
Chordeumatida						
Megalotyla brevichaeta	+					pk
Sakhalineuma basarukini			+			
S. curvatum			+	+		
S. globuliferum			+			
S. molodovae			+			
S. sakhalinicum			+			
S. tuberculatum			+	+		
Diplomaragna anuchino	+					pk
D. terricolor	+					pk
D. yakovlevka	+					pk

Tab. 1 cont.

Taxa	Islands off the Primorsky Province	Moneron Island	Sakhalin Island	Kurile Islands	Kamchatka Peninsula	Other territories
Maritimosoma antis	+					pk
Hoffmaneuma exiguum	+					pk, nk
Underwoodia kurtschevae	+	+	+	+	+	pk, kh, aa, j, nk
Polydesmida						
Levizonus thaumasius	+					pk
Oxidus gracilis			+			subcosmo politan
Haplogonosoma implicatum				+		ho
Sichotanus eurygaster	+					pk, kh, j, nch, nk,sk
Cawjeekelia koreana	+					pk, aa, nk
Epanerchodus cuspidatus				+		
E. koreanus	+					pk, nk, sk, ki, ti
E. kunashiricus				+		
E. polymorphus	+					pk, nk
Uniramidesmus aberrans	+					pk, kh
U. septimus		+	+	+		kh
Total	21	3	13	11	3	

si: Siberia; **pk**: Primorsky Province; **kh**: Khabarovsk Province; **aa**: Amurskaya Area; **j**: Jewish Autonomous Region; **nch**: North-eastern China; **nm**: Northern Mongolia; **nk**: North Korea; **sk** –South Korea; **ho**: Honshu Island; **ki**: Kyushu Island; **ti**: Tsushima Islands.

At present, 13 species from six genera, six families and four orders of Diplopoda have been recorded in the Sakhalin Island. The highest species diversity appears to be restricted to its southern part. The northern and central parts of Sakhalin support six species. The millipede species complex of southern Sakhalin differs sufficiently well from the one of northern-central Sakhalin. Only three species appear to be common to these parts of the island: *Orinisobates microthylax, Underwoodia kurtschevae* and *Uniramidesmus septimus*. Only two species occur throughout Sakhalin. However, at the family and generic levels the millipede faunas of southern Sakhalin and northern-central Sakhalin are almost identical, except for the family Paradoxosomatidae and the genus *Oxidus* represented by the synanthropic *O. gracilis* introduced to Sakhalin.



Map 1 Species diversity of Diplopoda within the islands of the Russian Far East and on the Kamchatka Peninsula.

As much as 30.8 % of the fauna of Sakhalin are represented by endemic species. These are all four species of *Sakhalineuma*. Altogether, 61.5 % of the species show insular ranges. Thus, *Angarozonium aduncum* is known only from the Sakhalin and Kurile islands. Two, possibly three species (*Orinisobates soror* and *Sakhalineuma* species) have been reported only from the Sakhalin, Moneron and Kurile islands. At the generic level, *Sakhalineuma* is endemic to Sakhalin-Moneron-Kuriles.

The millipede fauna of Moneron Island, which at present includes three species, is an organic part of the Sakhalin fauna. The Kamchatka Peninsula supports only three millipede species. These species are also known from Sakhalin and show vast distributions.

One genus (*Oxidus*) and one synanthropic species (*O. gracilis*) are common for Sakhalin and Hokkaido. At the family level, only 27.3 % of all families of these islands appear to be shared by Sakhalin and Hokkaido.

At present, 11 species from eight genera, seven families and four orders of Diplopoda are known to occur in the Kurile Islands. Millipedes have been reported from 11 of all 30 islands of this archipelago. Of all the northern islands, only one species has been registered in Paramushir. Of course, this pattern also reflects underexploration of the Kurile diplopod fauna.

Like other animals and plants, the highest species diversity within the archipelago is recorded in the Kunashir Island. Eventually, the millipede fauna of this island contains all of the millipedes generally known from this archipelago. This pattern contrasts the faunas of other invertebrate groups, when the species composition changes from island to island. As many as 63.6 % of the Kurile species are insular. Two species, *Epanerchodus cuspidatus* and

E. kunashiricus, both constituting 18.2 % of the total number of species occurring there, are endemic to the Kuriles. Two widespread species, *Orinisobates microthylax* and *Underwoodia kurtschevae*, as well as their respective genera, are common for the Kurile Islands and Kamchatka Peninsula.

A high species diversity is observed in the Hokkaido Island (18 species). However, not a single millipede has hitherto been found to be common for the Hokkaido Island and the Kuriles. In contrast, regional faunas of some other groups of animals contain common species. Only *Haplogonosoma implicatum* is common for the Kuriles and Japan. This species has been recorded in the southern Kuriles and central Honshu. At the generic level, only 25 % of all the regional genera (*Haplogonosoma* and *Epanerchodus*) appear to be shared by the Kurile Islands and Japan.

The millipede fauna of Sakhalin Island is especially 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 occurs both in the Sakhalin and in Kurile islands.

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