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THE GENERIC POSITION OF *ORTHOMORPHA BUCHARENSIS* LOHMANDER AND *O. MUMINABADENSIS* GULIČKA, AND THE TAXONOMIC STATUS OF *HEDINOMORPHA* VERHOEFF (DIPLOPODA, POLYDESMIDA, PARADOXOSOMATIDAE)

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ABSTRACT

Redescription of *Orthomorpha muminabadensis* Gulička based on topotypical specimens. It is a synonym of *Orthomorpha bucharensis* Lohmander, and the species belongs to the genus *Hedinomorpha* Verhoeff. The latter is referred definitely to the tribe Sulciferini.

INTRODUCTION

In 1933 Verhoeff published his paper on the scanty but precious collection of Myriapoda obtained during the Sven Hedin Expedition to China. A majority of the Diplopoda belonged to the family Paradoxosomatidae, of which Verhoeff described four monotypical genera. Two of these, *Kochliopus* Verhoeff and *Kansupus* Verhoeff, have long been recognized as synonyms of *Helicorthomorpha* Attems and *Kronopolites* Attems, respectively (cfr. Attems, 1937). The other two, *Hedinomorpha* Verhoeff and *Mandarinopus* Verhoeff, were treated as synonyms of *Orthomorpha* Bollman and *Sundanina* Attems, respectively, by Attems (l.c.), but reinstated as valid genera by the present writer (Jeekel, 1968), and tentatively referred to the tribe Sulciferini. With regard to *Hedinomorpha* the remark was made that

"possibly the discovery of related forms will throw some more light on the ultimate status of this genus" (Jeekel, l.c.: 74).

New information on *Hedinomorpha* has become available recently by the description of a new species, *H. biramipedicula*, from China by Zhang & Tang (1985).

Moreover, the examination of topotypical specimens of *Orthomorpha muminabadensis* Gulička, described from Muminabad, Tadzhikistan, U.S.S.R., kindly submitted to me by my colleague Dr. S.I. Golovatch, Moscow, has shown that this species belongs to *Hedinomorpha*.

In addition, Dr. Golovatch informed me that re-examination of the female type of *Orthomorpha bucharensis* Lohmander, 1933, from "Buchara, Tschilik-dara", proved the identity of this species with *O.*

muminabadensis. A redescription of this species is given presently.

Consequently, the genus *Hedinomorpha* now consists of the following taxa:

Hedinomorpha hummeli Verhoeff, 1933: 15.- China: Kansu.

Hedinomorpha bucharensis (Lohmander, 1933: 31).- U.S.S.R.: Tadjikistan. Syn.: *Orthomorpha muminabadensis* Gulička, 1972: 43.

Hedinomorpha biramipedicula Zhang & Tang, 1985: 35.- China: Shansi.

With three included species it is possible to evaluate the status of *Hedinomorpha* more precisely than before. It is clear now that the genus falls well within the spectrum of the genera assigned to the tribe Sulciferini. At the times of its reinstatement (Jeekel, 1968), this tribe included 16 named genera. Since then a considerable number of changes have been proposed. It may, therefore, be in place here to briefly enumerate the sulciferine genera recognized today. It should be emphasized here once again, that the limits of the tribe towards related paradoxosomatid tribes, such as Cnemodesmini, Orthomorphiini, Sundanini, etc. are still far from satisfactory.

