Elena V. Mikhaljova

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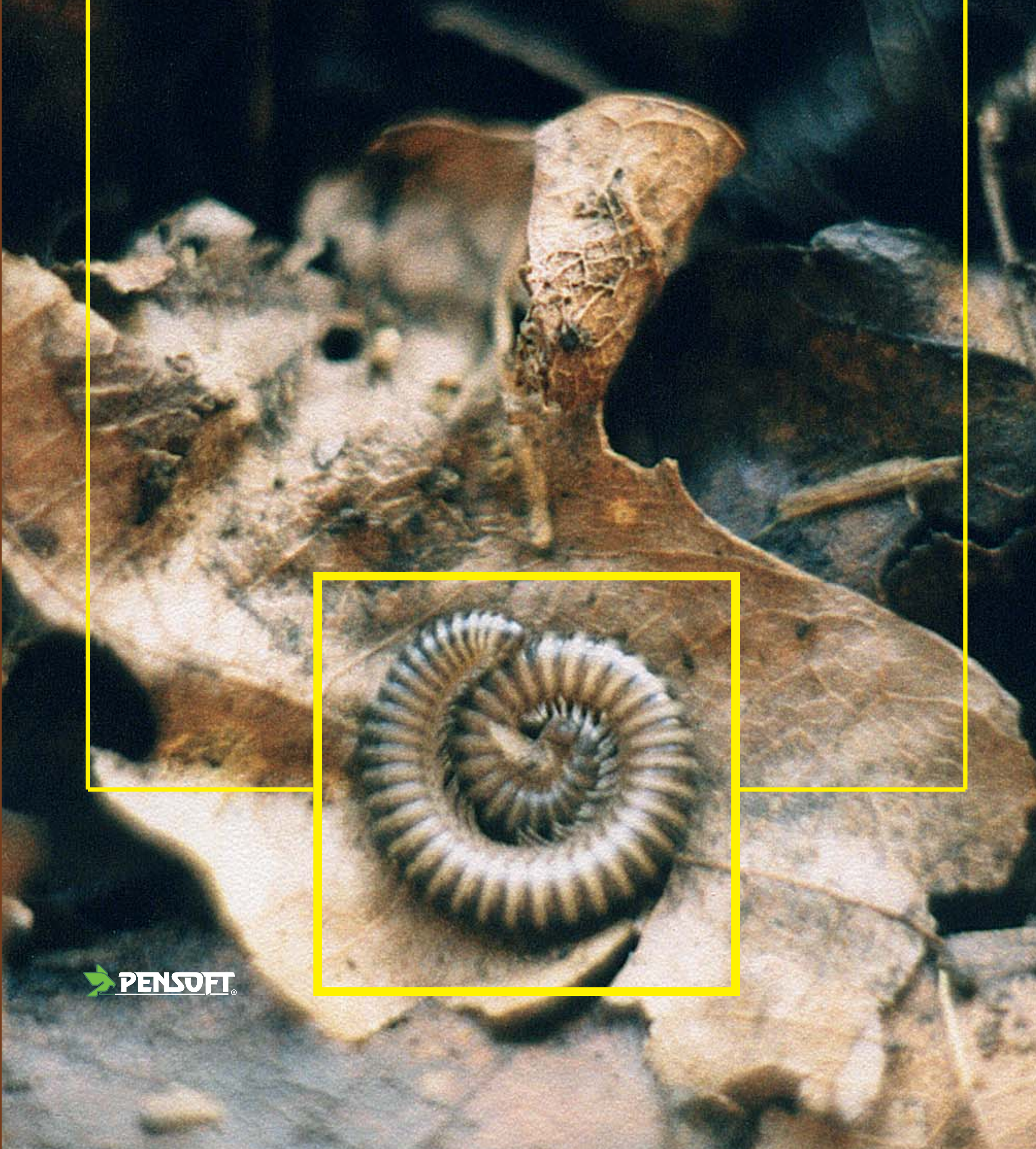

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Institute of Biology and Soil Science,
Far Eastern Branch of the Russian Academy of Sciences,
Prospekt 100 let Vladivostoku 159, Vladivostok 690022 Russia

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by
Elena V. Mikhaljova

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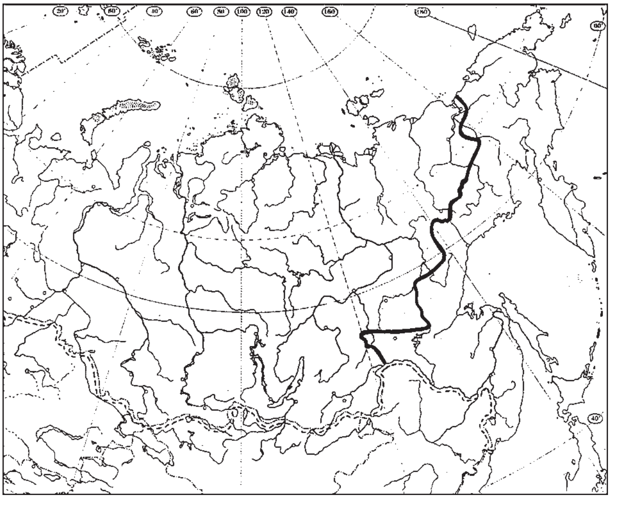
INTRODUCTION

Millipedes, or Diplopoda, as primary destructors of plant debris play highly important roles in soil formation processes. Many millipedes can also serve as indicators of environmental conditions, i.e. zoological soil diagnostics (Ghilarov, 1965) or soil pollution with heavy metals (Ganin, 1997). On the other hand, a few species are pests damaging various cultivated plants. In addition, studies of this ancient group, known since the early Palaeozoic, shed light on arthropod evolution as a whole.

Time has come to generalise the rather abundant data on the Diplopoda of the Asian part of Russia in a monographic way.

According to the Russian geographical tradition, the Asian part of Russia is not exactly the same as Siberia as is often considered abroad. The territories lying between the Ural Mountains in the west and the Pacific Ocean in the east, including the Sakhalin and Kuril (= Kurile) islands, are to be subdivided into Siberia proper and the Russian Far East (Map 1). Siberia extends from the Urals in the west to the administrative borders of the Magadan Area, Khabarovsk Province and Amurskaya Area in the east. The Far East encompasses the Magadan, Kamchatka, Amurskaya and Sakhalin (Sakhalin Island + Kuriles) areas as well as the Khabarovsk and Primorsky (= Maritime) provinces.



Map 1. Asian part of Russia. Territories lying west of the black line are termed Siberia, those to the east form the Russian Far East.

CHAPTER 1 HISTORICAL REVIEW

The first information concerning the Diplopoda of Siberia and the Far East of Russia refers to the southern part of this vast territory (Gerstfeldt, 1859; Stuxberg, 1876a, b; Haase, 1880). However, all species described or recorded then remained dubious for a very long time. Only not too long ago, almost all of them were revised and adequately redescribed (Hoffman, 1975; Shelley, 1998; Mikhaljova, 1993, 1998a, 2002b; Mikhaljova & Golovatch, 2001; Mikhaljova & Marusik, 2004).

This early period was followed by many decades of nearly complete inactivity. Only Attems (1898, 1899) described three new genera and species from the environs of Vladivostok, while Lohmander (1933) mentioned indirectly a few millipede genera as occurring in Siberia and Kamchatka. A number of new taxa from the Altais and the Kemerovo Area, Siberia were published by Gulièka (1963, 1972). In addition, the first ecological observations of general millipede abundance in the Ob and Tom interfluve appeared as well (Kozlovskaya, 1965), followed by similar data covering a number of places in the Far East: Primorsky Province (Ghilarov & Perel, 1971, 1973; Mineyeva, 1978; Kurcheva, 1979a, b), Khekhtsir Mt. Range, Zeysky Nature Reserve in the Khabarovsk Province (Ryabinin, 1977, 1978), and the southern part of Sakhalin Island (Molodova, 1973, 1974, 1976). However, because the taxonomy of Siberian and Far Eastern Diplopoda still remained nearly unknown, those early ecological as well as faunistic data were bound to be too general, only touching upon the abundance of several higher diplopod taxa. Furthermore, some of these publications contained a number of taxonomic errors. This situation also concerned the first review of the Diplopoda of the Russian Far East provided by Kurcheva (1977) in her faunistic lists covering all soil invertebrate groups occurring there.

More or less regular and steady faunistic, taxonomic and ecological studies of the millipedes inhabiting the Asian part of Russia have only begun since the mid-1970's. Numerous new taxa of various ranks have been described, including several revisions and reviews (Golovatch, 1976b, c, 1977, 1978b, 1979a-d, 1980a, 1992, 1995; Golovatch & Mikhaljova, 1978, 1979; Lokšina & Golovatch, 1977; Mikhaljova, 1979a, 1981a, b, 1982a, b, 1983a, 1984a, 1988a, 1990, 1993, 1995, 1996a, 1997a, b, 1998a, 2000, 2002a; Mikhaljova & Golovatch, 1981; Mauriès, 1982; Mikhaljova & Basarukin, 1995; Enghoff, 1985, 1991; Shear, 1987, 1988, 1990, 1992; Shear & Tsurusaki, 1995; Shear et al., 1997; Shelley, 1993, 1998; Golovatch et al., 1995; Mikhaljova & Nefediev, 2003; Mikhaljova & Korsós, 2003; Mikhaljova & Marusik, 2004). In addition, ecological and biological observations (Ryabinin, 1975; Golovatch, 1978c; Mikhaljova, 1978, 1979b, 1981c, d, 1983b, 1984b, 1987, 1988b, 1991, 1996b, 1997a; Kurcheva & Mikhaljova, 1980; Kozhukhova & Ryabinin, 1981; Mikhaljova & Petukhova, 1983; Ursova, 1983; Mikhaljova & Bakurov, 1989; Gromyko, 1990; Rybalov, 1991, 2002; Ganin, 1998a, 2000a; Rybalov & Rossolimo, 1998; Vorobiova, 1999; Vorobiova et al., 2002; Nefediev, 2001, 2002a-d) as well as millipede-based zoogeographical discussions (Golovatch, 1979e; 1980a; 1997a, b) have appeared. The roles the diplopods play both in some chemical elements' turnover and in the destruction of plant remains in Amurland (=Low Priamurye, =Cisamuria) have been accomplished by Ganin (1987, 1988, 1989a, b, 1994, 1997, 1998b; 2000b). Also, the impact of industrial pollution on millipedes and their role as indicators for ecological monitoring have been discussed (Filatova & Makarevich, 1984; Ryabinin et al., 1988; Ganin, 1992, 1993, 1995, 1997; Ganin & Manukhin, 2000).

The first general list of the Diplopoda of the former Soviet Union contained only some 45 species recorded both in Siberia and the Far East (Lokšina & Golovatch, 1979), as opposed to 83 listed some years later (Mikhaljova, 1993). The latest reviews of the millipede faunas of the Russian Far East including regional keys (Mikhaljova, 1998b) and Siberia (Mikhaljova & Golovatch, 2001), already refer to no fewer than 64 and 45 species, respectively. At the moment, the Asian part of Russia is known to support 103 diplopod species. However, despite all recent progress in the study of diplopod fauna and ecology, some territories of Asian Russia, especially in Siberia, remain relatively poorly investigated.

CHAPTER 2 AN ACCOUNT OF MILLIPEDE ECOLOGY

Diplopods are known as primary destructors of plant debris (Sokolov, 1956; Ghilarov, 1957; Striganova, 1980; Hopkin & Read, 1992). When feeding, millipedes crush mechanically into pieces the plant remains they consume, thus increasing the general surface of food particles, mixing both organic and mineral material and inoculating the litter with fungal spores and bacteria in the soil. They also change the substrate chemically, enhancing decomposition by microbes, fungi, precipitation and soil water (Striganova, 1980; Hopkin & Read, 1992). The activities of millipedes as primary desctructors are highly important, especially in the regions where they are abundant. Thus, in the leafy forests of the North Caucasus, on the average the millipedes consume about 400 kg leaf litter per ha per month (Striganova, 1969b). In the Lenkoran region of Azerbaijan, diplopods rework 250-300 kg leaf litter per ha per month (Striganova, 1971). In the forest strips of the forested steppe belt of southern Russia, julids alone destroy 80-90 kg plant debris per ha (Striganova, 1971). Based on experimental data, the diplopods dwelling in the foothills of Ukraine's Carpathian Mountains can consume 0.5-1.2 g leaf litter per sq. m per 24 h (Striganova, 1974). In the alpine meadows of the Caucasus Minor, Azerbaijan, millipedes destroy 120 kg leaf fall per ha (Striganova & Loginova, 1984), as opposed to 1.9-30.74 kg per ha in the leafy forests of Azerbaijan's Caucasus Major (Loginova, 1993). In the coniferous-broadleaved forests of Low Priamurye, Russian Far East, the millipedes alone account for rework of between 30 and 150-160 kg leaf fall per ha during the vegetative season (Ganin, 1989a, 1997). Also, several species are known to form mull, the best humus (Romell, 1935; Bano et al., 1976).

Diplopods are mainly characterised by saprophagy. Most of them consume hard, little decomposed plant debris. However, species of the order Polyzoniida feed on moist soil detritus. Their mouthparts are partly reduced and elongated anteriorly into an unusual rostrum, which allows feeding on semi-liquid food. According to Striganova (1980), polyzoniidans form a group of secondary destructor detritophages while most of the diplopods are primary destructors of plant remains. However, consumption of detritus has also been reported among julids in coniferous forests when the julids feed on coniferous mor (Striganova, 1980).

When eating, most of the millipedes swallow some soil, likely to enhance digestion by soil microflora decomposing the elements of plant tissues. In the mixed forests of Low Priamurye, mineral soil accounts for 30-35 % of the entire diet of local Diplopoda (Ganin, 1997).

Some species can consume live plant material. Diplopod phytophagy is related to an unfavourable humidity rate of food or the entire habitat, as a rule. Therefore, the damages some julids cause to agricultural plants in Eastern Europe are more often observed in arid regions (Aleksandrov, 1956; Roktanen, 1957; Striganova, 1977). Some millipedes can be predators or cannibals (Hopkin & Read, 1992); like necro- or coprophagy, such a diet is not usual for these invertebrates and it can be linked to additional water supply and stimulation of the digestion process (Striganova, 1980).

Striganova (1980) has revealed the common traits of diplopod saprophagy. When feeding, millipedes not only fragment mechanically the plant debris they eat, but first of all they also split the cellulose components by their own enzymes and by those released by symbiotic gut microorganisms. The feeding activity of diplopods is defined by many factors, including the animal's physiological state, the structure and chemical components of food as well as certain ecological peculiarities.

Among diplopods, the daily diet of the most active consumers of leaf litter in the forests of Amurland ranges from 0.6 to 22.5 mg/ind. (Ganin, 1988, 1997). The feeding activity of juveniles is normally higher than in adults, the specific absorption rate in the young ranging between 13.8 and 25.1% as opposed to 5.4 and 20% in adults (Ganin, 1989a).

Assimilation of plant debris in julids varies widely. Most of the species are characterised by relatively high assimilation rates: 30-39% in the broadleaved forests of the Ukrainian Carpathians (Striganova, 1980), 27-89% in the mid-montane leafy woodlands of the Caucasus Major of Azerbaijan (Loginova, 1993), 19.5-47% in the Nikitsky Botanical Garden in the Crimea (Kondeva, 1980), 66.6-84.6% in the alpine meadows of Azerbaijan's Caucasus Minor (Striganova & Loginova, 1984). In mixed (*Pinus koraiensis* Sieb. & Zucc. + broadleaved trees) forests of Low Priamurye, most of the leaf fall kinds are highly palatable, the assimilation rate averagining more than 40% (min. 5%, max. 91%) (Ganin, 1988, 1997). The overall feeding activity of Diplopoda seems to be higher in Low Priamurye than in the European part of Russia, but somewhat lower than in the terrace forests of Ciscaucasia (Ganin, 1989a, 1997).

The digestive system of most millipedes is rich in enzymes. However, nitrogen-containing substances are assimilated least of all (Striganova, 1970, 1980). Also, diplopods appear to support temporary microbial symbionts that destroy cellulose and pectin (Kozlovskaya, 1976). The composition of the symbionts swallowed during host nutrition depends strongly on the degree of destruction of the leaf fall consumed. Millipedes deprived of symbionts and own enzymes are largely characterised by low assimilation rates (5-13%). Apparently to avoid this and get inoculated, these diplopods repeatedly eat their own fecal pellets (Striganova, 1980).

Assimilation is variable, depending on food quality, animal condition and weather. During a dry period, assimilation is decreased. Low coefficients of specific assimilation are usual in species that do not accomplish feeding in the summer for a considerable time (Striganova, 1977). In contrast, the highest coefficients of specific assimilation are revealed in species that stop feeding over a hot dry season. All such species show a short period of feeding activity, during which they need to quickly accumulate enough nutrients.

Cellulose is highly important as a source of energy. *Pachyiulus varius* (Berl.) (= *flavipes* (C. L. K.)) in the Crimea assimilates 13.9-22.8 % of the entire energy at the expense of cellulose destruction (Kondeva, 1980), this amounting to as much as 70% in *Pacifiiulus amurensis* (Gerst.) in Priamurye (Ganin, 1997). In addition, millipedes play important roles in the turnover of Ca, which is accumulated in the cuticle and is returned to the soil after animal death (Ghilarov, 1957).

Diplopods are selective to food (Striganova, 1967, 1980; Kheirallah, 1978, 1979a). Series in diplopod preferences of leaf fall kinds have been revealed (Lyford, 1943; Dunger, 1962); these concern the rate of litter consumption only. However, the rate of plant debris decomposition is not the only criterion for their preference of a certain kind of leaf fall. The condition of the available food, the degree of its assimilation, the duration of feeding and the survival of the millipedes kept on this or that kind of litter must be considered as well (Striganova, 1969a).

Diplopods prefer moist plant debris with low C/N ratios, but rich in calcium and nitrogen. They are only capable of eating when food is available at a certain stage of decomposition. This stage varies depending on the kind of leaf fall. Thus, millipedes almost fully avoid feeding on fresh leaf fall of most tree species. Leaves of birch (*Betula*), beech (*Fagus*) and oak (*Quercus*) are much better consumed following 5-12 months of decay, i.e. after their exposure to temperature, humidity and microorganisms (Striganova, 1980; Kheirallah, 1979a). The degrees of leaf sclerotisation and hardness seem to play no decisive role in food choice. Thus, according to Striganova (1969a, b), julids feed reluctantly on fallen beech leaves, both hard, almost intact and old, injured. In contrast, the hard-epidermis oak leaf fall is willingly consumed, yet 2-4 times slower than hornbeam (*Carpinus*) leaves; still, their assimilation appears similar, amounting to 37.6 and 39.4%, respectively. However, diplopods in forest environments eat the leaf fall of different kinds, not only the litter of preferred tree species. In addition, consumption in the millipedes fed on mixed litter appears to be higher than in the animals kept on one leaf kind only (Striganova, 1980).

In the coniferous-broadleaved forests of Low Priamurye, millipedes consume the leaf fall of all main tree species. The most active consumers are *Pacifiiulus amurensis, Sichotanus eurygaster* (Att.) and *Skleroprotopus coreanus* (Poc.). Furthermore, the former diplopod species eats more readily the leached needle leaves of *Pinus koraiensis*, the second species the leaf fall of alder (*Alnus*), the third species the fallen leaves of birch (Ganin, 1997). Although the diplopods are generally believed to avoid the apparently too acidic litter of conifers (Striganova, 1980), at least in the conditions of Priamurye's humid climate, the needle fall of *Pinus koraiensis* containing little resin, wax and tannin is readily consumed to being preferred by diplopods (Ganin, 1997). Thus, the coefficient of assimilation of *P. koraiensis* needles in the above trio of millipede species amounts to 90.7, 62.9, and 81.0%, respectively (Ganin, 1988).

Millipedes occur in most of the globe's natural zones/belts, only excluding the icy zone (in terms of Milkov, 1977) (= Arctic and Antarctic desert) as well as the dryest deserts. Diplopods have been recorded just beyond the Arctic Circle (Golovatch, 1992; Mikhaljova & Marusik, 2004). In the Asian part of Russia, some millipede species, especially members of the order Chordeumatida, live, often highly abundantly, in the high-montane tundra within the subalpine/alpine belt (= goltsy) (Mikhaljova, 2000; Mikhaljova & Golovatch, 2001). In general, both millipede diversity and numbers tend to be increasingly fewer and sporadic with growing climatic continentality. In Europe, this is observed both north and south of the zone of broadleaved forest, apparently an ecological optimum for the diplopods (Golovatch, 1984, 1992). In Eurasia, the diplopod faunas appear impoverished both in the northern and central parts of the region (Golovatch, 1997a). In the Asian part of Russia, the bulk of species diversity are confined to the southern parts of the Far East, where it is the greatest, and to the montane formations lying in the south of Siberia (see also Chapter 6).

Millipede abundance is a highly variable characteristic. Thus, over the vast East European, or Russian, Plain on the average it ranges from 7 to 30 ind./m² in the taiga (= boreal coniferous forest belt), from 35 to 75 ind./m² in the belt of mixed coniferous-broadleaved forests, and up to 133 ind./m² in broadleaved forests (Lokšina, 1966). Further to the south, the numbers reach up to 30-80 ind./m² in the steppe and down to 2 ind./m² in dry steppe (Ghilarov, 1957; Ghilarov & Chernov, 1975). In the woodlands on brown forest soils in Ciscarpathia, Ukraine, the average abundance of diplopods amounts to 60 ind./m² (Kurcheva, 1972), while in the south of the Russian Far East, on similar soils in forests of different types, it ranges between 15.5 and 284.0 ind./m² in the Primorsky Province (Ghilarov & Perel, 1973; Mikhaljova, 1987, 1988b, 1996b), but only between 1 and 92 ind./m² more northerly in Priamurye (Ganin, 1997). In Southwest Siberia, in different forest biotopes, the average numbers range from 25.5 to 72.5 ind./m² (Nefediev, 2002d).

Outbreaks are occasionally observed in some millipede species, largely in the orders Julida and Polydesmida. Up to 3,000 ind./m² of *Japonaria laminata armigera* (Verh.) were registered in 1976 in Japan, where these rather large millipedes blocked the normal operation of a railway (Shinohara & Niijima, 1977). Mass appearances of diplopods often inflict serious damages to agricultural fields, berry plantations and farm buildings. Thus, in the environs of Wroc³aw, Poland, millipedes destroyed 80-100% sunflower crops in 1972 and 1973 (Niezgodziñski, 1976). In the southern part of Australia, the introduced Mediterranean *Ommatoiulus moreletii* (Lucas) and the local *Australiosoma castaneum* (Verh.) became so abundant in pastures as to prevent cattle from grazing (Baker, 1979). In a sandy fallow at Ensdorf, Germany, a mass migration of *Ommatoiulus sabulosus* (L.) (= *Schizophyllum sabulosum*) in May 1973 caused trouble to people (Helb, 1975).

Millipedes can be encountered nearly everywhere in places supporting plant debris. The vast majority diplopods live in forest, finding there not only a sufficiently abundant and diverse food, but also a relatively mesic environment. First of all, the distribution and activity of Diplopoda are related to the local hydrothermal conditions while forest type or floral composition seems to be of secondary importance. Thus, in the southern Far East of Russia, the millipede faunistic complexes of the same forest formation scattered over different territories can differ to a greater extent than the diplopod assemblages of different forest formations situated in the same territory (Mikhaljova & Petukhova, 1983; Ganin, 1997).

Only relatively few millipede species are capable of living in such open landscapes like meadow, field or arable land, where they eat herb debris (Tischler, 1971; Kurcheva, 1973; Pokarzhevsky, 1981). In general, compared to the other larger millipede groups, juliforms appear to be far more inclined to dwelling in harsher environments, including open terrain (Kime & Golovatch, 2000). In Priamurye, the julid *Pacifiiulus amurensis* occurs not only woodlands but also in dry meadows, where its numbers average 6-9 ind./m² (Ganin, 1997).

Rather numerous millipedes are cave-dwelling, being either troglobites or troglophiles (Causey, 1960; Tabacaru, 1970; Murakami, 1971, 1975; Golovatch, 1975, 1976a). In the Russian Far East, no troglobitic Diplopoda have been reported, but several species are troglophiles (Mikhaljova, 1997a).

Relatively few species are synanthropic, or anthropogenic. Some of them, both introduced and native, often are pests of field, vegetable, berry, hothouse and greenhouse plants. Only a few such diplopods occur in the Asian part of Russia (Mikhaljova, 1993; 1998a, b; Mikhaljova & Nefediev, 2003).

As the cuticle of the vast majority of millipede species is devoid of a protective layer that could prevent them from excessive water losses, diplopods are quite sensitive to air humidity. They largely prefer to live in such moist substrates as leaf litter, rotten wood, stumps, the uppermost soil, crevices under the bark and stones, tree logs, anthills, bird nests, rodent and earthworm burrows etc. At higher rates of air humidity, for example in summer in the southern part of Primorsky Province, millipedes can appear on the ground surface, when the level of relative air humidity is close to 100%, yet with the sun hidden behind the clouds (Mikhaljova & Golovatch, 1981).

Most of the millipedes possess certain morphological, physiological and behavioural adaptations to decrease water losses. A hard cuticle impregnated with calcites is especially well-developed in open-dwelling species (Ghilarov, 1970). Some species contain much water both in the cuticle and in soft tissues, e.g. *Ommatoiulus moreletii* which is capable of withstanding higher temperatures and low humidity levels (Baker, 1980). Air humidity is often the main reason underlying habitat choice. According to the laboratory experiments of Rossolimo & Rybalov (1979), the widespread, pan-European species *O. sabulosus* tolerates a broader range of relative air humidity oscillations compared to the Central and East European *Leptoiulus proximus* (Nìmec), which prefers 95-100% air humidity. In natural conditions, the former species occurs both in moist and dry habitats, while the latter in moist localities only. Apparently, *L. proximus* is more restricted both geographically and ecologically.

Many species swarm in moist places during reproduction and early development. Thus, in the south of Primorsky Province, females of *Epanerchodus* species prefer to lay eggs near water. I have observed accumulations of *E. koreanus* Verh. females on lake banks in the litter near water. In addition, stage-1 juvenile *E. polymorphus* Mikh. & Gol. can often be seen swarming in large numbers on wet rotting wood, on the surface of wet leaf litter and other wet debris near water in places where egg-laying occurs.

Yet most of the millipedes can endure neither excessive moisture nor submersion. During overmoisture, they tend to move to drier places. In the southern part of Primorsky Province, during heavy rains I have observed mass appearances of *E. polymorphus* on the litter surface, sometimes with migrations onto tree trunks up to 2 m high. On the other hand, such a behaviour can also be related to reproduction. As a rule, the cuticle of Diplopoda cannot serve as an obstacle for water penetration. Thus, some species of Polydesmidae swell in water (Blower, 1955, cited after Striganova, 1977). However, some millipedes including *Oxidus gracilis* (C. L. K.) and *Polydesmus denticulatus* C. L. K., which are capable of survival underwater for a relatively long time, for instance during an inundation period or in experiment, have been reported as examples of unusual habits (Hopkin & Read, 1992). Even a waterlogged food seems to repel many millipedes, as they reject dead leaves with drops of water on the surface (Striganova, 1977).

Millipedes are largely capable of feeding only at certain temperatures. In temperate species, in experimental conditions these temperatures normally range between 0 and 34 ºC, but the upper limit of feeding activity in diplopods appears to only vary quite modestly (Striganova & Rakhmanov, 1973). At temperatures below 0 ºC, most millipedes grow numb. Many temperate species show a respiration breach at 35 ºC, dying at 37 ºC (Byzova, 1973). Optimum temperatures of millipede feeding activity are different in inhabitants of diverse natural zones or belts, e.g. 16-20 ºC in the forests of Western Europe, but 21-24 ºC in the steppe and forested steppe of the Russian Plain (Byzova, 1973; Striganova, 1972). Thus, the range of the temperatures required for a normal feeding activity of diplopods is very broad, being similar to that reported for the epigean invertebrates, but exceeding that of deep soil-dwelling animals (Striganova, 1977)

Among the temperate species, two groups are distinguished: (1) the upper border of feeding activity does not exceed 28 ºC in the diplopods living in the zone of mixed coniferous-broadleaved or broadleaved forests with a thick litter layer that mitigates temperature oscillations; (2) the upper border is about 33 ºC in the species that dwell not only under forest canopy but also are able to live normally in open places characterised by pronounced temperature fluctuations, including bare grounds that get strongly heated in sunshine. Thus, the species *Rossiulus kessleri* (Lohm.) that, among other places, also inhabits the dry and warm steppe regions of the Russian Plain and North Caucasus remains active during entire summer (Striganova, 1977). Such species compensate for water deficiency of the organism, when the temperature is high, by the consumption of juicy plant tissues. This is the reason why millipede damages to agricultural plants occur more frequently in arid conditions.

Millipedes show two main forms of rest, or dormancy, i.e. physiological and physical (Striganova, 1977). The former is an adaptation to periodically unfavourable conditions, and it is genetically determined. The latter form of rest depends on a direct impact of unsuitable conditions. A summer diapause in diplopods in the arid regions belongs to the first type of rest. For instance, aestivation in *Amblyiulus continentalis* (Att.) in the Lenkoran region of Azerbaijan coincides in time both in nature and in the laboratory regardless of temperature of the environment (Striganova & Rakhmanov, 1973). A preparatory stage, when the accumulation of emergency nutrients and a hormonal reorganization of the organism takes place, precedes physiological rest. The beginning of winter physiological rest is observed in many species, when the temperature drops below the lower limit of their feeding and locomotor activity at 5-10 ºC (Striganova, 1977). Such early preparations allow to survive cold periods.

In contrast, the activity breaks at too low or too high temperatures or in a too dry soil belong to the second form of rest. In the temperate belt, most of the Diplopoda maintain activity during the entire period of vegetation. The feeding activity of these millipedes is mainly regulated by temperature. They end feeding in autumn when the temperature drops down to a certain level, e.g 5-9ºC for *Glomeris marginata* (Villers) in Great Britain (Bockock & Heath, 1967, cited after Striganova, 1977). During the preparation for overwintering, these diplopods empty their intestine and penetrate the soil or other shelters. According to my observations, in experimental conditions the Far Eastern species *Levizonus thaumasius* Att. fails to cease its activity, including egg laying and hatching in winter, when placed at 18-20ºC. On the other hand, Striganova (1977) states that the beginning of a winter rest has been observed in a *Levizonus* sp., when the temperature exceeds the lower limit of their feeding and locomotor activity at 5-10 ºC.

A dry summer period can also be a reason of feeding activity cessation. Thus, in the broadleaved forests of the Carpathians, *Cylindroiulus burzenlandicus* Verh. stopped feeding during the summer drought of 1972. In contrast, in humid years this species goes on consuming the leaf fall during the entire vegetation season (Striganova, 1977). In the North Caucasus, where the day temperature often reaches 25-30 ºC, *Pachyiulus krivolutskyi* Gol. (= *P. foetidissimus* (Mur.)) is active at night as well as in the forests with thick, sufficiently moist litter. These animals normally stop feeding in summer, yet resuming nutrition when placed in the laboratory under favourable temperature and humidity conditions (Striganova, 1977). Some species like *P. varius* in the Crimea, Ukraine show a combination of short rest caused by unfavourable conditions and a genetically determined dormancy (Striganova, 1977).

In temperate Diplopoda, fluctuations both in feeding and locomotor activity occur during the active period even in Western and Central Europe, where the summer is mild and relatively humid. The maximum feeding activities of these diplopods seem to be restricted to spring and autumn (Verhoeff, 1928-32; Kheirallah, 1979b).

Diplopoda are mainly heliophobic, avoiding direct sunlight. Illumination, temperature and humidity as well as some other ecological and physiological factors play important roles in determining the daily activity of millipedes. Diplopods are most active at night, in the evening and early in the morning, when they find favourable conditions. Thus, in an india-rubber plantation in the southern part of West Africa, *Pachybolus laminatus* Cook shows two peaks of locomotor activity: about 9 a.m. and about 10 p.m. (the greatest peak); between 11 a.m. and 4 p.m. the locomotor activity is the lowest, being totally suppressed on especially hot days (Levieux et al., 1978). *Rossiulus kessleri* inhabiting the wind forest strips of the Ukraine's steppe zone shows daily migrations during the hot period when the litter grows dry. In the morning, when the air is cool, these julids migrate to the fields where they eat live plants. Before midday they return to under the forest canopy (Striganova, 1977).

In the south of the Russian Far East, where the climate is of humid monsoon type, the millipedes maintain activity during the entire warm period before the first frost, when they finish up feeding and get prepared for hibernation like most of the other temperate Diplopoda. The highest locomotor activity in the Far Eastern diplopods is likewise observed in spring and autumn (Mikhaljova & Bakurov, 1989). In addition, peaks of abundance in these millipedes are also registered in spring and autumn (Ryabinin, 1975; Mikhaljova, 1988b).

Concerning the vertical distribution along the soil profile, most of the millipedes live in the litter and the uppermost soil down to 10-20 cm deep (Striganova, 1977; Mikhaljova, 1983b; Mikhaljova & Bakurov, 1989). The situation relates to the diplopods as generally being highly sensitive to humidity, temperature, insolation, soil pH, aeration, food availability etc. Two conventional groups can be distinguished: (1) mainly litter-dwelling species; and (2) upper-inhabitants, of which both adults and juveniles occupy the litter and upper soil strata freely distributed along these levels of the soil profile. Among the temperate Diplopoda, group 2 is mainly composed of members of the orders Julida and Glomerida. They are rather well adapted, both morphologically and physiologically, to a life and movement in the soil. As a rule, the species of the orders Polydesmida and Chordeumatida that show paraterga, longer legs and a flat dorsum belong to group 1. Among the Far Eastern litter-dwelling species, a subgroup of soil-litter interface inhabitants has been delimited. Such are *Levizonus* spp., *Sichotanus eurygaster* and *Cawjeekelia koreana* Gol., whose juveniles live in the soil up to 10 cm depth, whereas the adults mainly occur in the litter (Mikhaljova, 1983b).

Most diplopods even on open terrain at high temperatures and at low humidity levels remain in the uppermost soil (Ghilarov, 1947; Valiakhmedov, 1962). This contrasts the numerous other soil invertebrates occurring in arid regions and showing narrow hydrothermal valence that migrate to deeper soil horizons, where the conditions of temperature and humidity are more stable and favorable for these animals. Therefore, practically no change in habitat levels/strata is realised among Diplopoda; their activity in the regions with contrasting hydrothermal regimes is ensured by a different complex of adaptations (Striganova, 1977).

Only relatively few millipedes, rather juveniles than adults in larger forms, but both juveniles and adults in particularly miniature species, seem to be capable of penetrating the soil down to 40-60 cm deep. The polydesmid, *Schizoturanius kitabensis* (Gul.) from Uzbekistan, Central Asia has been registered at 60 cm depth (Ghilarov, 1970). Among the millipedes living in the Russian Far East, the detrivorous *Angarozonium bonum* Mikh., which depends little on the presence of leaf fall, as well as the juliform *Kopidoiulus continentalis* Gol. are known to be distributed all along the soil profile down to 40-50 cm depth, yet only in well-structured soils and only in some years (Mikhaljova, 1983b). Generally, among diplopods, true deep-dwelling edaphobionts are absent.

CHAPTER 3 METHODS OF MILLIPEDE COLLECTION, PREPARATION AND IDENTIFICATION

This chapter has been repeated here almost without change after Mikhaljova (1998b).

Faunistic collections of diplopods are usually effectuated by means of hand sorting from (sieved) forest litter, rotten wood and all other kinds of plant debris as well as the uppermost soil strata. Millipedes can be taken from under stones, logs, shingle, various driftwood remains, algae etc. on sea shores and banks of lakes and streams, on mushrooms etc. One should not overdo in terms of the number of (seemingly) conspecific individuals per sample. In fact this recommendation concerns collecting any arthropod group. For one thing, some species may prove rare, even endangered, so the restriction is fully in line with the increasing concern for nature conservation. Secondly, as at any site only one to a few species are dominant, it appears useless to collect too many specimens of such forms. Thirdly, a collecting vial or jar too full of millipedes is difficult to store: the animals stain each other with their often dark secretions, they get easily broken or even macerated if the alcohol content drops too much due to water absorption from the animal tissues.

Special devices like a sieve or sifter (Fig. 1) are particularly efficient for collecting millipedes and other groups of large soil or litter invertebrates. The most

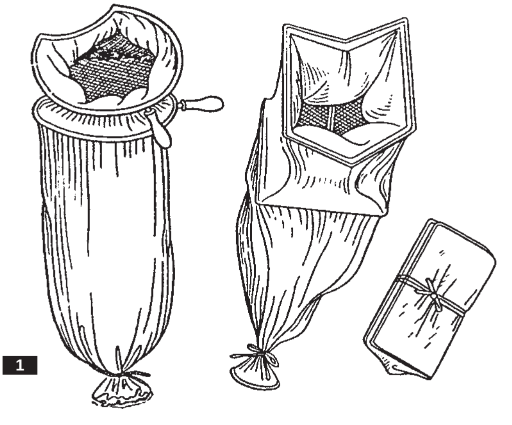


Fig. 1. Sifters for litter, bark and rotten wood to be sieved through (after Tikhomirova, 1975).

common sifters used are those which have the first hoop 275 mm in diameter, the second one 330 mm, and the third 120 mm. The second hoop supports a sieve (metallic or nylon strings) ca. 8-10 mm in mesh size and a handle fixed at 90° to the handle of the first hoop. The distance between the first and second hoops is about 290 mm, that between the second and third hoops ca. 750 mm.

Place some substrate (dead leaves, rotten wood, removed bark, moss etc.) on top of the sieve to almost fill the upper compartment and then, keeping both handles tightly, thrash the sifter rather energetically for about 1 min until the lower compartment is no longer filled with the debris fallen through the sieve from above. Then empty the upper compartment from the rougher debris, untie the laces just above the third hoop and spread the finer, sieved, fauna-containing debris on a larger white tray with upturned margins or a previously stretched piece of oilskin or plastic. However, the absence of upturned margins in the last case makes it possible some prompt animals to escape. Then the debris are disturbed, the emerging invertebrates are extracted and placed into vials or jars containing alcohol.

This operation is repeated as many times you like. Moreover, not only qualitative, but also quantitative samplings can be carried out using a sifter, e.g. from a square unit of a forest floor. Yet one must keep in mind that, besides the litter, a complete census must also include taking a soil sample, for which the sifter is useless.

Material is usually fixed with 70-75% ethanol which, to avoid maceration of the specimens (see above), is better to change for a fresh lot not later than 4 h after the first conservation. The temporary label written with soft pencil is placed into each vial or jar, according to the notes you make in your field notebook. When in the lab, all material is sorted out in alcohol into species, and this time each subsample is supplied with (a) permanent label(s) written with waterproof Indian ink or printed (photo label is worse because wet swelled inscription is lightly skinned during work with collected material), reading the exact locality (with reference to some place shown on most maps), the kind of habitat, the date(s) of capture, and the collector(s) name(s). Use thin but close and firm (archival) paper. Another label is added upon completion of the identification work: full Latin name of the species, its author and date of publication, the number (and sex) of the specimens, the year and the name(s) of the person(s) who determined the material (e.g. det. Mikhaljova, 1997). For the sake of comfort, the labels must not take more than a few square cm, i.e. comparable in size with the vials they accompany. In such a case there is no need to take out the label for reading, because the label would not be folded. Hence abbreviations are often implied, but please make sure these are conventional and not too numerous (e.g. Distr. instead of District, NE. instead of Northeast, 18.05.1997 instead of 18 May 1997, etc.).

Material is usually stored in glass or plastic vials filled with fresh alcohol and corked with special lids or cotton stoppers. Make sure no air bubble remains inside, otherwise some fragile specimens may easily become fragmented or lose appendages, or both. Keep the vials turned upside down in bigger jars and fully sunk in alcohol. Usually such a jar contains conspecific or congeneric material, so label the jar accordingly to make the samples easily available.

Identification of a millipede usually requires dissection, which in its turn makes the use both of a quality stereoscope with a focused light beam and jeweler's forceps mandatory. Small-sized diplopods are better to be dissected using insect pins. The dissected parts (mouthparts, antennae, certain appendages) are mounted either as temporary micropreparations (e.g. in glycerol) or constant slides using such liquid media as Canada balsam or the alcohol-based Euparal, or the toluene-based Eukitt. Make sure the dissected pieces are not dried up before mounting, because air bubbles inside can strongly hamper the transparency of the preparations. Upon completion of the identification work, all objects from the temporary micropreparations are returned into a microtube or wrapped in cotton which is placed inside the vial containing the respective specimen where they belonged. Constant slides are labeled the same way as the dissected specimen, but also indicating all mounted structures therein and a number (e.g. D76/1997, which stands for Diplopod Slide 76 made in 1997). Then the same number must accompany the alcohol material the slide belongs to. The labels on micropreparations are affixed using strong glue, they must be compact, too, and somewhat set off from the margins of the glass so as not to be damaged when kept in slits of special boxes.

The usual procedure of preparing a constant micropreparation begins with placing all necessary structures in a (cratered) object glass or a small Petri dish and gradually replacing 75% alcohol thereon with 96-100% one using filter paper and a pipette. Leaving the objects soaked in 96-100% alcohol, start with a new object glass or a covering glass, place a drop of the medium you prefer on top of it and then transfer the structures, one by one or all at once, using the forceps or pins. Make sure your objects are arranged accordingly and placed at the bottom of the medium drop, remove all possible air bubbles, and cover the mount with a covering glass. The procedure is over.

However, such a way requires large adroitness, because small structures can become air-filled during their transfer into the medium drop (air being inside the structure looks like a black spot which prevents examination of the structure). Therefore it is better to use the following procedure. All necessary structures are placed directly in an object or covering glass which will serve as a micropreparation. Then the operation to replace 75% alcohol by 96-100% one is followed during 1-3 min. Never permit the structure to dry up! After that a drop of Canada balsam is placed on soaked structures. At first the balsam becomes milky over but soon you will see a clear balsam drop. Then cover the mount with a covering glass and label your slide. If the object is capacious (for example gonopods), the covering glass is supplied with clay legs.

If you chose a covering glass to mount your objects, you must gently pick up both covering glasses (with structures in between) and, keeping them between four fingers, make sure their edges coincide, then put your mount on top of an object glass and label the latter, yet keeping it horizontal. The differences between a usual micropreparation (object glass + covering glass) and a two-covering-glass mount is, that in the latter case you can examine your objects at higher magnifications from both sides. Upon examination of such a micropreparation, you can easily affix it to the middle of the object glass using clay that is better than water-soluble glue. After that your slide can be kept in the same box with usual micropreparations, but in case you need to re-examine something, you can get the mount off in a moment without use of water.

Another trick lies in using half-dry to dry Canada balsam. I have heard of it from S.I. Golovatch, but I have never used it myself. The trick concerns the production of constant micropreparations. Canada balsam is usually disfavoured at present because it takes years to harden its liquid even in a thermostat at ca. 40 ºC. However, the use of crumble-dry Canada balsam removes this problem. Place several medium-sized crumbles in the middle of an object or covering glass, then wet them several times with 100% ethanol and wait until „boiling“ is over. When everything settles down, you will see a completely clear center (only sometimes the peripheries/edges remain milky, opaque for some more time) filled with smaller and rounded grains interspersed with a film/layer of fully diluted Canada balsam. Place your objects between the grains, arrange them accordingly and cover the mount with a covering glass pressing it rather hard to almost smash the grains (this will force most if not all possible air bubbles out) but leaving the objects intact. Even if a few air bubbles have not escaped, do not worry, because next day you will see them fully dissolved, the Canada balsam almost entirely homogenous and solid enough to keep in the usual boxes without further drying.

The gonopods of some larger forms (e.g. Diplomaragnidae species) are easier to examine when they are dry. Generally the same concerns some peripheral characters (e.g. metazonital striations, shape of the tail, etc.), but usually it suffices to remove the film of alcohol from the surface using filter paper. In any case, material is best preserved when kept in 75% alcohol.

When quantitatively assessing a millipede population, standard methods of soil zoological investigations are to be used [Methods..., 1975; Quantitative methods..., 1987).

CHAPTER 4 PECULIARITIES OF MILLIPEDE MORPHOLOGY

Body length of adult millipedes ranges between 2.0 and 300 mm. The species encountered in Siberia and the Russian Far East vary from about 2.0 to 70 mm in length. The body is elongate, usually worm-like, cylindrical or flattened dorsoventrally, or oniscomorph, capable of enrolling into a sphere. Species from the orders Polyzoniida and, especially, Polyxenida are short-bodied. No oniscomorph diplopods have hitherto been recorded in the Asian part of Russia.

The color is from whitish pallid to dark brown-black, sometimes rather vivid (e.g. pink, yellow, etc.), often with various patterns of bands, stripes or spots of the basic or a different color. Quite many tropical species are aposematic, coloured brightly, contrastingly, e.g. red or yellow with black. Cave-dwelling millipedes are usually uncoloured. Juveniles are normally completely pallid, white or with a faint pattern which is much lighter than in the adults. Most diplopods are hard-bodied with calcinated (= impregnated) teguments, only Polyxenida are soft-covered.

The body consists of a head and a trunk, the latter is composed of somites (also termed as body segments or rings) (Fig. 2).

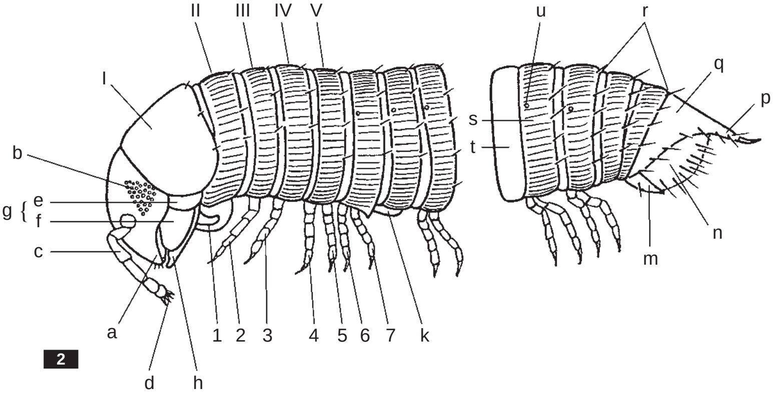


Fig. 2. A sketch of millipede external structures: a – labrum; b – eye patch with ocelli; c – antenna; d – sensory bacilli (=sensory cones); e – cardo; f – stipes (= stipites); g – basal lobe of mandible (= gena); h – gnathochilarium; 1 – modified male leg pair 1; 2-7 – numbers of leg pairs; k – gonopods; m – anal scale; n – anal valve; p – tail with claw; q – preanal ring; r – legless (= apodous) segments (= proliferation zone); s – metazonite; t – prozonite; u – ozopore; I – first segment of body (collum); II-V – numbers of subsequent segments of body (after Blower, 1985, with changes).

HEAD

Head rounded, only in species of Polyzoniida elongated anteriorly into a subtriangular (Fig. 28) or subquadrate rostrum. A head capsule and cephalic appendages (antennae and mouthparts) are distinguished. The head capsule is delimited anteriorly by a labrum, usually tridentate and supplied with a row of labral setae, followed by a clypeus which often supports supralabral setae. In julids the number of supralabral and labral setae can vary as often positively correlating with body size. More caudally, a frons and a vertex is distinguished. In Proterandria, the vertex carries a transverse endoskeletal partition or phragma superficially expressed as a more or less distinct axial epicranial suture. Representatives of the order Polyzoniida are devoid of an axial epicranial suture. An occiput with an opening forms the caudal wall of the head capsule. Laterally of the frons, the head supports a pair of antennae placed in antennal sockets. Behind them, sometimes there are Tömösvary's organs (orders Glomerida and Chordeumatida), often also fields/patches of ocelli (eyes, or ocellaria). The mouthparts lie beneath the head.

In most of the millipedes, the antennae are bent outside and down. Only in species of the order Polyzoniida the antennae are more or less straight. Antennae of diplopods are always uniramous, fili- to claviform, 8-segmented, the terminal antennomere (= antennal segment) being represented by sensory cones, usually 4 in number. Antennomeres 3 and 5 are the longest, 5th and 6th the thickest. In some taxa, each of antennomeres 5 and 6, seldom 4th as well, supports subapically a number of minute sensory bacilli placed dorsally and laterally or arranged into a corolla.

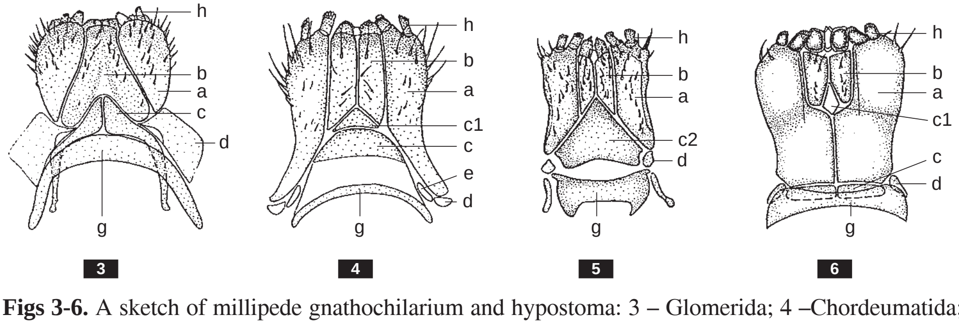
Among Diplopoda, eyes are either present or absent (Polydesmida, some Julida, troglobites). If present, eyes are mainly represented by simple ocelli grouped into eye patches. An eye patch can consist of one ocellus, several or many ocelli. The eye patch is variable in shape: oval, subtriangular as in Julida and most Chordeumatida, a chain/line consisting of identical or differently sized ocelli in Blaniulidae, Polyzoniidae, some Chordeumatida. Eyes are usually coloured, often black.

Tömösvary's organs, sometimes termed as post-antennal temporal organs, lie between the base of the antennae and the eye patch on each side of the head, being shoe-shaped, circular or oval. At present an olfactory function of these organs is the most plausible hypothesis (Hopkin & Read, 1992).

Mouthparts are reduced in Polyzoniida. In other diplopods, they consist of a pair of mandibles and an unpaired plate termed gnathochilarium which is homologue to maxillae II, while maxillae I are fully reduced in the course of embryonic development. The mandible is usually composed of two pieces: a 1- or 2-segmented gena (= basilare), though each of these segments, in its turn, can consist of several parts, especially in Polydesmida, and a stout premandibular part (= gnathal lobe), often also consisting of several segments. In Glomerida, the genae are 1-segmented. In the Polyzoniida the gena is strongly reduced into a narrow longitudinal filament. In most of the Diplopoda, the gena is composed of a cardo and stipes (= stipites). Stipes can be covered with crests and grooves, sometimes also supporting a ventral projection in males; sometimes the cardo is also supplied with an outgrowth as in some Julida. Species from the order Chordeumatida show an actually entire and strongly convex gena, because the suture dividing the cardo and stipes is short and not reaching even the middle of the gena. The gnathal lobe contains a molar plate, an anterior fringe, external and internal teeth and a few pectinate lamellae. The gena is the only piece of the mandibles which can be observed in lateral and dorsal views in an intact millipede; while the gnathal lobe is always covered with the gnathochilarium and is poorly visible only in frontal view.

The conformation of the gnathochilarium is characteristic of each order (Figs 3-6), but basically it is composed of a pair of stipites (a), a pair of separated or fused lamellae linguales (b), a mentum (c) sometimes divided by a transverse suture into a basal eumentum and a proximal promentum (c1), a pair of cardo (d) represented by two small sclerites, and an unpaired praebasilare which can be either rudimentary and termed as nodi (e) or absent as in most species from the orders Julida, Chordeumatida and Polydesmida. The caudal edge of the mentum borders a transverse plate termed hypostoma, or gula (g) often considered as the sternum of the collar body segment. The front edge of the gnathochilarium is supplied with three pairs of palps (h) usually surmounted by sensory cones. Each stipe bears two such palps, largely subcylindrical, whereas each lingual lamella supports a single, lobe-shaped palp.

In Glomerida, two lamellae linguales are fused to each other into an entire structure with or without apical palps; each stipe is supplied with 1-2 pairs of external palps; the mentum is entire or consisting of two parts; the praebasilare is



Figs 3-6. A sketch of millipede gnathochilarium and hypostoma: 3 – Glomerida; 4 –Chordeumatida; 5 – Polydesmida; 6 – Julida; a – stipes; b – lamella lingualis; c – mentum; c1 – promentum; c2 – mentum of Polydesmida (= diplomentum in terms of Lokšina, 1969); d – cardo; e – nodus; g – hypostoma; h – palp (after Lokšina, 1969).

absent; the cardo are very large. In Julida, Chordeumatida and Polydesmida, the always-present lamellae linguales and mentum are bordered from each other. The stipites are elongate and narrow at base in species from the order Chordeumatida, while broadened and contiguous at base in Julida. The mentum and promentum are separated from each other in Julida and some Chordeumatida. In contrast, species from the order Polydesmida are characterised by a large entire plate termed mentum which is formed by the fused eumentum and promentum, a diplomentum (c2) in terms of Lokšina (1969). In most species of the order Polyzoniida, all parts of the gnathochilarium are fused into an entire plate, while in larger species from the order Polyxenida a mentum, lamellae linguales and stipes with 1-2 pairs of large, characteristic palps can be distinguished. In smaller species of this order, the dividing sutures between the gnathochilarial parts are obscure.

TRUNK

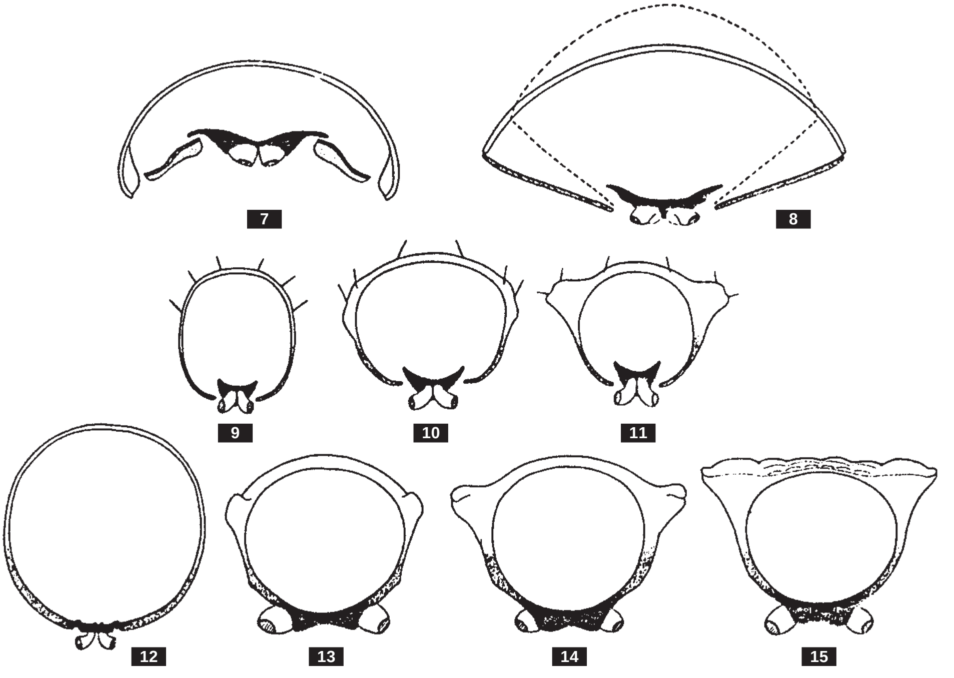
The trunk is composed of numerous segments, their number growing either steadily from molt to molt throughout millipede lifetime (Julida and Polyzoniida with highly inconstant number counts) or only to a certain stage, usually subadult, to remain stable at all subsequent molts if any, so that species are characterised by definitive segment numbers (Polydesmida, Chordeumatida, Polyxenida, the hemianamorphotic Glomerida). The trunk in Chordeumatida consists of 26-32 somites, the number of body segments being strictly constant and, as a rule, even, though odd numbers of somites (29) have occasionally been reported as well. Polydesmida are usually with 19-20 somites, very seldom 18, their number likewise being quite strict and constant, yet sometimes varied depending on sex, very seldom infraspecifically as well. Glomerida are with 12 somites, Polyxenida with 11-13 somites, their number also being strict and constant. Hence the juvenile is always with a lesser number of body segments than the adult. Traditionally, in all body segment counts, the last somite, i.e. the telson, is also included.

Among Diplopoda, especially in several species of the order Julida, a phenomenon termed periodomorphosis is observed. In such species, a functional adult male moults into a non-functional regressed (intercalary) male and then moults again into a second copulatory stage. These reversals may be repeated several times. Some male characters, especially leg pair 1, can thus vary depending on developmental stage.

Basically, each body segment, or somite, or ring, consists of a number of sclerites: tergite, or tergum (dorsal, sometimes divided by an axial suture), a pair of pleurites, or pleura (lateral, often coalesced with the tergite), and a pair of sternites, or sterna (ventral, often fused either with each other or coalesced with the pleura, or both). Sterna support legs.

In Polyxenida, all these sclerites are free. In Glomerida, a body ring consists of a strongly arched tergite, which extends laterally, displacing the pleurites to a ventral position, as well as two sternites placed one in front of the other. All sclerites are likewise free (Fig. 7). In Polyzoniida, all sclerites are also free, the tergum is devoid of an axial suture, the sternites are small and poorly-developed (Fig. 8). However, in contrast to Glomerida, pleurites are moved up to the tergal margin. In addition, in cross-section the ring of Polyzoniida is subtrapeziform, while in Glomerida it is crescent-shape. In Chordeumatida, the pleurites and the tergite are fused into a pleurotergal arch (= pleurotergum) divided axially, while the sternites are completely free (Figs 9-11). When free, the sternites can shift anteriorly or posteriorly, hence obscuring the attribution of the sternal pair and its legs to a certain somite. In Julida, all sclerites are likewise fused into a single ring, but the borders of the sternites are evident (Fig. 12). In Polydesmida, all sclerites are fused into a single solid ring (Figs 13-15).

The sternite is usually a (sub)triangular plate with a straight anterior margin and an apex pointed caudally. As the apical part is often truncated, the sternite



Figs 7-15. A sketch of diplosomite cross-section: 7 – Glomerida; 8 – Polyzoniida; 9-11 – Chordeumatida; 12 – Julida; 13-15 – Polydesmida. – Sternites black, pleurites stippled, tergites plain (after Blower, 1985).

becomes trapeziform. Such a sternite separates the legs. The sternite is supplied with a pair of spiracles, or stigmata, slightly anterior and lateral to the coxae of the legs. Each is the opening of a tracheal apodeme, that is, part of the tracheal system. In most of the Diplopoda, excluding Polyzoniida, the tracheal apodemes are the place for the attachment of leg muscles. They can be modified and of taxonomic importance.

Body segment 1 is only a tergite, or collum, while neither pleura nor sterna can be distinguished. The collum is legless. In some Julida, the collum overlaps the head and the second somite. In the Glomerida, the second tergite is much larger than the following and is extended further laterally. Somites 2 and 3 each are full but with a single pair of sterna, which are free from the pleurotergal arch. Among the legged somites, segments 2-4 are monopodous, while the others diplopodous; that is, each carries two sterna and two pairs of legs.

Typically, each diplosegment, excluding the collum, is divided by a transverse suture into two halves; the anterior one is termed as prozonum, or prozonite, while the posterior one as metazonum, or metazonite. The prozonite is always less in diameter than the metazonite; hence it is partly or almost fully withdrawn in a telescope-like way inside the lumen of the preceding metazonum. Because of this, numerous Helminthomorpha can spiral or roll up, this behaviour being considered as protective.

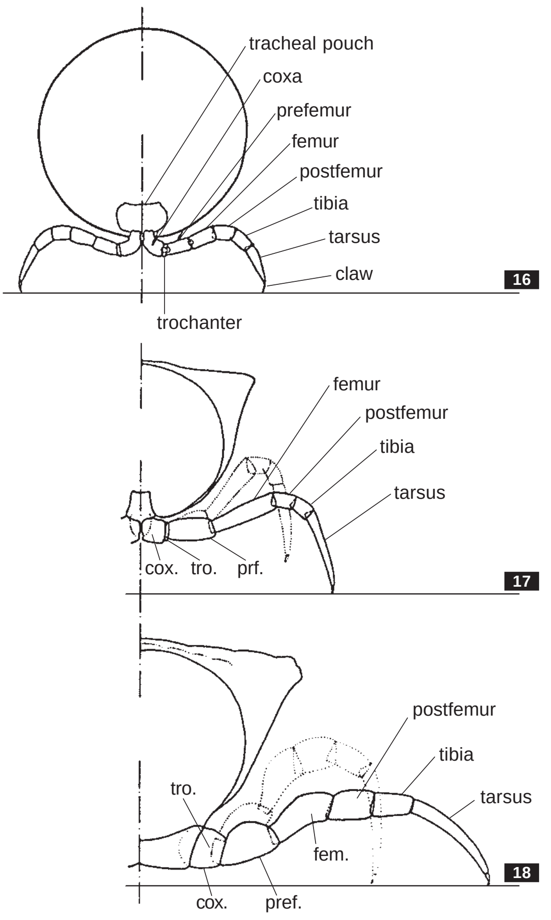
The prozonital surface is either smooth or finely reticulate, more seldom striolate. Metazonites are usually more strongly sculptured, often with lateral bulges, keels or wings (= paraterga). The dorsal part of the metazonites, or metatergum, can be smooth, tuberculate, granulate, striate, setose etc., while the paraterga smooth, bordered, incised or even serrate laterally (Figs 539, 572, 589, 623, 651).

Starting from segment 5 or 6, repugnatorial pores, or ozopores, can open flush on the metazonital surface. These pores are absent from Polyxenida and Chordeumatida, present only on certain somites on paraterga (the so-called pore formula), like in Polydesmida, or on (almost) all subsequent somites laterally near the suture between pro- and metazona, like in Polyzoniida and Julida, or are concealed in the intersegmentar membrane as in Glomerida. When present, ozopores function as the outlets for the repugnatorial glands secreting a repelling, often stinking liquid protecting the millipede from enemies.

The telson is always with neither legs nor tracheal apodemes, nor ozopores. Typically, the telson of Helminthomorpha consists of a preanal ring with its dorsal part, or epiproct, often produced into a caudal process, or tail; a pair of anal valves, or paraprocts; and a ventral plate (= subanal scale, or hypoproct). A proliferation zone where new somites are being formed lies between the (usually apodous) penultimate body segment and the telson. No subanal scale is present in Polyzoniida, whereas in Chordeumatida there are 1-3 pairs of tiny spinnerets protruding from under the dorsal part of the preanal ring (Fig. 520). In Polyxenida, the telson is supplied with 1-2 bundles consisting of long, hollow, serrate, highly conspicuous setae. In Glomerida, the anal opening and several posterior legs are covered by a large, dome-shaped tergite, or pygidium.

EXTREMITIES

Millipede walking legs are movably attached to the sternite laterally. The leg is always uniramous, normally consisting of 6-7 articles, or podomeres (Figs 16-18). The coxa is the basalmost joint attached to the sternum, while the remaining



Figs 16-18. A sketch of diplopod leg structure: 16 – Julida; 17 – Chordeumatida; 18 –Polydesmida (after Blower, 1985).

podomeres compose a telopodite. The coxa is usually simple, unmodified, ventrally (all legs in Polyzoniida, certain male legs in Chordeumatida) it can be supplied with the so-called coxal gland with an eversible sac; the presence of coxal glands is considered as a primitive character. The following telopoditomeres are distinguished from base to tip: trochanter, praefemur (= prefemur), femur, postfemur, tibia, and tarsus. Sometimes certain podomeres can get either coalesced or, on the contrary, secondarily subdivided. The trochanter is always very short, it can be fused with the coxa as in Glomerida or so far recessed into the coxa that it is only visible on the side of the leg opposite the flexion and is easily overlooked. The tarsus is usually supplied with a claw. In Helminthomorpha, legs 1 and 2 are largely devoid of a trochanter. The claw is dentiform to phylloid, at base sometimes with additional claws as in Julida and Chordeumatida or with bubbles as in Polyxenida. An additional claw (not too claw-like) can occur ventrally, dorsally or ventrally and dorsally to the main claw. Mainly in the species from the orders Julida and Chordeumatida, the ventral additional claw is often represented by a more or less long spinicle (= filament). The ventral side of leg segments, especially the male tarsus, is often with various modifications such as sole pads, brushes of particularly dense setae, special setae (e.g. sphaerotrichs, or sphaerotrichomes, which are strong, sometimes palmate setae each surmounting a tubercle/knob), papillae etc. Leg pairs 1 and/or 2 are subject to much greater modification as compared to most other legs. Thus, male leg pair 1 in Julida is either more or less reduced, mostly unciform, or greatly enlarged, often plate-like. Leg pair 2 can be reduced in size or otherwise modified, especially the coxa. In many Chordeumatida, (some) pregonopodal legs are enlarged. In general, male legs tend to be modified more strongly than female ones.

Millipede legs are unguligrade, applying just the tip of the leg, the tarsal claw, to the ground. In contrast, many insects are plantigrade, applying the whole tarsus, sometimes several jointed, to the ground. Only in *Polyxenus* and some exotic millipedes the tarsus is divided.

Walking in millipedes is an original feature of this class of Myriapoda. The wavy movements of the legs are created due to a delay in the movement of each preceding leg as compared with the following one. The leg of each pair accomplishes a similar movement circle. The speed does not depend on the quantity of leg waves.

In the male, paired vasa deferentia, or genital ducts, open either on a usually independent structure termed as penes (= penis) (which is incorrect since they take no part in direct sperm transfer but function only as gonopores) behind leg par 2 (e.g. in Stemmiulida, Julida, some Polyzoniida etc.) or pierce coxae 2 (sometimes forming a complex orifice) (e.g. in Penicillata, Pentazonia, Polydesmida, Chordeumatida, some Polyzoniida). Penes represent two chitin tubes either free or fused all along, each with an independent canal of vas deferens; penes can also be an entire structure.

In the female, exclusive of the Penicillata and Glomeridesmida with gonopores opening on the second coxae, each of the ducts ends up inside a structure termed a vulva, the latter lying inside somite 3 behind leg pair 2. The vulvae are sometimes species-characteristic and, although usually they are poorly-sclerotised, much more monotonous in structure, they can be useful in millipede systematics. Basically, each vulva consists of a bursa supplied with a gape directed anteriorly and covered by an operculum. The bursa is composed of two valves sometimes connected ventrally with a keel- to fringe-like membrane, sometimes with a deep gutter in between. Inside (at the bottom), the bursa is provided with an apodematic tube ending in one or two ampullae, which serve as seminal receptacles or spermathecae. The females of parthenogenetic species often possess a reduced seminal receptacle. Both valves and the operculum are usually characteristically setose. Vulvae are placed inside the body cavity, each in a special sac; the sac together with the vulva is everted during copulation. The epigynal region (= the anterior ventral edge of ring 3) is sometimes modified and can be useful taxonomically as well.

Copulation takes place in most but not all millipedes. Thus, Penicillata being one of the most primitive millipede groups, show no special structures destined for fertilization. Mating does not occur in these myriapods, which are characterised by indirect fertilization without direct contact between the male and the female. Thus, the male of the chiefly Euro-Mediterranean *Polyxenus lagurus* (L.) deposits a spermatophore onto a specially constructed silken web. Following the threads, the female finds the spermatophore and takes it up directly into her genital opening.

In Glomerida, copulation takes place but it is male mouthparts, not legs, that are involved in sperm transfer. The last three male leg pairs (17-19) are modified, pair 19 is especially enlarged into great pincers termed as telopods, serving for fixing the female during mating. Telopods are still leg-like, composed of a syncoxite with retained coxal glands and 3- or 4-segmented telopodites. Males count 19 leg pairs while females only 17.

In Helminthomorpha, certain male legs termed as gonopods are modified, often highly conspicuously, for carrying out the function of direct sperm transfer during copulation. The stronger the gonopods resemble the usual walking legs and the more gradual the metamorphosis, the more primitive the group. Earlier immature male instars have usual walking legs in place of gonopods, while later to penultimate instars display their primordia.

Gonopods function as a pipette, or spermatopositors, i.e. as the apparatus by which sperm is introduced into the female. Prior to mating, the sperm ejected through the gonopores or penes is picked or sucked up by the gonopods. During copulation, the gonopods containing the sperm enter and inseminate the vulvae of the female. The structure of the gonopods is of paramount importance in millipede systematics, often being the only reliable means of identification.

In Polyzoniida, the gonopods correspond to leg pairs 9 and 10. They are extremely leg-like, especially the posteror gonopods (Figs 25-26, 32-33, 38, 40). Mostly distal segments are subject to modifications, while basal segments retain the shape of a more or less complete ring. Coupled with the retention of completely free body sclerites, highly leg-liked gonopods, most of the walking legs with coxal glands, all this allows to consider this order among the most primitive millipede groups.

In Polydesmida, only male leg pair 8, or the first pair on body ring 7, is modified into gonopods. Though they retain primary articulation between the coxa and a relatively simple telopodite, the group can hardly be considered as rather primitive because of a whole number of such apparently derived characters as the loss of eyes, the complete fusion of the sclerites in body rings, the drastic gonopod metamorphosis from minute and completely non-articulated primordia etc. A typical polydesmidan gonopod (Figs 563, 624, 667) consists of a voluminous hollow coxa, or coxite, which stores the sperm shortly before mating, a pipe-like coxal horn, or cannula, which serves as a conduit for sperm transmission between the coxite and the telopodite, and a telopodite subdivided

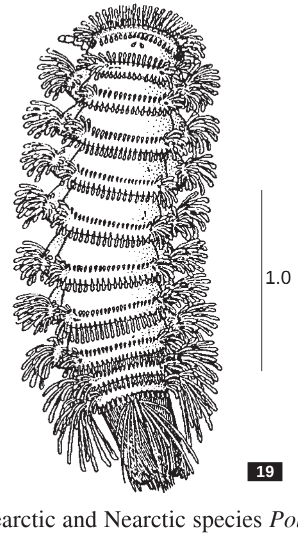


Fig. 19. Habitus of the West Palaearctic and Nearctic species *Polyxenus lagurus* (Linnaeus, 1758). – Scale in mm (after Blower, 1958).

into a densely setose “prefemur” and a more complex acropodite (= all subsequent leg segments, in this case “femorite” + “tibiotarsus”). Mostly a special distal branch is developed, termed solenomere*, carrying the seminal canal, or seminal groove (which is never closed), or prostatic groove. Gonopod coxites can be free (a more primitive condition) or fused, the sternal elements are always strongly reduced.

In Chordeumatida, both very strongly to dramatically modified male leg pairs of somite 7 serve as gonopods. Sometimes also certain adjacent male legs can be quite strongly transformed. Then one may term this as a single gonopod complex. The anterior gonopods, or legs 8, are always fused medially and less leg-like than the often independent posterior gonopods, or legs 9 (Figs 316, 330, 449, 450, 525). Gonopod primordia are often articulated. Coupled with the retention of an axial dorsal suture, free sternites, ocellaria, coxal glands on certain male legs, etc., all this is evidence of a relatively primitive condition represented by the Chordeumatida in millipede phylogeny.

The gonopods in Julida are likewise modified male leg pairs 8 and 9. The anterior gonopods, or peltogonopods (a term emphasizing their protecting function), are usually plate-like, covering the more delicate posterior, or true, gonopods frontally and from below. The julidan gonopod complex is always divided into 2-3 parts (Figs 48, 98, 167). The gonopods are either almost fully retractible inside a special cavity in somite 7 or are exposed. The anterior piece, often termed promere (formerly denoted as promerite but, being incorrect grammatically just like “solenomerite”, it is here rectified), corresponds fully to the peltogonopods, hence the homologue to leg pair 8. Typically, each promere retains a sternite, a flagellum (homologue to the coxal gland) and, usually, a more or less strongly reduced telopodite. The posterior gonopods can be either unipartite (a more primitive condition, hence the complete homologue to leg pair 9) or more or less deeply split into two pieces, the anterior of which is termed mesomere (formerly denoted as mesomerite), while the posterior one, or opisth-

* I have dropped the usage of the term solenomerite in favour of solenomere following the information and advice of R. L. Hoffman and S. I. Golovatch (in litt.). The reason is that the suffix “mere” derives from the Greek “meros”, meaning “a part”, thus solenomere would mean a “grooved part”. The suffix “-ite” usually denotes something that is part or subdivision of something. Thus, solenomerite would translate into “grooved-part-part”, but this is misleading. As the situation concerning the terms pro-, meso- and opisthomerite is similar, the usage of the terms promere, mesomere and opisthomere is preferable. By the way, the terms antennomere and telopoditomere are very commonly used in arthropod anatomy and systematics.

omere (formerly denoted as opisthomerite), usually supports a seminal groove on a solenomere branch. Since almost all sterna are fused to the ring-like pleuroterga (though retain a suture), the gnathochilarium is most strongly derived, the gonopod primordia are non-articulated, true coxal glands are missing etc., the order Julida is generally considered as one of the most advanced millipede groups.

CHAPTER 5 TAXONOMIC PART

CLASSIFICATION

The classification adopted here is basically that of Hoffman (1980), though an alternative family-level classification has recently been proposed (Shelley, 2003).

Class Diplopoda
Subclass Penicillata Latreille
Order Polyxenida Lucas, 1840
Family Polyxenidae Lucas, 1840
Genus *Polyxenus* Latreille, 1802/03
1. *Polyxenus* sp.

Subclass Helminthomorpha Pocock
Order Polyzoniida Gervais, 1844
Family Polyzoniidae Gervais, 1844
Genus *Angarozonium* Shelley, 1998
2. *Angarozonium aduncum* (Mikhaljova, 1995)
3. *Angarozonium amurense* (Gerstfeldt, 1859)
4. *Angarozonium bonum* (Mikhaljova, 1979)
5. *Angarozonium kurtschevae* (Mikhaljova, 1983)
6. *Angarozonium valerii* (Mikhaljova, 1981)

Order Julida Leach, 1814
Family Blaniulidae C. L. Koch, 1847
Genus *Nopoiulus* Menge, 1851
7. *Nopoiulus kochii* (Gervais, 1847)
Family Nemasomatidae Bollman, 1893
Genus *Orinisobates* Lohmander, 1933
8. *Orinisobates microthylax* Enghoff, 1985
9. *Orinisobates sibiricus* (Gulièka, 1963)
10. *Orinisobates soror* Enghoff, 1985

Family Mongoliulidae Pocock, 1903
Genus *Kopidoiulus* Attems, 1909
11. *Kopidoiulus continentalis* Golovatch, 1979
12. *Kopidoiulus khasanicus* Mikhaljova, 1997
Genus *Skleroprotopus* Attems, 1901
13. *Skleroprotopus coreanus* (Pocock, 1895)
14. *Skleroprotopus schmidti* Golovatch, 1979
Genus *Ansiulus* Takakuwa, 1940
15. *Ansiulus aberrans* Mikhaljova & Korsós, 2003
Genus *Ussuriiulus* Golovatch, 1980
16. *Ussuriiulus pilifer* Golovatch, 1980
Family Julidae Leach, 1814
Genus *Julus* Linnaeus, 1758
17. *Julus ghilarovi* Gulièka, 1963
17a. *J. ghilarovi ghilarovi* Gulièka, 1963
17b. *J. ghilarovi brachydactylus* Gulièka, 1972
Genus *Cylindroiulus* Verhoeff, 1894
18. *Cylindroiulus latestriatus* (Curtis, 1845)
Genus *Sibiriulus* Gulièka, 1963
19. *Sibiriulus altaicus* Gulièka, 1972
20. *Sibiriulus multinicus* Mikhaljova, 2001
21. *Sibiriulus profugus* (Stuxberg, 1876)
Genus *Anaulaciulus* Pocock, 1895
22. *Anaulaciulus golovatchi* Mikhaljova, 1982
Genus *Megaphyllum* Verhoeff, 1894
23. *Megaphyllum* aff. *sjaelandicum* (Meinert, 1868)
Genus *Pacifiiulus* Mikhaljova, 1982
24. *Pacifiiulus amurensis* (Gerstfeldt, 1859)

Order Chordeumatida C. L. Koch, 1847
Family Megalotylidae Golovatch, 1978
Genus *Megalotyla* Golovatch, 1978
25. *Megalotyla brevichaeta* Golovatch & Mikhaljova, 1978
Family Diplomaragnidae Attems, 1907
Genus *Ancestreuma* Golovatch, 1977
26. *Ancestreuma feynmani* (Shear, 1990)
27. *Ancestreuma longibrachiatum* (Shear, 1990)
28. *Ancestreuma ramiferum* Mikhaljova, 2000
29. *Ancestreuma ryvkini* (Shear, 1990)

30. *Ancestreuma subulatum* Mikhaljova, 2000
Genus *Asiatyla* Mikhaljova, 2000
31. *Asiatyla communicantis* (Golovatch, 1977)
32. *Asiatyla sajanica* (Gulièka, 1972)
33. *Asiatyla similata* Mikhaljova, 2000
Genus *Altajosoma* Gulièka, 1972
34. *Altajosoma bakurovi* (Shear, 1990)
34a. *Altajosoma bakurovi bakurovi* (Shear, 1990)
34b. *Altajosoma bakurovi longiprocessum* Mikhaljova, 2000
35. *Altajosoma coxale* (Shear, 1990)
36. *Altajosoma deplanatum* (Stuxberg, 1876)
37. *Altajosoma golovatchi* (Shear, 1990)
38. *Altajosoma katunicum* Mikhaljova, 2000
39. *Altajosoma kemerovo* (Shear, 1990)
40. *Altajosoma shilenkovi* (Shear, 1990)
Genus *Shearia* Mikhaljova, 2000
41. *Shearia calycina* Mikhaljova, 2000
42. *Shearia densecava* (Gulièka, 1972)
43. *Shearia khakassica* Mikhaljova, 2000
44. *Shearia oiskaya* Mikhaljova, 2000
45. *Shearia rybalovi* Mikhaljova, 2000
46. *Shearia shushenskaya* Mikhaljova, 2000
47. *Shearia teletskaya* Mikhaljova, 2000
Genus *Pacifiosoma* Mikhaljova, 2000
48. *Pacifiosoma cristofer* (Mikhaljova, 1993)
49. *Pacifiosoma kuruma* (Mikhaljova, 1997)
Genus *Orientyla* Mikhaljova, 2000
50. *Orientyla dahurica* (Gerstfeldt, 1859)
51. *Orientyla bureyinskaya* (Mikhaljova, 1997)
Genus *Sakhalineuma* Golovatch, 1976
52. *Sakhalineuma basarukini* (Mikhaljova, 1995)
53. *Sakhalineuma curvatum* (Mikhaljova, 1995)
54. *Sakhalineuma globuliferum* (Mikhaljova, 1995)
55. *Sakhalineuma molodovae* Golovatch, 1976
56. *Sakhalineuma sakhalinicum* (Mikhaljova, 1995)
57. *Sakhalineuma tuberculatum* (Mikhaljova, 1995)
Genus *Diplomaragna* Attems, 1907
58. *Diplomaragna anuchino* Shear, 1990
59. *Diplomaragna dalnegorica* Mikhaljova, 1993

60. *Diplomaragna ganini* Mikhaljova, 1993
61. *Diplomaragna kedrovaya* Mikhaljova, 1993
62. *Diplomaragna lysaya* Shear, 1990
63. *Diplomaragna terricolor* (Attems, 1899)
64. *Diplomaragna yakovlevka* Shear, 1990
65. *Diplomaragna zimoveinaya* Mikhaljova, 1997
Genus *Maritimosoma* Mikhaljova, 2000
66. *Maritimosoma piceum* (Shear, 1990)
67. *Maritimosoma reductum* (Shear, 1990)
68. *Maritimosoma schawalleri* (Mikhaljova, 1993)
69. *Maritimosoma turova* (Mikhaljova, 1997)
Family Conotylidae Cook, 1896
Genus *Crassotyla* Golovatch, 1980
70. *Crassotyla amurica* Golovatch, 1980
Family Anthroleucosomatidae Verhoeff, 1899
Genus *Ghilarovia* Gulièka, 1972
71. *Ghilarovia cylindrica* (Stuxberg, 1876)
72. *Ghilarovia kygae* Gulièka, 1972
Family Hoffmaneumatidae Golovatch, 1978
Genus *Hoffmaneuma* Golovatch, 1978
73. *Hoffmaneuma exiguum* Golovatch, 1978
Family Caseyidae Verhoeff, 1909
Genus *Underwoodia* Cook & Collins, 1895
74. *Underwoodia kurtschevae* Golovatch, 1980
Family Golovatchiidae Shear, 1992
Genus *Golovatchia* Shear, 1992
75. *Golovatchia magda* Shear, 1992
Family Altajellidae Mikhaljova & Golovatch, 2001
Genus *Altajella* Gulièka, 1972
76. *Altajella pallida* Gulièka, 1972
Genus *Teleckophoron* Gulièka, 1972
77. *Teleckophoron montanum* Gulièka, 1972
Chordeumatida nomina dubia
78. *Craspedosoma armatum* (Gerstfeldt, 1859)

Order Polydesmida Leach, 1815
Family Xystodesmidae Cook, 1895
Genus *Levizonus* Attems, 1898
79. *Levizonus distinctus* Mikhaljova, 1990

80. *Levizonus laqueatus* Mikhaljova, 1981
81. *Levizonus malewitschi* Lokšina & Golovatch, 1977
82. *Levizonus thaumasius* Attems, 1898
83. *Levizonus variabilis* Lokšina & Golovatch, 1977

Family Paradoxosomatidae Daday, 1889

Genus *Oxidus* Cook, 1911

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

Genus *Haplogonosoma* Brölemann, 1916

85. *Haplogonosoma implicatum* Brölemann, 1916

Genus *Sichotanus* Attems, 1914

86. *Sichotanus eurygaster* (Attems, 1898)

Genus *Cawjeekelia* Golovatch, 1980

87. *Cawjeekelia koreana* (Golovatch, 1980)

Family Polydesmidae Leach, 1815

Genus *Epanerchodus* Attems, 1901

88. *Epanerchodus cuspidatus* Mikhaljova, 1996
89. *Epanerchodus koreanus* Verhoeff, 1937
90. *Epanerchodus kunashiricus* Mikhaljova, 1988
91. *Epanerchodus polymorphus* Mikhaljova & Golovatch, 1981

Genus *Polydesmus* Latreille, 1802-03

92. *Polydesmus denticulatus* C. L. Koch, 1847

Genus *Schizoturanius* Verhoeff, 1931

93. *Schizoturanius clavatipes* (Stuxberg, 1876)
94. *Schizoturanius tabescens* (Stuxberg, 1876)

Genus *Uniramidesmus* Golovatch, 1979

95. *Uniramidesmus aberrans* Mikhaljova, 1979
96. *Uniramidesmus alveolatus* Mikhaljova, 1979
97. *Uniramidesmus constrictus* Mikhaljova, 1998
98. *Uniramidesmus cornutus* Mikhaljova, 1984
99. *Uniramidesmus lingulatus* Mikhaljova, 2004
100. *Uniramidesmus dentatus* Mikhaljova, 1979
101. *Uniramidesmus detersus* Golovatch, 1979
102. *Uniramidesmus perplexus* Mikhaljova, 1984
103. *Uniramidesmus septimus* Mikhaljova, 1990

Keys and descriptive accounts

Below are keys to the subclasses, orders, families, genera and species of the millipedes encountered in the regions concerned.

Key to the subclasses of Diplopoda:

1(2) Cuticle soft, not impregnated with calcites. Head, most of pleura and telson with bundles of hollow serrate setae (trichomes) (Fig. 19). .... Penicillata

2(1) Cuticle hard, impregnated with calcites. Such complex trichomes absent, body bare or with simple setae. .... Helminthomorpha

Subclass Penicillata Latreille

This subclass contains the only order Polyxenida Lucas, 1840, with four families distributed worldwide, mostly in the tropics.

These so-called bristly millipedes differ greatly from all other diplopods first of all in lack of a solid cuticle and in the presence of highly peculiar trichomes. The adult body consists of 11 to 13 segments only, i.e. the shortest in the entire class. All Polyxenida are devoid of any specialised sex-linked appendages. Being one of the most primitive millipede groups, they are characterised by indirect sperm transfer involving no copulation. These small, mostly whitish to brownish, relatively swiftly moving creatures dwell in rotten wood, under the bark of dead trees, in lichens, under stones, in anthills, bird nests, forest litter, etc.

Only the family Polyxenidae Lucas, 1840 occurs in the Asian part of Russia, represented yet by a single, closer unidentified species of the Holarctic genus *Polyxenus* Latreille, 1802/03. This species is rare, until now reported solely from the Sikhote-Alin Biosphere Reserve, Primorsky Province, Russian Far East (Map 4) (Mikhaljova, 1993; Ganin, 1997). The geographically closest, endemic congeners are known from Korea, China and Japan (Ishii, 1983; Ishii & Choi, 1988; Ishii & Liang, 1990).

Subclass Helminthomorpha Pocock

This subclass includes 11 or 12 Recent orders, largely distributed worldwide, mostly in the tropics. Only four orders occur in the Asian part of Russia.

Key to orders of Helminthomorpha:

1(2) Head very small, elongated anteriorly into a rostrum (Fig. 28). Body strongly flattened dorsoventrally, without paraterga. All body sclerites free (Fig. 8). .... Polyzoniida

2(1) Head larger, more or less ovoid, devoid of a rostrum. Body more or less cylindrical, with or without paraterga. All body sclerites fused or sternites free but tergites and pleurites fused into a single arch. 3

3(4) Telson with a pair of spinnerets (Fig. 520). Each metatergite with 3+3 macrochaetae (Figs 429, 440, 483). .... Chordeumatida

4(3) Telson without spinnerets. Metaterga with simple setae at most. 5

5(6) Metatergites normally with paraterga (Figs 538, 559, 572). Eyes absent. Adult body at most with 20 segments, including telson. .... Polydesmida

6(5) Metatergites without paraterga, body subcylindrical (Figs 132, 195). Eyes usually present at least as individual ocelli, more seldom completely reduced. Adult body usually with more than 30 segments. ....Julida

Order Polyzoniida Gervais, 1844

This order is distributed all over the world and consists of four families. In the Asian part of Russia, a single, Holarctic family, Polyzoniidae, is known to occur.

Unlike all other millipedes, Polyzoniida are detrivorous, possessing a small subtriangular or subquadrate head with a rostrum for absorbing a semi-liquid food. Body strongly flattened, leech-like, consisting of smooth bare segments without any lateral projections. Body parallel-sided on middle segments, gradually tapering toward both head and telson. These millipedes show some other disjunct, often primitive characters such as four pairs of legs in the first larva in contrast to the usual three in other orders; walking legs (except 1, 2 and hind leg pairs) with coxal glands; all somital sclerites free; gonopods highly leg-liked, represented by relatively poorly modified male legs 9 and 10.

Family Polyzoniidae Gervais, 1844

This family contains six genera distributed in North America and Eurasia. A map showing the global distribution of the Polyzoniidae can be found in Shelley (1998). The Asian part of Russia supports one endemic genus, *Angarozonium*.

Members of this family are distinguished by the follows characters. Body size ranging from small to large, that of *Angarozonium* species not exceeding 11 mm in length; coloration commonly pale white or yellowish with a peculiar pattern of light brown to brown spots and stripes on dorsum, pleura, telson and legs as in species of *Angarozonium*; tergites very short but very broad, also strongly attached to each other; smooth and bare metatergites devoid of bulges, paraterga or wings and mid-dorsal suture; telson narrow; penes either short, reaching only leg pair 3, or long, reaching leg pair 5-7; width of postgonopodal sterna variable; anterior gonopod sternum modified, apically with paramedial setose projections or a fovea and setae, as in some species of *Angarozonium*; most of anterior gonopod segments relatively short and broad, broader than long, coxae usually carrying processes; telopodite of anterior gonopods placed parallel to main axis or lying subperpendicularly to proximal segments.

Genus *Angarozonium* Shelley, 1998

DISTRIBUTION: Russia: Siberia and the Far East; North Korea, Northeast China, Mongolia. This genus contains six species, five of which are known from the Asian part of Russia. Only females of presumably *A. amurense* have hitherto been found in Mongolia (Mikhaljova & Marusik, 2004).

The main distinguishing characters are as follows. Head sparsely setose along external margins only; sterna narrow with leg coxae nearly touching in midline; leg pair 1 somewhat reduced in size; tarsal claws of leg pair 1 not stout; penes reaching up to beginning of leg pair 5 when the anterior part of body tucked in, lying close to each other; coxal process of anterior gonopod modified (bifid, semi-cylindrical, cup- or petal-like) with setae medially; anterior gonopod prefemur narrow, strongly attached to coxite; femur of anterior gonopod enlarged; apical telopoditomere of anterior gonopod with setae, bifid or entire apically, but (unlike the genus *Polyzonium*) without both distolateral flange of solenomere and serrate basal lobes; anterior gonopod sternite modified apically; posterior gonopods 5-segmented.

Key to *Angarozonium* species:

1(6) Coxal process of anterior gonopods not bifid. Ozopores strongly shifted off suture dividing pro- and metazona. Fore and marginal parts of telson brown. 2

2(3) External edge of coxal process of anterior gonopods with a small unciform outgrowth (Fig. 20). .... *A. aduncum*

3(2) External edge of coxal process of anterior gonopods without any outgrowths. 4

4(5) Coxal process of anterior gonopods cyathiform, i.e. cup-shaped (Figs 25-26). .... *A. amurense*

5(4) Coxal process of anterior gonopods petal-shaped (Figs 32-33). .... *A. valerii*

6(1) Coxal process of anterior gonopods bifid. Ozopores lying very close to suture dividing pro- and metazona. Telson colourless. 7

7(8) Coxal process of anterior gonopods with an internal branch ¼ shorter than external one, sternite with a few setae on tubercles (Fig. 38). .... *A. bonum*

8(7) Coxal process of anterior gonopods with an internal branch ¾ shorter than external one, sternite with numerous long setae on tubercles (Fig. 45). .... *A. kurtschevae*

Angarozonium aduncum (Mikhaljova, 1995)

Figs 20-21, Map 2.

Polyzonium aduncum Mikhaljova, 1995 in: Mikhaljova & Basarukin, 1995: 90: map, 91: figs.
Angarozonium aduncum – Shelley, 1998: 30; Mikhaljova, 1998b: 11: figs, 12: map.

DIAGNOSIS: The semi-cylindrical shape of the anterior gonopod coxal processes and the unciform process at the latter's external edge will serve to separate this species from congeners.

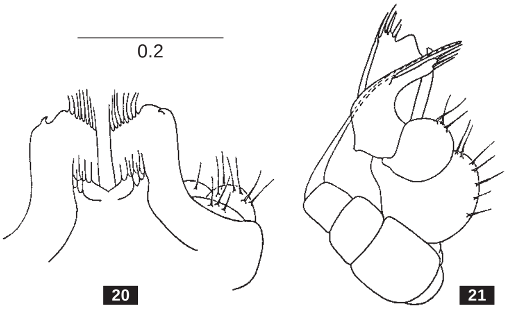
DESCRIPTION: Male. Body 6-10 mm in length, 0.9-1.9 mm in width, body segments varying from 31 to 39 in number.

General coloration of dorsum from beige to brown, of venter from beige to yellowish. Collum with an unpaired median marbled spot and paired lateral spots. Pale marbled bands of varying width along suture dividing pro- and metazona. Ozopores lying in the middle of a marbled spot. Legs beige, tarsi and tibiae pale brown distodorsally, prefemora brown or beige ventrally. Eyes black. Antennae dark brown. Telson with a beige central part and with brown external edges.

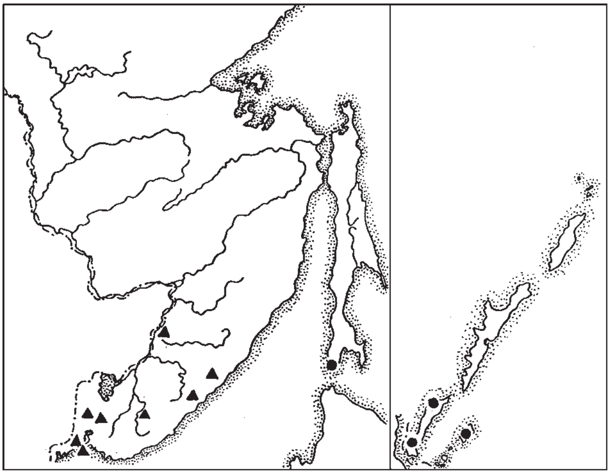
Comma-shaped eyes with three ocelli in lower row, with 1-2 setigerous knobs in upper row. Densely setose antennae relatively long. Length ratios of antennomeres 2-7 as 0.9:1.1:1.2:0.9:1.4:1, width ratios as 0.8:1.1:1.1:1.1:1.2:1, respectively. Collum ellipsoid, much wider than head. Ozopores from somite 6 on, set off behind suture dividing pro- and metazona, not touching this suture, only on somite 5 lying either right upon or touching the suture. Small telson with 3+3 ventral setae.

Legs slender. Length of narrow and conical penes characteristic of the genus. Claws of leg pairs 1 and 2 phylloid.

Anterior gonopods as usual 5-segmented (Figs 20-21). Coxal process semi-cylindrical, open on internal and posterior sides, its external edge with an



Figs 20-21. *Angarozonium aduncum* (Mikhaljova, 1995): 20 – gonopods (front view); 21 – gonopods (caudal view). – Scale in mm (after Mikhaljova & Basarukin, 1995).



Map 2. Distribution of *Angarozonium aduncum* (●) and *A. bonum* (▲).

unciform process, internal edge not explanate, with a few long strong setae. Telopodite lying subperpendicularly to proximal segments. External sides of segments 2-4 setose, forming a setigerous pad on femur. Telopodite bifurcated apically, internal branch serving as solenomere with a terminal opening of seminal/prostatic groove, external branch half as long as internal one, with long setae. Ventral part of sternite as a double hollow setose along external edges. Distal telopoditomere of posterior gonopods long, usual, tapering toward end, with a terminal funnel and a small subterminal projection.

Female. Length 6-9 mm, width 0.8-1.5 mm, the number of body segments varying from 30 to 33. Leg femora beige. Vulvae small, tapering caudally.

DISTRIBUTION (Map 2): Russia: Southern Sakhalin Island, Kuriles (Kunashir and Shikotan islands).

REMARKS: This species has been collected in forest litter and in mosses, also in *Sphagnum* bogs.

Angarozonium amurense (Gerstfeldt, 1859)

Figs 22-27, Map 3.

Platydesmus amurensis Gerstfeldt, 1859: 273.

Polyzonium germanicum - Stuxberg, 1876a: 36; 1876b: 317.

Polyzonium amurense - Mikhaljova, 1979a: 1591; 1993: 9; Lokšina & Golovatch, 1979: 382.

Polyzonium cyathiferum Mikhaljova, 1981b: 780, 781: figs.

Polyzonium cyathiferum - Mikhaljova, 1983a: 309; 1990: 137; 1993: 8: map; Ryabinin et al., 1988: 29; Rybalov, 1991: 87; Mikhaljova & Basarukin, 1995: 90: map; Ganin, 1997: 12.

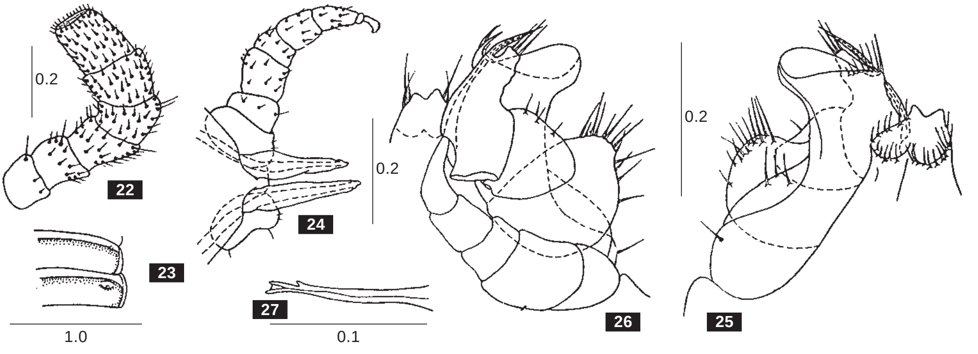
Polyzonium bonum – Ursova, 1983: 305.

