

The genus *Cultroribula* (Acari: Oribatida: Astegistidae) in Mongolia, with new findings from Altai Mountains and remarks on known species of the world

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Abstract

The oribatid mite genus *Cultroribula* Berlese, 1908 is represented in Mongolia with six species. Most species of *Cultroribula* found in Mongolia are inhabitants of litter of various types of forests, soils of steppes and the high mountain alpine zone, but are also commonly found in lichens growing on trees or bare rock and terricolous bryophytes. In this work, two species, *Cultroribula altaica* **sp. nov.** and *Cultroribula rarisetosa* **sp. nov.**, are described as new to science based on adults collected from litter of cool temperate forests and lichens growing on bare rock, respectively, in western Mongolia. In addition, two known species, *Cultroribula berolina* Weigmann, 2006 and *Cultroribula vtorovi* Krivolutsky, 1971 are redescribed. *Cultroribula berolina* is recorded for the first time for the fauna of Asia. Species descriptions are accompanied with detailed illustrations. Data on geographical distribution and habitat ecology are given for all known species in the world. Issues concerning the taxonomic status of some genera of Astegistidae and species of *Cultroribula* are discussed. The subgenus *Furcoppia* (*Mexicoppia*) is considered as a junior synonym of *Cultroribula*. The new combination, *Cultroribula hauseri* (Mahunka, 1983) for *Furcoppia* (*Mexicoppia*) *hauseri* Mahunka, 1983 is proposed. Furthermore, a key is provided for the identification of adults of the known species of *Cultroribula* in Mongolia.

Key words: new species, redescription, habitat ecology, distribution, identification key

Introduction

The oribatid mite family Astegistidae was erected by Balogh (1961) to encompass three genera, namely *Astegistes* Hull, 1916, *Cultroribula* Berlese, 1908 and *Furcoribula* Balogh, 1943. Later, several more genera were erected within the Astegistidae (see Subías 2004). Only two of the above-mentioned genera were found in Mongolia with four species. One of these species belongs to *Astegistes*, whereas the three other species belong to *Cultroribula* (Bayartogtokh 2007).

The present work deals with the genus *Cultroribula*, which is the largest in the family, showing extensive taxonomic diversity, with its representatives occurring in all continents of the world, except Antarctica. Most *Cultroribula* species are native to the Holarctic region. Recently,

Subías (2004) transferred some species of *Cultroribula* to *Furcoppia (Mexicoppia)*. In addition to the three Holarctic species, newly combined with *Furcoppia (Mexicoppia)*, Subías (2004) listed 24 species in *Cultroribula*. Furthermore, several fossil species have been revealed from Baltic amber and Jurassic deposits (Krivolutsky *et al.* 1990).

In a recent review of Central European oribatids, Weigmann (2006) accepted the genus *Cultroribula* in its broad sense, a view which is followed in the present work.

The genus *Cultroribula* is unique among the Astegistidae in the combination of following characters: lamella fused together; lamellar cusp long, separate from each other or close adjacent; tutorium well developed, with free distal cusp; anterior margin of notogaster well developed separating it from prodorsum; humeral process well developed, sometimes sharply projected distally; 10 or 11 pairs of notogastral setae short or medium long; chelicerae chelate-dentate; palpal eupathidium *acm* and solenidion separate; genital and anal apertures interspaced far from each other; genital plates with four to six pairs of setae; pedotectum I without deep incision; legs monodactylous or tridactylous, seta *d* absent from tibiae and genua. Immatures are not yet known.

The aim of this work is to describe two unknown species, *Cultroribula altaica* sp. nov. and *Cultroribula rarisetosa* sp. nov., and to redescribe two other species, *Cultroribula berolina* Weigmann, 2006 and *Cultroribula vtorovi* Krivolutsky, 1971, which were recently collected in western Mongolia. *Cultroribula berolina* is recorded for the first time from Asia. Giving remarks on the arguable issues of the status of some genera of Astegistidae and species of *Cultroribula*, on biogeography and habitat ecology of its known members, and construction of an identification key to the *Cultroribula* species occurring in Mongolia are additional objectives of the present work. The study of oribatid mite diversity in Mongolia is the subject of ongoing research as part of biodiversity assessments in various habitats of the country with emphasizes on effects of climate change and pastoral livestock grazing.

Material and methods

All materials used in this study were collected by the author with assistance of some of his graduate students from Altai Mountains in western Mongolia. Specimens were mounted in temporary slides to view the anterior, lateral, posterior aspects and other details of body, and then preserved in alcohol. All examined materials and data on their localities are given in the respective 'material examined' section. Species studied here are represented as adults.