The following genera are now assigned to the Sulciferini:

Annamina Attems, 1937 (1 sp., Indochina);

Anoplodesmus Pocock, 1895 (about 14 nominal sp., India, Ceylon, Burma, Sumatra);

Cawjeekelia Golovatch, 1980 (5 sp., Korea, Japan)¹);

Chapanella Attems, 1953 (1 sp., Indochina);

Chondromorpha Silvestri, 1897 (about 10 nominal sp. and ssp., India, Ceylon);

Echinopeltis Jeekel, 1979 (1 sp., Sumatra);

Harpagomorpha Jeekel, 1980 (1 sp., India);

Hedinomorpha Verhoeff, 1933 (3 sp., N. China, Centr. Asia);

Hoffmanina Jeekel, 1968 (1 sp., Mozambique);

Kaschmiriosoma Schubart, 1935 (3 sp., N. India, N. Pakistan)²);

Kronopolites Attems, 1914 (6 sp., China, Taiwan, Indochina, Thailand, N. India)³);

Mandarinopus Verhoeff, 1933 (1 sp., China);

Margaritosoma Jeekel, 1979 (3 sp., Sumatra,

Enggano, Java);

Oranomorpha Verhoeff, 1941 (4 sp., S.W. Europe, N.W. Africa, Macaronesia, Eritrea, Ethiopia);

Orthomorphella Hoffman, 1963 (1 sp., N. China, Korea, Japan)⁴);

Oxidus Cook, 1911 (4 sp., Korea, Japan, Riukiu Islands);

Paranedyopus Carl, 1932 (6 sp., India, Ceylon, Sikkim)⁵);

Parchondromorpha Jeekel, 1980 (3 sp., India)⁶);

Sichotanus Attems, 1914, (2 sp., East Siberia, Korea, N. China)⁷);

Sigipinius Hoffman, 1961 (1 sp., China);

Tylopus Jeekel, 1968 (6 sp., Burma, Thailand, Indochina)⁸).

Notes

- 1) Two generic names recently have become available for the unnamed genus comprising *Orthomorpha nordenskiöldi* (Attems, 1909) and *O. fimbriata* Attems, 1944, from Japan (Jeekel, 1968: 72). These are the one mentioned above and *Orientosoma* Golovatch, 1980. The North Korean type-species of these two genera, *C. gloriosa* Golovatch, 1980, and *C. koreana* (Golovatch, 1980), respectively, are clearly congeneric with the species described by Attems. The latter two, however, should be revised to reveal the characters of the gonopods which distinguish them from the other two species. In the light of the new information it seems right now to add to the same generic concept *Kronopolites kanoi* Takakuwa, 1943, from Japan (Jeekel: 74), which seems to be related to *C. koreana*.
- 2) Material of this genus has been examined and the tentative opinion on its relationship expressed earlier (Jeekel, 1968: 86) can be confirmed. It seems that *Kaschmiriosoma* is most closely related to *Parchondromorpha* Jeekel. The only noteworthy difference in the gonopods of the two genera concerns the great length of the solenomerite and solenophore in *Kaschmiriosoma*. Otherwise the basic structure of the gonopods is quite similar. It has been noted, that *Kaschmiriosoma* holds a position intermediate between the Sulciferini and the Cnemodesmini.
- 3) Since 1968 two species have been added (Golovatch, 1983; Jeekel, 1983), extending the known range of the genus from China as far westward as Kashmir.
- 4) Hoffman (1973) restudied material of the genus *Chamberlinius* Wang, 1956, and could discard the formerly expressed idea (Jeekel, 1968: 73) that this name is a synonym of *Orthomorphella*. The result was that *Orthomorphella* was reinstated as a valid name in the Sulciferini, whereas *Chamberlinius* was removed to the tribe Chamberliniini. *Orthomorphella*, with *O. pekuensis* (Karsch) as type-species, probably also embraces *O.*