Angarozonium amurense - Shelley, 1998: 29; Rybalov & Rossolimo, 1998; Mikhaljova, 1998a: 4; 1998b: 12: map, 13: figs; 2002b: 206; Mikhaljova & Golovatch, 2001: 104; Rybalov, 2002; Vorobiova et al., 2002: 63; Mikhaljova & Marusik, 2004: 3.

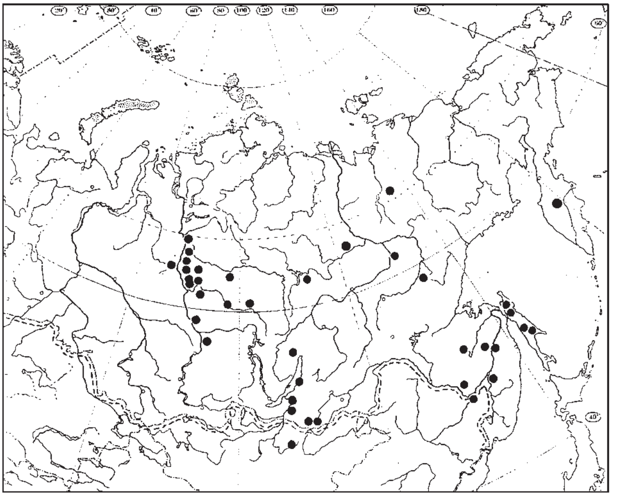
DIAGNOSIS: This species differs from congeners by the entire cyathiform coxal process of the anterior gonopods and the double foveiform sternite of the anterior gonopod apex.

DESCRIPTION: Male. Body 4-11 mm in length, 1-1.9 mm in width, up to now the maximum number of body segments recorded being 47; segment counts in adults always over 25.

General coloration increasingly pallid toward telson, dorsum castaneous-brown with a dark axial stripe that can be obscure or consisting of small individual spotlets. Venter yellowish, caudalmost edges of pleura light brown, growing increasingly brown toward telson. Collum with an unpaired median marbled spot and paired lateral marbled spots. Prozona brown with narrow triangular spots lying between lateral sides and axial line. A pale band broadening dorsad and turning near axis into a marbled spot along suture dividing pro- and metazona. Each metazonite with a pair of large marbled spots. Ozopores lying in the middle of a round pale spot. Lateral sides of metaterga with more or less distinct, whitish, oblique stripes extending from ozopore spot down to caudal corner. Eyes black. Legs pale, tarsi and distal parts of tibiae brownish, prefemora brown ventrally. Antennae dark brown. Central part of telson colourless, fore and lateral parts brown. Coloration and pattern variably intense; as a rule, youngest and smaller individuals light or colorless.



Figs 22-27. *Angarozonium amurense* (Gerstfeldt, 1859): 22 – antenna; 23 –sides of male body segments 5 and 6; 24 – male leg pair 2 and penes; 25 – gonopods (front view); 26 – gonopods (caudal view); 27 – last telopoditomere of posterior gonopod. – Scales in mm (after Mikhaljova, 1981b).



Map 3. Distribution of *Angarozonium amurense* (●).

Comma-shaped eyes with 3 ocelli in lower row and 1-2 setigerous knobs in upper row. Densely setose antennae (Fig. 22) long, in situ reaching to the middle of somite 5. Length ratios of antennomeres 2-7 as 1.2:1.0:1.7:1.9:1.9:1, width ratios as 1.2:1.5:1.6:1.6:1.4:1, respectively. Collum ellipsoid, considerably broader than head. Collum's length to width ratio as 1:2.7. Width ratios of collum and somites 2-5 as 1:1.3:1.5:1.6:1.9. Ozopores set off behind suture dividing pro- and metazona by a low and narrow ridge. On somite 5, ozopores located on prozonite right upon suture dividing pro- and metazona (Fig. 23). Telson small, with three pairs of sparse setae on pleurital bolster.

Legs slender. Anterior legs somewhat incrassate. Length of narrow and conical penes characteristic of the genus (Fig. 24).

Anterior gonopods as usual 5-segmented. Coxite extended into a cup-shaped process mesally almost fully concealed and beset with strong setae of varying length (Fig. 25). Telopodite lying subperpendicularly to proximal segments. Segments 1-4 setose laterally, with a setigerous pad on femur. Telopodite bifid apically, external branch with several setae (Fig. 26). A styloid interior branch serving as solenomere; seminal groove opening terminally. Sternite apically like a double fovea beset with setae at fore edge but elevated and bipartite caudally. Terminal telopoditomere of posterior gonopods particularly long and slender, foveolate at, and with a poor incision before, tip (Fig. 27).

Female. Body 4-12 mm in length, 1.1-2.0 mm in width, up to now the maximum number of body segments recorded being 43. Leg prefemora pallid ventrally.

Distribution (Map 3): Russia: Siberia (central part of Krasnoyarsk Province, Irkutsk and Chita areas, Buryatia, Republic of Sakha (Yakutia)), the Russian

Far East (southern part of Khabarovsk Province, Sakhalin Area, Kamchatka Area); Northeast China, North Mongolia.

REMARKS: Originally described by Gerstfeldt (1859) from near the mouth of Songari River, China as *Platydesmus amurensis*, this species was long suspected to actually represent a senior synonym of the trans-Siberian *Polyzonium cyathiferum* Mikhaljova, 1981 (e.g., Mikhaljova, 1993). However, the formal synonymy was only advanced rather recently (Shelley 1998), reconfirmed by the re-examination of a sample of what might be considered as near-topotypes (Mikhaljova, 1998a).

This is one of the very few diplopod species that has managed to reach very far northwards compared to the remaining millipedes occurring in the Holarctic (Mikhaljova & Marusik, 2004). In the Yenisey River basin, the range of *A. amurense* covers all forested subzones beginning from the subzone of northern taiga. More to the south, this species occurs in most of the woody habitats except valley forests and swamps. As *A. amurense* has only once been recorded west of Yenisey River (i.e. Elogui River valley, see Vorobiova et al., 2002), in the absence of further material it still appears premature to speculate if Yenisey River serves as a longitudinal biogeographical barrier for diplopod distribution or not. In the southern spurs of Yablonovyi Mt. Range, East Siberia, this species has been collected at 1,700-1,800 m a.s.l. (Mikhaljova, 1993). In Priamurye (= Amurland), it lives in different forest types within the subzone of mixed coniferous-broadleaved forest but is absent from meadows and swamps (Ganin, 1997). The maximum average population density of *A. amurense* recorded in the Yenisey River basin is 46 ind./m², the minimum 4 ind./ m² (Vorobiova et al., 2002), being 21 and 1.1 ind./ m², respectively, in the forests of Priamurye (Ganin, 1997). This species is dominant or sole in numerous woodlands of the Yenisey River basin, but not in Priamurye, where many other species of Diplopoda are known to occur. The numbers of *A. amurense* vary considerably both between years and over the vegetation season. Thus, in the mixed forests of the Yenisey River basin in 1988-1990, pitfall trapping yielded 12-40 ind. per 100 traps per 24 h, but in 1991 and 1993 only 5-9 ind. per 100 traps per 24 h. Apparently, this was related to the rather dry periods of vegetation recorded in 1991 and 1993. In addition, this species appears to be especially active/mobile there in the end of June (Vorobiova et al., 2002).

Angarozonium valerii (Mikhaljova, 1981)

Figs 28-34, Map 4.

Polyzonium valerii Mikhaljova, 1981b: 778, 779: figs.

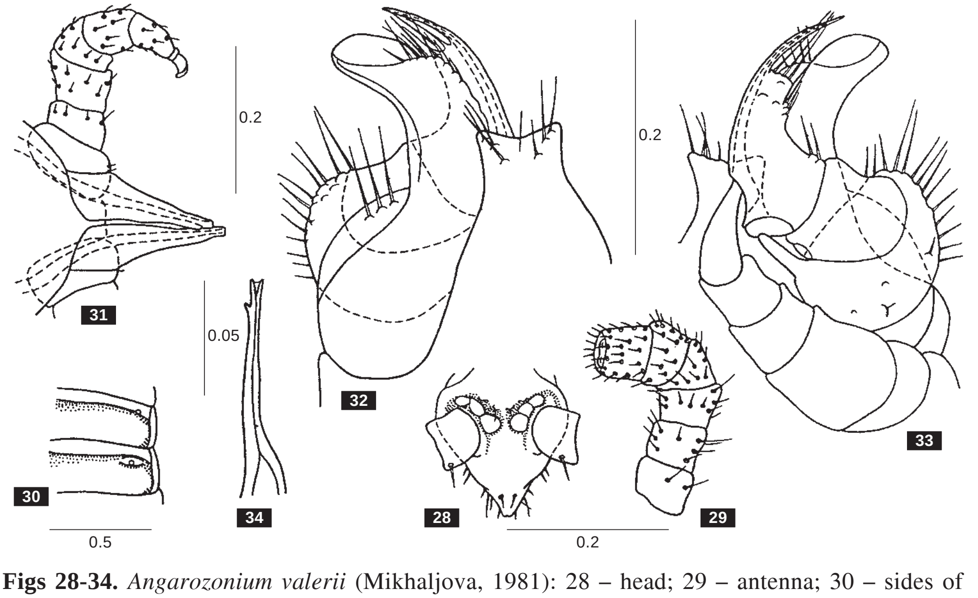
Polyzonium valerii - Mikhaljova, 1993: 8: map, 9; Ganin, 1997: 126.

Angarozonium valerii - Shelley, 1998: 29; Mikhaljova, 1998b: 13, 14: figs and map.

DIAGNOSIS: The species differs from congeners by the entire petal-shaped coxal process of the anterior gonopods and the anterior gonopod sternite bearing neither tubercles nor a fovea distally.

DESCRIPTION: Male. Body 4.0-9.5 mm in length, 0.8-1.1 mm in width, up to now the maximum body segment number recorded being 43; the minimum segment counts in adults 23.

Dorsum castaneous-brown with a dark axial stripe. Venter yellowish. Caudal-most edges of pleura light brown, growing increasingly brown toward telson, pleura colourless. Collum with an unpaired median marbled spot and paired lateral marbled spots. Prozona brown with pale triangular spots lying between lateral sides and axial line. A pale band broadening dorsad and turning near axis into a marbled spot along suture dividing pro- and metazona. Each metazonite with a pair of large, diffuse, marbled spots. Lateral sides of metaterga whitish



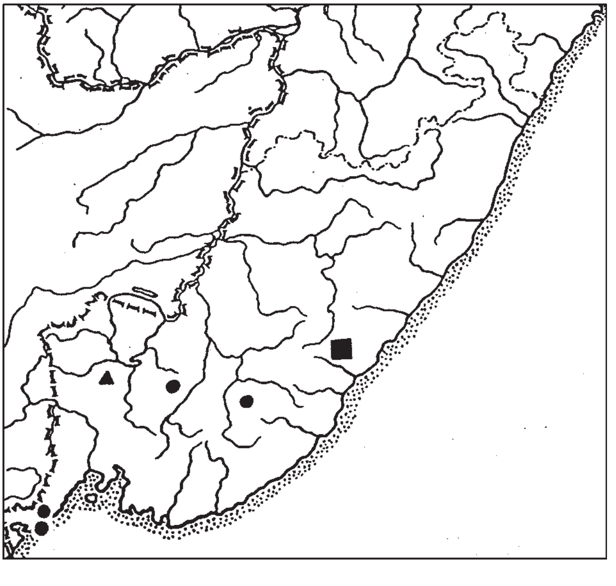
Figs 28-34. *Angarozonium valerii* (Mikhaljova, 1981): 28 – head; 29 – antenna; 30 – sides of male body segments 5 and 6; 31 – male leg pair 2 and penes; 32 – gonopods (front view); 33 – gonopods (caudal view); 34 – last telopoditomere of posterior gonopod. – Scales in mm (after Mikhaljova, 1981b).

with markings. Ozopore lying in the middle of a round pale spot. Eyes black. Legs pale, tarsi and distal parts of tibiae light brown, prefemora brown ventrally. Antennae brown. Central part of telson colourless, fore and lateral parts brown. Coloration and pattern variable in intensity; as a rule, youngest and small individuals light or colourless.

Head sparsely setose along external margins only (Fig. 28). Comma-shaped eyes with 3 ocelli in lower row and 1-2 setigerous knobs in upper row. Densely setose antennae (Fig. 29) in situ reaching to the end of somite 3. Length ratios of antennomeres 2-7 as 5.7:7.0:5.7:5.0:7.0:1, width ratios as 1.7:1.9:2.1:1.9:1.7:1, respectively. Collum ellipsoid, much broader than head. Length/width ratio of collum as 1:2.6. Width ratios of collum and somites 2-5 as 1:1.2:1.4:1.5:1.6. Telson with three pairs of sparse setae on pleural bolster ventrally. Ozopores set off behind suture dividing pro- and metazona by a low and narrow ridge. On somite 5, ozopores located on prozonite right upon suture dividing pro- and metazona (Fig. 30). Ozopore of somite 5 lying at a shorter distance from lateral edge of somite than ozopores of other somites.

Legs slender. Length of narrow and conical penes characteristic of the genus (Fig. 31). Pregonopodal legs somewhat incrassate. Claws of leg pairs 1 and 2 phylloid.

Anterior gonopods as usual 5-segmented. Coxite extended into a petal-like, broadly opening process with strong setae mesally (Fig.32). Telopodite lying subperpendicularly to proximal segments. Segments 2-5 setose laterally, with a setigerous pad on femur. Telopodite with long setae distally and only interior



Map 4. Distribution of *Angarozonium valerii* (▲), *A. kurtschevae* (●) and *Polyxenus* sp. (■).

branch serving as solenomere; seminal groove opening terminally (Fig. 33). Sternite without tubercles, with a shallow mesal hollow beset with long subapical setae. Terminal telopoditomere of posterior gonopods particularly long and slender, foveolate at, and with a poor incision before, tip (Fig. 34).

Female. Body 3.5-10.5 mm in length, 0.9-1.4 mm in width, up to now with the maximum record of 40 body segments. Leg prefemora pallid.

DISTRIBUTION (Map 4): Russia: Far East (Primorsky Province).

REMARKS: This species has been found abundant in mushrooms in a *Quercus* forest with *Betula* and *Populus* but, like other congeners, most probably *A. valerii* is largely also litter- and soil-dwelling. The shift to feeding on mushrooms seems to be related to low humidity in the litter during the dry and warm September of 1979, when the specimens were first collected (Mikhaljova, 1981b).

Angarozonium bonum **(Mikhaljova, 1979)**

Figs 35-41, Map 2.

Polyzonium bonum Mikhaljova, 1979a: 1591,1592: figs.

Polyzonium bonum - Lokšina & Golovatch, 1979: 382; Kurcheva & Mikhaljova, 1980: 121; Mikhaljova, 1983a: 309; 1983b: 82; 1988b: 70; 1993: 4, 8: map; 1997a: 145; Mikhaljova & Petukhova, 1983: 52; Ganin, 1997: 105; Shelley et al., 2000:14.

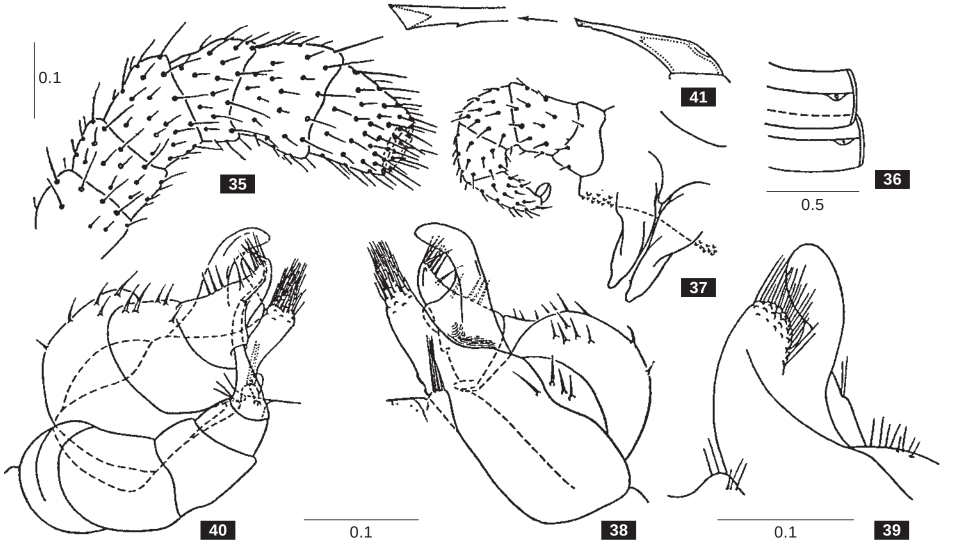
non *Polyzonium bonum* - Ursova, 1983: 305.

Angarozonium bonum - Shelley, 1998: 29: figs; Mikhaljova, 1998b: 12: map, 15: figs; Mikhaljova & Marusik, 2004: 2.

DIAGNOSIS: The species differs from congeners by the bifid coxal process of the anterior gonopods, in which the internal branch is by ¼ shorter than the external one, as well as by the distal part of the anterior gonopod telopodite being non-bifid, and the sternite of the anterior gonopods with a few setae borne on small tubercles.

DESCRIPTION: Male. Body 4-10 mm in length, 0.8-1.0 mm in width. Body segment counts of males and females ranging between 32 to 54. General coloration yellowish or white, each metazonite with light brown stripes. Eyes black. Antennae light brown or pale.

Comma-shaped eyes with 3 ocelli in lower row and 1-2 setigerous knobs in upper row. Densely setose antennae (Fig. 35) in situ reaching to beginning of somite 4. Length ratios of antennomeres 2-7 as 3.0:3.4:3.9:3.7:3.5:1, width ratios as 2.2:2.5:2.6:2.7:2.2:1, respectively. Collum semi-circular. Ozopores located on metazonite right upon or near suture dividing pro- and metazona (Fig. 36). Telson covered with sparse setae ventrally.



Figs 35-41. *Angarozonium bonum* (Mikhaljova, 1979): 35 – antenna; 36 – sides of male midbody segments; 37 – male leg pair 2 and penes; 38 – gonopods (front view); 39 – coxal process of anterior gonopod; 40 – gonopods (caudal view); 41 – last telopoditomere of posterior gonopod. – Scales in mm (35-38, 40-41 – after Mikhaljova, 1979a, with some changes; 39 – after Mikhaljova & Marusik, 2004).

Legs slender. Length of narrow and conical penes (Fig. 37) characteristic of the genus. Coxae of leg pair 2 with short and strong setae ventrally. Claws of leg pairs 1 and 2 phylloid.

Anterior gonopods setose laterally, as usual with 5-segments. Coxite with a large process bifid apically, interior branch with long strong setae. A bare external branch unciform and curved mesad. Branches of coxal process either well separated (Fig. 38) or placed closely to each other (Fig. 39). Telopodite lying subperpendicularly to proximal segments. Distal telopoditomere pointed apically, with long styloid setae; seminal groove opening terminally (Fig. 40). Sternite with a pair of setigerous small knobs. Posterior gonopods with a terminal segment particularly long and slender, foveolate at, and with a poor incision before, tip (Fig. 41).

Female: Body 7-12 mm in length, 1.0-1.7 mm in width. General coloration usually darker than in male.

Juvenile. Penes absent. Leg pairs 9 and 10 of immature males at a stage of 28-31 body segments representing underdeveloped 5-segmented gonopods, with coxites devoid of prominent outgrowths while terminal telopoditomeres devoid of awl-shaped setae. Early instars with reduced numbers of ocelli.

DISTRIBUTION (Map 2): Russia: Far East (Primorsky and Khabarovsk provinces).

REMARKS: The records of *A. bonum* in North Korea (Golovatch, 1980b; Mikhaljova & Kim, 1993) appear to be misidentifications, the species involved is actually *A. munsunum* Mikhaljova, Golovatch & Wytwer, 2000 (see Mikhaljova, 2002a); the latter form is the only representative of *Angarozonium* currently known to occur in Korea. This species shows geographical variation in gonopod structure, with morphs distinguishable in gonopod structure in different parts of the range (Mikhaljova & Marusik, 2004).

A. bonum dwells in litter, soil and rotten wood in broadleaved, mixed and coniferous forests. Both adults and juveniles occur along the soil profile up to 40 cm in depth (Mikhaljova, 1983b). The maximum average abundance recorded in the south of the Primorsky Province is 47.5 ind./m², the minimum 0.8 ind./m² (Mikhaljova, 1988b).

Angarozonium kurtschevae (Mikhaljova, 1983)

Figs 42-47, Map 4.

Polyzonium kurtschevae Mikhaljova, 1983a: 308, 309: figs; 1993: 8: map, 9; Mikhaljova & Bakurov, 1989: 40; Ganin, 1997: 123.

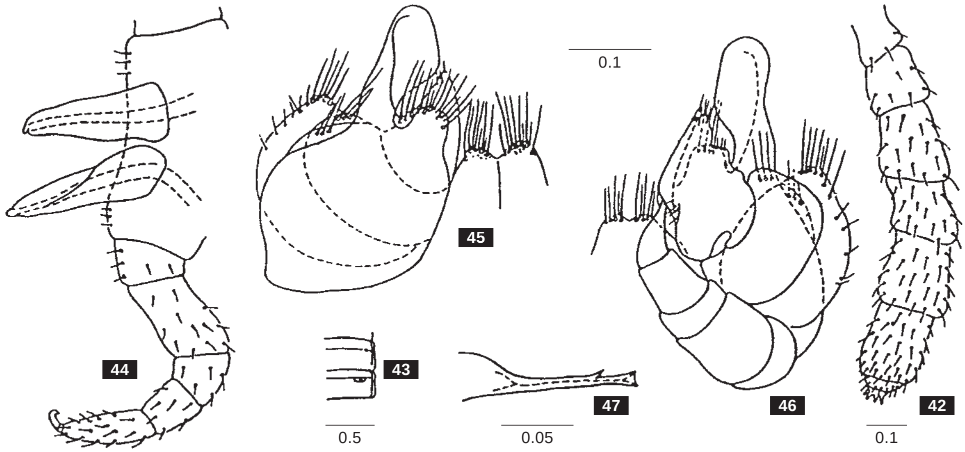
Angarozonium kurtschevae - Shelley, 1998: 29; Mikhaljova, 1998b: 15, 14: map, 16: figs; Mikhaljova & Marusik, 2004: 3.

DIAGNOSIS: The species differs from congeners by the bifid coxal process of the anterior gonopods with the internal branch by ¾ shorter than the external one, and the anterior gonopod sternite with numerous long setae on large tubercles.

DESCRIPTION: Male. Body 7-11 mm in length, 1.7-2.2 mm in width, with maximum recorded body segment number of 47. Segment counts in adult males always over 31.

General coloration yellow-brown, dorsum with a broad pale axial stripe and a pattern of bands and spots. Collum with an unpaired median marbled spot and paired lateral marbled spots. Prozona brownish with a pair of central triangular brown spots. Each metazonite with a pair of small dark spots lying between lateral sides and axial line. Lateral sides of metaterga whitish with markings. Eyes black. Legs pale, prefemora brownish ventrally, pallid in female. Telson pallid. Antennae brown. Coloration equally strong all long body, in most individuals pattern indistinct and poorly traceable, only in lager specimens bright and well-developed.

Comma-shaped eyes with 3 ocelli in lower row and 1-2 setigerous knobs in upper row. Densely setose antennae (Fig. 42) long, in situ reaching to beginning of somite 4. Length ratios of antennomeres 2-7 as 1.2:1.7:1.5:1.9:1, width ratios



Figs 42-47. *Angarozonium kurtschevae* (Mikhaljova, 1983): 42 – antenna; 43 – sides of male body segments 5 and 6; 44 – male leg pair 2 and penes; 45 – gonopods (front view); 46 – gonopods (caudal view); 47 – last telopoditomere of posterior gonopod. – Scales in mm (after Mikhaljova, 1983a).

as 1.5:1.8:1.9:2.0;1.5:1, respectively. Collum ellipsoid much broader than head. Length and width ratios of collum as 1:2.2. Telson with three pair of short setae on pleural bolster ventrally. Ozopores set off behind suture dividing pro- and metazona by a low and narrow ridge. On somite 5, ozopores located on prozonite right upon suture dividing pro- and metazona, being placed there at a shorter distance to lateral edge of somite than subsequent ozopores (Fig. 43).

Legs slender. Length of conical penes characteristic of the genus (Fig. 44). Coxae of leg pair 2 with short setae ventrally. Claws of leg pairs 1 and 2 phylloid.

Anterior gonopods as usual 5-segmented. Segments 2-5 setose laterally, with a setigerous pad on femur. Coxite with an external lobe-shaped and an interior knob-like process (Fig. 45). Latter beset with long setae and by ¾ stouter than former. Telopodite bifid apically, with short setae (Fig. 46). Seminal groove opening at tip of a very small, inner outgrowth of telopodite. Sternite with a pair tubercles carrying long setae. Terminal segment of posterior gonopods particularly long and slender, foveolate at, and with a poor incision before tip (Fig. 47).

Female. Body 7.8-12 mm in length, 1.9-2.7 mm in width. Legs pallid ventrally.

DISTRIBUTION (Map 4): Russia: Far East (Primorsky Province).

REMARKS: This species lives in the litter and uppermost soil horizons (0-10 cm) in mixed forests. The maximum abundance recorded is 14 ind./m^2, the maximum locomotor activity has been observed in the second half of September (Mikhaljova & Bakurov, 1989).

Order Julida Leach, 1814

The order comprises 15 families restricted mainly to the Holarctic. The Asian part of Russia supports four families.

Species in this order are distinguished first of all by a worm-like, subcylindrical to cylindrical body devoid of paraterga. Metazonites are longitudinally striate all over the circumference or only below ozopore level, with or without setae. Pleurites are usually fused with tergites into a single pleurotergal arch; the sternites and the pleurotergal arch are largely fused into a single ring, but the borders of the sternites are evident (as in Julidae and Blaniulidae), in the Nemasomatidae the sternites are free, but they are firmly held between the ventral edges of the pleurotergal arch. Eyes are present or absent. In males, the stipe of the mandible is with or without projection ventrally. The number of supralabral and labral setae can vary as often positively correlating with body size. Male legs 8 and 9 are modified into gonopods, which are often hidden in a special pouch inside somite 7, seldom exposed. Generally, the anterior gonopod (= promere, or coleopod) is provided with a flagellum arising from the basis of the coxite, but in some taxa it can be reduced (as in *Kopidoiulus*) to absent (as in *Ussuriiulus*). Male leg pair 1 highly modified, either reduced (more often) or enlarged, sometimes also male leg pair 2 and certain subsequent male legs show certain modifications, e.g. coxal processes, sole pads etc. Female leg pair 2 is either modified or not.

Key to families and genera of Julida:

1(12) Surface of metazonites completely striate. .... Family Julidae

2(3) Telson without tail. Metazonites bare, without setae.Genus *Cylindroiulus*

3(2) Telson with a tail. Metazonites bare or with a row of setae near caudal edge. 4

4(5) Male leg pair 2 with large, unciform, coxal processes. .... Genus *Julus*

5(4) Male leg pair 2 without coxal processes, normal. 6

6(7) Gonopods consisting of two parts: promere and opisthomere. Tail with a large claw curved upwards. .... Genus *Anaulaciulus*

7(6) Gonopods consisting of three parts: pro-, meso-, and opisthomere. Tail with a small claw directed caudoventrad. 8

8(11) Gonopod mesomere fully separated from opisthomere, as a distinct piece. 9

9(10) Gonopod opisthomere narrow, slender, curved forward. Distal part of opisthomere (= solenomere) unciform terminally (Fig. 98). .... Genus *Pacifiiulus*

10(9) Gonopod opisthomere broad, not curved forward. Distal part of opisthomere different, as in Figs 112-113, 122. .... Genus *Sibiriulus*

11(8) Gonopod mesomere not separated from opisthomere, as its process. .... Genus *Megaphyllum*

12(1) Surface of metazonites clearly striate only below ozopore level. 13

13(20) Male leg pair 1 without outgrowths on tibia, strongly enlarged. .... Family Mongoliulidae

14(19) Male leg pair 7 more or less modified, either with a coxal process or very considerably reduced compared to subsequent legs. 15

15(16) Body coloration beige. Anterior gonopods without evident flagella, latter only vestigial (Figs 128, 137-143). .... Genus *Kopidoiulus*

16(15) Body dark brown. Anterior gonopods with a pair of long flagella basally. 17

17(18) Posterior gonopod without evident telopodite (Figs 182-183). Male leg pair 7 with a 2-segmented telopodite (Figs 177-178). .... Genus *Skleroprotopus*

18(17) Posterior gonopod with a rudimentary telopodite (Figs 192-193). Male leg pair 7 with a 3-segmented telopodite (Figs 189-190). .... Genus *Ansiulus*

19(14) Male leg pair 7 normal. .... Genus *Ussuriiulus*

20(13) Male leg pair 1 with outgrowths on tibia, if enlarged then only modestly so. 21

21(22) Ocelli in a triangular or oval eye patch. .... Family Nemasomatidae (Genus *Orinisobates*)

22(21) Ocelli in a lineiform eye patch. .... Family Blaniulidae (Genus *Nopoiulus*)

Family Julidae Leach, 1814

The family is widely distributed over the Palaearctic. Several species are introduced though human agency almost all over the world. About 80 genera. Both Siberia and the Far East of Russia support six genera, among which *Cylindroiulus* is represented by the introduced anthropochorous species *C. latestriatus* (Curtis).

The main distinguishing external characters of the family in the region concerned are as follows. Metazonital surface mostly striate all over the circumference; prozona mostly smooth; molar plate of mandibles with two transverse grooves; male leg pair 1 modified; gonopods largely retractable inside a pouch of somite 7, except in *Anaulaciulus*; promeres often with barely traceable telopodite vestiges, except in some Siberian species; gonopods consisting of three or two pieces.

Genus *Cylindroiulus* Verhoeff, 1894

DISTRIBUTION: Europe and ancient Mediterranean, with a few introductions in North and South America, Africa, Australia and India. Over 100 species. The Asian part of Russia supports solely one anthropochorous species.

The main distinguishing characters of the genus are as follows. Eyes mostly present; epicranial suture absent; male genae often with projections ventrally; body usually pigmented; metazona mostly bare; preanal ring seldom extended as a pointed dorsocaudal process; vertigial setae absent; promeres with flagella; mesomeres strongly attached to promeres; opisthomeres strongly shifted caudad; flagellum groove present; coxal region of posterior gonopods strongly inflated.

Cylindroiulus latestriatus (Curtis, 1845)

Fig. 48, Map 5.

Cylindroiulus latestriatus - Mikhaljova, 1998a: 6; 1998b: 61: fig.; Mikhaljova & Golovatch, 2001: 104; Mikhaljova & Nefediev, 2003: 85.

DIAGNOSIS: Metazonital striae are widely spaced, each anal valve is usually with three submarginal setae; also the configuration of the gonopod opisthomere will serve to separate this species.

DESCRIPTION: Male. Length 8.6-12.5 mm, diameter 0.8-1.0 mm. Body segments 30-37(39). Coloration light brown, sometimes darker. Legs whitish, antennae light with a brown basal part of antennomeres. About 40 ocelli in an oval-triangular eye patch. Genae unmodified.

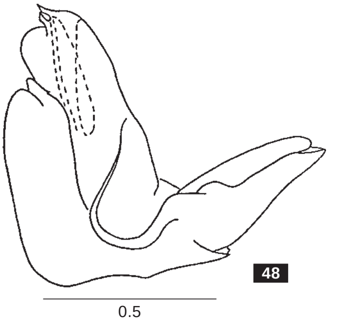
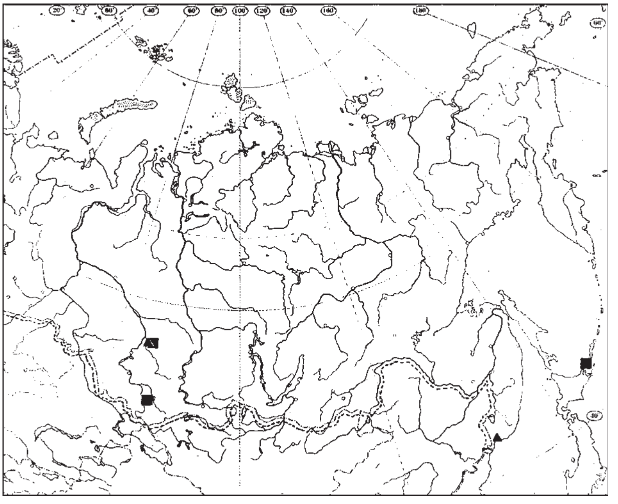


Fig. 48. *Cylindroiulus latestriatus* (Curtis, 1845): gonopods (mesal view). – Scale in mm (after Mikhaljova, 1998b).



Map 5. Distribution of *Nopoiulus kochii* (▲) and *Cylindroiulus latestriatus* (■) in the Asian part of Russia.

Body slender. A thin suture between pro- and metazona almost not constricting the ring. Striation of metazona not reaching the very rear margin of ring, 4-5 striae in a square with sides equal to metazonital length of a midbody ring. Metazona bare, without setae. Ozopores small, touching the suture between pro- and metazona from behind. Telson without tail dorsally. Each anal valve bearing only 3 setae located near caudal margin. Anal scale with two setae.

Legs slender, not very long. Male leg pair 1 unciform.

Gonopods (Fig. 48) consisting of distinct pro-, meso-, and opisthomere. Flagellum of promere thin, placed mesoparabasally. Mesomere with a simple apex, oblong, a little shorter than promere. Opisthomere broad, its coxal portion strongly inflated.

Female. Length 8.7-16.0 mm, diameter 0.9-1.3 mm. Body segments 30-43.

DISTRIBUTION: Europe, introduced into Canada, the U.S.A and as far as Peru, Chile, St. Paul Island (Antarctic), Gough Island in the Atlantic, and Mexico (see Blower, 1985). The records in Asia (Map 5) are in the Altai Mts (Chonbiliuli), Southwest Siberia (Tomsk City) and the Kuriles (Kunashir Island).

REMARKS: The Asian records are definitely introductions through human agency. The species has mainly been collected in anthropogenic and semi-natural habitats (sandy seashore hill, greenhouse and park).

Genus *Julus* Linnaeus, 1758

DISTRIBUTION: Europe (mainly), the Caucasus and Southwest Siberia. About 15 species. The Asian part of Russia supports only a single valid species, *Julus ghilarovi* Gulièka, 1963, with two subspecies.

Species of this genus can be discerned by the following characters. Coloration usually dark; genae without modifications; male leg pair 1 with rudimentary setose telopodites, not unciform; male leg pair 2 with a large and a small outgrowth on each coxa; gonopods consisting of three pieces; promere with a long and very thick flagellum; mesomere small.

REMARKS: The records of the European *Julus terrestris* Linnaeus, 1758 in East Siberia as well as in Northeast China and/or Khabarovsk Province (Gerstfeldt, 1859) appear to be wrong (Mikhaljova & Marusik, 2004).

Key to subspecies of *Julus ghilarovi*:

1(2) Large coxal outgrowth of male leg pair 2 with a posterior process; the second coxal process longer (Figs 50-51). Telopodites of male leg pair 1 setose externally (Fig. 49). .... *Julus ghilarovi ghilarovi*

2(1) Large coxal outgrowth of male leg pair 2 without posterior process; the second coxal process short and very slender (Figs 54-55). Telopodites of male leg pair 1 setose throughout (Fig. 56). .... *Julus ghilarovi brachydactylus*

Julus ghilarovi ghilarovi **Gulièka, 1963**

Figs 49-53, Map 6.

Julus ghilarovi Gulièka, 1963: 521, 520: figs.

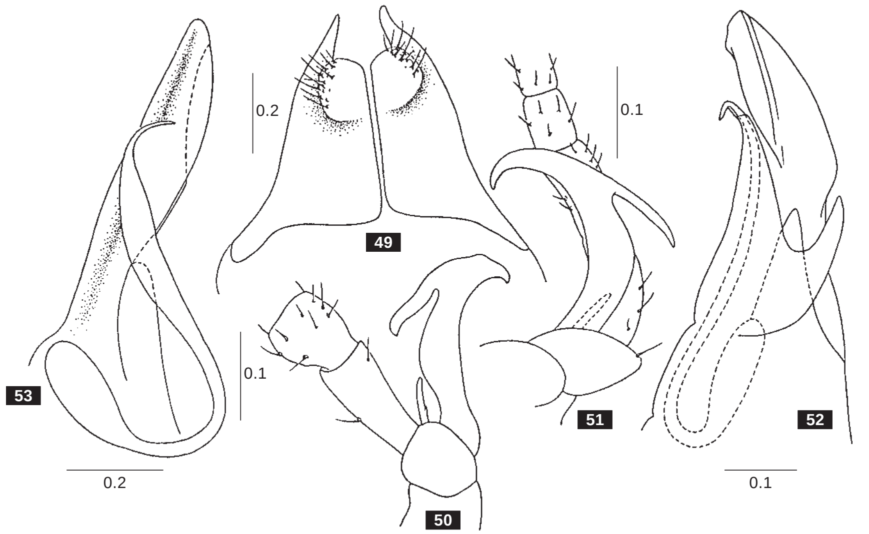
Julus ghilarovi - Mikhaljova, 2002b: 206; Nefediev, 2002b: 35; Mikhaljova & Nefediev, 2003: 84.

Julus ghilarovi ghilarovi - Lokšina & Golovatch, 1979: 386; Mikhaljova, 1993: 11: figs; Mikhaljova & Golovatch, 2001: 104.

DIAGNOSIS: This subspecies differs from congeners mainly in structure of the opisthomere with a strong process laterally as well as in configuration of the coxal processes of male leg pair 2.

DESCRIPTION: Male. Body 17-24 mm long, 0.9-1.4 mm in diameter, with 47(-2) to 51(-2) segments, excluding telson. Coloration in alcohol from dark brown via reddish-castaneous to light brown, sometimes ventrum paler. A thin, dark brown, axial line on dorsum. Each prozonite with a dark spot level to ozopore, with a larger, pale, marbled spot pleuroventrally and smaller marbled spots elsewhere. Metazona with a thin, transverse, pale band growing wider ventrad. Legs brown. Eyes black. Antennae dark brown.

Ca. 45 ocelli in a roundly subquadrate eye patch. Epicranial setae 1+1, supralabral setae 2+2, labral ones 9+9. Antennae medium-sized, rather clavate, in situ reaching to beginning of somite 4. Length ratios of antennomeres 2-7 as



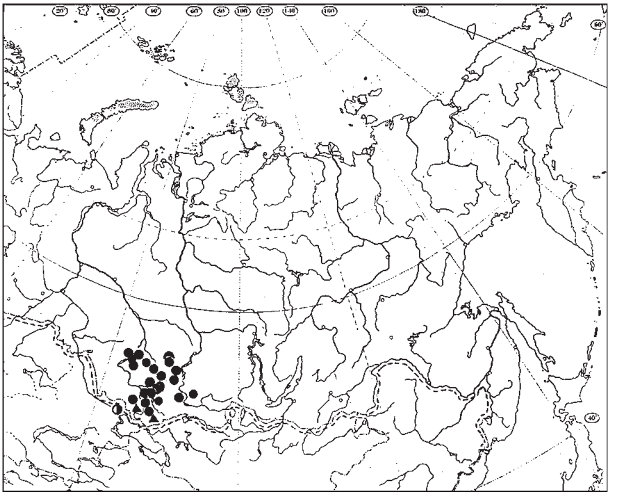
Figs 49-53. *Julus ghilarovi ghilarovi* Gulièka, 1963: 49 – male leg pair1; 50 – coxal processes of male leg pair 2 (mesal view); 51 – coxal processes of male leg pair 2 (caudomesal view); 52 – gonopods (caudolateral view); 53 – gonopod promere and mesomere (mesal view). – Scales in mm (after Mikhaljova, 1993).

3.6:2.8:2.9:3.5:2.3:1, width ratios as 1.3:1.3:1.3:1.7:1.6:1, respectively. Antennomere 5 with an incomplete distodorsal corolla of five minute sensory bacilli. Gnathochilarium normal.

Body particularly slender, somewhat compressed laterally. Suture dividing pro- and metazona poorly constricting both zonites. Ozopores small, lying behind suture without touching the latter. Metazonital striations failing to reach hind margin; 4-5 striae in a square with sides equal to midbody metazonital length. Caudal edges of metazonites with sparse, thin, moderately long setae gradually growing longer toward telson. Preanal ring dorsally produced into a long and slender tail with a claw directed caudad and somewhat ventrad. Entire telson and anal valves densely setose.

Legs thin and short. Pregonopodal pairs somewhat enlarged. Claws normal. Leg pair 1 (Fig. 49) with high, triangular coxites; telopodites like rudimentary knobs with a group of setae laterally. Leg pair 2 with large coxal outgrowths (Figs 50-51), each unciform distofrontally and with a long process caudally; in addition, each coxa bearing a slender, distally pointed process. Penes subconical, with an awl-shaped apex extending to level of leg pair 4.

Gonopods (Fig. 52) consisting of three pieces, highly condensed, especially so pro- and mesomeres. Promeres (Fig. 53) much higher than opisthomeres, their flagella well-developed, tapering toward end, but not filiform. Flagella varying in



Map 6. Distribution of *Julus ghilarovi ghilarovi* (●), *J. ghilarovi brachydactylus* (▲) and *Megaphyllum* aff. *sjaelandicum* (◑).

length from short to very long and well projecting beyond gonopod tips. Distal part of flagellum placed in a particular excavation on opisthomere. Promere without telopodite remnant; mesomere conical, rounded at apex. Opisthomere with a moderately developed coxite, solenomere tapering distad, lateral part with a strong process. Outer process of opisthomere varying from styletiform to relatively broad; notch between solenomere and outer process as deep as 1/3 to 2/3 opisthomere height.

Female. Body 20-35 mm long, 1.5-1.8 mm in diameter, with 47(-1) to 52(-1) segments, discarding telson. Vulvae elongate, tapering distad.

DISTRIBUTION (Map 6): Russia: Siberia (Kemerovo and Novosibirsk areas, the southern part of Krasnoyarsk Province, Republic of Khakassia, Republic of Altai).

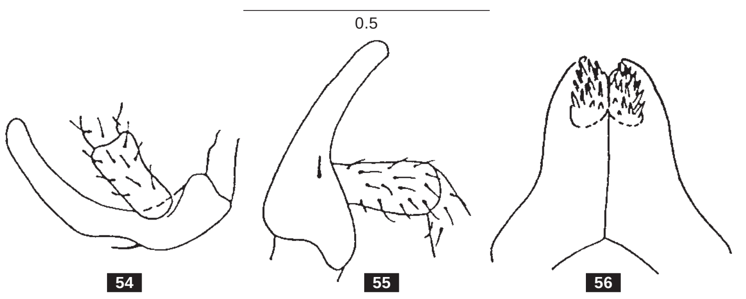
Julus ghilarovi brachydactylus Gulička, 1972

Figs 54-56, Map 6.

Julus ghilarovi brachydactylus Gulièka, 1972: 44: figs.

Julus ghilarovi brachydactylus - Lokšina & Golovatch, 1979: 386; Mikhaljova, 1993: 10; Mikhaljova & Golovatch, 2001: 105: figs.

DIAGNOSIS AND DESCRIPTION: All characters like in the nominotypical *J. ghilarovi ghilarovi*, but the posterior processes on the large coxal outgrowths of male leg pair 2 are absent, whereas the second coxal process is short, very slender, setiform (Figs 54-55). In addition, the telopodites of male leg pair 1 are setose throughout (Fig. 56), not only externally as in *J. ghilarovi ghilarovi*.



Figs 54-56. *Julus ghilarovi brachydactylus* Gulièka, 1972: 54 – coxal processes of male leg pair 2 (lateral view); 55 – coxal processes of male leg pair 2 (front view); 56 – male leg pair 1. – Scale in mm (after Mikhaljova & Golovatch, 2001).

DISTRIBUTION (Map 6): Russia: Siberia (Republic of Altai).

REMARKS: *Julus ghilarovi* is rather variable (see above). The subspecies *J. g. brachydactylus* was stated to only differ from the nominotypical *J. g. ghilarovi* by the shorter and broader outer process of the opisthomere coupled with the relatively shallow (only as deep as 1/3 opisthomere height) notch between both processes of the opisthomere (Gulièka, 1972). However, both opisthomere shape and depth of its notch appear to be variable (Mikhaljova & Golovatch, 2001). Probably both these forms are only varieties of a single species.

This species is characterised by euryoky. It occurs in different habitats like subalpine belt (= goltsy), montane moss-stony tundra, upper timberline of taiga, taiga proper, various leaved and mixed stands, *Tilia* insular relict forest, humid glades in leaved woodlands, thickets, mesophytous meadows, grassland, city woodland, near water and dry places, forest litter, mosses, under stones and bark of trees. The maximum altitude registered is 2,300 m a.s.l. (Mikhaljova & Nefediev, 2003).

Genus *Anaulaciulus* Pocock, 1895

DISTRIBUTION: Japan, Korea, Russian Far East, northeastern China, Taiwan, North Burma and the Himalaya of India, Nepal and Bhutan, Pakistan. 45 species with five subspecies. Only a single species, *Anaulaciulus golovatchi*, however highly variable, occurs in the Asian part of Russia. A map of the global distribution of this genus can be found in Korsós (2001).

The main distinguishing characters of the genus are as follows. Metazonites without setae; male gena without ventral projection; gonopods consisting of two pieces: promere and opisthomere; gonopods not retractable inside somite 7, at least opisthomere visible as stretched outside; promere short, with a plate-shaped coxal process, a rudimentary telopodite and a parabasal flagellum; posterior gonopods simple, elongated, with neither mesomeres nor mesomeral processes, represented only by opisthomeres; penes bifid apically; dorsocaudal process of preanal ring varying in length.

Anaulaciulus golovatchi Mikhaljova, 1982

Figs 57-88, Map 7.

Anaulaciulus golovatchi Mikhaljova, 1982a: 213, 214: figs.

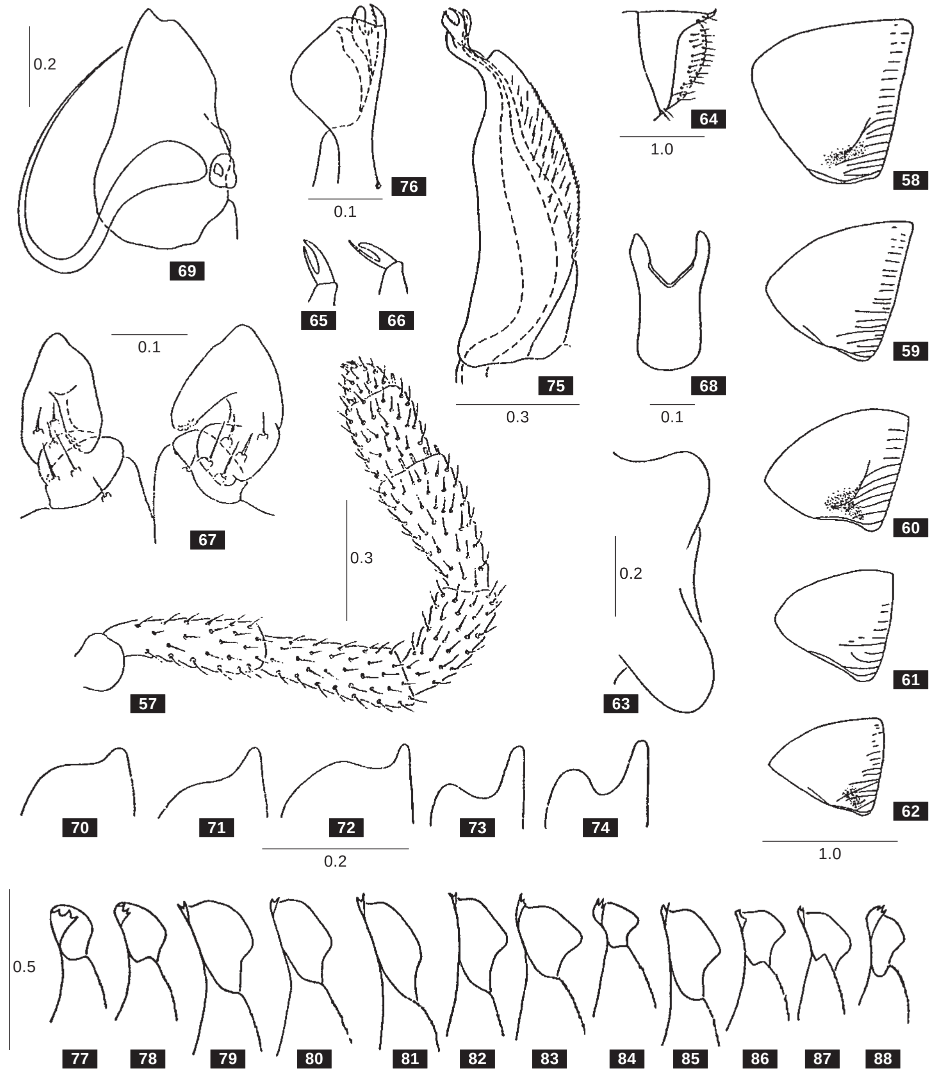
Anaulaciulus golovatchi – Mikhaljova & Petukhova, 1983: 53; Mikhaljova, 1983b: 87; 1988b: 70; 1993: 10; 1997a: 145; 1998a: 6; 1998b: 62: map, 63: figs; 2002a: 148: figs; Mikhaljova & Bakurov, 1989: 40; Korsós, 1996: 37; 2001: 67: map; Ganin, 1997: 22; Mikhaljova & Korsós, 2003: 228; Mikhaljova & Marusik, 2004: 4.

non *Anaulaciulus golovatchi* - Ganin, 1997: 105, 112.

DIAGNOSIS: Differs from congeners by the apex of the opisthomere bearing a short blade and three small processes, of which one is serrate at the inner margin, as well as by the mesal blade delicately fringed at a thin margin.

DESCRIPTION: Male. Length 15-30 mm, diameter 0.8-2.0 mm. Body segments without telson 43(-4)-55(-1). Coloration in alcohol varying from dark brown or brown with or without marbled sports and stripes to light brown with or without a pattern of marbled sports and stripes. Legs and antennae light brown. Eyes black.

About 40 ocelli in a roundly triangular eye patch. Epicranial setae 1+1, supralabral ones 2+2, labral ones 10+10. Genae unmodified. Antennae (Fig. 57) slender and clavate, in situ reaching to beginning of somite 4. Length ratios of antennomeres 2-7 as 4.7:5.0:4.0:4.5:3.0:1, width ratios as 1:1.5:1.5:1.8:1.7:1. Sensory bacilli at distal end of antennomere 5 rather few (about 8), forming no corolla. Gnathochilarium normal. Collar striation quite variable (Figs 58-62), caudal edge of collum with short striae, ventrally striae being longer, one of them reaching the fore collar margin. Body slender, metazona bare, not setose. Suture dividing pro- and metazona visibly constricting the ring. Metazonites striate all along their length, 6-7 striae in a square with sides equal to metazonital length of a midbody ring. Ventral edge of metazonite 7 (Fig. 63) outcurved, forming a gonopodal opening. Ozopores small, their location variable. In fore part of body, ozopores lying upon suture dividing pro- and metazonites, moving gradually off the suture toward rear body part. Tail terminating in a strong claw curved dorsally (Fig. 64). Anal valves as usual covered with dense and short setae. Anal scale bearing setae only near caudal margin.



Figs 57-88. *Anaulaciulus golovatchi* Mikhaljova, 1982: 57 – antenna; 58-62 –variation in striation of male and female collum; 63 – ventral edge of male metazona 7; 64 – telson; 65 – claw of male leg pair 2; 66 – claw of male leg pair 17; 67 – male leg pair 1; 68 – penes; 69 – gonopod promere; 70-74 – variation in shape of gonopod promere apex; 75 – gonopod opisthomere; 76 – distal part of opisthomere; 77-88 – variation in shape of gonopod opisthomere apex. – Scales in mm (57, 63-76 – after Mikhaljova, 1982a; 58-62 – after Mikhaljova, 2002a; 77-88 – after Mikhaljova & Korsós, 2003).

Legs slender, not very long. Claw with a rather slender, long, ventral, setiform, accessory outgrowth at base (Figs 65-66). Leg pair 1 (Fig. 67) unciform with papillae apically, strong setae ventrally and a roundly knob-shaped outgrowth of telopoditomere 2. Femur, postfemur and tibia of walking legs with sole pads characteristic of the genus. Penes flat, apical excavation as deep as 1/3 its height (Fig. 68).

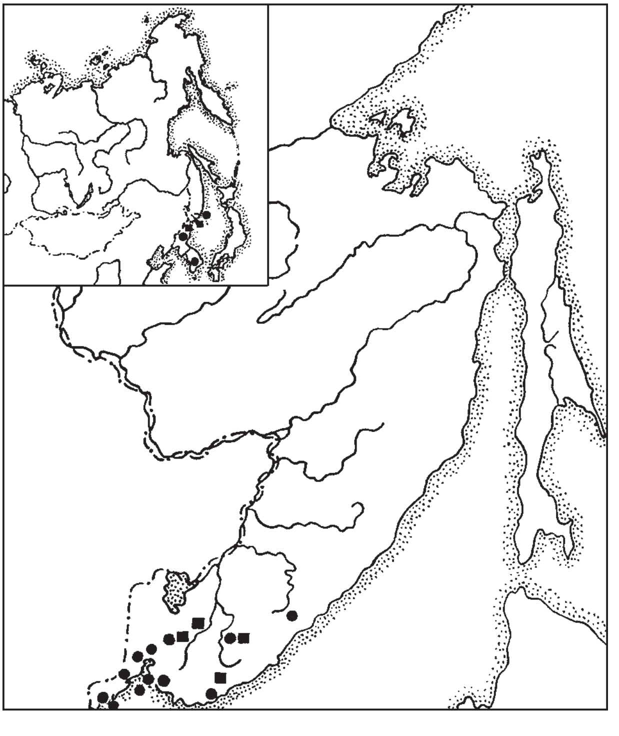
Promeres plate-shaped (Fig. 69), subtriangular; flagellum relatively long; rudimentary telopodites well-visible. Apex of promere from rounded to excavated (Figs 70-74), with a rounded outgrowth. Opisthomere (Fig. 75) with a mesal blade nearly all along its extent, its distal part varying from sloping to excavated (Figs 76-88), delicately fringed at a thin margin. Opisthomere covered with delicate cilia frontally. Apex of opisthomere (Fig. 76) with a short blade bearing 3 small processes, of which one serrate at inner margin. Apical blade of opisthomere ranging from narrow to broad (Figs 76-88).

Female. Length 17-36 mm, diameter1.2-2.5 mm. Body segments without telson 44(-3) to 56(-1). Rounded vulvae stretched distad. Valves with sparse strong setae.

Juvenile. Body with five apodous segments before telson.

Distribution (Map 7): Russia: Far East (Primorsky Province), Korea.

Remarks: This species appears to be a senior subjective synonym of the North Korean *Anaulaciulus riedeli* Jêdryczkowski, 1982 (cf. Mikhaljova, 2002a).



Map 7. Distribution of *Anaulaciulus golovatchi* (●) and *Ussuriiulus pilifer* (■).

A. golovatchi is common in the southern part of Primorsky Province as well as in North Korea. In South Korea, this species has only been reported from a single male taken from South Cholla Province (Mikhaljova & Korsós, 2003).

The record of a closer unidentified *Anaulaciulus* sp. in the Malyi (= Lesser) Khingan Mt. Range by Ursova (1983) is wrong (Mikhaljova & Marusik, 2004). This misidentification was later repeated by Ganin (1997), who already referred to *A. golovatchi* as occurring there. Though in principle the existence of this species in the Malyi Khingan cannot be excluded, because its distribution pattern is definitely Manchurian, no reliable *Anaulaciulus* material has ever been collected there.

This species inhabits mountain and valley forests of various types. It has also been recorded in caves (Mikhaljova, 1997a). The animals prefer forest litter and the uppermost soil strata; depending on the hydrothermal conditions and soil texture, it can readily migrate along the soil profile down to 20 cm depth (Mikhaljova, 1983b). In the south of Primorsky Province, the numbers range from 0.5 to 32.0 ind./m² (Mikhaljova, 1988b).

Genus *Pacifiiulus* Mikhaljova, 1982

DISTRIBUTION: This genus is distributed both in South Siberia and the Far East of Russia. Monotypical.

The main distinguishing characters of this genus are as follows. Body pigmented; epicranial setae 1+1; caudal edges of metazonites with thin short setae; telson dorsally with tail surmounted by a claw; male genae unmodified; male leg 1 modified, reduced; both postfemur and tibia of male walking legs with sole pads; gonopods consisting of three pieces; promere with a rudimentary telopodite and a caudo-parabasal flagellum mesally; mesomere set off from opisthomere, fronto-apically with a spoon-shaped excavation; entire coxosternal region modestly developed, not inflated; opisthomere curved frontally, with a well-developed coxite, but both velum and phylacum poorly-developed.

Pacifiiulus amurensis **(Gerstfeldt, 1859)**

Figs 89-99, Map 8.

Julus amurensis Gerstfeldt, 1859: 271; Lokšina & Golovatch, 1979: 387.

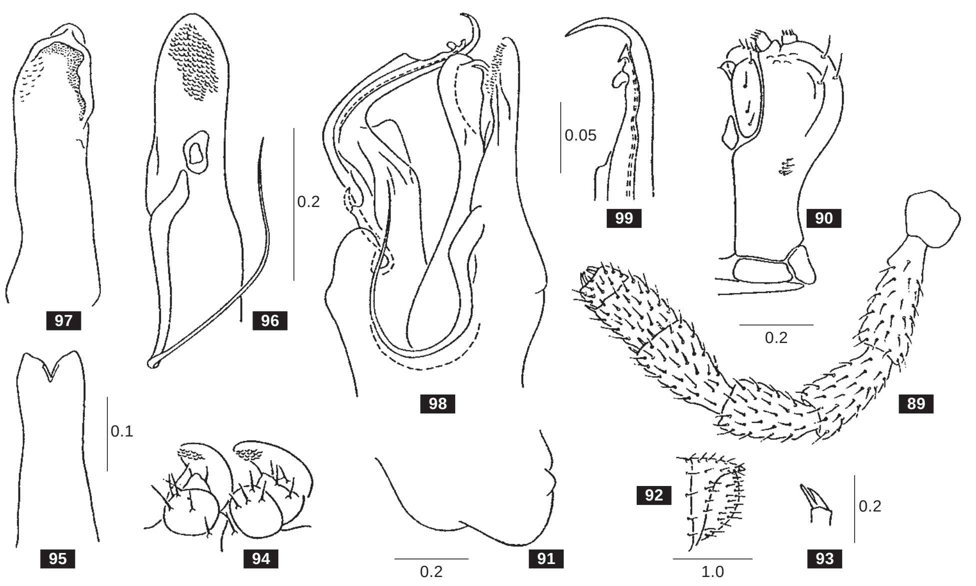
Pacifiiulus imbricatus Mikhaljova, 1982a: 211, 212: figs; 1983b: 87; 1988b: 70; 1993: 12: map; 1997a: 145; Mikhaljova & Petukhova, 1983: 53; Ganin, 1988: 7; 1989a: 145; 1994: 60; 1995: 370; 1997: 10; Ryabinin et al., 1988: 31; Mikhaljova & Bakurov, 1989: 40; Gromyko, 1990: 66; Enghoff, 1994: 27; Shelley et al., 2000: 50.

Pacifiiulus amurensis - Mikhaljova, 1998a: 5; 1998b: 64: figs, 65: map; Mikhaljova & Golovatch, 2001:105; Mikhaljova & Nefediev, 2003: 84; Mikhaljova & Marusik, 2004: 3.

DESCRIPTION: Male. Body 16-18 mm long, 0.6-0.8 mm in diameter. Coloration reddish-brown, each body segment with a dark spot laterally. Ventrum lighter. A thin, dark, axial line discernible on dorsum. Legs brownish. Eyes black.

About 45 ocelli in a roundly triangular eye patch. Epicranial setae 1+1, supralabral ones 2+2, labral ones 10+10. Antennae (Fig. 89) slender, in situ reaching to beginning of somite 4. Length ratios of antennomeres 2-7 as 3.3:2.9:2.9:3.1:2.1:1, width ratios as 1.1:1.1:1.1:1.3:1.3:1, respectively. Sensory bacilli at distal end of antennomere 5 rather few (about 8), forming no corolla. Gnathochilarium (Fig. 90) normal, with small setae at border between stipites and mentum. Collum with small striations laterally.

Body slender, somewhat compressed laterally. Suture dividing pro- and metazona relatively strongly constricting the ring. Metazonital striations failing to reach rear margin, 4-5 striae in a square with sides equal to metazonital length of a midbody ring. Ventral edge of metazonite 7 roundly outcurved, forming a gonopodal opening (Fig. 91). Ozopores lying behind and set off from suture



Figs 89-99. *Pacifiiulus amurensis* (Gerstfeldt, 1859): 89 – antenna; 90 – gnathochilarium; 91 – ventral edge of male metazonite 7; 92 – telson; 93 – claw of male leg pair 2; 94 – male leg pair 1; 95 – penes; 96 – gonopod promere (caudal view); 97 – gonopod mesomere (front view); 98 – gonopods (mesal view); 99 – distal part of gonopod opisthomere. – Scales in mm (after Mikhaljova, 1982a).

dividing pro- and metazona. Caudal edges of metazonites with a transverse row of sparse, thin, relatively short setae. Telson setose (Fig. 92), dorsally with a short tail round in cross-section and supplied with a small claw directed caudoventrad. Anal valves covered with thick long setae.

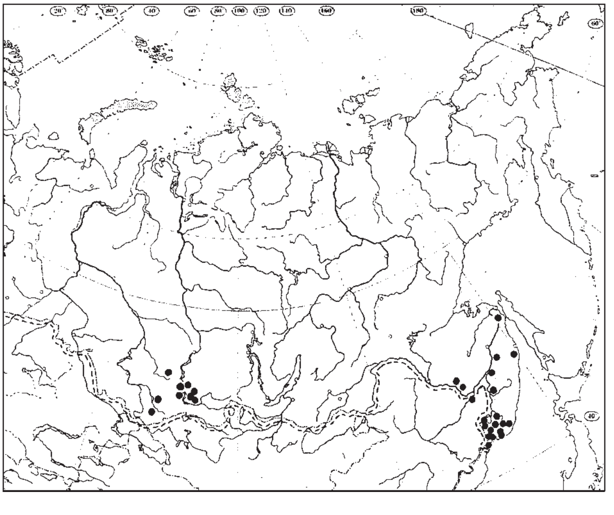
Legs slender, moderately long. Each claw with a relatively thin, long, setiform outgrowth ventrally (Fig. 93). Leg pair 1 (Fig. 94) unciform, with strong setae ventrally, a papillate field apically and a pointed knob-shaped outgrowth of telopoditomere 2. Starting from leg pair 2, both postfemur and tibia of walking legs with longitudinal sole pads, only several posteriormost legs without sole pads. Leg pair 2 somewhat reduced in size. Penes flat, apical exavation narrow and shallow (Fig. 95).

Promere (Fig. 96) with a caudal papillar field distally, somewhat higher than mesomere; flagellum relatively long; remnant of telopodite poorly-developed. Mesomere (Fig. 97) feebly curved caudodistally; inner surface of a spoon-shaped exavation covered with papillae. Opisthomere (Fig. 98) curved, narrow and slender. Interior parabasal spine well-developed. Both velum and phylacum small, more or less plate-shaped. Distal part of solenomere terminating in a hook (Fig. 99).

Female. Body 18-27 mm long, 0.9-1.5 mm in diameter, body segments without telson 46(-4)-50(-2). Legs without modifications. Vulvae oblong, covered with sparse, relatively strong setae; operculum higher than coxite.

DISTRIBUTION: (Map 8): Russia: Far East (Primorsky Province, southern part of Khabarovsk Province, Amurskaya Area), Siberia (Republic of Altai, southern part of Krasnoyarsk Province, Republic of Khakassia, Republic of Tuva); Northeast China.

REMARKS: This species appears to be a senior subjective synonym of *Pacifiiulus imbricatus* Mikhaljova, 1982 (cf. Mikhaljova, 1998a; Mikhaljova & Golovatch, 2001), a form described from the Primorsky Province (Mikhaljova, 1982a).



Map 8. Distribution of *Pacifiiulus amurensis* (●).

P. amurensis is characterised by geographical parthenogenesis. Males are extremely rare in the Far Eastern part of the distribution area, whereas in Siberia only bisexual populations are known to occur (Mikhaljova, 1993; Mikhaljova & Golovatch, 2001; Mikhaljova & Nefediev, 2003).

This species is highly euryoecic, living in different mountainous and valley forests; some of the Siberian populations have also been recorded at the upper timberline of taiga as well as in subalpine meadow and montane tundra habitats. The maximum altitude registered is 2,500 m a.s.l. (Mikhaljova & Nefediev, 2003).

In the forests of Primorsky Province, this species mainly occurs in litter and the uppermost soil strata (0-10 cm) (Mikhaljova, 1983b). It has also been recorded in caves (Mikhaljova, 1997a). The locomotor activity of *P. amurensis* cover the entire warm season (Mikhaljova & Bakurov, 1989). In the southern parts of both Primorsky and Khabarovsk provinces, the numbers range from 0.5 to 21.5 ind./m^2, depending on region and forest type (Mikhaljova, 1988b; Ganin, 1997).

This species is one of the most active destructors of forest litter in the southern part of Khabarovsk Province. Thus, the daily rate of food consumption ranges from 0.7 to 8.1 mg/ind., the coefficient of consumption from 6.7 to 90%, specific digestion from 3.8 to 82% (Ganin, 1997). The diet is chiefly composed of leaf litter of such common trees as *Pinus koraiensis, Acer, Betula, Quercus, Tilia* and *Populus* spp. Furthermore, the leached needles of *Pinus koraiensis* are the most readily consumed diet, while the debris of *Betula* appear the least attractive to this julid. The rate of assimilation during digestion shows a decrease in carbon amounting to 70%, in lignin to over 50%, but general nitrogen remains constant (Ganin, 1989a).

Genus *Sibiriulus* Gulièka, 1963

DISTRIBUTION: Russia: West and Southwest Siberia. Three species.

The main distinguishing characters of this genus are as follows. Caudal edges of metazonites with setae; male genae unmodified; male leg pair 1 modified, reduced; telson with a tail; gonopods consisting of pro-, meso- and opisthomere closely attached to each other; promere flattened, caudally papillate, with a flagellum but without remnants of a telopodite; mesomere papillate frontally, with a simple or modified apex; opisthomere with or without massive inner process; coxite of opisthomere clear-cut; solenomere broad.

Key to species of *Sibiriulus*:

1(2) Distal part of opisthomere without massive inner process. Apex of mesomere unmodified. .... *S. multinicus*

2(1) Distal part of opisthomere with a massive inner process. Apex of mesomere modified. 3
3(4) Inner process in distal part of opisthomere dentiform. .... *S. profugus*
4(3) Inner process in distal part of opisthomere straight. .... *S. altaicus*

Sibiriulus multinicus **Mikhaljova, 2001**

Figs 100-113, Map 9.

Sibiriulus multinicus Mikhaljova in Mikhaljova & Golovatch, 2001: 106: figs.
Sibiriulus dentiger - Nefediev, 2001: 84.
Sibiriulus multinicus - Mikhaljova & Nefediev, 2003: 85: figs.

DIAGNOSIS: This species differs from congeners by the absence of a massive inner process in the distal part of the gonopod opisthomere and the unmodified apex of the gonopod mesomere.

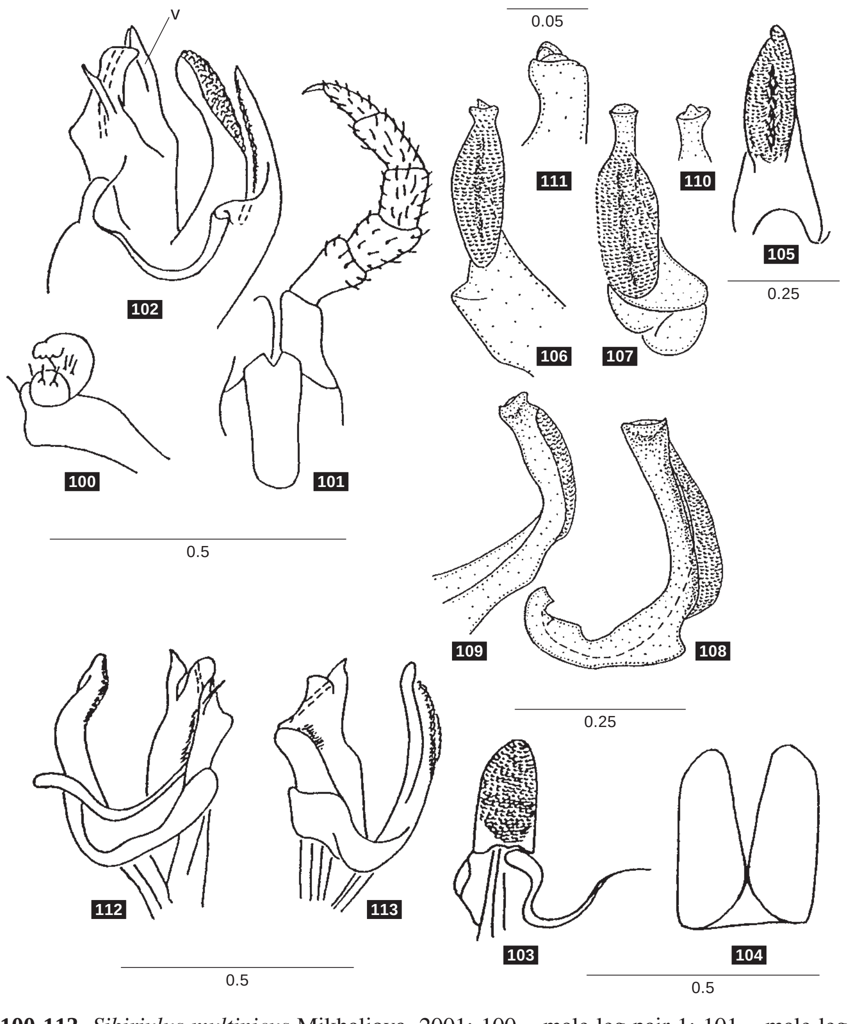
DESCRIPTION: Male. Body 15-17 mm long, 0.8-0.9 mm in diameter, with 41(-1) to 42(-1) segments, regardless of telson. Coloration in alcohol from dark brown with reddish tinge to pale brown; venter paler. A thin, dark, axial line discernible on dorsum. Each ring with a dark spot level to ozopore. Pro- and metazonites with oval marbled spots closer to venter. Collum almost entirely marbled brown, only fore and rear margins dark brown. Legs pale brown. Eyes black. Antennae brown.

Ca. 30 ocelli in a roundly subquadrate eye patch. Epicranial setae 1+1. Antennae medium-sized, rather slender and clavate. Antennomere 5 with an incomplete distodorsal corolla of six minute sensory bacilli. Gnathochilarium normal, with a seta on outer sides and with several short setae in medial part of stipites, each lamella lingualis with two long distal setae.

Body somewhat compressed laterally. Suture dividing pro- and metazona rather well constricting both zonites. Ozopores small, lying behind suture without touching the latter. Metazona with striae failing to reach hind margin; 5 striae in a square with sides equal to midbody metazonital length. Prozonital surface smooth, only on somite 7 delicately striate ventrally. Metazonital setae thin and short. Several thin setae on preanal ring of telson. Tail short, cylindrical, straight, carrying a small claw directed caudad and somewhat ventrad. Anal valves densely setose. Anal scale subtriangular, setose only along caudad edge.

Legs thin, short, claws normal. Leg pair 1 unciform (Fig. 100) setose ventrally, papillate apically, outgrowth of telopoditomere 2 low. Leg pair 2 (Fig. 101) unmodified, penes flattened, notched triangularly at tip.

Gonopod meso- and opisthomere of subequal height (Fig. 102). Promere (Figs 103-104) without telopodite remnants. Caudal surface of promere covered by papillae nearly throughout. Flagellum relatively long, filiform distally. Mesomere (Figs 105-109) slightly and regularly bent caudad; its front surface like a densely papillate oblong plate with a longitudinal groove along middle. Distal part of mesomere elongated, either with an apical fovea and a minute knob (Figs 107, 108, 110) or without prolongation but with an apical fovea and a



Figs 100-113. *Sibiriulus multinicus* Mikhaljova, 2001: 100 – male leg pair 1; 101 – male leg pair 2 and penes; 102 – gonopods (mesal view); 103 – gonopod promere (caudal view); 104 – gonopod promere (front view); 105-107 – gonopod mesomere (front view); 108 – gonopod mesomere (lateral view); 109 – gonopod mesomere (mesal view); 110-111 – distal part of gonopod mesomere (anterolateral view, somewhat twisted to the right); 112 – mesomere and opisthomere (mesal view); 113 – mesomere and opisthomere (lateral view); v – velum. – Scales in mm (100-105, 112-113 – after Mikhaljova & Golovatch, 2001); 106-111 – after Mikhaljova & Nefediev, 2003).

minute knob carrying a projection (Figs 106, 109, 111), or a simple apex (Fig. 105). Opisthomere (Figs 102, 112-113) with a simple and broad solenomere. Velum (v) membranous, with a pointed tip. A midway, mesal, styletiform process (?phylacum) on inner side of opisthomere.

Female. Body 17-18.5 mm long, 1.1-1.2 mm in diameter.

DISTRIBUTION (Map 9): Russia: Siberia (Republic of Altai and the southeastern part of Altai Province).

REMARKS: This species occurs in different habitats, including *Salix* stands in river valleys as well as taiga forests and alpine meadows at 2,100-2,300 m a.s.l. It dwells in litter and rotten wood, also found among pebbles. This species shows geographical variation in gonopod structure, with morphs distinguishable in gonopod structure in different parts of the range (Mikhaljova & Nefediev, 2003).

Sibiriulus profugus **(Stuxberg, 1876)**

Figs 114-124, Map 9.

Iulus (recte: *Julus*) *profugus* Stuxberg, 1876a: 33.

Iulus profugus - Stuxberg, 1876b: 316.

Julus profugus - Lokšina & Golovatch, 1979: 387; Mikhaljova, 1993: 34; Mikhaljova & Golovatch, 2001: 116.

Cylindroiulus (Sibiriulus) dentiger Gulièka, 1963: 519, 520: figs.

Cylindroiulus (Sibiriulus) dentiger - Shelley et al., 2000: 52.

Sibiriulus dentiger - Lokšina & Golovatch, 1979: 387; Mikhaljova, 1993: 13, 14: figs; Mikhaljova & Golovatch, 2001: 106.

non *Sibiriulus dentiger* - Nefediev, 2001: 84.

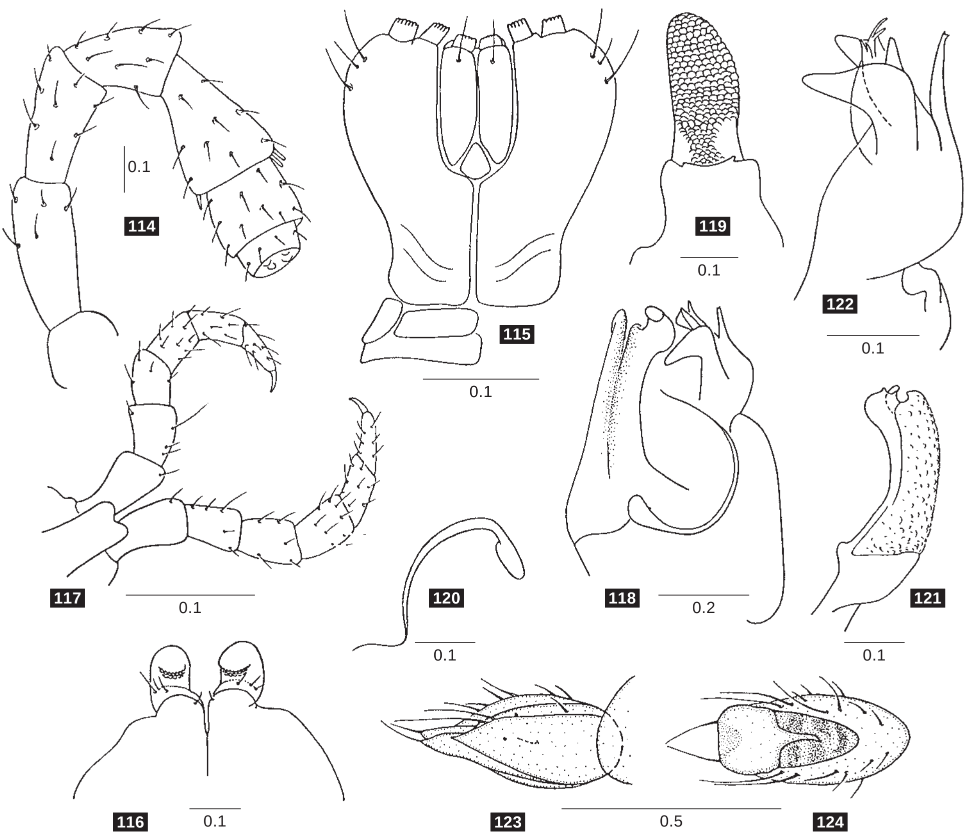
Sibiriulus profugus - Mikhaljova, 2002b: 204, 202: figs; Nefediev, 2002a: 40; 2002c: 138; 2002d: 30; Mikhaljova & Nefediev, 2003: 84. .

DIAGNOSIS: This species differs from congeners mainly by the presence of a massive, dentiform, inner process on the opisthomere.

DESCRIPTION: Male. Body 12-16 mm long, 0.8-0.9 mm in diameter; body rings 41(-1) to 42(-1), excluding telson. Coloration in alcohol varying from dark brown with reddish tinge to pale brown; ventrum paler. Each ring with a dark spot level to ozopore; prozonites dark brown, each with a middle, transverse, marbled band, pattern of spots and bands being especially distinct in paler specimens and more obscure in darker ones. Legs pale brown to yellowish. Antennae brown to dark brown. Eyes black.

Ca. 30 ocelli in a roundly subquadrate eye patch. Epicranial setae 1+1, supralabral setae 2+2, labral ones 10+10. Antennae medium-sized, rather slender and clavate, in situ reaching to beginning of somite 4 (Fig. 114). Length ratios of antennomeres 2-7 as 4.2:3.7:3.3:3.7:2.2:1, width ratios as 0.9:1.1:1.1:1.4:1.4:1, respectively. Antennomere 5 with an incomplete distodorsal corolla of six minute sensory bacilli. Gnathochilarium normal, without additional setae (Fig 115).

Body particularly slender, somewhat compressed laterally. Suture dividing pro- and metazona rather well constricting both zonites. Ozopore small, lying behind suture without touching the latter. Metazona with striae failing to reach hind margin; 4 striae in a square with sides equal to midbody metazonital length. Prozonital surface on somite 7 ventrally delicately striate, this striation passing into metazonite 7. Metazonital setae thin, rather short, gradually growing denser toward a rather densely setose telson. Tail short, cylindrical, straight, carrying a



Figs 114-124. *Sibiriulus profugus* (Stuxberg, 1876): 114 – antenna; 115 – gnathochilarium; 116 – male leg pair 1; 117 – male leg pair 2 and penes; 118 – gonopods (mesal view); 119 – gonopod promere (caudal view); 120 – flagellum of gonopod promere; 121 – gonopod mesomere (caudolateral view); 122 – gonopod opisthomere (submesal view); 123 – vulva (lateral view); 124 – vulva (caudal view). – Scales in mm (114-122 – after Mikhaljova, 1993; 123-124 – after Mikhaljova, 2002b).

small claw directed caudad and somewhat ventrad. Anal valves subtriangular, setose only along caudal edge.

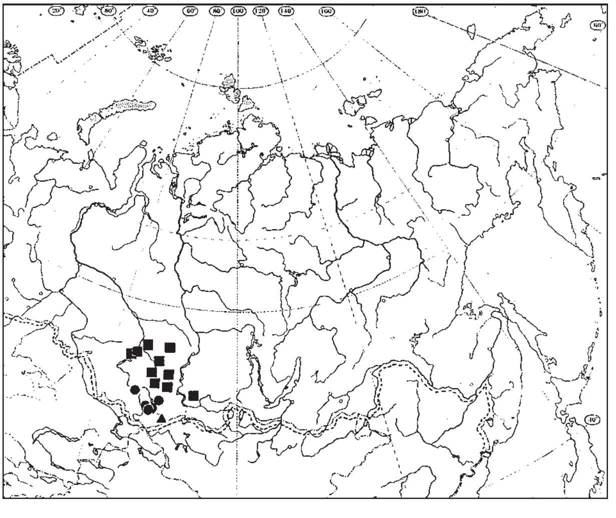
Legs thin, short; claws with a thin, long, setiform, ventral outgrowth at base. Leg pair 1 (Fig. 116) unciform, setose ventrally, papillar apically; outgrowth of telopoditomere 2 low. Leg pair 2 unmodified, penes flattened, triangularly notched at tip (Fig. 117).

Pro-, meso- and opisthomeres subequal in height (Fig. 118). Promere (Fig. 119) devoid of telopodite remnants, papillate caudally nearly throughout, its flagellum filiform distally (Fig. 120). Mesomere (Fig. 121) gently curved forward, its frontal papillar cover dense, its apex arcuatedly broadened, forming a protuberance. Though coxite of opisthomere (Fig. 122) distinct, coxosternal region poorly developed. Coxite with a massive, dentiform, inner process directed frontally. Solenomere broad, pointedly notched apically. Velum like a thin, rounded lobe; phylacum spiniform and carrying a fovea at tip.

Female. Length 15-17 mm, diameter 0.9-1.1 mm. Body segments regardless of telson 40(-2)-43(-2). Ocelli 29. Supralabral setae 2+2, 1+2 or 3+3, labral setae 6+6, 7+7, 8+8, 6+7, 7+8 or 8+9. Collum without striae. Vulva as in Figs 123-124.

DISTRIBUTION (Map 9): Russia: Siberia (Novosibirsk, Kemerovo and Tomsk areas, the southern part of Krasnoyarsk Province, Republic of Khakassia).

REMARKS: This species, originally described as *Julus profugus* (cf. Stuxberg, 1876a) and, later, transferred to *Sibiriulus*, appears to be a senior subjective synonym of *S. dentiger* Gulièka, 1963 (cf. Mikhaljova, 2002b), a form described from near Prokopievsk, Kemerovo Area, Siberia (Gulièka, 1963) and, later, redescribed based on material both from the Novosibirsk Area and the Republic of Khakassia (Mikhaljova, 1993).



Map 9. Distribution of *Sibiriulus multinicus* (●), *S. profugus* (■) and *S. altaicus* (▲).

This species mainly lives in various forests, but also reported from mixed herbaceous meadows and glades up to 1,450 m a.s.l.

Sibiriulus altaicus Gulièka, 1972

Fig. 125, Map 9.

Cylindroiulus (Sibiriulus) altaicus Gulièka, 1972: 43, 44: fig.

Sibiriulus altaicus - Lokšina & Golovatch, 1979: 387; Mikhaljova, 1993: 13; Mikhaljova & Golovatch, 2001: 106.

DIAGNOSIS: This species differs from congeners by the presence of a straight inner process in the distal part of the opisthomere.

DESCRIPTION (after Gulièka, 1972): The species is habitually similar to *S. profugus* (= *S. dentiger* Gulièka, 1963), but differs by certain details of gonopod structure (Fig. 125). Promere slender, with papillae caudally. Flagellum well-developed. Mesomere frontally covered with papillae, somewhat curved toward opisthomere, especially its distal part, which differs strongly from that of *S. profugus*. Opisthomere with a straight inner process distally as opposed to a dentiform inner process in distal part of opisthomere in *S. profugus*. Apex of opisthomere also different in shape compared to that of *S. profugus*.

DISTRIBUTION (Map 9): Russia: Siberia (Republic of Altai).

REMARKS: This species requires re-examination and a redescription, because the original diagnosis and illustrations are too incomplete and imperfect. It still remains known from the type series only. Gulièka (1972) considered *S. altaicus* as similar to *S. dentiger* (see above). However, now it becomes increasingly clear that, morphologically, it is more similar to the recently described *S. multinicus* (cf. Mikhaljova & Golovatch, 2001). In any case, type material or strict topotypes must be revised to solve the problem concerning the identity of *S. altaicus*.

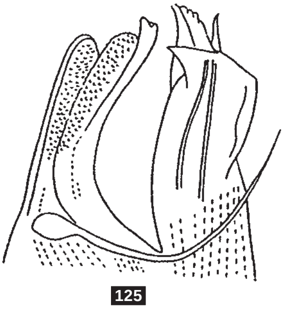


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Fig. 125. *Sibiriulus altaicus* Gulièka, 1972: gonopods (mesal view). – Scale absent (after Gulièka, 1972).

Genus *Megaphyllum* Verhoeff, 1894

About 70 species of this genus are known to occur over Central and Eastern Europe and, especially, in the eastern Mediterranean (Balkans, Anatolia, Caucasus, Levant etc.). The range is more or less uninterrupted up to the Urals and Iran in the east, with a conspicuous, highly remote, disjunct, easternmost outpost represented by a still undecribed species in the West (= Rudnyi) Altais, East Kazakhstan (Map 6). This record has been referred to as *Megaphyllum* aff. *sjaelandicum* (Meinert, 1868) (cf. Golovatch, 1992).

Strictly speaking, the West Altais of Kazakhstan lie somewhat beyond the geographical borders of Siberia, Russia, but so close that, as potential elements possibly populating at least the Russian Altais, this species and genus are being incorporated into the present study.

The main distinguishing character of *Megaphyllum* lies in the presence of a mesomere process positioned on a complex opisthomere instead of a distinct and wholly separated mesomere. The promere is usually simple, with a long flagellum mediobasally.

Family Mongoliulidae Pocock, 1903

This family is known to occur in China, Korea, Japan and the Russia (Far East). It comprises seven genera, but only three genera have been recorded in the Asian part of Russia.

Members of this family are readily recognizable externally using the following characters. Surface of metazonites clearly striate only below ozopore level; male leg pair 1 strongly enlarged; penes single; male leg pair 7 with enlarged coxae and reduced telopodites (except *Ussuriiulus* with a normal leg pair 7); genae modified; gonopods not retractible, anterior gonopods with evident telopodites.

Genus *Kopidoiulus* Attems, 1909

DISTRIBUTION: The genus is known from Japan, Northeast China and the southern part of the Russian Far East. This genus comprises 7 species, of which only two species occur in the Far East of Russia.

Species of this genus are mainly recognised by the very large leg pair 1 and the very small and otherwise unmodified leg pair 7 in the male, the absense of a tail of the telson, the anterior gonopods possessing long interior coxal processes and vestigial blade-like flagella carrying a few prongs, the presence of anterior gonopod telopodites, as well as the entire, distally flattened posterior gonopods.

Key to the species of *Kopidoiulus*:

1(2) Eyes absent. Segment 5 of male leg pair 1 cylindrical (Fig. 126). .... *K. khasanicus*

2(1) Eyes present. Segment 5 of male leg pair 1 elliptical (Fig. 134). .... *K. continentalis*

Kopidoiulus khasanicus **Mikhaljova, 1997**

Figs 126-131, Map 10.

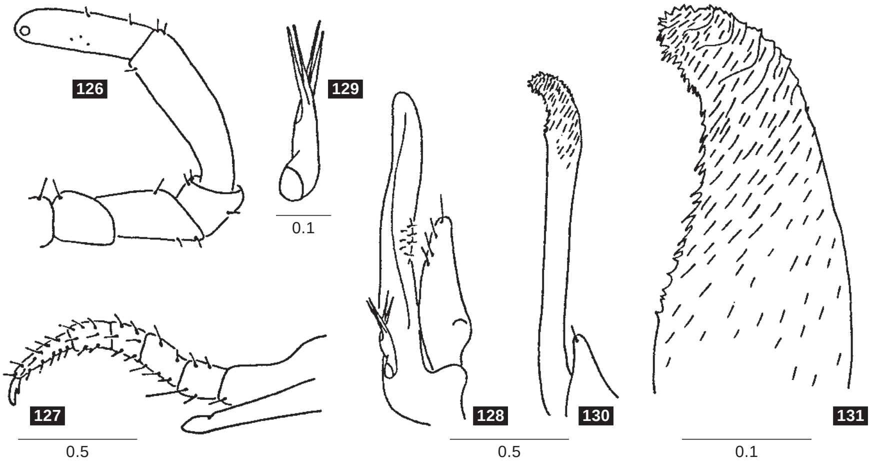
Kopidoilus khasanicus Mikhaljova, 1997a: 149, 148: figs.

Kopidoiulus khasanicus - Mikhaljova, 1998b: 68: figs and map; 2002a: 148; Mikhaljova & Marusik, 2004: 5.

DIAGNOSIS: The species differs from congeners in the absence of eyes, the cylindrical 5th segment of male leg pair 1, and the pilose distal part of the posterior gonopod.

DESCRIPTION: Male. Body 25-34 mm long, 1.0-2.0 mm wide and 1.4-3.0 mm high. Colour in alcohol beige, fore portion of metazonites dark beige. Legs and antennae pale.

Eyes absent. Epicranial setae 2+2, labral setae 10+10. Frons and clypeus clothed with sparse setae. Gena somewhat swollen at distoventral corner. Gnathochilarium with a distal seta on stipites and with 4-5 distomedial and 1-2

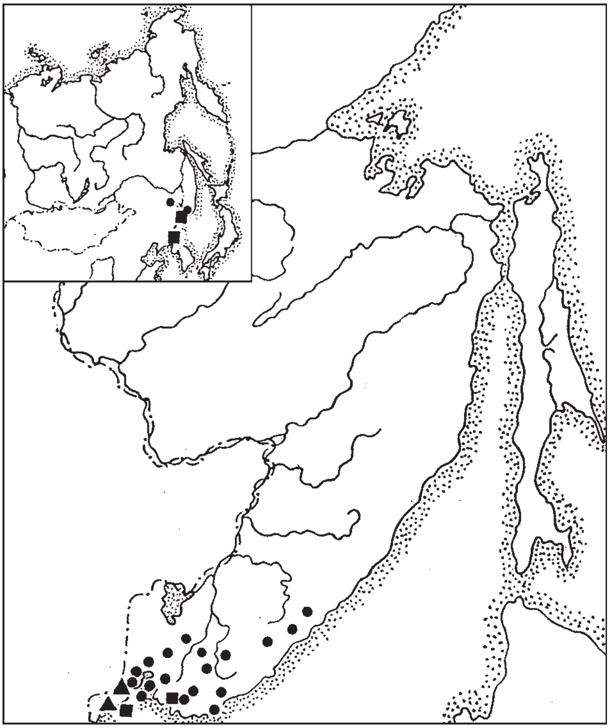


Figs 126-131. *Kopidoiulus khasanicus* Mikhaljova, 1997: 126 – male leg pair 1; 127 –male leg pair 2 and penes; 128 – anterior gonopod (caudal view); 129 – remnant of flagellum of anterior gonopods (mesal view); 130 – posterior gonopod (caudal view); 131 – tip of posterior gonopod. – Scales in mm (after Mikhaljova, 1997a).

basal setae on narrow lamellae linguales, latter completely divided by promentum. Antennae long and slender. Antennomere 5 with an external subapical group of sensory bacilli, antennomeres 6 and 7 each with a subapical corolla of minute sensory bacilli. Prozonites with transverse delicate striae. Metazonites of midbody segments ovoid in cross-section, compressed on sides, with a row of short sparse setae at caudal margins. Only in larger individuals, metazonites with distinct sublateral striae and dense, feebly visible dorsal and lateral striations on each side like in *K. continentalis.* Ozopores very small. Telson setose along hind margin. Anal valves with thin setae. Subanal scale with 1+1 setae.

Legs very long and slender. Only pregonopodal legs with an additional, ventral, small claw at base of each claw. Leg pair 1 (Fig. 126) incrassate, segment 5 cylindrical, segment 6 tiny. Leg pair 2 (Fig. 127) somewhat reduced. Penes longer than coxae, cylindrical, flattened distally, with a pointed apex. Leg pair 7 as usual visibly reduced in size.

Anterior gonopod telopodites (Fig. 128) longer than midlength of coxal process, gradually tapering toward apex, each with 4-5 distomesal setae. A long and slender coxal process of anterior gonopods with a field of several smaller setae on external side. Basal flap (= rudimentary flagellum) with four long apical spikes/branchlets (Fig. 129). Posterior gonopods (Fig. 130) long, flattened



Map 10. Distribution of *Kopidoiulus khasanicus* (▲), *K. continentalis* (●) and *Ansiulus aberrans* (■).

distally, each with a basal syncoxital process like a cone with one short apical seta. Distal part of posterior gonopods tapering and slightly curved toward apex, densely pilose (Fig. 131).

Female. Length 26-35 mm, width 1.1-2.1 mm, height 1.5-3.1 mm, body with 46-50 podous + 2-3 apodous segments, excluding telson. Anterior legs with an additional, ventral, small claw at base each claw, these accessory claws gradually disappearing toward the middle of body.

DISTRIBUTION (Map 10): Russia: Far East (Primorsky Province).

REMARKS: This species has been found in the litter of mixed forests and in caves.

Kopidoiulus continentalis Golovatch, 1979

Figs 132-158, Map 10.

Kopidoiulus continentalis Golovatch, 1979a: 338, 339: figs.

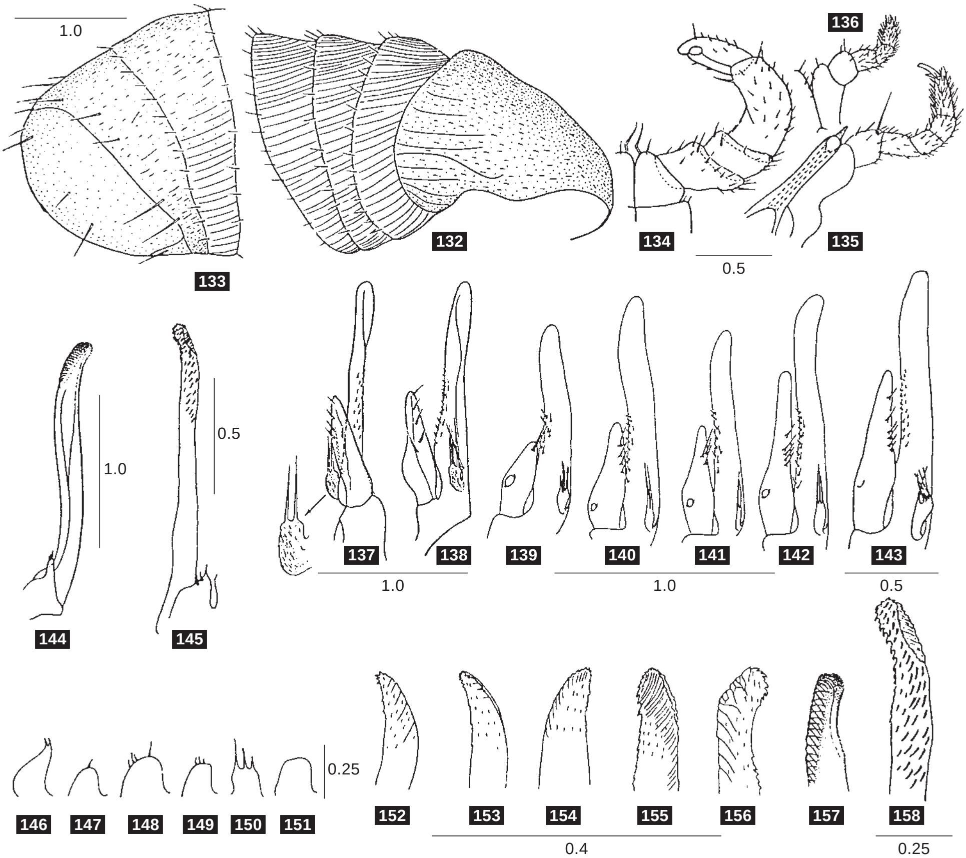
Kopidoiulus continentalis - Lokšina & Golovatch, 1979: 387; Kurcheva & Mikhaljova, 1980: 121; Mikhaljova, 1983b: 89; 1988b: 69; 1993: 15; 1997a: 146, 147-148: figs; 1998b: 69: figs, 68: map; 2002a: 148; Mikhaljova & Petukhova, 1983: 53; Mikhaljova & Bakurov, 1989: 40; Murakami, 1990: 8, 9: figs; Ganin, 1997: 121.