Specimens were cleared in lactic acid, mounted on temporary slides and preserved in alcohol. A differential interference contrast microscope was used for investigation in transmitted light. Line drawings were made using a camera lucida attached to the compound microscope.

The morphological terminology used below is mostly that developed over many years by F. Grandjean (see Travé & Vachon 1975 for references), also that by Weigmann (2006) and Norton and Behan-Pelletier (2009). All measurements are given as a range, with the mean in parentheses. Body length was measured in lateral view, from the tip of the rostrum to the

posterior edge of the ventral plate, to avoid discrepancies caused by different degrees of notogastral distension. Notogastral length was also measured in lateral aspect (when the dorsosejugal groove is discernable), from the anterior to the posterior edge; notogastral width refers to the maximum width in dorsal aspect. Setal formulas of the legs are given as numbers per segment for appendages (from trochanter to tarsus) and as number per podosomal segment (I-IV) for epimeres. Most species of *Cultroribula* show the same structure and setation of legs, palps and chelicerae. Therefore, in this work I made detailed descriptions and illustrations of the chelicera and the palp only for one of the studied species.

Results

Cultroribula altaica sp. nov.

(Figs. 1-3)

Diagnosis. Medium-sized species, covered with thin cerotegument; rostrum with 15–17 teeth, among them three central teeth much larger than lateral teeth; lamellae wide, fused medially; lamellar cusp long and wide, with large outer and inner teeth of subequal size; rostral and lamellar setae moderately long, with conspicuous barbs, interlamellar seta short, smooth; sensillus with short stalk and long fusiform head, its distal end setiform, long; tutorium wide at base, with long cusp sharply pointed distally; humeral process of notogaster sharply projected distally; ten pairs of notogastral setae short; six pairs of genital setae, legs tridactylous.

Measurements. Body length: 318–336 (328) μm ; width of notogaster 201–214 (208) μm . In total 15 specimens were measured.

Integument. Body yellowish to yellowish-brown in color. Surface of body and leg segments with very thin, nearly smooth cerotegument. Integument microtuberculate on lateral part of prodorsum and around leg acetabula.

Prodorsum. Rostrum with 15–17 teeth, among them three central teeth much larger than lateral teeth; most central tooth slightly shorter than two lateral teeth; size of rostral teeth becoming smaller toward posterior direction (Figs. 1 & 3E). Rostral seta (*ro*) moderately long, with sparse barbs. Lamella wide, fused medially; lamellar cusp slightly longer, but narrower than basal part of lamella, with large outer and inner teeth of subequal size. Lamellar seta (*le*) long, about 1.5 times as long as *ro*, sparsely barbed; interlamellar seta (*in*) short, smooth. Bothridium (*bo*) large, with wide opening directed anterolaterad, partly concealed under anterior margin of notogaster. Exobothridial seta (*ex*) short, as long as *in*, smooth. Sensillus (*ss*) with short stalk and long fusiform head, its distal end setiform, long. Tutorium (*tu*) wide at base, with long cusp sharply pointed distally almost reaching alveolus of rostral seta (Fig. 1C).

Notogaster. Oval, longer than wide, anterior margin almost straight, slightly rounded; humeral process sharply projected distally in both dorsal and lateral views (Fig. 1A & C). Ten pairs of notogastral setae short, thin, smooth, all setae equal in length. Lyrifissures *im*, *ih*, *ips*, *ip* and opisthonotal gland opening (*gla*) small in size; lyrifissure *ia* not evident.

Gnathosoma. Subcapitular mentum nearly as long as wide, without noticeable microtubercles. Hypostomal setae *a*, *m* and *h* medium long, thin, smooth (Fig. 1B). Chelicera typical for genus as shown in figure 3B, slender with few slightly sclerotized blunt teeth; seta *cha* barbed, about 1.4 times as long as smooth *chb*; Trägårdh's organ well developed, large. Palp typical for genus as shown in figure 3A, palpal setation: 0-2-1-3-9, including solenidion ω of tarsus.

Epimeral region. Apodemes *apo.2*, *apo.sj* and *apo.3* well developed, nearly transversely oriented. Epimeral setae short, smooth; setal formula: 3-1-3-3. Discidium well developed, projecting distally; circumpedal carina well developed, its anterior tectum reaching level of pedotectum II (Fig. 1B).