- cristata* (Takakuwa, 1942).
- 5) The synonymy of *Akribosoma* Carl, 1935, with *Paranedyopus* Carl, 1932, proposed by Golovatch (1984), is accepted here, adding the type-species of *Akribosoma* to the former concept of the genus (Jeekel, 1980).
- 6) This was proposed as a monotypical genus (Jeekel, 1980: 168). The name *Parchondromorpha* was taken up subsequently by Golovatch (1984: 336) for a new genus containing two new species from India. Although we are dealing here with an obvious case of junior homonymy, it does not seem necessary to propose a replacement name for *Parchondromorpha* Golovatch. Actually, the two species described by Golovatch seem congeneric with the type-species of *Parchondromorpha* Jeekel.
- 7) The gonopods in *Sichotanus eurygaster* (Attems, 1898) appear to be variable in the outline of various processes and lamellae. This has led to the description of a number of forms as different species. However, it seems best to follow Golovatch, 1981, and Mikhailova, 1982, and adopt a wider morphological concept. The consequence of this is, that, besides *S. popowi* Golovatch, 1976, and *S. mandshuricus* Golovatch, 1978, also *S. longipes* Verhoeff, 1936, should be united with *S. eurygaster*.
- 8) Since 1968 only one new species has been added to this genus (Hoffman, 1973). However, Dr. H. Enghoff, Copenhagen (pers. comm.) assures me that according to this personal experience *Tylopus* is richly represented in Thailand.
- Certain genera, like *Polylobosoma* Jeekel, 1980, and *Antichirogonus* Jeekel, 1980, formerly assigned to the Sulciferini are better removed from that tribe (Jeekel, 1980: 172). However, their taxonomic position has to be clarified.
- A similar problem is formed by another recently proposed genus, *Armolites* Golovatch, 1984, based on *Kronopolites spiniger* Attems, 1936, from N.E. India. The relationship of this genus with the Sulciferini, suggested by Golovatch, should be reconsidered.

To define to some extent the position of *Hedinomorpha* I give here an

Abbreviated key to the Sulciferini.

1. Gonopods with a (post)femoral process, lobe or spine, arising from near the base of the solenomerite.....*Chapanella, Kaschmiriosoma, Parchondromorpha, Sichotanus, Tylopus* p.p.
- No such process near the base of the solenomerite..... 2
2. Tibiotarsus of gonopods consisting of a solenophore and two additional processes..... *Annamina, Anoplodesmus, Hoffmanina, Kronopolites, Mandarinos, Oranmorpha, Oxidus, Paranedyopus, Sigipinius, Tylopus* p.p.

- Tibiotarsus consisting of a solenophore and an additional process, the latter usually arising from near the base of the solenophore..... 3
- 3. Tibiotarsus of gonopods in situ curving essentially mesad, in the direction of the opposite gonopod.....*Chondromorpha, Echinopeltis, Harpagomorpha, Margaritosoma, Orthomorphella*
- Tibiotarsus of gonopods in situ curving in a lateral direction, away from the opposite gonopod. 4
- 4. Femorite of gonopods relatively short in comparison to the prefemur, distally somewhat swollen; tibiotarsus with solenophore of moderate length, broadish lamellate, not curving in a circle. Paranota weakly developed, ridgelike, caudally not produced*Cavjeekelia*
- Femorite of gonopods relatively long in comparison to prefemur, not particularly swollen distally; solenophore slender, elongate, curved in an almost complete circle. Paranota well developed, winglike, with posterior edges caudally produced at least in posterior half of body..... *Hedinomorpha*

***Hedinomorpha buharensis* (Lohmander)**

Orthomorpha buharensis Lohmander, 1933: 31, figs. 16-17. (1)
Orthomorpha muminabadensis Gulička, 1972: 43, fig. 5-1. (2)