DIAGNOSIS: The species differs from congeners by the elliptical segment 5 of male leg pair 1, the shape of the basal flap of the anterior gonopod, the configuration of the distal part of the posterior gonopods, and by the presence of eyes.

DESCRIPTION: Male. Length 22-61 mm, width 0.9-2.9 mm, height 1.1-3.9 mm. Colour from light beige to red brown. Legs and ventrum yellow-gray. Eyes black.

Body ovoid in cross-section, compressed on sides. About 35-40 ocelli in an oval-triangular eye patch. Size, shape and pigmentation of eye patch varying in relation to age. Epicranial setae 2+2, labral ones about 20. Genae with pointed anteroventral corners and drop-shaped projections. Mandible with 9 rows of pectinate lamellae. Gnathochilarium with a distal seta on stipites and with 4-5 distomedial and 1-2 basal setae on narrow lamellae linguales, latter completely divided by promentum. Antennae very long and slender. Antennomere 3 longest; antennomeres 2, 4 and 5 subequal in length. Antennomere 5 with an external subapical group of sensory bacilli, antennomeres 6 and 7 each with a subapical corolla of minute sensory bacilli. Prozonites with 2-4 transverse, rather irregular striae, of which 2-3 closing on a well-developed axial line. Caudal margin of metazona with a row of short thin setae (Fig. 132). Caudal edge of collum with several longitudinal striae sublaterally, one of them deepest. Only in larger individuals, metazonites, in addition to being distinctly striate sublaterally, also feebly striate dorsally (like isosceles triangles) and laterally on somites 2-53; further on dorsum punctate but without distinct striae (Fig. 133). Tranverse suture between pro- and metazona rather well constricting both zonites. Telson (Fig. 133) sparsely setose. A subtriangular anal scale with 1+1 setae.

Legs very long, with weakly curved claws. Only pregonopodal legs with an additional, ventral, small claw at base of each claw. Leg pair 1 with an elliptical segment 5, segment 6 tiny (Fig. 134). Leg pair 2 somewhat reduced in size. Penes long, pointed apically (Fig. 135). Leg pair 7 (Fig. 136) visibly reduced in size as compared to other legs.



Figs 132-158. *Kopidoulus continentalis* Golovatch, 1979: 132 – anterior part of male body (lateral view); 133 – posterior portion of male body (lateral view); 134 – male leg pair 1; 135 – male leg pair 2 and penes; 136 – male leg pair 7; 137 – anterior gonopod(lateral view); 138 – anterior gonopod (caudal view); 139-143 – variation in length of anterior gonopod telopodite; 144 – posterior gonopod (mesal view); 145 – posterior gonopod (caudal view); 146-151 – variation in shape of syncoxital process at base of posterior gonopod; 152-158 – variation in shape of posterior gonopod apex. – Scales in mm, 157 without scale (132-138, 144, 157 – after Golovatch, 1979a; 139-143, 145-156, 158 – after Mikhaljova, 1997a).

Gonopods long and slender. A long coxal process of anterior gonopod (Fig. 137) setose laterally. Basal flap (= rudimentary flagellum) with 2-3, more seldom 5 (see Mikhaljova, 1997a), apical spikes. Anterior gonopod telopodite from less to more than half as short as interior coxal processes (Figs 137-143). Number and location of setae on anterior gonopod telopoditomere 1 ranging from one subapical to five-six nearly midway, telopoditomere 2 mostly traceable. Posterior gonopods (Figs 144-145) each with a basal syncoxital process. Shape and armature of latter ranging from almost pointed with 1-2 setae to rounded, bare to surmounted with a few spikes/setae (Figs 146-151). Distal part of posterior gonopods striate and, along edge, serrate. Shape of tip and the degree of striation variable (Figs 152-158).

Female. Length 22-69 mm, width 1.0-3.0 mm, height 1.2-4.0 mm. Anterior legs with an additional, ventral, small claw at base of each claw, these accessory claws gradually disappearing toward the middle of body.

DISTRIBUTION (Map 10): Russia: Far East (Primorsky Province), Northeast China.

REMARKS: This species lives in the litter and soil of various forest types. It has also been recorded in caves (Mikhaljova, 1997a). In the Primorsky Province, *K. continentalis* can occur as deep in the soil as 40-50 cm. Adults seem to prefer the litter and the uppermost soil strata (down to 10 cm deep), whereas juveniles are distributed all along the soil profile down to 50 cm depth, yet only in some years and in well-structured soils. In certain conditions, the development of this species seems to take place in the soil (Mikhaljova, 1983b). The abundance ranges from 0.5 to 10.0 ind./m² (Mikhaljova, 1988b; Mikhaljova & Bakurov, 1989).

Genus *Skleroprotopus* Attems, 1901

DISTRIBUTION: Japan, Korea, North China, Russia (Far East). This genus contains about 15 species, of which only two occur in the Asian part of Russia.

Members of this genus can be recognised by the following characters. Male leg pair 1 strongly enlarged, modified; male leg pair 7 with a 2-segmented telopodite and a coxal process; anterior gonopods with a coxal process and a flagellum at base; posterior gonopods with two branches but without telopodite; telson without tail.

Key to species of *Skleroprotopus*:

1(2) Male leg pair 7 with a relatively short coxal process covered with small setae (Fig. 166). Male leg pair 1 with a blunt claw apically (Fig. 164). Anterior gonopods (Figs 168-169) with 2-segmented telopodites. .... *S. schmidti*

2(1) Male leg pair 7 with a long coxal process covered with long setae (Figs 177-178). Male leg pair 1 with a transverse swelling apically (Fig. 175). Anterior gonopods (Figs 179-181) with 1-segmented telopodites. .... *S. coreanus*

***Skleroprotopus schmidti* Golovatch, 1979**

Figs 159-169, Map 11.

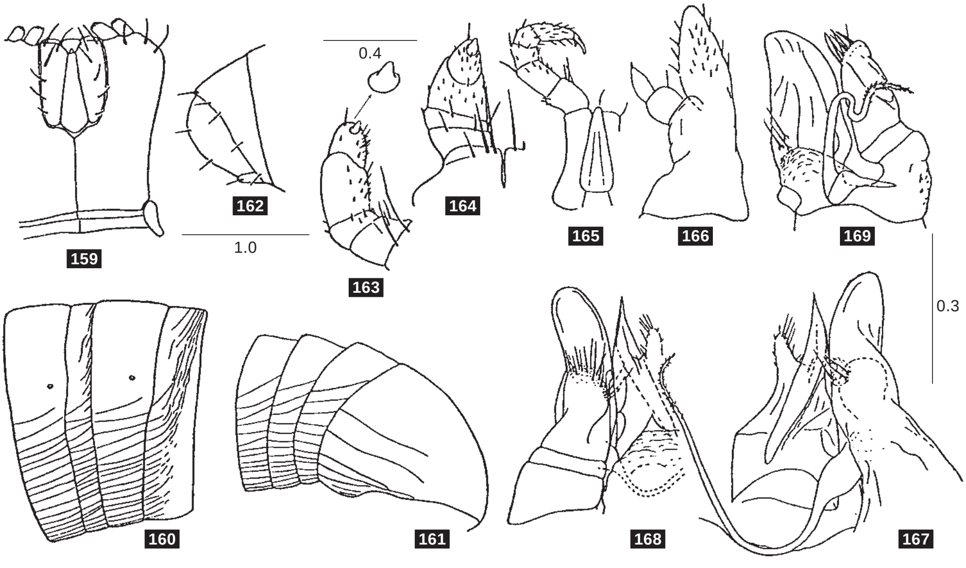
Skleroprotopus schmidti Golovatch, 1979b: 904, 905: figs.

Skleroprotopus schmidti - Lokšina & Golovatch, 1979: 387; Mikhaljova, 1993: 16; 1998b: 66: figs, 65: map.

non *Skleroprotopus schmidti* - Mikhaljova, 2002a: 147.

Diagnosis: This species differs from congeners by the 2-segmented telopodite of the anterior gonopods, the presence of a blunt claw on male leg pair 1 apically, and both the shape and proportions of the posterior gonopod branches.

Description: Male. Body about 22 mm long, 1.9 mm in diameter. Prozonites yellowish-red, metazonites gray-brown with yellowish-marbled spots in a transverse row behind suture between pro- and metazona dorsally and with a large



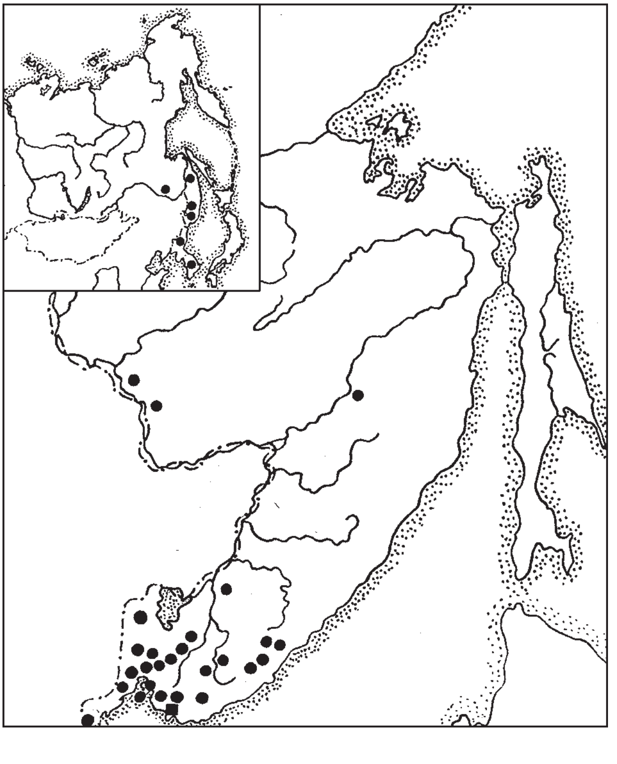
Figs 159-169. *Skleroprotopus schmidti* Golovatch, 1979: 159 – gnathochilarium; 160 – midbody rings (lateral view); 161 – front body segments (lateral view); 162 – telson; 163 – male leg pair 1 (lateral view); 164 – male leg pair 1 (front view); 165 – male leg pair 2 and penes; 166 – male leg pair 7; 167 – gonopods (mesal view); 168 – gonopods (lateral view); 169 – anterior gonopods (caudal view). – Scales in mm (after Golovatch, 1979b).

rounded spot lying below ozopore level. Ventral part of body yellowish, legs reddish tan. Eyes black.

About 30 ocelli in an oval-triangular eye patch. Epicranial setae absent. Supralabral setae 2+2, labral ones 9+9. Genae with a small plate subtruncate ventrally. Mandible with 7 rows of pectinate lamellar. Gnathochilarium (Fig. 159) with 3 short setae on stipites, an elongated promentum completely dividing lamellae linguales, each latter with 6 setae. Antennae relatively short, slender and clavate. Antennomeres 2 and 4 subequal in length; antennomere 3 longest; antennomeres 5 and 6 somewhat shorter than others; antennomere 7 shortest. Sensory bacilli absent.

Prozona with highly unequal and irregular transverse striae (Fig. 160). Caudal edge of collum with several longitudinal striae laterally, uppermost one poorly-developed (Fig. 161). Ozopores lying far behind suture dividing pro- and metazona. Anal valve weakly convex, with 2 setae; subanal scale subtriangular, with 1+1 setae (Fig. 162).

Legs long and slender, claws long, weakly curved, without modifications. Leg pair 1 (Figs 163-164) with a blunt claw apically. Leg pair 2 (Fig. 165) somewhat reduced in size, claw with an additional small claw. Penes subtriangular, bare. Coxal process of leg pair 7 small, setose (Fig. 166).



Map 11. Distribution of *Skleroprotopus coreanus* (●) and *S. schmidti* (■).

Gonopods (Figs 167-168) somewhat retracted inside the body. Anterior gonopods (Fig. 169) with a 2-segmented telopodite, basal telopoditomere poorly-developed, terminal one with long setae apically; flagellum long, with small spinules apically; coxal process bearing 3 medial setae, its apex rounded and curved cephalad. Anterior branch of posterior gonopods (= solenomere) with an interior seminal groove, posterior one with short setae apically.

Female unknown.

Juvenile. Body about 17 mm long, with 40(-6) somites, regardless of telson. Coloration lighter.

DISTRIBUTION (Map 11): Russia: Far East (Primorsky Province).

Skleroprotopus coreanus (Pocock, 1895)

Figs 170-185, Map 11.

Skleroprotopus similiserratus Golovatch, 1979b: 906, 907: figs.

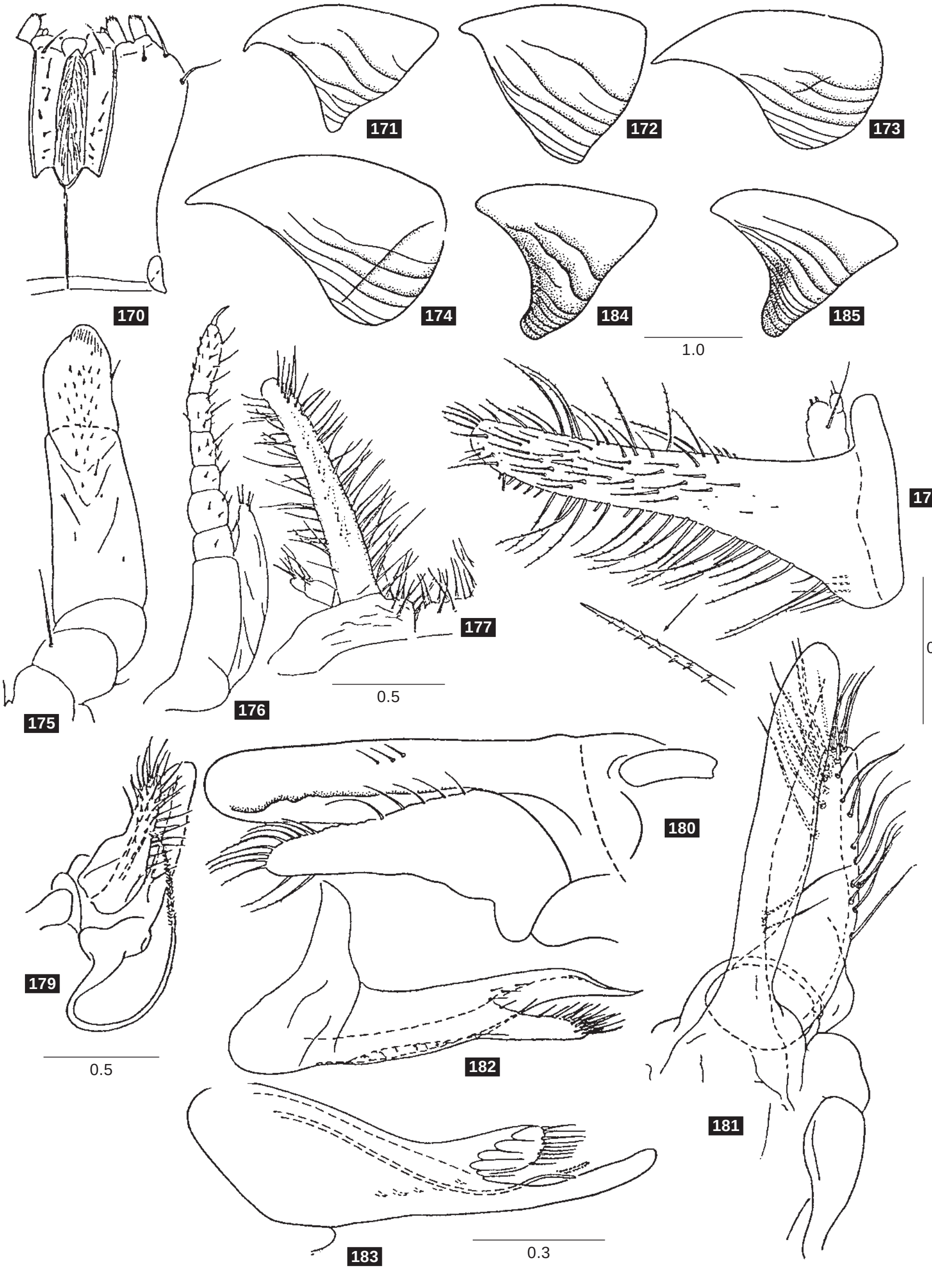
Skleroprotopus similiserratus - Lokšina & Golovatch, 1979: 387; Mikhaljova, 1981c: 87.

Skleroprotopus coreanus - Mikhaljova, 1982b: 1265, 1266: figs; 1983b: 87; 1988b: 70; 1993: 15, 12: map; 1997a: 145; 1998b: 66, 65: map, 67: figs; 2002a: 148; Mikhaljova & Petukhova, 1983: 53; Ursova, 1983: 305; Ganin, 1988: 7; 1989a: 145; 1994: 60; 1995: 371; 1997: 10; Mikhaljova & Bakurov, 1989: 40; Mikhaljova & Korsós, 2003: 220; Mikhaljova & Marusik, 2004: 4.

DIAGNOSIS: This species differs from congeners in the configuration of male leg pair 1, which has a transverse swelling apically, in male leg pair 7 with a long coxal process bearing spinose setae, and in structure of the posterior gonopod branches.

DESCRIPTION: Male. Body 30-43 mm long, 1.9-2.6 mm in diameter. Up to 62(-1) body segments regardless of telson, mostly from 50(-3) to 59(-1). Coloration gray-brown, dark. Posterior edges of metazonites both dorsally and below ozopore level with a light narrow strip, this strip gradually widening on sides. Frequently, gray-yellow, marbled, rounded fields also visible on body. Very seldom, coloration brown, lighter. Anterior part of body and lower portions of sides somewhat lighter. Sometimes ozopores with a light narrow border. Legs reddish-brown. Eyes black. Both head and collum with light marbled spots.

About 60 ocelli in an oval-triangular eye patch. Epicranial setae absent. Supralabral setae 2+2, labral ones 11+11 or 12+12. Genae with lower border like a broad “M”. Gnathochilarium (Fig. 170) with 3 setae on stipites and 6-7 setae on each lamella lingualis, latter completely divided by an elongated and prominent promentum. Antennae short, without sensory bacilli. Lower border of collum undulate laterally. Striation of collum varying (Figs 171-174).



Figs 170-185. *Skleroprotopus coreanus* (Pocock, 1895): 170 – gnathochilarium; 171 – 174 – variation in striation of male collum (lateral view); 175 – male leg pair 1; 176 – male leg pair 2 and penes; 177-178 – male leg pair 7; 179-180 – anterior gonopod(caudal view); 181 – anterior gonopod (mesal view); 182 – posterior gonopod (mesal view); 183 – posterior gonopod (lateral view); 184-185 – variation in striation of female collum (lateral view). – Scales in mm (170, 175-177, 179, 181-182 – after Golovatch, 1979b; 171-174, 178, 180, 183-185 – after Mikhaljova, 1982b).

Legs long and slender, claws long, without modifications. Leg pair 1 (Fig. 175) with a transverse swelling apically and a setose front surface of two last segments. Penes (Fig. 176) with 3 setae apically. Coxal process of leg pair 7 (Figs 177-178) very long, bearing plumose/spinose setae.

Telopodite of anterior gonopods 1-segmented, setose, coxal process flat, flagella relatively long, bearing small spinules apically (Figs 179-181). Anterior branch of posterior gonopod (= solenomere) with a pointed apex, posterior one setose (Figs 182-183).

Female. Body 30-43 mm long, 1.9-2.6 mm in diameter. Up to 63 (-1) body segments regardless of telson. Lower border of collum not as strongly incurved as in male. Variation in stration of collum as in Figs 184-185. Vulva long and slender, with a long seta on coxite and 2-3 long setae on operculum. Leg pair 1 somewhat enlarged.

Juvenile. Up to 51(-4)-53(-4) body segments regardless of telson.

DISTRIBUTION (Map 11): Korea; Russia: Far East (Primorsky Province, the southern part of Khabarovsk Province, the Jewish Autonomous Region, Amurskaya Area).

REMARKS: This species, originally described from southeastern Korea (Pocock, 1895, 1903), is widespread all over Korea, with *S. similiserratus* Golovatch 1979 being its junior synonym (Mikhaljova, 1982b).

The species is the quite common both in the southern parts of the Russian Far East and throughout Korea. It lives in forest litter, the uppermost soil strata (0-10 cm) (Mikhaljova, 1983b) and rotten wood; it has also been found in caves (Mikhaljova, 1997a). In dry periods, it can often be observed in mushrooms. In the southern parts of both Primorsky and Khabarovsk provinces, the numbers range from 0.5 to 33 ind./m^2 (Mikhaljova, 1988b; Ganin, 1997). This millipede species is one of the most active destructors of plant debris in the southern part of Khabarovsk Province (Ganin, 1997). Thus, its daily rate of consumption ranges from 0.8 to 3.8 mg/ind., depending on the kind of leaf litter, while the coefficient of digestion from 21.8 to 81.0%; *Betula* leaf litter appears to be the most readily consumed (Ganin, 1988). The feeding activity of *S. coreanus* varies during the period of vegetation; in summer, the coefficient of digestion is normally greater (15.5-84.1%) than in autumn (17.6%) (Ganin, 1989a). In the Primorsky Province, the peaks of locomotor activity have been registered in May and September (Mikhaljova & Bakurov, 1989). In addition, this species is a potential indicator of environmental pollution with such metals as Pb, Zn, Cd, Co, Cu, Cr, Ni, Mn, Sr and Hg (Ganin, 1997).

Genus *Ansiulus* Takakuwa, 1940

DISTRIBUTION: Korea, Russia: Southern Far East. The genus contains four species. The Russian Far East supports one of them.

This genus seems to be particularly closely related to *Skleroprotopus*, but differs mainly by the presence both of multi-segmented telopodites of male leg pair 7 and a remnant of the posterior gonopod telopodite. However, the high variability of some *Ansiulus* and *Skleroprotopus*, including the presence of a setigerous sublateral tubercle instead of a more distinct telopodite remnant on the posterior gonopod in the somewhat intermediate species *Ansiulus aberrans* (Mikhaljova & Korsós, 2003), might be evidence that *Ansiulus* actually represents a junior synonym of *Skleroprotopus*.

The main distinguishing characters of this genus are as follows. Posterior gonopod telopodite strongly reduced, from a setigerous sublateral tubercle to a few-segmented knob; male leg pair 7 with multi-segmented telopodites; anterior gonopods with a coxal process and a flagellum at base; posterior gonopods 2-branched; male leg pair 1 modified.

Ansiulus aberrans **Mikhaljova & Korsós, 2003**

Figs 186-193, Map 10.

Skleroprotopus schmidti – Mikhaljova, 2002a: 147.

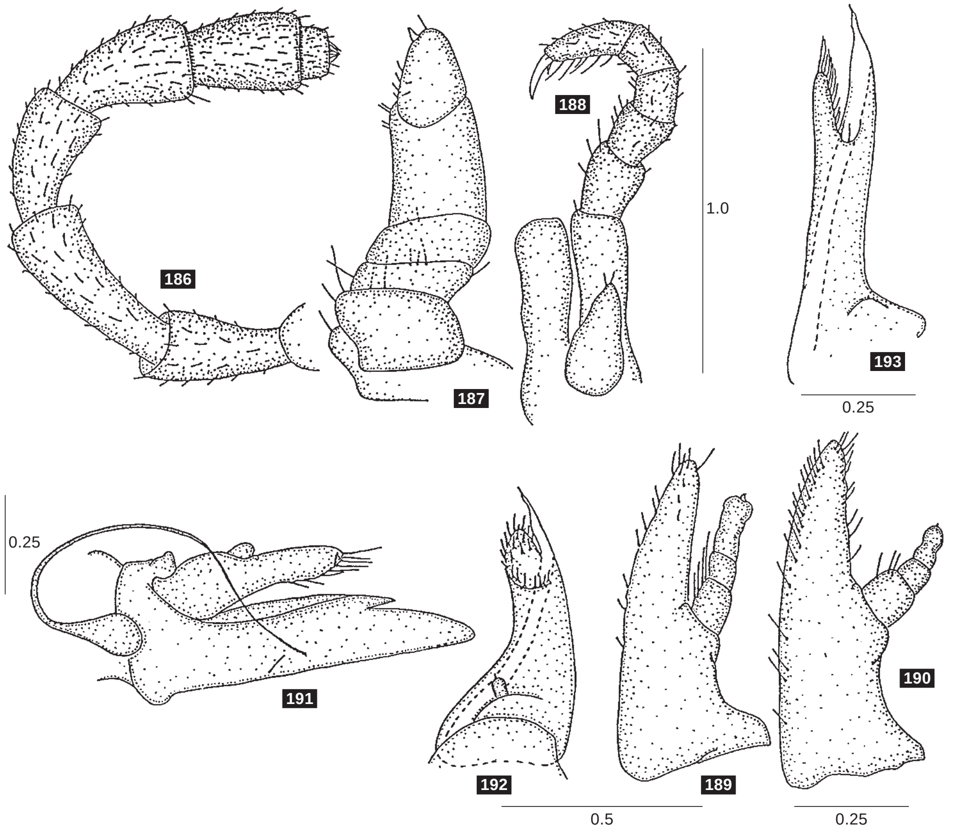
DIAGNOSIS: The species differs from congeners by the configuration of male leg pair 7 with a long, tongue-shaped, coxal process, a 3-segmented telopodite with a moniliform terminal telopoditomere, as well as by the presence of an apical claw in male leg pair 1.

DESCRIPTION: Male. Length 33-43 mm, diameter 2.0-3.0 mm. Body segments regardless of telson 50(-3)–56(-2). Prozona dark brown with marbled spots anterolaterally. Metazona dark brown with differently marbled spots dorsally and laterally. Caudal edge of each metazonite yellowish. Antennae brown, legs light brown, eyes black.

About 40 ocelli in a subtriangular eye patch. Epicranial setae absent. Supralabral setae 2+2, labral ones 12+12. Genae subtriangular, with ventral border like a broad “M”. Gnathochilarium with 3 distal setae and a very low basal knob on stipites. Antennae (Fig. 186) relatively short, clavate. Antennomeres 5 and 6 with a distal corolla of tiny and dense bacilli apiece; ventrally these corolla incomplete. Collum with 10 striae better expressed ventrad than dorsad. Striae on metazonites 2-7 especially well-developed, rather dense and deep ventrad, sparser and more vague dorsad. Prozona with very thin striation directed obliquely laterally and increasingly transversely dorsad. Ozopores small, lying behind and set off from suture dividing pro- and metazona.

Legs moderately long, slender, claw long, with an additional minute claw at base. Leg pair 1 (Fig. 187) enlarged, with 5-segmented telopodites and a blunt claw subapically. Penes (Fig. 188) subconical, relatively short, with apical setae. Leg pair 7 (Figs 189-190) reduced, with a 3-segmented telopodite, telopoditomere 3 longest, moniliform in appearance, with an apical claw, telopoditomere 1 with long setae mesally. Telopoditomere 3 varying in length. Coxa 7 with a long tongue-shaped process bearing setae both mesally and apically.

Anterior gonopods (Fig. 191) with an apically setose telopoditomere 1 and a rudimentary telopoditomere 2. Coxal process flat, lateral edge curved caudally, pointed apically; mesal edge with a seta. Long flagella with or without tiny spines



Figs 186-193. *Ansiulus aberrans* Mikhaljova & Korsós, 2003: 186 – antenna; 187 –male leg pair 1 (caudal view); 188 – male leg pair 2 and penes (caudal view); 189-190 – male leg pair 7 (front view); 191 – anterior gonopod (caudomesal view); 192-193 – posterior gonopod (lateral view). – Scales in mm (after Mikhaljova & Korsós, 2003).

apically. Length of flagella varying. Posterior gonopods (Figs 192-193) with a sublateral tubercle or a 1-segmented remnant of telopodite, each latter with an apical small or tiny seta. Anterior branch of posterior gonopod pointed, posterior one setose.

Female unknown.

DISTRIBUTION (Map 10): North Korea, Russia: Far East (Primorsky Province).

REMARKS: This species has recently been described from North Korea (Mikhaljova & Korsós, 2003). Since then I have found it to occur in the Primorsky Province as well: 1 ♂, Primorsky Province, Partizansk District, ca. 7 km E of Fridman, leafy forest, litter, 5-6.VIII.2002; leg. E. V. Mikhaljova. This species is formally new to the fauna of Russia.

In this connection, the recent record of *Ansiulus matumotoi* Takakuwa, 1940 in the Primorsky Province by Mikhaljova (2002a) appears to be a misidentification.

Genus *Ussuriiulus* Golovatch, 1980

DISTRIBUTION: Russia: Southern Far East, North Korea. Monotypical.

The main distinguishing characters are as follows. Male collum and body segment 6 enlarged; male genae modified; promentum of gnathohilarium subrectangular in male but subtriangular in female; caudal edge of metazonites with setae; telson with a tail; male leg pair 1 enlarged, with remnant of a claw; male leg pair 2 normal or slightly reduced in size, penes long, single; sternite of male leg pair 10 with a process; complex gonopods fused basally, without seminal groove; anterior gonopods without flagella.

Ussuriiulus pilifer Golovatch, 1980

Figs 194-204, Map 7.

Ussuriiulus pilifer Golovatch, 1980a: 204, 206: figs.

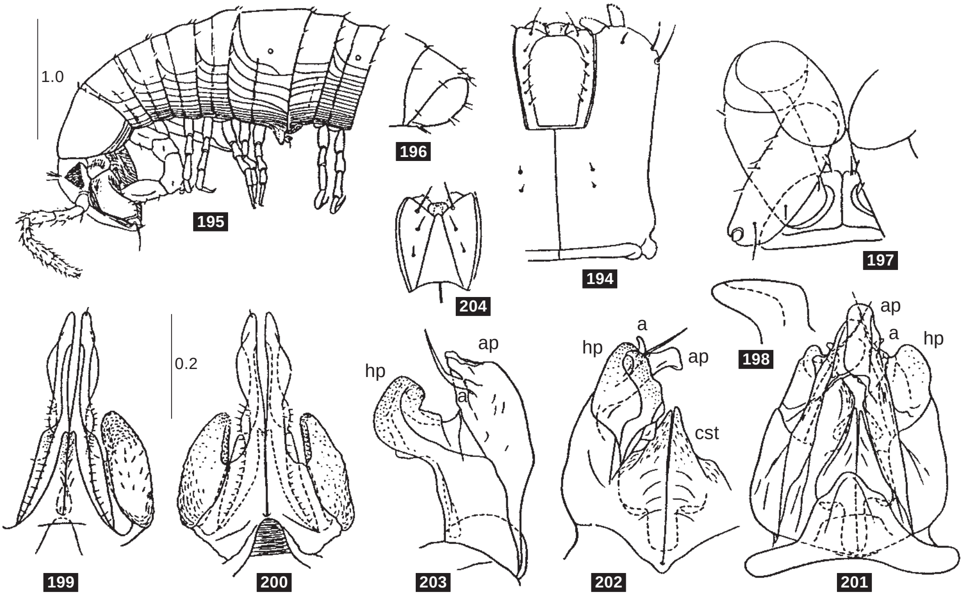
Ussuriiulus pilifer - Mikhaljova, 1981c: 87; 1983b: 87; 1988b: 70; 1993: 16; 1998b: 70, 71: figs, 62: map; Mikhaljova & Petukhova, 1983: 53; Enghoff, 1987: 207; Mikhaljova & Bakurov, 1989: 40; Ganin, 1997: 121; Shelley et al., 2000: 55.

DESCRIPTION: Male. Adult 20-24 mm long, 1.0-1.1 mm wide, body with 39(-2) to 47(-2) segments, excluding telson. Coloration from light yellow to brown-gray. Dorsum sometimes with a narrow, dark, axial line. Legs light yellow, sometimes reddish. Ozopores like dark oval spots. Eyes black.

About 35 ocelli in an oval-triangular eye patch. Epicranial setae 2+2, supralabral ones 2+2, labral ones 10+10. Antennae long and slender. Mandibles with 9 rows of pectinate lamellae, mesal row of lamellae poorly-developed. Genae with an oval plate ventrally. Gnathochilarium with narrow lamellae linguales divided by a broad, almost rectangular promentum (Fig. 194). Each lamella lingualis with 6 setae; 2 +2 tiny setae between stipites and mentum. Collum and somite 6 strongly enlarged.

Body slender, rings subelliptical in cross-section, compressed on sides. Transverse suture between pro- and metazotites poorly visible, relatively strongly constricting the ring. Metazonites with a row of short, thin, sparse setae at caudal margin. Prozonites with transverse striae. Ozopores distinctly visible (Fig. 195). Preanal ring with a very short, apically blunt dorsocaudal process (Fig. 196). Each anal valve with two setae.

Legs moderately long and slender. Claws large, with an additional tiny claw and a long seta at base. A strongly enlarged leg pair 1 (Fig. 197) 6-segmented, bent forward at right angles; claw vestigial. Penes erect, long. Leg pairs 7 and 10 normal. Sternal process of leg pair 10 (Fig. 198) large, beak-shaped, covering the gonopods from behind.



Figs 194-204. *Ussuriiulus pilifer* Golovatch, 1980: 194 – male gnathochilarium; 195 – anterior portion of male body (lateral view); 196 – telson; 197 – male leg pair 1; 198 – sternal process of male leg pair 10; 199 – anterior gonopods (caudal view); 200 –anterior gonopods (front view); 201 – posterior gonopods (front view); 202 – posterior gonopods (caudal view); 203 – posterior gonopods (lateral view); 204 – lamellae linguales and promentum of female gnathochilarium; cst – postertior projection of coxosternal part of posterior gonopod; ap – front part of posterior gonopod; a – caudal branchlet; hp – caudal part of posterior gonopod. – Scales in mm (after Golovatch, 1980a).

Anterior gonopods (Figs 199-200) in situ horizontal, with 1-segmented telopodites covered from behind with tiny and sparse setae and papillae, sometimes with one long apical seta. Coxal processes large, slender, fused basally, flattened laterally. Caudally and laterally, coxal processes with outgrowths and crests. Setation dense and short along base of basal and medial of lateral crests. Laterally, coxal processes like two plates, each 1/3 as wide as high and gradually rounded at apex. Sometimes coxal processes with apical setae as well. Posterior gonopods (Figs 202-203) flattened, fused medially with each other and sternite. Coxosternal part boat-shaped, with a low front and a large caudal conical projection (cst). Posterior gonopods proper strongly sclerotised caudally and clothed with tiny papillae, membranous anteriorly, and hyaline with a flagellum near apex. Anterior part (ap) split near apex into a large membrane and a smaller caudal branchlet (a). Posterior part (hp) with a groove and a short pocket mesally. Posterior gonopods completely covered with anterior ones from below and with sternal process of leg pair 10 from behind.

Female. Body 23-28 mm long, 1.0-1.2 mm wide, body with 39(-3) to 54(-2) segments. Each lamella lingualis of gnathochilarium with 3 setae. Promentum subriangular (Fig. 204). Collum and somite 6 not enlarged. Both genae and all walking legs normal. Sternite of leg pair 2 without modifications. Somite 3 with small lobes covering vulvae ventrally. Vulvae oblong. Both operculum and coxite covered with dense setae.

Juvenile. Body with up to 40(-4) (male) and 43(-3) (female) segments, thus possibly attesting to periodomorphosis.

DISTRIBUTION (Map 7): Russia: Far East (Primorsky Province), North Korea.

REMARKS: This species lives in the litter and uppermost soil strata (0-10 cm) of various forest types (Mikhaljova, 1983b). In the southern part of Primorsky Province, the abundance ranges between 1.0 to 5.0 ind./m² (Mikhaljova, 1981c, 1988b).

Family Nemasomatidae Bollman, 1893

Seven genera distributed in the Palaearctic and Nearctic regions. The Asian part of Russia supports a single genus.

Members of this family can be distinguished by the following characters (mainly after Enghoff, 1985). Sternites free from pleuroterga, locked to pleurotergites by intricate overlaps; mandibles with 4(-5) pectinate lamellae; teeth of pectinate lamellae branched; promentum of gnathochilarium completely separating lamellae linguales; metazonites striate only below ozopore level; no distinct suture dividing pro- and metazonites; telson without dorsocaudal process; gonopods not retractible; anterior gonopods with evident, mostly setose telopodite vestiges and a pair of flagella; posterior gonopods mostly bearing a field of short rod-like setae; male leg pair 1 modified, somewhat reduced in size.

Genus *Orinisobates* Lohmander, 1933

DISTRIBUTION: Nearctic and East Palaearctic. The genus contains eight species. The Asian part of Russia supports three of them.

The main distinguishing characters are as follows. Eyes present; lamellae linguales of gnathochilarium divided by a promentum; male mandibles with subrectangular stipes; female mandibles with oval stipes; 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; metazonites with about 20 setae or metazonital pilosity absent or extremely reduced; anal valves and subanal scale each with 2 setae; anterior gonopods with apical hooks on coxal processes and a pair of flagella at base; telopodites of anterior gonopods with a basal projection covering the base of each flagellum, and with a subapical group of spiniform setae; posterior gonopods with a subterminal row of digitiform processes and a groove for accomodation of flagellum; basal part of posterior gonopod telopodite with a group of spiniform setae; receptaculum seminis with a pair of internal flaps except in *O. soror*.

Key to the species of *Orinisobates*:

1(2) Setae on metazona distinctly visible. .... *O. soror*

2(1) Setae on metazona not or hardly visible even at high magnification. 3

3(4) Gnathochilarium with 4-5 setae on each lamella lingualis. Male unknown. Female receptaculum seminis reduced (Fig. 212). .... *O. microthylax*

4(3) Gnathochilarium with 3 setae on each lamella lingualis. Male known; gonopods as in Figs 213-217. Female receptaculum seminis well-developed. .... *O. sibiricus*

Orinisobates soror Enghoff, 1985

Figs 205-210, Map 12.

Orinisobates soror Enghoff, 1985: 48, 49: figs, 50: map.

Orinisobates soror - Mikhaljova, 1990: 137; 1993: 16, 12: map; 1998b: 72: figs, 73: map; 1998a: 7; Mikhaljova & Basarukin, 1995: 91, 90: map; Ganin, 1997: 133.

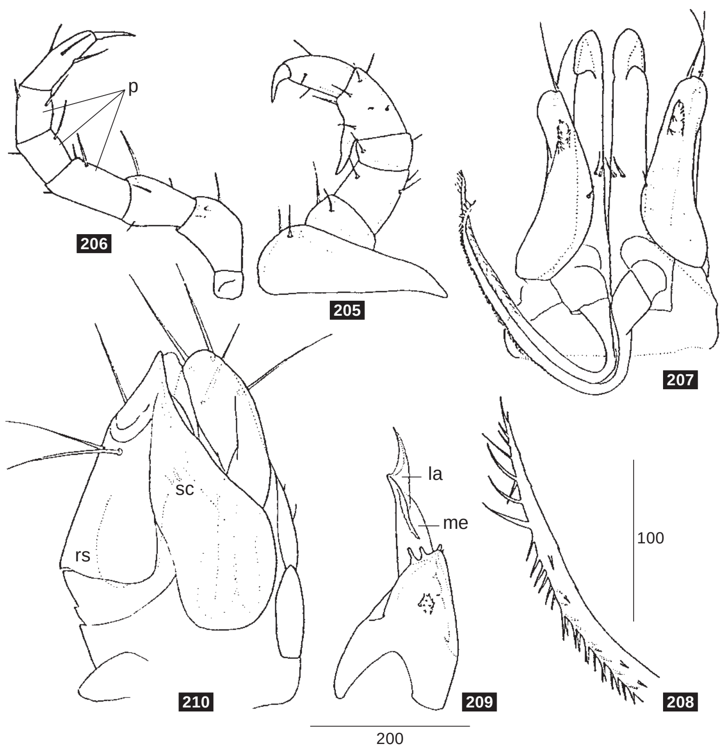
DIAGNOSIS: The species differs from congeners by the distinctly visible metazonital setae, the much longer and slenderer claws, the apex of the anterior gonopod flagellum with long spines, and the absence of internal flaps of the receptaculum seminis.

Description: Male. Length 10.5-14 mm, diameter 0.64-0.72 mm, body with 42(-2)-47(-1) segments, excluding telson. Coloration light brown, darkest laterally.

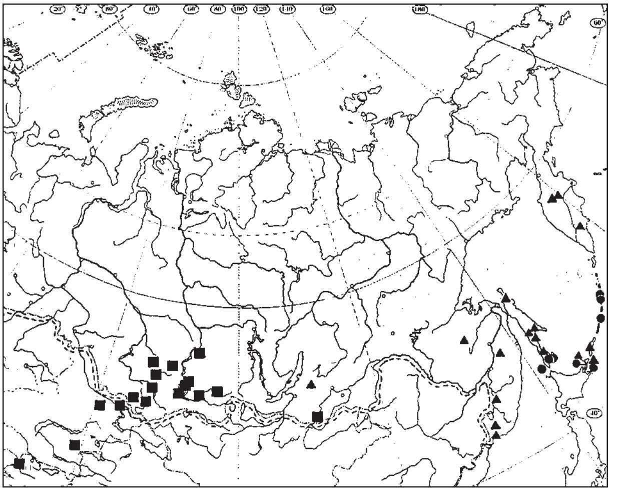
Epicranial setae 2+2, subequal in length. Supralabral setae 2+2. About 12-15 ocelli in a narrowly triangular eye patch. Length of antennae 157% of body vertical diameter. Gnathochilarium with 3 setae on each of stipites, and three setae on each lamella lingualis, length of setae increasing towards apex of lamellae linguales.

Anterior part of prozona with strong scaly microsculpture. Metazonital setae of midbody segments 17-18. Length of setae 11-13 % of body vertical diameter. Telson with setae along caudal edge and with 2 dorsal, non-marginal setae.

Legs slender. Claws normal, without additional claws. Relative length of claw 13.7-14.0%, length/height ratio 5.4-5.5. Leg pair 1 somewhat shorter than other legs, spiniform outgrowth of tibia well-developed; claw well-developed,



Figs 205-210. *Orinisobates soror* Enghoff, 1985: 205 – male leg pair 1 (front view); 206 – male midbody leg; 207 – anterior gonopods (caudal view); 208 – distal part of flagellum; 209 – right posterior gonopod (lateral view); 210 – 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 µm (after Enghoff, 1985).



Map 12. Distribution of *Orinisobates microthylax* (▲), *O. soror* (●) and *O. sibiricus* (■).

twisted more or less frontally (Fig. 205). Penes short, double, each lobe with two setae. Ventral, soft, transversely ridged pads (p) on femur, postfemur, and tibia of legs posterior to leg pair 2 (Fig. 206).

Coxal processes of anterior gonopods long and slender, apical hook distinct (Fig. 207). Mesal part of coxal process with 2 small setae. Flagella long, densely covered with pointed, needle-shaped spinules distally and apically (Fig. 208). Telopodites 1-segmented, about 2/3 length of coxal processes, with 1-3 long apical setae, 2-8 subapical ones minute and spine-like. Also telopodites carrying 1-2 small setae near midlength of mesal margin. Posterior gonopods as in Fig. 209, with only 1-2 digitiform processes; extreme tip directed distad, attenuate.

Female. Length 10.5-13 mm, diameter 0.65-0.82 mm, body with 43(-2)-45(-2) segments, excluding telson. Length of antennae 132% of body vertical diameter. Vulvae (Fig. 210) without internal flaps in receptaculum seminis (rs).

DISTRIBUTION (Map 12): Russia: Far East (Sakhalin Island, Kuriles: Kunashir, Shikotan, Zelyonyi, Chornye Bratya, Ushishir, Rasshua islands).

REMARKS: This species has been found in sea coast areas under pebbles, stones and logs.

Orinisobates microthylax Enghoff, 1985

Figs 211-212, Map 12.

Orinisobates microthylax Enghoff, 1985: 49, 50: map, 51: figs.

Orinisobates microthylax - Mikhaljova, 1988b: 70; 1993:16, 12: map; 1998b: 73: map, 72: figs, 1998a: 7; Enghoff, 1994: 29; Mikhaljova & Basarukin, 1995: 91, 90: map; Mikhaljova & Golovatch, 2001: 107; Mikhaljova & Korsós, 2003: 219; Mikhaljova & Marusik, 2004: 5.

DIAGNOSIS: This species differs from congeners by the presence of parthenogenesis and a much smaller receptaculum seminis, as well as by the presence of 4-5 setae on each lamella lingualis of gnathochilarium.

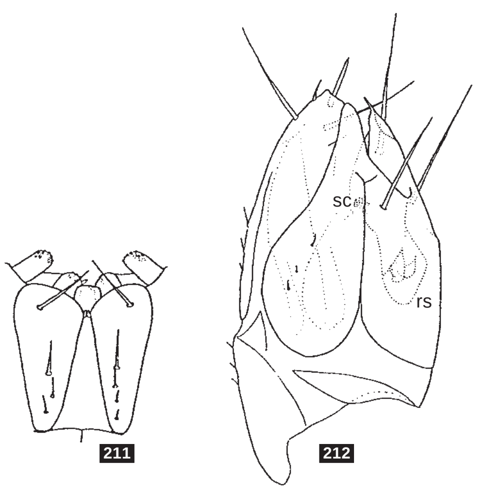
DESCRIPTION: Males unknown.

Female. Length 11.0-14.5 mm, diameter 1.0-1.8 mm. Body with 37(-2)-44(-2) segments, excluding telson. Coloration pale-brown to brown. Epicranial setae 2+2, middle pair longer. Supralabral setae 2+2. Ocelli about 40. Gnathochilarium with 4-5 setae on each lamella lingualis, all except distalmost seta in basal half of lamella (Fig. 211), length of setae increasing towards apex of lamellae linguales.

Anterior part of prozona shagrened. Metazonital setae absent or extremely reduced, hardly visible even at high magnification. Preanal ring with sparse setae along caudal edge only.

Legs slender. Claw with an additional claw reaching to about mid-length of claw. Relative length of midbody leg claws 10.4-10.6%, length/height raztio of claw 4.2-4.6.

Vulvae (Fig. 212) ovoid. Operculum and bursa of about equal length. Operculum with 3-4 long, distal setae. Bursa with aperture extending about 1/4 down its aboral side, distally with hyaline lobes fitting against operculum, sclerotised in basal 2/3, with a vertical suture on each side. Bursa with three long setae near aperture margin, and with setae distributed irregularly. Receptaculum seminis (rs) forming a small sac, near its opening with two sclerotizations. Receptaculum seminis much smaller than in congeners, with a pair of internal flaps.



Figs 211-212. *Orinisobates microthylax* Enghoff, 1985: 211 – lamellae linguales and promentum of female gnathochilarium; 212 – left vulva; rs – receptaculum seminis with a pair of internal flaps; sc – sclerotisations at base of receptaculum seminis. – Scale in µm (after Enghoff, 1985).

DISTRIBUTION (Map 12): Russia: Siberia (Buryatia), Far East (Kamchatka Peninsula, Sakhalin Island, southern Kurile Islands, Primorsky and Khabarovsk provinces).

REMARKS: This species is characterised by parthenogenesis, with no males hitherto recovered.

Orinisobates sibiricus (Gulièka, 1963)

Figs 213-217, Map 12.

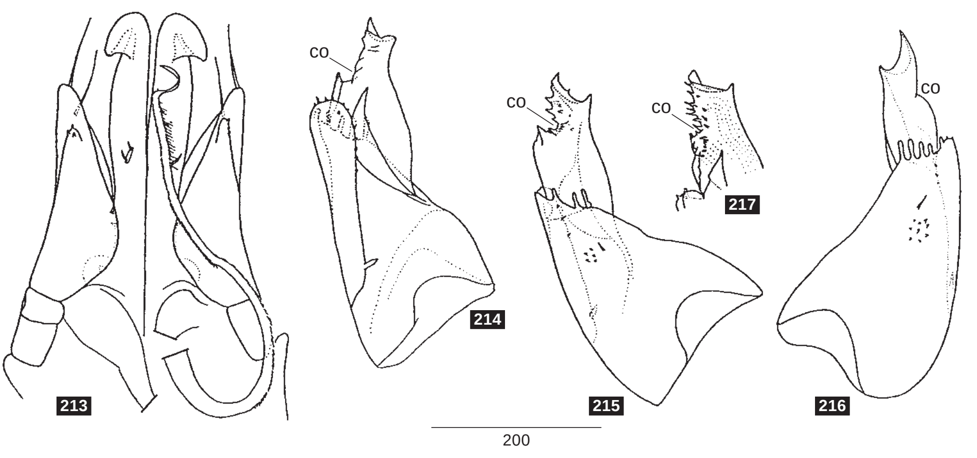
Isobates sibiricus Gulièka, 1963: 522: figs.

Isobates (Orinisobates) sibiricus - Gulièka, 1972: 45: fig.

Orinisobates sibiricus - Lokšina & Golovatch, 1979: 387; Enghoff, 1985: 53, 54: fugs; Mikhaljova, 1993: 16; 2002b: 206; Mikhaljova & Golovatch, 2001: 107; Mikhaljova & Nefediev, 2003: 83.

DIAGNOSIS: This species differs from congeners by the size ratio of the posterior gonopod lamellae: mesal lamella much smaller than lateral lamella, the presence of a constriction near the mid-length of the posterior gonopod lateral lamella, and the spiny or not lateral lamella of the posterior gonopods.

DESCRIPTION: Male. Length 6.5-18 mm, diameter 0.58-0.93 mm. Body with 25(-1)-51(-1) segments, excluding telson. Coloration brown, either without pattern or with the following pattern: a light brown dorsum, each somite with dark anterior margin and middorsal stripe extending almost to posterior margin. Legs light brown, antennae dark brown.



Figs 213-217. *Orinisobates sibiricus* (Gulièka, 1963): 213 – anterior gonopods (posterior view); 214 – posterior gonopod (mesal view); 215-216 – posterior gonopods (lateral view); 217 – distal part of posterior gonopod (mesal view); co – constriction. – Scale in μm (after Enghoff, 1985).

Head with two epicranial setae. Supralabral setae 2+2. Gnathochilarium with 3 setae on each stipe, and 3 setae on each lamella lingualis, length of setae increasing towards apex of lamellae linguales. Prozona and metazona separated by a distinct constriction. Metazonital setae extremely reduced in size, hardly visible even at high magnification. Telson with sparse setae along caudal edge.

Legs slender. Claws with an additional claws. Relative length of midbody leg claws 8.0-9.7% of sum of leg articles, length/height ratio 3.8-4.1. Leg pair 1 somewhat shorter than other legs; a spiniform tibial outgrowth long; claw well-developed, twisted more or less. Penes short, double, each lobe with 2 setae. Transversely ridged pads on legs posterior to leg pair 2.

Coxal processes of anterior gonopods slender, apical coxal hooks extending well laterad (Fig. 213). Flagella densely clad with long, hair-like spines in distal part, spines almost perpendicular to axis of flagellum; extreme tip of flagellum almost smooth. Posterior gonopods (Figs 214-217) with 3-5 digitiform processes; mesal lamella of distal part much smaller than lateral lamella; latter with a conspicuous constriction (co) near midlength, often more or less spiny distal to, and sometimes also immediately basal to, constriction.

Female. Length up to 19 mm, diameter up to 1.1 mm. Body with 39(-1)-51(-1) segments excluding telson.

DISTRIBUTION (Map 12): Russia: Siberia (southern part of Krasnoyarsk Province, Altais, Kemerovo Area, Chita Area, Republic of Tuva); East Kazakhstan and Kirghizia.

REMARKS: The species lives in forest litter, under the bark of trees, in mosses and mushrooms.

Family Blaniulidae C. L. Koch, 1847

This family is mainly distributed in the Western Palaearctic, marginally represented also in southeastern North America (one genus and species). About 20 genera. Several species are anthropochores, subcosmopolitan in distribution. In the Asian part of Russia, one such species, *Nopoiulus kochii*, is known to occur.

The main distinguishing characters are as follows. Metazonites distinctly striate only below ozopore level; a distinct suture dividing pro- and metazonites absent; telson without tail; sternites fused with pleurotergites; legs, including caudal pairs, with 1 or 2 lancet-shaped setae on postfemur, tibia and, sometimes, femur; gonopods not retractible; anterior gonopods with mesal coxal processes and lateral 1-segmented telopodites, without flagella; posterior gonopods long and slender, with small coxae, a very strongly reduced sternite and outgrowths distally; male leg pair 1 modified, reduced.

Genus *Nopoiulus* Menge, 1851

DISTRIBUTION: All indigenous members of this genus (over 10) are known from Turkey, the Caucasus and Iran. The Far East of Russia and Siberia support one species, the ubiquitous *N. kochii*, which is certainly introduced through human agency and is only known from anthropogenic habitats.

The main distinguishing characters are as follows. Sternite of posterior gonopods prolonged dorsoventally; posterior gonopods divided apically into two lamellae of subequal size; operculum of vulvae much longer than bursa.

Nopoiulus kochii **(Gervais, 1847)**

Figs 218-222, Map 5.

Nopoiulus kochii - Lokšina & Golovatch, 1979: 385; Golovatch & Enghoff, 1990: 115; Mikhaljova, 1993: 9; 1998a: 6; 1998b: 73, 74: figs; Mikhaljova & Nefediev, 2003: 85.

DIAGNOSIS: The species differs from congeners by the somewhat clavate anterior gonopod coxal process which is the thickest subapically.

DESCRIPTION: Male. Length 7.5-10 mm, diameter 0.5-0.6 mm, body segments, regardless of telson 32(-4)-43(-2). Coloration yellow-brown, sometime with brown spots laterally. Eyes black.

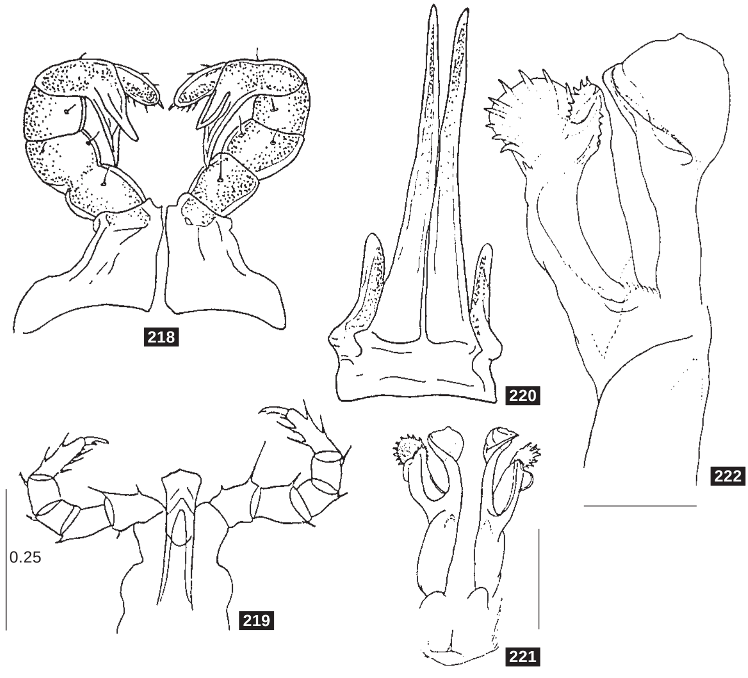
Five ocelli in one line. Epicranial setae 2+2. Genae with two pointed outgrowths from beneath (one each on cardo and stipe). Antennae long. Length of antennae 170-187% of midbody vertical diameter.

Body slightly compressed on sided. Metazonites with sparse (less than 35), thin, short setae along caudal margin. Preanal ring without dorsocaudal process but with sparse setae along posterior edge.

Length of legs 80-87% of midbody vertical diameter; relative length of claw 10.8-12.6% of sum of leg article length, claw length/height ratio 5.1-6.0. Legs from pair 2 backward with 4 lanceolate setae. Leg pair 1 (Fig. 218) somewhat incrassate, strongly curved, articles distinct, tibia with an inner process. Penes (Fig. 219) with a truncated apex.

Anterior gonopods (Fig. 220) with long coxal processes somewhat clavate in lateral view, subapically thickest. Telopodites 1-segmented, without setae in distal part. Lateral apical lamellae of posterior gonopods with a fringe along margin (Fig. 221-222).

Female. Length 11-12 mm, diameter 0.7-0.8 mm, body segments regardless of telson 35(-2)-39(-2). Length of antennae 138-156%, length of legs 68-75% of midbody vertical diameter. Leg pair 2 well-developed. Vulvae without setae.



Figs 218-222. *Nopoiulus kochii* (Gervais, 1847): 218 – male leg pair 1; 219 – male leg pair 2 and penes; 220 – anterior gonopods; 221 – posterior gonopods; 222 – distal part of posterior gonopod. – Scale in mm, 218 & 220 without scale, 221-222 – scales without designation (218, 220 – after Schubart, 1934, taken from Lang, 1954; 219 – after Lokšina, 1969; 221-222 – after Blower, 1985).

DISTRIBUTION: A ubiquitous species widely distributed in Europe, North and South America, Asia, North Africa and New Zealand, mainly as introductions.

REMARKS: The species lives in natural and anthropogenic habitats in soil, rotten wood and caves. In the Asian part of Russia (Map 5), it has been reported solely from anthropogenic localities. In Siberia, this species has been collected in the city of Tomsk both in greenhouses and park litter of the Siberian Botanical Garden (Mikhaljova & Nefediev, 2003). In the Far East, it has been found in the environs of Vladivostok as pest of some hothouse and kitchen-garden plants (Mikhaljova, 1998a, b), as well as in a mixed forest patch of the Vladivostok Botanical Garden (Golovatch & Enghoff, 1990).

Order Chordeumatida C. L. Koch, 1847

This is the largest order of Diplopoda, distributed mainly in the Holarctic, with relatively minor representation in the Oriental realm, Australia, Tasmania, New Zealand, Madagascar, Central America, and the extreme south of South

America. This is also the largest diplopod order populating the Asian part of Russia, supporting eight families with 53 valid species.

Chordeumatidans differ by a fixed number of somites in the adults (26, 28, 30 or 32, very seldom 31 or 29, including the telson). In the Asian part of Russia, their body consists of 28, 30 or 32 segments. Somites subcylindrical, pleurites coalesced with tergites, forming a pleurotergal arch with its ventral edges visible in lateral view. Metazonites either fully devoid of paraterga or only with poorly developed lateral to dorsolateral bulges, or with well-developed, wing-like, paraterga. Each metatergite with 3+3 macrochaetae of varying length. Axial suture evident; telson with spinnerets. Ozopores absent. Antennae slender or clavate, antennomere 3 longest. Genae strongly convex. Labrum with three medial teeth at fore margin, sometimes with prominent spines on labral angles in males. Legs 1 and 2 somewhat reduced in size as compared to subsequent pairs, at least pair 1 always with tarsal brushes. Sometimes female leg pair 2 modified (for example in the Siberian genus *Ghilarovia*). Certain male legs (except for legs 1 and 2) sometimes with tarsal papillae on ventral surface. Male legs 8 and 9 modified into gonopods, male legs 10 or 10 and 11 with coxal glands, some other male legs often also modified, sometimes adjacent ones approaching gonopods in structural complexity and forming so-called paragonopods or near-gonopods.

Key to families and genera of Chordeumatida:

1(20) Body segments with well- or modestly developed paraterga (Figs 267-268, 402). 2

2(19) Anterior gonopods consisting of a coxosternum with a T-shaped coxal part and elongated telopodites (Figs 365, 367, 385). .... Family Diplomaragnidae

3(4) Telopodites of anterior gonopods broad or thick all along their extent (Figs 223, 229, 232). .... Genus *Ancestreuma*

4(3) Telopodites of anterior gonopods subflagelliform or flagelliform, or, if broad, then broadened only at base. 5

5(6) Basal part of anterior gonopod telopodite dilated, distal part acuminate (Fig. 264). .... Genus *Asiatyla*

6(5) Basal part of anterior gonopod telopodite not dilated, distal part flagelliform or subflagelliform. 7

7(8) Colpocoxites of posterior gonopods flattened on sides, not sagittally. Lateral sheath process very long and broad (Figs 275, 279). .... Genus *Orientyla*

8(7) Colpocoxites of posterior gonopods different, if flattened, then frontocaudally. Lateral sheath process different. 9

9(10) Posterior gonopod colpocoxite with a large front prominence (Figs 289, 300, 305). ....Genus *Sakhalineuma*

10(9) Posterior gonopod colpocoxite without large front prominence. 11

11(14) Gonopod anterior angiocoxal process long, subflagelliform to flagelliform. 12

12(13) Gonopod anterior angiocoxal processes passing, sometimes through a foramen, between colpocoxites along midline (Fig. 326) as well as through a lateral foramen in each colpocoxite (Fig. 344), or each process placed inside a fold of colpocoxite (Fig. 340). .... Genus *Diplomaragna*

13 (12) Gonopod anterior angiocoxal processes either piercing the colpocoxites or sheathed on anterior face of colpocoxites (Figs 346, 349, 353). .... Genus *Maritimosoma*

14(11) Gonopod anterior angiocoxal process shorter, of a different shape. 15

15(16) Processes of sheath groove of posterior gonopod colpocoxite absent (Figs 365, 367). .... Genus *Pacifiosoma*

16(15) Processes of sheath groove of posterior gonopod colpocoxite (at least mesal sheath process) present. 17

17(18) Posterior angiocoxal process of posterior gonopod medium-sized, very small or absent. Colpocoxite (sub)cyathiform in shape (Fig. 377, 382, 387). .... Genus *Shearia*

18(17) Posterior angiocoxal process of posterior gonopod large. Colpocoxite different (Figs 391, 411, 420). .... Genus *Altajosoma*

19(2) Anterior gonopods biramous, with a large, digitiform, median process on sternum (Figs 434, 435). .... Family Conotylidae (genus *Crassotyla*)

20(1) Body segments either without paraterga/bulges or with poorly developed dorsolateral bulges. 21

21(26) Adults with 28 body segments. 22

22(23) Ocelli arranged in a single row. .... Family Hoffmaneumatidae (genus *Hoffmaneuma*)

23(22) Ocelli in a subtriangular or triangular patch. 24

24(25) Sternum of anterior gonopods with two pairs of anterior lyriform processes. Anterior gonopods as in Figs 449, 452. .... Family Anthroleucosomatidae (genus *Ghilarovia*)

25(24) Sternum of anterior gonopods without processes. Anterior gonopods as in Figs 476-479, 490-494). ....Family Altajellidae

26(21) Adults with 30 body segments. 27

27(28) Anterior gonopods with 2-segmented telopodites, last telopoditomere very small (Fig. 502). Male legs 10 with strongly enlarged lobulated coxae (Fig. 499). Body length 15 mm. .... Family Golovatchiidae (genus *Golovatchia*)

28(27) Anterior gonopods, male coxae 10 and body length different. 29

29(30) Body length 7-11 mm. Telopodites of posterior gonopods 1-segmented (Figs 516-517). Metazonites devoid of bulges laterally. .... Family Caseyidae (genus *Underwoodia*)

30(29) Body length 25-28 mm. Telopodites of posterior gonopods 2-segmented (Figs 525-526). Metazonites with poorly-developed bulges dorsolaterally (Fig. 519). .... Family Megalotylidae (genus *Megalotyla*)

Family Diplomaragnidae Attems, 1907

This large family contains 11 genera distributed in Russia (Siberia and Far East), Mongolia, Japan, Korea and Taiwan. In Siberia and the Russian Far East, it supports nine genera with 45 species and is the largest over the territories concerned.

Shear (1990) established the synonymy of the families Ancestreumatidae, Syntelopodeumatidae, Tokyosomatidae and Sakhalineumatidae with Diplomaragnidae, and of the genera *Ancestreuma, Syntelopodeuma, Tokyosoma, Niponiothauma, Pterygostegia, Altajosoma, Sakhalineuma* with *Diplomaragna.* Five of these genera have been revalidated, and five new genera described, in a recent review of the Diplomaragnidae (Mikhaljova, 2000).

Members of this family can be distinguished mainly by the following characters. Gnathochilarium without promentum; antennae slender; body largely with 32 segments, seldom 29 as in the Korean *Tokyosoma ronkayi* (Shear, 1990) and *Pterygostegia korsosi* (Shear, 1990) (Mikhaljova & Lim, 2000; Mikhaljova & Korsós, 2003); eyes present or absent; collum usual, not covering the head from above; metazonites largely with well-developed to medium-sized paraterga directed horizontally (only *Pterygostegia* species in Japan and Korea are characterised by the exaggerated paraterga, while most species of *Tokyosoma*, also from Japan and Korea, are distinguished by reduced paraterga); teguments smooth or finely alveolate; macrochaetae in a transverse row on segments 30-31, as an extended triangle on preceding segments; telson normal; male leg pairs 3-7 increasingly enlarged; male leg pairs 3-7 distally with tarsal papillae gradually disappearing toward gonopods, therefore leg pair 7 with tarsal papillae only apically near claw; postgonopodal legs in most cases with a group of tarsal papillae distally but hind legs without tarsal papillae; claws mostly with two additional minute claws dorsally and a long seta ventrally; each claw of male legs 3-7 largely with a long seta ventrally only; male coxae 2, 3 and 7 unmodified; penes absent; female leg pair 2 normal; male leg pairs 10 and 11 normal, with coxal glands; anterior gonopods consisting of a coxosternum with a T-shaped coxal part and mostly flagelliform to subflagelliform or, only relatively seldom, broad and thick 1- or 2-segmented telopodites, latter attached to or lying inside sheath grooves on posterior surfaces of posterior gonopod colpocoxites; posterior gonopod angiocoxites (coxal walls) of varying degrees of development, either with processes or without one of these (posterior or anterior); telopodites of posterior gonopods hypertrophied, setose, basically 2-segmented, though often with a rudimental, claw-shaped 3rd telopoditomere.

Genus *Ancestreuma* Golovatch, 1977

Distribution: Russia: Southern Siberia; northern Mongolia. This genus contains seven species, of which five occur in Siberia.

The main distinguishing characters are as follows. Body with 32 segments; paraterga well-developed to medium-sized; anterior gonopod telopodites large, broad or thick, flattened on posterior face, often with an elaborate tip, superficially 2-segmented, each positioned on posterior face of posterior gonopod colpocoxite, not sheathed; each colpocoxite entire; femur of posterior gonopod telopodite long.

Remarks: At least in the Siberian species, joints 1 and 2 of the anterior gonopod telopodite are only separated by a deep constriction, not by an intersegmental suture. Telopoditomere 1 is incomplete, represented by a posterior wall only.

Key to species of *Ancestreuma*:

1(4) Telopodite of anterior gonopods without branch in distal part. 2

2(3) Posterior angiocoxal process present. Telopodite of anterior gonopods broad, with a relatively complex tip (Fig. 223). .... *A. ryvkini*

3(2) Posterior angiocoxal process absent. Telopodite of anterior gonopods thick, with a simple tip (Fig. 226). .... *A. feynmani*

4(1) Telopodite of anterior gonopods branched in distal part. 5

5(6) Lateral process of posterior gonopod colpocoxite absent. Branch of anterior gonopod telopodite long, subulate (= awl-shaped) (Fig. 228)..... .... *A. subulatum*

6(5) Lateral process of posterior gonopod colpocoxite present. Branch of anterior gonopod telopodite different. 7

7(8) Branch of anterior gonopod telopodite long, tongue-shaped, with an oval tip. Lateral process of posterior gonopod colpocoxite plate-like (Fig. 232). ....*A. ramiferum*

8(7) Branch of anterior gonopod telopodite shorter, with a fimbriate tip. Lateral process of posterior gonopod colpocoxite subspatulate (Fig. 245). ....*A. longibrachiatum*

Ancestreuma ryvkini (Shear, 1990)

Figs 223-225, Map 13.

Diplomaragna ryvkini Shear, 1990: 15, 14: figs.

Diplomaragna ryvkini - Mikhaljova, 1993: 25.

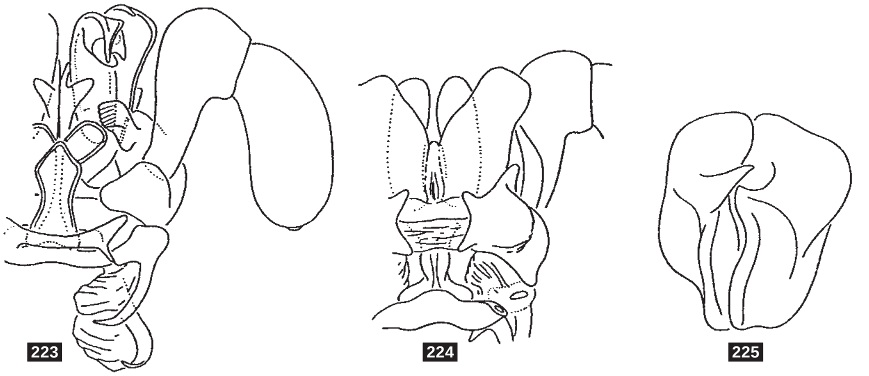
Diplomaragna longibrachiata – Mikhaljova, 1993: 25.

Ancestreuma ryvkini - Mikhaljova, 2000: 156; 2002b: 204; Mikhaljova & Golovatch, 2001: 109; Vorobiova et al., 2002: 62.

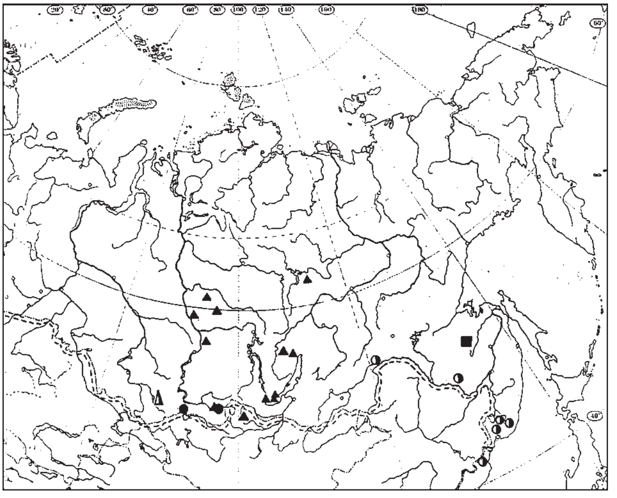
DIAGNOSIS: The species differs from congeners in shape of the posterior angiocoxal process and the configuration of the anterior gonopod telopodite with a relatively complex tip.

DESCRIPTION: Male. Length about 13 mm, width at somite 6 with paraterga 1.56 mm. Coloration regularly brown, faintly mottled brownish purple on posterior parts of metazonites, antennae, and anterior legs. Eyes black.

Body with 32 segments. Eye patches triangular, each composed of 27-30 ocelli. Antennomere 3, 0.63 mm long. Paraterga beginning on segment 2, strongest on segments 9-25, then gradually smaller, absent from segments 27-32. Metazonital macrochaetae acute, thin, about 0.4 mm long.



Figs 223-225. *Ancestreuma ryvkini* (Shear, 1990): 223 – gonopods (caudal view); 224 – gonopods (front view); 225 – vulva (ventral view). – Scale absent (after Shear, 1990).



Map 13. Distribution of *Ancestreuma ryvkini* (▲), *A. ramiferum* (●), *Orientyla bureyinskaya* (■), *O. dahurica* (◑) and *Altajella pallida* (△).

Legs long and slender. Leg pairs 3-7 with typical tarsal papillae, enlarged, incrassate; pairs 5-7 much larger, femora swollen and curved; claws at base with a long ventral seta only. Postgonopodal legs with a group of funnel-shaped tarsal papillae distally; claw at base with a long seta ventrally and two small additional claws dorsally. Legs 10 and 11 usual, with coxal glands, in other respects not modified.

Anterior gonopod telopodite large, broad, strongly curved posteriad, tip relatively complex, a flattened posterior surface smooth (Fig. 223). Posterior gonopods in anterior view (Fig. 224) with a subglobose angiocoxite and a small, subtriangular process. Colpocoxites fused at base, diverging apically, blunt. Posterior angiocoxal process ribbed apically, both this process and mesal subtriangular process of colpocoxite clasping anterior gonopod telopodite. Lateral process of colpocoxite absent. Colpocoxite with a small apical extension. Telopodite of posterior gonopod usual, with a long femur.

Female. Length about 15 mm, width at somite 6 with paraterga 1.96 mm. Antennomere 3, 0.65 long. Ocelli 27-30. Vulvae (Fig. 225) with each valve showing two depressed areas separated by distinct lamellae.

DISTRIBUTION (Map 13): Russia: Siberia (Buryatia, Irkutsk Area, Republic of Tuva, Republic of Sakha (=Yakutiya), southern part of Krasnoyarsk Province); northern Mongolia.

REMARKS: This species was originally described in *Diplomaragna* (Shear, 1990), but later transferred to *Ancestreuma* (Mikhaljova, 2000). In the Krasnoyarsk Province, this species is rather common in the southern taiga (Vorobiova et al., 2002).

Ancestreuma feynmani (Shear, 1990)

Figs 226-227, Map 14.

Diplomaragna feynmani Shear, 1990: 18, 17: figs.

Diplomaragna feynmani – Mikhaljova, 1993: 22.

Ancestreuma feynmani – Mikhaljova, 2000: 155; Mikhaljova & Golovatch, 2001: 109; Vorobiova et al., 2002: 62.

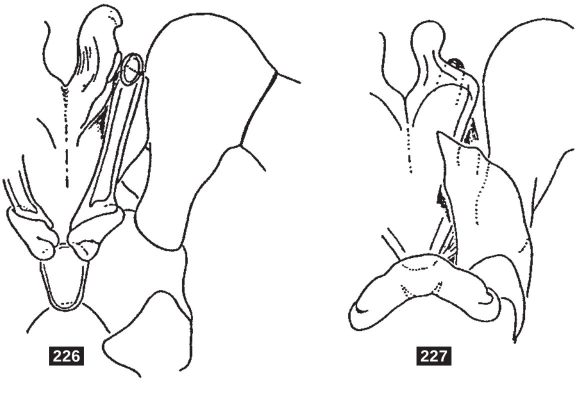
DIAGNOSIS: The species differs from congeners by certain details of gonopod structure, especially the peculiar tips of the posterior gonopod colpocoxites.

DESCRIPTION: Male. Length about 15 mm, width at somite 6 with paraterga 2.08 mm. Coloration light brown. Eyes black.

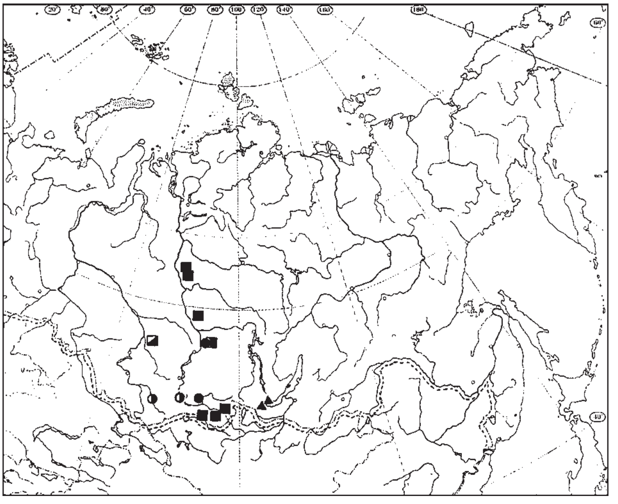
Body with 32 segments. Eye patches triangular, each composed of 19-20 ocelli. Paraterga very strongly pronounced, beginning on segment 2, strongest on segments 9-26, slightly reduced on segment 27, absent from segments 28-31. Metazonital macrochaetae acute, thin, about 0.54 mm long.

Legs long and slender. Leg pairs 3-7 with typical tarsal papillae, extremely incrassate, femora greatly swollen, nearly C-shaped; claw at base with a long ventral seta only. Postgonopodal legs without tarsal papillae; claw at base with a long seta ventrally and two small additional claws dorsally. Legs 10 and 11 usual, with coxal glands, coxae 10 with a short, coniform, setose projection.

Telopodite of anterior gonopod relatively short, slightly curved, thick, a flattened posterior surface smooth. Apex of telopodite simple (Fig. 226). Posterior gonopod in anterior view (Fig. 227) with a large angiocoxite bearing a strong, triangular process. Colpocoxite erect, only slightly curved, with a distinct



Figs 226-227. *Ancestreuma feynmani* (Shear, 1990): 226 – gonopods (caudal view); 227 – gonopods (front view). –Scale absent (after Shear, 1990).



Map 14. Distribution of *Ancestreuma feynmani* (●), *A. subulatum* (▲), *Asiatyla sajanica* (■), *Teleckophoron montanum* (◑) and *Polydesmus denticulatus* (◪) in the Asian part of Russia.

swelling at midway, tip abruptly narrowed, then club-shaped. In posterior view, lateral colpocoxite process absent, mesal process shifted laterally, lying in situ against tip of anterior gonopod telopodite. Posterior angiocoxal process absent. Telopodite of posterior gonopod usual, with a long femur.

Female. Length 16.5-17 mm, width 2.3-2.5 mm with, 1.8-2.0 mm without paraterga. Ocelli 19-20.

DISTRIBUTION (Map 14): Russia: Siberia (Republic of Tuva and the southern part of Krasnoyarsk Province).

REMARKS: This species was originally described in *Diplomaragna* (Shear, 1990), but later transferred to *Ancestreuma* (Mikhaljova, 2000). In the Krasnoyarsk Province, this species, recorded in subtaiga interfluve woodlands, seems rather uncommon, never too abundant (Vorobiova et al., 2002).

Ancestreuma subulatum Mikhaljova, 2000

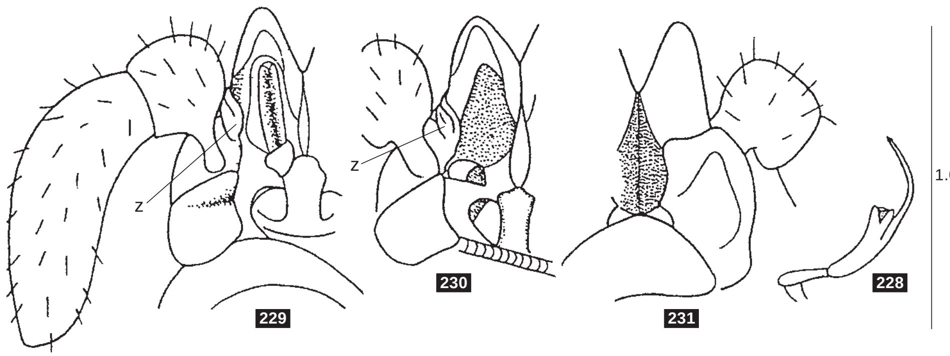
Figs 228-231, Map 14.

Ancestreuma subulatum Mikhaljova, 2000: 157: figs.

Ancestreuma subulatum – Mikhaljova & Golovatch, 2001: 109.

DIAGNOSIS: Differs from congeners by the long, awe-shaped branch of the anterior gonopod telopodites, the absence of colpocoxital and angiocoxal processes, and by the enlarged male somite 7 with strongly inflated paraterga.

DESCRIPTION: Male. Length 13-14 mm, width 1.0-1.1 mm without, 1.5-1.6 mm with paraterga. Coloration in alcohol light beige. Antennae light brown, eyes black, legs brownish, growing increasingly dark distad.



Figs 228-231. *Ancestreuma subulatum* Mikhaljova, 2000: 228 – telopodite of anterior gonopod (lateral view); 229 – gonopods (caudal view); 230 – gonopods (caudal view but without anterior gonopod telopodite); 231 – gonopods (front view); z – posterior fold of angiocoxite. – Scale in mm (after Mikhaljova, 2000).

Body with 32 segments. Eye patches triangular, each composed of 26-27 ocelli. Antennae long. Collum semi-circular. Head with genae equal in width to somite 3. Body width gradually growing until segment 7, body parallel-sided on segments 8-23, onward gradually tapering toward telson. Somite 7 somewhat longer and wider than others, its pleura with a rounded anteroventral projection. Paraterga beginning from segment 2, well-developed on segments 8-26 (caudolateral corners of these segments beak-shaped pointed), like small swellings on segment 28, missing on segments 29-31. Macrochaetae long, not filiform, lying as a highly extended triangle on segments 28 and 29 and arranged typically in a transverse triangle on other segments. Anterolateral and medial macrochaetae subequal in length, caudolateral ones longest, all pointed.

Legs long and slender, each claw with a minute accessory claw at base. Legs 3-7 increasingly enlarged toward gonopods, with typical tarsal papillae. Femora 5-7 swollen and curved. Legs 10 and 11 usual, with coxal glands, each coxa and prefemur bearing a digitiform process of varying length. Coxal process on pair 10 truncate, prefemoral one rounded at tip, both directed ventrad; on pair 11 both coxal and prefemoral processes smaller and rounded at tip, yet former directed caudad while latter ventrad.

Anal valves obtusangular at caudal edge in lateral view, each with three setae. Subanal scale triangular, with a rounded tip and 1+1 setae at caudal margin.

Gonopods in situ placed parallel to main body axis. Anterior gonopod telopodite rodlike, with a gutter on a flattened posterior face as well as a thin, long, awe-shaped anterior process arising at midway (Fig. 228). Broader part of telopodite ending up in a fovea. Posterior gonopods with colpocoxites concave on posterior face (Figs 229-230). Processes of colpocoxite absent. Colpocoxites fused mediobasally up to 2/3 extent, narrowed distally. Each angiocoxite with a caudal globule. A fold (z) instead of a definite posterior angiocoxal process. Angiocoxite in anterior view with a central depression (Fig. 231), mesal corner somewhat elongated. Posterior gonopod telopodite usual, with a long femur; prefemur with a thick stem.

Female. Length 15 mm, width 1.2 mm without, 1.7 mm with paraterga. Ocelli 29.

DISTRIBUTION (Map 14): Russia: Siberia (Irkutsk Area).

REMARKS: The species has been found in moss as well as forest litter, also taken by pitfall trapping.

Ancestreuma ramiferum Mikhaljova, 2000

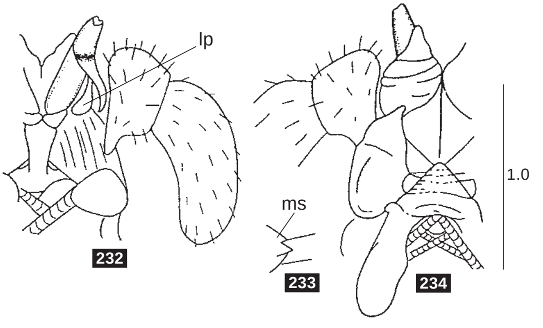
Figs 232-234, Map 13.

Ancestreuma ramiferum Mikhaljova, 2000: 156: figs.
Ancestreuma ramiferum - Mikhaljova & Golovatch, 2001: 109.

DIAGNOSIS: The species differs from congeners by the long branches of the anterior gonopod telopodites as well as the short colpocoxites of the posterior gonopods.

DESCRIPTION: Male. Length 18-18.5 mm, width 0.9-1.0 mm without, 1.4-1.5 mm with paraterga. Coloration in alcohol light tan, with a transverse, light marbled brown band dorsally on metazona. Antennae brown, eyes black, legs beige with marbled brown distal parts.

Body with 32 segments. Eye patches triangular, each composed of 27-28 ocelli. Genae elongated in lateral view. Antennae long. Collum semi-circular. Body width gradually growing until segment 7, body parallel-sided on segments 8-24, onward gradually tapering. Paraterga beginning from segment 2, well-



Figs 232-234. *Ancestreuma ramiferum* Mikhaljova, 2000: 232 – gonopods (caudal view); 233 – tip of posterior gonopod colpocoxite; 234 – gonopods (front view); lp – lateral process of colpocoxite; ms – mesal process of colpocoxite. – Scale in mm (after Mikhaljova, 2000).

developed on segments 8-27 (caudolateral corners of these segments beak-shaped pointed), with tubercles instead of paraterga on segment 28, and small swellings on segment 29, without traces of paraterga on subsequent segments. Paraterga 5-7 shorter and thicker than subsequent ones. Macrochaetae long, setiform, forming a highly extended triangle on segments 28 and 29 and a typical triangle on remaining segments. Anterolateral macrochaetae shorter than others, caudolateral ones longest, all pointed.

Legs long and slender, claws with a minute accessory claw at base. Legs 3-7 increasingly enlarged toward gonopods. Femora 5-7 swollen and curved. Coxa 7 with a ventral swelling. Legs 10 and 11 usual, with coxal glands, each of coxae 10 and 11 with a stump-like protuberance with a fovea at tip. Coxa 12 a little enlarged compared to subsequent ones.

Anal valve obtusangular and with three setae at caudal margin in lateral view. Subanal scale subtriangular, rounded at tip, with two setae.

Gonopods somewhat curved caudad. Anterior gonopod telopodite banana-shaped, flattened on posterior face, with a fovea on top and a long, linguiform branch posteriorly (Fig. 232). Colpocoxite shorter than or subequal in length to anterior gonopod telopodites. Both colpocoxites fused mediobasally to 2/3 extent, serrate at tip (Fig. 233), with a plate-shaped lateral process (lp) partly embracing the telopodite of anterior gonopod laterally. Mesal process of colpocoxite (ms) very small, positioned subapically (Fig. 233). Each angiocoxite with a caudal globule and a small front depression. Angiocoxite anteriorly extended into a digitiform process (Fig. 234). Posterior angicoxal process absent. Posterior gonopod telopodite usual, with a long femur.

Female unknown.

DISTRIBUTION (Map 13): Russia: Siberia (Republic of Tuva).

REMARKS: This species has been collected both in *Abies-Larix* taiga forest and mountainous tundra habitats at 2,300 m a.s.l.

Ancestreuma longibrachiatum **(Shear, 1990)**

Figs 235-253, Map 15.

Diplomaragna longibrachiata Shear, 1990: 15, 14: figs.

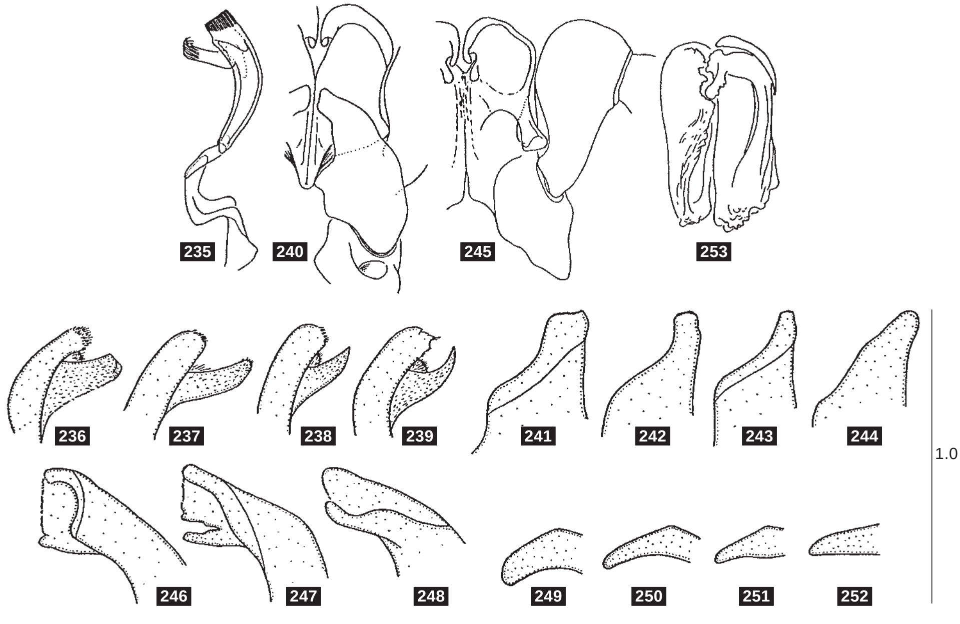
Ancestreuma longibrachiatum - Mikhaljova, 2000: 155; 2002b: 203, 205: figs; Mikhaljova & Golovtach, 2001: 109.

Diplomaragna longibrachiata - Mikhaljova, 1993: 25.

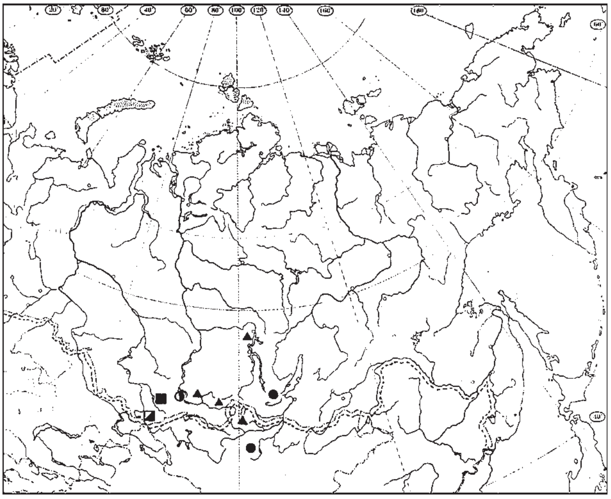
DIAGNOSIS: The species differs from congeners by shape of both anterior gonopod telopodite and the lateral process of the posterior gonopod colpocoxite.

DESCRIPTION: Male. Length 15-17 mm, width of midbody segments 2.2-2.3 mm with, 1.0-1.1 mm without paraterga. Width at metazonite 6, 2.13 mm. Coloration in alcohol uniform light brown either with a brown transverse piece on metazona or medium brown, mottled brownish purple on posterior parts of metazonites, antennae and anterior legs. Eyes black.

Body with 32 segments. Genae oval frontally. Eye patches triangular, each composed of 27-33 ocelli. Antennomere 3, 0.60 mm long. Collum semi-circular. Head with genae equal in width to somite 3. Somite 2 narrower than both head with genae and somite 3. Body width gradually growing until segment 7, body parallel-sided on segments 8-22, onward gradually tapering. Segment 7 somewhat longer and wider than others, its paraterga like swellings, its pleura with an anteroventral projection. Paraterga beginning from segment 2, well-developed on segments 9-26 (caudolateral corners on these segments beak-shaped pointed), somewhat reduced on segment 27, missing on segments 28-32. Macrochaetae acute, thin, about 0.4 mm long, forming a highly extended triangle on segments 27 and 29, and a typical triangle on other segments. On midbody segments,



Figs 235-253. *Ancestreuma longibrachiatum* (Shear, 1990): 235 – anterior gonopod (lateral view); 236-239 – variation in distal part of anterior gonopod telopodite (lateral view); 240 – posterior gonopod (front view); 241-244 – variation in apex of gonopod colpocoxite (ventral view); 245 – posterior gonopod (caudal view); 246-248 – variation in mesal process of colpocoxite (lateral view); 249-252 – variation in lateral process of colpocoxite (mesal view); 253 – vulva (ventral view). – Scale in mm, 235, 240, 245 & 253 without scale (235, 240, 245, 253 – after Shear, 1990; 236-239, 241-244, 246-248, 249-252 – after Mikhaljova, 2002b).



Map 15. Distribution of *Ancestreuma longibrachiatum* (▲), *Asiatyla communicantis* (●), *Shearia teletskaya* (■), *Shearia shushenskaya* (◑) and *Altajosoma katunicum* (◪).

anterolateral, medial and caudolateral macrochaetae subequal in length. On front segments, anterolateral and caudolateral macrochaetae subequal in length, medial ones longest.

Legs long and slender. Legs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods, incrassate, pairs 5-7 much larger, femora swollen and curved; claw with a long vental seta at base but without additional dorsal claws. Postgonopodal legs with a group of funnel-shaped tarsal papillae distally; hind legs without tarsal papillae; claw at base with a long seta ventrally and two small additional claws dorsally. Legs 10 and 11 usual, with coxal glands. Coxa 10 bearing a conical process with apical setae, prefemur with a mesal knob. Coxa 11 with a bare, trapezoid, flat process.

Anterior gonopod telopodite (Fig. 235) large, broad, strongly curved posteriad, with a simple tip; latter covered with a thin, subfimbriate cuticle and with a long subapical branch fimbriate apically. Subapical branch ranging from almost pointed to blunt apically (Figs 236-239). Posterior gonopod angiocoxite with large anterior process ending up in a quadrate tip (Fig. 240). Posterior angiocoxal process absent. Colpocoxites fused at base, diverging apically, then converging, strongly curved. Apex of colpocoxite ranging from narrow to oval (Figs 241-244). Mesal process of colpocoxite lying well distally of midlength (Fig. 245), width varied (Figs 246-248). Lateral process of colpocoxite very long, ranging from blunt with a subapical projection to pointed without distinct subapical projection (Figs 249-252). Posterior gonopod telopodite usual, with a long femur with or without claw vestige apically.

Female. Length about 15.5 mm, width 2.4-2.5 mm with, 1.9-2.0 mm without paraterga. Width at metazonite 6, 2.21 mm. Antennomere 3, 0.65 mm long. Eye patches triangular, each composed of 25-28 ocelli. Genae triangular frontally. Caudolateral macrochaetae everywhere longest, medial and anterolateral ones subequal in length. Vulvae (Fig. 253) strongly elongated longitudinally, without convex areas, lacking prominent lamellae.

DISTRIBUTION (Map 15): Russia: Siberia (southern part of Krasnoyarsk Province, Irkutsk Area, Republic of Tuva); northern part of Mongolia.

REMARKS: This species was originally described in *Diplomaragna* (Shear, 1990), later transferred to *Ancestreuma* (Mikhaljova, 2000).

Genus *Asiatyla* Mikhaljova, 2000

DISTRIBUTION: Russia: Southwest and Southeast Siberia; northern part of Mongolia. This genus contains four species, of which three occur in Siberia.

The main distinguishing characters are as follows. Body with 32 segments; paraterga of medium size; anterior gonopod telopodites not sheathed, base of each telopodite more or less dilated, distal part acuminate; posterior gonopods with colpocoxites fused basally; colpocoxite entire; mesal process of colpocoxite small or obsolete; lateral process of colpocoxite like a lamellar shelf; femur of posterior gonopod telopodite long.

REMARKS: In this genus, both telopoditomeres 1 and 2 of the anterior gonopod are divided not by a suture but by a shallow constriction which is up to obsolete in some individuals. Hence articulation is hardly traceable. However, the presence of the posterior wall alone at the base of the anterior gonopod telopodite and its considerable width allow to discriminate segment 1.