Ano-genital region. Anal and genital apertures medium in size, situated far from each other. Genital aperture nearly rounded, genital plates with six pairs of short, smooth setae; aggenital seta (*ag*) as long as genital setae, thin, smooth. Anal aperture widened posteriorly, slightly longer than wide; anal and adanal setae short, equal in size. Adanal lyrifissure (*iad*) well developed, situated adjacent to anterolateral corner of anal plate (Fig. 1B).

Legs. Tarsi heterotridactylous, median claw conspicuously thicker than lateral claws. Trochanter and femora of all legs with large porose areas. Most of tarsal and tibial setae barbed, but those of genua, femora and trochanters mostly smooth. Formula of leg setation (including famulus): I (1-5-3-4-18), II (1-5-2-4-16), III (1-3-1-3-15); IV (1-3-2-3-12); formula of solenidia: I (1-2-2); II (1-1-2); III (1-1-0); IV (0-1-0). Setation of legs as shown in figures 2 and 3D.

Material examined. Holotype (female): Mts. Mongol Altai, close to Lake Dayan, District Sagsai, Province Bayan-Ulgii, litter of cool temperate larch forest interior (*Larix sibiricus* Ledebour, 1833), N48°14', E88°57', elevation 2375 m a.s.l., 10 July 2010, Coll. B. Bayartogtokh; fourteen paratypes (eight females and six males): same data as holotype. The holotype and ten paratypes are deposited in the collection of the Department of Zoology, National University of Mongolia, Ulaanbaatar, Mongolia, and four paratypes are in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany. All type specimens are preserved in alcohol.

Remarks. *Cultroribula altaica* **sp. nov.** is easily distinguishable from other species of *Cultroribula* by the combination of following characters: sensillus with very long setiform tip, dentation of rostrum and sharply projected humeral process of notogaster. Among the known species of *Cultroribula*, only two Palaearctic species, namely *C. neonominata* Subías, 2004 and *C. variolosa* Fujikawa, 1991 resemble the present new species in the fusiform sensilli with pointed distal tip. However, both mentioned species are easily distinguishable from the new species in the short distal tip of sensilli as opposed to very long setiform distal tip of sensilli in *Cultroribula altaica* **sp. nov.** Moreover, they differ by the smoothly rounded tip of lamellar cusps in contrast to cusps with large outer and inner teeth in the new species, 11 pairs of very marginally placed notogastral setae as opposed to normally situated 10 pairs of setae in the new species, and different structure of rostrum. Both *C. neonominata* and *C. variolosa* are only known from Japan (Aoki 1965; Fujikawa 1991).

***Cultroribula rarisetosa* sp. nov.**

(Fig. 4)

Diagnosis. Medium-sized species, covered with thin cerotegument; rostrum with 13–15 teeth, among them four central teeth much larger than lateral teeth; lamellae wide, fused medially; lamellar cusp long and wide, with large outer tooth, but without inner tooth; rostral and lamellar setae moderately long, with conspicuous barbs, interlamellar seta short, smooth; sensillus with short stalk and club-shaped head with minute barbs; tutorium wide at base, with long cusp sharply pointed distally; humeral process of notogaster not sharply projected, but rounded distally; ten pairs of notogastral setae short; four pairs of genital setae, legs tridactylous.

Measurements. Body length: 338–346 (342) μm ; width of notogaster 187–194 (191) μm . In total two specimens were measured.

Integument. Body yellowish to yellowish-brown in color. Surface of body and leg segments with very thin, nearly smooth cerotegument. Integument microtuberculate on lateral part of prodorsum and around leg acetabula.

Prodorsum. Rostrum with 13–15 teeth, among them four central teeth much larger than lateral teeth; two most central teeth slightly shorter than next lateral teeth; size of rostral teeth becoming smaller toward posterior direction (Fig. 4B & C). Rostral seta moderately long, with long barbs. Lamella wide, fused medially; lamellar cusp slightly longer, but narrower than basal part of lamella, with large outer tooth, but without inner tooth (Fig. 4D). Lamellar seta long, about 1.6 times as long as *ro*, sparsely barbed; interlamellar seta short, thin, smooth. Bothridium large, with wide opening directed anterolaterad, partly concealed under anterior margin of notogaster. Exobothridial seta short, as long as *in*, smooth. Sensillus with short stalk and long fusiform head, distal end of which setiform, long. Tutorium wide at base, with long cusp sharply pointed distally, almost reaching alveolus of rostral seta (Fig. 4A & G).