Previous records

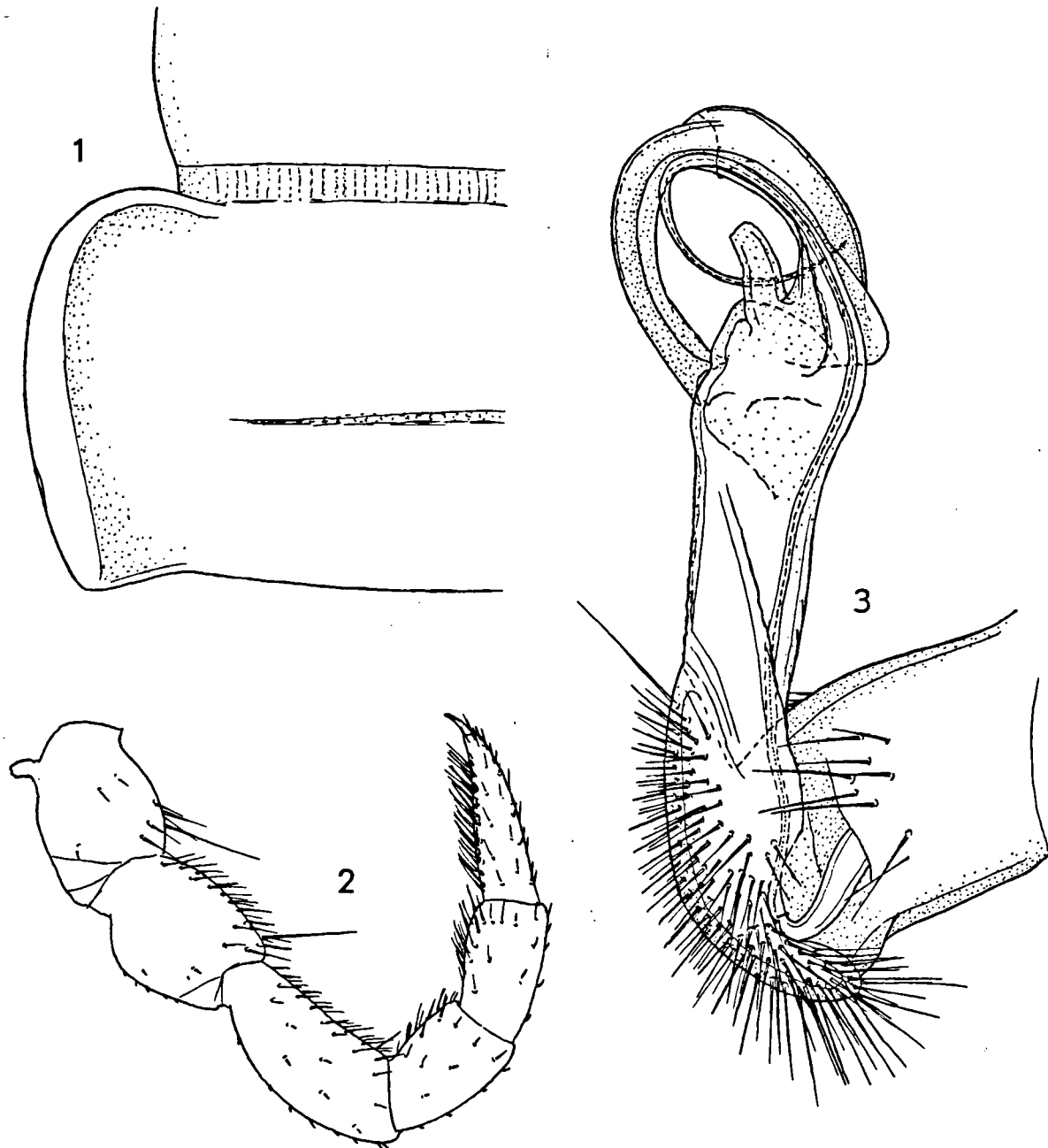
U.S.S.R., Tadjikistan, Chil-dara (= "Tschilik-dara") (1); Tadjikistan: Muminabad (2).

Material

U.S.S.R., Southern Turkmenia, Muminabad, virgin soil, 16.V.1965, leg. B. Waliakhmedow, 3♂, 3♀, 1 juv. ♂.