Key to species of *Asiatyla*:

1(2) Tip of posterior gonopod colpocoxite strongly narrowed (Fig. 258). Telopodite of anterior gonopod without branch (Fig. 259). .... *A. communicantis*

2(1) Tip of posterior gonopod colpocoxite different. Telopodite of anterior gonopod with a branch 3

3(4) Tip of posterior gonopod colpocoxite without lateral process (Fig. 266). .... *A. similata*

4(3) Tip of posterior gonopod colpocoxite with a lateral process (Fig. 271)... .... *A. sajanica*

Asiatyla communicantis **(Golovatch, 1977)**

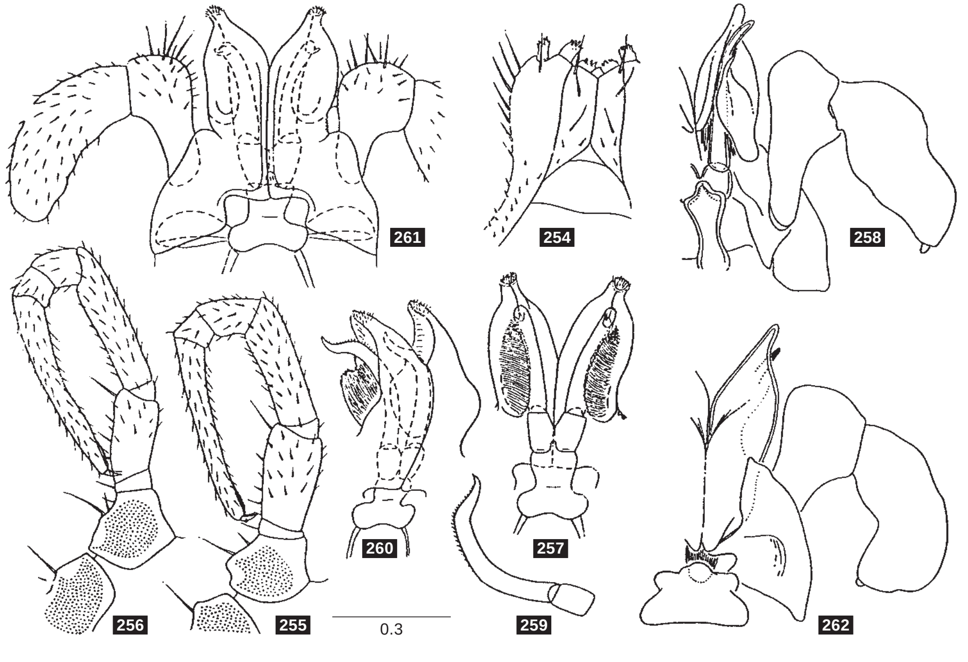
Figs 254-262, Map 15.

Asiatyla communicantis - Mikhaljova & Golovatch, 2001: 109.

DIAGNOSIS: This species differs from congeners by the slenderer anterior gonopod telopodite lacking a branch and by the configuration of the posterior gonopod, i.e. a narrowed tip of the colpocoxite, the shape of the lateral colpocoxite process, the presence and shape of the anterior angiocoxal process, the absence of a posterior angiocoxal process.

DESCRIPTION: Male. Length 12.0-12.2 mm, width 1.0 mm without, 1.6 mm with paraterga. Coloration yellow-brown. Paraterga and legs yellow.

Lamellae linguales of gnathochilarium with three long and three short setae (Fig. 254). Body with 32 segments, rather broad. Paraterga beginning on segment 2, relatively well-developed on midbody segments, reduced on segments 28-29, onward missing.



Figs 254-262. *Asiatyla communicantis* (Golovatch, 1977): 254 – gnathochilarium; 255 – male leg pair 10; 256 – male leg pair 11; 257-258 – gonopods (caudal view); 259 – telopodite of anterior gonopod (lateral view); 260 – gonopods (submesal view); 261-262 – gonopods (front view). – Scale in mm, 258 & 262 without scale (254-257, 259-261 – after Golovatch, 1977; 258, 262 – after Shear, 1990).

Legs long. Claw at base with a long seta ventrally and a small additional claw dorsally. Leg pairs 3-7 increasingly enlarged toward gonopods, with typical tarsal papillae. Postgonopodal legs with a group of tarsal papillae distally; hind legs without tarsal papillae; Legs 10 (Fig. 255) and 11 (Fig. 256) usual, with coxal glands.

Anterior gonopod telopodites 2-segmented (Figs 257-258), basal telopoditomere less dilated; an acuminate telopoditomere 2 like a setose strip ventrally (Figs 259). Basally fused colpocoxites of posterior gonopods strongly curved caudad in distal 2/3 extent, with narrow tips and relatively broad lateral processes, latter free from colpocoxite in their distal part; mesal processes blade-like, forming the edge of colpocoxite (Fig. 260). Apex of colpocoxite with or without short setae. Angiocoxite with an anterior process of varying length (Figs 261-262) but without posterior process. Posterior gonopod telopodite usual, with a long femur.

Female. Length 12.5-13 mm, width 1.3 mm without, 1.9 mm with paraterga.

DISTRIBUTION (Map 15): Mongolia (Ara-Khangai Aimak), Russia: Siberia (Irkutsk Area).

REMARKS: This species was originally described in *Ancestreuma* (Golovatch, 1977), but it has since been transferred first to *Diplomaragna* (Shear, 1990), then to *Asiatyla* (Mikhaljova, 2000).

Asiatyla similata **Mikhaljova, 2000**

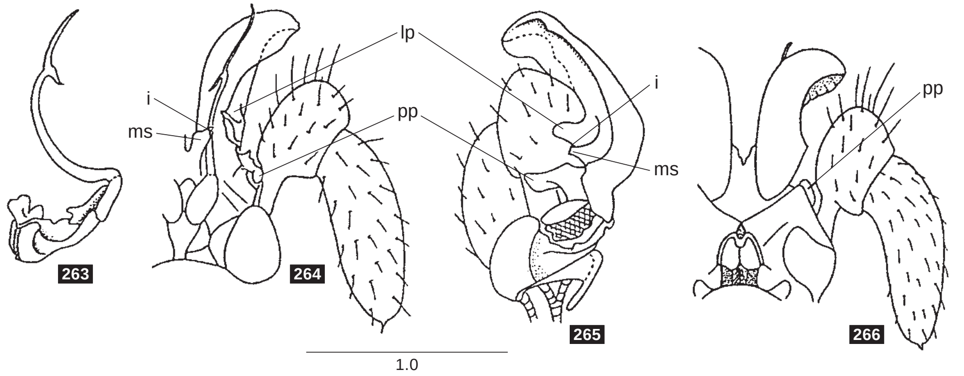
Figs 263-266, Map 16.

Asiatyla similata Mikhaljova, 2000: 158: figs.
Asiatyla similata - Mikhaljova & Golovatch, 2001: 110.

DIAGNOSIS: Closely related to *A. sajanica*, but distinguished by the oval tip of the colpocoxite, the latter being without lateral process, and the peculiar shape of the mesal process of the colpocoxite, the latter carrying a small apical outgrowth.

DESCRIPTION: Male. Length 17 mm, width 1.0 mm without, 1.5 mm with paraterga. Coloration in alcohol light beige without pattern of spots or stripes. Antennae light brown, eye patches black, legs beige, with brownish distal parts.

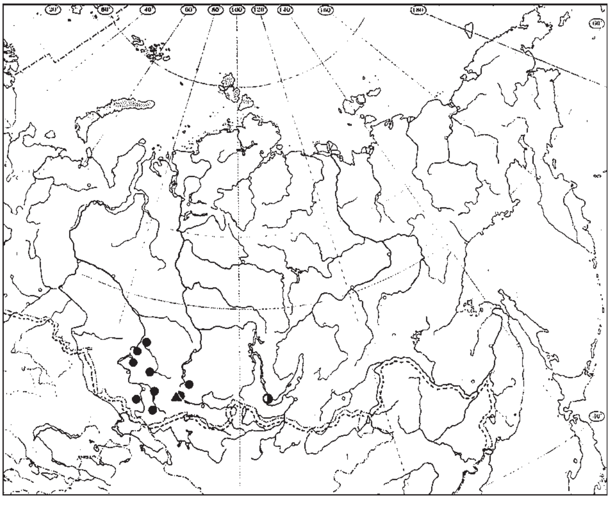
Body with 32 segments. Eye patches triangular, each composed of 30-32 ocelli, individual ocelli can also be near antennal sockets. Antennae long. Collum close to obcordate. Body width gradually growing until segment 7, body parallel-sided on segments 8-24, onward gradually tapering toward telson. Paraterga beginning from segment 2, well-developed on segments 4-27, shorter and thicker on segments 4-7, like small swellings on segment 28, missing on segments 29-31.



Figs 263-266. *Asiatyla similata* Mikhaljova, 2000: 263 – anterior gonopod (lateral view); 264 – gonopods (caudal view); 265 – gonopods (mesal view); 266 – gonopods (front view); i – projection of mesal process of colpocoxite; lp – lateral process of colpocoxite; ms – mesal process of colpocoxite; pp – posterior angiocoxal process. – Scale in mm (after Mikhaljova, 2000).

Macrochaetae long, non-filiform, forming a highly extended triangle on segments 28 and 29 and arranged typically in a transverse triangle on preceding segments. Anterolateral and medial macrochaetae subequal in length, caudolateral ones longest, all pointed. Anal valves obtusangular and supplied with 3+3 setae at caudal edge in lateral view. Subanal scale subtriangular, with a rounded tip and 1+1 setae.

Legs long and slender, claws with a minute accessory claw at base. Legs 3-7 increasingly enlarged toward gonopods, with typical tarsal papillae. Femora 5-7 swollen and curved. Legs 10 and 11 usual, with coxal glands. Coxa 10 with a rodlike process, coxa 11 with a digitiform process.



Map 16. Distribution of *Altajosoma bakurovi bakurovi* (●), *A. bakurovi longiprocessum* (▲) and *Asiatyla similata* (◑).

Gonopods slightly inclined caudally. A T-shaped coxal part of anterior gonopod coxosternum carrying a longitudinal ridge. Telopodite of anterior gonopods 2-segmented. Basal telopoditomere strongly dilated, an acuminate distal part with a long apical branch serrate at fore edge (Fig. 263). Tips of posterior gonopod colpocoxites curved posteriorly. Mesal processes (ms) of colpocoxites small, both fused basally, each with an apical projection (i) (Figs 264-265). Lateral process of colpocoxite (lp) plate-like, with a central prominence. Angiocoxite with a globule in posterior view and with a depression in anterior view. Posterior angiocoxal process (pp) rather long. Anterior angiocoxal process absent (Fig. 266). Posterior gonopod telopodite usual, with a long femur carrying a claw vestige apically.

Female unknown.

DISTRIBUTION (Map 16): Russia: Siberia (Irkutsk Area).

REMARKS: The species has been collected in a leafy stand.

Asiatyla sajanica **(Gulièka, 1972)**

Figs 267-274, Map 14.

Altajosoma sajanica (recte: *-um*) Gulièka, 1972: 38, 37: fig.

Altajosoma sajanicum - Lokšina & Golovatch, 1979: 382.

Ancestreuma boreale Golovatch, 1979a: 336, 337: figs; Lokšina & Golovatch, 1979: 382.

Diplomaragna borealis - Shear, 1990: 18, 17 and 20: figs; Mikhaljova, 1993: 18.

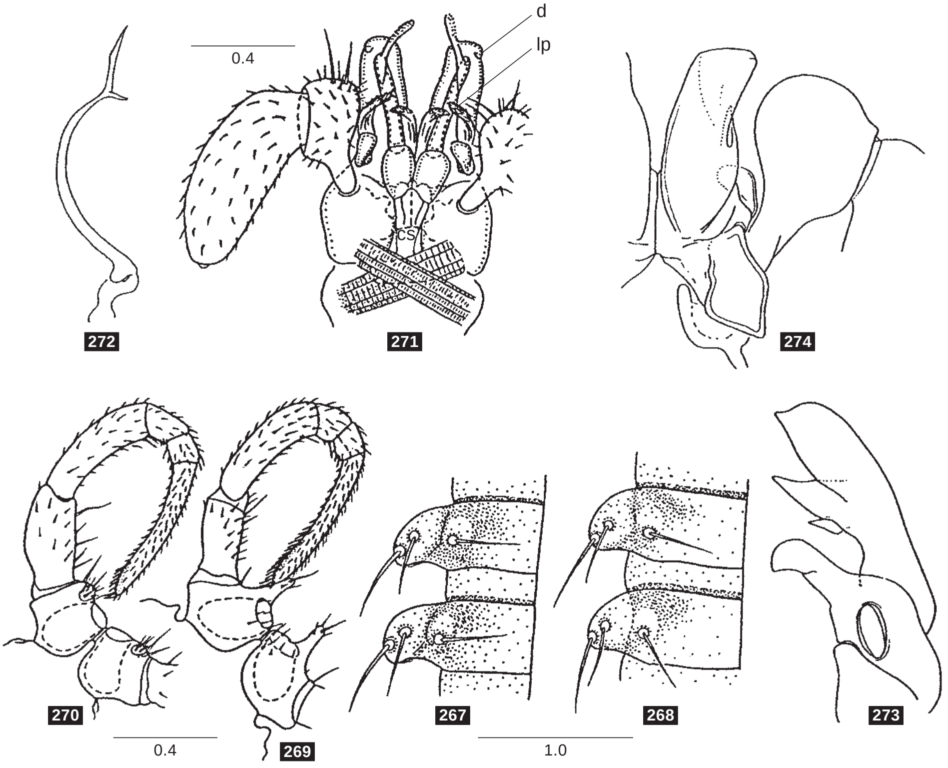
Diplomaragna sajanica - Shear, 1990: 39; Mikhaljova, 1993: 25.

Asiatyla sajanica - Mikhaljova, 2000: 159; Mikhaljova & Golovatch, 2001: 109; Vorobiova et al., 2002: 60; Rybalov, 2002.

DIAGNOSIS: The species differs from congeners by the configuration of the anterior gonopod telopodite with a bifurcated apex and of both the colpocoxite tip and mesal processes, as well as by the presence of a posterior angiocoxal process and the absence of an anterior angiocoxal process.

DESCRIPTION: Male. Length 12-15 mm, width 1.2-1.3 mm without, 1.8-1.9 mm with paraterga. Coloration yellowish tan or withish. Eyes black.

Body with 32 segments. Eye patches triangular, each composed of 28-30 ocelli. Stipites of gnathochilarium with dense setae, latter in apical part longest. Each lamella lingualis with three short basal setae in a triangle and three long distal setae in a longitudinal row. Suture between lamellae linguales broad and deep. Antennae very long. Antennomere 2 ca. 2 times shorter than 3rd, somewhat shorter than 4th, ca. 1.5 times shorter than 5th but somewhat longer than 6th. Collum oval, with a very weak projection laterally. Both collum and somite 2



Figs 267-274. *Asiatyla sajanica* (Gulièka, 1972): 267 – male midbody segments (dorsal view); 268 – female midbody segments (dorsal view); 269 – male leg pair 10; 270 – male leg pair 11; 271 – gonopods (caudal view); 272 – telopodite of anterior gonopod (lateral view); 273 – colpocoxite of posterior gonopod (mesal view); 274 – posterior gonopods (front view); d – lateral tooth; lp – lateral process of colpocoxite. – Scales in mm, 272-274 without scale (267-271 – after Golovatch, 1979a; 272-274 – after Shear, 1990).

visibly narrower than head with genae. Body width gradually growing until segment 7, body parallel-sided on segments 8-25, onward gradually tapering. Paraterga beginning from segment 2, well-developed on segments 5-27 (caudolateral corners on these segments beak-shaped pointed). Paraterga developed better in male (Fig. 267) than in female (Fig. 268). Distal part of paraterga visibly curved upwards.

Legs long and slender. Leg pairs 3-7 increasingly enlarged toward gonopods, with typical tarsal papillae; claws at base with a long ventral seta only. Postgonopodal legs without tarsal papillae; each claw at base with a long seta ventrally and two small additional claws dorsally. Legs 10 and 11 usual, with coxal glands. Coxa 10 with a digitiform setigerous process ventrally (Fig. 269). Coxa 11 with a small pad covered with setae ventrally (Fig. 270).

Anterior gonopods (Fig. 271) with 2-segmented telopodites, basal telopoditomere strongly dilated, apex bifurcated, carrying a long apical branch serrate at fore edge (Fig. 272). Basally fused posterior gonopod colpocoxites each with a lateral tooth (d) subapically. A lateral process of colpocoxite (lp) like a plate with a central prominence (Figs 271, 273). Small mesal processes fused basally, without projections. Angiocoxite with a posterior process but without anterior one (Fig. 274). A long femur of posterior gonopod with a claw vestige.

Female. Length 13-16 mm, width 1.4-1.5 mm without, up to 2.0 mm with paraterga. Distal part of paraterga somewhat curved upwards.

DISTRIBUTION (Map 14): Russia: Siberia (Tuva, central part of Krasnoyarsk Province).

REMARKS: This species, originally described in *Altajosoma* (Gulièka, 1972) and, later, transferred to *Diplomaragna* (Shear, 1990), is a senior subjective synonym of *Ancestreuma boreale* (Golovatch, 1979a) (Mikhaljova, 2000). It is relatively abundant in the subzones of southern and middle taiga, as well as in subtaiga stands; in the Krasnoyarsk Province, the numbers range from 4 to 12 ind./m² (Vorobiova et al., 2002).

Genus *Orientyla* Mikhaljova, 2000

DISTRIBUTION: Russia: Southern Far East, East Siberia; North Korea. This genus contains three species. The Asian part of Russia supports two species.

The main distinguishing characters are as follows. Body with 32 segments; paraterga normal, of medium size; anterior gonopod telopodite subflagelliform, placed inside a sheath groove of posterior gonopod colpocoxite; colpocoxites of posterior gonopods flattened on sides, not sagittally, curved anteriad (i.e. tip of colpocoxite directed anteriorly, not posteriorly); each colpocoxite entire; lateral sheath process of colpocoxite very long and broad; anterior angiocoxal process of posterior gonopod present; posterior angiocoxal process of posterior gonopod small or absent.

Key to species of *Orientyla*:

1(2) Lateral edge of posterior gonopod colpocoxite like a narrow bolster (Fig. 281) .... *O. dahurica*

2(1) Lateral edge of posterior gonopod colpocoxite like a wide lobe (Fig. 276) .... *O. bureyinskaya*

Orientyla bureyinskaya (Mikhaljova, 1997)

Figs 275-278, Map 13.

Diplomaragna bureyinskaya Mikhaljova, 1997b: 125, 126: figs.

Diplomaragna bureyinskaya - Mikhaljova, 1998b: 34: figs, 32: map.

Orientyla bureyinskaya - Mikhaljova, 2000: 171, 170: figs; Mikhaljova & Marusik, 2004: 5.

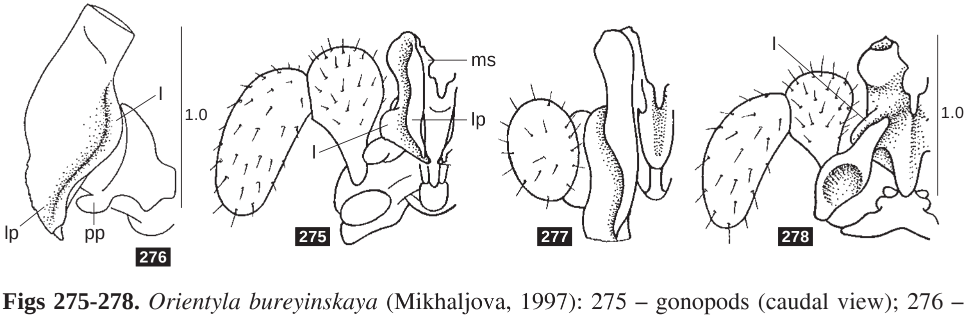
DIAGNOSIS: The species differs from congeners by the large lateral sheath processes of the colpocoxite, each carrying a lobe embracing the colpocoxite, the latter is strongly curved forward.

DESCRIPTION: Male. Length 18-19 mm, width 1.3-1.5 mm without, 1.8-2.0 mm with paraterga. Coloration in alcohol light brown. Antennae brown, distal parts of legs marbled brown, eyes black.

Body with 32 segments. Eye patch triangular, each composed of 29-30 ocelli. Antennae long. Collum semi-circular. Paraterga beginning on segment 2, well-developed on segments 4-27 (on segments 8-27 their caudolateral corners beak-shaped pointed), reduced on segments 28-29, onward missing. Curved paraterga 6-27 supporting a tiny knob at very tip.

Legs long. Leg pairs 3-7 strongly enlarged, with typical tarsal papillae. Legs 10 and 11 usual, with coxal glands.

Anterior gonopods with 1-segmented subflagelliform telopodites, each with a tiny tooth apically. Margins of colpocoxite sheath grooves converging distad and completely sheathing the apices of telopodites (Fig. 275). Colpocoxites of posterior gonopods fused basally, apically with a fovea terminating the sheath groove. A large, lateral, elongated process of colpocoxite (lp) supporting a broad and subtransverse lobe (l) embracing the colpocoxite laterally and frontally (Figs



Figs 275-278. *Orientyla bureyinskaya* (Mikhaljova, 1997): 275 – gonopods (caudal view); 276 – posterior gonopod (lateral view, telopodite removed); 277 – gonopods (frontoventral view); 278 – gonopods (front view); l – lobe of colpocoxite lateral sheath process; lp – colpocoxite lateral sheath process; ms – colpocoxite mesal sheath groove process, pp – posterior angiocoxal process. – Scales in mm (275, 277-278 – after Mikhaljova, 1997b; 276 – after Mikhaljova, 2000).

276-277); mesal processes each (ms) like a small lobe placed inside distal part of sheath groove. Angiocoxite in posterior view with a globule and a small posterior process (pp). In anterior view (Fig. 278), angiocoxite strongly depressed, with large dentiform process lying inside groove on colpocoxite. Posterior gonopod telopodite usual, femur long.

Female. Length 19-20 mm, width 1.6-1.7 mm without, 2.1-2.2 mm with paraterga. Ocelli 27-29.

DISTRIBUTION (Map 13): Russia: Far East (Khabarovsk Province).

REMARKS: This species, originally described in *Diplomaragna* (Mikhaljova, 1997b), was later transferred to *Orientyla* (Mikhaljova, 2000). This species has been collected in a *Larix* taiga forest with *Picea* and *Pinus pumila* at 900-1,400 m a.s.l.

Orientyla dahurica **(Gerstfeldt, 1859)**

Figs 279-283, Map 13.

Craspedosoma dahuricum Gerstfeldt, 1859: 272; Lokšina & Golovatch, 1979: 383.

Diplomaragna mikhaljovae Shear, 1990: 19, 20: figs.

Diplomaragna mikhaljovae - Mikhaljova, 1993: 25; 1998b: 35, 34: figs, 32: map; Ganin, 1997: 10.

Orientyla mikhaljovae - Mikhaljova, 2000: 171: fig.

Orientyla dahurica - Mikhaljova & Golovatch, 2001: 110; Mikhaljova & Korsós, 2003: 219; Mikhaljova & Marusik, 2004: 5.

DIAGNOSIS: The species differs from congeners by the configuration of the colpocoxite with its lateral narrow bolster getting fused to the lateral sheath process, the basal part of the sheath grooves supplied with fused mesal sheath processes, and the presence of posterior angiocoxal processes.

DESCRIPTION: Male. Length about 20-22 mm, width at metazonite 6, 2.86 mm. Coloration light brown. Antennae and legs darker marbled purplish brown. Eyes black.

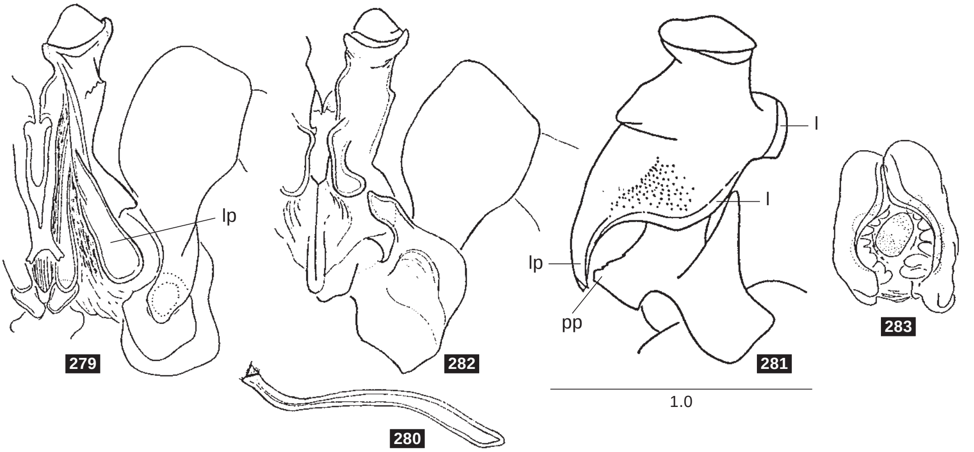
Body with 32 segments. Eye patches triangular, each composed of 25-27 ocelli. Antennomere 3, 1.04 mm long. Paraterga beginning on collum, strongest on segments 9-22, at first planar, then becoming angled dorsad, thinner, longer; abruptly smaller on segment 27, absent from segments 28-31. Macrochaetae acute, thin, about 0.65 mm long.

Legs long and slender. Leg pairs 3-7 with typical tarsal papillae, incrassate, pairs 5-7 much larger, femora swollen and curved; claws at base with a long ventral seta only. Postgonopodal legs with a group of papillae in distal part of tarsus only; claw at base with a long seta ventrally and two small additional claws dorsally. Coxae 10 and 11 usual, with glands.

Telopodites of anterior gonopods (Fig. 279) 2-segmented, subflagelliform. Tip of telopodite slightly swollen (Fig. 280). Colpocoxites of posterior gonopods fused at base, their distal parts each with a deep groove setting off a cap-like apex. Colpocoxite with a small, lamellar, subtriangular projection subapically. A lateral sheath process of colpocoxite (lp) large and broad, its distal part flattened dorsoventrally. A mesal sheath process of colpocoxite bipartite; basal parts of both mesal sheath processes fused medially, distal parts placed inside distal ends of sheath grooves, each like a lobe with a serrate external edge. A posterior angiocoxal process (pp) absent according to the original description (Shear, 1990), but present (Fig. 281) according to a restudy of topotypes (Mikhaljova, 2000). In anterior view (Fig. 282), colpocoxite with an outgrowth in the middle of front face. Angiocoxite strongly depressed on anterior face, with an apically blunt process fitting into grooves on colpocoxite at base of the outgrowth. An anterior outgrowth of colpocoxite shifted to lateral edge and, being like a narrow bolster (l) getting fused to lateral sheath process, embracing the colpocoxite subtransversely. Posterior gonopod telopodite usual, femur long, often with a claw vestige.

Female. Length about 22 mm, width at metazonite 6, 2.7 mm. Antennomere 3, 1.0 mm long. Ocelli 26-28. Vulva as in Fig. 283.

DISTRIBUTION (Map 13): Russia: Siberia (eastern part of Chita Area, the border between the Chita and Amurskaya areas), Far East (Primorsky Province, Amurskaya Area); North Korea.



Figs 279-283. *Orientyla dahurica* (Gerstfeldt, 1859): 279 – gonopods (caudal view); 280 – telopodite of anterior gonopod (lateral view); 281 – posterior gonopod (lateral view, telopodite removed); 282 – posterior gonopod (anterior view); 283 - vulva (ventral view); pp – posterior angiocoxal process; lp – lateral sheath process of colpocoxite; l – bolster of lateral sheath process of colpocoxite. – Scale in mm, 279-280, 282-283 without scale (279-280, 282-283 – after Shear, 1990; 281 – after Mikhaljova, 2000).

REMARKS: Originally described as *Craspedosoma dahuricum* from near the mouth of Shilka River, Chita Area (Gerstfeldt, 1859), this species is currently considered as a senior subjective synonym of *Orientyla mikhaljovae* (Shear, 1990) = *Diplomaragna mikhaljovae* Shear, 1990, a form described from the Ussuriysky Nature Reserve in Primorsky Province and from the Khingan State Reserve in Amurskaya Area (Shear, 1990).

The species lives in the litter of mixed and broadleaved forests. In the woodlands of Malyi Khingan Mt. Range, the numbers range between 7.0 and 18.0 ind./m² (Ganin, 1997).

Genus *Sakhalineuma* Golovatch, 1976

DISTRIBUTION: Russia: Far East (Sakhalin Island and Kurile Islands). Six species.

The main distinguishing characters are as follows. Body with 32 segments; paraterga normal, medium-sized; anterior gonopod telopodite flagelliform, placed inside a sheath groove of posterior gonopod colpocoxite; posterior gonopod colpocoxite with a front prominence; lateral sheath process of colpocoxite present; mesal sheath process of colpocoxite virtually undeveloped, wave-shaped; colpocoxites scarcely fused basally; each colpocoxite entire; angiocoxite with a mesal process but with neither anterior nor posterior processes; femur of posterior gonopod telopodite rather short.

REMARKS: Identification of the number of anterior gonopod telopoditomeres is difficult, as the division suture between the two supposed joints is absent. However, in some species there is a constriction of varying depth; in addition, the translucent posterior wall of the base of the telopodite can provide an illusion of joint 1 present. Hence, the number of segments of the anterior gonopod telopodite in the different descriptions can vary.

Key to species of *Sakhalineuma*:

1(2) A flagelliform telopodite of anterior gonopod spiralling (Figs 287, 289). .... *S. basarukini*

2(1) A flagelliform telopodite of anterior gonopod not coiled into a spiral..... 3

3(4) Male coxa 11 with a digitiform process. Lateral sheath process of posterior gonopod colpocoxite tuberculiform (Figs 292-293) .... *S. tuberculatum*

4(3) Male coxa 11 without processes. Lateral sheath process of posterior gonopod colpocoxite different. 5

5(6) Lateral sheath process of posterior gonopod colpocoxite globuliform (Fig. 297) .... *S. globuliferum*
6(5) Lateral sheath process of posterior gonopod colpocoxite different. 7
7(8) Front prominence of colpocoxite well-developed, dictinctly delimiting a distal hollow (Fig. 300). Lateral sheath process of colpocoxite cylindrical, curved (Figs 299-300). .... *S. curvatum*
8(7) Front prominence of colpocoxite either poorly expressed or obliterated distally, not demarcated by a hollow. Lateral sheath process of colpocoxite different. 9
9(10) Lateral sheath process of colpocoxite broad, with a blunt apex (Fig. 305). .... *S. molodovae*
10(9) Lateral sheath process of colpocoxite conical, with a pointed apex (Fig. 308). .... *S. sakhalinicum*

Sakhalineuma basarukini **(Mikhaljova, 1995)**

Figs 284-290, Map 17.

Diplomaragna basarukini Mikhaljova, 1995: 82, 81: figs.

Diplomaragna basarukini - Mikhaljova & Basarukin, 1995: 94, 93: map; Mikhaljova, 1998b: 21, 20: figs, 19: map.

Sakhalineuma basarukini - Mikhaljova, 2000: 172.

DIAGNOSIS: The species differs from congeners by the peculiar, spiralling anterior gonopod telopodite, the shape of the colpocoxite processes, the presence of processes on male coxae 10 and 11, and the larger body size.

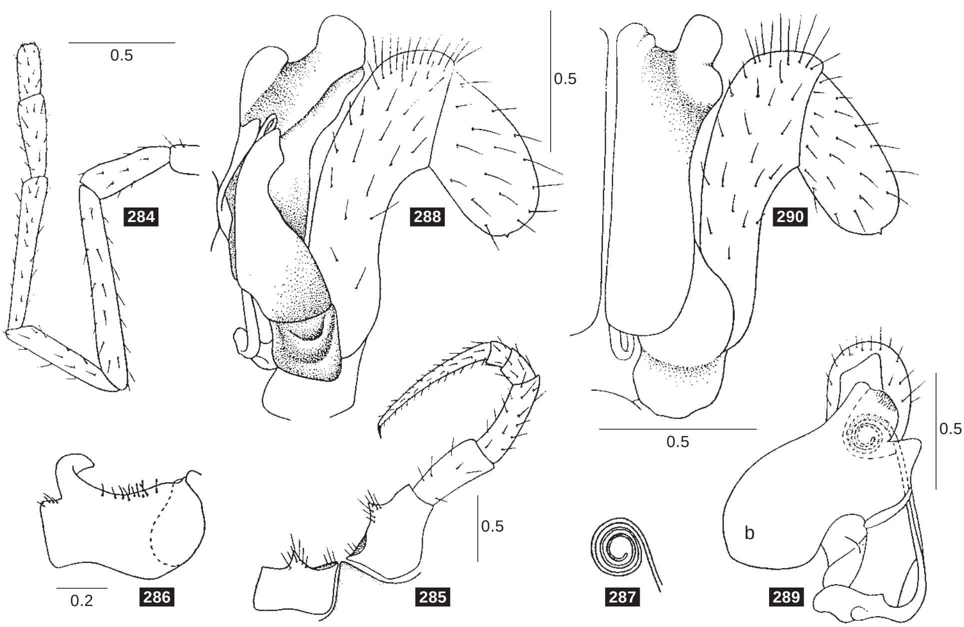
DESCRIPTION: Male. Length 18.5-21 mm, width 1.5-1.7 mm without, 2.0-2.3 mm with paraterga. Coloration in alcohol light brown with a transverse brown band at hind edge of metazonites. Legs marbled brown, antennae brown, eyes black.

Body with 32 segments. Gnathochilarium with several setae on outer sides of stipites and a few on lamellae linguales. Eye patches triangular, each composed of 28-30 ocelli. Antennae very long (Fig. 284). Collum semi-circular. Both collum and segment 2 narrower than head with genae. Body gradually growing in width until segment 7, parallel-sided on segments 8-23, onward gradually tapering toward telson. Paraterga beginning on segment 2, reduced on segments 28-29, absent from 30-31, on segments 8-27 their caudolateral corners beak-shaped pointed. Anterolateral macrochaetae shorter than others, posterolateral ones longest. Apex of all macrochaetae pointed.

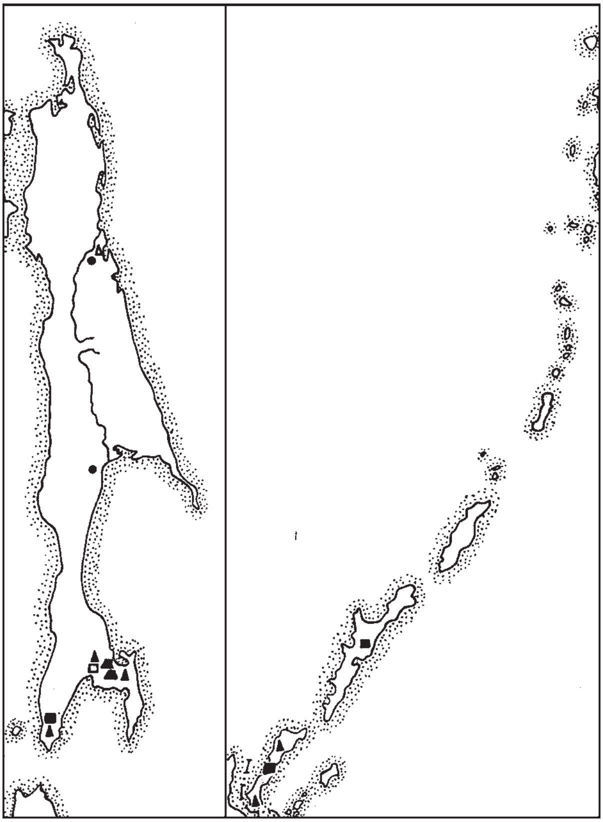
Legs long and slender. Leg pairs 3-7 with typical tarsal papillae. Coxae 3-6 each with a small ventral swelling increasing in size toward leg 6. Coxa 7 with a low hoof-shaped swelling. Legs 10 and 11 usual, with coxal glands. Coxa 10 setose, with a coniform process (Fig. 285). Coxa 11 with an unciform distal process ventrally (Fig. 286).

Coxal part of anterior gonopod coxosternum long. Flagelliform telopodites of anterior gonopods 1-segmented, characteristically spiralling (Fig. 287). Sheath groove of posterior gonopod colpocoxite formed by wave-shaped mesal and lateral processes, deep and open-edged (Fig. 288). Distal part of this sheath groove forming a receptacle for the spiral (Fig. 289). Basally scarcely fused posterior gonopod colpocoxites each with an external distal branch; a front prominence (b) large, drop-shaped. Angiocoxites depressed on anterior surface (Fig. 290), with semi-circular grooves from behind. Mesal processes of angiocoxites short and stylet-shaped. Posterior gonopod prefemur relatively long and slender, without stem, femur characterictically short.

Female. Somewhat smaller than male. Length 19 mm, width 1.5 mm without, 2.1 mm with paraterga. Ocelli 28-30. Vulva tapering caudally.



Figs 284-290. *Sakhalineuma basarukini* (Mikhaljova, 1995): 284 – antenna; 285 – male leg pair 10; 286 – male coxa 11; 287 – distal part of anterior gonopod telopodite (mesal view, enlarged not to scale); 288 – gonopods (caudal view); 289 – gonopods (mesal view); 290 – gonopods (front view); b – prominence of colpocoxite. – Scales in mm (284-285, 287-290 – after Mikhaljova, 1998b; 286 – after Mikhaljova, 1995).



Map. 17. Distribution of *Sakhalineuma basarukini* (●), *S. tuberculatum* (▲), *S. globuliferum* (△), *S. curvatum* (■), *S. molodovae* (□) and *S. sakhalinicum* (▲).

DISTRIBUTION (Map 17): Russia: Far East (Sakhalin Island).

REMARKS: This species, originally described in *Diplomaragna* (Mikhaljova, 1995), has been transferred to the revalidated genus *Sakhalineuma* (Mikhaljova, 2000).

Sakhalineuma tuberculatum (Mikhaljova, 1995)

Figs 291-295, Map 17.

Diplomaragna tuberculata Mikhaljova, 1995: 82, 83: figs.

Diplomaragna tuberculata - Mikhaljova & Basarukin, 1995: 94, 93: map; Mikhaljova, 1998b: 22, 21: figs, 19: map.

Sakhalineuma tuberculatum - Mikhaljova, 2000: 173.

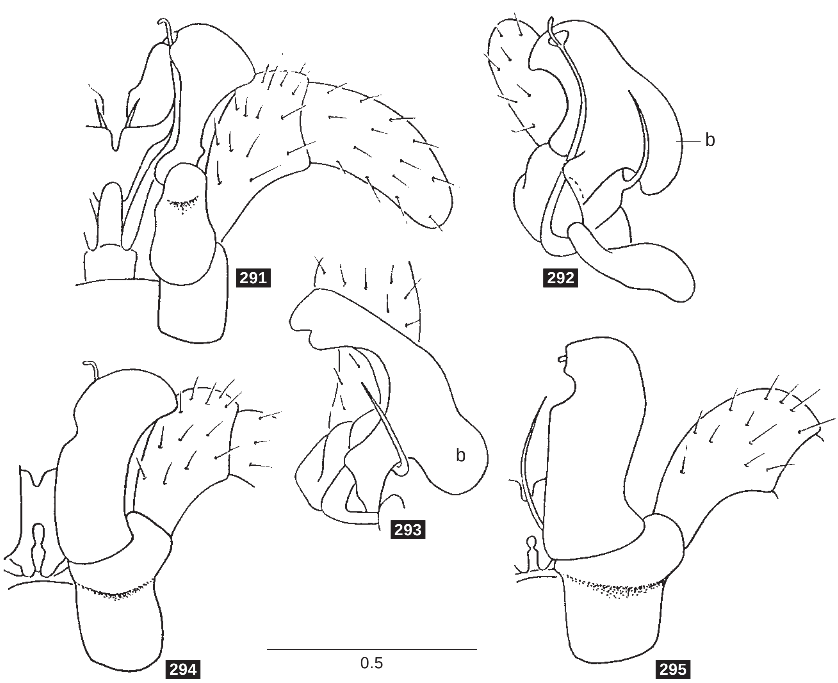
DIAGNOSIS: The presence of a process on male coxa 11 and of a tuberculiform lateral sheath process on the colpocoxite will serve to separate this species from congeners.

DESCRIPTION: Male. Length 13-14 mm, width 0.8-0.9 mm without, 1.4-1.5 mm with paraterga. Coloration in alcohol from light beige with a thin, brownish, transverse band at hind edge of metazonites 1-7 to beige with a transverse brown band of variable width at hind edge of all metazonites. Antennae brown, legs marbled brown, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 26-28 ocelli. Antennae long. Collum oval. Paraterga beginning on segment 2, well-developed on segments 5-27, reduced on segments 28-29, onward missing. Anterolateral macrochaetae slightly shorter than medial ones, posterolateral macrochaetae longest. Apex of all macrochaetae pointed.

Legs long, slender. Leg pairs 3-7 with typical tarsal papillae. Legs 10 and 11 usual, with coxal glands, coxa 11 with a digitiform process ventrally.

A flagelliform telopodite of anterior gonopod 1-segmented (Fig. 291). Sheath groove of posterior gonopod colpocoxite deep, open-edged. A lateral sheath process of posterior gonopod colpocoxite tuberculiform, mesal one like a low, wave-shaped swelling forming the edge of sheath groove. A front prominence (b) of basally scarcely fused colpocoxites large, smooth, varying in length



Figs 291-295. *Sakhalineuma tuberculatum* (Mikhaljova, 1995): 291 – gonopods (caudal view); 292-293 – gonopods (mesal view); 294-295 – gonopods (front view); b – prominence of colpocoxite. – Scale in mm (after Mikhaljova, 1998b).

and height (Figs 292-293). External edge of distal part of colpocoxite either beak-shaped pointed (Figs 291, 294) or not (Fig. 295). Angiocoxite depressed on anterior face (Figs 294-295), with a small globule caudally; its mesal process flagelliform, half as long as colpocoxite. Further angiocoxal processes absent. Femur of posterior gonopod usual relatively short.

Female. Length 14-16 mm, width 0.9-1.0 mm without, 1.5-1.6 mm with paraterga. Ocelli 26-28. Vulva small, spherical, bursal valves and operculum setose.

DISTRIBUTION (Map 17): Russia: Far East (Sakhalin Island, Kuriles: Kunashir Island).

REMARKS: The species, originally described in *Diplomaragna* (Mikhaljova, 1995), has been transferred to the revalidated genus *Sakhalineuma* (Mikhaljova, 2000). This species has been collected on seashores, lake banks as well as in leafy forest.

Sakhalineuma globuliferum **(Mikhaljova, 1995)**

Figs 296-298, Map 17.

Diplomaragna globulifera Mikhaljova, 1995: 87, 86: figs.

Diplomaragna globulifera - Mikhaljova & Basarukin, 1995: 94, 93: map; Mikhaljova, 1998b: 22: figs, 19: map.

Sakhalineuma globuliferum - Mikhaljova, 2000: 172.

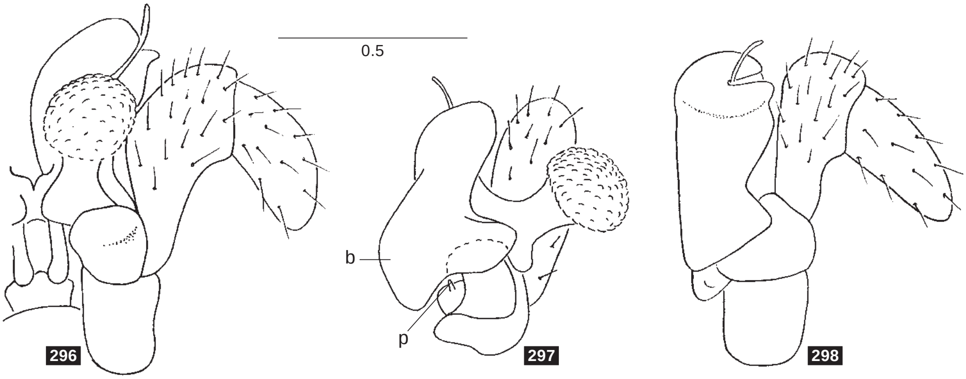
DIAGNOSIS: The species differs from congeners by the peculiar, globular end of the lateral sheath process of the posterior gonopod colpocoxite.

DESCRIPTION: Male. Body ca.11 mm long, ca. 0.9 mm wide without, ca. 1.3 mm with paraterga. Coloration in alcohol pale brown, each prozonite with a brown dorsal spot, each metazonite with a transverse brown band at hind edge. Legs marbled brownish, antennae brown, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 26-28 ocelli. Antennae long. Collum oval. Both collum and segment 2 narrower than head with genae and segment 3. Paraterga beginning on segment 2, well-developed on segments 5-27, reduced on segments 28-29, onward missing. Anterolateral macrochaetae shortest, posterolateral ones longest, all pointed.

Legs long, slender. Leg pairs 3-7 with typical tarsal papillae. Legs 10 and 11 usual, with coxal glands, coxae without processes.

A flagelliform telopodite of anterior gonopod (Fig. 296) 1-segmented. Sheath groove of posterior gonopod colpocoxite deep, open-edged. A front prominence (b) of basally scarcely fused posterior gonopod colpocoxites oval, supplied with a beak-shaped basal part (Fig. 297-298). A lateral sheath process of



Figs 296-298. *Sakhalineuma globuliferum* (Mikhaljova, 1995): 296 – gonopods (caudal view); 297 – gonopods (mesal view); 298 – gonopods (front view); b – prominence of colpocoxite; p – mesal process of angiocoxite. – Scale in mm (after Mikhaljova, 1998b).

colpocoxite with a large, apically papillate, globose outgrowth, mesal one like a broad knob forming the edge of sheath groove. Angiocoxite with a small globule caudally and a short digitiform process (p) mesally, without further processes. Femur of posterior gonopod usual, relatively short.

Female. Length 12 mm, width 0.9 mm without, 1.3 mm with paraterga. Ocelli 26-28. Vulva spherical, setose.

DISTRIBUTION (Map 17): Russia: Far East (northern Sakhalin Island).

REMARKS: This species, originally described in *Diplomaragna* (Mikhaljova, 1995), has been transferred to the revalidated genus *Sakhalineuma* (Mikhaljova, 2000).

Sakhalineuma curvatum (Mikhaljova, 1995)

Figs 299-303, Map 17.

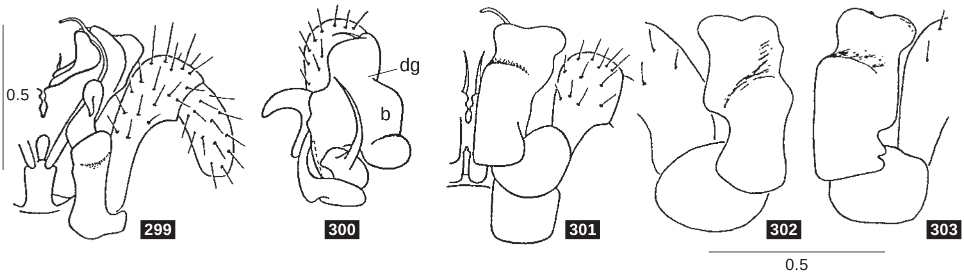
Diplomaragna curvata Mikhaljova, 1995: 83, 84: figs.

Diplomaragna curvata - Mikhaljova & Basarukin, 1995: 94, 93: map; Mikhaljova, 1998b: 23: figs, 19: map.

Sakhalineuma curvatum - Mikhaljova, 2000: 172.

DIAGNOSIS: The species differs from congeners by the curved lateral sheath process of the posterior gonopod colpocoxite, the especially long mesal process of the angiocoxite, and by shape of the front colpocoxite prominence.

DESCRIPTION: Male. Length 13-15 mm, width 0.8-1.0 mm without, 1.3-1.6 mm with paraterga. Coloration in alcohol from beige to pale brown with a thin or wide transverse brown band at hind edge of metazonites; fore body half usually colored more intensely. Legs marbled brown, antennae brown, eyes black.



Figs 299-303. *Sakhalineuma curvatum* (Mikhaljova, 1995): 299 – gonopods (caudal view); 300 – gonopods (mesal view); 301-303 – gonopods (front view); b –prominence of colpocoxite; dg – distal groove of colpocoxite. – Scales in mm (299-301 – after Mikhaljova, 1998b; 302-303 – after Mikhaljova, 1995).

Body with 32 segments. Eye patches triangular, each composed of 26-28 ocelli. Antennae long. Collum oval. Paraterga beginning on segment 2, well-developed on segments 5-27, reduced on segments 28-29, onward missing. Anterolateral macrochaetae shortest, posterolateral ones longest. Apex of all macrochaetae pointed.

Legs long, slender. Leg pairs 3-7 with typical tarsal papillae. Legs 10 and 11 usual, with coxal glands, coxae without processes.

A flagelliform anterior gonopod telopodite 1-segmented, of variable length. A T-shaped coxal part of anterior gonopod coxosternum long (Fig. 299). Sheath groove of posterior gonopod colpocoxite deep, open-edged. A lateral sheath process of posterior gonopod colpocoxite cylindrical, long, curved, with an almost pointed tip, mesal one like a wave-shaped swelling forming the edge of sheath groove. A front prominence (b) of basally scarcely fused colpocoxites more or less distinctly delimited by a distal hollow (dg) (Fig. 300). External edge of colpocoxite with a narrow, more or less long blade (Figs 301-303). Each angiocoxite with a small globule caudally and a flagelliform mesal process more than half as long as colpocoxite. Femur of posterior gonopod usual, relatively short.

Female. Length 14-16 mm, width 1.0-1.3 mm without, 1.6-2.2 mm with paraterga. Ocelli 26-28. Vulva small, oval, setose.

Distribution (Map 17): Russia: Far East (Sakhalin Island, Kuriles: Kunashir and Iturup islands).

Remarks: This species, originally described in *Diplomaragna* (Mikhaljova, 1995), has been transferred to the revalidated genus *Sakhalineuma* (Mikhaljova, 2000). It has been collected in the litter of leafy forests with bamboo undergrowth, also on vegetation and seashores.

Sakhalineuma molodovae Golovatch, 1976

Figs 304-306, Map 17.

Sakhalineuma molodovae Golovatch, 1976b: 1491, 1490: figs.

Sakhalineuma molodovae - Lokšina & Golovatch, 1979: 382; Mikhaljova, 2000: 172: figs; Shelley et al., 2000: 78.

Diplomaragna molodovae - Shear, 1990: 27, 25: figs; Mikhaljova, 1993: 25; 1995: 79, 80: figs; 1998b: 23, 24: figs,19: map; Mikhaljova & Basarukin, 1995: 94, 93: map; Ganin, 1997: 133.

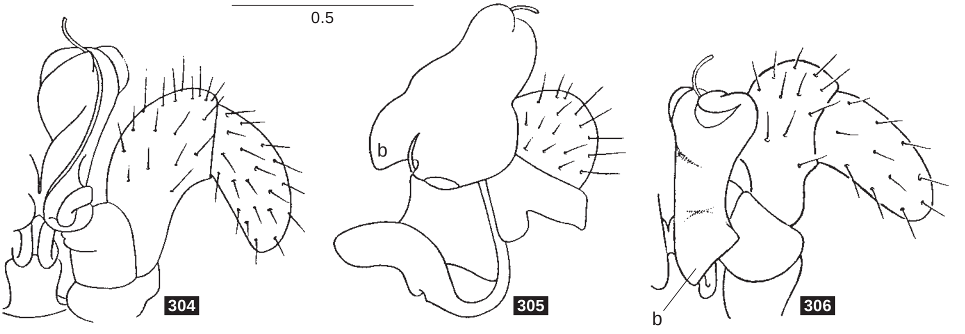
DIAGNOSIS: The species differs from congeners by the broad and blunt lateral sheath process of the posterior gonopod colpocoxite and by the configuration of the anterior surface of the colpocoxite.

DESCRIPTION: Male. Body 14-15 mm long, width 0.8-0.9 mm without, 1.2-1.3 mm with paraterga. Coloration in alcohol light beige with a thin, transverse, brownish band at hind edge of metazonites in body's fore part. Antennae brown, legs light marbled brown, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 26-28 ocelli. Antennae long. Collum oval. Paraterga beginning on segment 2, well-developed on segments 4-27, reduced on segments 28-29, onward missing. Anterolateral macrochaetae shorter than others, posterolateral ones longest, all pointed.

Legs long. Leg pairs 3-7 with typical tarsal papillae. Legs 10 and 11 usual, with coxal glands.

Flagelliform telopodites of anterior gonopods (Fig. 304) 1-segmented, long. A T-shaped coxal part of anterior gonopod coxosternum with two chaetae on each side. Sheath groove of posterior gonopod colpocoxite deep, open-edged. A front prominence (b) of basally scarcely fused colpocoxites beak-shaped at base,



Figs 304-306. *Sakhalineuma molodovae* Golovatch, 1976: 304 – gonopods (caudal view); 305 – gonopods (mesal view); 306 – gonopods (front view); b – prominence of colpocoxite. – Scale in mm (after Mikhaljova, 1998b).

indistinctly delimited by a distal hollow (Figs 305-306). A lateral sheath process of colpocoxite large, broad and blunt, mesal one blade-like, forming much of the edge of sheath groove. Angiocoxite with a short, stylet-shaped, mesal process but without futher processes. Femur of posterior gonopod usual, relatively short.

Female. Length 14-16 mm, width 0.9-1.0 mm without, 1.3-1.5 mm with paraterga. Ocelli 26-28. Vulva oval, setose.

DISTRIBUTION (Map 17): Russia: Far East (Sakhalin Island).

REMARKS: This form was originally described as a new genus and species (Golovatch, 1976b), later transferred to *Diplomaragna* (Shear, 1990) and then to the revalidated genus *Sakhalineuma* (Mikhaljova, 2000). Based on topotypes, the original diagnosis of this species has been rectified (Mikhaljova, 1995). This species has been collected in the litter of coniferous, mixed and *Betula* forests.

Sakhalineuma sakhalinicum **(Mikhaljova, 1995)**

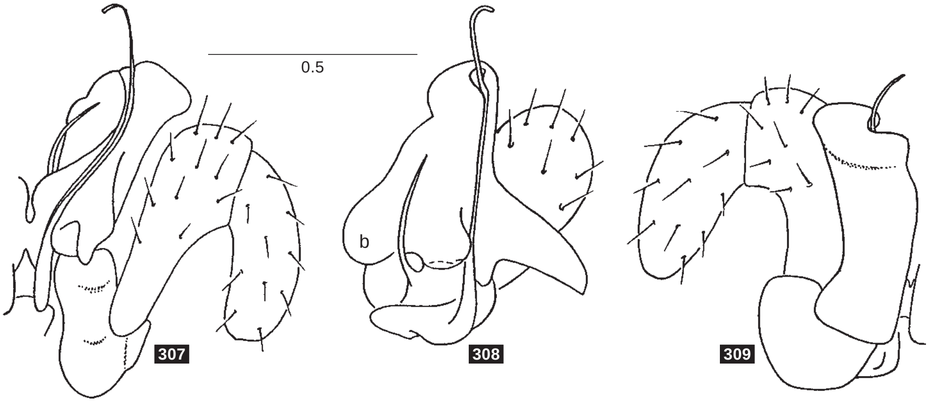
Figs 307-309, Map 17.

Diplomaragna sakhalinica Mikhaljova, 1995: 86, 85: figs.

Diplomaragna sakhalinica - Mikhaljova & Basarukin, 1995: 94, 93: map; Mikhaljova, 1998b: 25, 24: figs, 19: map.

Sakhalineuma sakhalinicum - Mikhaljova, 2000: 173.

DIAGNOSIS: This species differs from congeners by the peculiar, dentiform, lateral sheath process of the posterior gonopod colpocoxite combined with the structure and height of the front prominence on the colpocoxite as well as the length of the mesal angiocoxal process.



Figs 307-309. *Sakhalineuma sakhalinicum* (Mikhaljova, 1995): 307 – gonopods (caudal view); 308 – gonopods (mesal view); 309 – gonopods (front view); b – prominence of colpocoxite. – Scale in mm (after Mikhaljova, 1998b).

DESCRIPTION: Male. Length 13-15 mm, width 0.8-1.0 mm without, 1.3-1.6 mm with paraterga. Coloration in alcohol from beige to pale brown with a thin or wide transverse brownish band at hind edge of metazonites; fore body half usually brighter. Antennae brown, legs marbled brownish, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 26-28 ocelli. Antennae long. Collum oval. Paraterga beginning on segment 2, well-developed on segments 5(6)-27, reduced on segments 28-29, onward missing. Anterolateral macrochaetae slightly shorter than medial ones. Posterolateral macrochaetae longest. Apex of all macrochaetae pointed.

Legs long, slender. Leg pairs 3-7 with typical tarsal papillae. Legs 10 and 11 usual, with coxal glands.

Flagelliform telopodites of anterior gonopods (Fig. 307) 1-segmented, long. Sheath groove of posterior gonopod colpocoxite deep, open-edged. A lateral sheath process of colpocoxite dentiform while a conical mesal one like a broad swelling forming the edge of sheath groove. A front prominence (b) of basally scarcely fused colpocoxites low, indistinctly delimited by a distal hollow (Figs 308-309). Angiocoxite with a small globule caudally, with neither anterior nor posterior processes. Mesal process of angiocoxite flagelliform, a little more than half as long as colpocoxite. Femur of posterior gonopod usual, relatively short.

Female. Length 14-16 mm, width 1.0-1.3 mm without, 1.6-2.2 mm with paraterga. Ocelli 26-28. Vulva small, oval, setose.

DISTRIBUTION (Map 17): Russia: Far East (Sakhalin Island).

REMARKS: This species, originally described in *Diplomaragna* (Mikhaljova, 1995), has been transferred to the revalidated genus *Sakhalineuma* (Mikhaljova, 2000).

Genus *Diplomaragna* Attems, 1907

DISTRIBUTION: Russia: Southern Far East; Japan: Hokkaido; Taiwan. The genus contains 11 species, the Asian part of Russia supports eight of them.

The main distinguishing characters are as follows. Body with 32 segments; paraterga normal, medium-sized; anterior gonopod telopodite flagelliform or subflagelliform, placed inside a sheath groove of posterior gonopod colpocoxite; lateral sheath process of colpocoxite absent; each colpocoxite entire; anterior angiocoxal processes present, passing, sometimes through a foramen, between colpocoxites along midline, through lateral foramina in colpocoxite in *D. lysaya*, or placed inside folds on colpocoxite's front surface; posterior angiocoxal processes large.

REMARKS: Identification of the number of anterior gonopod telopoditomeres is difficult, as there is no division suture between the two supposed segments.

However, in some species there is a constriction of varying depth; in addition, the translucent posterior wall of the base of the telopodite can provide an illusion of segment 1 present. Hence, the number of joints of the anterior gonopod telopodite in the different descriptions can vary.

Key to species of *Diplomaragna*:

1(13) Anterior angiocoxal processes of posterior gonopods passing, sometimes through a foramen, between colpocoxites along midline or placed inside a fold of colpocoxite. 2

2(3) Apex of posterior gonopod colpocoxite broad and blunt (Fig. 318). Metatergal macrochaetae clavate. .... *D. ganini*

3(2) Apex of posterior gonopod colpocoxite narrow, often pointed, sometimes unciform. Metatergal macrochaetae different. 4

4(5) Body length 20-23 mm. Posterior angiocoxal process of posterior gonopod with apical arms of different size (Figs 322-324). .... *D. terricolor*

5(4) Body less than 20 mm long. Posterior angiocoxal process of posterior gonopod different. 6

6(7) Colpocoxites of posterior gonopods strongly curved caudad and deeply emarginate at each mesal edge, forming a large cordiform foramen (Fig. 329). Body length 12-13 mm. .... *D. anuchino*

7(6) Colpocoxites of posterior gonopods either not curved strongly caudad or only their tips curved; no deep emargination at each mesal colpocoxital edge. Body length different. 7

7(8) Posterior angiocoxal process of posterior gonopod like a caudally convex plate with an undulate edge, devoid of teeth (Figs 330-331). Body length 12-12.5 mm. .... *D. zimoveinaya*

8(7) Posterior angiocoxal process of posterior gonopod different, with arms and outgrowths. 9

9(10) Posterior angiocoxal process of posterior gonopod with apex curved forward, carrying a long, slender, median spine (Fig. 334). Gonopods smaller (0.75x1.0 mm). .... *D. dalnegorica*

10(9) Posterior angiocoxal process of posterior gonopod with apex not curved forward; long and slender spines missing. Gonopods larger. 11

11(12) Edges of front colpocoxital folds set horizontally to body axis (Fig. 337), posterior angiocoxal process with a pointed apex (Fig. 336) .... *D. kedrovaya*

12(11) Edges of front colpocoxital folds set obliquely to body axis (Fig.340), posterior angiocoxal process with a blunt apex (Fig. 339) .... *D. yakovlevka*

13(1) Anterior angiocoxal processes of posterior gonopods passing through external lateral foramina in colpocoxites (Fig. 344) .... *D. lysaya*

Diplomaragna ganini Mikhaljova, 1993

Figs 310-319, Map 18.

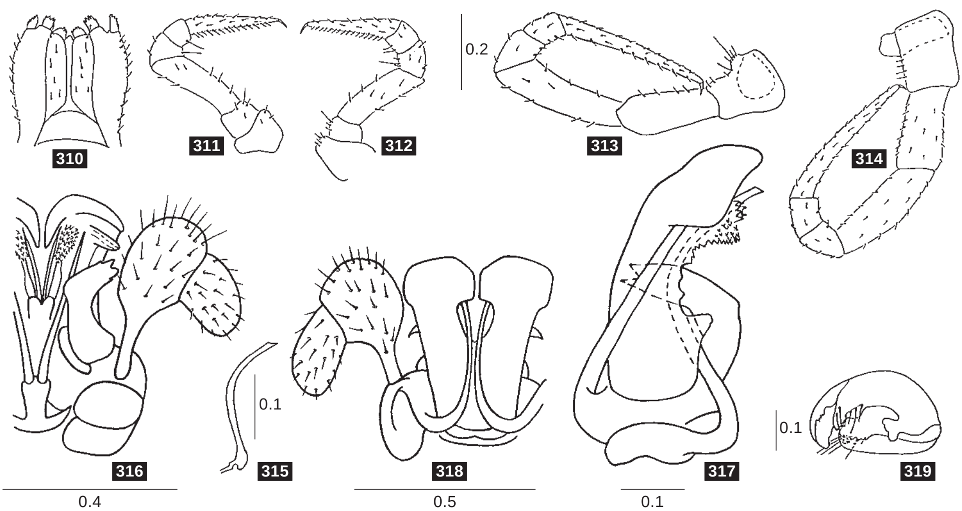
Diplomaragna ganini Mikhaljova, 1993: 22, 23: figs.

Diplomaragna ganini - Ganin, 1995: 371; 1997: 25; 2000a: 431; Mikhaljova, 1997b: 129: figs; 1998b: 25: figs, 26: map.

DIAGNOSIS: The species differs from congeners in shape of the posterior gonopod colpocoxite's distal part with medial spinulate outgrowths and transverse lateral folds, as well as in the configuration of the posterior angiocoxal processes.

DESCRIPTION: Male. Adult 9-10 mm long, 0.7-0.8 mm wide without, 0.9-1.0 mm with paraterga. Coloration beige, yellowish or whitish, sometimes with transverse brownish bands dorsally on metazona. Legs light marbled brown, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 28-30 ocelli. Gnathochilarium (Fig. 310) with several strong and long setae on outer sides of stipites, lamellae linguales divided by a distinct and deep suture, each

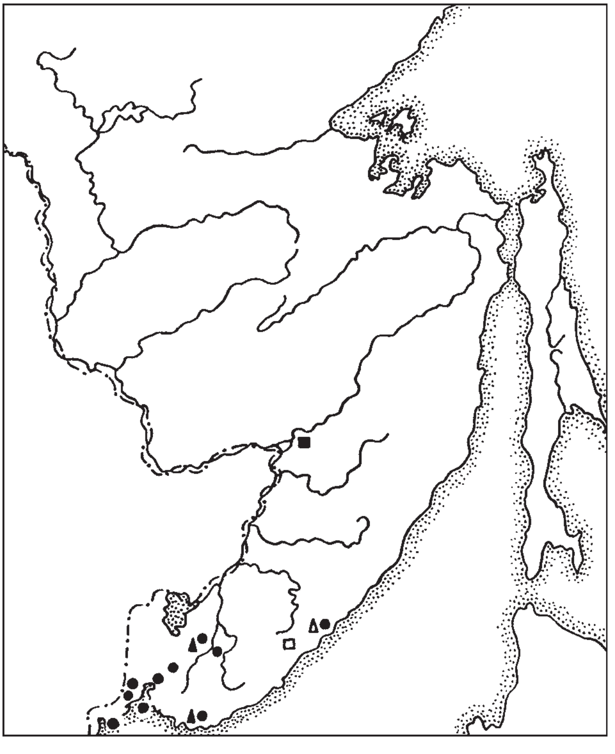


Figs 310-319. *Diplomaragna ganini* Mikhaljova, 1993: 310 – gnathochilarium; 311 –male leg pair 1; 312 – male leg pair 2; 313 – male leg pair 10; 314 – male leg pair 11; 315 – telopodite of anterior gonopod (lateral view); 316 – gonopods (caudal view); 317 – gonopods (mesal view); 318 – posterior gonopods (front view); 319 – vulva (ventral view). – Scales in mm (310-315, 317, 319 – after Mikhaljova, 1993; 316, 318 – after Mikhaljova, 1997b).

with three short parabasal setae forming a triangle and further three longer setae in a longitudinal row. Antennae long. Collum semi-circular, both collum and somite 2 narrower than head with genae. Body width gradually growing until segment 7, body parallel-sided on segments 8-24, onward gradually tapering toward telson. Paraterga well-developed from segment 2, on segments 5-27 their caudolateral corners beak-shaped pointed. Anterolateral macrochaetae shorter than others, blunt; others longer, pointed. Surface finely alveolate.

Legs long. Leg pairs 1 (Fig. 311) and 2 (Fig. 312) somewhat reduced in size as usual. Leg pairs 3-7 with typical tarsal papillae, somewhat enlarged, in other respects unmodified. Legs 10 (Fig. 313) and 11 (Fig. 314) usual, with coxal glands.

Anterior gonopod telopodites 1-segmented, flagelliform (Fig. 315). Apex of anterior gonopod telopodite pointed, visible as stretched beyond sheath groove (Fig. 316). Colpocoxites of posterior gonopods fused basally, each with a medial notch and an oval apex, with medial spinulate outgrowths and transverse lateral folds in posterior view. Colpocoxite with a small mesal process but without lateral process (Fig. 317). Angiocoxites of posterior gonopods depressed centrally on anterior face (Fig. 318). An anterior angiocoxal process long, flagelliform,



Map 18. Distribution of *Diplomaragna terricolor* (●), *D. ganini* (■), *D. dalnegorica* (□), *D. anuchino* (▲), *D. zimoveinaya* (△)

its distal portion placed inside a front fold of each colpocoxite. Large posterior angiocoxal processes curved forward, with two larger and a few smaller teeth disto-apically. Femur of posterior gonopod relatively short, with or without claw vestige.

Female. Length 9-11 mm, width 0.9-1.0 mm without, 1.1 mm with paraterga. Vulvae (Fig. 319) very small, bursal valve with long setae along ventral edge.

DISTRIBUTION (Map 18): Russia: Far East (Khabarovsk Province).

REMARKS: Based on type material, a redescription of gonopod structure was provided (Mikhaljova, 1997b). *D. ganini* inhabits the litter of both mixed and dark coniferous forests. In the south of Khabarovsk Province, the numbers range between 8.7 ind./m² in the subzone of mountain mixed forests in a transitional belt, and 14.0 ind./m² in dark coniferous taiga woodlands (Ganin, 1997). This species is listed in the Red Data Book of Khabarovsk Province, claimed as requiring protection (Ganin, 2000a). *D. ganini* appears to be a poor indicator of environmental pollution with heavy metals in the southern part of this Province (Ganin, 1997).

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

Figs 320-327, Map 18.

Placodes terricolor Attems, 1899: 320; figs.

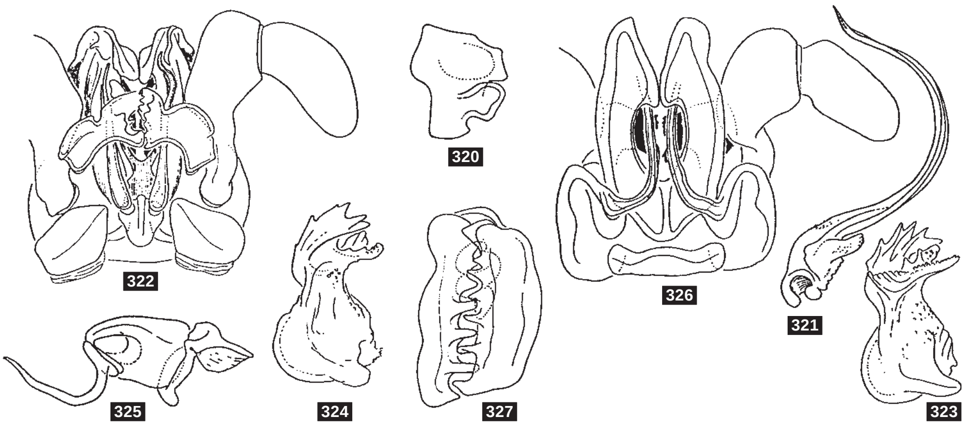
Diplomaragna terricolor - Attems, 1907: 123; Lokšina & Golovatch, 1979: 382; Golovatch, 1979d: 88; Kurcheva & Mikhaljova, 1980: 121; Mikhaljova, 1981c: 87; 1983b: 85; 1988b: 70; 1993: 29; 1997b: 130; 1998b: 26: figs, map; 2000: 174: figs; 2002a: 150; Mikhaljova & Petukhova, 1983: 52; Mikhaljova & Bakurov, 1989: 40; Shear, 1990: 28, 29: figs; Ganin, 1997: 121; Mikhaljova & Marusik, 2004: 6.

DIAGNOSIS: The species differs from congeners in shape of the posterior gonopod's posterior angiocoxal process with apical arms of different size, and by the configuration of the colpocoxite's distal part.

DESCRIPTION: Male. Adult 20-22 mm long, 1.5-1.6 mm wide without, 2.5-2.6 mm with paraterga. Coloration light brown with head, antennae and distal part of legs marbled brown, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 26-30 ocelli. Antennae long. Collum oval. Paraterga beginning on segment 2, well-developed on segments 9-25, reduced on segment 28, onward missing. Macrochaetae acute, thin, about 0.6 mm long.

Legs long and slender, claw at base with a long seta ventrally and two small additional claws dorsally. Each leg pair 1 and 2 with claw carrying a long seta at



Figs 320-327. *Diplomaragna terricolor* (Attems, 1899): 320 – male coxa 10 (posterior view); 321 – telopodite of anterior gonopods (mesal view); 322 – gonopods (caudal view); 323 – right posterior angiocoxal process of posteror gonopod (dorsocaudal view); 324 – right posterior angiocoxal process of posterior gonopod (front view); 325 – right angiocoxite of posterior gonopod (front view); 326 – gonopods (front view); 327 – vulva (ventral view). – Scale absent (after Shear, 1990).

base ventrally. Leg pairs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods; femora swollen and curved; claw at base with a relatively short ventral seta only. Postgonopodal legs without tarsal papillae. Legs 10 and 11 usual, with coxal glands, coxae 10 (Fig. 320) enlarged, with a small process distal to gland.

Anterior gonopod telopodite (Fig. 321) 1-segmented, flagelliform, with a pointed apex. Sheath groove of posterior gonopod colpocoxite open-edged, without processes (Fig. 322). Colpocoxites fused basally, without processes, with apices curved caudally. Large posterior angiocoxal processes (Figs 323-324) with larger and smaller teeth disto-apically. Anterior angiocoxal processes (Fig. 325) long, flagelliform, passing between colpocoxites in an incomplete fossa formed by a median notch on each side (Fig. 326). Posterior gonopod telopodites with relatively short femora.

Female. Adult 20-22 mm long, 1.5-1.6 mm wide without, 2.5-2.6 mm with paraterga. Ocelli 26-28. Vulvae as in Fig. 327.

Distribution (Map 18): Russia: Far East (Primorsky Province).

Remarks: This species is rather common in the southern part of Primorsky Province. However, its numbers are relatively small and range from 0.5 to 2.5 ind./m^2 (Kurcheva & Mikhaljova, 1980, Mikhaljova, 1988b). Adults live in forest litter; juveniles can occur down to 20 cm deep in the soil (Mikhaljova, 1983b).

Diplomaragna anuchino Shear, 1990

Figs 328-329, Map 18.

Diplomaragna anuchino Shear, 1990: 32, 31: figs.

Diplomaragna anuchino - Ganin, 1997: 124; Mikhaljova, 1993: 18; 1997b: 127; 1998b: 26: map, 27: figs; 2000: 174.

Diplomaragna suputinca - Mikhaljova, 1993: 28.

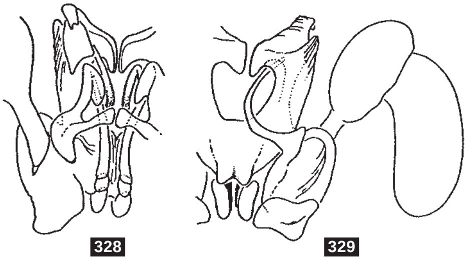
DIAGNOSIS: The species differs from congeners in configuration of the posterior gonopod colpocoxites strongly curved caudad and deeply emarginate at each mesal edge, forming a large cordiform foramen, as well as in shape of the posterior angiocoxal processes.

DESCRIPTION: Male. Length 12-13 mm. Width at metazonite 6, 1.48 mm. Coloration tan, antennae and legs very lightly marbled, darker purplish brown. Eyes black.

Body with 32 segments. Eye patches triangular, each composed of 29-30 ocelli. Paraterga beginning on segment 2, relatively low on segments 3-5, strongest on segments 9-17. Macrochaetae acute, thin, about 0.35 mm long.

Legs long and slender; claw at base with a long seta ventrally and two small additional claws dorsally. Leg pairs 3-7 with typical tarsal papillae, incrassate, pairs 5-7 much larger, femora swollen and curved; claw with a long ventral seta at base only. Postgonopodal legs without tarsal papillae. Legs 10 and 11 usual, with coxal glands.

Anterior gonopod telopodite (Fig. 328) 1- or 2-segmented, flagelliform, acute. Colpocoxites of posterior gonopods fused basally, curved at nearly 90º posteriorly, deeply excavate on each mesal side above fusion, with blunt mesal processes meeting at midline. Apex of colpocoxite unciform. Posterior gonopods with two pairs of angiocoxal processes. Posterior angiocoxal processes each with two arms, of which mesal ones meeting at midline, lateral ones extending back



328 329

Figs 328-329. *Diplomaragna anuchino* Shear, 1990: 328 – gonopods (caudal view); 329 – gonopods (front view). – Scales absent (after Shear, 1990).

against posterior faces of colpocoxites. Anterior angiocoxal processes very long, thin, curved mesally to pass through an opening formed by fusion of colpocoxites proximally, two mesal knobs distally, butting against one another (Fig. 329). Prefemur of posterior gonopod with a very thin stem, femur medium-sized.

Female unknown.

DISTRIBUTION (Map 18): Russia: Far East (Primorsky Province).

Diplomaragna zimoveinaya **Mikhaljova, 1997**

Figs 330-332, Map 18.

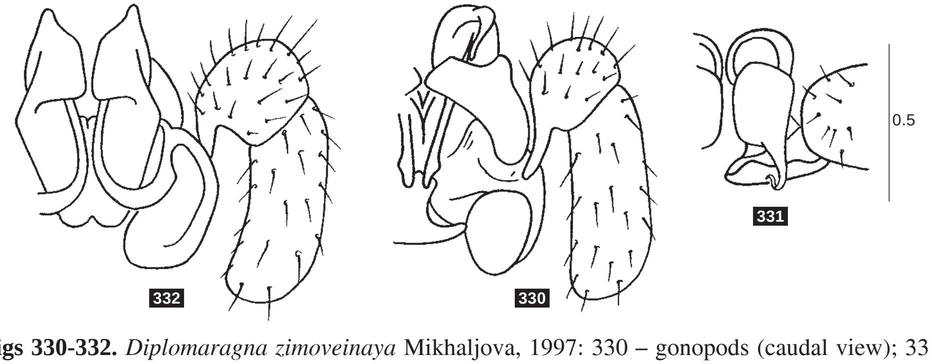
Diplomaragna zimoveinaya Mikhaljova, 1997b: 123, 124: figs.
Diplomaragna zimoveinaya - Mikhaljova, 1998b: 26: map, 27: figs; 2000: 175.

DIAGNOSIS: The species differs from congeners in shape of the posterior angiocoxal process, which is a caudally swollen lobe with an uneven distal edge.

DESCRIPTION: Male. Length 12-12.5 mm, width 0.8-0.9 mm without, 1.3-1.4 mm with paraterga. Coloration in alcohol light beige. Antennae light brown, legs (most of all fore leg pairs) slightly brownish, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 25-26 ocelli. Antennae long. Collum semi-circular. Somite 2 narrower than both head with genae and somite 3. Paraterga beginning on segment 2, well-developed on segments 4-27, reduced on segments 28-29, onward missing. Anterolateral macrochaetae shortest, medial and posterolateral ones subequal in length. All macrochaetae pointed, but not very sharply so.

Legs long and slender. Leg pairs 3-7 with typical tarsal papillae, somewhat enlarged, otherwise unmodified. Legs 10 and 11 usual, with coxal glands.



Figs 330-332. *Diplomaragna zimoveinaya* Mikhaljova, 1997: 330 – gonopods (caudal view); 331 – gonopods (ventral view); 332 – posterior gonopods (front view). – Scale in mm (after Mikhaljova, 1997b).

Telopodite of anterior gonopod flagelliform, 1-segmented, apex pointed, visible from outside (Fig. 330). Colpocoxites of posterior gonopods fused basally, their distal part flagelliform, terminating in a hook (Fig. 331). Colpocoxite sheath groove shallow, open-edged, without evident processes; a very low, narrow, undulate swelling instead of a mesal sheath process, and a tiny knob instead of a lateral sheath process. Posterior angiocoxal processes broad, like thin, caudally convex plates with an undulate distal edge. Angiocoxites strongly depressed on anterior face, anterior processes long, flagelliform, their distal portions placed inside folds of colpocoxites (Fig. 332). Posterior gonopod telopodites with long femora.

Female unknown.

DISTRIBUTION (Map 18): Russia: Far East (Primorsky Province).

Diplomaragna dalnegorica Mikhaljova, 1993

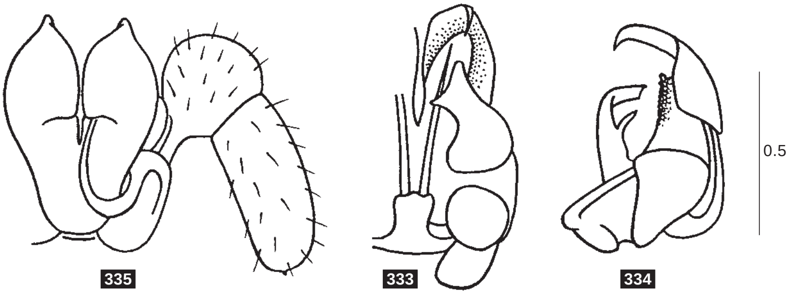
Figs 333-335, Map 18.

Diplomaragna dalnegorica Mikhaljova, 1993: 20, 21: figs.

Diplomaragna dalnegorica - Ganin, 1997: 126; Mikhaljova, 1997b: 129: figs; 1998b: 26: map, 28: figs; 2000: 174.

DIAGNOSIS: The species differs from congeners in shape of the posterior gonopod's posterior angiocoxal process bearing a long median spine, by the finely papillate/spinulate surface of the colpocoxite caudally, and the pointed and unciform apex of the colpocoxite.

DESCRIPTION: Male. Length 16-17 mm, width 0.7-0.8 mm without, 1.0-1.1 mm with paraterga. Coloration beige, with transverse brown bands dorsally on metazona. Legs light marbled brown, increasingly intensely coloured toward telson. Antennae brown, eyes black.



Figs 333-335. *Diplomaragna dalnegorica* Mikhaljova, 1993: 333 – gonopods (caudal view); 334 – gonopods (mesal view); 335 – posterior gonopods (front view). – Scale in mm (after Mikhaljova, 1997b).

Body with 32 segments. Eye patches triangular, each composed of 28-30 ocelli. Gnathochilarium with several strong and long setae on outer sides of stipites, lamellae linguales contiguous, each with three short parabasal setae. Antennae very long. Collum semi-circular, narrower than head with genae. Body width gradually growing until segment 7, body parallel-sided on segments 8-24, onward gradually tapering toward telson. Paraterga well-developed from segment 2, on segments 5-27 their caudolateral corners beak-shaped pointed. Anterolateral macrochaetae shorter than others, caudolateral ones longest, all blunt.

Legs long. Leg pairs 3-7 with typical tarsal papillae, a little enlarged. Legs 10 and 11 usual, with coxal glands.

Anterior gonopod telopodite (Fig. 333) 1- or 2-segmented, flagelliform, apex pointed, visible as stretched beyond sheath groove. Colpocoxites of posterior gonopods fused basally, with a small medial notch, apices curved, pointed and unciform. Colpocoxite sheath groove shallow, without processes. Colpocoxites' caudal surface finely papillate/spinulate. A large posterior angiocoxal process with a tip narrowed and curved forward, its subapical branch long (Fig. 334). Posterior gonopods in anterior view (Fig. 335) with angiocoxites depressed centrally on anterior face, with long, flagelliform, anterior angiocoxal processes, distal portion of each latter placed inside a front fold of each colpocoxite. Posterior gonopod femur long, with a claw vestige.

Female unknown.

DISTRIBUTION (Map 18): Russia: Far East (Primorsky Province).

REMARKS: Based on type material, a redescription of the gonopod structure of this species has been provided (Mikhaljova, 1997b). This species has been collected in the litter of *Picea* forest.

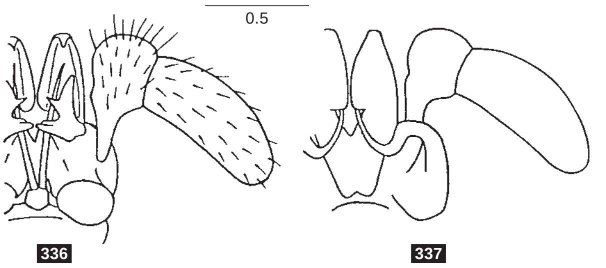
Diplomaragna kedrovaya **Mikhaljova, 1993**

Figs 336-337, Map 19.

Diplomaragna kedrovaya Mikhaljova, 1993: 24: figs.
Diplomaragna kedrovaya - Ganin, 1997: 121; Mikhaljova, 1998b: 28: figs, 29: map; 2000: 174.

DIAGNOSIS: The species differs from congeners in shape of the posterior angiocoxal processes, in the tip of the colpocoxites of the posterior gonopods and in the edges of the front colpocoxital folds holding horizontal to the body axis.

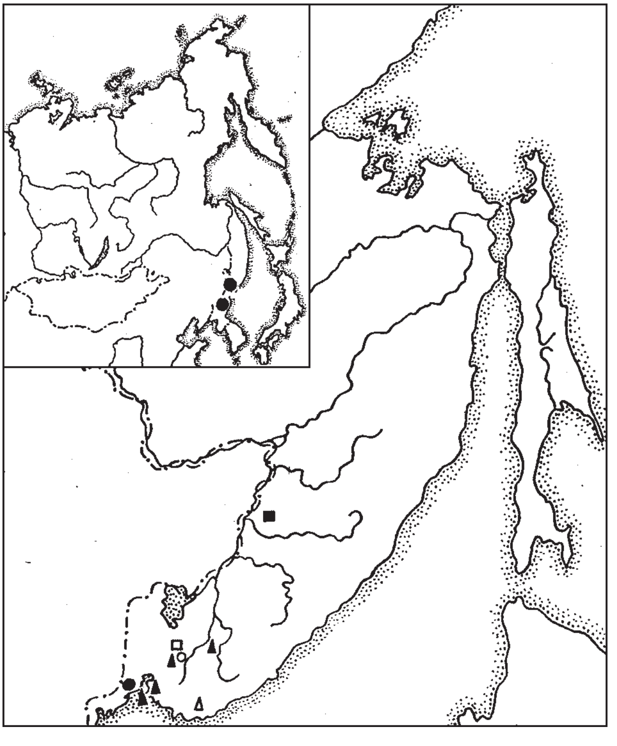
DESCRIPTION: Male. Length 16-17 mm, width 0.9-1.0 mm without, 1.4-1.5 mm with paraterga. Coloration beige, antennae brown, legs pale brown, marbled brownish dorsally, eyes black.



Figs 336-337. *Diplomaragna kedrovaya* Mikhaljova, 1993: 336 – gonopods (caudal view); 337 – posterior gonopods (front view). – Scale in mm (after Mikhaljova, 1998b).

Body with 32 segments. Eye patches triangular, each composed of 28-30 ocelli. Antennae long. Collum oval, both collum and somite 2 narrower than head with genae. Body growing in width toward segment 7, parallel-sided on segments 8-24, onward gradually tapering toward telson. Segments 2-7 instead of paraterga with increasingly well-developed lateral swellings, from segment 8 on already with well-developed paraterga. Posterolateral macrochaetae longest, pointed; anterolateral ones shortest, blunt; medial macrochaetae blunt.

Legs long. Legs 3-7 somewhat enlarged, with typical tarsal papillae. Legs 10 and 11 usual, with coxal glands.



Map 19. Distribution of *Diplomaragna kedrovaya* (●), *D. yakovlevka* (▲), *D. lysaya* (△), *Maritimosoma schawalleri* (■), *M. turova* (□) and *M. piceum* (○).

Anterior gonopod telopodites (Fig. 336) 1- or 2-segmented, subflagelliform, pointed apices either invisible or visible as stretched beyond sheath groove. Colpocoxites of posterior gonopods fused at base, distal parts directed caudad, pointed apically. A large posterior angiocoxal process of posterior gonopod with subapical teeth and medially contiguous, rounded outgrowths. An anterior angiocoxal process flagelliform, its distal part passing between colpocoxites into an incomplete fossa formed by a median notch on each side. Apices of anterior angiocoxal processes placed inside front folds of colpocoxites (Fig. 337). Edges of folds placed horizontally to body axis. Femur of posterior gonopods relatively long.

Female unknown.

DISTRIBUTION (Map 19): Russia: Far East (Primorsky Province); North Korea.

Diplomaragna yakovlevka **Shear, 1990**

Figs 338-341, Map 19.

Diplomaragna yakovlevka Shear, 1990: 28, 29: figs.

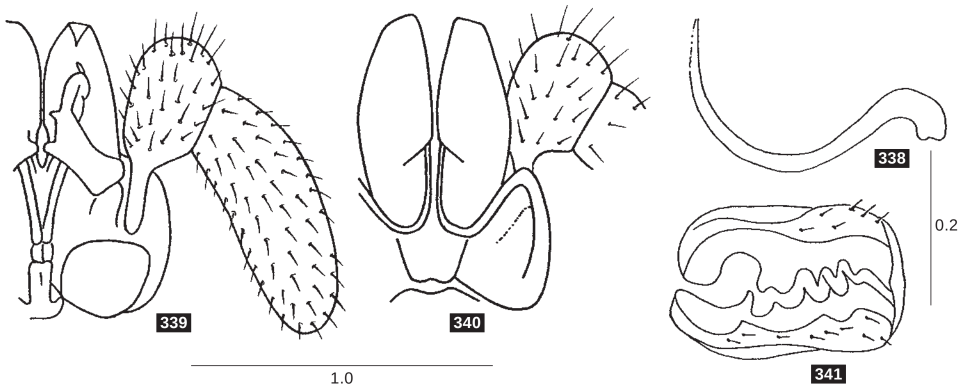
Diplomaragna suputinca - Mikhaljova, 1993: 28, 27: figs; Ganin, 1997: 123.

Diplomaragna yakovlevka - Mikhaljova, 1993: 29; 1997b: 127, 126: figs; 1998b: 30, 29: figs and map; 2000: 175; 2002a: 150.

DIAGNOSIS: The species differs from congeners by the flagelliform anterior angiocoxal processes of the posterior gonopods passing between the colpocoxites in an indistinct notch, in the edges of the front colpocoxital folds set obliquely to the body axis, and in shape of the posterior angiocoxal processes.

DESCRIPTION: Male. Length 12-15 mm, width 0.9-1.0 mm without, 1.2-1.5 mm with paraterga. Coloration yellowish or light creamy brown, antennae brown, legs brownish, pregonopodal legs with a pale marbled brown pattern dorsally, eyes black or only slightly pigmented.

Body with 32 segments. Eye patches triangular, each composed of 20-26 ocelli. Gnathochilarium with several strong and long setae on outer sides of stipites, lamellae linguales contiguous, divided by a narrow, thin suture, each with shorter parabasal setae forming a triangle and with longer distal setae in a longitudinal row. Antennae long, antennomere 3, 0.60 mm long. Collum oval. Both collum and somite 2 narrower than head with genae. Body width gradually growing until segment 7, body parallel-sided on segments 8-24, onward gradually tapering toward telson. Paraterga well-developed from segment 2 on, strongest on segments 9-22, on segments 5-26 or 5-27 their caudolateral corners beak-shaped pointed, absent from 27- or 28-31. Macrochaetae about 0.4 mm long, thin,



Figs 338-341. *Diplomaragna yakovlevka* Shear, 1990: 338 – telopodite of anterior gonopod; 339 – gonopods (caudal view); 340 – posterior gonopods (front view); 341 – vulva. – Scales in mm (338, 341 – after Mikhaljova, 1993; 339, 340 – after Mikhaljova, 1997b).

pointed, but not very sharply so. Anterolateral macrochaetae shortest, medial ones shorter than posterolateral ones. Surface finely alveolate.

Legs long, claws at base with two additional small claws dorsally and a long seta ventrally. Leg pairs 3-7 with typical tarsal papillae, somewhat incrassate, pairs 5-7 much larger, femora swollen and curved; claws at base with a long ventral seta only. Postgonopodal legs without tarsal papillae. Legs 10 and 11 usual, with coxal glands, coxa 10 enlarged.

Anterior gonopod telopodites (Fig. 338) 1- or 2-segmented, flagelliform, pointed apically, finely serrate or with a small posterior lamella subapically, visible as stretched beyond sheath groove (Fig. 339). Colpocoxites of posterior gonopods fused basally, with a small median foramen and beak-shaped apicies but without sheath processes. Large posterior angiocoxal processes of posterior gonopods with several outgrowths; mesal arms either meeting at midline or not exactly so due to separated median mesal arms. Anterior angiocoxal processes like medium-sized or long flagella, their distal portions positioned between colpocoxites in front folds or hidden behind these folds. Edges of the folds skewed (Fig. 340). Angiocoxites strongly depressed on anterior face. Femur of posterior gonopods long.

Female. Length 14-15 mm, width 1.0-1.1 mm without, 1.3-1.4 mm with paraterga. Ocelli 26. Vulva as in Fig. 341.

DISTRIBUTION (Map 19): Russia: Far East (Primorsky Province).

REMARKS: This species appears to be a senior subjective synonym of *Diplomaragna suputinca* Mikhaljova, 1993 (cf. Mikhaljova, 1997b), a form described from the Primorsky Province (Mikhaljova, 1993).

The species seems to prefer a life in valley/lowland forests.

Diplomaragna lysaya Shear, 1990

Figs 342-344, Map 19.

Diplomaragna lysaya Shear, 1990: 30, 29: figs.

Diplomaragna lysaya - Mikhaljova, 1993: 25; 1998b: 31, 29: map, 30: figs; 2000: 174; Ganin, 1997: 124.

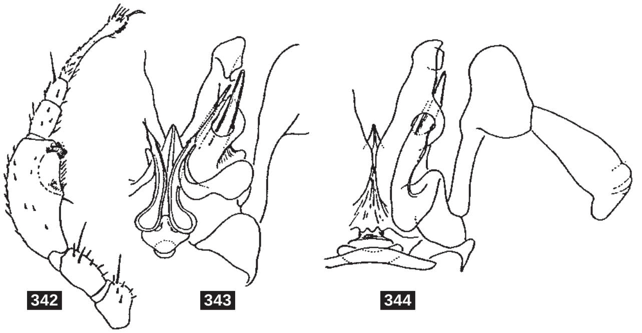
DIAGNOSIS: The species differs from congeners by the lateral position of the anterior angiocoxal processes, which are bifid distally.

DESCRIPTION: Male. Length about 12 mm. Width at metazonite 6, 1.74 mm. Coloration tan, very lightly mottled darker purplish brown on antennae and legs. Eyes black.

Body with 32 segments. Paraterga prominent, horizontal on segments 3-5, strongest on segments 9-26, slightly reduced on 27 and 28, absent from 29-31.

Leg pairs 3-7 with typical tarsal papillae, incrassate. Leg pair 4 (Fig. 342) with clavate femora and a depressed glabrous area posterodistally, framed by an eyelash-like group of setae, tarsus with a mesally depressed glabrous area. Leg pairs 5-7 slightly larger than 4th, femora swollen and curved, lacking modifications present on 4th. Legs 10 and 11 usual, with coxal glands.

Anterior gonopods with 1-segmented, simple, acuminate telopodites (Fig. 343). Colpocoxites of posterior gonopods fused basally, diverging distally, slightly and smoothly curved posteriorly. A posterior angiocoxal processes of posterior gonopods relatively small, laminate, curved into a semi-circle. Anterior angiocoxal processes very large, bifid distally and passing through lateral foramina in colpocoxites (Fig. 344). Angiocoxites sigmoid on anterior face. Prefemur of posterior gonopod with a very thin stem, femur long, with some indication of segmentation distally.



Figs 342-344. *Diplomaragna lysaya* Shear, 1990: 342 – right leg 4 of male (caudal view); 343 – gonopods (caudal view); 344 – gonopods (front view). – Scale absent (after Shear, 1990).

Female unknown.

DISTRIBUTION (Map 19): Russia: Far East (Primorsky Province).

Genus *Maritimosoma* Mikhaljova, 2000

DISTRIBUTION: Russia: Southern Far East; Japan: Hokkaido. The genus contains four species, of which three occur in the Russian Far East.

The main distinguishing characters are as follows. Body with 32 segments; telopodite of anterior gonopod flagelliform, placed inside a sheath groove; colpocoxites of posterior gonopods fused basally; each colpocoxite entire; both mesal sheath processes of colpocoxites fused at midline, forming a single piece clasping the anterior gonopod telopodites; angiocoxite of posterior gonopod with only one anterior and only one posterior process; anterior angiocoxal process either piercing the colpocoxite or sheathed on anterior face of colpocoxite; posterior angiocoxal process large; femur of posterior gonopod rather short.

REMARKS: Identification of the number of anterior gonopod telopoditomeres is difficult, as there is no division suture between the two supposed segments. However, in some species there is a constriction of varying depth; in addition, the translucent posterior wall of the base of the telopodite can provide an illusion of segment 1 being present. Hence the number of joints of the anterior gonopod telopodite in the different descriptions can vary.

Key to species of *Maritimosoma*:

1(2) Posterior angiocoxal process of posterior gonopod like a caudad convex plate with a long, slender, distal process (Fig. 345) . ... *M. piceum*

2(1) Posterior angiocoxal process of posterior gonopod different. 3

3(4) Posterior angiocoxal process like a subrectangularly bent, broad plate devoid of considerable outgrowths or teeth. Apex of posterior gonopod colpocoxite regularly rounded (Figs 347, 349). .... *M. turova*

4(3) Posterior angiocoxal process different, with outgrowths and arms. Apex of colpocoxite considerably narrowed. 5

5(6) Outgrowths of posterior angiocoxal process of posterior gonopod strongly separated (Fig. 352) . ... *M. schawalleri*

6(5) Outgrowths of posterior angiocoxal process of posterior gonopod close to each other (Fig. 355) .... *M. reductum*

Maritimosoma piceum **(Shear, 1990)**

Figs 345-346, Map 19.

Diplomaragna picea Shear, 1990: 34, 31: figs.
Diplomaragna picea - Mikhaljova, 1993: 25; 1998b: 31, 30: figs, 29: map; Ganin, 1997: 124.
Maritimosoma piceum - Mikhaljova, 2000: 177.

DIAGNOSIS: This species differs from congeners mainly in configuration of the posterior angiocoxal process, which is attenuate distally.

DESCRIPTION: Male. Adults 9-10 mm long, width at metazonite 6, 1.2 mm.Coloration light creamy tan, antennae white. Ocelli about 25, black.