Notogaster. Oval, longer than wide, anterior margin almost straight, slightly rounded; humeral process not sharply projected, but rounded distally in both dorsal and lateral views (Fig. 4A & G). Ten pairs of notogastral setae short, thin, smooth, all setae equal in length. Lyrifissures *im*, *ih*, *ips*, *ip* and opisthonotal gland opening well developed; lyrifissure *ia* not evident.

Gnathosoma. Subcapitular mentum nearly as long as wide, with minute microtubercles. Hypostomal setae *a*, *m* and *h* medium long, thin, smooth (Fig. 4F). Chelicera typical for genus as shown in the previous species, with few slightly sclerotized blunt teeth; seta *cha* barbed, about 1.5 times as long as smooth *chb*; Trägårdh's organ well developed, large. Palp typical for genus as in the previous species, palpal setation: 0-2-1-3-8, including solenidion ω of tarsus.

Epimeral region. Apodemes *apo.2*, *apo.sj* and *apo.3* well developed, slightly obliquely or nearly transversely oriented. Epimeral setae short, smooth; setal formula: 3-1-3-3. Discidium well developed, projecting distally; circumpedal carina well developed, its anterior tectum reaching level of pedotectum II (Fig. 4F).

Ano-genital region. Anal and genital apertures medium in size, situated far from each other. Genital aperture nearly rounded, genital plates with four pairs of short, smooth setae (Fig. 4E). Aggenital seta as long as genital setae, thin, smooth. Anal aperture widened posteriorly, slightly longer than wide; anal and adanal setae short, equal in size. Adanal lyrifissure well developed, situated adjacent to anterolateral corner of anal plate (Fig. 4F).

Legs. Tarsi heterotridactylous, median claw conspicuously thicker than lateral claws. Trochanter and femora of all legs with large porose areas. Setation of legs as in the former species. Most of tarsal and tibial setae barbed, but those of genua, femora and trochanters mostly smooth. Formula of leg setation (including famulus): I (1-5-3-4-18), II (1-5-2-4-15), III (1-3-1-3-15); IV (1-3-2-3-12); formula of solenidia: I (1-2-2); II (1-1-2); III (1-1-0); IV (0-1-0).

Material examined. Holotype (female): Mts. Mongol Altai, close to Lake Dayan, District Sagsai, Province Bayan-Ulgii, foliose or subfruticose lichens growing on bare rocks (*Xantoria candelaria*, *Melanelixia exasperatula*, *Parmelia sulcata*), N48°15', E88°54', elevation 2337 m a.s.l., 16 July 2010, Coll. B. Bayartogtokh; one paratype (female): same data as holotype. The holotype and a paratype are deposited in the collection of the Department of Zoology, National University of Mongolia, Ulaanbaatar, Mongolia. All type specimens are preserved in alcohol.

Remarks. *Cultroribula rarisetosa* **sp. nov.** is clearly distinguishable from other species of *Cultroribula* by the combination of following characters: absence of inner tooth of lamellar cusp, presence of only four pairs of genital setae and dentation of rostrum. Among the known species of *Cultroribula*, only four Palearctic species, *C. lata* Aoki, 1961, *C. angulata* Aoki, 1984, *C. elongata* Fujikawa, 1972 and *C. neonominata* Subías, 2004 are being with four pairs of genital setae. However, none of these species show outer teeth of lamellar cusps, and moreover they differ in the structure of rostral dentation and sensilli.

In the description of a Siberian species, *C. ligulata*, Grishina (1980) illustrated four pairs of genital setae, but she did not mention about this structure in the description. Judging the figure 4 of her work, it is obvious that she overlooked the genital seta g_1 , which is always at the anterior edge of genital plate. Moreover, *C. ligulata* have different structures of rostrum (with only three large teeth deeply incised in-between), lamella with smoothly rounded narrow cusp, sensillus with rough barbs throughout its head, and very short interlamellar and notogastral setae, in which its clearly differs from *C. rarisetosa* **sp. nov.**

***Cultroribula vtorovi* Krivolutsly, 1971**

(Fig. 5)

Cultroribula vtorovi Krivolutsly, 1971, p. 940, fig. 2.

Cultroribula vtorovi: Krivolutsly, 1975, p. 184, fig. 378; Bayartogtokh, 2007, p. 64, fig. 5.

Furcoppia (Mexicoppia) vtorovi: Subías, 2004, p. 92.