DESCRIPTION

Colour: Dark castaneous. Headplate darkest in frontal and vertigial regions; vertex and lateral sclerites of head areolated with pale yellowish dots; the lateral sutures yellowish. Antennae also dark castaneous, distal antennomeres darkest; antennomeres each apically annulated with brownish yellow. Collum and tergites of subsequent somites dark castaneous, light brown towards anterior part of prosomites. Lateral lappets of collum and all paranota entirely yellow. Lateral sides, venter and sternites pale brownish. Legs pale brownish to brownish yellow. Anal somite and paraprocts dark castaneous, lighter brown



Figs. 1-3. *Hedinomorpha bucharensis* (Lohmander), ♂. 1, left side of 12th somite, dorsal aspect; 2, left leg of 7th somite; 3, right gnopod, medial aspect.

ventrally; sutures of paraprocts yellowish. Epiproct yellow.

Width: ♂: 1.8-2.2 mm, ♀: 2.3-2.4 mm, juv. ♂ (19 somites): 2.0 mm.

Head and antennae: Labral emargination of moderate depth and width. Clypeus rather weakly convex, rather weakly impressed towards labrum; lateral border faintly convex, without emargination near labrum. Antennal sockets orally a little impressed, separated from each other by 1.6 times the diameter of a socket or by the length of the 2nd antennomere. Frons not particularly prominent, not demarcated from clypeus or vertex. Postantennal groove wide and rather deep; the wall in front moderately prominent. Postantennal beanshaped area weakly indicated, not inflated. Vertex transversely weakly and evenly convex; longitudinally moderately convex, strongest in upper part. Vertigial sulcus rather weakly impressed above, more deeply so below, not reaching level of sockets. Headplate shiny; pubescence moderately dense up to frons, lateral sclerites of head almost hairless. Setae of moderate length. Antennae rather short, a little clavate, with 5th and 6th antennomeres a little thicker than the others. Antennomeres 2 to 4 subcylindrical, widening a little distad; 5th more obconical; 6th obconical, with sides scarcely inflated. Pubescence moderate to rather dense. Relatively length of antennomeres 2 to 6: 0.85, 1.00, 0.90, 0.85, 0.80.

Collum: a little wider than the head, semielliptical in dorsal outline. Anterior border almost evenly convex, widely convex in middle part, slightly more convex towards lateral sides. Caudal border scarcely emarginate in middle part, widely and weakly convex more laterally, faintly knicked at base of lappet. Lateral margin widely convex, the posterior edge about rectangular and narrowly rounded. Surface smooth and shiny, along anterior margin a few fine longish hairs. Surface longitudinally almost evenly widely convex; transversely evenly convex, only slightly flattened in middle part, weakly concave at base of lateral edge, with the edge slightly flaring, though not horizontal. Lateral margin moderately incassate, the premarginal furrow quite distinct, fading away towards middle of anterior border.

Somites: Constriction moderate. Prosomites dulled by a fine but rather pronounced cellular structure. Waist of moderate width or widish, sharply demarcated from both prosomites and metatergites. Waist dorsally longitudinally ribbed down to level of paranota, but the striae not deeply impressed; striation faint and scarcely visible laterally. Metatergites smooth and shiny, with two setae in anterior somites. Transverse furrow deeply impressed in 5th to 17th somites, very faint in 18th; sulcus without sculpture, disappearing laterally at a distance of 1.5 to 2 times the diameter of a paranotum from the dorsal demarcation of the paranota. Sides granulate-leathery. Pleural keels in anterior somites up to the 7th represented by well developed curved crenulate ridges, caudally narrowly rounded but not produced. From the 8th somite onwards to about the 16th somite they are represented by a swelling above the anterior legs and an abbreviate crest above the posterior legs.