Body with 32 segments. Paraterga beginning on segment 2, prominent, horizontal on segments 3-5, strongest, squarish, horizontal on segments 3-23, slightly reduced on segments 25-27, absent from segments 28-31.

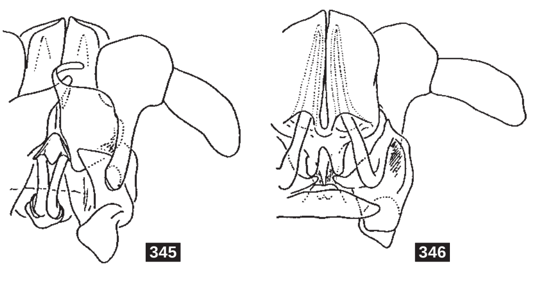
Legs long and slender. Leg pairs 3-7 with typical tarsal papillae, enlarged, somewhat incrassate. Coxae 10 and 11 usual, with glands.

Coxosternum of anterior gonopods very broad, flagelliform telopodites 1-segmented, strongly curved (Fig. 345). Basally fused colpocoxites relatively broad, very deeply cupped, sharply curved posteriorly in distal 1/3 extent. Both mesal sheath processes of colpocoxites fused with each other into a single piece and, together with lateral swellings, tightly clasping the anterior gonopod telopodites. A posterior angiocoxal processes broad, blade-like, each with a distal outgrowth curved far back into colpocoxites. Anterior angiocoxal processes long, slender, sheathed on anterior face of colpocoxites (Fig. 346). Femur of posterior gonopod usual, short.

Female unknown.

DISTRIBUTION (Map 19): Russia: Far East (Primorsky Province).

REMARKS: The species, originally described in *Diplomaragna* (Shear, 1990), has since been transferred to *Maritimosoma* (Mikhaljova, 2000).



Figs 345-346. *Maritimosoma piceum* (Shear, 1990): 345 – gonopods (caudal view); 346 – gonopods (front view). – Scale absent (after Shear, 1990).

Maritimosoma turova (Mikhaljova, 1997)

Figs 347-349, Map 19.

Diplomaragna turova Mikhaljova, 1997b: 125, 124: figs;

Diplomaragna turova - Mikhaljova, 1998b: 31: figs, 29: map.

Maritimosoma turova - Mikhaljova, 2000: 177: figs; Mikhaljova & Korsós, 2003: 219.

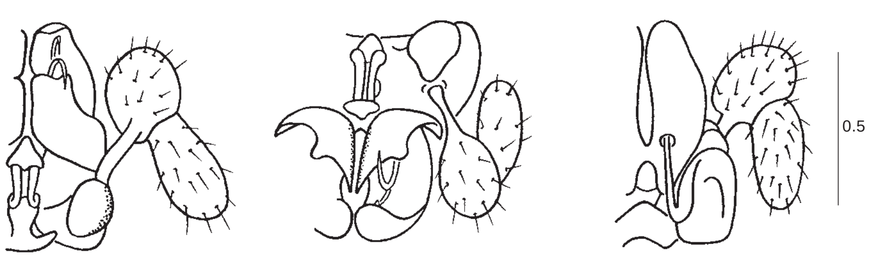
DIAGNOSIS: The species differs from congeners by the medial sheath processes fused medially and by the shape of the posterior angiocoxal processes, each of which is like a broad, almost rectangularly elongate plate with an uneven emarginate edge.

DESCRIPTION: Male. Body 11.5 mm long, 0.7 mm wide without, 1.2 mm with paraterga. Coloration in alcohol light beige. Antennae and legs light beige, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 30 ocelli. Antennae long. Collum semi-circular. Paraterga beginning on segment 2, well-developed on segments 4-27, reduced on segments 28-29, onward missing. Macrochaetae in a transverse row on segments 30-31, like an extended triangle on preceding segments. Anterolateral macrochaetae shortest, medial ones longest. All macrochaetae cylindrical and pointed, but not very sharply so.

Legs long and slender. Leg pairs 3-7 with typical tarsal papillae, somewhat enlarged. Legs 10 and 11 usual, with coxal glands.

Flagelliform telopodites of anterior gonopods 1-segmented, a pointed apex visible as stretched beyond sheath groove (Fig. 347). Basally fused colpocoxites of posterior gonopods each with an oval apex curved caudally. Mesal sheath processes fused into a single piece and tightly clasping the telopodites of anterior gonopods. Angiocoxite with a globule in posterior view. A large posterior angiocoxal process resembling a broad, caudally almost rectangularly elongate plate with an uneven emarginate distal edge (Fig. 348). Angiocoxite depressed centrally in anterior view



347 348 349

Figs 347-349. *Maritimosoma turova* (Mikhaljova, 1997): 347 – gonopods (caudal view); 348 – gonopods (ventral view); 349 – gonopods (front view). – Scale in mm (after Mikhaljova, 1997b).

(Fig. 349). Anterior angiocoxal processes long, slender, flagelliform, piercing the colpocoxites and with tips visible subapically on caudal face of colpocoxites. Prefemur of posterior gonopod with a thin stem, femur usual, short.

Female unknown.

DISTRIBUTION (Map 19): Russia: Far East (Primorsky Province).

REMARKS: This species, originally described in *Diplomaragna* (Mikhaljova, 1997b), has since been transferred to *Maritimosoma* (Mikhaljova, 2000). The specimens have been collected in wet fallen leaves near a stream and in forest litter.

Maritimosoma schawalleri **(Mikhaljova, 1993)**

Figs 350-354, Map 19.

Diplomaragna schawalleri Mikhaljova, 1993: 27, 26: figs.

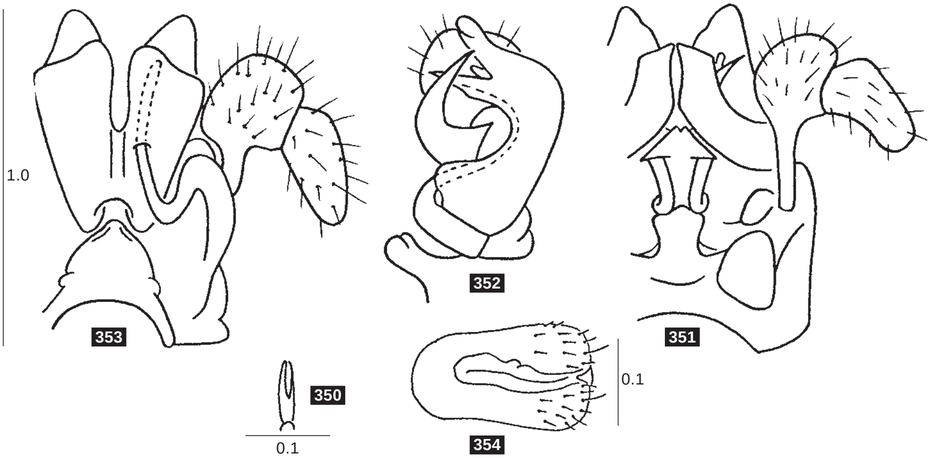
Diplomaragna schawalleri - Ganin, 1997: 105, Mikhaljova, 1997b: 128, 129: figs; 1998b: 32: figs, 29: map.

Maritimosoma schawalleri - Mikhaljova, 2000: 177.

DIAGNOSIS: This species differs from congeners in shape of the posterior angiocoxal process and of the distal part of the posterior gonopod colpocoxites. The species seems to be especially close to *M. reductum*. However, both differ in certain details of gonopod structure. In *M. schawalleri*, the horns of the posterior angiocoxal processes on the posterior gonopods are widely separated and the processes proper are curved gradually, whereas in *M. reductum* these horns lie closer to each other, and the processes are sharply curved. Also, the colpocoxites of the posterior gonopods are sharply bent caudad in *M. schawalleri*, being curved more gradually in *M. reductum*.

DESCRIPTION: Male. Length 11 mm, width 0.7 mm without, 0.9 mm with paraterga. Coloration pale yellowish, with indistinct brownish spots dorsally. Eyes black.

Body with 32 segments. Eye patches triangular, each composed of 20-25 ocelli. Gnathochilarium with several strong and long setae on outer sides of stipites, lamellae linguales contiguous, each with shorter parabasal setae forming a triangle and with longer distal setae in a longitudinal row. Antennae long. Collum oval, with brownish spots on each side. Both collum and segment 2 narrower than head with genae. Body width gradually growing until segment 7, body parallel-sided on segments 8-23, onward gradually tapering toward telson. Paraterga well-developed from segment 2, on segments 5-27 their caudolateral corners beak-shaped pointed. Macrochaetae in a transverse row on segments 30-31, like an extended triangle on



Figs 350-354. *Maritimosoma schawalleri* (Mikhaljova, 1993): 350 – male claw 7; 351 – gonopods (caudal view); 352 – gonopods (mesal view); 353 – gonopods (front view); 354 - vulva (ventral view). – Scales in mm (350, 354 – after Mikhaljova, 1993; 351-353 – after Mikhaljova, 1997b).

preceding segments. Anterolateral macrochaetae a bit shorter than both others; all macrochaetae blunt apically. Surface finely alveolate.

Legs long. Leg pairs 3-7 with typical tarsal papillae, somewhat enlarged. Claw 7 with a long parabasal seta (Fig. 350). Legs 10 and 11 usual, with coxal glands.

Flagelliform telopodites of anterior gonopods 1- or 2-segmented, apex pointed, visible as stretched beyond sheath groove (Figs 351). Basally fused colpocoxites of posterior gonopods strongly curved caudad, gradate as it were. Mesal sheath processes of colpocoxites fused into a single piece and clasping the anterior gonopod telopodites. Posterior gonopods with angiocoxites depressed centrally on anterior face and with two pairs of angiocoxal processes, large posteror ones resembling a caudally convex plate with an apical and a median pointed horn (Fig. 352). These horns strongly separated. Anterior angiocoxal processes long, like relatively thick flagella (Fig. 353), distal portion of latter either piercing the colpocoxite so that tip visible on caudal face of colpocoxite or placed inside front folds of colpocoxites. Femur of posterior gonopod with a relatively evident ventral hump at midway, usual, short.

Female. Length 11-12 mm, width 0.8 mm without, 1.0 mm with paraterga. Ocelli 18-20. Vulva as in Fig. 354.

Distribution (Map 19): Russia; Far East (Khabarovsk Province).

Remarks: This species was first described in *Diplomaragna* (Mikhaljova, 1993), later transferred to *Maritimosoma* (Mikhaljova, 2000). Based on type material, the gonopod structure of this species has been redescribed more adequately (Mikhaljova, 1997b).

***Maritimosoma reductum* (Shear, 1990)**

Figs 355-356, Map 20.

Diplomaragna reducta Shear, 1990: 34, 35: figs.

Diplomaragna reducta - Mikhaljova, 1993: 25; 1997b: 127; 1998b: 33: figs, 32: map; Ganin, 1997: 127.

Maritimosoma reductum - Mikhaljova, 2000: 177.

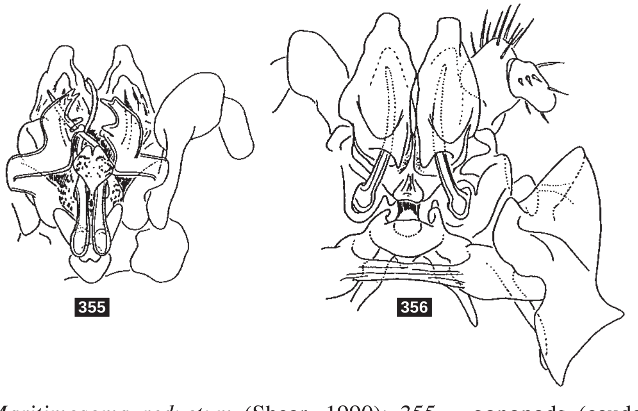
DIAGNOSIS: The species differs from congeners by the medially fused medial sheath processes forming a single piece fixing the anterior gonopod telopodites coupled with the shape of the posterior angiocoxal process which is strongly curved cephalad and supplied with poorly separated horns.

DESCRIPTION: Male. Length about 10 mm, width at metazonite 6, 1.2 mm. Coloration light creamy tan, antennae white, eyes black. Antennomere 3, 0.9 mm long.

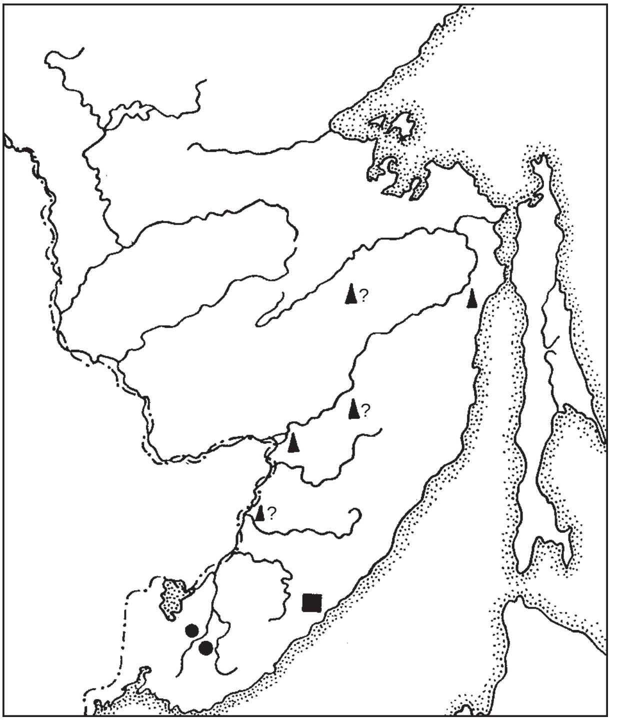
Body with 32 segments. Paraterga beginning on collum, prominent, horizontal on segments 3-5, strongest, squarish, horizontal on segments 9-23, slightly reduced on segments 24-26, absent from segments 27-31. Posterolateral macrochaetae longest. Apex of all macrochaetae blunt.

Legs carrying claws with two additional small claws dorsally. Leg pairs 3-7 with typical tarsal papillae, enlarged, somewhat incrassate; claws with a long ventral seta only. Postgonopodal legs without tarsal papillae. Coxae 10 and 11 usual, with glands; coxae 10 with small posteroventral knobs.

Coxosternum of anterior gonopods very broad, flagelliform telopodites 1-segmented. Basally fused colpocoxites of posterior gonopods relatively broad, sharply curved posteriorly in distal 1/3 extent. Mesal sheath processes fused into a single piece and together with lateral swellings tightly clasping the telopodites



Figs 355-356. *Maritimosoma reductum* (Shear, 1990): 355 – gonopods (caudal view); 356 – gonopods (front view). – Scale absent (after Shear, 1990).



Map 20. Distribution of *Maritimosoma reductum* (●), *Pacifiosoma kuruma* (■) and *P. cristofer* (▲).

of anterior gonopods (Fig. 355). Large posterior angiocoxal processes curved first mesally, then ventrally, with small mesal knobs probably in contact at midline, a larger dentate lamella with a more proximal tooth separated from others. Anterior angiocoxal processes set in a membranous socket, long, slender, sheathed on anterior face of colpocoxites (Fig. 356). Angiocoxites in anterior view sigmoid, reduced. Femur of posterior gonopod usual, short.

Female unknown.

DISTRIBUTION (Map 20): Russia: Far East (Primorsky Province).

REMARKS: Originally described in *Diplomaragna* (Shear, 1990), this species has been transferred to *Maritimosoma* (Mikhaljova, 2000). Based on type material and intact topotypes, the original diagnosis of this species has been rectified with the establishment of 32, not 30, body segments (Mikhaljova, 1997b). The species has been collected both in coniferous-broadleaved and purely coniferous forests.

Genus *Pacifiosoma* Mikhaljova, 2000

DISTRIBUTION: Russia: Southern Far East. This genus contains two species.

The main distinguishing characters are as follows. Body with 32 segments; paraterga normal, medium-sized; anterior gonopod telopodites subflagelliform to flagelliform, each placed inside a sheath groove; each colpocoxite of posterior gonopods entire; processes of colpocoxite sheath groove absent; posterior angiocoxal process present.

REMARKS: Identification of the number of anterior gonopod telopoditomeres is difficult, as there is no division suture between the two presumed segments. However, in some species there is a constriction of varying depth; in addition, the translucent posterior wall of the base of the telopodite can provide an illusion of segment 1 being present. Hence the number of joints of the anterior gonopod telopodite in the different descriptions can vary.

Keys to the species of *Pacifiosoma*:

1(2) Anterior angiocoxal processes of posterior gonopods present (Fig. 366). .... *P. cristofer*

2(1) Anterior angiocoxal processes of posterior gonopods absent (Fig.368). .. .. *P. kuruma*

Pacifiosoma cristofer **(Mikhaljova, 1993)**

Figs 357-366, Map 20.

Diplomaragna cristofer Mikhaljova, 1993: 18, 19: figs.

Diplomaragna cristofer - Ganin, 1997: 10; Mikhaljova, 1997b: 128, 126: figs; 1998b: 36, 35: figs, 32: map.

Pacifiosoma cristofer - Mikhaljova, 2000: 169, 170: figs.

DIAGNOSIS: The species differs from congeners in shape of the anterior gonopod telopodite's distal part as well as by the angiocoxal processes and the configuration of the colpocoxite of the posterior gonopod.

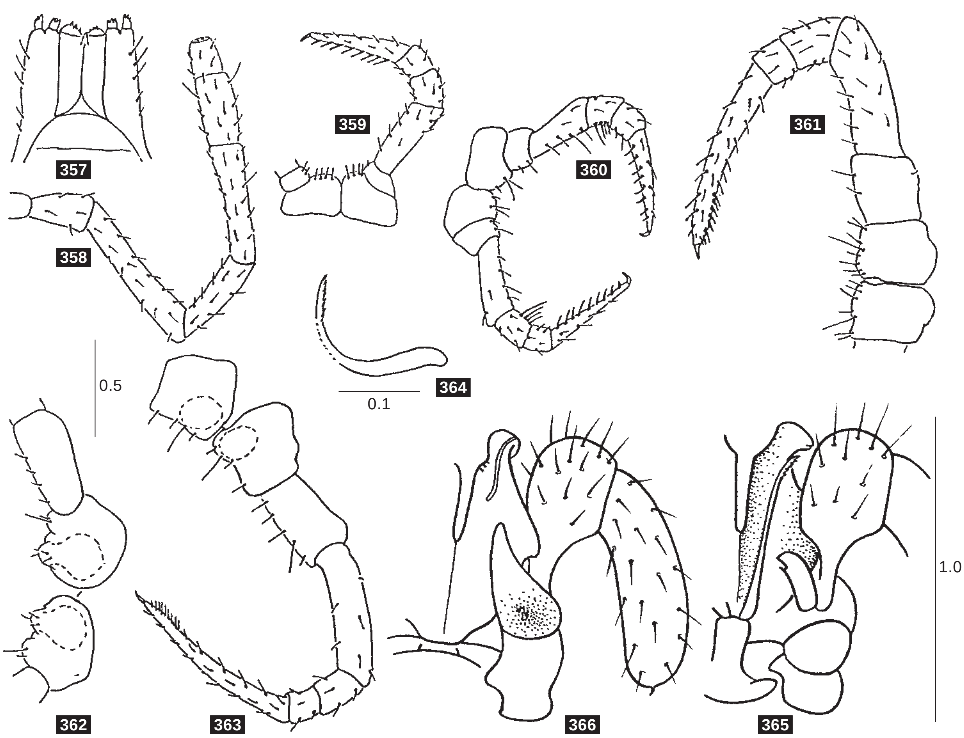
DESCRIPTION: Male. Length 15-16 mm, 1.7-1.8 mm wide without, 1.9-2.0

mm with paraterga. Coloration brown-yellow, with transverse brown bands on dorsal and lateral sides of metazona. Collum with faint marbled spots on each side. Legs marbled brownish dorsally. Eyes black, antennae brown.

Body with 32 segments. Eyes triangular, each composed of 28-30 ocelli. Gnathochilarium as in Fig. 357. Antennae (Fig. 358) very long. Collum oval. Both collum and somite 2 narrower than head with genae. Body growing in width toward segment 7, parallel-sided on segments 8-24, onward gradually tapering toward telson. Paraterga well-developed from segment 2, on segments 5-27 their caudolateral corners beak-shaped pointed. Macrochaetae in a transverse row on segments 30-31, like an extended triangle on preceding segments. Anterolateral macrochaetae shorter than others, all pointed. Somital surface microreticulate.

Legs long, claws at base with two small additional claws dorsally and a long seta ventrally. Legs 1 and 2 typical (Figs 359-360). Legs 3-7 (Fig 361) with typical tarsal papillae, enlarged; claws at base with a long ventral seta only. Postgonopodal legs with tarsal papillae distally; hind legs without tarsal papillae. Legs 10 and 11 (Figs 362-363) usual, with coxal glands.

Telopodite of anterior gonopod 1-segmented, subflagelliform, with a cristate apex (Fig. 364) visible as stretched beyond sheath groove (Fig. 365). Latter splitting longitudinally the distal end of colpocoxite into two tightly adjacent parts so that unciform apices of colpocoxites look bifid. Colpocoxites fused along basal 2/3 extent, each external edge drawn into a triangular plate, as usual without sheath processes. Colpocoxite surface finely papillate/spinulate. Posterior angiocoxal processes small, chip-shaped, each with an incision at distal edge. In anterior view (Fig. 366), angiocoxite depressed centrally, carrying a digitiform process with a blunt apex. Femur of posterior gonopod relatively long, with a claw vestige apically.



Figs 357-366. *Pacifiosoma cristofer* (Mikhaljova, 1993): 357 – gnathochilarium; 358 – antenna; 359 – male leg pair 1; 360 – male leg pair 2; 361 – male leg pair 3; 362 – male coxae 10; 363 – male leg pair 11; 364 – telopodite of anterior gonopod; 365 – gonopods (caudal view); 366 – posterior gonopods (front view). – Scales in mm (357-364 – after Mikhaljova, 1993; 365-366 – after Mikhaljova, 1997b).

Female. Length 15.5-16 mm, width 1.7-1.8 mm wide without, 1.9-2.0 mm with paraterga.

DISTRIBUTION (Map 20): Russia: Far East (Khabarovsk Province).

REMARKS: Originally described in *Diplomaragna* (Mikhaljova, 1993), this species has since been transferred to *Pacifiosoma* (Mikhaljova, 2000). Based on type material, the gonopod structure of this species has been redescribed more adequately (Mikhaljova, 1997b). This species lives in mountainous *Picea* and mixed forests. In the northern Sikhote-Alin (Skalistyi Mt. Range), its numbers amount to 21.0 ind./m² (Ganin, 1997).

Pacifiosoma kuruma **(Mikhaljova, 1997)**

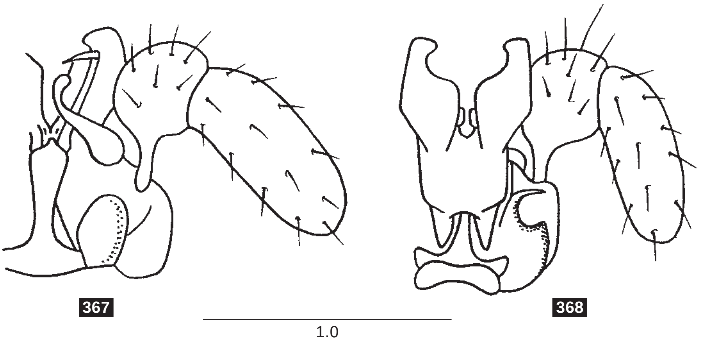
Figs 367-368, Map 20.

Diplomaragna kuruma Mikhaljova, 1997b: 125, 124: figs.
Diplomaragna kuruma - Mikhaljova, 1998b: 36: figs, 32: map.
Pacifiosoma kuruma - Mikhaljova, 2000: 170.

DIAGNOSIS: The species differs from congeners in the absence of anterior angiocoxal processes of the posterior gonopods, the subdigitiform posterior angiocoxal processes, the very long T-shaped coxal portion of the anterior gonopod coxosternum and the clavate anterolateral macrochaetae on the metazonites.

DESCRIPTION: Male. Length of the only holotype male 9 mm, width 0.4 mm without, 0.9 mm with paraterga. Coloration in alcohol light beige. Antennae and legs light beige, eyes black.

Body with 32 segments. Eyes triangular, each composed of 30 ocelli. Antennae long. Collum oval. Paraterga beginning on segment 2, well-developed on segments 4-28, reduced on segment 29, onward missing. Macrochaetae in a



Figs 367-368. *Pacifiosoma kuruma* (Mikhaljova, 1997): 367 – gonopods (caudal view); 368 – gonopods (front view). – Scale in mm (after Mikhaljova, 1997b).

transverse row on segments 30-31, like an extended triangle on preceding segments. Anterolateral macrochaetae shortest, clavate, posterolateral ones longest. Medial and posterolateral macrochaetae cylindrical and pointed, but not very sharply so.

Legs long and slender. Leg pairs 3-7 with typical tarsal papillae, somewhat enlarged. Legs 10 and 11 usual, with coxal glands.

Anterior gonopod coxosternum with a very long coxal part; telopodite 1-segmented, flagelliform, distal part with a pointed apex visible as stretched beyond sheath groove with elevated edges (Fig. 367). Posterior gonopod colpocoxites fused basally, their distal parts curved caudally, apices rounded. Colpocoxite sheath groove without evident processes. Tiny flattened knobs fused in the middle in place of mesal sheath processes. Posterior angiocoxal processes subdigitiform, slender, slightly curved distally, with rounded apices. In anterior view, angiocoxte (Fig. 368) strongly depressed in basal part and supporting a globule in distal part. Anterior angiocoxal processes absent. Femur of posterior gonopod relatively long.

Female. Length 9-9.5 mm, width 0.4 mm without, 0.9 mm with paraterga. Ocelli 26-27.

DISTRIBUTION (Map 20): Russia: Far East (Primorsky Province).

REMARKS: Originally described in *Diplomaragna* (Mikhaljova, 1997b), this species has since been transferred to *Pacifiosoma* (Mikhaljova, 2000). It has been collected in *Quercus* woodlands.

Genus *Shearia* Mikhaljova, 2000

DISTRIBUTION: Russia: Siberia (Sayan and Altai Mts). This genus contains seven species.

The main distinguishing characters are as follows. Body with 32 segments; paraterga normal, medium-sized; anterior gonopod telopodite flagelliform, placed inside a sheath groove of posterior gonopod colpocoxite; mesal sheath processes fused into a single cup-shaped structure; lateral sheath process tiny or absent; each colpocoxite entire, (sub)cyathiform in shape; anterior angiocoxal process present; posterior angiocoxal process poorly developed to absent; femur of posterior gonopod telopodite of medium length or long.

REMARKS: The basal part of the anterior gonopod telopodite in all species displays the posterior wall only, with the division sulcus/constriction between segments 1 and 2 dubious but evident enough to discriminate segment 1 at least superficially.

Key to species of *Shearia*:

1(4) Anterior angiocoxal process of posterior gonopod very large and broad. 2

2(3) Colpocoxite of posterior gonopod strongly curved caudad, with an external lateral blade (Fig. 370). .... *S. shushenskaya*

3(2) Colpocoxite of posterior gonopod regularly curved caudad, without external lateral blade (Fig. 375). .... *S. teletskaya*

4(1) Anterior angicoxal process of posterior gonopod different. 5

5(6) Colpocoxite tip with a subquadrate excavation (Fig. 377). Telopodites of anterior gonopods very long. .... *S. rybalovi*

6(5) Colpocoxite tip different. Telopodites of anterior gonopods shorter. 7

7(8) Posterior gonopod angiocoxite in anterior view with one outgrowth (Fig. 380). .... *S. calycina*

8(7) Posterior gonopod angiocoxite in anterior view with two outgrowths. 9

9(10) Mesal sheath plate (ms) small (Fig. 382). .... *S. densecava*

10(9) Mesal sheath plate (ms) very large (Figs 385, 387) 11

11(12) Posterior angiocoxal process of posterior gonopod almost absent, like a small knob (pp) (Fig. 385). Branches of anterior angiocoxal process pointed (Fig. 386). .... *S. khakassica*

12(11) Posterior angiocoxal process of posterior gonopod rather well-developed (Fig. 387). Branches of anterior angiocoxal process blunt (Fig. 388). .... *S. oiskaya*

Shearia shushenskaya **Mikhaljova, 2000**

Figs 369-374, Map 15.

Shearia shushenskaya Mikhaljova, 2000: 169, 168: figs.
Shearia shushenskaya - Mikhaljova & Golovatch, 2001: 110.

DIAGNOSIS: Differs from congeners in shape of both the anterior angiocoxal process and the colpocoxite of the posterior gonopods.

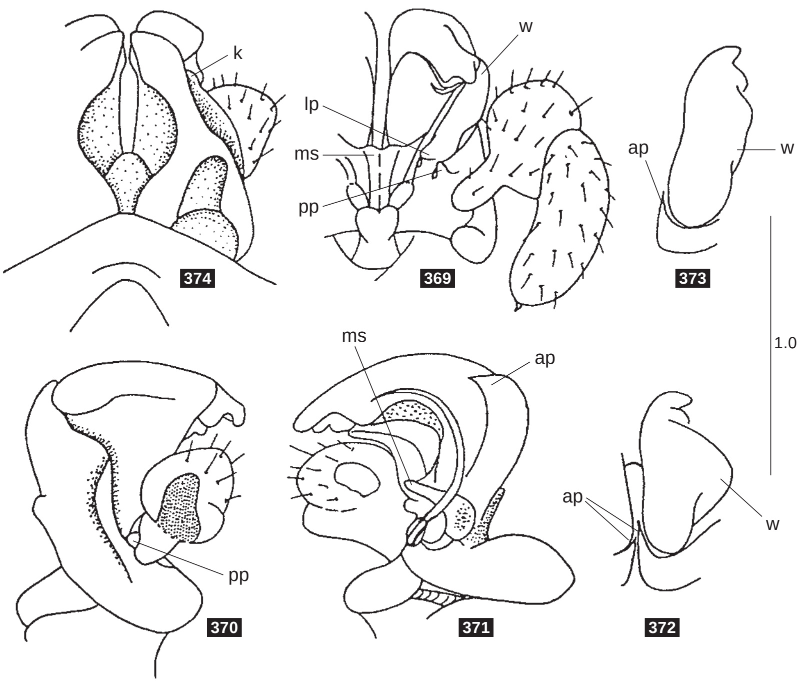
DESCRIPTION: Male. Length 23-24 mm, width 1.5-1.6 mm without, 2.0-2.1 mm with paraterga. Coloration in alcohol tan with a dark brown, marbled, oval spot in dorsal part of paraterga. Antennae and legs brown, growing darker distad, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 24-25 ocelli. Antennae long. Collum semi-circular. Paraterga beginning from segment

2, well-developed on segments 4-27 (on segments 8-27 their caudolateral corners beak-shaped pointed), reduced on segment 28, onward missing. Paraterga 4-7 shorter and thicker than others. Macrochaetae in a transverse row on segments 29-31, arranged typically in a transverse triangle on preceding segments. Posterolateral macrochaetae longest, medial ones shortest, all filiform, very finely pointed.

Legs long and slender, each claw with a tiny accessory claw basally. Legs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods. Femora 5-7 swollen and curved. Tarsi of postgonopodal legs with minute ventral papillae subapically. Legs 10 and 11 usual, with coxal glands. Coxa 10 with a conical, setose, ventral process.

Distal part of flagelliform telopodites of anterior gonopods visible from outside, tip pointed (Fig. 369). Colpocoxites of posterior gonopods fused basally, broad, concave from behind, strongly curved caudad (Figs 370-371). Lateral margin of colpocoxite (w) more (Fig. 372) or less (Fig. 373) strongly convex,



Figs 369-374. *Shearia shushenskaya* Mikhaljova, 2000: 369 – gonopods (caudal view); 370 – gonopods (lateral view); 371 – right gonopod (mesal view, telopodite of left anterior gonopod visible); 372-373 – variation in convexity of colpocoxite lateral margin; 374 – gonopods (front view); ap – anterior process of angiocoxite; k – lateral projection of anterior angiocoxal process; lp – lateral sheath process of colpocoxite; ms – colpocoxite mesal sheath processes fused in midline; pp – posterior angiocoxal process; w – external lobe of colpocoxite. – Scale in mm (after Mikhaljova, 2000).

inner one a little incurved. Mesal sheath processes (ms) a large cup-shaped structure. A lateral sheath process (lp) tiny, like an explanate edge of sheath groove. Angiocoxite in posterior view with a globule and a small process (pp), in anterior view (Fig. 374) depressed centrally. An anterior angiocoxal process (ap) very large, broad, with a small lateral projection (k) (Figs. 371, 374). Tip of anterior angiocoxal process pointed, reaching the fissure between colpocoxites (Fig. 372). Femur of posterior gonopod telopodite medium-sized, with a claw vestige.

Female. Length 23-24 mm, width 1.4-1.5 mm without, 1.9-2.0 mm with paraterga. Ocelli 27-28.

DISTRIBUTION (Map 15): Russia: Siberia (Krasnoyarsk Province).

Shearia teletskaya Mikhaljova, 2000

Figs 375-376, Map 15.

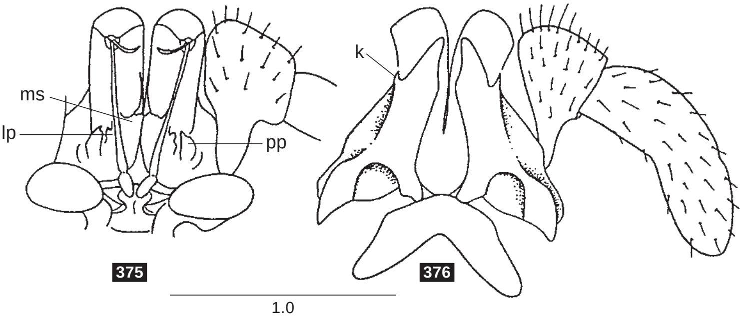
Shearia teletskaya Mikhaljova, 2000: 167: figs.

Shearia teletskaya - Mikhaljova & Golovatch, 2001: 111.

DIAGNOSIS: Differs from congeners in shape of both the anterior angiocoxal process and the colpocoxite of the posterior gonopods.

DESCRIPTION: Male. Length 17-18 mm, width 1.3-1.4 mm without, 1.9-2.0 mm with paraterga. Coloration in alcohol tan, with a transverse dark tan line on prozona and metazona dorsolaterally. Antennae brown, legs marbled brown, darker distad, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 27-28 ocelli. Antennae long. Collum semi-circular. Segment 2 equal in width to head



Figs 375-376. *Shearia teletskaya* Mikhaljova, 2000: 375 – gonopods (caudal view); 376 – gonopods (front view); k – lateral projection of anterior angiocoxal process; lp – lateral sheath process of colpocoxite; ms – colpocoxite sheath mesal processes fused in midline; pp – posterior angiocoxal process. – Scale in mm (after Mikhaljova, 2000).

with genae but narrower than segment 3. Paraterga beginning from segment 2, well-developed on segments 4-27 (on segments 8-27 their caudolateral corners beak-shaped pointed), reduced on segment 28, onward missing. Macrochaetae in a transverse row on segments 29-31, arranged typically in a transverse triangle on preceding segments. Posterolateral macrochaetae longest, medial ones shortest, all pointed.

Legs long and slender, each claw with a tiny accessory claw basally. Legs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods. Femora 5-7 swollen and curved. Tarsi of postgonopodal legs subapically with minute ventral papillae. Legs 10 and11 usual, with coxal glands. Coxae 10 with a dentiform process ventrally.

Gonopods in situ subparallel to main body axis. Distal part of a flagelliform telopodite of anterior gonopod cristate, visible from outside (Fig. 375). Colpocoxites of posterior gonopods fused medially almost to midway, relatively broad, regularly curved caudad. Inner margins of colpocoxites a little incurved. Distal part of colpocoxites narrowed, tips oval. A mesal sheath processes (ms) like a small cup-shaped structure. A lateral sheath process (lp) tiny. Angiocoxite with a globule and a small process (pp) in posterior view, depressed centrally in anterior view. An anterior angiocoxal process very large, broad, with a lateral dentiform projection (k) (Fig. 376). Femur of posterior gonopod telopodite long.

Female. Length 18.5-19 mm, width 1.5-1.6 mm without, 2.0-2.1 mm with paraterga. Ocelli 28-29.

DISTRIBUTION (Map 15): Russia: Siberia (Republic of Altai).

REMARKS: This species has been collected in *Picea obovata* + *Pinus sibirica* taiga stands at 1,350-1,750 m a.s.l. and in the subalpine belt (= goltsy) at 1,750-2,000 m a.s.l.

Shearia rybalovi **Mikhaljova, 2000**

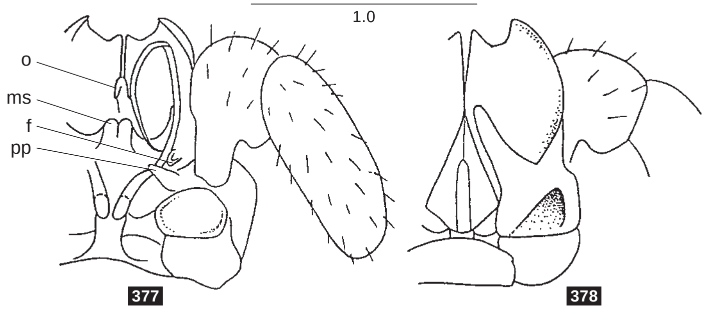
Figs 377-378, Map 21.

Shearia rybalovi Mikhaljova, 2000: 164: figs.

Shearia rybalovi - Mikhaljova & Golovatch, 2001: 110; Vorobiova et al., 2002: 67; Rybalov, 2002.

DIAGNOSIS: Differs from congeners by the subquadrate excavation at the tip of the colpocoxite, the unequally long anterior gonopod telopodites, and the shape of the colpocoxite.

DESCRIPTION: Male. Length 15.5-20 mm, width 1.1-1.4 mm without, 1.7-2.0 mm with paraterga. Coloration in alcohol tan. Antennae and legs brown, eyes black.

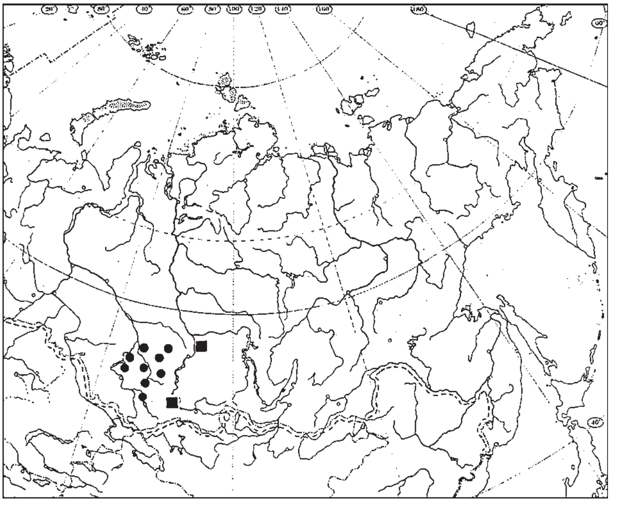


Figs 377-378. *Shearia rybalovi* Mikhaljova, 2000: 377 – gonopods (caudal view); 378 – gonopods (front view); f – lateral fold of colpocoxite sheath groove; ms –colpocoxite sheath mesal processes fused in midline; o – fused projections of mesal colpocoxite edges; pp – posterior angiocoxal process. – Scale in mm (after Mikhaljova, 2000).

Body with 32 segments. Eye patches triangular, each composed of 28-30 ocelli. Antennae long. Collum semi-circular. Paraterga beginning from segment 2, well-developed on segments 5-27 (on segments 8-27 their caudolateral corners beak-shaped pointed), reduced on segment 28, onward missing. Macrochaetae filiform, arranged in a transverse row on segments 28-31, arranged typically in a transverse triangle on preceding segments. Posterolateral macrochaetae longest, medial and anterolateral ones subequal in length, all pointed.

Legs long and slender. Legs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods. Femora 5-7 swollen and curved. Legs 10 and 11 usual, with coxal glands. Coxae 10 and 11 each with a setose, dentiform, ventral process.

Distal part of a ribbon-shaped telopodite of anterior gonopod produced well beyond top of colpocoxite, tip pointed, without modifications (Fig. 377).



Map 21. Distribution of *Altajosoma deplanatum* (●) and *Shearia rybalovi* (■).

Colpocoxites of posterior gonopods fused basally, broad, each with a subquadrate excavation in distal part. Mesal sheath processes (ms) like small cup-shaped structures. Mesal margins of colpocoxites with lamellar outgrowths (o) which can be either fused or remain free. No lateral sheath process expressed, an oval fold (f) in its place. Angiocoxite with a globule and a small dentiform process (pp) in posterior view and with a depression and two branches in anterior view (Fig. 378). Medial branch longer, outer one somewhat shifted onto lateral face of colpocoxite. Femur of posterior gonopod telopodite not very long.

Female. Length 15.5-20 mm, width 1.0-1.3 mm without, 1.7-2.0 mm with paraterga. Paraterga shorter than in male.

DISTRIBUTION (Map 21): Russia: Siberia (Krasnoyarsk Province).

REMARKS: This species is relatively abundant, living in subtaiga stands (Vorobiova et al., 2002).

Shearia calycina Mikhaljova, 2000

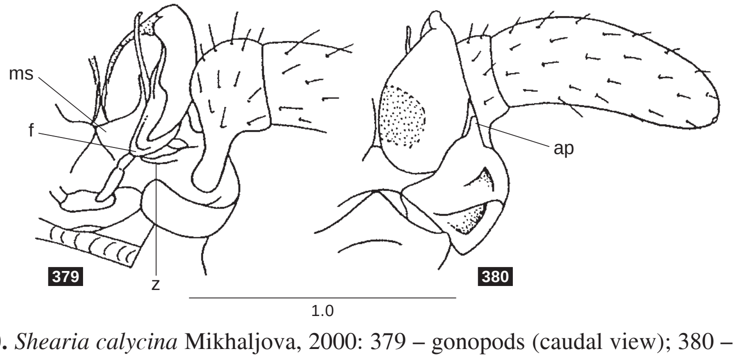
Figs 379-380, Map 22.

Shearia calycina Mikhaljova, 2000: 166, 167: figs.
Shearia calycina - Mikhaljva & Golovatch, 2001: 110.

DIAGNOSIS: Differs from congeners in shape of the posterior gonopod colpocoxites and the single anterior angiocoxal process.

DESCRIPTION: Male. Length 14.5 mm, width 1.3 mm without, 1.7 mm with paraterga. Coloration in alcohol tan. Antennae dark brown, legs brown, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 30 ocelli. Antennae long. Collum semi-circular. Paraterga beginning from segment 2, well-



Figs 379-380. *Shearia calycina* Mikhaljova, 2000: 379 – gonopods (caudal view); 380 – gonopods (front view); ap – anterior process of angiocoxite; f – lateral fold of colpocoxite sheath groove; ms – colpocoxite sheath mesal processes fused in midline; z – posterior fold of angiocoxite. – Scale in mm (after Mikhaljova, 2000).

developed on segments 5-26 (on segments 8-26 their caudolateral corners beak-shaped pointed), reduced on segment 27, onward missing. Paraterga 5-7 shorter and thicker than others. Macrochaetae in a transverse row on segments 29-31, arranged typically in a transverse triangle on preceding segments. Macrochaetae not very long, stout. Posterolateral macrochaetae longest, anterolateral ones shortest, all pointed.

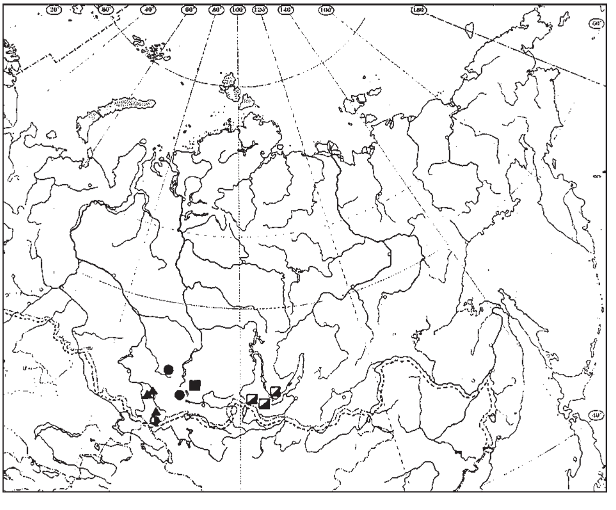
Legs long and slender, each claw with a tiny accessory claw basally. Legs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods. Tarsi of postgonopodal legs with a group of papillae distally. Femora 5-7 swollen and curved. Legs 10 and 11 usual, with coxal glands. Coxa 10 with a dentiform, setose, ventral process.

Distal part of a flagelliform telopodite of anterior gonopods protruding well beyond top of colpocoxite of posterior gonopod, tip of the telopodite without modifications (Fig. 379). Sheath groove extending up to midway of colpocoxite. Colpocoxites fused basally, broad, distal parts narrowed. Inner margins of colpocoxites a little incurved. Mesal sheath processes (ms) like a fused, medium-sized, cup-shaped structure. A lateral sheath process not expressed, with an oval fold (f) in its place. Angiocoxite with a globule in posterior view. Posterior angiocoxal process absent, with a small fold (z) in its place. Angiocoxite in anterior view (Fig. 380) depressed centrally, with a short lateral process (ap). Femur of posterior gonopod telopodite medium-sized.

Female. Length 15-17 mm, width 1.4 mm without, 1.8 mm with paraterga. Ocelli 30-31.

Distribution (Map 22): Russia: Siberia (Republic of Altai).

Remarks: This species has been collected in the mountains among stones at the snow line at ca. 2,800 m a.s.l.



Map 22. Distribution of *Shearia khakassica* (●), *Shearia oiskaya* (■), *Shearia densecava* (▲), *Shearia calycina* (◑), *Altajosoma shilenkovi* (◪).

Shearia densecava (Gulièka, 1972)

Figs 381-384, Map 22.

Altajosoma densecavum Gulièka, 1972: 38, 37: fig.

Altajosoma densecavum – Lokšina & Golovatch, 1979: 382.

Diplomaragna densecava – Shear, 1990: 38; Mikhaljova, 1993: 22.

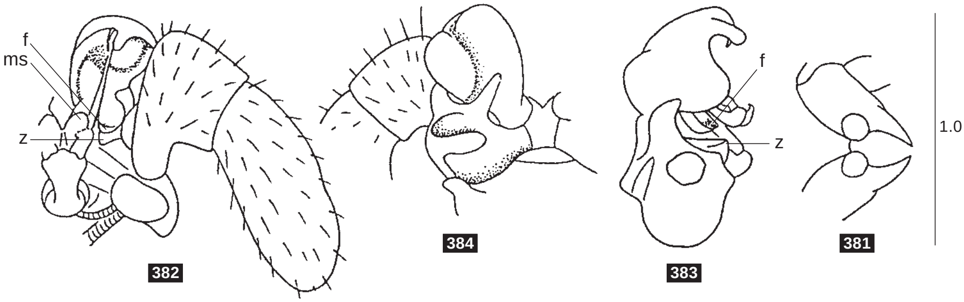
Shearia densecava – Mikhaljova, 2000: 165, 166: figs; Mikhaljova & Golovatch, 2001: 110; Mikhaljova & Nefediev, 2003: 86.

DIAGNOSIS: The species differs from congeners in the configuration of the gonopod colpocoxite, the small mesal sheath processes fused medially into a single cup-shaped structure, the presence of a long, curved, dentiform process of coxa 10

DESCRIPTION: Male. Length 18.5-22 mm, width 1.1-1.2 mm without, 1.7-1.8 mm with paraterga. Coloration in alcohol tan or beige, antennae brown or beige, eyes black, legs brownish or beige with marbled brown distal parts.

Body with 32 segments. Eye patches triangular, each composed of 28-29 ocelli. Antennae long. Collum semi-circular. Paraterga beginning from segment 2, well-developed on segments 5-27 (on segments 8-27 their caudolateral corners beak-shaped pointed), reduced on segment 28, onward missing. Macrochaetae in a transverse row on segments 29-31, arranged typically in a transverse triangle on preceding segments. Posterolateral macrochaetae longest, medial macrochaetae a bit shorter than anterolateral ones, all pointed.

Legs long and slender, each claw at base with two small accessory claws dorsally and a long seta ventrally. Legs 3-7 with typical tarsal papillae, increasingly



Figs 381-384. *Shearia densecava* (Gulièka, 1972): 381 – male coxae 10; 382 – gonopods (caudal view); 383 – gonopods (mesal view, posterior gonopod telopodite removed); 384 – posterior gonopods (front view); f – lateral fold of colpocoxite sheath groove; ms – colpocoxite sheath mesal processes fused in midline; z – posterior fold of angiocoxite. – Scale in mm (after Mikhaljova, 2000).

enlarged toward gonopods; claws at base with a long ventral seta only. Femora 5-7 swollen and curved. Tarsi of postgonopodal legs with a group of funnel-shaped papillae apically. Legs 10 and 11 usual, with coxal glands. Coxa 10 with a long curved dentiform process (Fig. 381).

Distal part of a flagelliform telopodite of anterior gonopods projecting beyong top of colpocoxite of posterior gonopods, tip of the telopodite pointed, without modifications (Fig. 382). Colpocoxites fused basally, broad, each with an apical projection. Mesal sheath processes (ms) like a fused, small, cup-shaped structure. Lateral sheath processes not expressed, an oval fold (f) in their place (Fig. 383). Angiocoxite with a globule in posterior view; a posterior angiocoxal process absent, with a fold (z) in its place. Angiocoxite in anterior view (Fig. 384) with two equally long branches, of which outer one shifted onto lateral face of colpocoxite. Femur of posterior gonopod telopodite medium-sized.

Female unknown.

DISTRIBUTION (Map 22): Russia: Siberia (Republic of Altai).

REMARKS: This species was originally described in *Altajosoma* (Gulièka, 1972), later transferred first to *Diplomaragna* (Shear, 1990) and then to *Shearia* (Mikhaljova, 2000). It has been collected at 500-800 and 2,500 m a.s.l. in taiga and mountain tundra habitats.

***Shearia khakassica* Mikhaljova, 2000**

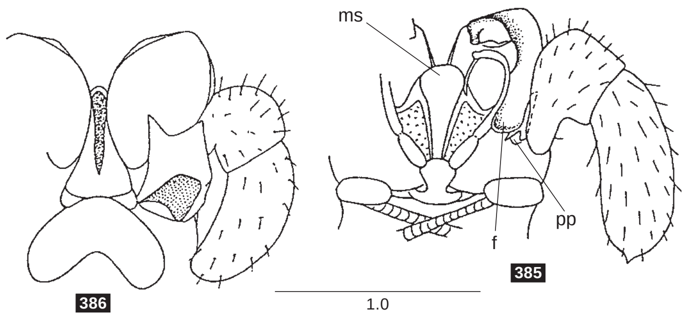
Figs 385-386, Map 22.

Shearia khakassica Mikhaljova, 2000: 163: figs.
Shearia khakassica – Mikhaljova & Golovatch, 2001: 110.

DIAGNOSIS: Differs from congeners by the very large cyathiform structure, into which both mesal sheath processes merge, the pointed tips of both anterior angiocoxal branches, and the small posterior angiocoxal processes.

DESCRIPTION: Male. Length 19 mm, width 1.3 mm without, 1.9 mm with paraterga. Coloration in alcohol dark beige with brown oval spots on paraterga dorsally. Antennae brown, eyes black. Legs dark beige with marbled brown distal parts.

Body with 32 segments.Eye patches triangular, each composed of 27 ocelli. Antennae long. Collum semi-circular. Paraterga beginning from segment 2, well-developed on segments 4-27, reduced on segment 28, onward missing. Macro-chaetae in a transverse row on segments 29-31, arranged typically in a transverse triangle on preceding segments. Posterolateral macrochaetae longest, medial and anterolateral ones subequal in length, all pointed.



Figs 385-386. *Shearia khakassica* Mikhaljova, 2000: 385 – gonopods (caudal view); 386 – gonopod (front view); f – lateral fold of colpocoxite sheath groove; ms –colpocoxite sheath mesal processes fused in midline; pp – posterior angiocoxal process. – Scale in mm (after Mikhaljova, 2000).

Legs long and slender. Legs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods. Femora of legs 5-7 swollen and curved. Legs 10 and 11 usual, with coxal glands. Coxa 10 with a dentiform process.

Distal part of a flagelliform telopodite of anterior gonopod extending well beyond colpocoxite of posterior gonopods, tip of the telopodite pointed, without modifications (Fig. 385). Colpocoxites broad, fused basally. Distal part of colpocoxite curved posterad. A cup-shaped structure (ms) being fused mesal sheath processes large. A lateral sheath process not expressed, an oval fold in its place (f). Angiocoxite with a globule and a very small dentiform process (pp) in posterior view, with a depression and a bifurcated process in anterior view (Fig. 386), apices of branches pointed. Femur of posterior gonopod telopodite not very long, apex with a claw vestige.

Female. Length 18 mm, width 1.5 mm without paraterga, 2.0 mm with paraterga.

DISTRIBUTION (Map 22): Russia: Siberia (Republic of Khakassia, Krasnoyarsk Province).

REMARKS: The species has been collected in montane forest-tundra and mossy stony tundra habitats at 1,300-1.400 m a.s.l., also taken by pitfall trapping in woodlands.

Shearia oiskaya Mikhaljova, 2000

Figs 387-388, Map 22.

Shearia oiskaya Mikhaljova, 2000: 165: figs.

Shearia oiskaya – Mikhaljova & Golovatch, 2001: 110.

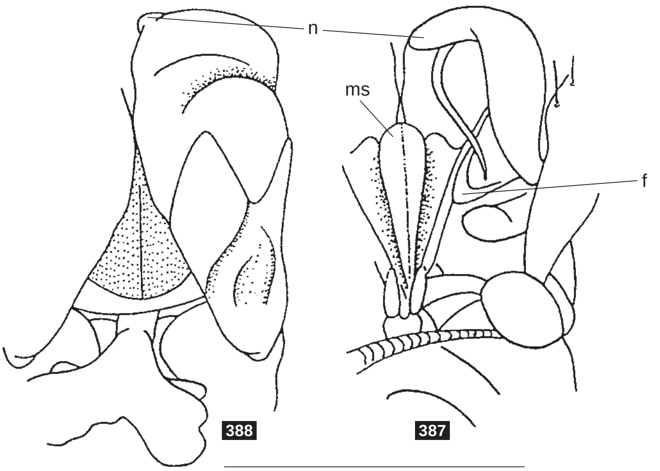
DIAGNOSIS: Differs from congeners in shape of the posterior gonopod colpocoxites and the equally long anterior angiocoxal branches.

DESCRIPTION: Male. Length 20 mm, width 1.3 mm without, 2.0 mm with paraterga. Coloration in alcohol light beige. Antennae brown, legs brownish, eyes black.

Body with 32 segments. Eye parches triangular, each composed of 29 ocelli. Antennae long. Collum semi-circular. Paraterga beginning from segment 2, well-developed on segments 5-27 (on segments 8-27 their caudolateral corners beak-shaped pointed), reduced on segments 28-29, onward missing. Macrochaetae in a transverse row on segments 28-31, arranged typically in a transverse triangle on preceding segments. Posterolateral macrochaetae longest, medial and anterolateral ones subequal in length, all pointed.

Legs long and slender, each claw with a tiny accessory claw dorsally. Legs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods. Femora 5-7 swollen and curved. Tarsi of postgonopodal legs with papillae apically. Legs 10 and 11 usual, with coxal glands. Coxa 10 with a small, dentiform, setose process curved posterad.

Distal part of a ribbon-shaped, subflagelliform telopodite of anterior gonopods produced well beyond top of colpocoxite of posterior gonopods, tip of the telopodite pointed, without modifications (Fig. 387). Colpocoxites fused basally, broad, each with a projection (n) distally. Mesal sheath processes (ms) like a fused, high, oval structure. A lateral sheath process not developed, an oval fold (f) in its place. Angiocoxite with a globule in posterior view and a bifurcated process in anterior view (Fig. 388); medial and lateral branches subequal in length. A



Figs 387-388. *Shearia oiskaya* Mikhaljova, 2000: 387 – gonopods (caudal view); 388 – gonopods (front view); f – lateral fold of colpocoxite sheath groove; ms –colpocoxite sheath mesal processes fused in midline; n – projection of colpocoxite tip. – Scale in mm (after Mikhaljova, 2000).

posterior angiocoxal process medium-sized. Femur of posterior gonopod telopodite long, with a claw vestige.

Female unknown.

DISTRIBUTION (Map 22): Russia: Siberia (Krasnoyarsk Province).

REMARKS: The species has been found in a subalpine meadow and in montane tundra at 1,600-1,700 m a.s.l.

Genus *Altajosoma* Gulièka, 1972

DISTRIBUTION: Russia: Southwest Siberia, southern part of Middle Siberia, Bashkortostan (= Bashkiria), Ural Mts. This genus contains seven species.

The main distinguishing characters are as follows. Body with 32 segments; paraterga normal, medium-sized; anterior gonopod telopodites narrowed or subflagelliform, modified distally, each placed inside a narrow sheath groove of posterior gonopod colpocoxite; each colpocoxite entire; lateral sheath process of colpocoxite well-developed; mesal sheath process of colpocoxite small or absent; posterior angiocoxal process large; femur of posterior gonopod telopodite of medium size or elongate.

REMARKS: Identification of the number of anterior gonopod telopoditomeres is difficult, as there is no division suture between the two presumed segments. However, in some species there is a constriction of varying depth; in addition, the translucent posterior wall of the base of the telopodite can provide an illusion of segment 1 being present. Hence the number of joints of the anterior gonopod telopodite in the different descriptions can vary.

Keys to species or subspecies of *Altajosoma*:

1(2) Lateral sheath process of posterior gonopod colpocoxite very long, positioned basally (Fig. 391). .... *A. deplanatum*

2(1) Lateral sheath process of posterior gonopod colpocoxite different. 3

3(4) Male coxae 12 enlarged, trapezoidal, with small cones on posterior faces (Fig. 396). Gonopods as in Figs 398-399. .... *A. coxale*

4(3) Male coxae 12 different. Gonopods different... 5

5(6) Gonopods greatly large, as in Figs 405-406, strongly projecting from segment 7. .... *A. shilenkovi*

6(5) Gonopods different. 7

7(8) Lateral sheath process of posterior gonopod colpocoxite strongly projecting beyond colpocoxite, well visible in anterior view, its tip swollen (Fig. 412) ....*A. golovatchi*

8(7) Lateral sheath process of posterior gonopod colpocoxite not protruding considerably beyond colpocoxite, almost invisible in anterior view, its apex different. 9

9(10) Posterior angiocoxal process of posterior gonopod long, narrow, curved anteriad (Fig. 417). .... *A. katunicum*

10(9) Posterior angiocoxal process of posterior gonopod different. 11

11(14) One of the five teeth on posterior angiocoxal process set well apart from the others. Lamella of lateral sheath process long, reaching the tip of colpocoxite. 12

12(13) Anterior angiocoxal process of posterior gonopods short (Fig. 421). .... *A. bakurovi bakurovi*

13(12) Anterior angiocoxal process of posterior gonopods long (Fig. 423). .... *A. bakurovi longiprocessum*

14(11) None of the five teeth on posterior angiocoxal process set well apart from the others. Lamella of lateral sheath process short, not reaching the tip of colpocoxite (Fig. 425). .... *A. kemerovo*

***Altajosoma deplanatum* (Stuxberg, 1876)**

Figs 389-393, Map 21.

Craspedosoma deplanatum Stuxberg, 1876a: 34, figs.

Craspedosoma deplanatum - Stuxberg, 1876b: 317; Lokšina & Golovatch, 1979: 382.

Altajosoma pinetorum Gulièka, 1972: 37: fig.

Altajosoma pinetorum - Lokšina & Golovatch, 1979: 382; Shelley et al., 2000: 62.

Diplomaragna deplanata - Shear, 1990: 19, 20: figs; Mikhaljova, 1993: 22.

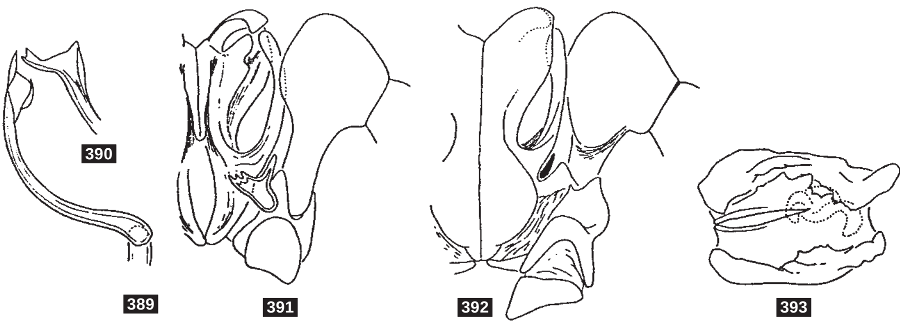
Diplomaragna pinetorum - Shear, 1990: 38; Mikhaljova, 1993: 25.

Altajosoma deplanatum - Mikhaljova, 2000: 160: figs; Mikhaljova & Golovatch, 2001:108; Nefediev, 2002b: 35; 2002d: 30; Mikhaljova & Nefediev, 2003: 86.

DIAGNOSIS: Distinguished in the lateral colpocoxite process being very long, erect instead of being extended posteriorly, originating near the colpocoxite base.

DESCRIPTION: Male. Length about 13.5 mm, width at metazonite 6, 1.53 mm. Coloration tan, with light mottling of purplish brown along posterior margins of metazonites, on antennae and anterior legs. Eyes black.

Body with 32 segments. Antennomere 3, 0.78 mm long. Eye patches triangular, each composed of 29 ocelli. Paraterga beginning on segment 2, strongest on segments 9-26, somewhat reduced on segments 27 and 28, absent from segments 29-31. Macrochaetae acute, thin, about 0.4 mm long.



Figs 389-393. *Altajosoma deplanatum* (Stuxberg, 1876): 389 – anterior gonopod telopodite (lateral view); 390 – tip of anterior gonopod telopodite (caudal view); 391 – posterior gonopods (caudal view); 392 – posterior gonopods (front view); 393 – vulva (ventral view). – Scale absent (after Shear, 1990).

Leg pairs 3-7 with typical tarsal papillae, incrassate, pairs 5-7 much larger, femora swollen and curved. Legs 10 and 11 usual, with coxal glands, not modified.

Telopodite of anterior gonopod narrowed, 1-segmented, regularly curved posteriad (Fig. 389), apex expanded, with a long mesal extension seen in posterior view (Fig. 390). Colpocoxites of posterior gonopods fused to 2/3 extent, diverging apically, blunt (Fig. 391). A mesal sheath process of colpocoxite not expressed. A lateral sheath process of colpocoxite very long, erect, rodlike, slightly club-shaped at tip, originating near colpocoxite base, visible in anterior view. Angiocoxite with a globule in posterior view. A large posterior angiocoxal process curved, with a large lateral and three smaller mesal teeth. Angiocoxite in anterior view (Fig. 392) reduced, without anterior process. Femur of posterior gonopod relatively long, sometimes with a claw vestige.

Female. Length about 11 mm, width at metazonite 6, 1.61 mm. Antennomere 3, 0.57 mm long. Ocelli 27-30. Vulva as in Fig. 393.

DISTRIBUTION (Map 21): Russia: Siberia (Kemerovo Area, between Marrinsk in Kemerovo Area and Achinsk in Krasnoyarsk Province, Republic of Khakassia, Novosibirsk and Tomsk areas, Republic of Altai).

REMARKS: This species, originally described as *Craspedosoma deplanatum* from between Achinsk, Krasnoyarsk Province and Mariinsk, Kemerovo Area (Stuxberg, 1876a), has since been redescribed and transferred first to *Diplomaragna* (Shear, 1990) and to the resurrected genus *Altajosoma*, with *A. pinetorum*, a species described from the Altai Mts, representing its junior subjective synonym (Mikhaljova, 2000).

This species lives mainly in various forests including insular stands. It also occurs in meadow. *A. deplanatum* contributes 20% to the total diplopod catch in the southern taiga lying between Ob and Tom rivers (Nefediev, 2002d).

***Altajosoma coxale* (Shear, 1990)**

Figs 394-401, Map 23.

Diplomaragna coxalis Shear, 1990: 26, 25: figs.

Diplomaragna coxalis - Mikhaljova, 1993: 18.

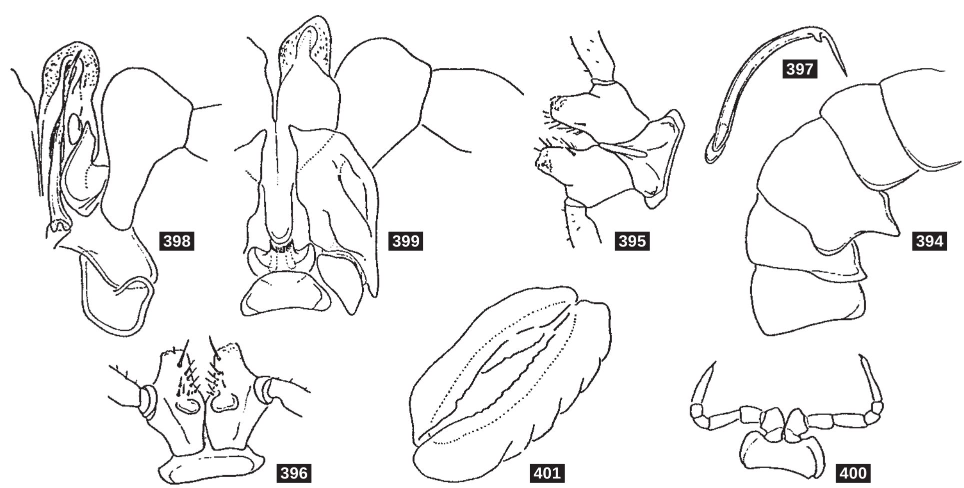
Altajosoma coxale - Mikhaljova, 2000: 161; Mikhaljova & Golovatch, 2001: 108.

DIAGNOSIS: The modifications of coxae 12 and of body segment 7 will serve to separate this species from any other.

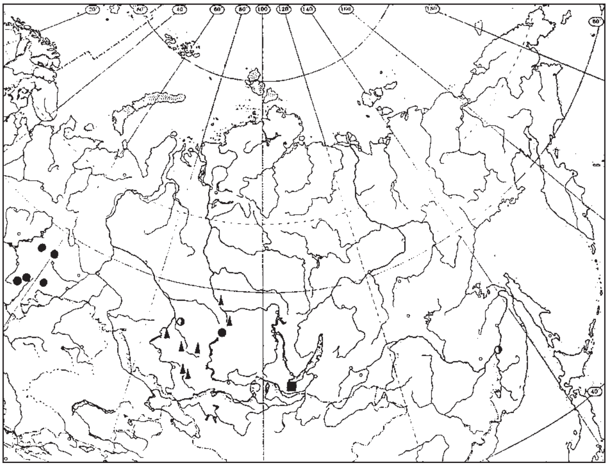
DESCRIPTION: Male. Length about 15-16 mm, width at metazonite 6, 1.92 mm. Coloration uniform creamy tan. Eyes black.

Body with 32 segments. Antennomere 3, 0.73 mm long. Eye patches triangular, each composed of 28 ocelli. Paraterga beginning on collum, strongest on segments 9-22, reduced on 28, absent from segments 29-31. Segment 7 greatly enlarged, paraterga lower on sides, larger, more strongly rounded; lateral ventral margins with an acute anterior and an arcuate posterior lobe (Fig. 394). Segment 8 larger than 9th, with a slight posteroventral marginal lobe. Bodies of preserved specimens often with a characteristic sharp flexure between segments 7 and 8. Macrochaetae acute, thin about 0.55 mm long.

Leg pairs 3-7 with typical tarsal papillae, enlarged, pairs 5-7 much larger, femora swollen and curved. Legs 10 and 11 usual, with coxal glands, coxae 10 and 11 each with a prominent cone-like projection. Coxae 12 (Fig. 395) strongly



Figs 394-401. *Altajosoma coxale* (Shear, 1990): 394 – body segments 5-9 (lateral view, anterior to the right); 395 – male coxae 12 (front view); 396 – male coxae 12 (caudal view); 397 –anterior gonopod telopodite (lateral view); 398 – gonopods (caudal view); 399 – gonopods (front view); 400 – female leg pair 3 (caudal view); 401 – vulva (ventral view). – Scale absent (after Shear, 1990).



Map 23. Distribution of *Altajosoma golovtachi* (●), *A. coxale* (■), *A. kemerovo* (▲) and *Oxidus gracilis* (◑) in the Asian part of Russia.

enlarged, trapezoidal, with small cones on posterior faces (Fig. 396); small apical cones present on coxae 13, 14 and possibly 15.

Telopodite of anterior gonopod rodlike, 2-segmented, strongly curved posteriad, apex abruptly narrowed, with a small subapical process (Fig. 397). Colpocoxites of posterior gonopods fused for much of their length, diverging apically, blunt, flattened, with shagreened apices (Fig. 398). A mesal sheath process of colpocoxite not expressed, a lateral one relatively short, blunt and curved. A large posterior angiocoxal process lamellar, without teeth. Angiocoxite of posterior gonopod in anterior view (Fig. 399) large, with a pointed process. Femur of posterior gonopod rather long.

Female. Length about 15 mm, width at metazonite 6, 2.08 mm. Antennomere 3, 0.63 mm long. Ocelli 28-30. Leg pair 3 (Fig. 400) with a broad sternum and with coxae bearing ventral lobes. Vulva as in Fig. 401.

DISTRIBUTION (Map 23): Russia: East Siberia (Irkutsk Area).

REMARKS: This species was originally described in *Diplomaragna* (Shear, 1990), later transferred to *Altajosoma* (Mikhaljova, 2000).

Altajosoma shilenkovi (Shear, 1990)

Figs 402-408, Map 22.

Diplomaragna shilenkovi Shear, 1990: 24, 23: figs.

Diplomaragna shilenkovi - Mikhaljova, 1993: 28.

Altajosoma shilenkovi - Mikhaljova, 2000: 161; Mikhaljova & Golovatch, 2001: 109.

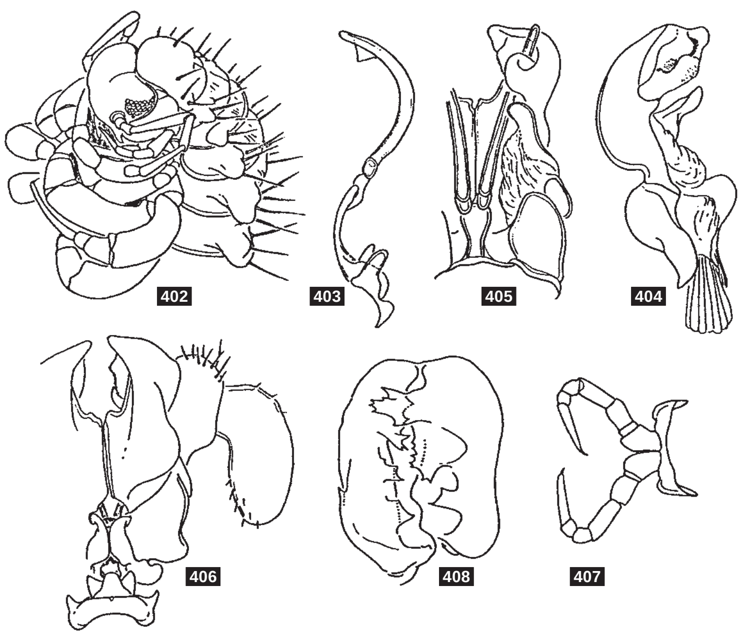
DIAGNOSIS: The species differs from congeners by the very large, protruding gonopods, the particular structure of both the posterior angiocoxal process and the mesal and lateral sheath processes as well as in the colpocoxites fused only basally.

DESCRIPTION: Male. Length about 16 mm, width at metazonite 6, 2.34 mm. Coloration uniform light brown. Eyes black.

Body with 32 segments. Antennomere 3, 0.86 mm long. Eye patches triangular, each composed of 29 ocelli. Paraterga beginning on collum, well-developed on segments 9-22, reduced on 28, absent from segments 29-31. Segment 7 greatly enlarged, paraterga lower, larger, more strongly rounded. Macrochaetae pointed, thin, about 0.55 mm long.

Leg pairs 3-7 with typical tarsal papillae, enlarged, pairs 5-7 much larger, femora swollen and curved (Fig. 402). Legs 10 and 11 usual, with coxal glands, coxa 10 with a prominent coniform projection.

Gonopods greatly enlarged, strongly projecting from segment 7. Telopodite of anterior gonopod rodlike, 2-segmented, strongly curved posteriad, distal part with a subapical triangular lamella (Fig. 403). Length of anterior gonopod telopodites varying. Colpocoxites tightly oppressed (but not fused) according to the original description, but fused only basally according to Mikhaljova (2000); distal parts diverged, apices blunt (Fig. 404). Mesal and lateral sheath processes of colpocoxite near apex complexly embracing each anterior gonopod telopodite, distal part of latter extending beyond colpocoxite (Fig. 405). A large posterior



Figs 402-408. *Altajosoma shilenkovi* (Shear, 1990): 402 – anterior part of male body (anteriorlateral view); 403 – anterior gonopod (lateral view); 404 – right posterior gonopod coxae (mesal view); 405 – gonopods (caudal view); 406 – gonopods (front view); 407 – female leg pair 3 (caudal view); 408 – vulva (ventral view). – Scale absent (after Shear, 1990).

angiocoxal process rounded apically, without teeth. Angiocoxite of posterior gonopod large, without process in anterior view (Fig. 406). Femur of posterior gonopod telopodite of medium size.

Female. Length about 15 mm, width at metazonite 6, 2.08 mm. Antennomere 3, 0.63 mm long. Ocelli 28-30. Leg pair 3 (Fig. 407) with normal coxae and a narrow sternum. Vulva as in Fig. 408.

DISTRIBUTION (Map 22): Russia: East Siberia (Irkutsk Area, Buryatia).

REMARKS: This species was originally described in *Diplomaragna* (Shear, 1990), later transferred to *Altajosoma* (Mikhaljova, 2000).

Altajosoma golovatchi (Shear, 1990)

Figs 409-413, Map 23.

Diplomaragna golovatchi Shear, 1990: 24, 23: figs.

Diplomaragna golovatchi - Golovatch, 1992: 374; Mikhaljova, 1993: 24; Kime & Golovtach, 2000: 334.

Altajosoma golovatchi - Mikhaljova, 2000: 161; Mikhaljova & Golovatch, 2001: 108.

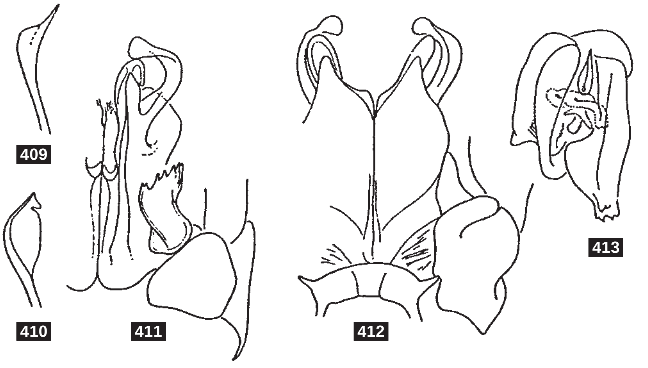
DIAGNOSIS: This species differs from congeners by the strongly enlarged lateral sheath process of the posterior gonopod colpocoxite visibled for most of its length in anterior view, by the swollen tip of the lateral sheath process and by the absence of an anterior angiocoxal process.

DESCRIPTION: Male. Length about 11-12 mm, width at metazonite 6, 1.3 mm. Coloration even, medium brown, faintly mottled brownish purple on antennae, legs and posterior parts of metazonites. Eyes black.

Body with 32 segments. Antennomere 3, 0.60 mm long. Eye patches triangular, each composed of 30 ocelli. Paraterga beginning on collum, well-developed on segments 9-25, somewhat reduced on segments 26 and 27, absent from 28-31. Macrochaetae pointed, thin, about 0.4 mm long.

Leg pairs 3-7 with typical tarsal papillae, enlarged, pairs 5-7 much larger, femora swollen and curved. Legs 10 and 11 usual, with coxal glands, not modified.

Telopodite of anterior gonopod 1-segmented, subflagelliform, curved posteriad, apex with a broad posterior lamella (Figs 409-410). Colpocoxites of posterior gonopods fused at base, sharply curved posteriorly at about 2/3 length. A mesal sheath process of colpocoxite in normal position. A lateral sheath process greatly enlarged, originating near apex of colpocoxite, strongly projecting, curved, with a swollen apex (Fig. 411). A large posterior angiocoxal process with about seven irregular teeth. Angiocoxite of posterior gonopod subglobose in



Figs 409-413. *Altajosoma golovatchi* (Shear, 1990): 409 – tip of anterior gonopod telopodite (caudal view); 410 – tip of anterior gonopod telopodite (lateral view); 411 – posterior gonopods (caudal view); 412 – posterior gonopods (front view); 413 – vulva (ventral view). – Scale absent (after Shear, 1990).

anterior view, somewhat depressed on anterior face, without processes (Fig. 412). Posterior gonopod telopoditomeres large.

Female. Length about 12 mm, width at metazonite 6, 1.35 mm. Antennomere 3, 0.60 mm long. Ocelli 30. Vulva as in Fig. 413.

DISTRIBUTION (Map 23): Russia: Siberia (Krasnoyarsk Province); Urals (Republic of Bashkiria, Sverdlovskaya Area; the species has also been discovered in the Chelyabinsk and Perm areas (Golovatch, in litt.)).

REMARKS: This species was originally described in *Diplomaragna* (Shear, 1990), later transferred to *Altajosoma* (Mikhaljova, 2000).

Altajosoma katunicum Mikhaljova, 2000

Figs 414-418, Map 15.

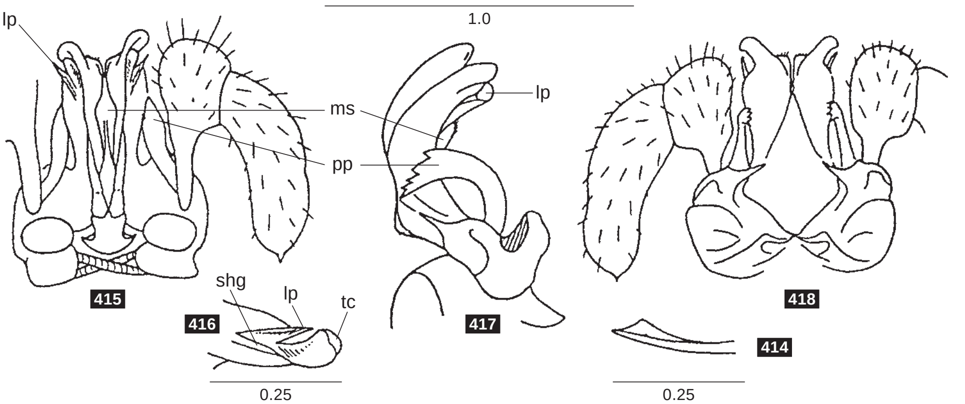
Altajosoma katunicum Mikhaljova, 2000: 161, 162: figs.
Altajosoma katunicum - Mikhaljova & Golovatch, 2001: 108.

DIAGNOSIS: The species differs from congeners in structure of the colpocoxite and the long, curved forward, posterior angiocoxal process with a serrate apex.

DESCRIPTION: Male. Length 12-13 mm, width 0.8-0.9 mm without,

1.0-1.1 mm with paraterga. Coloration in alcohol usually light tan, seldom entirely pallid. Antennae and legs light brown or beige, eyes black.

Body with 32 segments. Eye patches triangular, each composed of 27-28 ocelli. Antennae long. Collum semi-circular. Paraterga beginning on segment 2, well-developed on segments 4-26, reduced on segments 27-28, onward missing. On segments 5-26, caudolateral corners of paraterga beak-shaped pointed. Macrochaetae in a transverse row on segments 29-31, arranged typically in a



Figs 414-418. *Altajosoma katunicum* Mikhaljova, 2000: 414 – distal part of anterior gonopod telopodite; 415 – gonopods (caudal view); 416 – distal part of colpocoxite; 417 – gonopods (lateral view, telopodite of posterior gonopod removed); 418 – gonopods (front view); lp – lateral sheath process of colpocoxite; ms – mesal sheath process of colpocoxite; shg – sheath groove; tc – tip of colpocoxite. – Scales in mm (after Mikhaljova, 2000).

transverse triangle on preceding segments. Anterolateral macrochaetae shortest, medial and posterolateral ones subequal in length, all blunt.

Anal valves obtusangular and supplied with 3+3 setae at caudal edge in lateral view. Subanal scale triangular, with a rounded tip and 1+1 setae.

Legs long and slender. Legs 3-7 with typical tarsal papillae, increasingly enlarged toward gonopods. Legs 10 and 11 usual, with coxal glands. Coxa 10 with a conical process.

Gonopods curved posteriad. Anterior gonopod telopodite narrowed, its tip with a posterior lamella (Fig. 414) fully concealed inside a sheath groove (Fig. 415). Colpocoxites of posterior gonopods fused to 2/3 extent. Distal part of colpocoxite narrowed. A mesal sheath processes (ms) like high lamellae fused medially and forming a single, very finely serrate structure, its origins from fusion being readily traceable. A lateral sheath process (lp) curved acutangularly caudad and slightly ventrad (Fig. 416). Angiocoxite of posterior gonopod with a globule in posterior view. A posterior angiocoxal process (pp) long, curved forward, with a serrate apex (Fig. 417). Angiocoxite with a depression and crests in anterior view as well as with a short but slender process (Fig. 418). Femur of posterior gonopod telopodite elongate, apex with a claw vestige.

Female. Length 13 mm, width with paraterga 1.3 mm. Ocelli 26-28. Body more or less stout.

DISTRIBUTION (Map 15): Russia: Southwest Siberia (Republic of Altai).

REMARKS: This species has been collected at 1,600-2,200 m a.s.l. in a montane taiga stand.

Altajosoma bakurovi bakurovi **(Shear, 1990)**

Figs 419-422, Map 16.

Diplomaragna bakurovi Shear, 1990: 22, 23: figs.

Diplomaragna bakurovi - Mikhaljova, 1993: 18.

Altajosoma bakurovi - Mikhaljova, 2000: 161; Mikhaljova & Golovatch, 2001:108; Mikhaljova & Nefediev, 2003: 86; Nefediev, 2002d: 30.

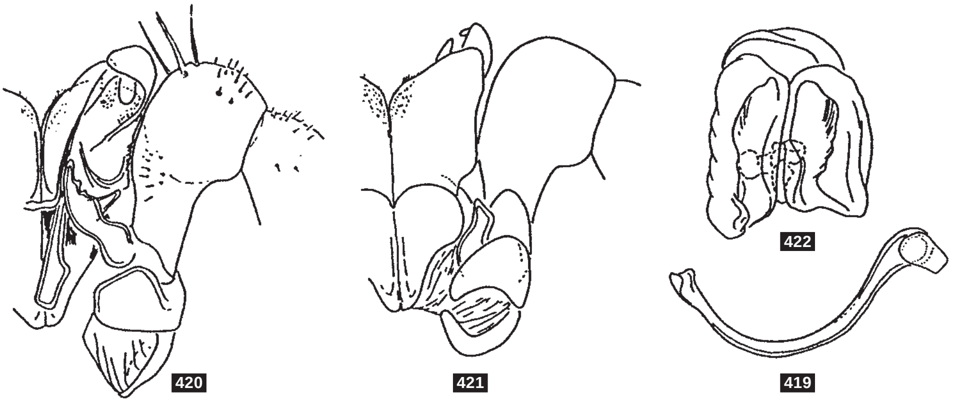
DIAGNOSIS: The subspecies differs in the size and configuration of the lateral sheath process of the colpocoxite, in shape both of the posterior angiocoxal process and the distal part of the colpocoxite.

DESCRIPTION: Male. Length about 12 mm, width at metazonite 6, 1.2 mm. Coloration brown. Eyes black.

Body with 32 segments. Antennomere 3, 0.52 mm long. Eye patches triangular, each composed of 26-28 ocelli. Paraterga beginning on segment 2, well-developed on segments 9-22, reduced on segments 23-25, absent from segments 26-31. Macrochaetae pointed, thin, about 0.4 mm long.

Legs carrying claws with two additional minute claws dorsally and a relatively short seta ventrally. Leg pairs 3-7 with typical tarsal papillae, enlarged, pairs 5-7 much larger, femora swollen and curved; claws with a ventral seta only. Postgonopodal legs with a group of tarsal papillae distally. Legs 10 and 11 usual, with coxal glands, coxa 10 with a short conical projection.

Telopodite of anterior gonopod narrowed, 2-segmented, strongly curved posteriad, tip with a short sinuous region (Fig. 419), not projecting beyond



Figs 419-422. *Altajosoma bakurovi bakurovi* (Shear, 1990): 419 – telopodite of anterior gonopod (mesal view); 420 – posterior gonopods (caudal view); 421 – posterior gonopods (front view); 422 – vulva (ventral view). – Scale absent (after Shear, 1990).

colpocoxite (Fig. 420). Colpocoxites of posterior gonopods fused for much of their length, diverging apically, blunt. A mesal sheath process of colpocoxite strongly reduced; a lateral sheath process enlarged, complex, with a laterally cupped lamella, a long, thin, posteriorly extending arm. A large posterior angiocoxal process curved, with five apical teeth. Angiocoxite of posterior gonopods reduced, with a small subtriangular process in anterior view (Fig. 421). Posterior gonopod telopoditomeres large.

Female. Length about 12 mm, width at metazonite 6, 1.44 mm. Antennomere 3, 0.62 mm long. Ocelli 27-30. Vulva as in Fig. 422.

DISTRIBUTION (Map 16): Russia: Siberia (Novosibirsk, Kemerovo and Tomsk areas, Krasnoyarsk Province, Republic of Altai).

REMARKS: Originally described in *Diplomaragna* (Shear, 1990), but later transferred to *Altajosoma* (Mikhaljova, 2000), this species shows two distinct forms treated here as subspecies.

Altajosoma bakurovi longiprocessum Mikhaljova, 2000

Fig. 423, Map 16.

Altajosoma bakurovi longiprocessum Mikhaljova, 2000: 161: fig.
Altajosoma bakurovi longiprocessum - Mkhaljova & Golovatch, 2001: 108.

DIAGNOSIS and DESCRIPTION: All characters like in *A. bakurovi bakurovi*, but the anterior angiocoxal process is long (Fig. 423).

DISTRIBUTION (Map 16): Russia: Siberia (Krasnoyarsk Province: Sayano-Shushensky Nature Reserve).

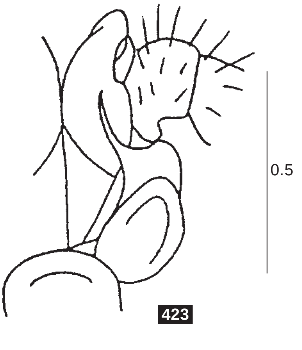


Fig. 423. *Altajosoma bakurovi longiprocessum* Mikhaljova, 2000: gonopods (front view). – Scale in mm (after Mikhaljova, 2000).

Altajosoma kemerovo (Shear, 1990)

Figs 424-427, Map 23.

Diplomaragna kemerovo Shear, 1990: 21, 20: figs.

Diplomaragna kemerovo - Mikhaljova, 1993: 25.

Altajosoma kemerovo - Mikhaljova, 2000: 161; Mikhaljova & Golovatch, 2001: 108; Vorobiova et al., 2002: 67; Mikhaljova & Nefediev, 2003: 86;.

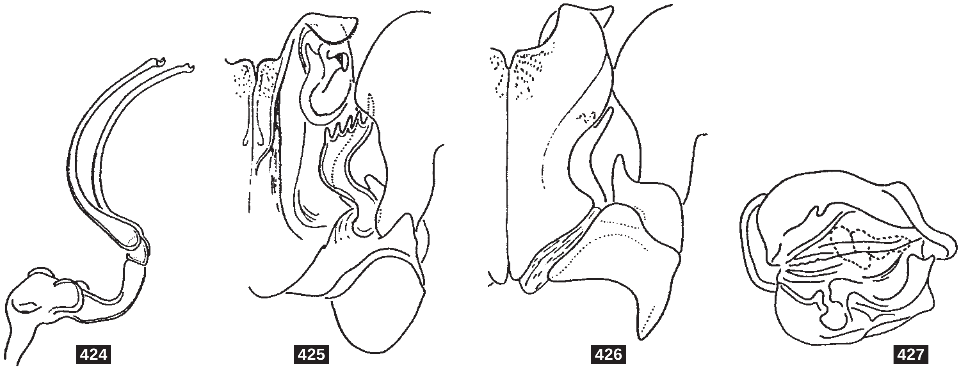
DIAGNOSIS: This species is close to *A. bakurovi*, but differs by the much smaller lateral sheath process of the posterior gonopod colpocoxite and in configuration of the posterior angiocoxal process.

DESCRIPTION: Male. Length, about 12 mm, width at metazonite 6, 1.3 mm. Coloration in alcohol creamy tan or brown.

Body with 32 segments. Antennomere 3, 0.65 mm long. Eye patches triangular, each composed of 26-28 ocelli. Paraterga beginning on segment 2, well-developed on segments 9-26, somewhat reduced on 27, absent from segments 28-31. Macrochaetae pointed, thin, about 0.4 mm long.

Leg pairs 3-7 with typical tarsal papillae, pairs 5-7 strongly enlarged, femora swollen and curved. Legs10 and 11 usual, with coxal glands, not modified.

Telopodite of anterior gonopod narrowed, 2-segmented, strongly curved posteriad, tip with a short sinuous region (Fig. 424), not projecting beyond colpocoxite. Colpocoxites of posterior gonopods (Fig. 425) fused for much of their length, diverging apically, blunt. A mesal sheath process of colpocoxite strongly reduced; a lateral sheath process enlarged, complex, with a laterally cupped lamella, a long, thin, posteriorly extending arm. A large posterior



Figs 424-427. *Altajosoma kemerovo* (Shear, 1990): 424 – anterior gonopods (lateral view); 425 – posterior gonopods (caudal view); 426 – posterior gonopods (front view); 427 – vulva (ventral view). – Scale absent (after Shear, 1990).

angiocoxal process curved, with five apical teeth. Angiocoxite of posterior gonopod reduced, with a small subtriangular process in anterior view (Fig. 426). Posterior gonopod telopoditomeres large.

Female. Length about 14 mm, width at metazonite 6, 1.82 mm. Antennomere 3, 0.65 mm long. Ocelli 27-30. Vulva as in Fig. 427.

DISTRIBUTION (Map 23): Russia: Siberia (Kemerovo and Novosibirsk areas, Krasnoyarsk Province, Republic of Khakassia, Republic of Altai).

REMARKS: Originally described in *Diplomaragna* (Shear, 1990), this species has been transferred to *Altajosoma* (Mikhaljova, 2000). In the south of Krasnoyarsk Province, it only occurs in the subtaiga and southern taiga belts, never being too abundant though (Vorobiova et al., 2002).

Family Conotylidae Cook, 1896

This family contains a dozen genera distributed mainly in North and Central America, with relatively minor representation in Japan and Russia (Far East). The latter region supports one endemic genus.

The main distinguishing characters of the family are as follows. Gnathohilarium without promentum; antennae slender; body with 30 segments; collum not covering the head from above; paraterga rather well-developed, medium-sized, directed horizontally; teguments smooth or finely alveolate; macrochaetae in a transverse row on last somites, arranged in an extended triangle on preceding somites; telson normal; male leg pairs 4-7 increasingly enlarged, yet male leg pair 3 particularly hypertrophied; pregonopodal legs with tarsal papillae; at least some claws with a long dorsal seta and an accesssory claw at base; male coxae 2, 3 and 7 unmodified; penes absent; female leg pair 2 normal; male leg pair 10 normal, with coxal glands; male leg pair 11 normal, without coxal glands; coxites and telopodites of anterior gonopods fused medially, forming structures of various degrees of division in different species; sternite of anterior gonopods well-developed, plate- to ribbon-like, rarely membranous; posterior gonopods with complex colpocoxites.

Genus *Crassotyla* Golovatch, 1980

DISTRIBUTION: Russia: Far East. Monotypical.

Some remarks on the relationships of this genus within Conotylidae can be found in Mauriès (1982) and Shear (1987).

The genus is mainly distinguished by the presence of a large anteromedian process on a membranous sternite of the anterior gonopods, the highly complex triramous colpocoxites of the posterior gonopods with 2-segmented telopodites, and the hypertrophied male leg pair 3.

Crassotyla amurica Golovatch, 1980

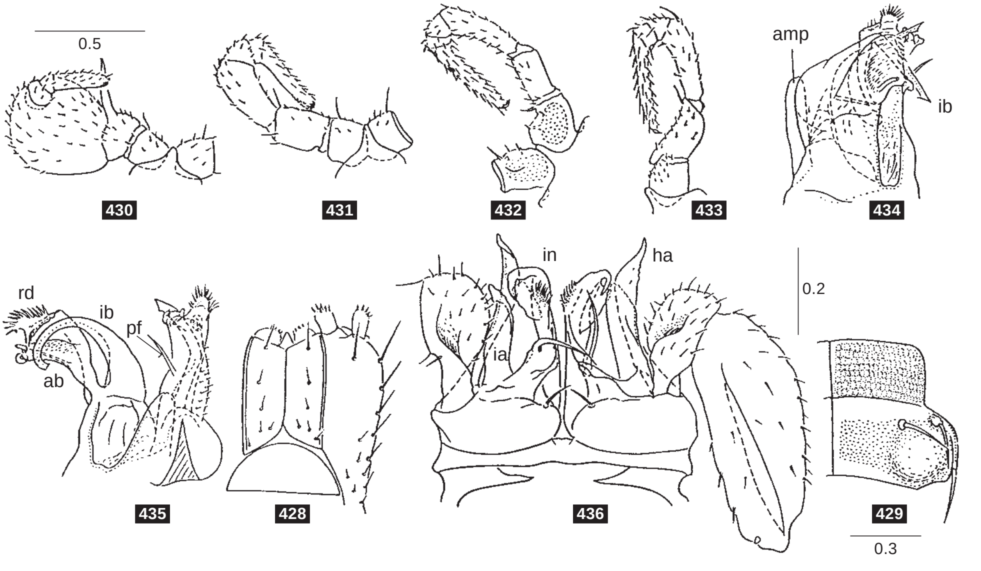
Figs 428-436, Map 24.

Crassotyla amurica Golovatch, 1980a: 202, 203: figs.

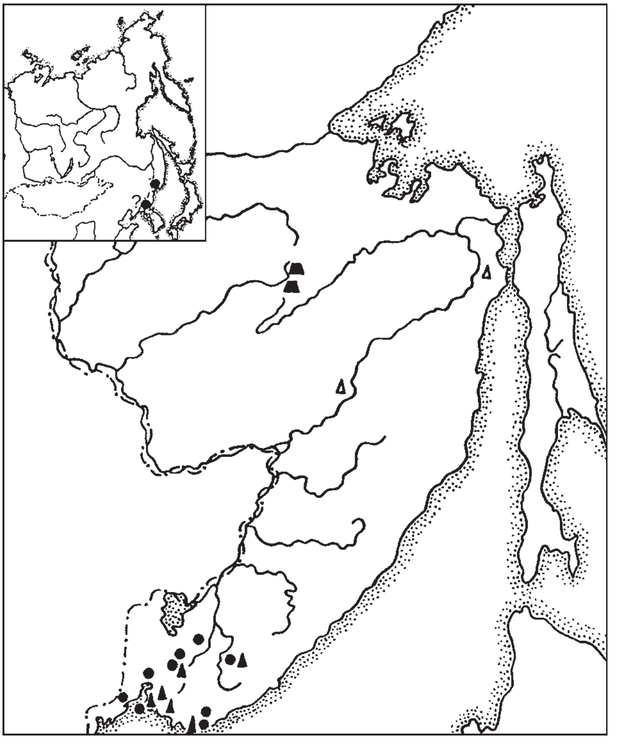
Crassotyla amurica - Shear, 1987: 21; Ganin, 1989a: 145; 1997: 50; Mikhaljova, 1993: 18; 1998b: 18: map, 17: figs; Shelley et al., 2000: 67.