Diagnosis. Medium-sized species, covered with thin cerotegument; rostrum with 17 teeth, among them five central teeth much larger than lateral teeth and deeply incised; lamellae wide,

fused medially; lamellar cusp long and wide, with large outer and slightly smaller inner teeth; rostral and lamellar setae moderately long, with conspicuous barbs, interlamellar seta short, thin, smooth; sensillus with short stalk and club-shaped or fusiform head smooth or minutely barbed; tutorium wide at base, with long cusp sharply pointed distally; humeral process of notogaster projected distally or rounded; ten pairs of notogastral setae short; five or six pairs of genital setae, legs tridactylous.

Measurements. Body length: 348–360 (355) μm ; width of notogaster 210–220 (216) μm ; length of notogaster 259–271 (266) μm . In total three specimens were measured.

Integument. Body yellowish to yellowish-brown in color. Surface of body and leg segments with very thin, nearly smooth cerotegument. Integument microtuberculate on lateral part of prodorsum and around leg acetabula.

Prodorsum. Rostrum with 17 teeth, among them five central teeth much larger than lateral teeth and deeply incised; size of rostral teeth becoming smaller toward posterior direction (Fig. 5C). Rostral seta moderately long, with long barbs (Fig. 5E). Lamella wide, fused medially; lamellar cusp slightly longer, but narrower than basal part of lamella, with large outer and slightly smaller inner teeth. Lamellar seta long, about 1.3 times as long as *ro*, finely barbed (Fig. 5F). Interlamellar seta short, thin, smooth; bothridium large, with wide opening directed anterolaterad, partly concealed under anterior margin of notogaster (Fig. 5A). Exobothridial seta short, but longer than *in*, smooth. Sensillus with short stalk and club-shaped or fusiform head smooth or minutely barbed. Tutorium wide at base, with long cusp sharply pointed distally, but not reaching alveolus of rostral seta (Fig. 5D).

Notogaster. Oval, longer than wide, anterior margin almost straight, slightly rounded; humeral process projected distally in both dorsal and lateral views (Fig. 5A & D). Ten pairs of notogastral setae short, thin, smooth, all setae equal in length. Lyrifissures *im*, *ih*, *ips*, *ip* and opisthonotal gland opening (*gla*) well developed; lyrifissure *ia* not evident.

Gnathosoma. Subcapitular mentum nearly as long as wide, with minute microtubercles. Hypostomal setae *a*, *m* and *h* medium long, thin, smooth (Fig. 5B). Chelicera typical for genus as shown in *C. altaica* sp. nov., with few slightly sclerotized blunt teeth; seta *cha* barbed, about 1.4 times as long as smooth *chb*; Trägårdh's organ well developed, large. Palp typical for genus as in *C. altaica* sp. nov., palpal setation: 0-2-1-3-8, including solenidion ω of tarsus.

Epimeral region. Apodemes *apo.2*, *apo.sj* and *apo.3* well developed, slightly obliquely or nearly transversely oriented. Epimeral setae short, smooth; setal formula: 3-1-3-3. Discidium well developed, projecting distally; circumpedal carina well developed, its anterior tectum reaching level of pedotectum II (Fig. 5B).

Ano-genital region. Anal and genital apertures medium in size, situated far from each other. Genital aperture nearly rounded, genital plates with five or six pairs of short, smooth setae. Aggenital seta as long as genital setae, thin, smooth. Anal aperture widened posteriorly, slightly longer than wide; anal and adanal setae short, equal in size. Adanal lyrifissure well developed, situated adjacent to anterolateral corner of anal plate (Fig. 5B).

Legs. Tarsi heterotridactylous, median claw conspicuously thicker than lateral claws. Trochanter and femora of all legs with large porose areas. Setation of legs as in *C. altaica* sp. nov. Most of tarsal and tibial setae barbed, but those of genua, femora and trochanters mostly smooth. Formula of leg setation (including famulus): I (1-5-3-4-18), II (1-5-2-4-15), III (1-3-1-3-15); IV (1-3-2-3-12); formula of solenidia: I (1-2-2); II (1-1-2); III (1-1-0); IV (0-1-0).

Material examined. Three specimens (two females and one male): Mts. Mongol Altai, close to Lake Dayan, District Sagsai, Province Bayan-Ulgii, litter of cool temperate larch forest (*Larix sibiricus* Ledebour, 1833), N48°14', E88°56', elevation 2358 m a.s.l., 04 July 2010, Col. B. Bayartogtokh. All specimens are preserved in alcohol and deposited in the collection of the Department of Zoology, National University of Mongolia.