Paranota: 2nd somite a little wider than collum, 3rd and 4th each a little narrower than the preceding somites. Paranota of 2nd somite from above with anterior border widely rounded, shouldered at base. Lateroanterior edge more narrowly rounded, without tooth. Lateral border almost straight, parallel to margin of opposite paranotum. Lateroposterior edge subacuminate, acute or almost rectangular. Posterior border slightly convex, emarginate at base of paranotum. In lateral aspect the paranota are sloping a little cephalad and laterad; marginal rim of paranotum thickest in middle, the upper and lower demarcations both a little convex. Marginal rim posteriorly narrowly rounded; the rim anteriorly curving upward rather abruptly. Caudal edge projecting well behind margin of somite. Paranota of 3rd and 4th somites subsimilar; in dorsal aspect anteriorly shouldered (especially in 4th somite), with a rounded anterior and lateroanterior border. Lateral border widely convex (3rd somite) or almost straight (4th somite); the lateroposterior edge acuminate and slightly acutely angular (3rd somite) or somewhat obtusely angular and narrowly rounded (4th somite). Posterior border widely convex, narrowly concave at base. In both somites the posterior edges are projecting

caudad of border of somite (weakly so in 4th somite). Marginal rims rather thick, thicker than in 2nd somite, but narrower than in 5th. In lateral aspect the paranota are sloping a little cephalad; laterad they are horizontal. Marginal rim also ventrally demarcated. Paranota of 5th and subsequent somites (fig. 1) well developed. Anterior and lateroanterior border from above evenly rounded, a little shouldered at base. Lateral border weakly convex, becoming straight in the caudal half of the body; in poriferous somites a slight dent at pore area. Posterior edge obtuse or almost rectangular, becoming slightly acutely angular in 11th, 13th and subsequent somites. Posterior border weakly convex, narrowly concave near base of paranotum. Marginal rim laterally rather broad; anterior and posterior borders narrowly rimmed. The premarginal furrow well developed, laterocaudally ending at posterior border of paranotum, well mesad of the lateroposterior edge. Marginal rim in lateral aspect both dorsally and ventrally distinctly demarcated and on both sides a little convex, sloping slightly in anterior direction, or horizontal in posterior half of body; in poriferous paranota the marginal rim is narrowing abruptly immediately caudad of pore area. Posterior end of rim narrowly rounded, projecting caudad of border in 7th to 19th somites. Pores rather large, situated in a well impressed pit, quite near ventral demarcation of rim.

Sternites end legs: Sternites of middle somites as long as wide between anterior coxae. Cross impressions rather weakly developed; the transverse impression deepest, rather narrow and furrowlike, the longitudinal a weak and wide excavation. Pubescence moderately dense, the setae of moderate length. No sternal cones. Sternite of 4th somite rather wide, medially impressed by a rather deep furrow. Pubescence moderate. Sternite of 5th somite with a low, transversely crested process between the anterior coxae. Anterior surface of process faintly concave, the apex not at all projecting in front of the sternite; near the apex densely set with short setae. Process about two times broader than long, its width about half the distance between the anterior coxae. Crest distally with rounded lateral edges, medially weakly concave. Transverse furrow of ster-

nite rather deep; posterior half of sternite scarcely modified; pubescence moderate. Sternite of 6th somite with the anterior part scarcely, the posterior part not raised above the ventral level of the metasomal ring. Sternite transversely widely and weakly concave; the coxal sockets scarcely raised; transverse furrow shallow. Pubescence weak and unapparent. Sternite of 7th somite, laterocephalad of gonopod aperture, with a low rounded swelling. Sternite of 8th somite unmodified. Legs (fig. 2) of moderate length, incrassate, with the prefemur rather strongly convex dorsally, the femora faintly arched. Pubescence rather dense ventrally in the four proximal podomeres, dorsally and ventrally in tibiae and tarsi; setae shortish. Scopulae well developed in anterior legs, gradually thinning out towards the legs of the 11th somite and absent from there onwards. Relative length of podomeres 2 to 6 in middle legs: 0.70, 1.00, 0.55, 0.50, 0.80. Coxae of legs of 2nd pair broad, medially low triangularly inflated.