DESCRIPTION: Male and female. Body 9-11 mm long, 1.0-1.1 mm wide. Coloration beige cream to whitish with darker metazonites, thus providing a slightly cingulate pattern. Anterior and posterior body portions usually somewhat more intensely coloured. Ocelli black.

Body with 30 segments, moniliform. Ocelli about 15 in a subtriangular eye patch on each side of head. Slender antennae very long. Gnathochilarium usual (Fig. 428). Epicranial suture well-developed. Somites 1-5(6) narrower than head



Figs 428-436. *Crassotyla amurica* Golovatch, 1980: 428 – gnathochilarium; 429 – male midbody segment; 430 – male leg pair 3; 431 – male leg pair 4; 432 –male leg pair 10; 433 – male leg pair 11; 434 – anterior gonopods (lateral view); 435 – anterior gonopods (sublateral view); 436 – posterior gonopods (anterior view); ab – external branch; amp – anteromedial sternal process; ha – caudo-external branch; ia – intermediate external branch; ib – internal branch; in – interior branch; pf – flagelliform process; rd – comb of spinicles. – Scales in mm (after Golovatch, 1980a).



Map 24. Distribution of *Hoffmaneuma exiguum* (●), *Golovatchia magda* (▲), *Megalotyla brevichaeta* (▲), *Crassotyla amurica* (△).

with genae. Macrochaetae long, pointed. Paraterga like well-developed dorsolateral bulges (Fig. 429).

Legs long and slender, claw with a small additional claw and a long dorsal seta at claw base. Male leg pair 3 very strongly hypertrophied (Fig. 430), especially so due to a swollen femur; prefemur with a long, digitiform, mesal process. Male tarsi 4-7 each with papillae over distal 1/3 extent (Fig. 431). As usual, only male legs 10 with coxal glands (Fig. 432), male legs11 with a small, dorsomesal, coxal process (Fig. 433).

Anterior gonopods (Figs 434-435) biramous, placed on a membranous sternite with a large, anteromedian, digitiform process (amp). Inner branch (ib) bare, unciform, while outer branch (ab) with a comb (rd) of long, thin and sharp spines apically, a flagelliform outgrowth (pf) caudally, and beset with short setae laterally. Posterior gonopods (Fig. 436) with 2-segmented telopodites and highly complex, triramous colpocoxites. Posterolateral branch (ha) hyaline, adjacent to a membranous postero-intermediate branch (ia). Inner branch (in) with a flagelliform outgrowth parabasally and a short front uncus apically. Each coxite with a medium-sized seta frontally.

Vulvae strongly setose.

DISTRIBUTION (Map 24): Russia: Far East (Khabarovsk Province).

REMARKS: Certain data concerning the feeding activity and ecology of this species are available (Ganin, 1989a; 1997).

Family Hoffmaneumatidae Golovatch, 1978

This family comprises two genera, one each from Russia (Far East) and Japan. It seems quite plausible that this family occurs in North Korea as well*. The Asian part of Russia supports one monotypical genus. A review of this family can be found in Shear et al. (1997).

Members of this family are recognised by the following characters. Body very small (at most 10.0 mm long), with 28 segments; gnathochilarium without promentum, antennae relatively long, somewhat clavate; collum not covering the head from above; somites cylindrical in cross-section, without pronounced lateral keels or paranota on metazonites but with small dorsolateral bulges, surface of somites finely reticulate, macrochaetae short and pointed, arranged in a nearly transverse row; telson normal; legs without tarsal papillae; prego-nopodal legs of males either somewhat enlarged or entirely unmodified; male coxae 2, 3 and 7 unmodified; penes absent; female leg pair 2 normal; male leg pair 10 strongly reduced, without coxal glands; male leg pair 11 without modifications but with coxal glands; anterior gonopods with two coxites, a flagelliform branch on the anterior side sheathed by the inner coxite, and a posterior fimbriate process; posterior gonopods with complex coxites and a reduced, 1-segmented telopodites. Posterior gonopods of *Hoffmaneuma* bearing long flagelliform branches.

Genus *Hoffmaneuma* Golovatch, 1978

DISTRIBUTION: Russia: Far East; ?North Korea. Monotypical.

The main distinguishing nonsexual characters as in the family. This genus differs from the second, Japanese genus *Japanoparvus* Shear, Tanabe & Tsurusa-ki, 1997 mainly by the presence in the posterior gonopodof a long, flagelliform branch, as well as by the configuration of male leg pair 10 (3-segmented telopodite, modified sternite and coxa bearing a mesal outgrowth).

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* Recently, among the material from North Korea, kept in the Hungarian Natural History Museum, Budapest, I together with Dr. Korsós have found three females presumably belonging to *Hoffmaneuma exiguum*. However, in the absence of adult males it appears impossible to verify this record.

Hoffmaneuma exiguum Golovatch, 1978

Figs 437-448, Map 24.

Hoffmaneuma exiguum Golovatch, 1978b: 1009, 1010: figs.

Hofmaneuma exiguum - Lokšina & Golovatch, 1979: 383; Kurcheva & Mikhaljova, 1980: 121; Mikhaljova, 1981c: 87; 1983b: 83; 1988b: 70; 1993: 29; 1998a: 7; 1998b: 38, 37: figs, 18: map; Mikhaljova & Petukhova, 1983: 52; Mikhaljova & Bakurov, 1989: 40; Shear, 1992: 68; Shear et all., 1997: 89, 91: figs; Ganin, 1997: 121; Shelley et al., 2000: 70.

DIAGNOSIS: The only species of the genus that differs from the species of *Japanoparvus* in the presence of a long flagelliform branch of the posterior gonopod, by male leg pair 10 with a 3-segmented telopodite and the coxal process projecting mesally.

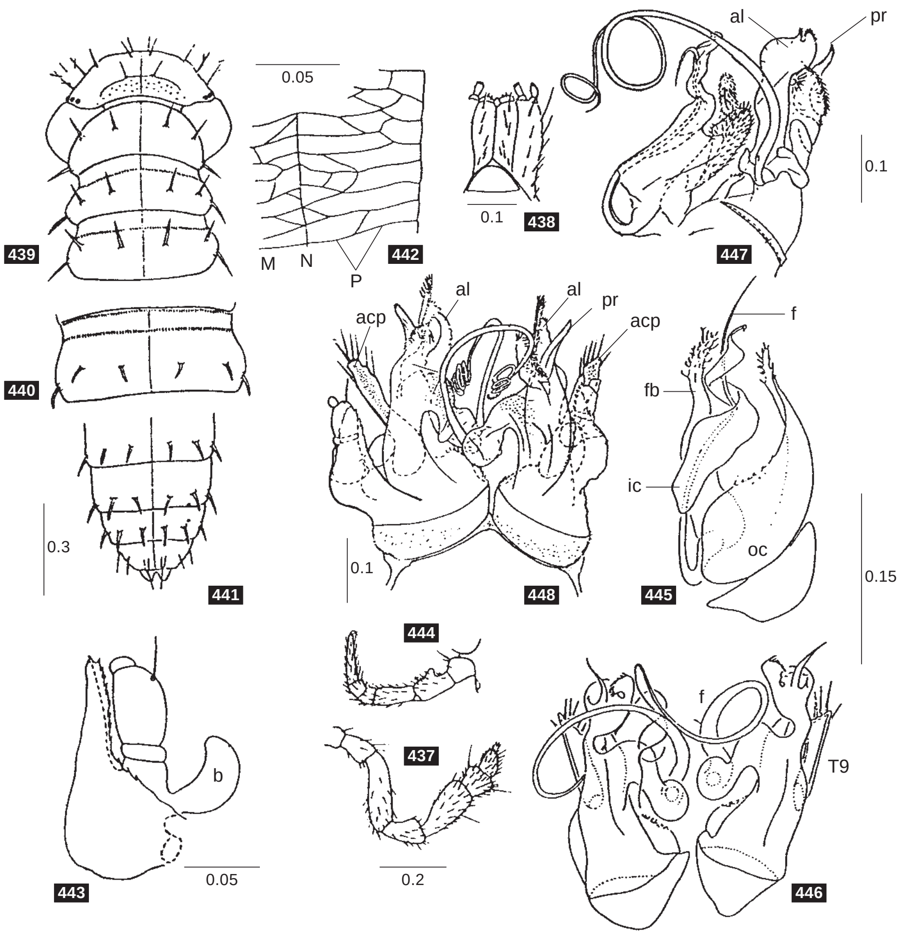
DESCRIPTION: Male. Length 6-7 mm long, width 0.4-0.5 mm. Coloration from brown to dark brown, marbled, with two obscure, paler, marbled stripes dorsally. Legs brownish. Eyes black.

Head with a few pairs of long setae on vertex and clypeus. Ocellaria of adults as six black ocelli in a single uneven row on each side of head. Epicranial suture well-developed. Genae setose. Antennae relatively long, somewhat clavate (Fig. 437). Each lamella lingualis of gnathochilarium with three longer apical and four shorter basal setae, stipites with long and strong setae in distal part (Fig. 438). Inner palp with two tiny sensory cones.

Body with 28 segments, subcylindrical. Collum ovoid. Somite 2 somewhat narrower than head and somite 3 (Fig. 439). Somites 2-24 with poorly-developed dorsolateral bulges (Fig. 440). Somites 25-27 with straight lateral margins (Fig. 441). Metazonites (M) densely microreticulate (Fig. 442). Macrochaetae on anterior somites longer and sharper than on posterior ones.

Legs relatively long, devoid of tarsal papillae as typical of the family; legs 3 and 4 somewhat enlarged. Claw long, somewhat curved, with a long seta at base. Legs 10 (Fig. 443) strongly reduced, without coxal glands, sternum wide and band-like, with a median lobe and a strong, ventral, serrate extension on either side; coxae with prominent lobe-shaped mesal processes (b), telopodite 3-segmented, middle telopoditomere longest. Legs 11 with coxal glands. Leg 12 (Fig. 444) with a mesal uncus on prefemur (sensu Shear, 1992 and Golovatch, 1978b) or coxa (sensu Shear et al., 1997).

Gonopods complex. Anterior gonopods (Fig. 445) consisting of a relatively unmodified sternum and two separate articulated coxae, latter giving rise to inner and outer coxites on each side. Inner coxite (ic) sheathing a long flagelliform branch (f) originating on posterior face of coxa but passing between the coxae to a sheath groove on anterior face of inner coxite. Outer coxite (oc) shorter and less complex than inner one. A heavily fimbriated process (fb) originating near base of a flagelliform branch on posterior side of anterior gonopod. Posterior gonopods (Figs 446-448) with a pair of very long, spiralling, flagelliform branches arising from posterior surface of coxa and passing anteriorly between



Figs 437-448. *Hoffmaneuma exiguum* Golovatch, 1978: 437 – antenna; 438 – male gnathochilarium; 439 – fore part of male body; 440 – male midbody segment; 441 – back part of male body; 442 – part of lateral surface of pleurotergal arch; 443 – male leg pair 10; 444 – male leg pair 12; 445 – anterior gonopod (posterior view); 446 – posterior gonopods (caudal view); 447 – anterior and posterior gonopods (lateral view, posterior gonopods without telopodite); 448 – posterior gonopods and male leg pair 10 (caudal view); M – metazona; N – transverse suture dividing pro- and metazona; P – prozona; b – process of male coxa 10; f – flagelliform branch; ic – inner coxite; oc – outer coxite; fb – fimbriated process; acp & T9 – posterior gonopod telopodite; al – anterior projection; pr – digitiform process. – Scales in mm (437-444, 447-448 – after Golovatch, 1978b; 445-446 – after Shear et al., 1997).

the coxae. Base of these branches very thick and sharply curved. Sternum of posterior gonopods reduced, partially fused to coxae, divided in midline. Coxae complex, each with a large anterior projection with a finely fimbriate apex (al), a posteromesal outgrowth strongly fimbriate apically, and an outer digitiform process (pr) pointed at apex. A rodlike, flattened, 1-segmented telopodite (acp in Fig. 448 and T9 in Fig. 446) ending up by a small group of setae.

Female. Length 6.5-7.5 mm, width 0.5-0.6 mm.

DISTRIBUTION (Map 24): Russia: Far East (Primorsky Province); ? North Korea.

REMARKS: The original interpretation of gonopod structure in *Hoffmaneuma* by Golovatch (1978b) was corrected two times (Shear, 1992; Shear et al., 1997).

The species dwells in the litter and uppermost soil horizons in montane mixed and valley broadleaved forests. Both adults and juveniles prefer to dwell in forest litter (Mikhaljova, 1983b). The numbers range from 0.3 to 7.5 ind./m² depending on forest type (Kurcheva & Mikhaljova, 1980; Mikhaljova, 1981c, 1988b; Mikhaljova & Bakurov, 1989).

Family Anthroleucosomatidae Verhoeff, 1899

The family is distributed mainly in the Balkans and the eastern Mediterranean region, marginally represented also in Iran, Russia (South and Southwest Siberia), as well as Japan. About 30 genera. Only one genus occurs in the Asian part of Russia. The taxonomy of the family is extremely tangled.

Members of this family in Siberia can be recognised by characters of the genus *Ghilarovia*.

Genus *Ghilarovia* Gulièka, 1972

DISTRIBUTION: Russia: West Siberia. This genus comprises two species only.

The main distinguishing characters are as follows. Body with 28 segments; epicranial suture well-developed; forehead (= frons) of male distinctly flattened; gnathochilarium with a promentum; antennae slender; collum not covering the head from above; teguments smooth or finely alveolate; paraterga absent; metazona with a small knob at base of each macrochaeta; macrochaetae arranged in a subtransverse row; male leg pairs 3-7 somewhat increasingly enlarged; male legs with tarsal papillae; claws with two accessory claws dorsally at base; male coxae 2, 3 and 7 unmodified; penes absent; female leg pair 2 modified, reduced; male legs 10 and 11 somewhat enlarged, with coxal glands; sternum of anterior gonopods with two pairs of anterior lyriform processes; anterior gonopod angiocoxite divided, with an acute posterior lamella and a complex lateral part; anterior gonopod colpocoxites two-branched, mesal branch fimbriate, hooked, lateral one broken distally into small rods; telopodites strongly reduced, lobe-like; coxite of posterior gonopods with two processes and a lamella; posterior gonopod telopodites 2-segmented.

Key to species of *Ghilarovia*:

1(2) Median sternal process of anterior gonopods smaller; apical blade of lateral part of angiocoxite broader (Fig. 449). .... *G. kygae*

2(1) Median sternal process of anterior gonopods larger; apical blade of lateral part of angiocoxite narrower (Fig. 452). .... *G. cylindrica*

Ghilarovia kygae **Gulièka, 1972**

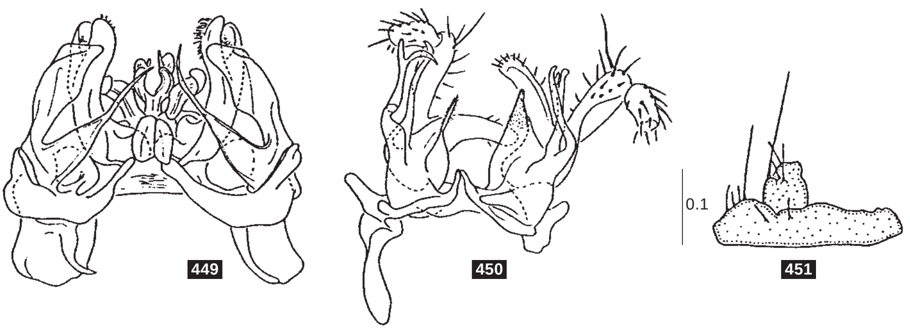
Figs 449-451, Map 25.

Ghilarovia kygae Gulièka, 1972: 39, 40: figs.

Ghilarovia kygae - Lokšina & Golovatch, 1979: 383; Shear, 1988: 55: figs; Mikhaljova, 1993: 16; 2002b: 203; Shelley et al., 2000: 68; Mikhaljova & Golovatch, 2001: 107.

DIAGNOSIS: This species differs from the only other congener by the much smaller median sternal process of the anterior gonopods, the larger knob of male sternite 10 projecting between the coxae on the anterior side, the broader apical blade of the angiocoxal lateral part, and the structure of both vulva and female leg pair 2.

DESCRIPTION: Male. Body 7.5-9 mm long, 0.9-1.0 mm wide. Coloration in alcohol from beige-yellowish to light brown; front and caudal portions of body marbled light brown to brown. Legs whitish brown, growing increasingly dark distad. Antennae brown. Eyes black.



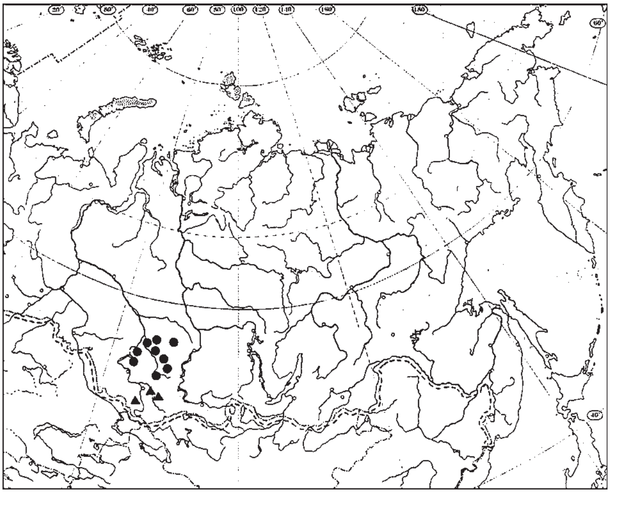
Figs 449-451. *Ghilarovia kygae* Gulièka, 1972: 449 – anterior gonopods (posterior view); 450 – posterior gonopods (anterior view); 451 – female leg pair 2. – Scale in mm, 449 & 450 without scale (449-450 - after Shear, 1988; 451 – after Mikhaljova, 2002b).

Body with 28 segments, subcylindrical. Head setose. Frons with a flattened cavity. Genae sparsely setose. Eye patches subtriangular, each composed of 23-24 ocelli. Antennae long. Collum semi-circular, narrower than both head with genae and somite 2. Gnathochilarium with setae of different length on outer sides and in front portion of stipites. Lamellae linguales bearing setae, of which anterior ones longer.

Body width gradually growing until segment 7, body parallel-sided on segments 8-21, onward gradually tapering. A distinct knob at base of each macrochaeta. Macrochaetae long, pointed, as usual lying in a subtransverse row. All three macrochaetae subequal in length.

Legs slender, not very long, tarsal papillae occupying about 2/3 tarsal length. Two accessory claws placed dorsally at base of claw, normal, minute. Legs 3-7 somewhat increasingly enlarged toward gonopods as usual. Legs 10 and 11 with coxal glands. Sternite 10 with a long and large knob projecting between coxae on anterior side. Coxae 10 and 11 somewhat enlarged, not otherwise modified.

Anterior gonopods (Fig. 449) by 1/3 wider than long, not so strongly projecting. Anterior lyriform processes of sternum relatively small. Angiocoxite entirely lateral, shallowly divided, with an acute posterior lamella and a complex lateral part carrying a broad apical blade (cf. Mikhaljova, 2002b). Colpocoxites 2-branched, mesal branch fimbriate, hooked, lateral branch broken up distally into small chitinous rods. Telopodites strongly reduced, lobe-like. Posterior gonopods (Fig. 450) with large coxae, each latter bearing two acuminate processes, one of which being bifid, and an anterior triangular lamella. Prefemur with a large setose knob, distal segment small, subglobose.



Map 25. Distribution of *Ghilarovia kygae* (▲), *G. cylindrica* (●).

Female. Length 10-11 mm, width 1.1-1.2 mm. Forehead normal, without flattened cavity. Ocelli 24-25. Leg pair 2 modified, strongly reduced, 1-segmented, setose apically (Fig. 451). Vulvae oval, with long setae ventrally.

DISTRIBUTION (Map 25): Russia: Siberia (Republic of Altai).

REMARKS: As the original description of the species was too schematic, it has since been adequarely redescribed by Shear (1988), supplemented by Mikhaljova (2002b), as based on topotypes.

Ghilarovia cylindrica (Stuxberg, 1876)

Figs 452-469, Map 25.

Craspedosoma cylindricum Stuxberg, 1876a: 35, 38: figs.

Craspedosoma cylindricum - Stuxberg, 1876b: 317; Lokšina & Golovatch, 1979: 383; Mikhaljova, 1993: 34.

Ghilarovia novosibirica Shear, 1988: 56: figs.

Ghilarovia novosibirica - Mikhaljova, 1993: 16; Mikhaljova & Golovatch, 2001: 108.

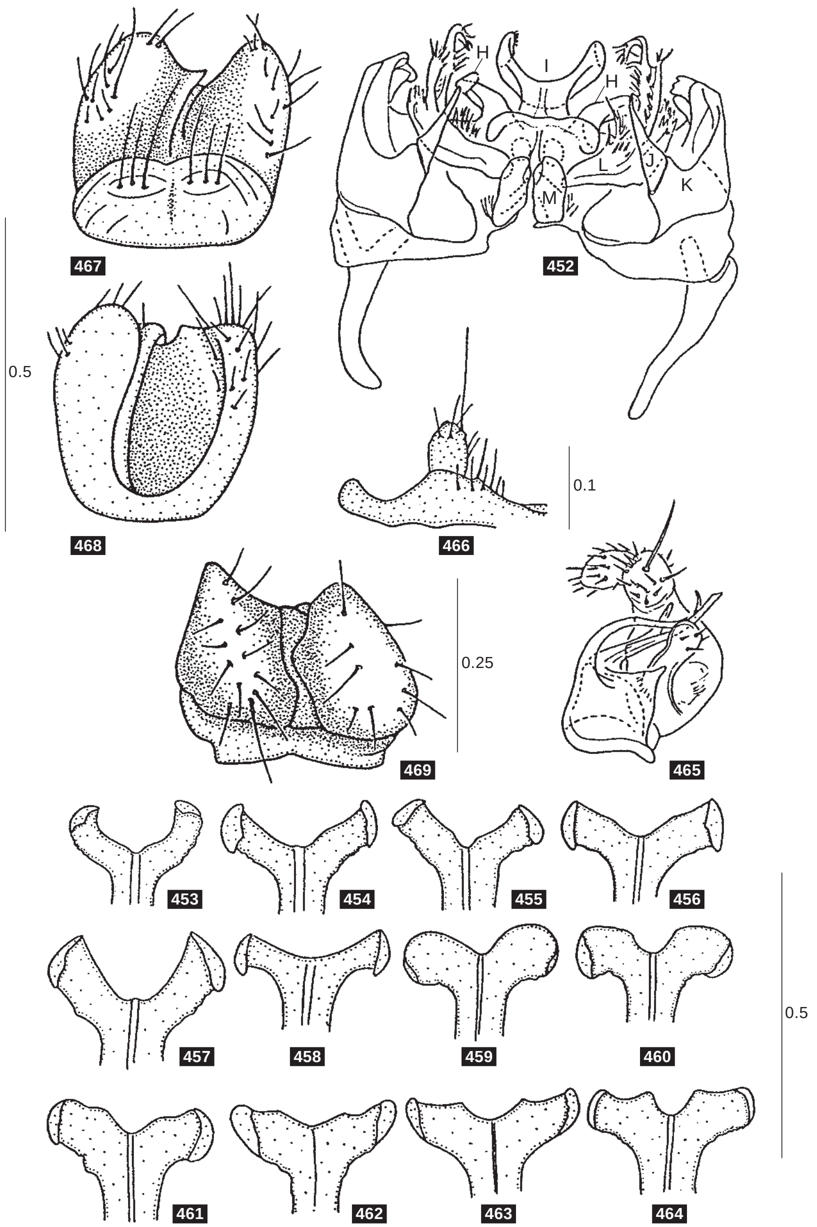
Ghilarovia cylindrica - Mikhaljova, 2002b: 201, 202: figs; Nefediev, 2002b: 35; 2002d: 30; Mikhaljova & Nefediev, 2003: 86.

DIAGNOSIS: The species differs from the only other congener by the much larger median sternal process of the anterior gonopods, its variable structure, the narrower apical blade of the angiocoxal lateral part, the smaller knob projecting between the coxae on male sternite 10, the peculiar structure both of the vulva and female leg pair 2.

DESCRIPTION: Male. Length 9-10 mm, width 1.0-1.1 mm. Coloration uniform light tan, ocelli black, antennae suffused with dark purplish brown.

Body with 28 segments, subcylindrical. Head setose. Genae micropilose. Ocelli 19 or 20 in a subtriangular eye patch. Forehead distinctly flattened, with a faintly indicated transverse carina between eyes above flattened area. Slender antennae long. Length of antennomere 3, 0.52 mm. Collum semi-circular. Somite 2 somewhat narrower than both head with genae and somite 3. Transverse suture between pro- and metazona well-developed. Small knob at base of each macrochaeta distinct. Metazonital macrochaetae thin, pointed, as usual arranged in a nearly transverse row. All metazonital macrocheatae either subequal in length or median ones shortest. Each anal valve with three setae at caudal margin. Subanal scale with 1+1 setae.

Legs slender but not very long. Two additional claws placed dorsally at base of claw, normal, small. Ventral tarsal papillae present, only subapical part of tarsus without papillae. Leg pairs 3-7 slightly incrassate as usual, but not otherwise



Figs 452-469. *Ghilarovia cylindrica* (Stuxberg, 1876): 452 – anterior gonopods (posterior view); 453-464 – variation in shape of median sternal process of anterior gonopods; 465 – posterior gonopod (mesal view); 466 – female leg pair 2; 467 – vulva (front view); 468 – vulva (caudal view); 469 – vulva (ventral view); H – lateral sternal process of anterior gonopods; I – median sternal process of anterior gonopods; J – posterior lamella of angiocoxite; K – lateral part of angiocoxite; L – colpocoxite; M – telopodite. – Scales in mm, 452 & 465 without scale (452, 465 – after Shear, 1988; 453-464, 466-469 – after Mikhaljova, 2002b).

modified. Coxae 10 and 11 with glands, somewhat enlarged, not otherwise modified. Sternite 10 with an oblong knob projecting between coxae on anterior side.

Anterior gonopods (Fig. 452) much wider than long, not strongly projecting. Two pairs of anterior lyriform processes (H and I) of sternum large. Median sternal process quite variable in shape (Figs 453-464). Angiocoxite entirely lateral, shallowly divided, with a pointed posterior lamella (J) and a complex lateral part (K) with a narrow apical blade (cf. Mikhaljova, 2002b). Colpocoxites (L) 2-branched, mesal branch fimbriate, hooked, lateral branch broken up distally into small, chitinous rods. Telopodites (M) strongly reduced, lobe-like. Posterior gonopods (Fig. 465) with large coxae, each latter bearing two acuminate processes, one of which being bifid, and an anterior triangular lamella. Prefemur with a large setose knob, distal segment small, subglobose.

Female. Length 10.2-12 mm, width 1.0-1.14 mm. Color in alcohol beige, beige-gray or light tan. Forehead not flattened. Leg pair 2 modified, strongly reduced, 1-segmented, setose apically (Fig. 466). Vulva well-sclerotised, as in Figs 467-469.

Leg pair 2 normal in subadult females with 26 body segments.

DISTRIBUTION (Map 25): Russia: Siberia (Novosibirsk, Tomsk and Kemerovo areas, southern part of Krasnoyarsk Province, Republic of Khakassia).

REMARKS: This species, originally described as *Craspedosoma cylindricum*, lists *Ghilarovia novosibirica* Shear, 1988, from the Novosibirsk Area (Shear, 1988), as a junior synonym (Mikhaljova, 2002b).

This species dwells in coniferous, mixed and leafy forests. In some places in the subzone of south taiga, between Ob and Tom rivers, this species amounts to 12-30% of the total diplopod catch using soil sampling (Nefediev, 2002d).

Family Altajellidae Mikhaljova & Golovatch, 2001

The family is distributed in Russia (Siberia), Kirghizia and eastern Kazakhstan. Four monobasic genera, the Asian part of Russia supports two of them.

The main distinguishing characters are as follows. Body with 28 segments; antennae somewhat clavate; gnathochilarium without promentum; collum not covering the head from above; metazonites devoid of paraterga or bulges; macrochaetae forming an extended transverse triangle; teguments smooth; telson normal; male coxae 2 and 3 unmodified, male coxae 7 rarely modified; penes absent; female leg pair 2 not modified; tarsal papillae largely present from male leg pair 3 at least until midbody legs; male leg pairs 3-7 somewhat increasingly enlarged; male legs 10 and 11 or only legs 10 with coxal glands, their sternites and coxae often slightly modified, never reduced; some claws with minute accessory spinicle(s) or claw(s); anterior gonopods placed either on a plate-like sternum with tracheal apodemes laterally or on a membranous sternite devoid of tracheal apodemes laterally, never with considerable structures medially so that coxites, however complex, remaining fully independent, more or less elongate, each more or less tripartite, often one branch represented by a long paramedian flagellum and always another branch being a solenomere-like structure supporting a prostatic groove, then both these branches being in tight contact at least over most of their extent and sheathed by remaining parts of coxite; posterior gonopods rather strongly reduced, barely functional, lying on a narrow plate-like sternite or coxosternum supplied with tracheal apodemes; each coxite with 1-2 median processes; telopodites short, few-segmented to totally missing.

Key to genera and species of Altajellidae:

1(2) Male coxa 11 with a strong, distomesal, unciform process and a caudal, lobe-shaped, papillate outgrowth (Fig. 475). Gonopods as in Figs 476-480. ....Genus *Teleckophoron* (*T. montanum*)

2(1) Male coxa 11 without strong, distomesal, unciform process and a caudal, lobe-shaped, papillate outgrowth (Fig. 489). Gonopods as in Figs 490-498. .... Genus *Altajella* (*A. pallida*)

Genus *Teleckophoron* Gulièka, 1972

DISTRIBUTION: Russia: Southwest Siberia. Monotypical.

The main distinguishing characters are as follows. Body subcylindrical; coxa 11 with a distomedian process and a caudal outgrowth; anterior gonopods placed on a narrow, plate-like, sclerotised sternite with clearly traceable tracheal apodemes; flagella of coxites absent; external branch of coxite slenderer, represented by a relatively simple “solenomere”, prostatic groove terminating at apex; inner branch higher than both other branches, subdivided distally; third branch lying in between, lamelliform, of irregular shape; coxites of posterior gonopods relatively simple, telopodites totally reduced.

Teleckophoron montanum Gulièka, 1972

Figs 470-480, Map 14.

Teleckophoron montanum Gulièka, 1972: 41: figs.

Teleckophoron montanum - Lokšina & Golovatch, 1979: 383; Mikhaljova, 1993: 35; Shelley et al., 2000: 79; Mikhaljova & Golovatch, 2001: 113, 114: figs.

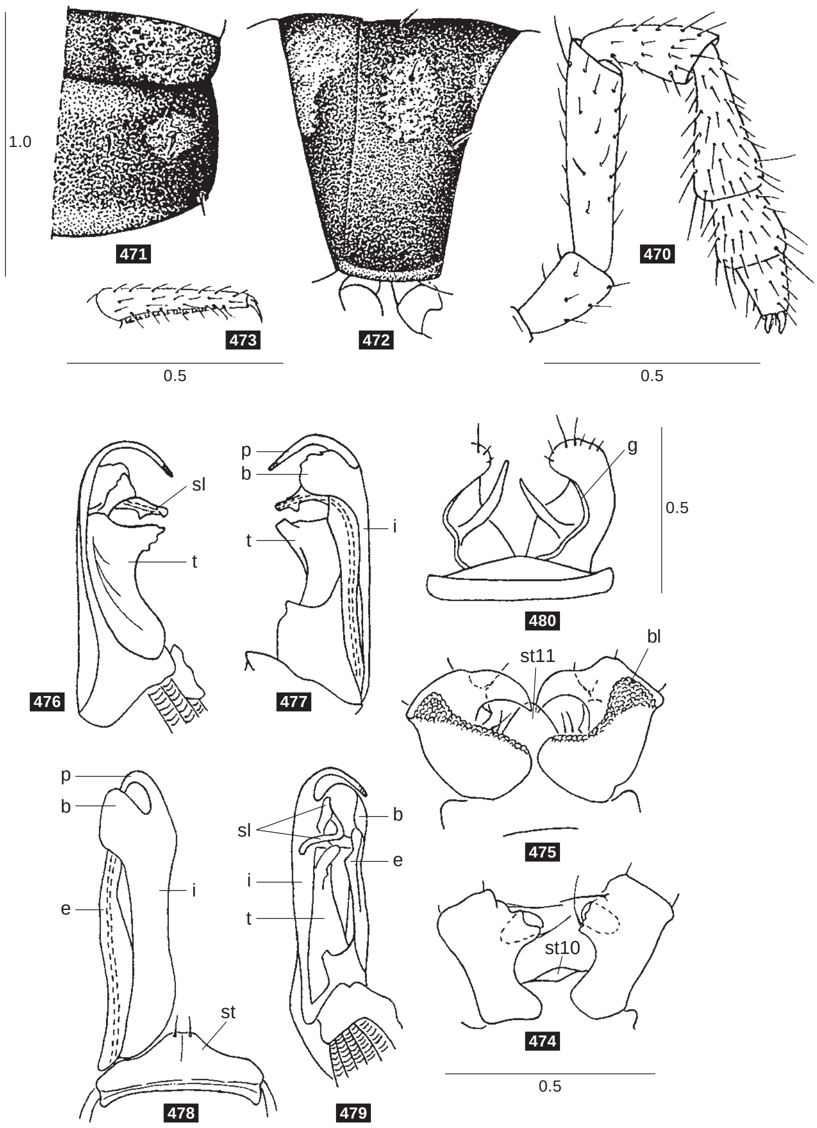
DESCRIPTION: Male. Length 13-14 mm, width 0.9-1.2 mm. Coloration in alcohol brown, with oval marbled spots laterally on pro- and metazona. Forehead and vertex dark brown, antennae and legs brown, ocelli black.

Body with 28 segments, subcylindrical, juloid, smooth. Head setose, vertigial suture hardly visible. Eye patches triangular, each composed of 22-23 ocelli. Antennae long, somewhat clavate (Fig. 470). Gnathochilarium with several strong setae on outer sides of distal parts of stipes. Remaining parts of stipes beset with setae, latter shorter and more numerous basally than distally. Each lamella lingualis with several medium-sized setae, a long seta only distally. Collum oval. Paraterga or bulges on metazonites absent (Figs 471-472). Transverse suture/stricture between pro- and metazona rather well-developed, macrochaetae on metazonites relatively short, pointed. Each anal valve with three setae at caudal margin. Subanal scale with 1+1 setae.

Legs slender but not very long, claws long, slightly curved, at least from pair 3 on with two minute, poorly traceable, accessory claws dorsally at base (Fig. 473). Orifice of vas deferens opening apically on a small knob. Claws 1 and 2 each not only with two minute accessory claws dorsally but with or without a spinicle (= filament) ventrally at base. Male legs 3-7 slightly but increasingly enlarged as usual, without any further modifications. Tarsal papillae present from male legs 3 until legs of somite 24, onward missing, especially strongly developed on pairs 3-7, missing just proximally of claw from male legs 10 on. Somite 27 legless. Legs 10 and 11 with coxal glands; pair 10 with sternite (st10) supplied with a median outgrowth curved caudally (Fig. 474); coxa 11 with a strong, distomesal, unciform protuberance and a caudal, lobe-shaped, papillate outgrowth (bl), sternite 11 (st11) with a similar but larger median outgrowth caudally (Fig. 475).

Anterior gonopods (Figs 476-479) positioned on a narrow, plate-like, strongly sclerotised sternite devoid of median structures (except for 1+1 minute paramedian setae) but with clearly traceable tracheal apodemes; coxites independent, not contiguous medially, tripartite, curved distocaudally. External branch of coxite (e) slenderer, representing a relatively simple “solenomere” (sl), prostatic groove terminating at a curved apex. Inner branch (i) higher than both other branches, divided distally into an outer lobe (b) and an inner flagelliform process (p). Third branch (t) lying in between, lamelliform, of irregular shape. Posterior gonopods (Fig. 480) placed on a nearly normal, plate-like sternite with clearly expressed tracheal apodemes; coxites curved distocaudally, setose terminally, each with a front groove (g) and a parabasal styletiform process; telopodites totally reduced.

Female. Length 14 mm, width 1.3 mm. Each eye patch with 21 ocelli. Leg pair 2 normal, coxa with a small distocaudal knob. Prefemur 3 with a small but distinct distolateral outgrowth.



Figs 470-480. *Teleckophoron montanum* Gulièka, 1972: 470 – antenna; 471 – male body segment 15 (dorsal view); 472 - male body segment 15 (lateral view); 473 – male tarsus 15; 474 – basal part of male leg pair 10; 475 – basal part of male leg part 11; 476 – anterior gonopod (mesal view); 477 – anterior gonopod (lateral view); 478 – anterior gonopod (front view); 479 – anterior gonopod (caudal view); 480 – posterior gonopods (front view); b – lobe of inner piece; bl – lobe of male coxite 11; e – external piece (= "solenomere") of anterior gonopod coxite; g – groove on posterior gonopod coxite; i – inner piece of anterior gonopod coxite; p – process of inner piece; sl – distal part of "solenomere"; st – sternite of anterior gonopods; st10 – sternite of male leg pair 10; st11 – sternite of male leg pair 11; t – third piece of anterior gonopod coxite. – Scales in mm (after Mikhaljova & Golovatch, 2001).

DISTRIBUTION (Map 14): Russia: Siberia (Republic of Altai and the southern part of Krasnoyarsk Province).

REMARKS: For a long time *T. montanum* was listed among nomina dubia, because Gulièka's (1972) original description and illustrations were too incomplete, while the holotype returned without gonopods (currently housed in the Zoological Institute, St. Petersburg) was virtually useless for revision. The species has been redescribed based on new samples from the southern part of Krasnoyarsk Province (Mikhaljova & Golovatch, 2001).

This species has been reported both from taiga and montane tundra habitats.

Genus *Altajella* Gulièka, 1972

DISTRIBUTION: Russia: Southwest Siberia. Monotypical.

The main distinguishing characters are as follows. Body subcylindrical; coxa 10 with a distomedial process; one additional spinicle on claw either both middorsally and midventrally (legs 1-3) or only middorsally (from legs 4 until about midbody); sternite of male leg pair 10 with a long uncifirm outgrowth laterally on each side and a protuberance caudomedially; sternite of male leg pair 11 with a protuberance caudomedially; sternite of anterior gonopods membranous, devoid of tracheal apodemes as well as of structures medially and laterally; coxites independent, elongate, tripartite, each divided into an external and an internal (=”solenomere”) piece, these both embracing a glandular globule at base, and a pair of paramedian flagella beginning near base of coxites, mostly attached to “solenomere” and ending in a free coil; small coxites of posterior gonopods contiguous medially, each with two more or less conical outgrowths; telopodites short, few-segmented.

Altajella pallida **Gulièka, 1972**

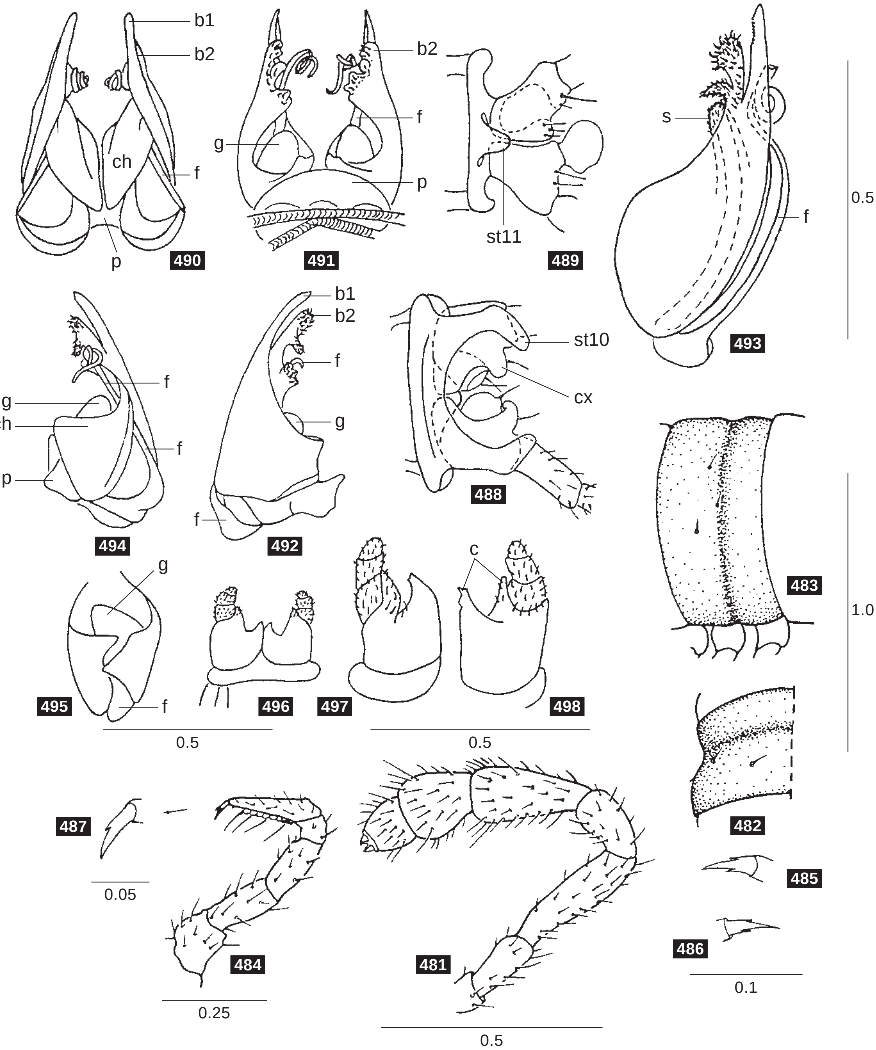
Figs 481-498, Map 13.

Altajella pallida Gulièka, 1972: 42, 43: figs.

Altajella pallida - Lokšina & Golovatch, 1979: 383; Shear, 1988: 51; Mikhaljova, 1993: 34; Shelley et al., 2000: 61; Mikhaljova & Golovatch, 2001:111, 112: figs.

DESCRIPTION: Male. Length 7 mm, width 0.7 mm. Coloration in alcohol pale yellowish with a marbled anterior part, maybe so because freshly moulted. Antennae light brown, legs pale, ocelli black.

Body with 28 segments, subcylindrical, juloid. Head densely setose, epicranial suture well visible. Eye patches oval-triangular, rather small, composed of 12-13 ocelli, 13 ocelli on right side, 12 on left side. Antennae long, somewhat



Figs 481-498. *Altajella pallida* Gulièka, 1972: 481 – antenna; 482 – male body segment 15 (dorsal view); 483 – male body segment 15 (lateral view); 484 – male leg pair 15; 485 – claw of male leg pair 1; 486 – claw of male leg pair 2; 487 – claw of male leg pair 15; 488 – basal part of male leg pair 10 (front view); 489 – basal part of male leg pair 11 (caudal view); 490 – anterior gonopods (front view); 491 – anterior gonopods (caudal view); 492 – anterior gonopod (lateral view); 493 – anterior gonopod (anterolateral view, flagellum displaced); 494 – anterior gonopods (mesal view); 495 – basal part of anterior gonopod (ventral view); 496 – posterior gonopods (front view); 497 – left posterior gonopod (front view); 498 – right posterior gonopod (front view); b1, b2 – branches of external piece of coxite (b2 = "solenomere"); c – coxal processes of posterior gonopods; ch – inner piece of coxite; cx – coxal process of male leg pair 10; f – flagellum; g – glandular globule (?coxal gland); p – membranous sternite; s – caudo-parabasal outgrowth of "solenomere" terminating the seminal groove; st10 – caudal outgrowth on sternite of male leg pair 10; st11 – caudal outgrowth on sternite of male leg pair 11. – Scales in mm (after Mikhaljova & Golovatch, 2001).

clavate (Fig. 481). Gnathochilarium with several strong distal setae on outer sides of stipes. Remaining parts of stipes beset with short to medium-sized setae, shorter ones more basally. Lamellae linguales likewise with short setae basally and longer ones distally. Collum semi-circular. Paraterga or bulges on metazonites absent (Figs 482-483). Metazonital macrochaetae short, always pointed, on a few posteriormost metazona forming a transverse row.

Legs short and slender. Legs 3-7 slightly but increasingly enlarged as usual, coxa 7 particularly incrassate dorsoventrally. Tarsal papillae (Fig. 484) present from legs 3 until legs of somite 20, onward absent. From legs 10 on, ventral patch immediately proximally of claw lacking tarsal papillae. Claws of legs 1 and 2 each with a very delicate ventral and a dorsal midway spinicle (Figs 485-486); onward both spinicles increasingly reduced, ventral one being absent already from legs 4 on (Fig. 487), dorsal spinicle retained until legs of somite 11 where barely traceable. Legs 10 and 11 with coxal glands, coxa 10 (Fig. 488) somewhat enlarged, with a curved distomedian process (cx), sternite (st10) with a long, lateral, unciform outgrowth on each side and a caudomedian protuberance. Sternite (st11) of leg pair 11 (Fig. 489) with a distinct caudomedian protuberance. Somite 27 legless. Each anal valve with three setae at caudal margin. Subanal scale with 1+1 setae.

Anterior gonopods (Figs 490-495) placed on a membranous sternite (p) devoid of tracheal apodemes as well as of structures lying both medially and laterally; coxites tripartite, independent, not contiguous medially, suberect. External piece of coxite bifid (b1 and b2) (Figs 490-491). Branch b2 (= "solenomere") micropilose distally, with variously shaped outgrowths; prostatic groove terminating on a caudo-parabasal outgrowth (s) (Fig. 493). Branch b1 smooth, slender, simple, a little higher than b2. Inner piece of coxite (ch) narrowed distally, broadly lobe-shaped parabasally (Figs 490, 494). At base, both these pieces of coxite embracing a glandular globule (?coxal glands) (g) (Figs 491, 495). Third piece represented by a paramedian pair of flagella (f) originating in basal part of coxites, each forming a U-shaped loop, lying inside a prostatic groove along "solenomere" and finally ending in a free coiled spiral; tip of each flagellum slightly concave and with a subterminal incision. Posterior gonopods strongly reduced (Figs 496-498), placed on a narrow plate-like sternite supplied with evident tracheal apodemes, coxites contiguous medially, each coxite with two conical processes (c), telopodites strongly reduced, 3-segmented, pubescent.

Female unknown.

DISTRIBUTION (Map 13): Russia: Siberia (Republic of Altai).

REMARKS: For a long time *A. pallida* was listed among nomina dubia, because the original description and illustrations given by Gulièka (1972) were too incomplete, often even misleading; in addition, the holotype was returned without gonopods. It was only due to a fresh topotypic sample that the species could finally be revised (Mikhaljova & Golovatch, 2001).

This species has been collected in valley forests at 500 m a.s.l. and in taiga forest at 1,350 m a.s.l.

Family Golovatchiidae Shear, 1992

The family is known only from Russia (south of the Far East). Represented by a single genus and species.

The main distinguishing characters are as follows. Body with 30 segments; teguments smooth; collum usual, not covering the head from above; metazonites devoid of paraterga or bulges; macrochaetae forming an extended transverse triangle; gnathochilarium without promentum; telson normal; pregonopodal legs enlarged, curved mesally but not otherwise modified; male legs with tarsal papillae; claw at base with two additional claws dorsally and a long seta ventrally; male coxae 2, 3 and 7 unmodified; penes absent; female leg pair 2 normal; telopodite of anterior gonopods 2-segmented, terminal segment small, button-shaped; posterior gonopods widely separated, placed on a broad sternum, with deeply cupped coxites each carrying a 3-segmented, non-hypertrophied telopodite; distal telopoditomere not swollen; male leg 10 with a well-sclerotised, enlarged gland-bearing coxite but with telopodite also reduced to three segments only; male legs 11 without coxal glands.

Genus *Golovatchia* Shear, 1992

DISTRIBUTION: Russia: southern part of Far East. Monotypical.

The main distinguishing characters as in the family.

Golovatchia magda Shear, 1992

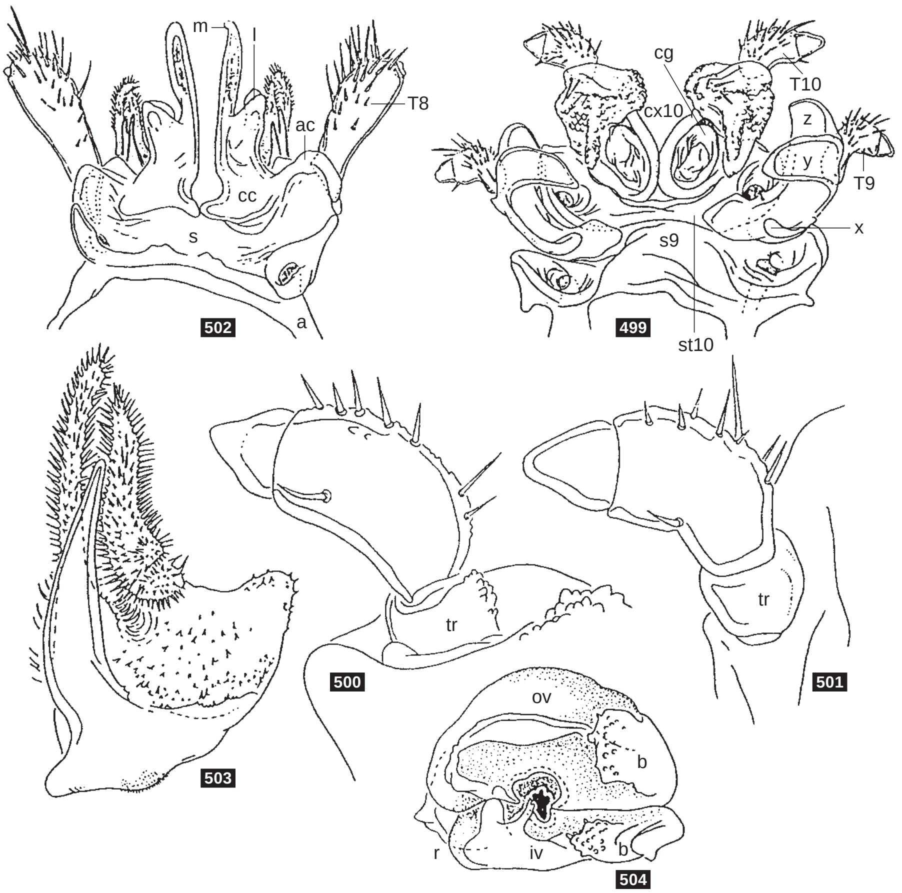
Figs 499-504, Map 24.

Golovatchia magda Shear, 1992: 66, 65, 67,69,70: figs.

Golovatchia magda - Mikhaljova, 1993: 29; 1998b: 39, 38: figs, 18: map; Ganin, 1997: 133; Shelley et al., 2000: 69; Mikhaljova & Marusik, 2004: 6.

DESCRIPTION: Male. Body ca. 15 mm long, width 1.2-1.3 mm. Coloration light brown, anterior somites mottled darker dorsally. Eyes black.

Body with 30 segments. Head glabrous, rounded. Eyes with ca. 30 uniform ocelli in a subtriangular patch on each side of head. Antennae relatively short, antennomere 3, 0.5 mm long. Metaterga with short, somewhat clavate macrochaetae, with neither paraterga nor sculpture, nor tubercles. Leg pairs 3-7 enlarged, prefemora curved inward, not otherwise modified; papillae arranged ventrally all along tarsus. Hind legs without tarsal papillae. Leg pair 10 (Fig. 499) with a normal sternum (S10); coxae (cx 10) enlarged, medially contiguous, each lobed, heavily



Figs 499-504. *Golovatchia magda* Shear, 1992: 499 – posterior gonopods and male leg pair 10 (front view); 500 – left telopodite of male leg pair 10; 501 – left posterior gonopod telopodite (caudal view); 502 – anterior gonopods (anterior view); 503 – right anterior gonopod angiocoxites (anterior view); 504 – left vulva (ventral view); S9 – sternite of posterior gonopods; S10 – sternite of male leg pair 10; T8 – anterior gonopod telopodite; T9 – posterior gonopod telopodite; T10 – male telopodite 10; ac – angiocoxite of anterior gonopod; cc – colpocoxite; cg – coxal gland of male leg pair 10; cx10 – male coxa 10; l – lateral outgrowth of colpocoxite; m – mesal outgrowth of colpocoxite; s – sternite of anterior gonopods; x – anterior coxal branch of posterior gonopod; y – mesal coxal branch of posterior gonopod; z – posterior coxal branch of posterior gonopod; tr – trochanter; r – receptacle; iv – inner valve of vulva; ov – outer valve of vulva; b – posterior lamina. – Magnification: 499 & 502 – 97x, 504 – 130x, 500-501 & 503 – 265x (after Shear, 1992).

sclerotised, with a strongly roughened cuticle and a large coxal gland (cg); telopodite (T10) (Fig. 500) much like in that of posterior gonopods (Fig. 501). Leg pair 11 without coxal glands. Legs posterior to leg pair 10 not modified.

Sternum (S) of anterior gonopods (Fig. 502) broad, unmodified, with pronounced tracheal openings and short, rod-like apodemes (a). Coxae enlarged, contiguous medially, with biramous colpocoxites (cc), of which lateral branch (l) curved strongly posteriorly and flattened laterally, and mesal branch (m) suberect, more rod-like, slightly curved at tip. Angiocoxites (ac) (Fig. 503) with several branches, of which two (anterior) acuminate, smooth and three posterior strongly fimbriate, "bottle brush" in appearance. Telopodites (T8) (Fig. 502) of anterior gonopods relatively large, basal segment setose and clavate, terminal one bare and very small. Posterior gonopods (Fig. 499) with a broad, unmodified sternum (S9). Coxites widely separated from one another, strongly depressed, with margins drawn out into three flattened branches (x, y, z); a single small seta at posterior edge. Anteriormost branches (x) embracing lateral branch (l) of anterior gonopod colpocoxite, and posteriormost branches (y) fitting lateral to coxa 10. Telopodites (T9) (Figs 499, 501) with three segments, the basal a ring-like trochanter (tr); second arched, heavily setose, third small, conical, lacking setae.

Female. Body ca.16.5 mm long, width 1.4 mm. Antennomere 3, 0.5 mm long. Vulva (Fig. 504) with a rather small receptacle (r), drawn out to a point between valves; inner (iv) and outer valves (ov) both with posterior laminae (b) recurved anteriorly.

DISTRIBUTION (Map 24): Russia: Far East (Khabarovsk Province).

REMARKS: This species has been collected in *Larix* taiga.

Family Caseyidae Verhoeff, 1909

The family is distributed mainly in the Nearctic, represented also in the Russian Far East. It seems plausible that this family occurs in North Korea as well*.

Seven genera. The Asian part of Russia supports only one genus.

The main distinguishing characters of the family are as follows. Body with 30 segments, subcylindrical; teguments smooth; antennae slender; gnathochilarium with a promentum; collum normal, not covering the head from above; metazonites with neither paraterga nor bulges, nor tubercles; metatergal setae arranged in a single transverse row; pleurosternal regions of metazona striated or

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* Recently, among the material from North Korea, kept in the Hungarian Natural Hustory Museum, Budapest, I together with Dr. Korsós have found 3 juveniles presumably belonging to *Underwoodia kurtschevae*. However, in the absence of an adult male it appears impossible to verify this record.

not; male mandibular stipes mostly with a ventral lobe; telson normal; female leg pair 2 unmodified; male tarsal papillae absent; claws with additional claws; male coxa 2 with a more or less well-developed gonapophysis; male coxa 3 hypertrophied; male coxa 7 unmodified; only male legs 10 with coxal glands; anterior gonopods mostly 2- to 4-branched, placed on a sternal plate either with or without lateral process; posterior gonopod sternite narrow, coxite with a distomesal colpocoxite, telopodite 1-segmented, hypertrophied.

Genus *Underwoodia* Cook & Collins, 1895

Distribution: Russia: Far East; northern and central parts of North America; ?North Korea.

Three species. The Asian part of Russia supports one species. This genus has been reviewed by Shelley (1993).

The main distinguishing characters of the genus are as follows. Body small (6-11 mm long), pleurosternal striations wanting; mandibular stipes devoid of a lobe; gonapophysis on male coxa 2 relatively short; anterior gonopod sternite without lateral process; colpocoxites triramous; flagellocoxite split into two subequal branches, of which caudal longer and barbed, anterior branch shorter, without barbs; male legs 2 and 3 short; some species parthenogenetic.

Underwoodia kurtschevae Golovatch, 1980

Figs 505-517, Map 26.

Underwoodia kurtschevae Golovatch, 1980a: 199, 200: figs, 201: map.

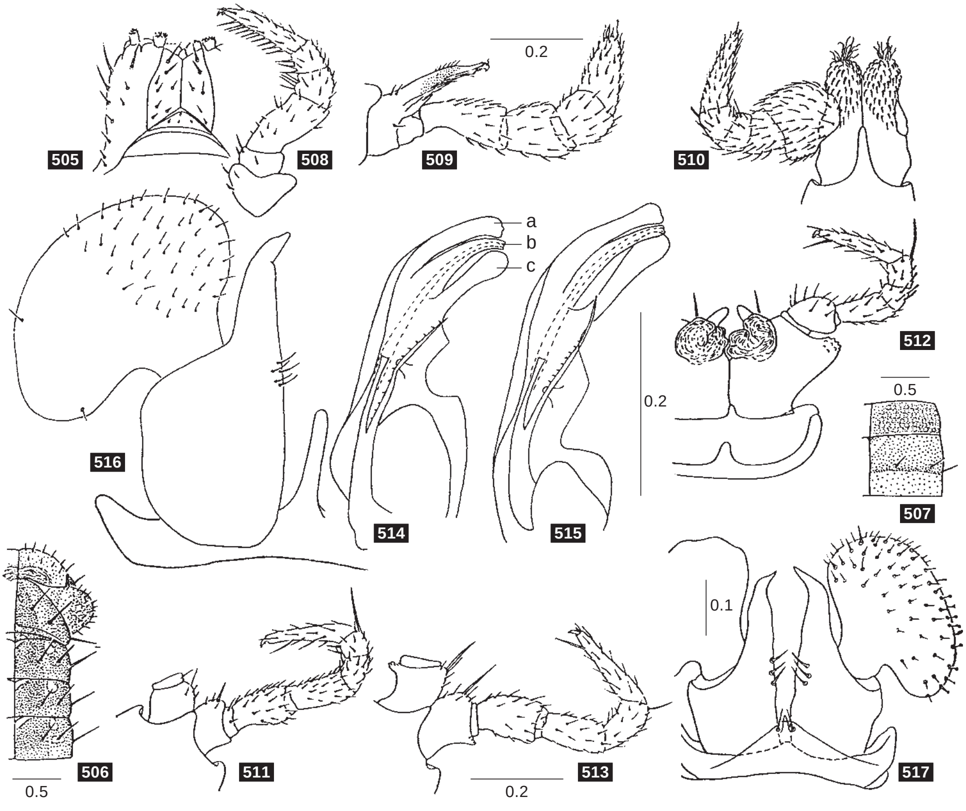
Underwoodia kurtschevae – Kurcheva & Mikhaljova, 1980: 121; Mikhaljova, 1981c: 87; 1983b: 83; 1988b: 70; 1990: 137; 1993: 17; 1998b: 40: map, 39: figs; Mikhaljova & Petukhova, 1983: 52; Ursova, 1983: 305; Mikhaljova & Bakurov, 1989: 40; Ganin, 1989a: 145; 1994: 60; 1997: 10; Gromyko, 1990: 66; Shelley, 1993: 175: map, 172: figs; Enghoff, 1994: 26; Mikhaljova & Basarukin, 1995: 92: figs, 93: map; Mikhaljova & Marusik, 2004: 6.

Diagnosis: The species differs from congeners by the branches of the anterior gonopod colpocoxite holding generally upright, not curved, by the configuration of the medial branch of the anterior gonopod colpocoxite with a subterminal lobe and a straight and upright distal portion, by the caudal branch which is widely separated from the lateral branch, sinuate, not bent at midlength, the inner margin being sublinear.

Description: Male. Body length 7-8 mm, width 1.5-2.0 mm. Coloration pale red-brown, more intense and marbled in anterior body part. Eyes black.

Body with 30 segments. Head with sparse facial setae. Epicranial suture well-developed. Ocelli ca.15, in a subtriangular eye patch on each side of head. Antennae relatively long, typically slender. Promentum bearing four tiny setae (Fig. 505). Body subcylindrical, metazona with neither paraterga nor lateral bulges, nor tubercles as usual in the family (Figs 506-507). Body parallel-sided, narrower than head with genae, growing very visibly in height toward midbody, onward up to segments 24-25 constantly high. Metazonital macrochaetae thin and pointed. Macrochaetae on segments 1-3(4) longer than those on subsequent segments. Striation absent from all segments.

Legs relatively short; claw with a small accessory claw. Legs 1 normal (Fig. 508). Legs 2 with a short tarsus, gonapophyses terminally unciform (Fig. 509).



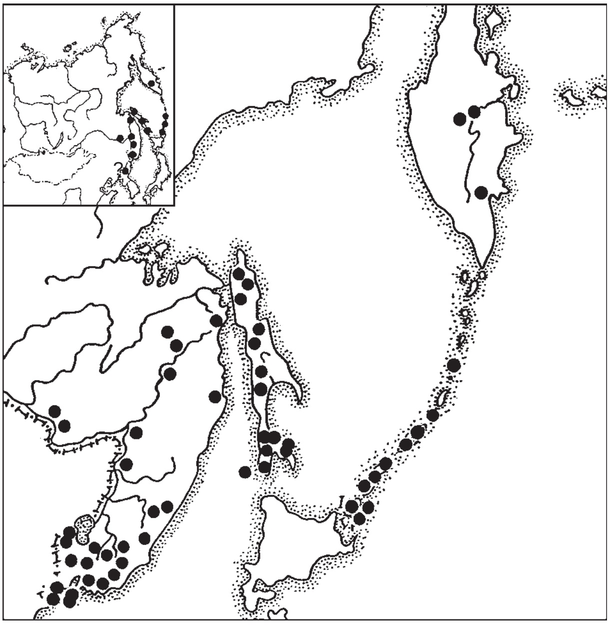
Figs 505-517. *Underwoodia kurtschevae* Golovatch, 1980: 505 – gnathochilarium; 506 – fore part of male body (dorsal view); 507 – male midbody segment (dorsal view); 508 – male leg pair 1; 509 – male leg pair 2; 510 – male leg pair 3; 511 – male leg pair 4; 512 – male leg pair 10; 513 – male leg pair 11; 514-515 – anterior gonopods (caudal view); 516 – posterior gonopod (caudal view); 517 – posterior gonopods (front view); a – mesal branch of colpocoxite; b – lateral branch of colpocoxite; c – posterior branch of colpocoxite. – Scales in mm (505-513 – after Golovatch, 1980a; 514-516 – after Mikhaljova & Basarukin, 1995).

Legs 3 somewhat hypertrophied, inner coxal lobes setose, with apical bundles of hairs (Fig. 510). Legs 4 normal (Fig. 511). Legs 10 (Fig. 512) with glands on enlarged coxae, each coxa with a caudomesal finger-shaped process. Legs 11 (Fig. 513) without coxal glands but with a small coxal projection laterally.

Anterior gonopods (Figs 514-515) relatively large, in situ oriented caudad. Sternite broad, moderately sclerotised, without processes. Each colpocoxite divided into three suberect branches: medial (a) with a small subterminal lobule, lateral (b), and caudal (c), latter well-separated from b, with an even mesal edge and a rounded apex. Laterally, colpocoxite with an external basal projection varying in length. Flagellocoxite swollen near base, lying over and obscuring part of telopodite in lateral view, biramous, caudal branch longer and barbed, front branch shorter and simple. Telopodites short and stout. Sternite of posterior gonopods (Figs 516-517) narrow, with a median process of varying length. Coxites pointed at apex, setose on inner side. Telopodites 1-segmented, greatly swollen, setose.

Female. Length 7-11 mm, width 1.6-2.5 mm. Vulvae with valves fused basally, markedly unequal, outer valve much larger. Both coxite and operculum of vulva setose. Coxite with a small, posterior, beak-shaped process ventrally. Receptacle and postgenital plate absent.

DISTRIBUTION (Map 26): Russia: Far East (Primorsky and Khabarovsk provinces, Malyi Khingan Mt. Range (border between Amurskaya Area and Jewish Autonomous Region), Sakhalin Island, Kuriles, Kamchatka Peninsula); ?North Korea.



Map 26. Distribution of *Underwoodia kurtschevae* (●).

REMARKS: This species is characterised by parthenogenesis, males being extemely rare. *U. kutschevae* lives in the litter and uppermost soil horizons in coniferous, mixed and broadleaved forests both on mountain slopes and in river valleys. The species tends to prefer forest litter (Mikhaljova, 1983b), but seldom it occurs even on seashores in sand under debris cast ashore. The average numbers range from 0.5 to 37.0 ind./m^2 in forests of the Primorsky and Khabarivsk provinces, depending on forest type (Kurcheva & Mikhaljova, 1980; Mikhaljova, 1981c, 1988b; Mikhaljova & Bakurov, 1989; Ganin, 1997). Some data are also available on the feeding activity of this species in the forests of Khabarovsk Province (Ganin, 1989a, 1994, 1997).

Family Megalotylidae Golovatch, 1978

The family is distributed in the south of the Far East of Russia, in North Korea, southern China, the Nepal Himalaya, Vietnam, Thailand and Burma. Represented by two genera, *Megalotyla* Golovatch, 1978 and possibly also by *Nepalella* Shear, 1979. However, the assignment of *Nepalella* to Megalotylidae is still questioned, as actually "it may belong in Conotylidae" (Shear & Tsurusaki, 1995; Shear, 2000). The Asian part of Russia supports *Megalotyla* only.

The main distinguishing characters of the family are as follows. Body with 30 segments; antennae slender; gnathochilarium without promentum; collum normal, not covering the head from above ; metazona with dorsolateral bulges instead of paraterga; teguments smooth or finely alveolate; macrochaetae generally arranged in a subtransverse row; penes absent; telson normal; female leg pair 2 unmodified; male tarsal papillae present, claw with a short auxiliary spine near base; male leg pairs 3-7 somewhat increasingly enlarged; male coxae 2, 3 and 7 unmodified; both male legs 10 and 11 with coxal glands; anterior gonopods reduced to a large, square, coxosternal plate either with or without any projection dorsally but with tracheal apodemes; posterior gonopods with 2-segmented, significantly reduced telopodites, hypertrophied coxae and large, either entire or bipartite colpocoxites.

Genus *Megalotyla* Golovatch, 1978

DISTRIBUTION: Russia: Far East; North Korea. Two species. The Russian Far East supports one species.

The main distinguishing nonsexual characters as in the family. This genus is mainly recognised from the rather closely related *Nepalella* by the absence of projections on the coxosternal plate (= anterior gonopods) and by the entire colpocoxite of the posterior gonopods.

Megalotyla brevichaeta Golovatch & Mikhaljova, 1978

Figs 518-527, Map 24.

Megalotyla brevichaeta Golovatch & Mikhaljova, 1978: 66, 67: figs.

Megalotyla brevichaeta - Lokšina & Golovatch, 1979: 383; Kurcheva & Mikhaljova, 1980: 121; Mikhaljova, 1981c: 87; 1983b: 84; 1988b: 70; 1993: 29; 1998b: 42, 41: figs, 18: map; Mikhaljova & Petukhova, 1983: 52; Ganin, 1997: 121; Shear, 1999: 3; 2000: 373; Shelley et al., 2000: 73; Mkhaljova et al., 2000: 113.

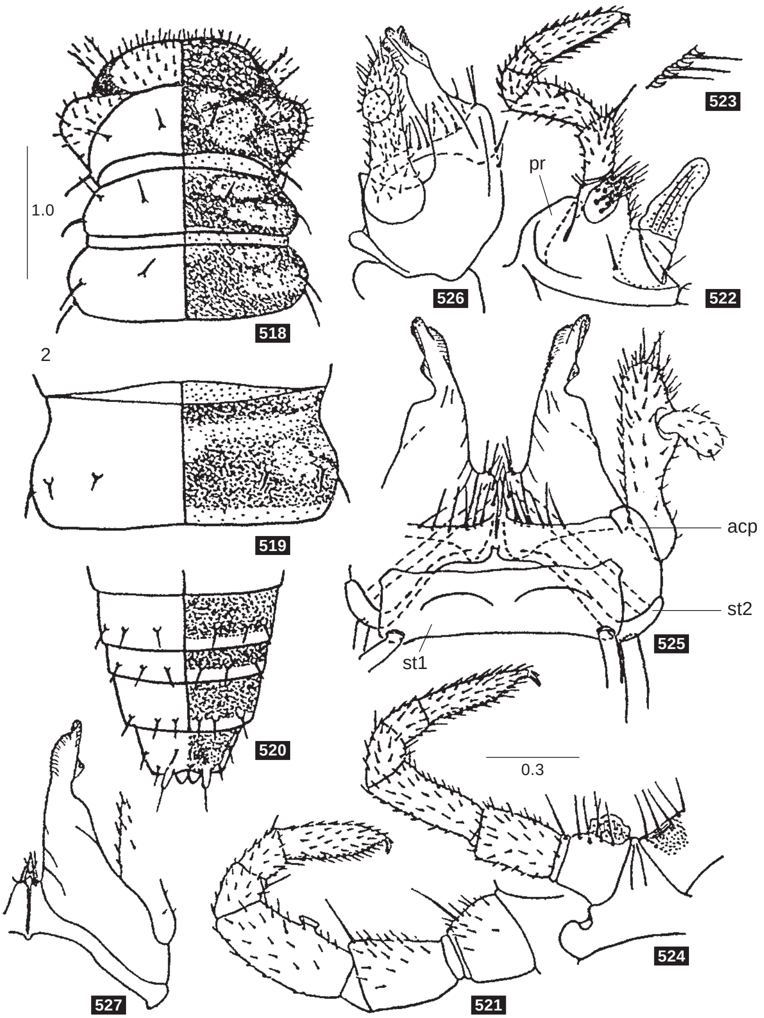
Diagnosis: The species differs from the sole, Korean congener by the presence both of pubescence and processes in the basal part of the coxite as well as on the sternite of the posterior gonopods, by the presence of median fusion of the posterior gonopod coxae, by the smaller telopoditomere 2 of the posterior gonopods, by the shape of the sternite of the anterior gonopods, by the absence of anterior processes on male coxae 11, and by the larger body.

Description: Male. Body 25-27 mm long, 2.3-2.4 mm wide. Body and legs from light brown to brown mottled with marbled yellowish spots of varying size. Distal part of legs more intensely coloured. Prozona yellow. Eyes black.

Body with 30 segments. Ocelli 29-30, in a subtriangular eye patch on each side of head. Head densely pubescent. Each stipe with 5 large anterolateral and 1 anteromesal seta, each lamella lingualis with 3 long distal setae in a transverse row and 4 short basal setae. Antennae long. Length ratios of antennomeres 2-7 as 1.0:2.3:1.3:1.6:1.1:0.4, width and length ratios as 2.3:6.2:3.7:4.5:3.6:1.4, respectively. Collum ovoid. Somite 2 narrower than both head with genae and somite 3. Somites 2-25 with poorly developed dorsolateral bulges (Figs 518-519), somites 26-30 subcylindrical (Fig. 520). Prozona finely shagreened. Metazona smooth and glossy. Metatergal macrochaetae short, fragile, arranged in a subtransverse row on midbody segments, like an extended triangle on anterior somites. Each anal valve with three setae, subanal scale with two setae.

Legs long, gradually growing in length toward telson due to both prefemur and femur. Tarsal papillae present as usual for the family. Tarsal patch near claw without papillae from pair 10 on. Claw long, poorly curved, with a short dorsal spine. Legs 3-7 very poorly but increasingly enlarged toward gonopods as usual for the family. Legs 3-6 with a small mushroom-shaped protuberance on inner side of femur (Fig. 521). Legs 10 and 11 with coxal glands. A hypertrophied coxa 10 with a rounded outgrowth (pr) near base and a distofrontal setose pad (Fig. 522), tarsi with dense long setae and papillae (Fig. 523). Legs 11 normal (Fig. 524).

Anterior gonopods (Fig. 525) reduced to a large, square, coxosternal plate (st1) with tracheal apodemes but without traces of appendages. Posterior gonopods (Figs 526-527) with syncoxite bearing small front processes (acp) laterally, 2-segmented, setose telopodites, and large colpocoxites. Syncoxite placed on a plate-like sternum (st2), latter thicker and sclerotised at periphery, membranous centrally; tracheal apodemes well-developed. Coxae with long setae paramedially, telopoditomere 2 with a claw vestige apically.



Figs 518-527. *Megalotyla brevichaeta* Golovatch & Mikhaljova, 1978: 518 – fore part of male body (dorsal view); 519 – male midbody segment (dorsal view); 520 – back part of male body; 521 – male leg pair 6; 522 – male leg pair 10 (front view); 523 – piece of ventral surface of tarsus of male leg pair 10; 524 – male leg pair 11; 525 – gonopods (front view); 526 – posterior gonopods (lateral view); 527 – colpocoxite of posterior gonopods (caudal view); st1 – anterior gonopod sternite; st2 – sternite of posterior gonopods; acp – anterior outgrowth; pr – external process of male coxae 10. – Scales in mm (after Golovatch & Mikhaljova, 1978).

Female. Length up to 28.3 mm. Vulvae large, operculum with numerous long setae.

DISTRIBUTION (Map 24): Russia: Far East (Primorsky Province).

REMARKS: The species lives in the litter and uppermost soil horizons in coniferous and mixed forests on mountain slopes and in broadleaved forests of river valleys. It tends to prefer forest litter, but often occurs in rotten wood as well (Mikhaljova, 1983b). The average numbers range from 0.5 to 2.5 ind./m², depending on forest type (Kurcheva & Mikhaljova, 1980; Mikhaljova, 1981c)

Chordeumatida nomen dubium

Craspedosoma armatum (Gerstfeldt, 1859)

Julus armatus Gerstfeldt, 1859: 272.

Craspedosoma armatum - Haase, 1880: 224; Mikhaljova, 1993: 34; Mikhaljova & Golovatch, 2001: 117.

Ancestreuma armatum - Lokšina & Golovatch, 1979: 383.

REMARKS: This species was very poorly described from Irkutsk, East Siberia. At present it appears impossible to revise it because of the absence both of type material and strict topotypes. However, there is little doubt that is actually represents a species of Diplomaragnidae.

Order Polydesmida Leach, 1815

Distributed all over the globe except for Antarctica, especially prolific in tropical areas. The order comprises about 30 families. The Asian part of Russia supports only three families.

Members of this order are distinguished by the absence of ocelli. The genae are largely rectangular in dorsal view. The number of body segments in adults is fixed, usually 20 or 19, including the telson; in the Asian part of Russia, the body of polydesmidans consists of 20 segments only. In all our species, the so-called ozopore formula is normal, i.e. ozopores are present on segments 5, 7, 9, 10, 12, 13, 15-19. All somital sclerites are fused into a complete ring. Metazonites except the collum are usually provided with lateral keels or wings, or bulges called paraterga or paranota, the latter sometimes with peritremata. Frontal corners of the paraterga are mostly rounded, the caudal corners are normally acutanglar. Only male leg pair 8 is modified into gonopods, the latter always retain primary segmentation between coxite and telopodite. Cannula present. The telopodite's prefemoral portion is densely setose. Certain male legs sometimes carry sphaerotrichs, or sphaerotrichomes (= setae on knobs), ventrally.

Key to families, genera and species of Polydesmida:

1(8) Paraterga well-developed, serrate at lateral margin, without peritremata. Body relatively slender; metaterga relatively flat, with three transverse rows of bosses/tubercles*. Gonopod coxites fused medially. .... Family Polydesmidae

2(5) Paraterga broad (Figs 529, 539, 559). Body relatively large (adults >15 mm long). 3

3(4) Gonopods with 2-3 distofemoral processes, as in Figs 532, 533, 541, 553, 555. Usually forest-dwellers. .... Genus *Epanerchodus*

4(3) Gonopods different, as in Fig. 558. Confined to hot- and greenhouses or parks. .... Genus *Polydesmus* (*P. denticulatus*)

5(2) Paraterga narrow (Figs 567, 594, 604). Body relatively small (adults <15 mm long). 6

6(7) Gonopods unipartite. Loop of seminal groove parabasal. .... Genus *Uniramidesmus*

7(6) Gonopods bifid. Loop of seminal groove distal. .... Genus *Schizoturanius*

8(1) Paraterga relatively poorly-developed, with peritremata, non-serrate at lateral margin. Body stout, metaterga strongly convex, arched, usually without traces of areation. Gonopods free from each other basally. 9

9(10) Adults poorly pigmented: whitish to yellowish with or without brown dorsal pattern. Gonopods simple, without conspicuous solenomere branch (Fig. 624). Body relatively large (adults >25 mm long). .... Family Xystodesmidae (Genus *Levizonus*)

10(9) Adults strongly pigmented: brown to dark brown with yellow peritremata. Gonopods usually complex, with an evident solenomere branch. Body medium-sized (adults 15-19 mm long). .... Family Paradoxosomatidae

11(14) Peritremata of midbody segments poorly demarcated ventrally (Fig. 651). 12

12(13) Gonopods not coiled ring-like, twisted, very complex (Figs 653-655). Adult body brown to dark brown, 25-30 mm long. .... Genus *Sichotanus* (*S. eurygaster*)

13(12) Gonopods coiled ring-like (Figs 665-667). Body brown to light brown, 18-19 mm long. .... Genus *Haplogonosoma* (*H. implicatum*)

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* Not to be confused with the very faint metatergal bosses in *Levizonus variabilis* from the family Xystodesmidae.

14(11) Peritremata of midbody segments evidently demarcated ventrally (Fig. 671). 15

15(16) Gonopods as in Figs 669-670. Caudal corners of peritremata projecting strongly beak-like from segment 15 on. Confined to hot- and greenhoses. .... Genus *Oxidus* (*O. gracilis*)

16(15) Gonopods different, as in Figs 673-675. Caudal corners of peritremata poorly projecting beak-like from segment 17 on. Forest-dwellers. .... Genus *Cawjeekelia* (*C. koreana*)

Family Polydesmidae Leach, 1815

This family is mainly Holarctic in distribution, with only marginal representation in the Oriental realm. About 25 genera (Hoffman, 1980). The Asian part of Russia supports four genera, of which the genus *Polydesmus* is only represented by an introduced synanthropic species.

In Siberia and the Russian Far East, members of this family are distinguished by the following characters. Body slender, with a flat dorsum; paraterga more or less strongly developed, devoid of lateral peritremata, their frontal corners widely rounded; metatergal polygonal sculpture evident as three transverse rows of bosses (not to be confused with metatergal bosses in *Levizonus variabilis* from the family Xystodesmidae); male legs with or without sphaerotrichs; gonopod aperture subcordate; coxae of gonopods subglobose, deeply excavate for accommodation of telopodites, fused medially; femorite well-developed; seminal groove with a loop frontally, usually opening on a usually hairy pulvillus; a subterminal accessory seminal chamber normally present. The genus *Uniramidesmus* is somewhat isolated in being devoid of an accessory seminal chamber.

Genus *Epanerchodus* Attems, 1901

Distribution: Japan, China, Taiwan, Korea and the Far East of Russia. This genus encompasses about 70 species. In the Asian part of Russia, only four species have been encountered.

In Siberia and the Russian Far East, members of this genus are recognised by the following characters. Body relatively large (ca. 2 cm long); metaterga flat, with a distinct polygonal sculpture; paraterga well-developed, wide and set about as high as dorsum; sphaerotrichs on ventral side of certain male legs present; gonopods in situ holding parallel to each other; using traditional terminology, gonopod telopodite with a vestigial outer horn, a postfemoral and an additional process; using modern terminology (Golovatch, 1991; Djursvoll et al., 2001), gonopod telopodite with an exomerite (= endomerite) and always with 2-3 strong distofemoral processes; clivus broad; seminal groove with a characteristic loop, ending up at or near bottom of a caudal excavation of femorite on a hairy pulvillus supplied with a subterminal accessory seminal chamber; vulvae supplied with spiral structures at bottom of bursa's gutter/fissure.

Key to species and morphs of *Epanerchodus*
(using traditional terminology):

1(8) Gonopod telopodite without two branches apically. 2

2(5) Tibia and postfemur of male legs with an outgrowth. Gonopods as in Figs 531-533. .... *E. polymorphus*

3(4) Distal part of gonopod telopodite with a dentiform process and a group of bacilli (Fig. 532). Lager: male body length 18-22 mm. Postfemoral and tibial outgrowths in male extending up to leg 28. .... *E. polymorphus*, forma *digitata*

4(3) Distal part of gonopod telopodite with neither process nor bacilli (Fig. 533). Smaller: male body length 15.5-18 mm. Postfemoral and tibial outgrowths in male extending up to leg 25. .... *E. polymorphus*, forma *simplificata*

5(2) Tibia and postfemur of male legs without outgrowth. Gonopods different. 6

6(7) Gonopod telopodite with a group batons subapically. Postfemoral process longer (Figs 541-542). .... *E. koreanus*

7(6) Gonopod telopodite without group of batons subapically. Postfemoral process very short (Figs 553-554). .... *E. cuspidatus*

8(1) Gonopod telopodite with two branches apically (Figs 555-557). .... *E. kunashiricus*

Key to species and morphs of *Epanerchodus*
(using modern terminology by Golovatch, 1991):

1(8) Cephalic distofemoral process without two branches apically. 2

2(5) Tibia and postfemur of male legs with an outgrowth. Gonopods as in Figs 531-533. .... *E. polymorphus*

3(4) Distal part of cephalic distofemoral process of gonopod with a dentiform process and a group of bacilli (Fig. 532). Larger: male body length 18-22 mm. Postfemoral and tibial outgrowths in male extending up to leg 28. . ... *E. polymorphus*, forma *digitata*

4(3) Distal part of cephalic distofemoral process of gonopod with neither process nor bacilli (Fig. 533). Smaller: male body length 15.5-18 mm.

Postfemoral and tibial outgrowths in male extending up to leg 25. .... *E. polymorphus*, forma *simplificata*

5(2) Tibia and postfemur of male legs without outgrowth. Gonopods different. 6

6(7) Cephalic distofemoral process with a group batons subapically. Caudal distofemoral process longer (Figs 541-542). .... *E. koreanus*

7(6) Cephalic distofemoral process without group of batons subapically. Caudal distofemoral process very short (Figs 553-554). .... *E. cuspidatus*

8(1) Cephalic distofemoral process with two branches apically (Figs 555-557). .... *E. kunashiricus*

Epanerchodus polymorphus **Mikhaljova & Golovatch, 1981**

Figs 528-536, Map 27.

Epanerchodus polymorphus Mikhaljova & Golovatch, 1981: 1183, 1184: figs.

Epanerchodus polymorphus – Mikhaljova, 1983b: 85; 1988b: 70; 1993: 30; 1997a: 145; 1998b: 43, 44: figs, 45: map; 2002a: 150; Mikhaljova & Petukhova, 1983: 53; Mikhaljova & Bakurov, 1989: 40; Ganin, 1997: 121; Mikhaljova & Korsós, 2003: 234; Mikhaljova & Marusik, 2004: 10.

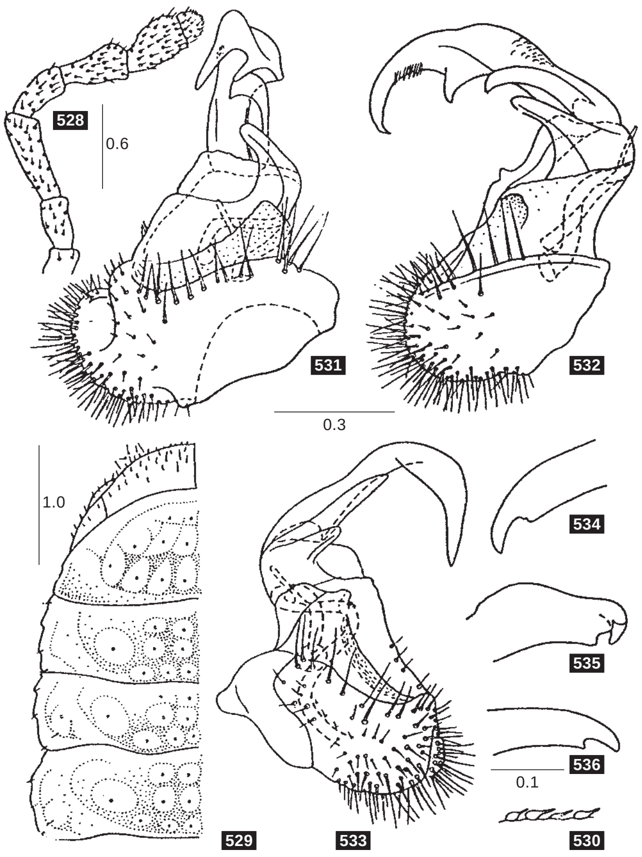
DIAGNOSIS: The species differs from congeners by the presence of two male morphs, the size of the postfemoral process (= caudal distofemoral process in terms of Golovatch, 1991), the configuration of the cephalic distofemoral process in terms of Golovatch (1991) which is either with a dentiform process and a group of batons (forma *digitata*) or with neither process nor batons (forma *simplificata*).

DESCRIPTION: This species displays morphism, i.e. two distinct male morphs (forma *digitata* and forma *simplificata*) and a continuous variation range in females, all invariably coexisting.

Male. Adult 18-22 mm in length, 2.6-3.0 mm in width (forma *digitata*) and 15.5-18 mm in length, 2.5-2.6 mm in width (froma *simplificata*). Coloration from pink to pinkish beige, legs whitish yellow, antennae brown, but uncoloured after long preservation in alcohol.

Head moderately densely setose, pubescence on occiput weaker, with two pairs of longer vertigial setae. Antennae (Fig. 528) slender, clavate, in situ reaching to segment 4. Antennomere 7 with two small knobs, one bare, the other with short pubescence. Length ratios of antennomeres 2-7 as 2.4:4.1:2.6:3.0:2.9:1, width ratios as 1:1.1:1.0:1.1:1.4:1.1, respectively. Collum in width subequal to or a bit broader than head. Body parallel-sided on segments 7-17, further on gradually tapering toward telson. Both 2nd and 3rd rows of metatergal polygonal sculpture developed more strongly than 1st row (Fig. 529). Tergal setae short, blunt apically. Paratergal anterior corners broadly rounded, caudolateral corners beak-shaped pointed on segments 5(8)-18, blunt (forma *digitata*) or acute apically (forma *simplificata*). Tail long, rounded at tip, setose.

Legs moderately long and slender, somewhat incrassate in male as compared to female. Coxae 1 and 2 contiguous medially. Starting from leg pair 3, coxae gradually but increasingly well separated by setigerous sternites. Sterna somewhat elevated at base of coxae but flat in the middle. Leg pair 1 as well as last two leg pairs somewhat reduced. Starting from leg pair 3, tarsus, postfemur and, partly, femur with sphaerotrichs on ventral surface (Fig. 530). Tibia and

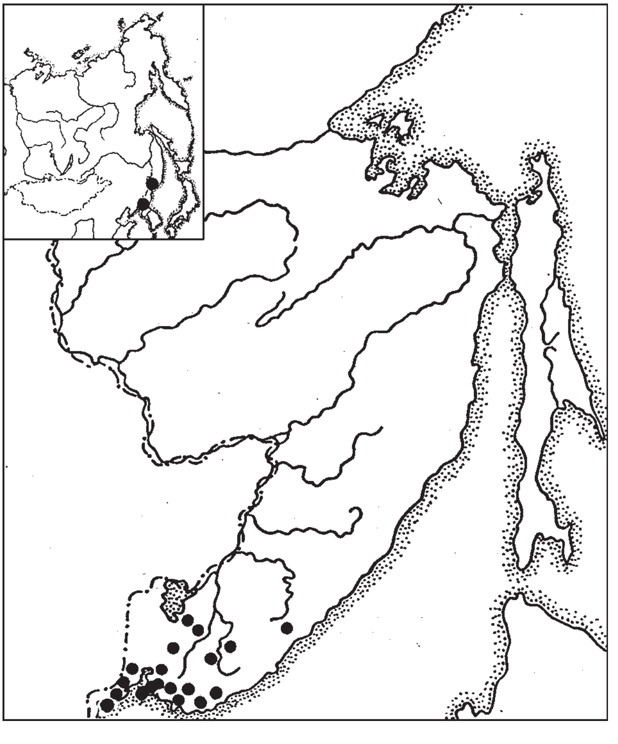


Figs 528-536. *Epanerchodus polymorphus* Mikhaljova & Golovatch, 1981: 528 – antenna; 529 – fore part of male body (dorsal view); 530 – sphaerotrichs; 531 – forma *digitata,* gonopod (ventral view); 532 – forma *digitata,* gonopod (lateral view); 533 – forma *simplificata*, gonopod (lateral view); 534-536 – distal parts of gonopod telopodite of apparently anomalous males (534-536 – distal parts of cephalic distofemoral process, according to Golovatch, 1991). – Scales in mm (after Mikhaljova & Golovatch, 1981).

postfemur of leg pairs 9(10)-28 (forma *digitata*) or 13(15)-25 (forma *simplificata*) with a ventral process.

Using traditional terminology, gonopods (Figs 531-533) are as follows. Setation of gonopod prefemoral portion heavy. Femoral outer horn bacilliform. Clivus low, with excavations, delicately roughened. Seminal groove ending up at bottom of a broad femoral cavity. Postfemoral process digitiform. Gonopod telopodites falcate. Telopodite ventrally with folds in middle part (forma *digitata*) or smooth (forma *simplificata*). Telopodite distally either with a dentiform process and a group of batons (forma *digitata*) (Fig. 532) or with neither process nor batons (forma simplificata) (Fig. 533). Telopodite basally with a slender, curved (forma *digitata*) or erect (forma *simplificata*) additional branch.

Using modern terminology (Golovatch, 1991; Djursvoll et al., 2001), gonopods with a well-developed femorite, a bacilliform exomerite (= endomerite, = outer horn) and three distofemoral processes. Cephalic distofemoral process longest, falcate, with folds in middle part (forma *digitata*) or smooth (forma *simplificata*) ventrally, as well as either with a dentiform process and a group of batons (forma *digitata*) (Fig. 532) or with neither process nor batons (forma *simplificata*) distally (Fig. 533). Middle distofemoral process slender, curved (forma *digitata*) or erect (forma *simplificata*). Caudal distofemoral process digitiform.



Map 27. Distribution of *Epanerchodus polymorphus* (●).

In addition, there are some males somewhat deviating in structure of the gonopods from both morphs of the species. Habitually, these males are similar to the forma *simplificata*, but differ in the presence subterminally of different outgrowths or excavations on the cephalic distofemoral process in terms of Golovatch (1991) (Figs 534-536). Such instances are rare though, apparently teratologies.

Female. Adult 16.5-21.5 mm in length, 2.5-2.9 mm in width. Legs unmodified, epigynal ridge behind coxae 2 low, transverse, rounded, often shallowly sinuate. Vulvae greatly elongated, valves setose distally. Operculum with a few long setae.

Juvenile. Caudolateral corners of paraterga always pointed.

DISTRIBUTION (Map 27): Russia: Far East (Primorsky Province), North Korea.

REMARKS: This species is common in the southern part of Primorsky Province. As it lives in forest litter and rotten wood, it belongs to a group of litter-dwelling species (Mikhaljova, 1983b). Rarely, both adults and juveniles occur in the uppermost soil (Mikhaljova, 1983b). In addition, it has been recorded in caves (Mikhaljova, 1993, 1997a). The abundance ranges from 1.0 to 9.5 ind./m² (Mikhaljova, 1981c, 1988b; Mikhaljova & Bakurov, 1989; Kurcheva & Mikhaljova, 1980), but during reproduction it can be observed in great numbers.

Being a member of the family Polydesmidae, this species prefers humid habitats, and at higher rates of air humidity it can appear on the surface. Females prefer to lay eggs near water on banks of springs and rivers, where accumulations of early instar juveniles can be observed. Yet this species is sensitive to inundation, as during the rain the animals climb onto higher places like trees, stumps and logs.

Mass mating takes place in May-June, egg-laying obviously from May to July and early August (in the lab from May to July). Immatures start appearing in July-August, molting occurs in special chambers which the larva constructs using soil particles and its own faeces. Hibernation usually as penultimate instars, sometimes also as adults.

Epanerchodus koreanus **Verhoeff, 1937**

Figs 537-552, Map 28.

Epanerchodus bifidus - Golovatch & Mikhaljova, 1979: 837; Lokšina & Golovatch, 1979: 384; Mikhaljova & Petukhova, 1983: 52; Mikhaljova, 1988b: 70; 1993: 30; 1997a: 145; 1998a: 4; 1998b: 46, 47: figs, 45: map; Ganin, 1997: 121.

Epanerchodus koreanus - Mikhaljova & Lim, 2002: 22, 23: figs; Mikhaljova, 2002a: 150; Mikhaljova & Korsós, 2003: 233; Mikhaljova & Marusik, 2004: 10.

DIAGNOSIS: The species differs from congeners by a bifid outer femoral horn (= endomerite in terms of Golovatch, 1991; = exomerite after Djursvoll et al.,

2001) of the gonopods, the presence of a group of batons subapically on the gonopod telopodite, and a broad and high clivus.

DESCRIPTION: Male. Length 15-22 mm, width 3.3-3.8 mm with paraterga. Coloration uniform reddish beige, grayish brown, pink-beige, gray-beige or reddish brown with paraterga bright pink dorsally, forming a characteristic pattern of spots and stripes; legs yellowish, antennae beige.

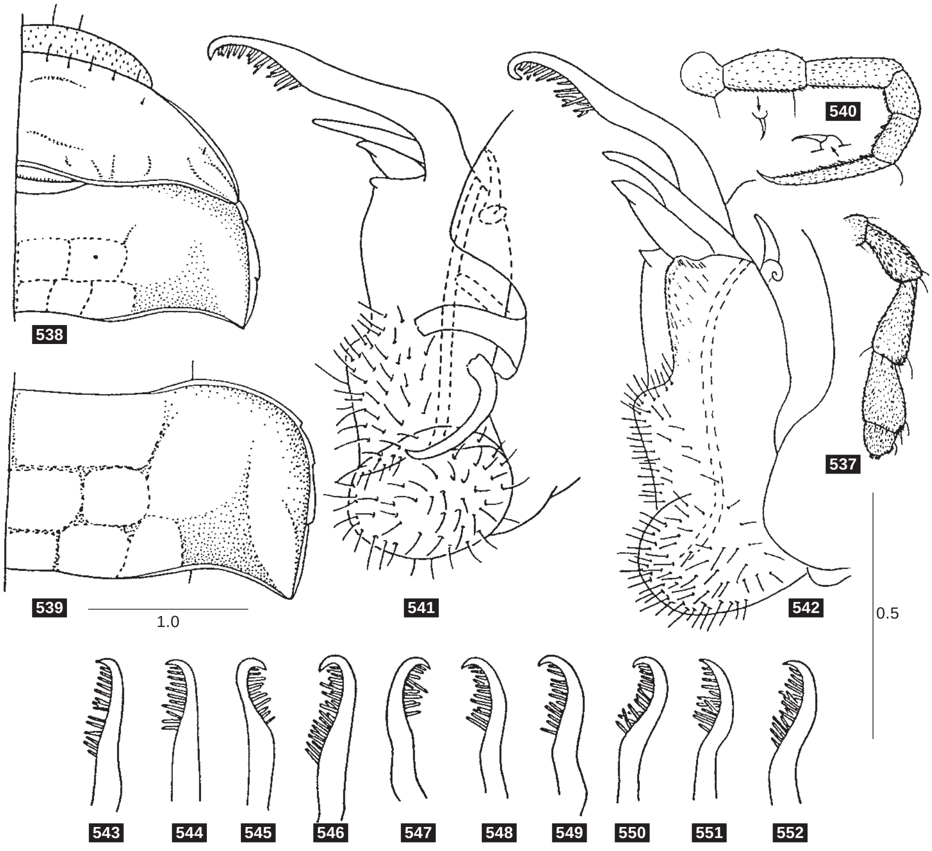
This species displays colour variation. There are at least two distinct colour forms, i.e. the typical brightly reddish pink-brown with characteristic spots and bands on the metazonites and a pinkish beige or beige form with neither spots nor bands both in males and females (Mikhaljova, 1998a). In addition, the coloration of males ranges from gray-brown with characteristic but indistinct spots on the metazona to pink-brown with a distinct dorsal pattern (Mikhaljova & Lim, 2000).

Head moderately setose, with two pairs of longer epicranial setae. Antennae long and slender, clavate (Fig. 537). Length ratios of antennomeres 2-7 as 2.1:3.9:2.7:3.0:2.7:1, width ratios as 1:1:1:1.1:1.3:1, respectively. Collum much broader than head, elliptical transversely; lateral ends angular, with one very weak notch on each side; a row of fine setae present along anterior margin. Segment 2 broader than collum, paraterga somewhat bent forward. Body parallel-sided on segments 6-15, further on gradually tapering toward telson. Each metapleurite divided by a deep transverse groove into two unequal parts. Metatergal polygonal sculpture weak, very weak on anterior segments, both 2nd and 3rd rows developed more strongly than 1st one (Figs 538, 539). Tergal setae tiny, blunt. Paraterga horizontal, usually as wide as long; their caudolateral corners increasingly pointed on segments 4-19; lateral margin with 3-4 weak incisions, each bearing a minute seta. Tail rounded at tip, sparsely setose. Posterior edge of subanal scale varying from round to subquadrate.

Legs moderately long and slender, claws normal. Leg pairs 1 and 2 somewhat reduced in size as compared to subsequent legs. Male tarsus, tibia and, partly, postfemur with sphaerotrichs on ventral surface (Fig. 540).

Using traditional terminology, gonopods (Figs 541-542) are as follows. Setation of prefemoral portion heavy. Clivus broad, with a lamelliform margin, outer horn unequally bifurcate. Gonopod telopodite with a hook-shaped apex and a group of batons subapically. Number of batons and projections of telopodite's middle part varied (Figs 543-552). Telopodite basally with an additional process variable in length. Postfemoral process long, pointed apically, of varying thickness.

Using modern terminology (Golovatch, 1991; Djursvoll et al., 2001), gonopods with a bifurcate exomerite (= outer horn) and three distofemoral processes, of which cephalic one the strongest, bearing a group of batons subapically and a

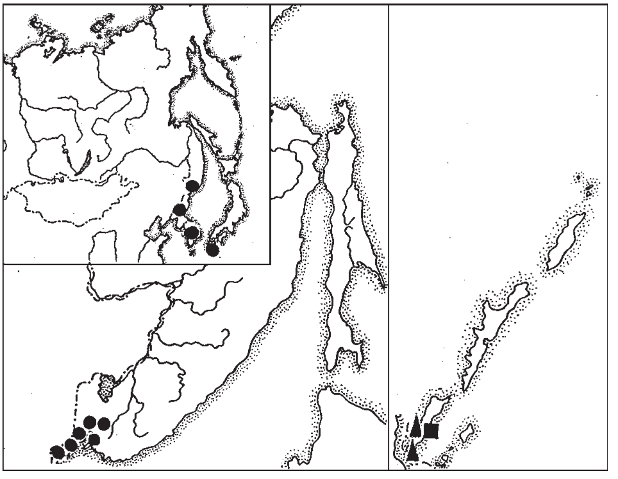


Figs 537-552. *Epanerchodus koreanus* Verhoeff, 1937: 537 – antenna; 538 – fore part of male body (dorsal view); 539 – male body segment 8 (dorsal view); 540 – male leg pair 7; 541 – gonopod (anteromesal view); 542 – gonopod (posterolateral view); 543-552 – variation in distal part of gonopod telopodite (543-552 – variation in distal part of cephalic distofemoral process, according to Golovatch, 1991). – Scales in mm, 537 & 540 without scale (538, 539, 541-552 – after Mikhaljova & Lim, 2002; 537, 540 – after Murakami & Paik, 1968).

hook-shaped tip. Number of batons and projections on cephalic process' middle part varied (Figs 543-552). Middle distofemoral process slender, pointed apically, somewhat curved, with certain variation in length; caudal one with a pointed apex, variable in thickness.

Female. Length 33-35 mm, width 4.2-4.5 mm with paraterga. Coloration always reddish brown with paraterga bright pink dorsally, forming a characteristic pattern of spots and stripes. Legs without sphaerotrichs. Epigynal ridge behind leg pair 2 low, rounded transversely.

Distribution (Map 28): Russia: Far East (Primorsky Province); North and South Korea, southern Japan.



Map 28. Distribution of *Epanerchodus koreanus* (●), *E. cuspidatus* (■) and *E. kunashiricus* (▲).

REMARKS: This species is a senior subjective synonym of *E. dichotomus* Takakuwa, 1954 and *E. bifidus* Takakuwa, 1954 (Mikhaljova & Lim, 2002). In the fauna of the Russian Far East, this species has largely been referred to as *E. bifidus* (e.g. Mikhaljova, 1998b).

This is a litter-dwelling species (Mikhljova, 1983b), also registered in caves (Murakami & Paik, 1968; Mikhaljova, 1997a). In the southern part of Primorsky Province, it is relatively rare, with the numbers averaging 0.2 ind./m² (Mikhaljova, 1988b). However, I have observed accumulations of females on the bank of a forest lake, probably for egg-laying. In contrast, in Korea this species is common and abundant (Mikhaljova & Lim, 2000; Mikhaljova et al., 2000).

Epanerchodus cuspidatus Mikhaljova, 1996

Figs 553-554 Map 28.

Epanerchodus cuspidatus Mikhaljova, 1996a: 2, 3: figs.
Epanerchodus cuspidatus – Mikhaljova, 1998b: 45: map, 46: figs.
Epanerchodus kunashiricus – Golovatch in: Mikhaljova & Basarukin, 1995: 96.

DIAGNOSIS: The species differs from congeners by the configuration of the gonopod cephalic distofemoral process in terms of Golovatch (1991) devoid of any modifications as well as in a very small, caudal, distofemoral process in terms of Golovatch (1991) (= gonopod postfemoral process).

DESCRIPTION: Male. Body ca.15 mm long, 2.0 mm wide. Colour in alcohol pinkish beige, legs light. Antennae brown.

Head large, densely covered with minute hairs. Antennae long and clavate. Length ratios of antennomeres 2-7 as 1.5:2.7:2.2:2.1:1.9:1, width ratios as 0.9:1.1:1.1:1.2:1.4:1, respectively; 7th with several sensory bacilli. Collum elliptical, somewhat narrower than head; posterior corners slightly angular; a row of setae along anterior margin, further two rows on the surface. Segments 3 and 4 somewhat shorter and narrower than others. Subsequent segments gradually increasing in width toward segment 10, body parallel-sided between segments 10 and 17, gradually tapering toward telson. Second and third rows of metatergal polygonal sculpture developed stronger than first row. Tergal setae short, blunt apically. Outer margin of paraterga moderataly convex, with 3 minute notches. Caudolateral corners of paraterga beak-shaped pointed on segments 5-18. Tail medium-sized, conical, rounded at tip, with setae.

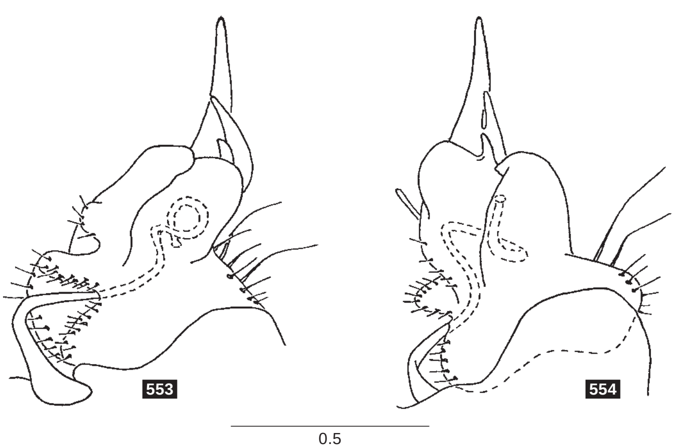
Legs moderately long and slender; tibia and tarsus with small spherical setae on ventral surface. Legs 1 and 2 somewhat reduced in size.

Following traditional terminology, gonopods (Figs 553-554) are as follows. Setation of gonopod prefemoral portion heavy. Clivus broad, with a flattened margin. Seminal groove ending up at bottom of a sufficiently narrow femoral cavity. Femoral outer horn bacilliform. Postfemoral process very small, with a pointed apex. Gonopod telopodite somewhat curved and pointed apically, at base with an additional process.

Using modern terminology (Golovatch, 1991; Djursvoll et al., 2001), exomerite (= outer horn) bacilliform while distofemoral processes three, of which cephalic one longest, somewhat curved. Middle distofemoral process shorter; caudal one very small. All distofemoral processes pointed apically.

Female. Length 15.5 mm, width 2.0 mm.

DISTRIBUTION (Map 28): Russia: Far East (Kuriles: Kunashir Island).



Figs 553-554. *Epanerchodus cuspidatus* Mikhaljova, 1996: 553 – gonopod (lateral view); 554 - gonopod (ventral view). – Scale in mm (after Mikhaljova, 1996a).

Epanerchodus kunashiricus Mikhaljova, 1988

Figs 555-557, Map 28.

Epanerchodus kunashiricus Mikhaljova, 1988a: 620: figs.

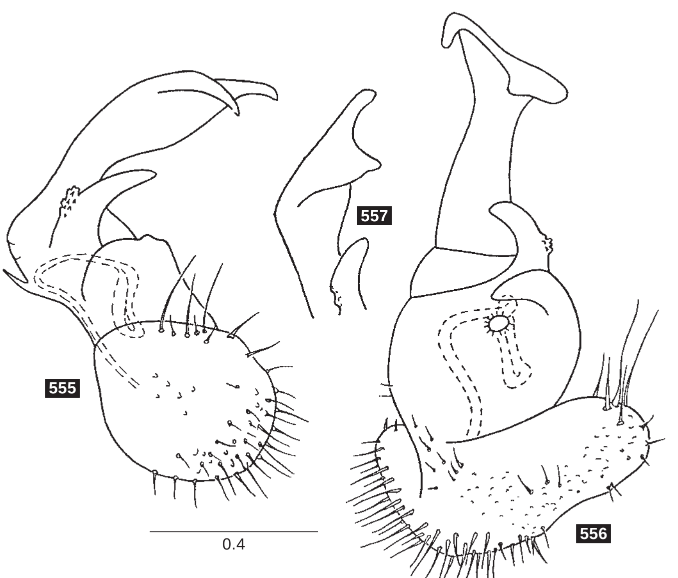
Epanerchodus kunashiricus – Mikhaljova, 1993: 30; 1998b: 44, 45: figs and map; Mikhaljova & Basarukin, 1995: 94, 95: map; Ganin, 1997: 133.

non *Epanerchodus kunashiricus* – Golovatch in Mikhaljova & Basarukin, 1995: 96.

DIAGNOSIS: The species differs from congeners in the configuration of the cephalic distofemoral process in terms of Golovatch (1991), this process being branched at the end, the presence of both a caudal distofemoral process and an exomerite in terms of Golovatch (1991) and Djursvoll et al. (2001) (= postfemoral process and an outer bacilliform horn, respectively), the absence of a middle distofemoral processes in terms of Golovatch (1991) (= additional process).

DESCRIPTION: Male. Adult 16-18 mm long, 2.0-2.5 mm wide. Coloration in alcohol beige, antennae brown.

Head clothed with very short and sparse setae, with two pairs of longer epicranial setae. Antennae clavate, in situ reaching the anterior part of segment 4. Length ratios of antennomeres 2-7 as 2.0:4.2:3.1:3.3: 3.1:1.0, width ratios as



Figs 555-557. *Epanerchodus kunashiricus* Mikhaljova, 1988: 555 – gonopod (lateral view); 556 – gonopod (ventral view); 557 – gonopod telopodite and postfemoral process (557 – cephalic and caudal distofemoral processes, according to Golovatch, 1991) . – Scale in mm (after Mikhaljova, 1988a).

1:1.1:1.0:1.1:1.4:1.0, respectively; antennomere 5 laterally with several short sensory bacilli. Collum in width equal to head. Body parallel-sided on segments 6-17. Both 2nd and 3rd rows of metatergal polygonal sculpture developed more strongly than 1st row. Metatergal setae blunt apically. Caudolateral corners of paraterga beak-shaped pointed on segments 6(7)-18. Tail rounded at tip, sparsely setose.

Legs moderately long and slender; tibia and tarsus with small sphaerotrichs on ventral surface. Leg pair 1 somewhat reduced.

Using traditional terminology, gonopods (Figs 555-557) are as follows. Setation of prefemoral portion usual. Femoral outer horn bacilliform. Clivus low. Seminal groove ending up at bottom of a broad femoral cavity. Postfemoral process strong, pointed or blunt apically, with a high to very low, rough knob basally. Telopodites falcate, with two branches apically, of which one longer than the other.

Using modern terminology (Golovatch, 1991; Djursvoll et al., 2001), gonopods with a bacilliform exomerite (= outer horn) and two distofemoral processes. Cephalic distofemoral process longest, falcate, with two unequal branches apically. Caudal distofemoral process strong, pointed or blunt apically, with a high to very low, rough knob basally.

Female. Adult 16-17 mm long, 2.0-2.5 mm wide. Epigynal ridge behind coxae 2 transverse, low, rounded. Leg pair 1 somewhat reduced.

DISTRIBUTION (Map 28): Russia: Far East (Kuriles: Kunashir Island).

REMARKS: The species lives in the litter of mixed and broadleaved forests; it has also been collected in sand under debris on seashores, under stones near water on lake banks.

Genus *Polydesmus* Latreille, 1802-03

DISTRIBUTION: Europe, Mediterranean west of the Central Caucasus, Japan. Over 200 species or subspecies. Only one synanthropic species *Polydesmus denticulatus* has been recorded in the Asian part of Russia, more precisely in Siberia.

This genus is distinguished by the presence of a loop of the seminal groove terminating into a well-developed accessory seminal chamber provided with a hairy pulvillus at the orifice, by the presence of a well-developed and mostly elaborate exomerite (= endomerite) in terms of Golovatch (1991) and Djursvoll et al. (2001) as well as by the vulvae supplied with spiral structures at the bottom of the bursa’s gutter/fissure.

Polydesmus denticulatus C.L. Koch, 1847

Figs 558-559, Map 14.

Polydesmus denticulatus – Mikhaljova & Nefediev, 2003: 83.

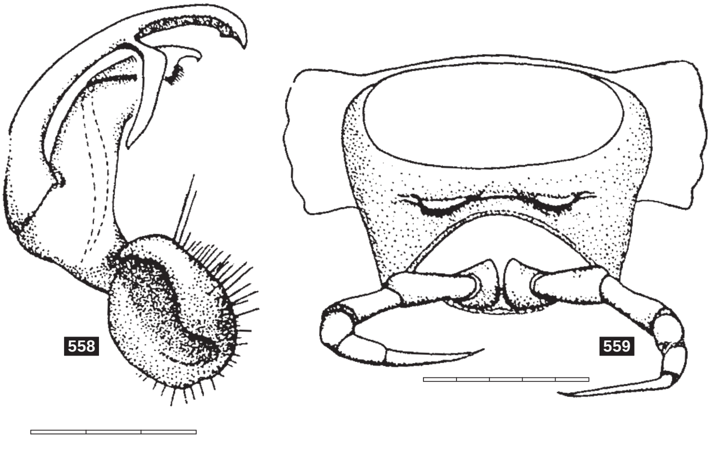
DIAGNOSIS: This species differs from congeners mainly by the presence of a lateral process on the gonopod secondary branch (= exomerite in terms of Djursvoll et al., 2001).

DESCRIPTION: Adults 10-17 mm long, 1.5-2.5 mm wide. Coloration from light to dark brown. First row of metatergal polygonal sculpture poorly-developed, 2nd and 3rd ones more distinct. Paraterga broad, distinctly serrate laterally. Caudolateral corners of paraterga beak-shaped pointed on segments 6-7. Metatergal setae slightly expanded distally, almost clavate.

Gonopods as in Fig. 558, with a usual seminal groove making a loop distally and terminating into an accessory seminal chamber provided with a hairy pulvillus at orifice. Secondary branch (= exomerite in terms of Djursvoll et al., 2001) with a long lateral process.

Female with an epigynal ridge like two plates behind leg pair 2 (Fig. 559).

DISTRIBUTION (Map 14): Europe, introduced both to Southwest Siberia and Newfoundland, Canada. In Siberia, this species has only been reported very recently (Mikhaljova & Nefediev, 2003), taken in a *Betula* stand near the Siberian Botanical Garden, the city of Tomsk. This species seems to have been introduced together with plant material or soil.



Figs 558-559. *Polydesmus denticulatus* C. L. Koch, 1847: 558 – gonopod (lateral view); 559 – female body segment 3 (ventral view). – Scales without designations (after Blower, 1985).

Genus *Uniramidesmus* Golovatch, 1979

DISTRIBUTION: Russia: Siberia (Cisbaikalia) and the Far East. Nine species.

The main distinguishing characters are as follows. Body small (usually ca. 1 cm long); head covered with dense minute hairs; antennomeres 5-7 each with a small field of tiny bacilli dorsally; metaterga rather convex; paraterga small or medium-sized and set below dorsum, with marginal incisions; metatergal polygonal sculpture ranging from well-developed to poorly-developed; metatergal setae pointed; sphaerotrichs present or absent; gonopods slender, strongly falcate to coiled caudally, relatively simple, in situ crossing each other; seminal groove with a loop parabasally; accessory seminal chamber absent; opening of seminal groove subterminally to terminally on a bare to more or less pubescent pulvillus; spiral structures at bottom of ventral fissure of vulva absent.

Key to species of *Uniramidesmus*:

1(8) Gonopod telopodite with more or less long process(es). 2

2(3) Subapically gonopod telopodite with a horn-shape process (Fig.564). .... *U. cornutus*

3(2) Gonopod telopodite different subapically. 4

4(5) Gonopod femorite with a very low posterior projection (Fig. 566). .... *U. lingulatus*

5(4) Gonopod femorite with a high, distinct, posterior process. 6

6(7) Telopodite of gonopods with one long process in middle portion. Gonopod femorite with a large lobe-shaped process (Fig. 569). ....*U. perplexus*

7(6) Telopodite of gonopods with two long processes in middle portion. Gonopod femorite with a dentiform process (Fig. 573). .... *U. dentatus*

8(1) Gonopod telopodite without more or less long process(es). 9

9(10) A deep sulcus present between gonopod femorite and postfemoral portion (Figs 576, 578). .... *U. constrictus*

10(9) No deep sulcus between gonopod femorite and postfemoral portion. 11

11(12) Femorite of gonopods without posterior projections. Gonopod telopodite ring-shaped (Fig. 581). ....*U. aberrans*

12(11) Femorite of gonopods with a posterior process or projection. Gonopods falcate. 13

13(14) Posterior projection of gonopod femorite very low, subtriangular (Fig. 586). .... *U. septimus*

14(13) Posterior projection of gonopod femorite different. 15

15(16) Posterior process of gonopod femorite rounded. Telopodite with a tiny denticle subapically. (Fig. 592). .... *U. alveolatus*

16(15) Posterior process of gonopod femorite cariniform. Telopodite with a small tooth ventrally and a denticle proximally of orifice of seminal groove (Figs 595-596). .... *U. detersus*

Uniramidesmus cornutus Mikhaljova, 1984

Figs 560-564, Map 29.

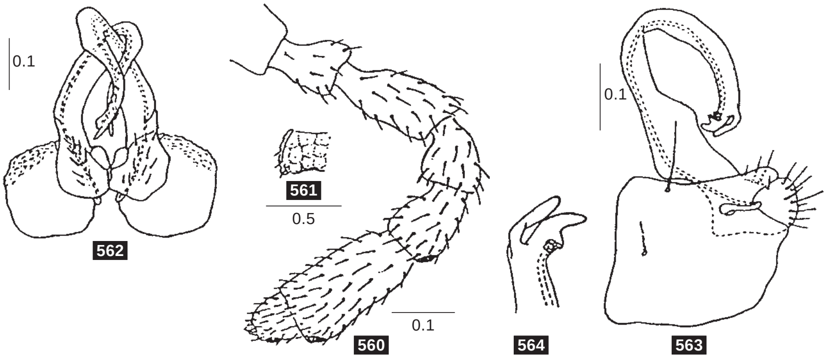
Uniramidesmus cornutus Mikhaljova, 1984a: 455, 456: figs.

Uniramidesmus cornutus - Mikhaljova & Bakurov, 1989: 40; Mikhaljova, 1993: 32; 1998b: 50: figs, 48: map; Ganin, 1997: 124.

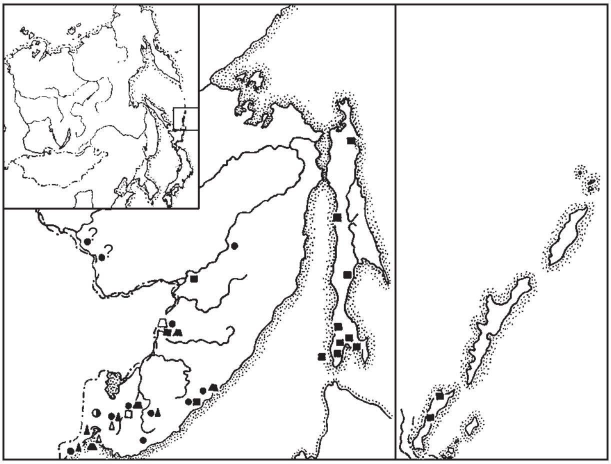
DIAGNOSIS: The species differs from congeners by the gonopod telopodite with only a ventro-apical unciform process.

DESCRIPTION: Male. Length 8-10 mm, width 0.8-0.9 mm. Coloration brown-pink, in alcohol darker.

Epicranial setae absent. Antennae short, clavate, in situ reaching the end of segment 2 (Fig. 560). Distal part of antennomeres 5-7 dorsally with groups of short baton-shaped sensilla. Length ratios of antennomeres 2-7 as 1.5:2.3:1.5:1.7:2.7:1, width ratios as 1.1:1.1:1.1:1.6:1, respectively. Collum ovoid, narrower than head with genae. Metazonites 3 and 4 somewhat shorter than subsequent ones. Lateral bosses of 3rd row of metatergal polygonal sculpture inconspicuous. Metatergal polygonal sculpture of segments 1-4 and 17-19 strongly developed. Paraterga narrow, arcuate laterally, caudolateral corners blunt (Fig. 561). Body not moniliform. Body rings finely alveolate; metatergal bosses smooth.



Figs 560-564. *Uniramidesmus cornutus* Mikhaljova, 1984: 560 – antenna; 561 – male body segment 11 (dorsal view); 562 – gonopods (caudal view); 563 – gonopod (mesal view); 564 – distal part of gonopod telopodite. – Scales in mm (after Mikhaljova, 1984a).



Map 29. Distribution of *Uniramidesmus dentatus* (●), *U. alveolatus* (▲), *U. detersus* (△), *U cornutus* (□), *U. septimus* (■), *U. aberrans* (▲), *U. lingulatus* (◑) and *U. constrictus* (⏢).

Legs relatively long, similar to female ones. Each coxa 2 with a projection terminating a vas deferens.

Gonopods (Figs 562-564) strongly falcate. Coxae medium-sized, retractible inside segment 7, each with two setae ventrally. Femorite with a posterior tuberculiform projection. Telopodite = solenomere apically with a ventral unciform outgrowth; orifice of seminal groove subterminal, lying on a small micropilose pulvillus. Angle between basal and apical parts of telopodite obtuse.

Female. Length 8.5-10 mm, width 0.8-0.9 mm. Epigynal ridge behind coxae 2 bisinuate. Angle between mesal and ventral margin of coxa 2 obtuse. Vulvae sphaeroid, densely setose.

DISTRIBUTION (Map 29): Russia: Far East (Primorsky Province).

REMARKS: This species dominates the uppermost soil of forest consisting of *Pinus koraiensis* and leafy trees (Mikhaljova & Bakurov, 1989). In addition, juveniles prevail in populations and prefer to live in the soil while the adults in litter. The maximum locomotor activity is observed in the second half of May and the first half of June. The numbers range from 1.0 to 16.0 ind./m² (Mikhaljova & Bakurov, 1989).

Uniramidesmus lingulatus Mikhaljova, 2004

Figs 565-566, Map 29.

Uniramidesmus lingulatus Mikhaljova in: Mikhaljova & Marusik, 2004: 6, 7: figs.

DIAGNOSIS: This species differs from congeners by the gonopod telopodite bearing a long process sublaterally and one tiny denticle ventrally as well as by a very low projection on the gonopod femorite.

DESCRIPTION: Male. Body ca. 9.0 mm long, 1.0 mm wide. Coloration dark pink. Antennae relatively short, clavate. Distodorsal parts of antennomeres 5-7 each with a group of short baton-shaped sensilla. Length ratios of antennomeres 2-7 as 1.3:2.3:1.7:1.7:2.7:1, width ratios as 1.25:1.3:1.3:1.4:1.8:1, respectively. Collum oval, narrower than head with genae. Metazonites 3 and 4 somewhat shorter than others. Lateral knob of 3rd row of metatergal polygonal sculpture inconspicuous. Metatergal setae pointed. Paraterga narrow, weakly rounded laterally, caudolateral corners blunt. Paraterga of segments 2-4 broader. Somital microsculpture microreticulate throughout.

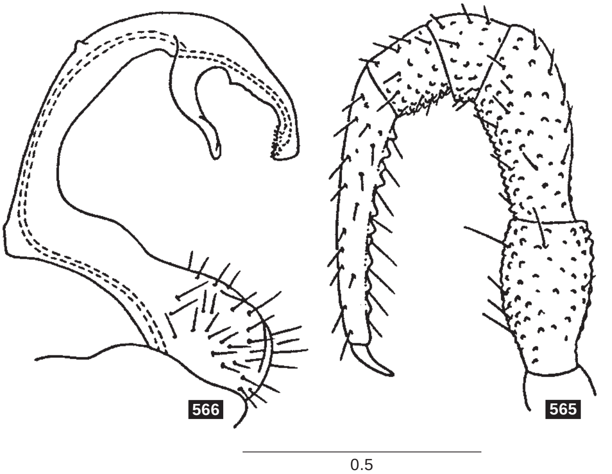
Legs somewhat incrassate compared to female ones. Tarsus with sphaerotrichs ventrally; preceding segments except coxa covered with tiny papillae; claws normal (Fig. 565). Each coxa 2 with a sparsely setose projection of vas deferens.

Gonopod opening subcordate. Gonopods (Fig. 566) falcate. Coxae large, nearly completely retractile inside segment 7, each with two setae ventrally. Femorite with a very low, posterior, subtriangular projection. Entire telopodite = solenomere with a long tongue-shaped process sublaterally and one tiny denticle ventrally; subterminal orifice of seminal groove opening on a very low, micropilose pulvillus.

Female. Length ca. 9.0 mm, width 0.8-0.9 mm. Epigynal ridge behind coxae 2 absent.

DISTRIBUTION (Map 29): Russia: Far East (Primorsky Province).

REMARKS: This species has been collected on the bank of a stream in a dry habitat within a forested steppe area.



Figs 565-566. *Uniramidesmus lingulatus* Mikhaljova, 2004: 565 – male midbody leg; 566 – gonopod (lateral view). – Scale in mm (after Mikhaljova & Marusik, 2004).

Uniramidesmus perplexus Mikhaljova, 1984

Figs 567-570, Map 30.

Uniramidesmus perplexus Mikhaljova 1984a, 456: figs.

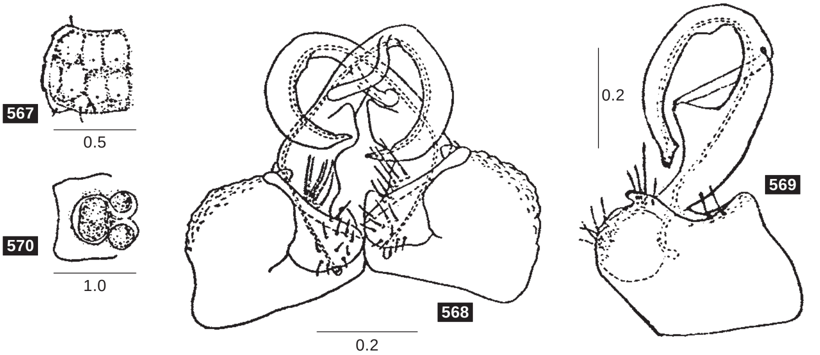
Uniramidesmus perplexus - Mikhaljova, 1993: 33; Mikhaljova & Golovatch, 2001: 116; Mikhaljova & Marusik, 2004: 8.

DIAGNOSIS: The species differs from congeners by the gonopod telopodite bearing a long process and a small lateral projection in the middle part as well as by the gonopod femorite with a large lobe-shaped outgrowth.

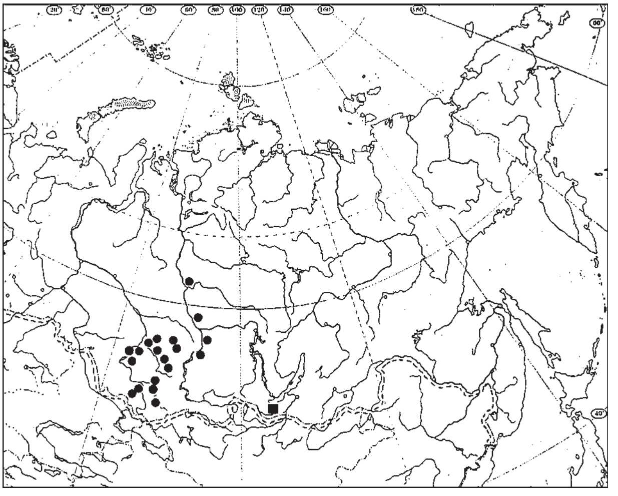
DESCRIPTION: Male. Length 10-13 mm, width 1.0-1.3 mm. Coloration pinkish or yellowish. Metazonites with or without narrow brown strip along posterior margin.

Epicranial setae absent. Antennae short, in situ reaching the middle of segment 2. Distodorsal parts of antennomeres 5-7 each with a group of short baton-shaped sensilla. Length ratios of antennomeres 2-7 as 1.5:1.3:2.8:1.9:2.1:3.0:1, width ratios as 1.6:1.4:1.2:1.3:1.3:1.6:1, respectively. Collum oval, narrower than head with genae. Metazonites 3 and 4 somewhat shorter than subsequent ones. 3^{rd} row of metatergal polygonal sculpture narrowest (Fig. 567). Lateral boss of 3rd row inconspicuous. Polygonal sculpture developed more strongly in anterior and posterior portions of body. Paraterga very narrow, rounded laterally, caudolateral corners blunt. Body moniliform. Body rings finely alveolate; metatergal bosses smooth.

Legs somewhat incrassate compared to female. Last leg pair somewhat reduced. Each coxa 2 with a projection of a vas deferens, sparsely setose.



Figs 567-570. *Uniramidesmus perplexus* Mikhaljova, 1984: 567 – male body segment 14 (dorsal view); 568 – gonopods (caudal view); 569 – gonopod (lateral view); 570 – gonopod aperture. – Scales in mm (after Mikhaljova, 1984a).



Map 30. Distribution of *Schizoturanius clavatipes* (●) and *Uniramidesmus perplexus* (■).

Gonopods (Figs 568, 569) falcate. Coxae medium-sized, nearly completely retracted inside segment 7, each with two setae ventrally. Gonopod aperture subcordate (Fig. 570). Telopodite = solenomere with a long sabre-shaped process and a small lateral projection; seminal groove ending terminally on a very low and bare pulvillus. Femorite with a posterior, large, lobe-shaped outgrowth. Angle between basal and apical parts of telopodite obtuse.

Female. Length 10.5-13 mm, width 1.1-1.3 mm. Epigynal ridge behind coxae 2 very low and rounded. Angle between mesal and ventral margins of coxae 2 obtuse Vulvae rounded, short.

Juvenile. Body colourless. Polygonal sculpture developed more strongly than in adults.

DISTRIBUTION (Map 30): Russia: Siberia (Irkutsk Area).

Uniramidesmus dentatus Mikhaljova, 1979

Figs 571-574, Map 29.

Uniramidesmus dentatus Mikhaljova in: Golovatch & Mikhaljova, 1979: 833, 834: figs.

Uniramidesmus dentatus - Lokšina & Golovatch, 1979: 384; Kurcheva & Mikhaljova, 1980: 121; Mikhaljova, 1981c: 87; 1983b: 85; 1988b: 70; 1993: 32; 1998b: 47, 48: figs and map; Mikhaljova & Petukhova, 1983: 53; Mikhaljova & Bakurov, 1989: 40; Ganin, 1997: 114, 121, 124, 126, 128, 140.

? *Uniramidesmus dentatus* - Ganin, 1997: 12, 13, 23, 109, 112, 128.

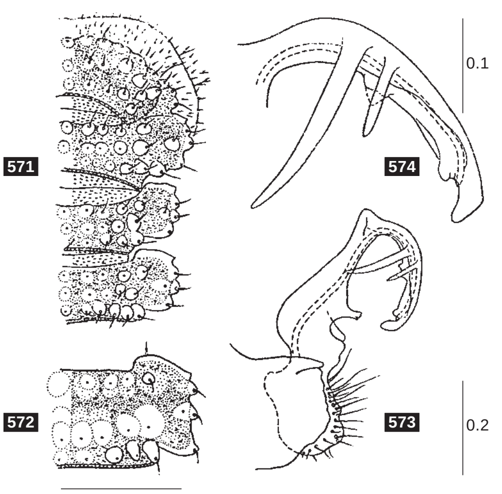
DIAGNOSIS: The species differs from congeners by two lateral long branches and an inner dentiform process on each gonopod.

Description: Male. Length 8-9 mm, width 1.1-1.3 mm. Coloration pinkish. Antennae short, clavate. Distodorsal parts of antennomeres 5-7 each with a group of short baton-shaped sensilla. Length ratios of antennomeres 2-7 as 1.5:2.2:1.5:1.5:2.6:1, length and width ratios as 1.1:1.1:1.1:1.2:1.5:1, respectively. Collum semi-circular, somewhat narrower than head with genae. Segment 2 subequal to segment 3 in width but longer (Fig. 571). Body growing in width toward segment 5 or 6, onward parallel-sided until segment 17, further on tapering caudally. 3rd row of metatergal polygonal sculpture developed more strongly than both preceding ones, with a lateral knob of 3rd row well-developed. Metatergal setae longer on segments 1-5 and 17-19, all pointed. Paraterga broad, straight laterally, caudolateral corners pointed (Fig. 572). Body rings strongly alveolate; metatergal bosses smooth. Tail long, cylindrical, blunt at tip.

Legs somewhat incrassate compared to female. Each coxa 2 with a small projection terminating a vas deferens.

Gonopods (Figs 573-574) strongly falcate. Femorite with a posterior process; entire telopodite = solenomere with two lateral long branches and an inner dentiform process, as well as with a subterminal orifice of seminal groove opening on a small, bare pulvillus.

Female. Length 8.5-9 mm, width 1.2-1.3 mm. Angle between mesal and ventral margin of coxa 2 acute. Epigynal ridge behind coxa 2 low, setose apically. Vulvae rounded, operculum with four long setae. Inner valve somewhat lower than lateral and posterior parts. Slope of inner valve covered with short setae,



Figs 571-574. *Uniramidesmus dentatus* Mikhaljova, 1979: 571 – fore part of male body (dorsal view); 572 – male body segment 11 (dorsal view); 573 – gonopod (lateral view); 574 – distal part of gonopod telopodite. – Scales in mm (after Golovatch & Mikhaljova, 1979).

excluding front part with long setae. Lateral valve with long setae medially, with shorter ones frontally and caudally. Marginal setae of both lateral and inner valves longest ventrally. Caudal portion of vulva with short setae.

DISTRIBUTION (Map 29): Russia: Far East (Primorsky and Khabarovsk provinces, ?Amurskaya Area). The records of this species in the Amurskaya Area (Ganin, 1997) require confirmation, because the material taken from there contained juvenile material only. However, the presence of this species in that Area is quite plausible.

REMARKS: The species is relatively common in montane and valley forests. Yet the numbers are modest, averaging between 0.5 and 11.0 ind./m² (Kurcheva & Mikhaljova, 1980; Mikhaljova & Bakurov, 1989; Mikhaljova, 1981c, 1988b; Ganin, 1997). Mainly juvenile instars have been observed in the uppermost soil, sometimes even as dominants (Mikhaljova & Bakurov, 1989), but such a habitat is not typical of this basically litter-dwelling species (Mikhaljova, 1983b). The maximum locomotor activity of *U. dentatus* in the Primorsky Province has been observed in the second half of May and in the first half of June (Mikhaljova & Bakurov, 1989).

Uniramidesmus constrictus **Mikhaljova, 1998**

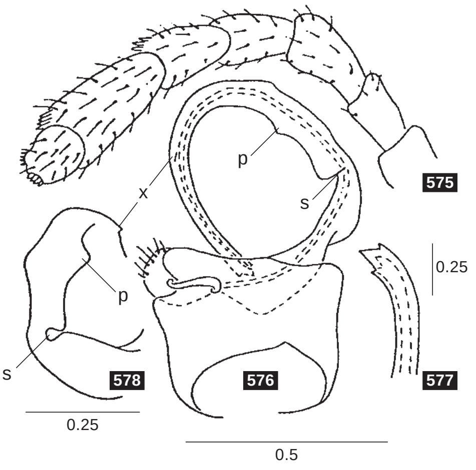
Figs 575-578, Map 29.

Uniramidesmus constrictus Mikhaljova, 1998a: 2, 3: figs.
Uniramidesmus constrictus - Mikhaljova, 1998b: 51, 52: figs, 48: map.

DIAGNOSIS: The circular, ring-shaped, coiled gonopod telopodite with a deep sulcus between the femorite and postfemur will serve to separate this species from congeners.

DESCRIPTION: Male. Length 7-8 mm, width 0.5-0.6 mm. Body coloration beige, antennae and legs also beige.

Antennae short, clavate. Distal parts of each of antennomeres 5 and 6 with a group of small bacilli dorsally; distal part of antennomere 7 with a very small knob bearing several bacilli dorsally (Fig. 575). Length ratios of antennomeres 2-7 as 1.2:1.8:1.5:1.4:2.1:1, width ratios as 1.1:1.1:1.1:1.3:1.5:1, respectively. Body substrongylosomoid. Collum ovoid, somewhat narrower than head. Segment 2 somewhat narrower than head but nearly equal in length to segment 3. Body growing in width toward segment 5 or 6, onward parallel-sided until segment 18, further on tapering caudally. All rows of metatergal polygonal sculpture equally well-developed. Lateral boss of caudal row indistinguishable. Metatergal polygonal sculpture best developed on segments 1-4 and 17-19, being strongly obliterat-



Figs 575-578. *Uniramidesmus constrictus* Mikhaljova, 1998: 575 – antenna; 576 – gonopod (mesal view); 577 – distal part of gonopod telopodite; 578 – medial part of gonopod telopodite; p – prominence of postfemoral part; s – sulcus; x – external outgrowth of telopodite. – Scales in mm (after Mikhaljova, 1998a).

ed in between. Metatergal setae short, thin, pointed apically, a little longer on segments 1-4 and 17-19, strongly obliterated on 5-16 segments. Paraterga very small, poorly rounded laterally except for paraterga 2-4 with arcuated lateral edges. Caudolateral corners of paraterga obtuse. Legs and body rings finely alveolate; metatergal bosses smooth. Tail long, cylindrical, blunt apically. Anal valves with a gutter and sparse setae along mesal margin. Subanal scale with two setae along caudal margin.

Legs relatively long, claws normal. Legs 1-2 somewhat reduced as compared to subsequent pairs. Each coxa 2 with a ventral projection terminating a vas deferens.

Gonopods (Figs 576-578) ring-shaped, coiled caudad. Coxite with two strong setae ventrally. Subterminal orifice of seminal groove opening on a very small and bare pulvillus (Fig. 577). Distal part of telopodite with a small external outgrowth (x). Femorite set off from postfemoral portion by a deep sulcus (s). Postfemoral part with a low protuberance (p). Angle between basal and apical parts of telopodite obtuse.

Female. Length 7-8 mm, width 0.5-0.6 mm. Sternite 3 with a very low eminence but without epigynal ridge.

DISTRIBUTION (Map 29): Russia: Far East (Khabarovsk Province).

Uniramidesmus aberrans **Mikhaljova, 1979**

Figs 579-584, Map 29.

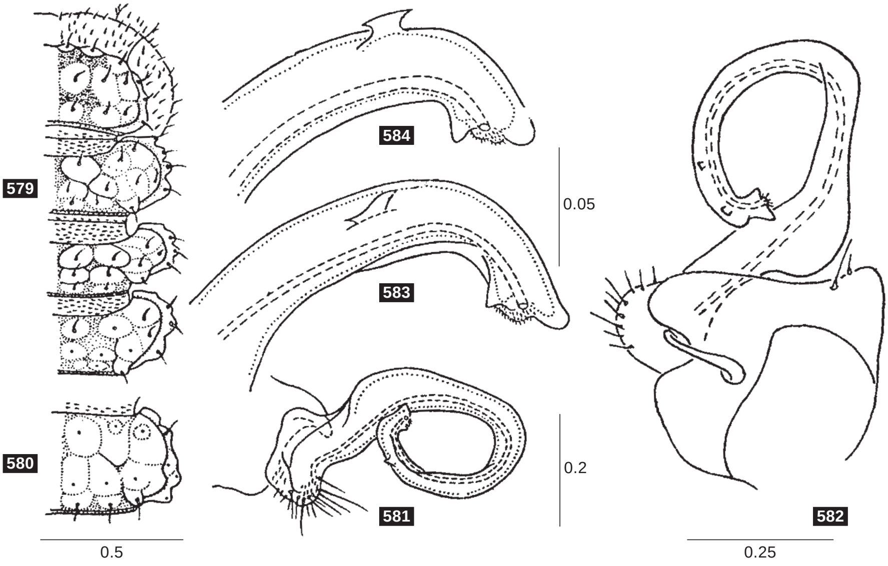
Uniramidesmus aberrans Mikhaljova in: Golovatch & Mikhaljova, 1979: 835, 834: figs.

Uniramidesmus aberrans - Lokšina & Golovatch, 1979: 384; Mikhaljova & Petukhova, 1983: 53; Mikhaljova & Bakurov, 1989: 40; Mikhaljova, 1993: 32; 1998a: 4, 3: fig; 1998b: 51-52: figs, 48: map.

DIAGNOSIS: The species differs from congeners by the ring-shaped gonopod telopodite devoid of a femoral process.

DESCRIPTION: Male. Length 7-9 mm, width 1.0-1.1 mm. Coloration dark pink.

Antennae short, clavate. Distodorsal parts of antennomeres 5-7 each with a group of short baton-shaped sensilla. Length ratios of antennomeres 2-7 as 1.8:2.5:1.8:1.9:3.0:1; length to width ratios of antennomeres 2-7 as 1.2:1.2:1.2:1.3:1.6:1, respectively. Collum ovoid, somewhat narrower than head with genae. Segment 2 equal to head in width (Fig. 579). Body growing in width toward segment 5, onward parallel-sided until segment 17, further on tapering caudally. Metatergal setae both of segments 1-5 and 17-19 somewhat longer than



Figs 579-584. *Uniramidesmus aberrans* Mikhaljova, 1979: 579 – fore part of male body (dorsal view); 580 – male body segment 11; 581 – gonopod (lateral view); 582 – gonopod (mesal view); 583-584 – distal parts of gonopod telopodite. – Scales in mm (579-581, 583-584 – after Golovatch & Mikhaljova, 1979; 582 – after Mikhaljova, 1998a).

on other segments. Lateral knob of 3rd row of metatergal polygonal sculpture inconspicuous. Paraterga small, rounded laterally, caudolateral corners blunt (Fig. 580). Body moniliform. Body rings very finely alveolate, metaterga virtually smooth. Tail long, cylindrical, with a blunt tip.

Legs somewhat incrassate as compared to female. Each coxa 2 with a ventral projection terminating a vas deferens.

Gonopods (Figs 581-584) ring-shaped, coiled caudally. Femorite without projection. Telopodite = solenomere very simple, only subterminally with 1-2 tiny, blade-like outgrowths, with (Fig. 582) or without (Figs 583-584) very broad sulcus; seminal groove terminating on a micropilose pulvillus.

Female. Epigynal ridge behind coxae 2 small, with two paramedian setae apically. Mesal and ventral margins of coxa 2 subrectangular. Vulva rounded with very long setae on operculum and in medial hollow on inner valve. External valve with relatively short setae on its slope but with long ones in front part and along medial margin. Hind part of external valve bare. Inner valve covered with long setae growing longer both along margin of medial hollow and at its caudal margin. Inner valve with two very long setae medially.

DISTRIBUTION (Map 29): Russia: Far East (Primorsky and Khabarovsk provinces).

REMARKS: The species contains a distinct geographical male morph. In males from the Khabarovsk Province, the gonopod solenomere is with a very broad sulcus and two small, blade-like, ventral outgrowths subapically (Fig. 582). In the typical *U. aberrans* from the Primorsky Province, the gonopod solenomere (Figs 583-584) is devoid of such a sulcus but with one blade-like outgrowth (Mikhaljova, 1998a).

In the Primorsky Province, this species is not abundant; its numbers range from 1.0 to 4.0 ind./m² (Mikhaljova, 1988b). The maximum locomotor activity in the Anuchino District has been observed in the second half of May and in the first half of June (Mikhaljova &Bakurov, 1989).

Uniramidesmus septimus Mikhaljova, 1990

Figs 585-587, Map 29.

Uniramidesmus septimus Mikhaljova, 1990: 136, 137: figs.

Uniramidesmus septimus - Mikhaljova, 1993: 33; 1998b: 50: figs, 48: map; Mikhaljova & Basarukin, 1995: 94, 95: map; Ganin, 1997: 105.

DIAGNOSIS: The species differs from congeners by the gonopod telopodite with 1-2 small blade-like processes and a very low subtriangular projection on the gonopod femorite.

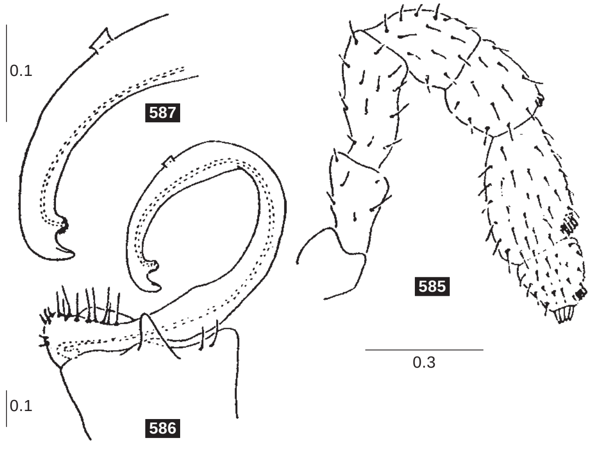
DESCRIPTION: Male. Length 9-10 mm, width 0.9-1.0 mm. Colour pinkish, brighter in anterior body part.

Epicranial setae absent. Antennae clavate, in situ reaching the beginning of segment 2 (Fig. 585). Distal part of antennomeres 5-7 dorsally with a group of short baton-shaped sensilla. Length ratios of antennomeres 2-7 as 1.4:2.15:1.5:1.5:2.4:1, width ratios as 0.95:1.0:1.2:1.2:1.5:1, respectively. Collum semi-circular, somewhat narrower than head with genae. Segment 2 somewhat narrower than head with genae, but somewhat longer than segment 3. Metazonites 2-4 somewhat shorter than subsequent ones. Body growing in width toward segment 4 or 5, onward parallel-sided until segment 17-18, further on tapering caudally. 3rd row of metatergal polygonal sculpture much narrower than both preceding ones. Lateral bosses of 3rd row rather conspicuous. Paraterga narrow, arcuated laterally, caudolateral corners blunt. Body not moniliform. Body rings finely alveolate; metatergal bosses smooth.

Legs slender, but somewhat enlarged compared to female.

Gonopods (Figs 586-587) strongly falcate. Coxite medium-sized, with two setae ventrally. Femorite with a very low, posterior, subtriangular projection. Telopodite = solenomere with 1-2 small blade-like outgrowths ventrally; orifice of seminal groove subterminal, lying on a high micropilose pulvillus. Tip of telopodite unciform.

Female. Length 8.5-9.5 mm, width 0.8-0.95 mm. Epigynal ridge behind coxae 2 like two low transverse-oval crests, front one single-humped, serving as an anterior edge of sternite, while caudal one bisinuate. Leg pair 1 somewhat reduced. Vulvae oval.



Figs 585-587. *Uniramidesmus septimus* Mikhaljova, 1990: 585 – antenna; 586 – gonopod (lateral view); 587 – distal part of gonopod telopodite. – Scales in mm (after Mikhaljova, 1990).

DISTRIBUTION (Map 29): Russia: Far East (Sakhalin Island, Kuriles: Kunashir Island, Khabarovsk Province).

REMARKS: This species inhabits the litter of coniferous, mixed and leaved forests, being relatively common. The numbers reach up to 28.0 ind./m² in the Bolshekhekhtsirsky Nature Reserve, Khabarovsk Province (Ganin, 1997). An abundance level of 280 ind./m² as given by Mikhaljova (1998b) is a misprint.

Uniramidesmus alveolatus Mikhaljova, 1979

Figs 588-592, Map 29.

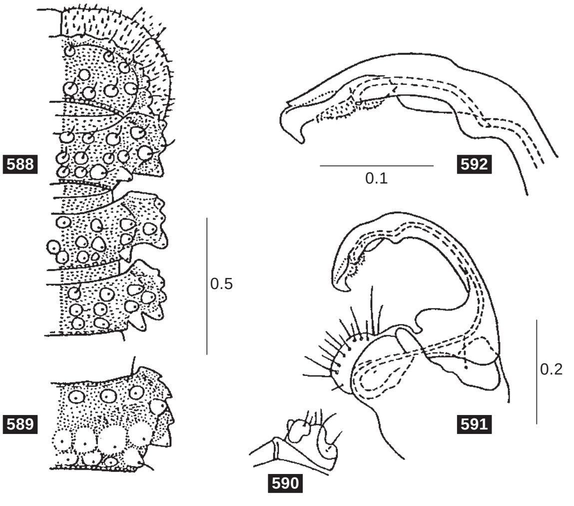
Uniramidesmus alveolatus Mikhaljova in: Golovatch & Mikhaljova, 1979: 832, 831: figs.

Uniramidesmus alveolatus - Lokšina & Golovatch, 1979: 384; Mikhaljova, 1983b: 85; 1988b: 70; 1993: 32; 1998b: 48: map, 49: figs; Mikhaljova & Petukhova, 1983: 53; Ganin, 1997: 121.

DIAGNOSIS: The species differs from congeners by the gonopod telopodite without process but with a tiny denticle subapically as well as by the gonopod femorite with a rounded outgrowth.

DESCRIPTION: Male. Length 8-9 mm, width 0.8-1.0 mm. Coloration dark pink.

Antennae short, clavate. Distodorsal parts of antennomeres 5-7 each with a group of short baton-shaped sensilla. Length ratios of antennomeres 2-7 as 1.1:1.8:1.2:1.2:2.1:1; length to width ratios of antennomeres 2-7 as 1.1:1.1:1.1:1.3:1.7:1, respectively. Collum semi-circular, somewhat narrower



Figs 588-592. *Uniramidesmus alveolatus* Mikhaljova, 1979: 588 – fore part of male body (dorsal view); 589 – male body segment 11 (dorsal view); 590 – male coxa 2; 591 – gonopod (lateral view); 592 – distal part of gonopod telopodite. – Scales in mm (after Golovatch & Mikhaljova, 1979).

than head with genae. Segment 2 equal to head in width. Body growing in width toward segment 5 or 6, onward parallel-sided until segment 18, further on tapering caudally. Metatergal polygonal sculpture of segments 1-4 with high setigerous knobs; metatergal setae relatively long and pointed (Fig. 588). Starting from segment 5, knobs getting gradually reduced, turning into usual three rows of flat bosses, with rows 1 and 3 developed better (Fig. 589). Lateral boss of 3rd row well-developed. Paraterga small, mostly moderately rounded laterally, caudolateral corners pointed. Paraterga 2 and 3 straight laterally. Body rings strongly alveolate; metatergal bosses smooth. Tail long, cylindrical with a rounded tip.

Legs somewhat incrassate compared to female, increasingly slender toward telson. Each coxa 2 with a small projection terminating a vas deferens (Fig. 590).

Gonopods (Figs 591-592) strongly falcate. Femorite with a rounded posterior outgrowth. Telopodite = solenomere with a tiny denticle subapically and a posterior outgrowth/fold at ca. 3/4 extent of telopodite. A subterminal orifice of seminal groove opening on a small micropilose pulvillus. Tip of gonopod subunciform.

Female. Length 8.5-9 mm, width 0.9-1.0 mm. Epigynal ridge behind coxae 2 small, bare. Coxae 2 contiguous medially. Angle between mesal and ventral edges of coxa 2 obtuse, about 100º. Vulvae oval. Operculum with four long setae. Inner valve caudally somewhat lower than external one, both setose. Hind part of vulva bare.

DISTRIBUTION (Map 29): Russia: Far East (Primorsky Province).

REMARKS: This is a rare and never abundant species living in litter but sometimes penetrating the uppermost soil of coniferous-broadleaved forests (Mikhaljova, 1983b). Its average numbers range from 0.5 to 2.0 ind./m² (Mikhaljova & Petukhova, 1983).

Uniramidesmus detersus Golovatch, 1979

Figs 593-596, Map 29.

Uniramidesmus detersus Golovatch in: Golovatch & Mikhaljova, 1979: 830, 831: figs.

Uniramidesmus detersus - Lokšina & Golovatch, 1979: 384; Mikhaljova, 1983b: 85; 1988b: 70; 1993: 33; 1998b: 49: 48: map; Mikhaljova & Petukhova, 1983: 53; Ganin, 1997: 121; Shelley et al., 2000: 137.

DIAGNOSIS: The species differs from congeners by the gonopod femorite with a high cariniform outgrowth, the gonopod telopodite with a small dentiform process proximal of the orifice of the seminal groove and an outgrowth ventrally.

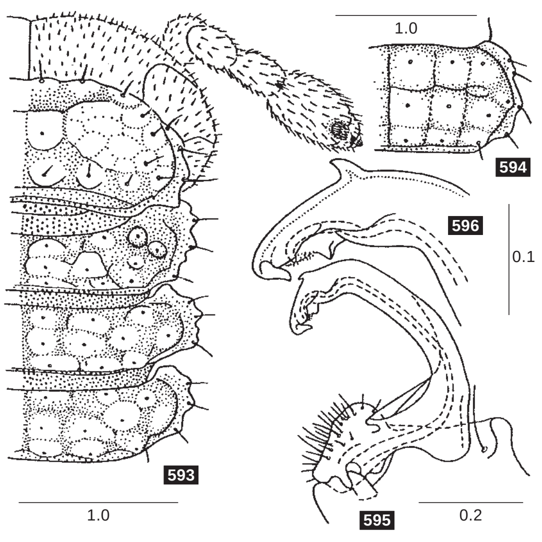
DESCRIPTION: Male. Length 9-11 mm, width 1.0-1.2 mm. Coloration pinkish, more intense in front body part.

Antennae short, clavate. Distodorsal parts of antennomeres 5-7 each with a group of short batons-shaped sensilla (Fig. 593). Length ratios of antennomeres 2-7 as 1.1:1.8:1.4:1.4:2.4:1; length to width ratios of antennomeres 2-7 as 1.2:1.2:1.2:1.4;1.8:1, respectively. Collum semi-circular, somewhat narrower than head with genae. Segment 2 equal to head in width, but somewhat longer than segment 3. Body growing in width toward segment 5 or 6, onward parallel-sided until segment 18, further on tapering caudally. Metatergal polygonal sculpture relatively strongly obliterated (Fig. 594), exclusive of segments 1-4 and 17-19 . Lateral boss of 3rd row inconspicuous. Paraterga very small, rounded laterally, caudolateral corners blunt, but collum with pointed caudolateral corners. Body moniliform. Body rings finely alveolate; metatergal bosses smooth. Tail long, cylindrical, blunt at tip.

Legs somewhat incrassate compared to female. Each coxa 2 with a projection terminating a vas deferens.

Gonopods (Figs 595-596) strongly falcate. Femorite with a high cariniform outgrowth. Telopodite = solenomere with a ventral process and a small dentiform process proximal of a subterminal orifice of seminal groove opening on a small micropilose pulvillus; tip of gonopod unciform.

Female. Length 9.5-11 mm, width 1.1-1.2 mm. Epigynal ridge behind coxae 2 small, bare; coxae contiguous medially. Angle between mesal and ventral margins of coxa 2 obtuse, about 130º. Vulvae oval. Operculum with four



Figs 593-596. *Uniramidesmus detersus* Golovatch, 1979: 593 – fore part of male body (dorsal view); 594 – male body segment 11 (dorsal view); 595 – gonopod (lateral view); 596 – distal part of gonopod telopodite. – Scales in mm (after Golovatch & Mikhaljova, 1979).

long setae. External valve with sparse long setae frontally and medially but with short setae near base and caudally. Inner valve with several long setae in front part of vulva, toward hind marginal setae shorter and sparser. Hind part of vulva bare. Marginal setae on both external and inner valves long and dense over 1/3 of vulva length.

DISTRIBUTION (Map 29): Russia: Far East (Primorsky Province).

REMARKS: This is a rare and never abundant litter-dwelling species of mixed and broadleaved forests, both mountainous and in valleys (Mikhaljova, 1983b), also collected in rotten wood. The numbers average 0.3 ind./m² (Mikhaljova, 1988b).

Genus *Schizoturanius* Verhoeff, 1931

DISTRIBUTION: Russia: Siberia; northeastern part of Kirghizia, eastern part of Kazakhstan. Six species. Only two species occur in Siberia.

In Siberia, species of this genus are mainly recognised by the following characters. Body small, strongylosomoid (= without prominent paraterga), moniliform; paraterga narrow; gonopods falcate and bifid distally; an accessory seminal chamber present; gonopod femorite carrying a process; vulvae devoid of spiral structures at bottom of bursa's gutter.

Key to species *Schizoturanius*:

1(2) Gonopod telopodite at midway with a process serrate distally (Figs 600-601). .... *S. clavatipes*

2(1) Gonopod telopodite at midway without process serrate distally (Figs 605-606). .... *S. tabescens*

Schizoturanius clavatipes (Stuxberg, 1876)

Figs 597-602, Map 30.

Polydesmus clavatipes Stuxberg, 1876a: 34, figs.

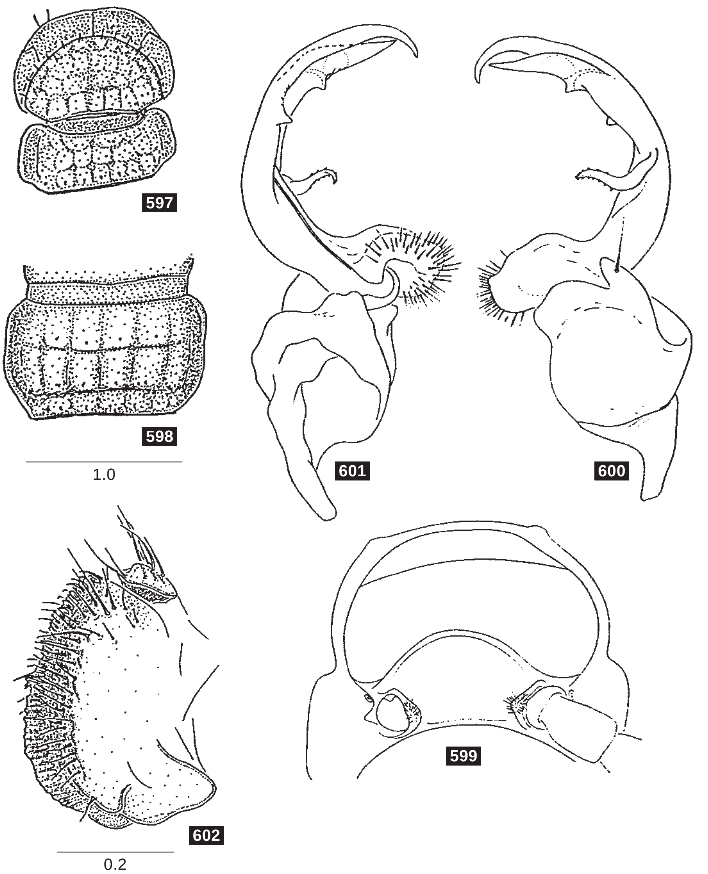
Polydesmus clavatipes - Stuxberg, 1876b: 316.

Schizoturanius clavatipes - Lohmander, 1933: 27; Hoffman, 1975: 81, 82: figs; Lokšina & Golovatch, 1979: 384; Mikhaljova, 1993: 31, 32: figs; 2002b: 206; Mikhaljova & Golovatch, 2001: 116; Nefediev, 2001: 84; 2002c: 139; 2002d: 30; Vorobiova et al., 2002: 62.

DIAGNOSIS: The species differs from congeners by the gonopod femorite with a process serrate distally.

DESCRIPTION: Male. Length 10-13 mm, width 1.2-1.3 mm. Coloration in alcohol pale pinkish beige, colour brighter in anterior and posterior body portions.

Antennae clavate, in situ reaching to somite 3. Length ratios of antennomeres 2-7 as 2.7:3.9:3.0:3.0:4.1:1, width ratios as 1:1.2:1.1:1.3:1.5:1, respectively. Collum ovoid, considerably narrower than head with genae (Fig. 597). Body growing considerably broader from segment 5 and, especially, 6, remaining parallel-sided until segment 17. Edges of narrow paraterga rounded. Metazonites 2-4 shorter than subsequent ones. Metazonital polygonal sculpture best developed on somites 1-5, less clear on somites 17-19, being strongly obliterated in between. Male macrosculpture less distinct than female one. 3rd row of bosses with indistinct lateral tubercles, but developed stronger than both preceding ones (Fig. 598). Somital microsculpture microreticulate throughout. Tail medium-sized, digitiform, rounded at tip.



Figs 597-602. *Schizoturanius clavatipes* (Stuxberg, 1876): 597 – fore part of male body (dorsal view); 598 – male body segment 10 (dorsal view); 599 – gonopod aperture; 600 – gonopod (lateral view); 601 – gonopod (mesal view); 602 – vulva. – Scales in mm, 599-601 without scale (599-601 – after Hoffman, 1975; 597-598, 602 – courtesy of S. I. Golovatch, unpublished).

Leg pair 1 somewhat enlaged. Legs grow increasingly slender toward telson, ventrally more densely setose.

Gonopod aperture (Fig. 599) enlarged, with a transverse internal shelf anteriorly and a broad median projection of sternum posteriorly. Subcoxal region of sternum produced at base of each leg into a long, setose, conical projection extending ventrad as far as lower surface of coxae. Gonopods (Figs 600-601) bifid distally, falcate, telopodites in situ crossing each other, pointed apically. Seminal groove usual, terminating on a small pad/pulvillus surmounting a tubercle. Femoral process normal, denticulate distally.

Female. Length 10.5-13.5 mm, width 1.3-1.4 mm. Epigynal edge behind leg pair 2 traceable. Sternite of somite 2 with a low subconical knob at midwidth. Vulva rounded (Fig. 602).

DISTRIBUTION (Map 30): Russia: Siberia (Kemerovo, Novosibirsk and Tomsk areas, Krasnoyarsk Province, Altai Province, Republic of Khakassia, eastern part of Altai Republic).

REMARKS: This species is relatively common in forest habitats. In the subzone of southern taiga between Ob and Tom rivers, the species can amount to 38% all millipede catches (Nefediev, 2002d), its abundance averaging about 20 ind./m2 in the Yenisey River basin (Vorobiova et al., 2002). In the Tomsk Area, it also populates meadows, where its numbers reach 32 ind./m^2 (Nefediev, 2002c).

Schizoturanius tabescens **(Stuxberg, 1876)**

Figs 603-607, Map 31.

Polydesmus tabescens Stuxberg, 1876a: 27, figs.

Polydesmus tabescens - Stuxberg, 1876b: 316; Lokšina & Golovatch, 1979: 385.

Turanodesmus salairicus Gulièka, 1963:523, 522: fig.

Schizoturanius salairicus - Lokšina & Golovatch, 1979: 384; Mikhaljova, 1993: 31; Mikhaljova & Golovatch, 2001: 116; Nefediev, 2001: 84; 2002a: 40; 2002b: 35; 2002c: 138; 2002d: 30; Mikhaljova & Nefediev, 2003: 83.

Schizoturanius tabescens - Mikhaljova, 1993: 31, 32: fig; Mikhaljova & Golovatch, 2001: 116; Vorobiova et al., 2002: 62; Rybalov, 2002; Mikhaljova & Marusik, 2004: 8, 7: figs.

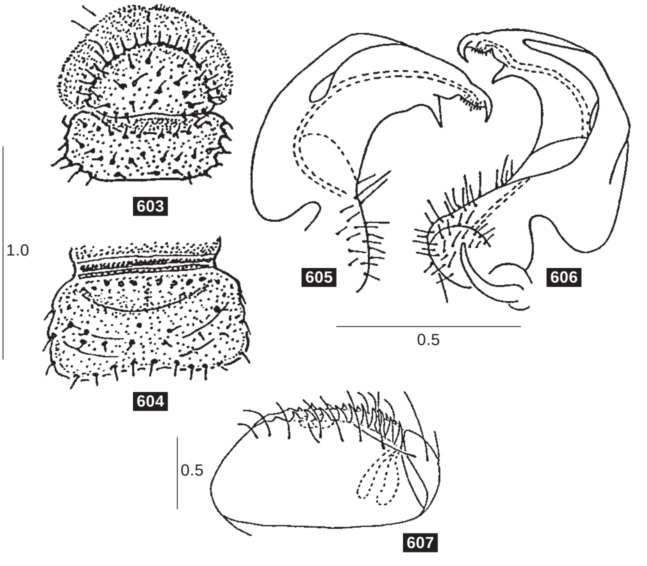
DIAGNOSIS: The species differs from congeners in configuration of the gonopods.

DESCRIPTION: Male. Length 7-9 mm, width 0.8-1.0 mm. Coloration in alcohol entirely from white to pinkish yellow.

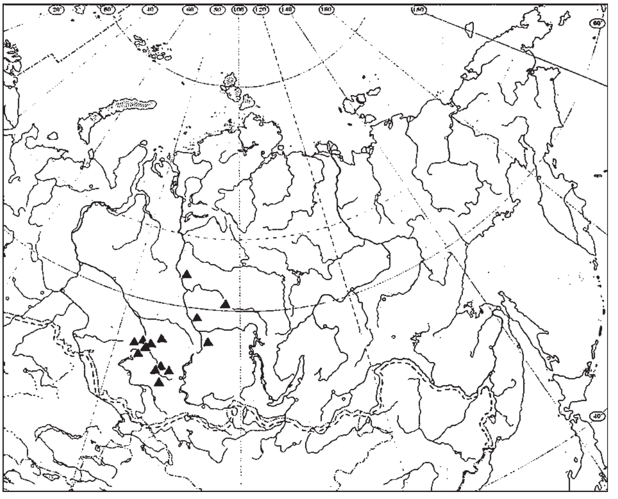
Head covered with dense and short setae. Antennae clavate, relatively slender. Distodorsal parts of antennomeres 5-7 each with a group of short baton-shaped sensilla. Collum ovoid, setose (Fig. 603). Body strongylosomoid, growing in width toward segment 5(6), onward parallel-sided until segment 16(17), further on tapering caudally. Head considerably broader than collum, subequal to somite 2. Metazonites 2-4 shorter than subsequent ones. Metatergal polygonal sculpture relatively poorly expressed (Fig. 604), bosses best developed in anterior and posterior parts of body. Lateral boss of caudal row indistinguishable. Paraterga narrow, set low (at about midheight of midbody segments), weakly rounded laterally, caudal corners obtuse. Metatergal setae blunt apically. Somital microsculpture microreticulate throughout, excluding metatergites. Telson densely covered with relatively long setae. Tail subconical. Subanal scale subtriangular with two subapical long setae each surmounting a knob.

Legs moderately long, incrassate dorsally; tarsus with sphaerotrichs on ventral surface; tibia with a few sphaerotrichs only. Claws normal, without additional claws. Legs growing increasingly slender toward telson. Legs 1 and 2 as usual somewhat reduced, legs 1 more strongly so.

Gonopods (Figs 605-606) falcate, curved caudad. Femorite with a front lobe-like projection. Telopodite bifid distally. A curved, relatively broad solenomere well-developed, with both a hook-shaped apex and a tooth in distal part. A subapical orifice of seminal groove opening on a setigerous pulvillus.



Figs 603-607. *Schizoturanius tabescens* (Stuxberg, 1876): 603 – fore part of male body (dorsal view); 604 – male body segment 10 (dorsal view); 605 – gonopod (lateral view); 606 – gonopod (mesal view); 607 – vulva (ventromesal view). – Scales in mm (603-604 – courtesy of S. I. Golovatch, unpublished; 605-607 – after Mikhaljova & Marusik, 2004).



Map 31. Distribution of *Schizoturanius tabescens* (▲).

Female. Length 7-7.5 mm, width 0.9 mm. Legs slender throughout, without sphaerotrichs. Each claw of leg pairs 1 and 2 with an accessory slender claw ventrally. Epigynal ridge behind leg pair 2 very low, straight along ventral margin. Vulvae as in Fig. 607.

DISTRIBUTION (Map 31): Russia: Siberia (Krasnoyarsk and Altai provinces, Kemerovo, Tomsk and Novosibirsk areas, Khakassian Republic).

REMARKS: Considering the synonymy of *S. salairicus* recently advanced (Mikhaljova & Marusik, 2004), *S. tabescens* seems to show geographical parthenogenesis. Over the southern populations, males are quite common, whereas in the Evenkia and Yenisey River valley, among the rather numerous northernmost samples, only a single male has hitherto been encountered. The numbers of the species vary from 4 to 70 ind./m² in different years (Vorobiova et al., 2002).

Family Xystodesmidae Cook, 1895

This family is distributed in the Nearctic (about 40 genera), Southeast and East Asia (about 10 genera) and the Mediterranean (about 5 genera). Only one genus occurs in the Asian part of Russia.

The main distinguishing characters are as follows. Peritremata on paraterga present; metatergal polygonal sculpture from absent to inconspicuous; gonopod aperture transversely oval, without front shelf; coxites of gonopods subcylindrical, not fused medially; gonopods without conspicuous separate solenomere branch; gonopod telopodite often circular.

Genus *Levizonus* Attems, 1898

DISTRIBUTION: Russia: Far East (Primorsky Province); North Korea; Japan.

This genus contains 8 species. The Russian Far East supports 5 species.

The main distinguishing characters are as follows. Body stout; transverse metatergal sulcus absent; dorsal surface of metazona smooth (except in *L. variabilis*, whose metaterga carry transverse rows of low bosses); gonopods circular, arcuate to coiled ring-like; gonopod telopodite slender, uniramous, with a modified apex; seminal groove opening terminally on a tiny solenomere.

Key to species of *Levizonus*:

1(8) Metatergal surface smooth, without bosses. 2

2(3) Apex of gonopod telopodite like two plates placed perpendicular to each other; one of the plates serrate at outer margin, the other a rudimentary solenomere (Figs 610-611). .... *L. malewitschi*

3(2) Apex of gonopod telopodite different. 4

4(5) Solenomere with a large horn basally (Figs 614-615). .... *L. distinctus*

5(4) Solenomere without horn basally. 6

6(7) Interior edge of telopodite apex always smooth, with neither spines nor outgrowths. Solenomere straight (Fig. 619). .... *L. laqueatus*

7(6) Interior edge of telopodite apex smooth or with one to numerous small outgrowths. Solenomere curved (Fig. 632). .... *L. thaumasius*

8(1) Metatergal surface with bosses (Fig. 638). .... *L. variabilis*

Levizonus malewitschi Lokšina & Golovatch, 1977

Figs 608-611, Map 32.

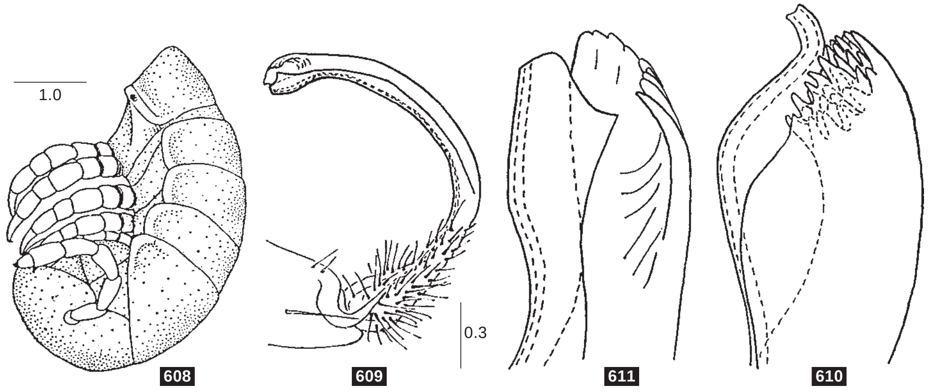
Levizonus malewitschi Lokšina & Golovatch, 1977: 73, 74-75: figs.

Levizonus malewitschi - Lokšina & Golovatch, 1979: 385; Kurcheva & Mikhaljova, 1980: 120; Mikhaljova, 1981a: 66: map; Mikhaljova, 1983b: 81; 1990: 136; 1993: 33; 1998b: 52, 53: figs, 54: map; Mikhaljova & Petukhova, 1983: 53; Ganin, 1997: 124.

DIAGNOSIS: The species differs from congeners by the configuration of the gonopod telopodite apex like two plates placed perpendicular to each other, the external one being serrate at outer margin, the inner one with a seminal canal (= solenomere).

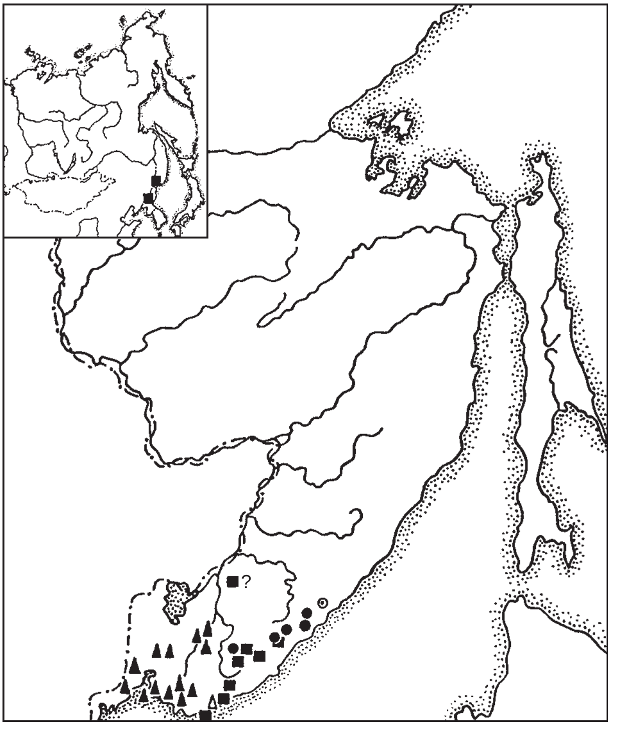
DESCRIPTION: Male. Adult 23-28 mm long, 3.6-4.0 mm wide. Coloration shining whitish.

Head setose frontally, more densely so at external margin, with 2+2 vertigial setae and a deep epicranial suture. Lateral excavation of head relatively deep for



Figs 608-611. *Levizonus malewitschi* Lokšina & Golovatch, 1977: 608 – fore part of male body; 609 – gonopod (mesal view); 610-611 – distal parts of gonopod telopodite. – Scales in mm (after Lokšina & Golovatch, 1977).

accomodation of antennae. Antennae slender, slightly clavate, in situ reaching the posterior edge of somite 2. Collum ovoid, considerably broader than head but somewhat narrower than somite 2 (Fig. 608). Metatergites without bosses. Peritremata relatively poorly-developed, rounded at front and caudal margins, non-angulate. Only posterior edge of metazonite 18 with a small dentiform



Map 32. Distribution of *Levizonus malewitschi* (●), *L. distinctus* (⊙), *L. laqueatus* (△), *L. thaumasius* (▲), *L. variabilis* (■).

outgrowth. Lateral keels thin on somites 1-4 but thicker on remaining somites but telson. Pleural keels small, present only on somites 2-3. Tail relatively long, cylindrical, bearing sparse but long setae. Anal valve with two setae. Subanal scale subtriangular, with two setae subapically.

Legs relatively long, stronger in front body portion. Claws long, somewhat curved. Coxa 2 with a large, setose, unciform process curved forward and terminating a vas deferens. Sternite 4 with very small projections frontally.

Gonopod coxite with three setae distally (Fig. 609). Coiled, ring-like telopodites in situ holding parallel to each other. Apex of telopodite (Figs 610-611) split into two plates, exterior one serrate or with numerous dentiform knobs of different size, interior one smooth, carrying the end of seminal groove.

Female. Adult 23-30 mm long, 3.0-3.8 mm wide. Body increasingly stout and legs increasingly slender than in male. Each coxa 2 with a spiniform process.

DISTRIBUTION (Map 32): Russia: Far East (Primorsky Province).

REMARKS: This species is characterised by an extended period of reproduction, with dominance of soil-dwelling juveniles over adults that prefer forest litter (Mikhaljova, 1983b). The abundance ranges from 3.5 ind./m² in mountainous forests to 62 ind./m² in valley forests (Kurcheva & Mikhaljova, 1980).

Levizonus distinctus Mikhaljova, 1990

Figs 612-616, Map 32.

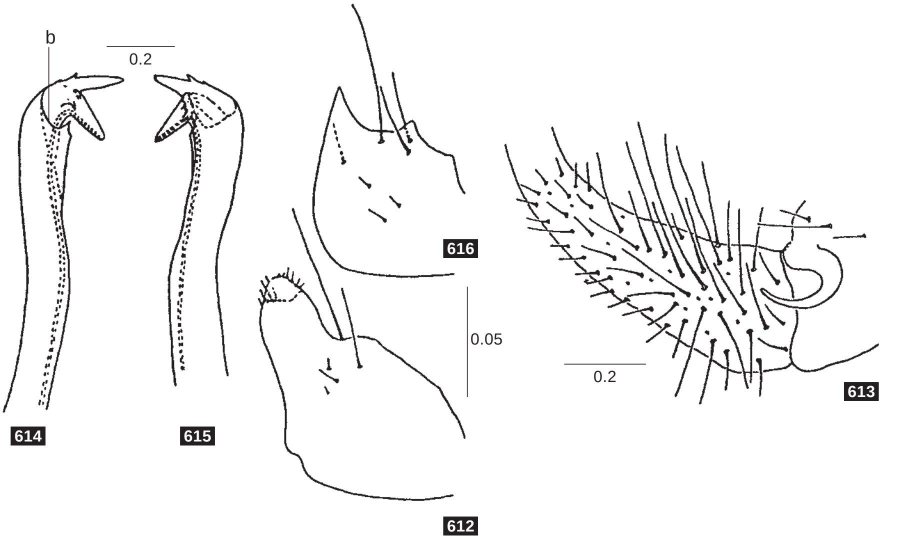
Levizonus distinctus Mikhaljova, 1990: 134, 135: figs.

Levizonus distinctus - Mikhaljova, 1993: 33; 1998b: 53: figs, 54: map.

DIAGNOSIS: The species differs from congeners by the presence of a horn at base of the solenomere and the concave, with a pointed outgrowth, inner edge of the telopodite apex as well as the smaller body.

DESCRIPTION: Male. Adult 20-23 mm long, 1.8-2.0 mm wide. Coloration in alcohol yellow or yellow-white. A very vague tergal pattern traceable as transverse pale yellow or white bands and lateral spots.

Head setose frontally, more densely so at external margin; epicranial setae 2+2. Epicraniual suture distinct, somewhat not reaching the level of antennal sockets. Lateral excavation of head relatively deep for accomodation of antennae. Antennae slender, medium-sized. Length ratios of antennomeres 2-7 as 2.4:2.5:2.3:2.4:2.6:1, width ratios as 1.3:1.3:1.2:1.4:1, respectively. Collum ovoid, considerably broader than head and somewhat narrower than somite 2. Metatergal surface without bosses. Peritremata relatively poorly-developed, rounded laterally, caudolateral corners absent. Peritremata 19 rather strongly



Figs 612-616. *Levizonus distinctus* Mikhaljova, 1990: 612 – male coxa 2; 613 – coxite and prefemoral part of gonopod telopodite; 614 – distal part of gonopod telopodite (mesal view); 615 – distal part of gonopod telopodite (lateral view); 616 – female coxa 2; b – interior edge of gonopod apex. – Scales in mm (after Mikhaljova, 1990).

reduced. Lateral keels thin on somites 1-4 but thicker on remaining somites but telson. Rings delicately wrinkled. Telson with a long tail blunt apically. Medial edge of anal valve as a bolster with two setae. Subanal scale subtriangular, with 1+1 setae.

Legs long, relatively slender, stronger in front body part. Claws large, curved. Both coxae 1 and 2 contiguous basally. Coxa 2 with long setae and a large process curved forward and terminating a vas deferens (Fig. 612).

Gonopod coxite with strong three setae (Fig. 613). Coiled, ring-like telopodites in situ holding parallel to each other. Distal part of telopodite (Figs 614-615) with a dentiform process = solenomere curved inside, carrying a large horn with spinules of different sizes and terminating the seminal groove. Inner edge of telopodite apex (b) concave, with a pointed outgrowth.

Female. Adult 22-24 mm long, 2.8-2.9 mm wide. Coloration brighter than in male. Starting from somite 8, peritremata gradually forming caudolateral corners, never clear-cut though. Coxae 2 with long setae and a pointed process (Fig. 616). Vulvae sphaeroid; operculum and valves with numerous long and short setae.

Juveniles. Body almost colourless, only metazona light yellowish. Subadult males with 19 somites carrying gonopod primordia like rounded tubercles.

DISTRIBUTION (Map 32): Russia: Far East (Primorsky Province).

Levizonus laqueatus Mikhaljova, 1981

Figs 617-622, Map 32.

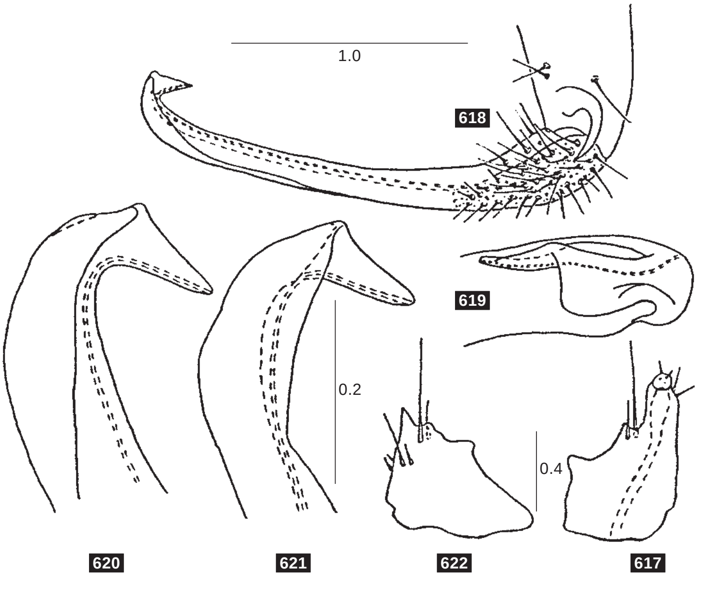
Levizonus laqueatus Mikhaljova, 1981a: 62, 63: figs.

Levizonus laqueatus - Mikhaljova, 1983b: 87; 1993: 33; 1998b: 54: figs and map; Mikhaljova & Petukhova, 1983: 53.

DIAGNOSIS: The species differs from congeners by the always smooth interior edge of the telopodite apex and the dentiform solenomere.

DESCRIPTION: Male. Adult 25-27 mm long, 3.1-3.2 mm wide. Coloration of ventral and lateral body parts yellow-white. Tergites with a brown pattern. Head light, with a marbled spot on frons. Anterior part of metazona marbled brown, lateral part above peritremata with oval marbled spots, posterior part with a transverse light brown strip. Aged adults brighter.

Head setose frontally, more densely so at anterior margin, with 2+2 vertigial setae. Epicranial suture deep, somewhat not reaching the level of antennal sockets. Lateral excavation of head relatively deep for accomodation of antennae. Antennae long and slender, reaching to frontal edge of somite 4. Length ratios of antennomeres 2-7 as 1:0.8:0.9:0.7:0.5:0.3; width ratios as 1:0.9:0.8:0.9:1.0:0.8,



Figs 617-622. *Levizonus laqueatus* Mikhaljova, 1981: 617 – male coxa 2; 618 – gonopod (mesal view); 619 – distal part of gonopod telopodite (ventral view); 620 – distal part of gonopod telopodite (mesal view); 621 – distal part of gonopod telopodite (lateral view); 622 – female coxa 2. – Scales in mm (after Mikhaljova, 1981a).

respectively. Collum ovoid, considerably broader than head but not broader than somite 2. Pleural keels traceable as ventrolateral swellings on somites 3-6. Metatergites without tubercles. Peritremata small, rounded laterally. Peritremata 19 somewhat reduced. Starting from somite 12 or 13, peritremata with a rounded, though never clear-cut, caudal corner. Telson with a long tail bearing sparse setae of different size, blunt apically. Medial edge of anal valve like a bolster with two setae. Subanal scale subtriangular, with 1+1 setae.

Legs long, stronger in front part of body. Claws large, curved. Coxae 1 contiguous basally, further coxae gradually moved apart toward somite 5, following coxae widely separated. Coxa 2 with a large setigerous process curved forward and terminating a vas deferens (Fig. 617). Sterna 4 with a very small projection frontally.

Gonopod coxite subcylindrical, with three strong setae (Fig. 618). Telopodites coiled, ring-like, in situ holding parallel to each other. Distal part of telopodite (Figs 619-621) with an external, straight, dentiform process = solenomere curved inside and terminating the seminal groove. Inner edge of telopodite apex smooth, with neither outgrowths nor excavation.

Female. Adult 27-29 mm long, 4.0-4.2 mm wide. Coloration weaker than in male. Legs slenderer than in male. Legs 1 and 2 somewhat incrassate. Coxae 2 with a small, apically pointed process bearing setae at base (Fig. 622). Vulvae ovoid. Operculum and valves covered with dense long setae. Opening of vulval sac ovoid, with a medial projection.

Juvenile. Body pallid.

DISTRIBUTION (Map 32): Russia: Far East (Primorsky Province).

REMARKS: This is a highly local species collected only in a *Quercus mongolica* forest at a small pass (about 250 m a.s.l.) in the outcrops of Zapovednyi Mt. Range, South Sikhote-Alin Mts, in the Lazovsky Nature Reserve. It has never been found in other habitats even at the base of the pass. Furthermore, it is gradually substituted by *L. variabilis* down the slope. However, *L. laqueatus* is a dominant species, as its number is 166 ind./m^2 (Mikhaljova, 1981c). This species is characterised by an extended period of reproduction, with dominance of soil-dwelling juveniles over adults that prefer to live in litter (Mikhaljova, 1983b).

Levizonus thaumasius Attems, 1898

Figs 623-637, Map 32.

Levizonus thaumasius Attems, 1898: 352, fig.

Levizonus thaumasius - Attems, 1931: 69, fig; 1938: 173, figs; Golovatch, 1979c: 17, 19: figs; Lokšina & Golovatch, 1979: 385; Mikhaljova, 1981a: 64, 65: figs, 66: map; 1983b: 81; 1984b: 14; 1988b: 70; 1990: 136; 1993: 33; 1997a: 143; 1998b: 55: figs, 54: map; 2002a: 150; Mikhaljova & Petukhova, 1983: 53; Mikhaljova & Bakurov, 1989: 40; Ganin, 1997: 121; Mikhaljova & Korsós, 2003: 234.

Levizonus orientalis - Lokšina & Golovatch, 1977: 77: figs.

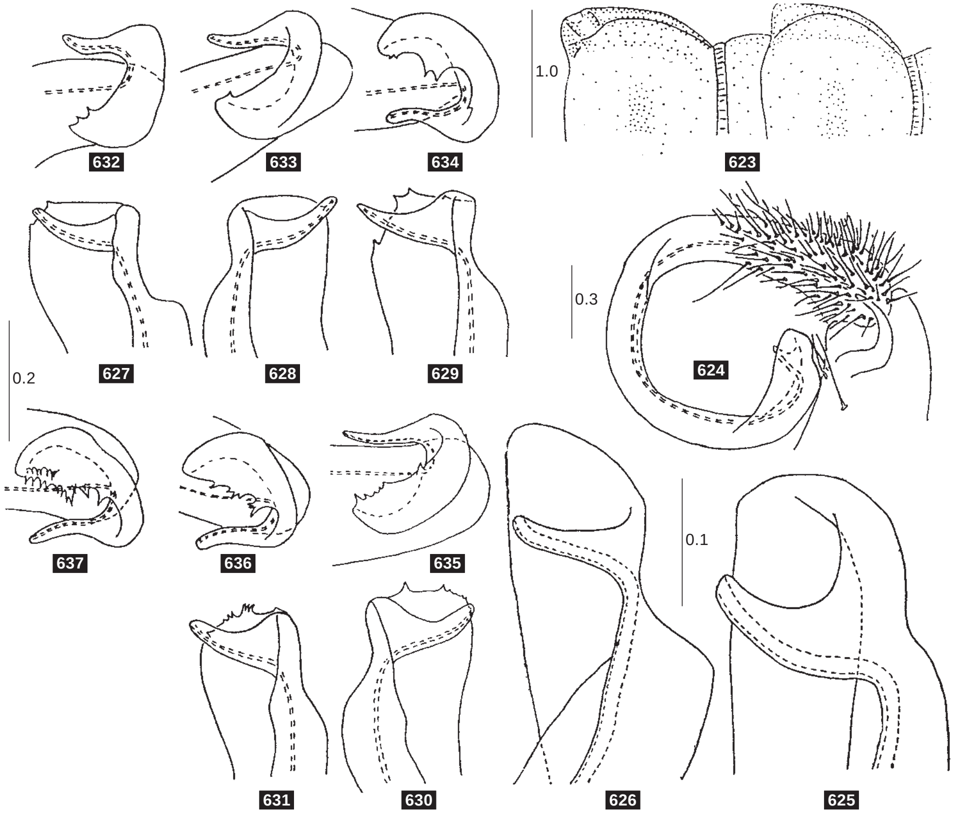
DIAGNOSIS: The species differs from congeners by the configuration of the inner edge of the telopodite apex, which is smooth or with one to numerous small outgrowths and with a curved solenomere.

DESCRIPTION: Male. Body 27-30 mm long, 3.8-5.0 mm wide. Coloration shining whitish. Frons with a marbled light brown spot. Prozona brown dorsally, with a light, narrow, transverse strip before suture/stricture between pro- and metazona. Frontal part of metazona marbled brown, lateral part above peritremata with oval marbled spots, caudal part with a transverse light brown strip.

Head setose frontally, more densely so at external margin. Vertigial setae 2+2. Epicranial suture well-developed, somewhat not reaching the level of antennal sockets. Lateral excavation of head relatively deep for accomodation of antennae. Antennae long, relatively slender. Length ratios of antennomete 2-7 as 1:1.1:0.9:0.9:0.8:0.3. Collum ovoid, considerably broader than head but somewhat narrower than somite 2. Peritremata relatively poorly-developed, rounded laterally, somewhat raised caudally (Fig. 623). Tergal lateral keels of somites 1-4 thin, onward thicker. Peritremata 19 somewhat reduced. Pleural keels traceable as ventrolateral swellings on somites 3 and 4. Rings delicately wrinkled. Telson with a thick long tail, blunt apically, toward apex with 1+1, 2+2, 2+2, 2+2 long setae. Anal valve with two setae; subanal scale subtriangular, with 1+1 long setae.

Legs relatively long, increasingly strong in front part of body. Coxa2 with a large setose process curved forvard and terminating a vas deferens. Coxae 1 continguous medially, further coxae gradually moved apart toward somite 5, following coxae widely separated. Sterna 3 with two very small projections, sterna 4 with two small conical projections frontally.

Gonopod coxite with three strong setae (Fig. 624). Coiled, ring-like telopodites in situ holding parallel to each other. Distal part of telopodite with an external dentiform, curved process = solenomere terminating the seminal groove. Inner edge of telopodite apex smooth or carrying one to numerous, small outgrowths (Figs 625-637).



Figs 623-637. *Levizonus thaumasius* Attems, 1898: 623 – sides of male body segments 14 and 15 (dorsal view); 624 – gonopod (mesal view); 625-631 – variation in shape of distal part of gonopod telopodite (lateral view); 632-637 – variation in shape of distal part of gonopod telopodite (ventral view). – Scales in mm (623 – after Golovatch, 1979c; 624-626 – after Lokšina & Golovatch, 1977; 627-637 – after Mikhaljova, 1981a).

Female. Body 25-30 mm long, 4.0-4.5 mm wide. Body stouter than in male. Pleural keels traceable on somites 2-5. Pleurite 2 with a midway swelling. Peritremata developed somewhat more poorly as compared to male. Legs long and slender throughout. Coxa 2 with a large pointed process bearing sparse but long setae. Vulvae large, coxite and operculum with numerous long setae.

Juveniles. Body about 20 mm long, 3.2-3.5 mm wide. Coloration whitish. Juvenile male carrying gonopod primordia like ovoid tubercles and a small inner process on coxa 2. Legs long and slender both in juvenile males and juvenile females.

Distribution (Map 32): Russia: Far East (Primorsky Province).

Remarks: This species is common and abundant in the southern part of Primorsky Province. It is dominant in montane forests with mature soil, where its numbers range from 24 to 86.5 ind./m2, but not so numerous (4 ind./m2) in floodplain forests with truncated soil (Mikhaljova, 1988b). This species is characterised by an extended period of reproduction, egg-laying and earliest instars occurring throughout the warm season (Mikhaljova, 1984b). As a result, 81-99% of the population are represented by juveniles. Juvenile instars live mainly in the uppermost soil (up to 20 cm depth) but the adults prefer the litter (Mikhaljova, 1983b). The maximum numbers registered are 172.5 ind./m^2 (Mikhaljova, 1988b).

Levizonus variabilis Lokšina & Golovatch, 1977

Figs 638-650, Map 32.

Levizonus variabilis Lokšina & Golovatch, 1977: 76: figs.