Anal somite: Upper profile straight at base, otherwise vaguely and evenly convex. Epiproct broadish, rather thick, straight and moderate length. Sides rather strongly concavely converging, becoming straight and almost parallel towards the end. Sides at apex rather narrowly rounded, with the preterminal setae close to the apex, not arising from granules and not forming a stepwise narrowing of the epiproct. Apex straight truncate or vaguely convex. Surface of anal somite irregularly rugulose. Paraprocts also somewhat rugulose, the setae not on tubercles. The marginal rims narrowish and of moderate height. Hypoproct broadish triangular-truncate or trapezoidal; the sides a little concave, especially at base, the caudal margin a little convex with the setiferous tubercles well developed and equalling the middle of the caudal margin.

Gonopods (fig. 3): Coxa relatively short and thick, distally with some setae on lateral and medial sides. Prefemur elongate-ovoid, laterally sharply obliquely demarcated from acropodite. Femorite straight, stoutish, medially with an oblique crest. Postfemoral section of femorite indistinctly demarcated. Spermal channel following a straight course along medio-caudal side of femorite, towards base of solenomer-

ite. Tibiotarsus consisting of a long, ribbonlike solenophore, curving almost circularly in a lateral direction, sheating the solenomerite over most of its length, and bearing about halfway a short, membranous lateral lappet. Apex of solenophore truncate. At caudal side of base of solenophore a short additional tibiotarsal branch. Solenomerite slender, gradually tapering towards apex.

Female: Antennal sockets separated by 1.3 times the diameter of a socket or by 0.85 times the length of the 2nd antennomere. Relative length of antennomeres 2 to 6: 1.00, 1.00, 0.85, 0.85, 0.85. Collum about as wide as head. Somite 2 a little wider than collum; the 3rd and 4th somites each scarcely wider than the preceding somites. Sternites of middle somites 1.7 times wider than long. Cross impressions weakly developed. Legs of moderate width, not particularly slender; femora straight. Relative length of podomeres 2 to 6: 0.60, 1.00, 0.50, 0.50, 0.70. Ventral side of 2nd somite with caudal margin widely paramedially emarginate to accommodate coxae of 2nd legs. Ventral side of 3rd somite without special modification. Coxae of 2nd legs not modified, medial side straight, not convex.

Remarks

H. bucharensis differs from the other two species of the genus by the gonopods having a shorter coxa, a somewhat thicker femorite, and in particular by the distinctly more proximal basis and the relative shortness of the tibiotarsal branch. In *hummelii* this branch ("Pseudosolänophor", Verhoeff) is particularly conspicuous in being long, recurved and directed more or less parallel to the solenophore. Apparently the lateral lappets of the solenophore are lacking in *hummelii*. *H. biramipedicula* has the solenophore more complicated by the presence of several secondary lamellae; this species has the tibiotarsal branch only a little longer than *bucharensis*, with its apex shortly bifurcate. In the non-gonopod characters the most obvious character of *bucharensis* seems to be found in the shape of the epiproct. This has a "normal" outline instead of being clubshaped as in the other two species.

In addition to the localities mentioned above, *H. bu-*

charensis has been collected at the following Central Asian localities: Faizabad, Khodzha-Obi-G-arm, Sharak, and Galaba (Golovatch, pers. comm.). Apparently the species is the only paradoxosomatid occurring in the area.

The allocation of *bucharensis* in an otherwise apparently north-chinese genus is interesting because of the resulting distributional pattern. *Hedinomorpha* now appears to occupy a long east-west zone in the southern part of the eastern half of the Palearctic region, a wide distributional pattern rarely met with in Asiatic paradoxosomatid genera. The record of a species of *Kronopolites* in Kashmir (Golovatch, 1983) results in a somewhat similar geographical picture for that genus. Geographically, *Hedinomorpha* appears to form largely the northern limit of the distribution of the Paradoxosomatidae in Asia. To the west, from Iran to Central Europe, this limit is shaped by the range of the genus *Strongylosoma* Brandt, an equally widely distributed but taxonomically unrelated paradoxosomatid genus. The ecological, zoogeographical and paleogeographical meaning of these large ranges remains to be investigated.

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