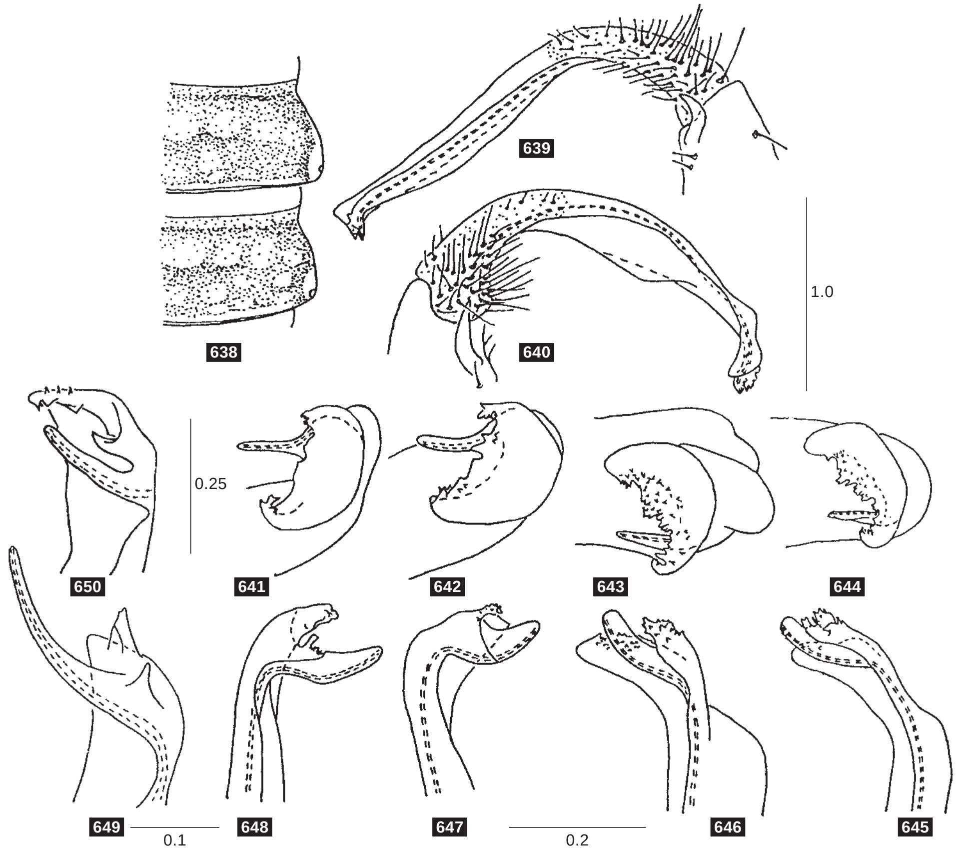
Levizonus variabilis - Lokšina & Golovatch, 1979: 385; Kurcheva & Mikhaljova, 1980: 120; Mikhaljova, 1981a: 64-66: figs and map; 1981c: 87; 1983b: 81; 1990: 136; 1993: 34; 1998b: 55, 56: figs, 54: map; Mikhaljova & Petukhova, 1983: 53; Ganin, 1997: 124.

DIAGNOSIS: The species differs from congeners by the presence of bosses on the surface of metazonites, by the configuration of both solenomere, which more or less strongly curved mesad, and the interior edge of the gonopod telopodite apex with outgrowths and spinules.

DESCRIPTION: Male. Body 20-30 mm long, 3.3-3.8 mm wide. Coloration shining whitish, dorsally often brown.

Head setose frontally, more densely at anterior margin, with 2+2 vertigial setae. Epicranial suture distinct, somewhat not reaching the level of antennal sockets. Lateral excavation of head relatively deep for accomodation of antennae. Antennae long and somewhat slender, slightly clavate. Collum ovoid, broader than head but not broader than somite 2. Metaterga with transverse rows of bosses (Fig. 638) increasingly evident from somite 5 on, especially so in male in contrast to female and juvenile. Metaterga 1-4 carrying such bosses only in lateral parts above peritremata. Peritremata relatively poorly-developed, rounded laterally, peritremata 19 especially strongly reduced. Starting from somite 12-13, peritremata with rounded, though never clear-cut, caudal corners. Tergal lateral keels thin on somites 1-4, onward thicker. Somites 3-13(14) with traceable pleural keels. Telson with a long setose tail, blunt apically. Anal valve with two setae at a bolster-shaped mesal edge. Subanal scale subtriangular, bearing two subapical setae, each with a small projection at base.

Legs somewhat long but stout, growing increasingly slender toward telson. Coxa 2 with a large setigerous process curved forward and terminating a vas



Figs 638-650. *Levizonus variabilis* Lokšina & Golovatch, 1977: 638 – male body segments 12 and 13 (dorsal view); 639-640 – gonopods (mesal view); 641-644 – variation in shape of distal part of gonopod telopodite (ventral view); 645-650 – variation in shape of distal part of gonopod telopodite (lateral view). – Scales in mm (649 – after Lokšina & Golovatch, 1977; 638-648 – after Mikhaljova, 1981a; 650 – after Mikhaljova et al., 2000).

deferens. Coxae 1 contiguous medially, further coxae gradually moved apart toward somite 5, following coxae strongly separated. Sterna 3 with two very small projections, sterna 4 with two small conical projections frontally.

Gonopod coxite (Figs 639-640) with three strong setae. Telopodites in situ holding parallel to each other. Distal part of telopodite with an external dentiform process = solenomere more (Figs 645-649) or less (Fig. 650) strongly curved mesad. Seminal groove opening terminally. Inner edge of telopodite apex with outgrowths and spinules of varying shape and size (Figs 641-650).

Female. Body 25-32 mm long, 3.0-4.0 mm wide, stouter than in male. Metatergal bosses traceable, same as in juvenile. Coxa 2 with a small, pointed, setigerous process. Vulvae large, with long setae.

DISTRIBUTION (Map 32): Russia: Far East (Primorsky Province); North Korea.

REMARKS: The gonopods of the species are variable. The solenomere is less strongly curved mesad (Fig. 650) in specimens from Korea as compared to that of Russian samples (Mikhaljova et al., 2000).

This species dominates the forests in the southern part of Primorsky Province, where its abundance reaches up to 143 ind./m^2 (Mikhaljova, 1981c). The adults prefer to live in forest litter, but juvenile instars in the uppermost soil down to 20 cm deep (Mikhaljova, 1983b). The species is characterised by an extended period of reproduction.

Family Paradoxosomatidae Daday, 1889

This prolific family, one of the largest in the Diplopoda, is distributed in Eurasia, Africa, Australia and South America and it contains about 190 genera. The Asian part of Russia supports only four genera, of which *Oxidus* contains only an introduction (*O. gracilis*) living in hot- and greenhouses.

In Siberia and the Far East of Russia, representatives of this family are recognised by the following characters. Peritremata on paraterga present; paraterga 2 set considerably lower than both paraterga 3 and lateral end of collum; metatergal sculpture absent; metaterga with a transverse sulcus; upper seta on anal valves removed from caudal margin; most genera with a sternal lamina between male coxae 4; gonopod aperture transversely oval; gonopods not fused medially.

Genus *Sichotanus* Attems, 1914

DISTRIBUTION: Russia: Far East (Primorsky and Khabarovsk provinces); Korea; Northeast China. Two species. The Russian Far East supports one species.

Four species have been described in this genus, two long shown to represent junior subjective synonyms of *S. eurygaster* (cf. Mikhaljova, 1982b). Jeekel (1988) suggests that the fourth congener, *S. longipes*, described from Korea (Verhoeff, 1936), is to be synonymised with *S. eurygaster* as well. This is why Mikhaljova (1998b) has treated this genus as monospecific. However, only a re-examination of the types of *S. longipes* and their direct, side-by-side comparison with *S. eurygaster* will allow to finally solve the riddle.

The main distinguishing characters of the genus are as follows. Gonopod femorite with a groove mesally; distal part of gonopod telopodite strongly twisted, very complex; postfemoral portion demarcated by a transverse sulcus, with 4-5 processes; paraterga very moderately developed.

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

Figs 651-661, Map 33.

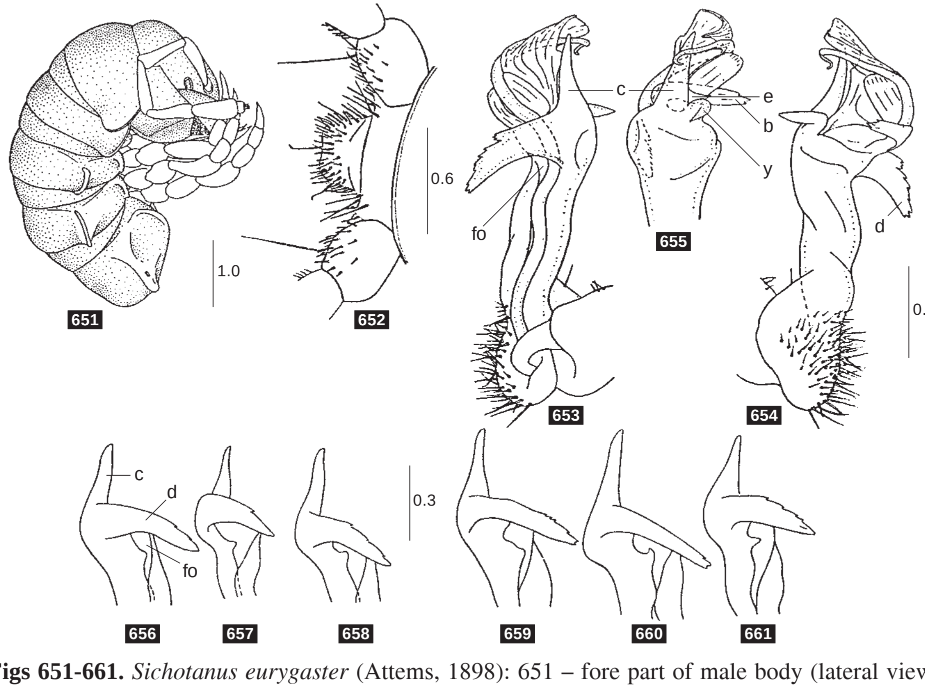
Strongylosoma eurygaster Attems, 1898: 303, figs.

Sichotanus eurygaster - Attems, 1914: 216; 1937: 215, figs; Lokšina & Golovatch, 1979: 382; Mikhaljova, 1982b: 1267: figs; 1983b: 85; 1988b: 70; 1993: 30; 1997a: 145; 1998b: 57: figs, 56: map; 2002a: 150; Mikhaljova & Petukhova, 1983: 52; Ursova, 1983: 503; Ganin, 1988: 7; 1989a: 145; 1992: 92; 1993: 120; 1994: 60; 1995: 370; 1997: 10; 1998b: 81; 2000b: 33; Mikhaljova & Bakurov, 1989: 40; Gromyko, 1990: 66; Mikhaljova & Korsós, 2003: 238; Mikhaljova & Marusik, 2004: 10.

Sichotanus popowi - Golovatch, 1976c: 1570, 1569: figs; Lokšina & Golovatch, 1979: 382.

DIAGNOSIS: The species differs from congener by the absence of process "a" of the gonopod postfemur.

DESCRIPTION: Male. Adult 26-31 mm long, ca. 3.0 mm wide. Body light brown to brown with yellow peritremata.



Figs 651-661. *Sichotanus eurygaster* (Attems, 1898): 651 – fore part of male body (lateral view); 652 – lamina between male coxa 4; 653 – gonopod (mesal view); 654 – gonopod (lateral view); 655 – distal part of gonopod (front view); 656-661 – variation in shape of gonopod process **d** and mesal groove of femorite ; **b**, **c**, **d**, **e**, **y** – processes of postfemoral part of gonopod; fo – femoral groove. – Scales in mm (651-652 – after Golovatch, 1976c; 653-655 – after Golovatch, 1978a; 656-661 – after Mikhaljova, 1982b).

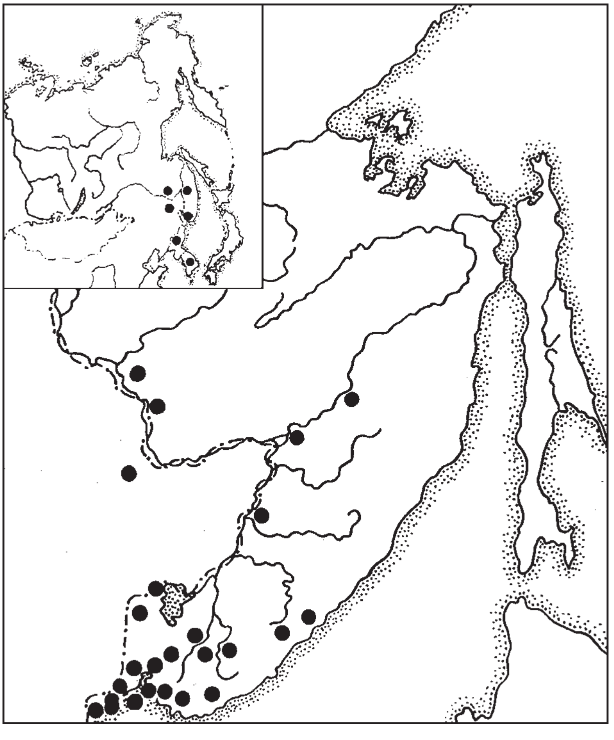
Antennae long and slender, antennomeres 2-6 subequal in length. Head smooth, finely setose frontally, with 1+1 vertigial setae. Epicranial suture well-developed, somewhat not reaching the level of antennal sockets. Collum narrower than head and somite 2. Collum with a transverse row of thin and long setae frontally. Metazona with small peritremata and a few short setae. Transverse metatergal sulcus starting from somite 4, fully developed on somites 5-18. Pleural keels present only on somites 2-9 (Fig. 651), onward traceable only as ventrolateral swellings. Telson with a long tail bearing sparse thin setae, blunt apically. Subanal scale with 1+1 setae.

Legs relatively long. A setose lamina between male coxae 4 subquadrate (Fig. 652). Some setae of leg ventral side bifurcate apically.

Gonopods (Figs 653-655) particularly complex. Mesal groove of femorite (fo) flanked by edges which can be even or with small outgrowths (Figs 656-661). Postfemoral part of telopodite with a large, twisted, phylloid solenophore supporting a flagelliform solenomere, a slightly fringed, similarly phylloid tibiotarsus, and up to five process (**b**, **c**, **y**, **d**, **e**). Process **b** phylloid, with or without teeth apically. Process **y** unciform, curved. Processes **c**, **d** and **e** with or without teeths distally.

Female. Adult 27-32 mm long, ca. 3.0 mm wide.

DISTRIBUTION (Map 33): Russia: Far East (Primorsky and Khabarovsk provinces); Korea; Northeast China.



Map 33. Distribution of *Sichotanus eurygaster* (●).

REMARKS: This species appears to be a senior subjective synonym of two forms (cf. Mikhaljova, 1982b): *Sichotanus popowi* Golovatch, 1976, described from the Primorsky Province (Golovatch, 1976c), and of *Sichotanus mandshuricus* Golovatch, 1978, described from the northeastern China (Golovatch, 1978a).

This is a common and widespread species in the southern part of Russian Far East and in Korea. Animals live in litter, rotten wood and the uppermost soil of different types of mountainous and valley forest. Juveniles occur both in litter and in the soil, mostly down to 20 cm deep (Mikhaljova, 1983b). Adults are litter-dwelling. In the southern part of Primorsky as well as in the Khabarovsk Province, the numbers of *S. eurygaster* are small and range from 1.1 to 8.0 ind./m^2 (Mikhaljova, 1988b; Ganin, 1997). This is one of the region's most active destructors (Ganin, 1988, 1989a, 1997), consuming the leaf litter of all main tree species. Daily diet ranges between 2.5 and 21.1 mg per 24 h/ind. (Ganin, 1988). The leaf litter of alder is consumed by this species to a greater extent as compared to that of the other sympatric trees. This species can also serve as indicator of environmental pollution with heavy metals (Ganin, 1992, 1997).

Genus *Haplogonosoma* Brölemann, 1916

DISTRIBUTION: Russia: Far East (Kuriles: Kunashir Island); Japan: Honshu and Kyushu islands; ?Sumatra. The genus contains two species. The Asian part of Russia supports one species.

The main distinguishing characters of the genus are as follows. Paraterga very modestly developed; gonopod femorite without evidence of torsion; distal part of femorite with a ventrolateral sulcus demarcating a postfemoral portion; latter with a very large tooth parabasally making a subrectangular knee of more or less slender, spiraling solenophore and a flagelliform solenomere.

Haplogonosoma implicatum Brölemann, 1916

Figs 662-667, Map 34.

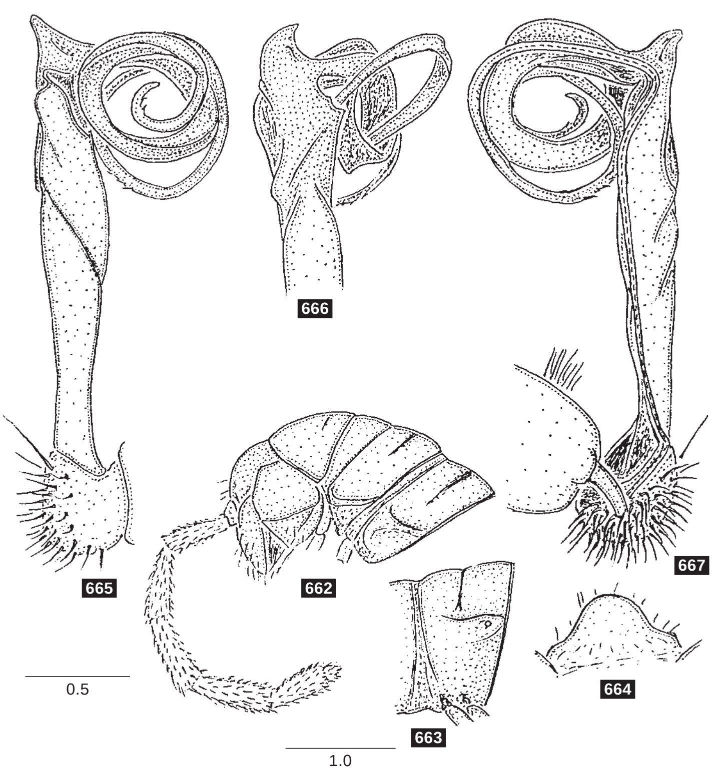
Haplogonosoma implicatum – Golovatch et al., 1995: 72, 74: figs; Mikhaljova, 1998b: 58: figs and map.

DIAGNOSIS: The species differs by the complete absence of a gonopod prefemoral projection, the less prominent apical gonopostfemoral tooth and the somewhat longer solenophore.

DESCRIPTION: Male. Length ca. 18-19 mm, width of midbody pro- and metazona 0.9-1.0 and 1.2-1.3 mm. Coloration varying from beige to brown; collum and most of metaterga each with a pair of large, rounded, lateral, pale brown spots;

head darker; antennomere 7 dark brown; remaining distodorsal parts of other antennomeres, sutures dividing pro- and metazona, and ventrum yellowish beige to pale brown. Tip of antennae and peritremata yellowish to whitish.

Head densely setose, especially at external margin. Antennae long, slender, slightly clavate, in situ reaching the middle of somite 4 dorsally (Fig. 662). Head subequal in width to somite 5, collum narrower than head and subequal in width to somite 2, body parallel-sided on segments 5(6)-16, onward gradually tapering. Paraterga, like lateral swellings, set low (at about midheight of midbody segments); only on somite 2 rather narrow, ridge-shaped, considerably broadened on pore-bearing somites laterally (Fig. 663), caudal corners rounded and never projecting beyond rear tergal contour, only caudal corner on collum like a quite narrowly rounded lappet. Somite 19 with a small pore-bearing knob instead of paratergum. Ozopores small. Surface of prozona shining, very delicately shagreened, metaterga strongly shining, rather poorly rugulose on somites 2-5, onward almost polished;



Figs 662-667. *Haplogonosoma implicatum* Brölemann, 1916: 662 – fore part of male body; 663 – male body segment 10; 664 – lamina between male coxae 4; 665 – gonopod (lateral view); 666 – distal part of gonopod (subventral view); 667 – gonopod (mesal view). – Scales in mm (after Golovatch et al., 1995).

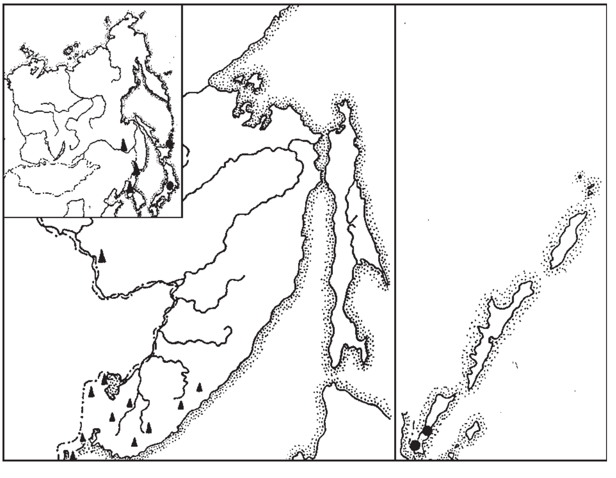
surface below paraterga a little more coarsely shagreened on somites 2-4, onward as finely shagreened as prozona. Tergal setae completely missing, present only on telson. Collum with a poorly expressed, shallow, transverse sulcus at rear 1/3. Transverse sulcus on metaterga thin, deep, lineiform, starting from somite 2, on somites 2-4 more shallow and short, onward fully developed and reaching to almost reaching the base of paraterga, absent from 19th. Pleural keels present as small swellings only on somites 2-4. Tail long, digitiform, broadly truncate at apex. Subanal scale subtriangular, with a narrowly rounded caudal corner.

Legs long and slender, somewhat enlarged. Pregonopodal pairs with tarsal brushes. Sterna simple, shining, sparsely setose, without modifications. Lamina between male coxae 4 broadly rounded, densely setose frontally (Fig. 664).

Gonopod coxite moderately long, with setae distoventrally (Figs 665-667). Prefemoral part small well demarcated from femorite by a lateral sulcus. Femorite high, slender, very slightly broadening distad, set off from postfemoral portion by an oblique ventrolateral demarcation sulcus. Postfemoral part prominent, apically with a rather large tooth marking at base both a subrectangular knee of solenophore and a free solenomere. Solenophore great, long, laminate, coiled, gradually attenuating toward tip, in situ directed mostly caudally, supporting but not sheathing a similarly very long, slender, coiled, at places slightly spiculate, ribbon-shaped, subfiliform solenomere.

Female. Length ca. 15-17 mm, width of midbody pro- and metazona 1.1-1.3 and 1.4-1.6 mm. Coloration as in male besides lesser lateral spots both on collum and most of metaterga. Antennae in situ hardly reaching the end of somite 3. Collum subequal in width to head and narrower than somite 2. Paraterga developed more poorly as compared to male. Legs not enlarged, without tarsal brushes.

Distribution (Map 34): Russia: Kuriles (Kunashir Island); Japan: Hoshu Island.



Map 34. Distribution of *Haplogonosoma implicatum* (●) and *Cawjeekelia koreana* (▲).

Genus *Oxidus* Cook, 1911

DISTRIBUTION: East China, Korea, Japan and Indochina, one species subcosmopolitan. Altogether 4 species. The Asian part of Russia supports one sububiquitous species.

The main distinguishing characters are as follows. Paraterga well-developed, peritremata bordered; gonopod with a postfemoral lamina separated from femorite by a distinct sulcus; femorite without evidence of torsion but with a mesal groove; solenophore spiralled, with or without lobule in distal part.

Oxidus gracilis (C. L. Koch, 1847)

Figs 668-670, Map 23.

Oxidus gracilis - Mikhaljova, 1993: 30; 1998b: 59: fig; Mikhaljova & Nefediev, 2003: 83.

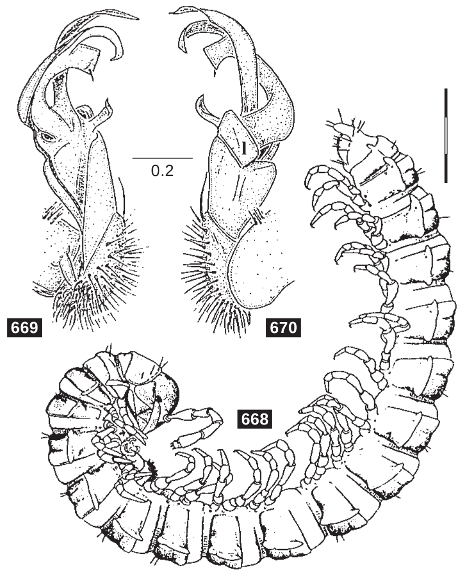
DIAGNOSIS: The species differs from congeners in structure of the distal part of the gonopods, as well as by the presence of a lamellar process on the solenophore.

DESCRIPTION: Male. Length 18-21 mm, width 1.9-2.2 mm. Coloration brown to reddish brown.

Head strongly convex, setose anteriorly. Vertex smooth. Epicranial suture well-developed, somewhat not reaching the level of antennal sockets. Antennae long and slender, slightly clavate. Collum subequal in width to head with genae but somewhat narrow than somite 2. Body relatively slender (Fig. 668), parallel-sided on segments 5-17, onward gradually tapering. Paraterga moderately broad, their caudolateral corners beak-shaped pointed on segments15-19. Peritremata well-developed. Transverse sulcus on metaterga deep, lineiform, starting from somite 4, on somite 4 more shallow, onward fully developed, absent from 19th. Metatergal surface smooth and modestly shining, with two pairs of setae in anterior half of metaterga. Pleural keels present on somites 2-8, onward like small ventrolateral swellings. Tail long, setose, somewhat flattened dorsoventrally, apex bifurcated. Subanal scale trapeziform, with rounded caudal corners and 1+1 setae, caudal margin with a mesal cut. Anal valves setose.

Legs long, with tarsal brushes gradually disappearing toward telson. Sternites moderately densely setose, without modifications.

Gonopods (Figs 669-670) extended anteriad. Coxites setose distally. Prefemoral part not swollen. Femorite smooth and relatively slender, somewhat enlarged distally, set off laterally from a lobe-like postfemoral portion (= lamina **l**) by a demarcation sulcus. Edges of femoral groove without distinct outgrowths. Solenomere largely sheathed by a mostly coiled solenophore. Distal part of solenophore with a well-developed lamellar process. Postfemoral process unciform.



Figs 668-670. *Oxidus gracilis* (C. L. Koch, 1847): 668 – male habitus (lateral view); 669 – gonopod (mesal view); 670 – gonopod (lateral view); **l** - lamina. – Scales in mm, 668- scale without designation (668- after Blower, 1985; 669-670 – after Golovatch & Enghoff, 1993).

Female. Length 19-22 mm, width 2.0-2.5 mm. Setae on head somewhat longer than in male. Legs without tarsal brushes. Pleural keels distinct on somites 2-4, onward gradually thinning out toward telson. Paraterga somewhat narrower.

DISTRIBUTION (Map 23): This species is free-living in the subtropics and tropics, in the temperate conditions it largely occurs in green- and hothouses as well as some anthropogenic places. It has become subcosmopolitan through human agency. In the Asian part of Russia, *O. gracilis* has only been reported in green- or hothouses in the cities of Khabarovsk (Mikhaljova, 1993) and Tomsk (Mikhaljova & Nefediev, 2003).

Genus *Cawjeekelia* Golovatch, 1980

DISTRIBUTION: Eastern China, Korea, Japan, Taiwan, Russian Far East. Eight species. The Asian part of Russia supports one species.

The main distinguishing characters of this genus are as follows. Paraterga moderately developed; pleural keels present; a trapeziform lamina between male coxae 4 present; femorite of gonopod without evidence of torsion, set off from postfemoral portion by a demarcation sulcus, with an inconspicuous folded process distoventrally; solenophore lamellate, directed laterad, with specific folds, ridges, processes; solenomere moderately long, flagelliform, mostly sheathed by solenophore.

Cawjeekelia koreana (Golovatch, 1980)

Figs 671-675, Map 34.

Orientosoma koreanum - Mikhaljova & Petukhova, 1983: 53; Mikhaljova, 1983b: 85; 1988b: 70; Mikhaljova & Bakurov, 1989: 40.

Cawjeekelia koreana - Jeekel, 1988: 98; Mikhaljova, 1993: 30; 1998b: 60: figs, 58: map; 2002a: 150; Golovatch, 1995: 89, 91: figs; Ganin, 1997: 13; Mikhaljova & Marusik, 2004: 10.

DIAGNOSIS: The species differs from congeners both by a stout process **d** and an inconspicuous folded process **b** on the solenophore, also by dentiform paraterga on somite 19.

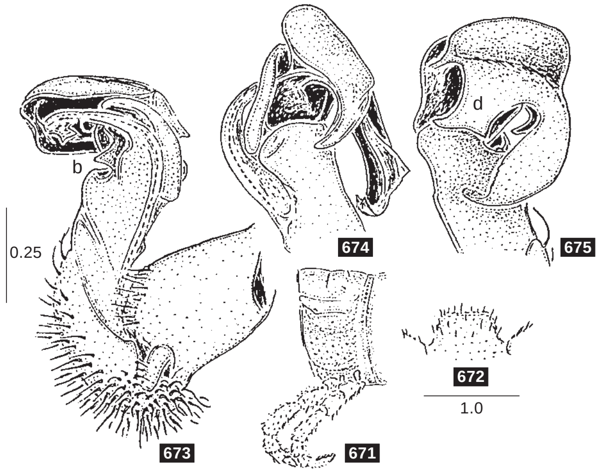
DESCRIPTION: Male. Length 16-17 mm , width 1.5-1.6 mm without, 1.95-2.0 mm with paraterga. Coloration uniform pale yellowish brown to brown, legs and ventrum somewhat paler, peritremata yellowish, antennae brownish, antennomeres 6-7 distinctly infuscate, dark brown, tip whitish.

Head moderately densely setose, subequal in width to somite 2, latter narrower than somite 3 and more so than somite 4.. Collum narrowest. Body broadest and parallel-sided on somites 5-15(16), onward gradually tapering.

Antennae relatively short and stout, in situ reaching the beginning of somite 3 dorsally. Paraterga set low, mostly at about 1/3 metasonital height, slightly sloping down, mostly rounded caudally, almost pointed and dentiform caudally only on somites 18-19. Peritremata bordered both dorsally and ventrally, in lateral view like thick (pore-bearing) or thin (poreless) ridges devoid of incisions (Fig. 671). Body smooth and polished on dorsum, shagreened to microgranulate below paraterga. Anterior parts of metaterga with 2+2 medium-sized setae. Transverse metatergal sulcus starting from somite 4, fully developed on somites 5-18, lineiform, poorly beaded at bottom, shallow, not reaching the bases of paraterga, missing on somite 19. Pleural keels strongly developed on somites 2-7, each coarsely microtuberculate and with a caudal lappet (not tooth); onward keels gradually turning into bulges on somites 18-19, always devoid of a caudal lappet. Tail relatively long, distinctly flattened dorsoventrally, both apical and subapical papillae small, latter quite strongly removed from tip. Subanal scale with a pair of small, well separated, setigerous, paramedian knobs at caudal margin.

Legs long, incrassate; tarsal brushes present almost throughout, missing only on two last leg pairs. Setose lamina between coxae 4 (Fig. 672) subtrapeziform, slightly emarginate.

Gonopods (Figs 673-675) with relatively stout coxites and highly complex telopodites. Coxite strongly setose distally. Prefemoral part prominent. Femorite slightly enlarged distally, with an oblique ventromesal sulcus modestly demarcat-



Figs 671-675. *Cawjeekelia koreana* (Golovatch, 1980): 671 – male body segment 10 (dorsal view); 672 – lamina between male coxae 4; 673 – gonopod (mesal view); 674 – gonopod (dorsolateral view); 675 – gonopod (sublateral view); b – process of gonopod postfemoral part; d – lateral process of solenophore. – Scales in mm (after Golovatch, 1995a).

ing a postfemoral portion, with an inconspicuous folded process (b) distoventrally. Solenophore somewhat coiled, consisting only of a lamina lateralis, subdivided into a shorter parabasal fold, two midway ridges, a subsecuriform lateral process (d) and an elongated end portion supplied with a lateral serrate lamella and a shaggy tip. Solenomere moderately long, flagelliform, mostly sheathed by solenophore, latter supporting the distal end of solenomere with a small inner lobule.

Female. Length 17-17.5 mm, width 1.6-1.8 mm.

Distribution (Map 34): Russia: Far East (Primorsky Province, Amurskaya Area); North Korea.

Remarks: This is a common species in the Primorsky Province, Russian Far East. *C. koreana* has even been reported from a montane tundra habitat at 1,100 m a.s.l. (Mikhaljova & Marusik, 2004). The abundance of this species is small, ranging from 0.3 to 2.3 ind./m^2 (Mikhaljova, 1981c; 1988b; Mikhaljova & Bakurov, 1989; Ganin, 1997). Animals live in the litter and uppermost soil strata of different forest types. Juveniles prefer the uppermost soil 0-20 cm deep, while adults inhabit the litter (Mikhaljova, 1983b). In the southern part of Primorsky Province, two maxima of locomotor activity have been observed one from the end of May to the beginning of June, the other in September (Mikhaljova & Bakurov, 1989).

CHAPTER 6 ZOOGEOGRAPHICAL NOTES

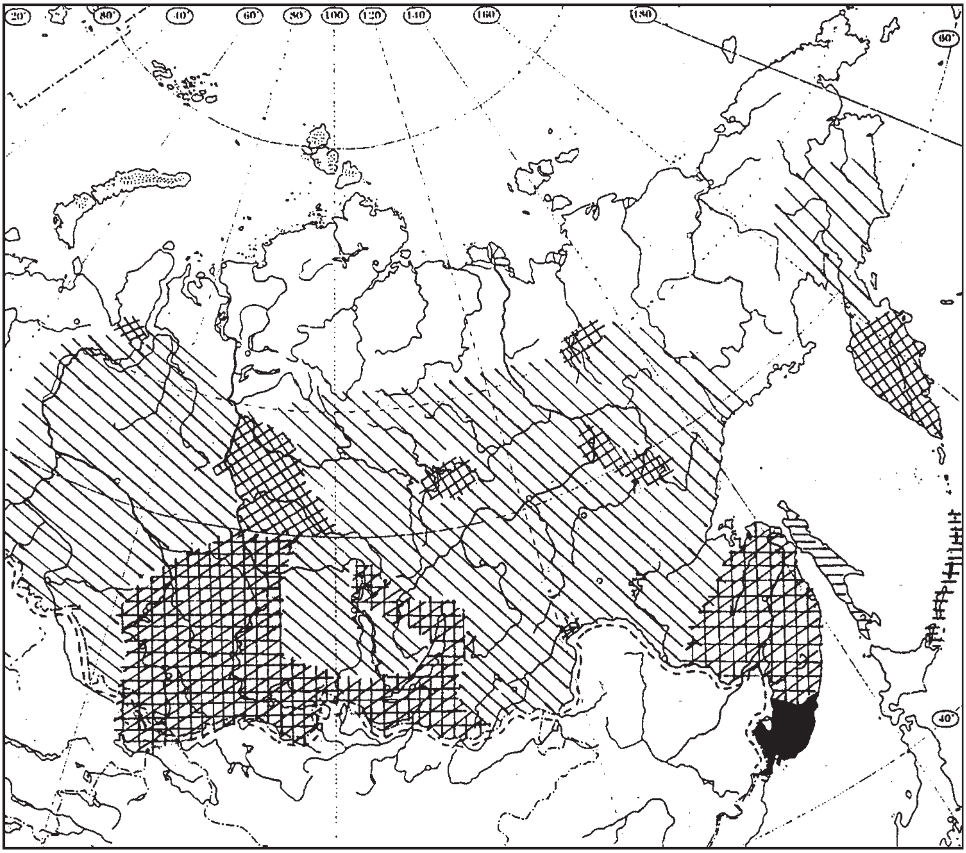
At present, because of a still insufficient knowledge of the fauna, ecology and distribution of Diplopoda in Asian part of Russia, especially in Siberia, only a rather general zoogeographical review appears possible.

The Asian part of Russia occupies much of the Palaearctic, yet with conditions ranging there from hyperboreal to mild temperate, from a very severe, sharply continental climate in the northern parts to a rather mild monsoon climate in the southeast. From north to south, the territories cover a number of natural zones which mostly support mountainous countries and taiga (Milkov, 1977). Milkov's ice zone (= the belts of Arctic and Antarctic desert) is totally devoid of Diplopoda. However, diplopods are known to occur in high-montane tundra habitats within the subalpine and alpine belts (= goltsy) (Mikhaljova, 2000; Mikhaljova & Golovatch, 2001). At present, the northernmost records of millipedes in the Holarctic are ca. 67º30´N and ca. 67º40´N; they concern the European *Proteroiulus fuscus* (Am Stein), collected in the southern part of Yamal Peninsula, Russia's North (Golovatch, 1992; Kime & Golovatch, 2000), and *Angarozonium amurense*, collected in the middle flow of Yana River, Republic of Sakha (Yakutia) (Mikhaljova & Marusik, 2004). While *P. fuscus* has been reported from under the bark of dead conifers, i.e. a highly special habitat, *A. amurense* is detritophagous.

The diplopod faunas of the zone of forested steppe that covers relatively small areas in Southwest Siberia and some even smaller parts in the southwest of Primorsky Province, Russian Far East, appear to be comparatively more impoverished and seem to support no zonal (sub)endemics. This contrasts the forested steppe biome of the East European, or Russian, Plain that harbours virtually all of the regional (sub)endemic Diplopoda (Golovatch, 1992).

The distribution of generic diversity of Diplopoda within the Asian part of Russia is given in map 35. However, this map is especially preliminary. Rather it expresses the degree of Diplopod's fauna study.

The bulk of millipede diversity is recorded in the south of the Far East, where the floristically rich, ancient Turgai forests have persisted because of the absence or relative mildness of a glacial period. These Turgai forests grew to the end of the Pliocene within the extratropical parts of both Palaearctic and Nearctic (Krishtofov-



Map 35. Distribution of generic diversity in Diplopoda within the Asian part of Russia. – Symbols:

– millipede-free territories;

– non-prospected territories (absence of samples);

– 1-3 genera;

– 4-6 genera;

– 7-14 genera;

– 15-20 genera.

NB: The data exclude the apparent anthropochores.

ich, 1932; Sochava, 1946). At present, such relict forests also remain in Southern Europe (Iberian, Italian and Balkan peninsulas, Caucasus, partly also in the Alps, Carpathians and Crimea), along the Atlantic parts of North America, on Hokkaido Island, in the northern part of Korean Peninsula and in Northeast China. Floristic and faunistic exchanges between the provinces of Tertiary mixed forest occurred during different stages of forest development. The complex structure of Far Eastern nemoral forest depends on the presence of Turgai elements as well as of cold-resistant and steppe forms that penetrated during cold phases.

At present, 103 species from 39 genera, 17 families and five orders of Diplopoda are known to occur in Siberia and the Russian Far East. Only one species described too succinctly (Gerstfeldt, 1859) still requires revision.

The fauna of Diplopoda of the Asian part of Russia is composed of elements of different origin and distribution patterns.

Synanthropic, often subcosmopolitan species are to be treated separately, as these elements are not natural, but have become introduced to Siberia and/or the Far East through human agency. Such are *Nopoiulus kochii, Cylindroiulus latestriatus, Oxidus gracilis* and *Polydesmus denticulatus*, all accounting for 3% of the total number of species, and all found in anthropogeneous or nearly anthropogeneous habitats only. It seems noteworthy that each of above genera is only represented in the region by one introduced species. Even though these four genera amount to 10% of the region's total generic diversity, they are to be excluded from further analysis. Even *Oxidus*, whose natural range encompasses East and Southeast Asia, is absent from natural habitats in the adjacent parts of the southern Far East of Russia. As *O. gracilis* has only been reported from hothouses, apparently this is introduction from the European part of Russia.

Generally, the fauna of Diplopoda of the Asian part of Russia is highly original. It is characterised by high-level endemism, which is especially strongly expressed in the Far East. Thus, 77.5% of all regional species are endemic. Their bulk can be attributed to a Japanese-Manchurian faunal nucleus (Golovatch, 1997a, b), composing an organic whole together with many other larger taxa occurring in these and adjacent territories. Still, at the species level only 11.8% of the total species number appear to be shared by the Far East of Russia, Korea and China. Of course, this figure is to grow in the future because of the currently too poorly known fauna of Chinese Diplopoda. However, already now the Far Eastern diplopod fauna can be stated as being characterised by a rather high degree of species originality and endemism. On the other hand, the presence of only very few species (3.9%) common for the Russian Far East and Japan is likely to root in the geological the past of the region, with Japan being long enough isolated from mainland Asia.

The family Diplomaragnidae is definitely dominant in the diplopod fauna of Siberia and the Far East. It can be postulated as being Central Asian in origin, with the centre of diversity lying in northern Mongolia and East Siberia (Shear, 1990), whence spread of certain members could have occurred to the east and west together with forest (Golovatch, in Shear, 1990). A northerly flow seems to have only been modest. The main flow of migrants must have moved to the east, covering the southern parts of the Far East of Russia (including the islands), Korea, Japan and Taiwan. Species of this family definitely occur at least in the adjacent parts of Northeast China, but none has hitherto been recorded in China.

The evolutionarily most advanced genera occur at the eastern periphery of the family's distribution range, i.e. in Japan and Korea (Mikhaljova, 2000). At present, three species (2.9%) and two of the most primitive genera (*Ancestreuma* and *Asiatyla*) have been recorded as common elements both in the Mongolian and Siberian faunas. Only one species, *Altajosoma golovatchi*, has penetrated far westerly, from Yenisey River to slightly beyond the Ural Mountains. Its congeners occur in West and Southwest Siberia as well as Cisbaikalia.

Of 40 millipede genera currently known from the Asian part of Russia, 30% occur only there. These are *Sibiriulus, Pacifiiulus, Shearia, Pacifiosoma, Sakhalineuma, Crassotyla, Ghilarovia, Hoffmaneuma*, *Golovatchia, Altajella, Teleckophoron* and *Uniramidesmus*. Both *Sibiriulus* and *Pacifiiulus* are members of the large, basically European subfamily Julinae. The oligotypic *Sibiriulus* is restricted to West and Southwest Siberia. The range of the monotypic *Pacifiiulus* covers the southern parts both of Siberia and the Russian Far East; it is solely represented in the Far East of Russia by parthenogenetic populations, while in Siberia only sexual populations are known to occur.

The genus *Shearia*, a member of Diplomaragnidae, is distributed in the Altai and Sayan mountains, close to the presumed origin centre of the family. In contrast, the diplomaragnid genera *Pacifiosoma* and *Sakhalineuma* are peripheral; both are confined to the southern part of the Far East, the former to mainland, the latter to the Sakhalin and Kurile islands. Neither shows any species living close to the family's presumed centre of origin.

Although the highest taxonomic diversity of Conotylidae is observed in North and, to a lesser extent, Central America, its origin centre is supposed to have lain in Asia (Shear & Tsurusaki, 1995). In Asia, this family contains *Crassotyla*, endemic to the Russian Far East, and *Yasudatyla* Shear & Tsurusaki, 1995, from Japan.

The monotypic family Golovatchiidae is confined to the Far East of Russia. *Golovatchia* has been assigned to the superfamily Brannerioidea (Shear, 1992, 2000) which altogether encompasses 10 families distributed in Europe, North America, Japan, Nepal, Vietnam and Australia. Although the taxonomy of this superfamily is rather intricate and invites revision, Shear (1992) notes certain similarities between *Golovatchia* and *Branneria* Bollman, 1893, the latter genus restricted to the southeastern USA.

The taxonomy of the family Anthroleucosomatidae, and of the entire superfamily Anthroleucosomatoidea, is tangled even to a larger degree. This superfamily is perhaps the most poorly known in the entire order Chordeumatida. Genera belonging to Anthroleucosomatidae are distributed from Europe through the East Mediterranean to Central Asia. The relations and faunal connections of the Southwest Siberian genus *Ghilarovia* are obscure. This genus is relatively similar to the Iranian *Alloiopus* Attems, 1951 in posterior gonopod structure, but is rather close to the Hyrcanian *Persedicus* Mauriès, 1982 in anterior gonopod conformation (Shear, 1988). The strikingly reduced female leg pair 2 of *Ghilarovia* resembles the situation observed in the Euro-Caucasian family Mastigophorophyllidae (Mikhaljova, 2002b).

The relations of the recently established Siberio-Central Asian subendemic family Altajellidae are rather obscure as well. It contains two genera in South Siberia (*Altajella* and *Teleckophoron*), and one genus each in the Tian-Shan (*Elongeuma* Golovatch, 1982) and Tarbagatay mountains (*Tarbagataya* Golovatch & Wytwer, 2003) (Golovatch & Wytwer, 2003). The most recent allocation of Altajellidae is in the basically European superfamily Neoatractosomatoidea (cf. Mauriès, 2003). Altajellidae do resemble Mastigophorophyllidae (Mikhaljova & Golovatch, 2001), both in Neoatractosomatoidea together with Hoffmaneumatidae (cf. Mauriès, 2003).

Hoffmaneuma is monotypic and it occurs in the Primorsky Province of Russia and likely also in Korea (see Chapter 5). The second currently known genus of Hoffmaneumatidae is the oligotypic *Japanoparvus* Shear, Tanabe & Tsurusaki, 1997, from Honshu and Shikoku, Japan. Particularly close relationships of Hoffmaneumatidae seem to be with the Mastigophorophyllidae (Shear et al., 1997; Shear, 2000).

Uniramidesmus (Polydesmidae) is represented by eight species in the southern Far East of Russia and one species in East Siberia. It seems particularly similar to the North American *Bidentogon* Buckett & Gardner, 1968 and *Speodesmus* Loomis, 1939 (Golovatch & Mikhaljova, 1979; Mikhaljova, 1984).

Only 11.8% of the families and 25% of the genera, especially those occurring in the Far East of Russia, demonstrate faunal connections with East and Southeast Asia. First of all, according to Semenov-Tian-Shansky (1936), such forms are confined to the Palaearchaearctic Subregion of the Palaearctic Region. Thus, Mongoliulidae are represented by seven genera in Northeast and North China, Korea, the southern part of the Russian Far East, Japan and possibly Central Asia. *Kopidoiulus, Skleroprotopus, Ansiulus* and *Ussuriiulus* have been recorded in the Russian Far East. Most, five of seven, species of *Kopidoiulus* occur in Japan. The remaining two forms, *K. continentalis* and *K. khasanicus,* are mainland, occurring in the Primorsky Province, but the former species has also been recorded in Northeast China.

The larger genus *Skleroprotopus* with its about 15 species is more abundantly represented in Japan and Korea. The Far East of Russia supports two species, one endemic (*S. schmidti*), the other (*S. coreanus*) widespread throughout Korea.

Ansiulus contains four species, all in Korea, with one also recorded in the southern part of Primorsky Province. However, the occurrence of further species in the Russian Far East is likely.

The monotypic *Ussuriiulus* is shared by the faunas of the Russian Far East (only the Primorsky Province) and North Korea.

Megalotyla is represented by two species. One occurs in the Primorsky Province, the second in North Korea. However, Megalotylidae show broader zoogeographical connections, as the range of the genus *Nepalella* covers the Nepal Himalaya, Vietnam, Thailand and Burma. This family is so similar to Conotylidae (Shear, 1999) that *Nepalella* may actually prove to be a conotylid (Shear & Tsurusaki, 1995; Shear, 2000).

Levizonus, with eight species, mainly contains forms endemic to the Primorsky Province. Only one, *L. variabilis*, penetrates North Korea, while *L. circularis* Takakuwa, 1942 is endemic in Korea. In addition, two species are known to occur in Japan. There can be no doubt that this genus also inhabits the adjacent parts of Northeast China, but this still requires formalisation. The distribution of the highly prolific family Xystodesmidae, which contains *Levizonus*, covers mainly North America, with only minor representation in the Mediterranean and Southeast and East Asia. As the vast majority of genera in the subfamily Xystodesminae are Nearctic, this allows to suggest past penetration of these diplopods into the Palaearctic via the Bering Land Bridge (Golovatch, 1979e).

The family Paradoxosomatidae is represented in the region by the Palae-archaearctic genera *Sichotanus, Cawjeekelia* and *Haplogonosoma*. The zoogeo-graphical connections are clearly with the more southerly faunas of East and Southeast Asia.

The center of species diversity for the prolific *Epanerchodus* is Japan and Korea. Only two species endemic in the Kuriles, as well as *E. polymorphus* which occurs both in the Primorsky Province and North Korea, are known from the Russian Far East.

The prolific genus *Anaulaciulus*, with about 45 species, likewise shows clear connections with Southeast Asia. Its range covers most of the Palaearchaearctic. The northern range limit of this genus is in the Primorsky Province, with only one species occurring in Russia.

The proportion of the diplopods showing a trans-Beringian distribution pattern is small. *Orinisobates* contains eight species, of which three are known from North America (two in the USA, and one from the USA and adjacent parts of Canada), while the remaining five are Palaearctic. The Palaearctic, probably its eastern part, is a presumed origin centre of Nemasomatidae, whence these diplopods, including *Orinisobates*, could have reached the Nearctic via the Bering Land Bridge (Enghoff, 1985). It is in the opposite direction, i.e. from the Nearctic to Asia, that migrants among Xystodesminae and *Underwoodia* seem to have spread (Golovatch, 1980a). Most genera and species of Caseyidae, including three species of *Underwoodia*, occur in North America. Only one caseyid species, *U. kurtschevae*, is known to occur in the Far East of Russia.

The situation concerning the Holarctic family Polyzoniidae is peculiar. Polyzoniidae are divided into two subfamilies (Shelley, 1998). Buzoniinae are represented by three genera and five species in the western USA, whereas Polyzoniinae by three genera and 14 species in northern Eurasia and the eastern part of North America. In general, the diplopod fauna of eastern North America seems closer to the European fauna than to that of the western part of North America (Hoffman, 1969; Shelley, 1998).

Among both Palaearctic genera of Polyzoniinae, *Angarozonium* is widely distributed in the Asian part of Russia; it also penetrates Korea and Mongolia. The highest species diversity (five species in the southern Far East, one in Korea) in this genus is observed in the northern part of the Palaearchaearctic. Only *A. amurense* penetrates the boreo-Eurasian subregion. The second Palaearctic genus, *Polyzonium*, seems to be purely European.

Clear-cut zoogeographical connections with the European fauna are only minor. The Ural Mountains appear to represent a natural border between the European and Asian faunas of Diplopoda (Golovatch, 1984, 1992). There are no European non-anthropochorous species occurring east of the Urals. The basically European *Julus* and the Euro-Mediterranean *Megaphyllum* are the only millipede genera that (still) exist beyond the Urals and show remarkably disjunct outposts in Southwest Siberia and/or adjacent parts; yet each is already with some neoendemic species involved. The opposite pathway of dispersion, from Asia to Europe, is demonstrated by the Siberio-Central Asian genus *Schizoturanius* which must have crossed the Urals and still shows several outposts in the Ukraine and Central Russia as represented by the neoendemic species *S. dmitriewi* (cf. Read & Golovatch, 1994). Another example of Siberian migrants to Europe is the above *Altajosoma golovatchi.*

Summarising, the diplopod fauna of the Asian part of Russia is characterised by a sufficiently high degree of antiquity and originality, with rather numerous palaeoendemics of high rank involved. About equally important roles in the processes of faunogenesis seem to have been played by the Central Asian and East Asian origin centres. The influence of the European fauna seems to have been insignificant. The importance of trans-Beringian connections has also been relatively minor, though not negligible.

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COLOUR PLATES

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Plate 1. *Skleroprotopus coreanus* (Pocock, 1895)

Plate 2. *Skleroprotopus coreanus* (Pocock, 1895)

Plate 3. *Levizonus thaumasius* Attems, 1898

Plate 4. *Sichotanus eurygaster* Attems, 1898

Plate 5. *Diplomaragna terricolor* (Attems, 1899)

Plate 6. *Cawjeekelia koreana* (Golovatch, 1980)

Plate 7. *Epanerchodus koreanus* Verhoeff, 1937

Plate 8. *Epanerchodus koreanus* Verhoeff, 1937

REFERENCES

ALEKSANDROV F. 1956. [Julids are pests of corn]. – Zashchita rasteniy ot vrediteley i bolezney, 1: 59 (in Russian).

ATTEMS C. 1898. System der Polydesmiden, 1. – Denkschr. Akad. Wiss. Wien, Math.-naturw. Klasse, 67, 1: 221-482.

ATTEMS C. 1899. Neues über paläarktische Myriopoden. – Zool. Jahrb., Syst., 12: 286-366.

ATTEMS C. 1907. Japanische Myriopoden, gesammelt von Direktor Dr. K. Kraepelin im Jahre 1903. – Mitt. naturh. Mus. Hamburg, 24: 78-142.

ATTEMS C. 1914. Die indo-australischen Myriopoden. – Arch. Naturg., 80A, 4: 1-398.

ATTEMS C. 1931. Die Familie Leptodesmidae und andere Polydesmiden. – Zoologica, 79: 1-150.

ATTEMS C. 1937. Myriopoda 3, Polydesmoidea 1. Fam. Strongylosomidae. – Tierreich, 68: 1-300.

ATTEMS C. 1938. Myriopoda 3, Polydesmoidea 2. Fam. Leptodesmidae, Platyrhachidae, Oxydesmidae, Gomphodesmidae. – Tierreich, 69: 1-487.

BAKER G.N. 1979. Eruptions of the introduced millipede, *Ommatoiulus moreletii* (Diplopoda, Julidae), in Australia, with notes on the native *Australiosoma castaneum* (Diplopoda, Paradoxosomatidae). – South Australian Naturalist, 53, 3: 36-41.

BAKER G.N. 1980. The water and temperature relationships of *Ommatoiulus moreletii* (Diplopoda; Julidae). – J. Zool., 190, 1: 97-108.

BANO K., BAGYARAJ D.J., KRISHNAMOORTHY R.V. 1976. Feeding activity of the millipede, *Jonespeltis splendidus* Verhoeff and soil humification. – Proc. Indian Acad. Sci., 83B, 1: 1-11.

BLOWER J.G. 1958. British millipedes (Diplopoda). Synopses of the British Fauna, 11, 74 p.

BLOWER J.G. 1985. Millipedes. Keys and notes for the identification of the species. Synopses of the British Fauna, 35, 242 p.

BYZOVA Yu.B. 1973. [Respiration of soil invertebrates]. – Ekologiya pochvennykh bespozvonochnykh. Moscow: Nauka Publ.: 1-39 (in Russian).

CAUSEY N.B. 1960. Speciation in North American cave millipeds. – Amer. Midland Naturalist, 64, 1: 116-122.

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

DUNGER W. 1962. Methoden zur vergleichenden Auswertung von Fütternungsversuchen in der Bodenbiologie. – Abh. Ber. Naturkundemus.Görlitz, 37, 2: 143-162.

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.

ENGHOFF H. 1987. *Karteroiulus niger* Attems, 1909, in China (Diplopoda, Julida, Parajulidae). – Entomologist's Monthly Magazine, 123: 207-208.

ENGHOFF H. 1991. A revised cladistic analysis and classification of the millipede order Julida with establishment of four new families and description of a new nemasomatoid genus from Japan. – Z. zool. Syst. Evolutionsforsch., 29: 241-263.

ENGHOFF H. 1994. Geographical parthenogenesis in millipedes (Diplopoda). – Biogeographica, 70, 1: 25-31.

FILATOVA L.D. & MAKAREVITCH R.A. 1984. [Change in population structure of soil invertebrates affected by technogeneous emissions]. – Sovremennye problemy geografii ekosistem. Abstr. All-Union Conf., Moscow: 287-288 (in Russian).

GANIN G.N. 1987. [The role of millipedes in the decay of forest litter in the southern Khabarovsk Province]. – Problemy pochvennoy zoologii. Abstr. 9 All-Union Conf. Soil Zool., Tbilisi: 66-67 (in Russian).

GANIN G.N. 1988. [Estimation of the role of millipedes of Siberian pine-broadleaved forests of Priamurye in litter destruction]. – Izvestiya Sibirskogo otdeleniya AN SSSR, Biol., 20, 3: 7-10 (in Russian, English summary).

GANIN G.N. 1989a. [The role of millipedes in the decay and transformation of forest litter in the southern Khabarovsk Province]. – Zool. Zhurnal, 68, 1: 145-149 (in Russian, English summary).

GANIN G.N. 1989b. [Structural and functional characteristics of soil mesofauna of the Siberian pine-broadleaved forests of the Lower Amur region]. – Pochvennye bespozvonochnye yuga Dalnego Vostoka, Khabarovsk: 30-38 (in Russian).

GANIN G.N. 1992. [Biogeochemical indication for protected and developed territories (soil invertebrates taken as an example)]. – Biogeokhimicheskaya indikatsiya prirodnykh i tekhnogennykh kontsentratsiy khimicheskikh elementov v okruzhayushchei srede, Vladivostok: 100-111 (in Russian).

GANIN G.N. 1993. Biogeochemical indication for protected and developed territories (on the example of soil invertebrates). – Sci. Total Envir., Supplement, 1: 217-223.

GANIN G.N. 1994. [Role of soil mesofauna in the biogenic turnover of elements in forest and meadow ecosystems of the Amur region]. – Ekologiya, 5-6: 59-67 (in Russian).

GANIN G.N. 1995. [Heavy metals in soil invertebrates in nature reserves of the Russian Far East]. – Ekologiya, 5: 368-372 (in Russian).

GANIN G.N. 1997. [Soil animals of the Ussuri region]. Vladivostok & Khabarovsk: Dalnauka Publ., 159 p. (in Russian, English summary).

GANIN G.N. 1998a. Soil invertebrates of the Ussuri taiga (protected and developed territories of the South of the Russian Far East). – Abstr., 6th European Congr. Entom., eské Budjovice: 372.

GANIN G.N. 1998b. Soil invertebrates of the Ussuri Taiga (Priamurye and Primorye of the Russian Far East). – Ecology and Management of northern forest soils. Proceedings: 80-82.

GANIN G.N. 2000a. [Millipedes]. Krasnaya kniga Khabarovskogo kraya: 431-432 (in Russian).

GANIN G.N. 2000b. Invertebrate pedobionts (mesofauna) of the Amur River region and the Sichote-Alin Mountain Range. – Biodiversity and dynamics of ecosystems in North Eurasia, Novosibirsk, 3, 1: 32-35.

GANIN G.N., MANUKHIN I.V. 2000. [Fire succession of pedobionts and their bioindication capacity]. – Nauchnye issledovaniya v zapovednikakh Priamuriya. Vladivostok & Khabarovsk: 75-83 (in Russian).

GERSTFELDT G. 1859. Ueber einige zum Theil neue Arten Platoden, Anneliden, Myriapoden und Crustaceen Sibiriens, namentlich seines östlichen Theiles und des Amur-Gebietes. – Mém. savants étrangers Acad. Imp. Sci. St. Pétersbourg, 8: 1-36.

GHILAROV M.S. 1947. [Soil fauna of terra rossa on the southern coast of the Crimea]. – Vestnik Moskovskogo gosudarstvennogo universiteta, 2: 105-117 (in Russian).

GHILAROV M.S. 1957. [Juloids (Juloidea) and thier role in pedogenesis]. – Pochvovedenie, 6: 74-80 (in Russian).

GHILAROV M.S. 1965. [Zoological method of soil diagnostics]. Moscow: Nauka Publ., 278 p. (in Russian).

GHILAROV M.S. 1970. [Regularities in adaptations of arthropods to a terrestrial life]. Moscow: Nauka Publ., 276 p. (in Russian).

GHILAROV M.S. & CHERNOV YU. I. 1975. [Soil invertebrates as components of the temperate belt complex]. – Resursy biosfery, Leningrad: Nauka Publ., 1: 218-240 (in Russian).

GHILAROV M.S. & PEREL T.S. 1971. Soil fauna in mixed coniferous-broadleaved forests of Southern Primorie. – Pedobiologia, 11, 3: 240-261.

GHILAROV M.S. & PEREL T.S. 1973. [Complexes of soil invertebrates of coniferous-broadleaved forests of the Far East as indicator of the type of their soils]. Ekologiya pochvennykh bespozvonochnykh. Moscow: Nauka Publ.: 40-59 (in Russian).

GOLOVATCH S.I. 1975. [Two genera of Oniscomorpha (Diplopoda) new to the USSR fauna, found in Transcaucasia, and their zoogeographical connections]. – Zool. Zhurnal, 54, 10: 1566-1571 (in Russian, English summary).

GOLOVATCH S.I. 1976a. [Description of new species of *Trachysphaera* (Oniscomorpha, Diplopoda) from caves of Western Transcaucasia with notes on *T. rotundata* (Lignau), 1911]. – Byulleten Moskovskogo obshchestva ispytateley prirody, Biol., 81, 5: 30-43 (in Russian, English summary).

GOLOVATCH S.I. 1976b. [A new species, *Sakhalineuma molodovae* Golovatch (Chordeumida, Diplopoda), from South Sakhalin]. – Doklady Akademii nauk SSSR, 227, 6: 1489-1492 (in Russian).

GOLOVATCH S.I. 1976c. [New species of Polydesmida (Diplopoda) from the USSR]. – Zool. Zhurnal,.55, 10: 1567-1570 (in Russian, English summary).

GOLOVATCH S.I. 1977. [Systematic position of some Asian Chordeumida (Diplopoda)]. – Zool. Zhurnal, 56, 5: 714-724 (in Russian, English summary).

GOLOVATCH S.I. 1978a. [Some new East Asian millipedes (Diplopoda) in the collection of the Zoological Institute of the USSR Academy of Sciences]. – Entom. Obozrenie, 57, 3: 677-681 (in Russian).

GOLOVATCH S.I. 1978b. [A new family of East Asiatic Chordeumida (Diplopoda)]. – Zool. Zhurnal, 57, 7: 1008-1011 (in Russian, English summary).

GOLOVATCH S.I. 1978c. [On the diversity of Diplopoda in the USSR]. – Problemy pochvennoy zoologii. Abstr. 6 All-Union Conf. Soil Zool., Minsk: 58 (in Russian).

GOLOVATCH S.I. 1979a. [Three genera of Diplopoda–Chilognatha new to the USSR fauna]. – Zool. Zhurnal, 58, 3: 336-343 (in Russian, English summary).

GOLOVATCH S.I. 1979b. [A new genus of the superfamily Parajuloidea (Diplopoda) new to the USSR]. – Entom. Obozrenie, 58, 4: 904-908 (in Russian, English summary).

GOLOVATCH S.I. 1979c. [Notes on *Levizonus thaumasius* Att. (Diplopoda)]. – Ekologiya i biologiya chlenistonogikh yuga Dalnego Vostoka. Vladivostok: 17-20 (in Russian).

GOLOVATCH S.I. 1979d. [Systematic position of the genus *Diplomaragna* Attems (Chordeumida, Diplopoda)]. – Byulleten Moskovskogo obshchestva ispytateley prirody, Biol., 84, 4: 88-90 (in Russian, Englush summary).

GOLOVATCH S.I. 1979e. Trans-Beringian faunal connections in millipedes (Diplopoda). – Abstr. XIV Pacific Sci. Congr., Khabarovsk, C – Geogr.: 214-215.

GOLOVATCH S.I. 1980a. [New forms of Diplopoda from the Soviet Far East and their zoogeographical relationships]. – Zool. Zhurnal, 59, 2: 199-207 (in Russian, English summary).

GOLOVATCH S.I. 1980b. A contribution to the millipede fauna of Korea (Diplopoda). – Folia Entom. Hung., 41, 1: 49-58.

GOLOVATCH S.I. 1984. [Distribution and faunogenesis of the millipedes (Diplopoda) of the USSR European part]. – Chernov Y.I. (ed.). Faunogenez i filotsenogenez. Moscow: Nauka Publ.: 92-138 (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. 1992. Some patterns in the distribution and origin of the millipede fauna of the Russian Plain (Diplopoda). – Ber. nat.-med. Ver. Innsbruck, Suppl. 10: 373-383.

GOLOVATCH S.I. 1995. On several new or poorly-known Oriental Paradoxosomatidae (Diplopoda, Polydesmida), III. – Arthropoda Selecta, 4, 2: 89-97.

GOLOVATCH S.I. 1997a. On the main pattern of millipede diversity in Eurasia. – Senckenberg. biol., 77, 1: 101-106.

GOLOVATCH S.I. 1997b. On the main traits of millipede distribution and faunogenesis in Eurasia (Diplopoda). – Entom. scand., 51: 199-208.

GOLOVATCH S.I. & ENGHOFF H. 1990. [The millipede *Nopoiulus kochii* (Gervais, 1847) in the Caucasus]. – Striganova B.R. (ed.). Pochvennye bespozvonochnye Kavkaza. Moscow: Nauka Publ.: 114-118 (in Russian, Emglish summary).

GOLOVATCH S.I. & ENGHOFF H. 1993. Review of the millipede genus *Tylopus,* with description of new species from Thailand (Diplopoda, Polydesmida, Paradoxosomatidae). – Steenstrupia, 19, 3: 85-125.

GOLOVATCH S.I. & MIKHALJOVA E.V. 1978. [A new family of East Palearctic Chordeumida (Diplopoda), with the description of a new genus and species]. – Byulleten Moskovskogo obshchestva ispytateley prirody, Biol., 83, 4: 66-71 (in Russian, English summary).

GOLOVATCH S.I. & MIKHALJOVA E.V. 1979. [New Polydesmidea millipedes (Diplopoda) from the Far East]. – Zool. Zhurnal, 58, 6: 830-838 (in Russian, English summary).

GOLOVATCH S.I. & WYTWER J. 2003. A new genus and species of the millipede Altajellidae from eastern Kazakhstan, Central Asia (Diplopoda, Chordeumatida). – Annales Zoologici, 53, 3: 205-210.

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

GROMYKO M.N. 1990. [Peculiarities in the structure of soil populations in oakwood ecosystems of the Sikhote-Alin Biosphere Reserve]. – Ekologicheskie issledovaniya v Sikhote-Alinskom zapovednike. Moscow: TSNIL Glavokhoty RSFSR Publ.: 57-72 (in Russian).

GULIÈKA J. 1963. [New millipedes (Diplopoda) from the USSR. Part 1]. – Zool. Zhurnal, 42, 4: 518-524 (in Russian, English summary).

GULIÈKA J. 1972. [New millipedes (Diplopoda) from the USSR. Part 2]. – Zool. Zhurnal, 51, 1: 36-45 (in Russian, English summary).

HAASE E. 1880. Zur Kenntnis der sibirischen Myriopoden. – Zool. Anz., 3: 223-225.

HELB H.W. 1975. Zum Massenauftreten des Schnurfüssers *Schizophyllum sabulosum* in Saarland (Myriapoda, Diplopoda). – Entom. Germ., 1, 3-4: 376-381.

HOFFMAN R.L. 1969. The origin and affinities of the southern Appalachian diplopod fauna. – Holt P.C. (ed.). The distributional history of the biota of the southern Appalachians, Part I: Invertebrates. Res. Div. Monog. 1, Virginia Polytech. Inst., Blacksburg: 221-246.

HOFFMAN R.L. 1975. A note on the status of *Polydesmus clavatipes* and some related species from Central Asia (Diplopoda, Polydesmidae). – Zool. Anz., 194: 79-83.

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

HOPKIN S.P. & READ H.J. 1992. The biology of millipedes. Oxford Univ. Press, 288 p.

ISHII K. 1983. A new species of penicillate diplopods of the family Polyxenidae (Diplopoda, Penicillata) from Japan. – Can. Ent., 115: 1355-1357.

ISHII K. & CHOI S.-S. 1988. A new species of the genus *Polyxenus* (Diplopoda: Penicillata; Polyxenidae) from Korea. – Can. Ent., 120: 711-715.

ISHII K. & LIANG L. 1990. Two new species of penicillate diplopods of the family Polyxenidae (Diplopoda: Penicillata) from China. – Can. Ent., 122: 1239-1246.

JEEKEL C.A.W. 1988. The generic position of *Orthomorpha bucharensis* Lohmander and *O. muminabadensis* Gulièka, and the taxonomic status of *Hedinomorpha* Verhoeff (Diplopoda, Polydesmida, Paradoxosomatidae). – Bull. Zoöl. Mus. Univ. Amsterdam, 11, 11: 97-104.

KHEIRALLAH A.M. 1978. The consumption and utilization of two different species of leaf litter by a laboratory population of *Orthomorpha gracilis* (Diplopoda, Polydesmoidea). – Entom. exp. appl., 23, 1: 14-19.

KHEIRALLAH A.M. 1979a. Behavioural preference of *Julus scandinavius* (Myriapoda) to different species of leaf litter. – Oikos, 33, 3: 466-471.

KHEIRALLAH A.M. 1979b. Seasonal variations in the feeding activity of the millipede *Julus scandinavus* (Latzel) in natural habitats. – Rev. roum. Biol., Sér. Biol. anim., 24, 1: 81-85.

KIME R.D. & GOLOVATCH S.I. 2000. Trends in the ecological strategies and evolution of millipedes (Diplopoda). – Biol. J. Linn. Soc., 69: 333-349.

KONDEVA E.A. 1980. [Feeding activity of *Pachyiulus flavipes* (C. L. Koch, 1847) (Diplopoda, Pachyiulidae)]. – Doklady Akademii nauk SSSR, 254, 6: 1511-1514 (in Russian).

KORSÓS Z. 1996. An approach to the revision of the East Asian millipede genus *Anaulaciulus*. – Geoffroy J.-J., Mauriès J.-P. & Nguyen Duy–Jacquemin M. (eds). Acta Myriapodologica. Mém. Mus. natn. Hist. nat., Paris: 169: 35-43.

KORSÓS Z. 2001. Diplopoda from the Nepal Himalaya: Toward the clarification of the genus *Anaulaciulus* Pocock 1895 (Diplopoda, Julida, Julidae, Brachyiulini). – Senckenberg. biol., 81, 1/2: 61-86.

KOZHUKHOVA O.A. & RYABININ N.A. 1981. [An ecofaunistic characteristic of soil mesofauna of meadow coenoses of the Jewish Autonomous Region]. – Ekosistemy yuga Dalnego Vostoka. Vladivostok: 74-78 (in Russian).

KOZLOVSKAYA L.S. 1965. [Fauna of swampy forest soils in the Ob and Tom interfluve]. – Osobennosti bolotoobrazovaniya v nekotorykh lesnykh i predgornykh rayonakh Sibiri i Dalnego Vostoka. Moscow: Nauka Publ.: 141-164 (in Russian).

KOZLOVSKAYA L.S. 1976. [The role of soil invertebrates in the transformation of organic matter of swampy soils]. Leningrad: Nauka Publ., 211 p. (in Russian).

KRISHTOFOVITCH A.N. 1932. [A geological review of the Far Eastern countries]. Leningrad & Moscow: Geologo-razvedochnoe Publ., 332 p. (in Russian).

KURCHEVA G.F. 1972. [Soil invertebrates in the forests of Transcarpathia]. – Pedobiologia, 12, 5: 381-400 (in Russian, German summary).

KURCHEVA G.F. 1973. [The role of animals in soil formation (invertebrates)]. Moscow: Znanie Publ., Biol., 61 p. (in Russian).

KURCHEVA G.F. 1977. [Soil invertebrates of the Soviet Far East]. Moscow: Nauka Publ., 132 p. (in Russian).

KURCHEVA G.F. 1979a. [A comparative rate of decomposition of various tree litter kinds in the forests of southern Maritime Province]. – Ekologiya i produktivnost lesnykh biogeotsenozov. Vladivostok: 20-30 (in Russian).

KURCHEVA G.F. 1979b. [Abundance and ratios of soil invertebrates in some forest types of the Verhne-Ussuriyskii Research Station]. – Ekologiya i biologiya chlenistonogikh yuga Dalnego Vostoka. Vladivostok: 3-16 (in Russian).

KURCHEVA G.F. & MIKHALJOVA E.V. 1980. [Millipedes (Diplopoda) of some forest types of the Verkhne-Ussuriyskii Research Station]. – Kompleksnye issledovaniya lesnykh biogeotsenozov. Vladivostok: 117-127 (in Russian).

LANG J. 1954. Mnohono•ky–Diplopoda. Fauna œR, Praha, Sv. 2, 186 p. (in Czech).

LEVIEUX J., AOUTI A. & DIOMANDE T. 1978. Observations on daily migrations of *Pachybolus laminatus* Cook (Diplopoda; Spirobolida; Pachybolidae). – Ann. Univ. Abidjan, E11: 39-52 (in French).

LOGINOVA N.G. 1993. [The role of diplopods in the biological turnover in forests of the Caucasus Major]. – Zool. Zhurnal, 72, 7: 151-154 (in Russian, English summary).

LOHMANDER H. 1933 (for 1932). Über Diplopoden aus Zentralasien. – Ark. Zool., 25A, 6: 1-71.

LOKŠINA I.E. 1966. [Distribution of Diplopoda of the Russian Plain in a zonal aspect]. – Zool. Zhurnal, 45, 12: 1773-1778 (in Russian, English summary).

LOKŠINA I.E. 1969. [Keys to the millipedes (Diplopoda) of the plain areas of the European part of the USSR]. Moscow: Nauka Publ., 78 p. (in Russian).

LOKŠINA I.E. & GOLOVATCH S.I. 1977. [New millipedes (Diplopoda) from the USSR]. – Byulleten Moskovskogo obshchestva ispytateley prirody, Biol., 82, 1: 73-78 (in Russian).

LOKŠINA I.E. & GOLOVATCH S.I. 1979. Diplopoda of the USSR fauna. – Pedobiologia, 19, 6: 381-389.

LYFORD W.H. 1943. The palatability of freshly fallen forest tree leaves to millipedes. – Ecology, 24, 2: 252-261.

MAURIÈS J.-P. 1982. Une espèce nouvelle du genre *Lankasoma* (Diplopoda, Craspedosomida, Lankasomidae), avec notes sur quelques Chordeumida récemment décrits. – Steenstrupia, 8, 7: 177-180.

MAURIÈS J.-P. 2003 (for 2002). *Schizmohetera olympica* sp. n. from Greece, with a reclassification of the superfamily Neoatractosomatoidea (Diplopoda, Chordeumatida). – Arthropoda Selecta, 12, 1: 9-16.

Methods of soil zoological studies. 1975. Moscow: Nauka Publ., 280 p. (in Russian).

MIKHALJOVA E.V. 1978. [On the fauna of Diplopoda in coniferous-broadleaved forests of the Ussuryskiy Nature Reserve]. – Problemy pochvennoy zoologii. Abstr. 6 All-Union Conf. Soil Zool., Minsk: 157 (in Russian).

MIKHALJOVA E.V. 1979a. [A new species of the millipede genus *Polyzonium* (Diplopoda, Polyzoniidae) from the Far East]. – Zool. Zhurnal, 58, 10: 1591-1593 (in Russian, English summary).

MIKHALJOVA E.V. 1979b. [Millipedes (Diplopoda) of the USSR Primorsky Province]. – Abstr. XIV Pacific Sci. Congr., Khabarovsk, K – Entom.: 37 (in Russian).

MIKHALJOVA E.V. 1981a. [The millipede genus *Levizonus* (Diplopoda, Xystodesmidae) from the USSR Far East]. – Byulleten Moskovskogo obshchestva ispytateley prirody, Biol., 86, 3: 62-67 (in Russian, English summary).

MIKHALJOVA 1981b. [New species of the genus *Polyzonium* (Diplopoda, Polyzoniidae) from Siberia and the Far East]. – Zool. Zhurnal, 60, 5: 778-782 (in Russian, English summary).

MIKHALJOVA E.V. 1981c. [Millipedes (Diplopoda) of broadleaved and broadleaved-pine forests of the Lazovskii Nature Reserve]. – Fauna i ekologiya nasekomykh Primorskogo kraya i Kamchatki. Vladivostok: 84-91 (in Russian).

MIKHALJOVA E.V. 1981d. [Peculiarities in the fauna of Diplopoda of the southern USSR Far East]. – Problemy pochvennoy zoologii. Abstr. 7 All-Union Conf. Soil Zool., Kiev: 140-141 (in Russian).

MIKHALJOVA E.V. 1982a. [New millipedes of the family Julidae (Diplopoda) from the USSR Far East]. – Zool. Zhurnal, 61, 2: 210-216 (in Russian, English summary).

MIKHALJOVA E.V. 1982b. [On the synonymy of two forms of Diplopoda from the USSR Far East]. – Zool. Zhurnal, 61, 8: 1265-1268 (in Russian, English summary).

MIKHALJOVA E.V. 1983a. [A new species of the genus *Polyzonium* (Diplopoda, Polyzoniidae) from the USSR Far East]. – Zool. Zhurnal, 62, 2: 308-310 (in Russian, English summary).

MIKHALJOVA E.V. 1983b. [Distribution of millipedes (Diplopoda) along the soil profile in the forests of the Primorsky Province]. – Fauna i ekologiya chlenistonogikh Dalnego Vostoka. Vladivostok: 77-90 (in Russian).

MIKHALJOVA E.V. 1984a. [Two new species of *Uniramidesmus* (Diplopoda, Polydesmidae) from the Asian part of the USSR, with notes on the status of the genus]. – Zool. Zhurnal, 63, 3: 455-458 (in Russian, English summary).

MIKHALJOVA E.V. 1984b. [On the breeding of *Levizonus thaumasius* Att. (Diplopoda)]. – Problemy pochvennoy zologhii. Abstr. 8 All-Union Conf. Soil Zool. Ashkhabad, 2: 14 (in Russian).

MIKHALJOVA E.V. 1987. [Abundance of Diplopoda in forests of the southern Primorsky Province]. – Problemy pochvennoy zoologii. Abstr. 9 All-Union Conf. Soil Zool., Tbilisi: 187 (in Russian).

MIKHALJOVA E.V. 1988a. [New millipedes (Diplopoda) from the Kurile Islands]. – Zool. Zhurnal, 67, 4: 620-621 (in Russian, English summary).

MIKHALJOVA E.V. 1988b. [Millipedes (Diplopoda) of the Ussuriyskii and "Kedrovaya Pad" nature reserves]. – Rol nasekomykh v biotsenozakh Dalnego Vostoka. Vladivostok: 114-126 (in Russian).

MIKHALJOVA E.V. 1990. [On the fauna of Diplopoda of the USSR Far East]. – Zool. Zhurnal, 69, 5: 134-138 (in Russian, English summary).

MIKHALJOVA E.V. 1991. [On the diversity of Diplopoda in Siberia and the Soviet Far East]. – Problemy pochvennoy zoologii. Abstr. 10 All-Union Conf. Soil Zool., Novosibirsk: 75 (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. 1996a. A new species of the genus *Epanerchodus* (Diplopoda, Polydesmidae) from Kuril Islands. – Far Eastern Entomologist, 29: 1-4.

MIKHALJOVA E.V. 1996b. Fauna and some ecological peculiarities of the millipedes (Diplopoda) of the Russian Southern Far East. – Abstr. 10 Intern. Congr. Myriapodology, Copenhagen: 40.

MIKHALJOVA E.V. 1997a (for 1996). Review of the cavernicolous millipede fauna of the Far East of Russia, with description of a new troglophilic species (Diplopoda). – Arthropoda Selecta, 5, 3/4: 143-149.

MIKHALJOVA E.V. 1997b. New data on the millipede genus *Diplomaragna* Attems, 1907, in the Far East of Russia (Diplopoda Chordeumatida Diplomaragnidae). – Arthropoda Selecta, 6, 1/2: 123-130.

MIKHALJOVA E.V. 1998a. On new and poorly-known millipedes (Diplopoda) from the Far East of Russia. – 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. 2000 (for 1999). Review of the millipede family Diplomaragnidae (Diplopoda: Chordeumatida). – Arthropoda Selecta, 8, 3: 153-181.

MIKHALJOVA E.V. 2002a (for 2001). A contribution to the millipede faunas of Korea and the Russian Far East (Diplopoda). – Arthropoda Selecta, 10, 2, 147-150.

MIKHALJOVA E.V. 2002b (for 2001). On some poorly-known millipedes from Siberia (Diplopoda). – Arthropoda Selecta, 10, 3: 201-207.

MIKHALJOVA E.V. & BAKUROV V.D. 1989. [On millipedes (Diplopoda) of the Siniy Mountain Ridge (Sikhote-Alin)]. – Pochvennye bespozvonochnye yuga Dalnego Vostoka. Khabarovsk: 38-47 (in Russian).

MIKHALJOVA E.V. & BASARUKIN A.M. 1995. The millipedes (Diplopoda) of the Sakhalin and Kurile islands. – Arthropoda Selecta, 4, 3/4: 89-96.

MIKHALJOVA E.V. & GOLOVATCH S.I. 1981. [Polymorphism in a new species of the genus *Epanerchodus* (Diplopoda, Polydesmidae) from the USSR Far East]. – Zool. Zhurnal, 60, 8: 1183-1189 (in Russian, English summary).

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

MIKHALJOVA E.V., GOLOVATCH S.I. & WYTWER J. 2000. On some new or poorly-known millipedes (Diplopoda) from North Korea. – Fragmenta Faunistica, 43, 10: 109-122.

MIKHALJOVA E.V. & KIM J.P. 1993. Contribution to the millipede fauna of Korea (Diplopoda). – Korean Arachnology, 9, 1-2: 31-42.

MIKHALJOVA E.V. & 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. & LIM K.Y. 2000. Millipede fauna (Diplopoda) of South Korea. – Korean J. Syst. Zool., 16, 2: 147-157.

MIKHALJOVA E.V. & LIM K.Y. 2002. New millipedes from Korea, with notes on the identity of *Epanerchodus koreanus* Verhoeff, 1937 (Diplopoda) – Arthropoda Selecta, 10, 1:19-26.

MIKHALJOVA E.V. & 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.

MIKHALJOVA E.V & NEFEDIEV P.S. 2003 (for 2002). A contribution to the millipede fauna of Siberia (Diplopoda). – Arthropoda Selecta, 11, 1: 81-87.

MIKHALJOVA E.V. & PETUKHOVA E.V. 1983. [A comparative analysis of the millipede faunas (Diplopoda) of Primorsky Province's forests with the help of inclusion and similarity indices]. – Teoretiko-grafovye metody v biogeograficheskikh issledovaniyakh. Vladivostok: 48-66 (in Russian).

MILKOV F.N. 1977. [Nature zones of the USSR]. Moscow: Mysl Publ., 295 p. (in Russian).

MINEYEVA N.Ya. 1978. [Soil invertebrates of broadleaved forests of the Middle Sikhote-Alin]. – Zool. Zhurnal, 57, 12: 1799-1805 (in Russian, English summary).

MOLODOVA L.P. 1973. [Soil invertebrate fauna of South Sakhalin]. – Ekologiya pochvennykh bespozvonochnykh. Moscow: Nauka Publ.: 60-74 (in Russian).

MOLODOVA L.P. 1974. [The zoogeographical composition and altitudinal belt distribution of soil invertebrates in southern Sakhalin]. – Zool. Zhurnal, 53, 8: 1178-1186 (in Russian, English summary).

MOLODOVA L.P. 1976. Pedozoological data for characterization of soil types on the Southern Sakhalin. – Pedobiologia, 16,.6: 401-417.

MURAKAMI Y. 1971. The fauna of the insular lava caves in West Japan. X. Myriapoda. – Bull. Natn. Sci. Mus. Tokyo, 14, 3: 311-322.

MURAKAMI Y. 1975. The cave myriapods of the Ryukyu Islands. I. – Bull. Natn. Sci. Mus. Tokyo, 1, 2: 85-113.

MURAKAMI Y. 1990. The millipeds of the genus *Kopidoiulus* (Diplopoda, Julida, Mongoliulidae). – J. Speleol. Soc. Japan, 15: 1-14.

MURAKAMI Y. & PAIK K.Y. 1968. Results of the speleological survey in South Korea. 1966. XI. Cave-dwelling myriapods from the southern part of Korea. – Bull. Natn. Sci. Mus., 11, 4: 363-384.

NEFEDIEV P.S. 2001. [On the fauna and ecology of myriapods (Myriapoda) in the environs of the village of Smolenskoe, Altai Province]. – Abstr. 7 Int. Conf. "Day of the Earth. Landscapes of Western Siberia. Investigation problems, ecology and regional use". Biysk: 84-86 (in Russian).

NEFEDIEV P.S. 2002a. [Eco-faunistic investigations of myriapods in the Teguldet District, Tomsk Area]. – Abstr. Int. Conf. of Students and Young Researchers "Lomonosov–2002". Moscow, 7: 40-41 (in Russian).

NEFEDIEV P.S. 2002b. [The fauna and ecology of myriapods (Myriapoda) of a relict lime grove (village of Kuzedeyevo)]. – Abstr. 40 Int. Scientific Student Confer. "Students and Scientific and Technical Progress". Novosibirsk: 35 (in Russian).

NEFEDIEV P.S. 2002c. [Populations and some ecological peculiarities of myriapods of gray forest soils in the southern Tomsk Area]. – Abstr. 6 School Conf. of Young Researchers "Biology, a Science of the 21st Century". Pushchino-on-Oka: 138-139 (in Russian).

NEFEDIEV P.S. 2002d. On the Diplopoda fauna of South-West Siberia. – Abstr. 12 Int. Congr. Myriapodology. Pietermaritzburg: 30.

NIEZGODZIDSKI P. 1976. Dwuparce (Diplopoda) wyst'pujace w ostatnich latach masowo w okolicach Wroclawia. – Przegld zoologiczny, 20, 4: 432-437.

POCOCK, R. I. 1895. Report upon the Chilopoda and Diplopoda obtained by P. W. Basset-Smith, Esq., Surgeon R. N., and J. J. Walker, Esq., R. N., during the cruise in the Chinese Seas of H. M. S. 'Penguin', Commander W. U. Moore commanding. – Ann. Mag. Nat. Hist., Ser. 6, 15: 346-372.

POCOCK, R.I. 1903. Remarks upon the morphology and systematics of certain chilognathous Diplopoda. – Ann. Mag. Nat. Hist., Ser. 7, 12: 515-532.

POKARZHESKY A.D. 1981. [On the nutrition of millipedes on dead roots in meadow steppe]. – Doklady Akademii nauk SSSR, 256, 6: 1510-1511.

Quantitative methods in soil zoology. 1987. Moscow: Nauka Publ., 288 p. (in Russian).

READ H.J. & GOLOVATCH S.I. 1994. A review of the Central Asian millipede fauna. – Bull. Brit. Myriapod Group, 10: 59-70.

ROKTANEN L.P. 1957. [Julids as pests of both seeds and young corn]. – Zashchita rasteniy ot vrediteley i bolezney, 2: 37 (in Russian).

ROMELL L.G. 1935. An example of myriapods as mull formers. – Ecology, 16, 1: 67-71.

ROSSOLIMO T.E. & RYBALOV L.B. 1979. [Thermo- and hygropreferences of some soil invertebrates in relation to their between-habitat distribution]. – Zool. Zhurnal, 58, 12: 1802-1810 (in Russian, English summary).

RYABININ N.A. 1975. [Seasonal change in population density in some groups of soil invertebrates in three forests types of the Khekhtsyr Mountain Ridge (Khabarovsk Province)]. – Zool. Zhurnal, 54, 1: 133-136 (in Russian, English summary).

RYABININ N.A. 1977. [Soil invertebrate complexes of the Khekhtsyr Mountain Range]. – Ekologiya i fauna zhivotnykh. Tyumen: 63-76 (in Russian).

RYABININ N.A. 1978. [Animal population of soils in the Amur region]. – Doklady Moskovskogo obshchestva ispytateley prirody: 61-63 (in Russian).

RYABININ N.A., GANIN G.N. & PANKOV A.N. 1988. [Effect of sulfuric acid industry wastes on soil invertebrate complexes]. – Ekologiya, 6: 29-37 (in Russian).

RYBALOV L.B. 1991. [Soil fauna of taiga and floodplain ecosystems in a middle flow region of Yenisey River]. – Problemy pochvennoy zoologii. Abstr. 10 All-Union Conf. Soil Zool., Novosibirsk: 87 (in Russian).

RYBALOV L.B. 2002. [Zonal and landscape change in soil invertebrates populations in a near Enisey River region of Middle Siberia and the role of temperature adaptations in the meridional (zonal) distribution of invertebrates]. – Russ. Entom. J., 11, 1: 77-86 (in Russian).

RYBALOV L.B. & ROSSOLIMO T.E. 1998. Asian Ecological Transect: Evaluation of biodiversity of soil animal communities in Central Siberia. – Proc. 6 World Wilderness Congress. Symposium on Research, Management and Allocation: 532-546.

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.

SHEAR W.A. 1987. Systematic position of the milliped *Japanosoma scabrum* Verhoeff (Chordeumatida, Conotylidae). – Myriapodologica, 2, 4: 221-227.

SHEAR W.A. 1988. Systematic position of the milliped species *Alloiopus solitarius* Attems and the genus *Ghilarovia* Gulièka (Chordeumatida, Anthroleucosomatidae). – Myriapodologica, 2, 8: 51-58.

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

Shear W.A. 1992. *Golovatchia*, new genus, and Golovatchiidae, new family, from the Far East of the Russian Republic, with a comment on Hoffmaneumatidae (Diplopoda, Chordeumatida). – Myriapodologica, 2, 10: 63-72.

Shear W.A. 1999. A new troglobitic milliped of the genus *Nepalella* from China (Diplopoda, Chordeumatida, Megalotylidae). – Myriapodologica, 6, 1:1-10.

Shear W.A. 2000. On the miliped family Heterochordeumatidae, with comments on the higher classification of the order Chordeumatida (Diplopoda). – Invertebrate Taxonomy, 14: 363-376.

Shear W.A. & Tsurusaki N. 1995. Japanese chordeumatid millipeds. III. *Jasudatyla*, a new genus of Alpine conotylid millipeds (Diplopoda, Chordeumatida, Conotylidae). – Myriapodologica, 3, 11: 97-106.

Shear W.A., Tanabe T. & Tsurusaki N. 1997. Japanese chordeumatid millipeds. IV. The new genus *Japanoparvus* (Diplopoda, Chordeumatida, Hoffmaneumatidae). – Myriapodologica, 4, 11: 89-99.

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.

Shelley R.M., Sierwald P., Kiser S.B. & Golovatch S.I. 2000. Nomenclator generum et familiarum Diplopodorum II. A list of the genus and family-group names in the class Diplopoda from 1958 through 1999. Sofia & Moscow: Pensoft Publ., 167 p.

Shinohara K. & Niijima K. 1977. On the mass apearances of *Japonaria laminata armigera* Verhieff (Diplopoda). – Edaphologia, 16: 4-8.

Sochava V.B. 1946. [Problems of florogenesis and phylocoenogenesis of the Manchurian mixed forest]. – Materialy po istorii flory i rastitelnosti SSSR. Moscow & Leningrad: AN SSSR Publ., 2:.283-320 (in Russian).

Sokolov D.F. 1956. [On the role of julids in organic matter decomposition in the soil under forest in the steppe]. – Doklady Akademii nauk SSSR, 100, 3: 563-566 (in Russian).

Striganova B.R. 1967. Über die Zersetzung von überwinterter Laubstreu durch Tausendfü²Ber und Landasseln. – Pedobiologia, 7, 2/3: 125-134.

Striganova B.R. 1969a. [Evaluation of the assimilability of different leaf litters by millipedes (Diplopoda)]. – Zool. Zhurnal, 48, 6: 821-826 (in Russian, English summary).

Striganova B.R. 1969b. [Distribution of Diplopoda in mixed forests of the North Caucasus and their participation in the decomposition of leaf litter]. – Zool. Zhurnal, 48, 11: 1623-1628 (in Russian, English summary).

Striganova B.R. 1970. [On the decomposition of cellulose in the intestine of *Pachyiulus foetidissimus* (Mur.) (Julidae, Diplopoda)]. – Doklady Akademii nauk SSSR, 190, 3: 703-705 (in Russian).

Striganova B.R. 1971. [Comparative characteristics of the activity of various groups of soil invertebrates in the process of ground litter decomposition]. – Ekologiya, 4: 36-43 (in Russian).

Striganova B.R. 1972. Effect of temperature on the feeding activity of *Sarmatiulus kessleri* (Diplopoda). – Oikos, 23, 2: 197-199.

Striganova B.R. 1974. [Distribution of Diplopoda in the Carpathian foothills and their role in the decomposition of forest fall]. – Zool. Zhurnal, 53, 9: 1308-1314 (in Russian, English summary).

Striganova B.R. 1977. [Adaptations of millipedes (Diplopoda) to dwelling in soils with different hydrothermal conditions]. – Adaptatsiya pochvennykh zhivotnykh k usloviyam sredy. Moscow: Nauka Publ.: 151-166 (in Russian).

STRIGANOVA B.R. 1980. [Nutrition of soil saprophages]. Moscow: Nauka Publ., 244 p. (in Russian).

STRIGANOVA B.R & LOGINOVA N.G. 1984. [The role of diplopods in biological matter turnover in the alpine meadows of the Caucasus Minor]. – Zhurnal Obshchey Biologii, 45, 2: 196-202 (in Russian, English summary).

STRIGANOVA B.R. & RAKHMANOV R. 1973. [Seasonal rhythm of the feeding activity of *Amblyiulus continentalis* and *Schizophyllum caspium* (Diplopoda) in Lenkoran, Azerbaijan]. – Zool. Zhurnal, 52, 3: 372-378 (in Russian, English summary).

STUXBERG A. 1876a. Myriopoder från Sibirien och Waigatsch on samlade under Nordenskiöldska expeditionen 1875. – Öfversigt k. Vetensk.-Akad. Förhandl., 33, 2: 11-38.

STUXBERG A. 1876b. On the Myriopoda, from Siberia and Waigatsch Island, collected during the expedition of Prof. Nordenskiold, 1875. – Ann. Mag. Nat. Hist., Ser. 4, 17: 306-318.

TABACARU I. 1970. Sur la répartition des Diplopodes cavernicoles européens. – Livre du centenaire Emile G. Racovitza 1868–1968. Bucarest: 421-443.

TIKHOMIROVA A.L. 1975. [Sampling the stratobiotic invertebrates]. – Metody pochvenno-zoologicheskikh issledovaniy. Moscow: Nauka Publ., 73-85 (in Russian).

TISCHLER V. 1971. [Agricultural ecology]. Moscow: Kolos Publ., 455 p. (in Russian).

URSOVA O.A. 1983. [Soil invertebrates in the mesofauna of mountainous forests of southern Cisamuria]. – Zool. Zhurnal, 62,.2: 305-308 (in Russian, English summary).

VALIAKHMEDOV B.V. 1962. [Soil fauna characteristics of Tajikistan's gray-soil zone]. – Zool. Zhurnal, 41, 12: 1783-1792 (in Russian, English summary).

VERHOEFF K.W. 1928–32. Diplopoda. Bronn's Klassen und Ordnungen des Tierreichs, 5: 1-2021.

VERHOEFF K.W. 1936. Zur Kenntnis ostasiatischer Strongylosomiden und Fontariiden (149. Diplopoden-Aufsatz). – Zool. Anz., 115: 297-311.

VOROBIOVA I.G. 1999. [An ecofaunistic characteristic of the myriapod population (Myriapoda) in a midflow region of Yenisey River]. – Bioraznoobrazie i zhizn' pochvennoy sistemy. Abstr. 12 All-Union Conf. Soil Zool., Moscow: 33 (in Russian).

VOROBIOVA I.G., RYBALOV L.B., ROSSOLIMO T.E. & ZALESSKAYA N.T. 2002. [Zonal and landscape distribution of the myriapod fauna and populations (Myriapoda) in the Yenisey River basin]. – Izuchenie, sokhranenie i vosstanovlenie bioraznoobraziya ekosistem na Eniseyskom ekologicheskom transekte: Zhivotnyi mir, etno-ekologicheskie issledovaniya, 2. Moscow: 60-71 (in Russian).

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INDEX OF DIPLOPOD TAXA

(ORDERS, FAMILIES, GENERA, SPECIES, SUBSPECIES)
All specific and generic names are given in italics, valid names are listed in normal script, synonyms and invalid specific names in bold, subspecific names in italics and in brackets.