Remarks. The features of the specimens from Mongolia agree well with those of the specimens from Kyrgyzstan as described by Krivolutsky (1971), and redescribed by Bayartogtokh (2007). The only differences are the relatively shorter interlamellar seta in the present material, more sharply projected humeral process and presence of six pairs of genital setae rather than five pairs in the previously studied specimens. In addition the body size of these specimens was slightly larger than those of the type specimens described by Krivolutsky (1971), and specimens studied previously by me. In my opinion, these are intraspecific variations of different populations of this widely distributed Palaearctic species, which do not merit taxonomic recognition.

***Cultroribula berolina* Weigmann, 2006**

(Figs. 6 & 7)

Cultroribula berolina Weigmann, 2006, p. 234, fig. 125d.

Cultroribula berolina: Subías, 2006, p. 139; Weigmann, 2008, p. 146, figs. 1 & 2.

Diagnosis. Small species, covered with thin cerotegument; males relatively smaller than females; rostrum with three large central teeth of equal size, deeply incised in-between, and further two small teeth situated laterally; lamella relatively narrow, fused medially; lamellar cusp slightly shorter, but wider than basal part of lamella, with large rounded distal end bearing long lamellar seta; rostral and lamellar setae moderately long, with conspicuous barbs, interlamellar seta short, thin, smooth; sensillus with short stalk and club-shaped head smooth or with minute barbs; tutorium wide at base, with relatively short, but sharply pointed cusp distally not reaching alveolus of rostral seta; humeral process of notogaster well developed, with distinct protruding blades; ten pairs of notogastral setae medium long; five or six pairs of genital setae, legs monodactylous.

Measurements. Body length: 278–291 (285) μm ; width of notogaster 131–157 (145) μm ; length of notogaster 198–205 (202) μm . In total eight specimens were measured.

Integument. Body yellowish to light yellowish in color. Surface of body and leg segments with very thin, nearly smooth cerotegument. Integument finely microtuberculate on lateral part of prodorsum and around leg acetabula.

Prodorsum. Rostrum with three large central teeth of equal size, deeply incised in-between; further two small teeth situated laterally (Fig. 6). Rostral seta moderately long, with fine barbs. Lamella relatively narrow, fused medially; lamellar cusp slightly shorter, but wider than basal part of lamella, with large rounded distal end bearing long lamellar seta. Interlamellar seta short, thin, smooth; bothridium large, with wide opening directed anterolaterad, partly concealed under anterior margin of notogaster (Figs. 6 & 7B). Exobothridial seta short, but longer than *in*, smooth. Sensillus with short stalk and club-shaped head minutely barbed. Tutorium wide at base, with relatively short, but sharply pointed cusp distally not reaching alveolus of rostral seta (Figs. 6C & 7B).

Notogaster. Oval, longer than wide, anterior margin almost straight, slightly rounded; humeral process well developed, with distinct protruding blades (Fig. 6A & B). Ten pairs of medium long notogastral setae thin, smooth, all setae subequal in length. Lyrifissures *im*, *ih*, *ips*, *ip* and opisthonotal gland opening (*gla*) well developed; lyrifissure *ia* not evident.

Gnathosoma. Subcapitular mentum nearly as long as wide, with minute microtubercles. Hypostomal setae *a*, *m* and *h* medium long, thin, smooth (Fig. 7A). Chelicera typical for genus as shown in *C. altaica* sp. nov., with few slightly sclerotized blunt teeth; seta *cha* barbed, about 1.4 times as long as smooth *chb*; Trägårdh's organ well developed, large. Palp typical for genus as in *C. altaica* sp. nov., palpal setation: 0-2-1-3-8, including solenidion ω of tarsus.

Epimeral region. Apodemes *apo.2*, *apo.sj* and *apo.3* well developed, slightly obliquely oriented. Epimeral setae medium long, smooth; setal formula: 3-1-3-3. Discidium well developed, projecting distally; circumpedal carina well developed, its anterior tectum not reaching level of pedotectum II (Fig. 7A).

Ano-genital region. Anal and genital apertures medium in size, situated far from each other. Genital aperture nearly rounded, genital plates with five or six pairs of short, smooth setae. Aggenital seta as long as genital setae, thin, smooth. Anal aperture widened posteriorly, slightly longer than wide; anal and adanal setae short, equal in size. Adanal lyrifissure (*iad*) well developed, situated adjacent to anterolateral corner of anal plate (Fig. 7A).

Legs. Tarsi monodactylous, trochanter and femora of all legs with large porose areas. Setation of legs similar to that of *C. altaica* sp. nov. Most of tarsal and tibial setae barbed, but those of genua, femora and trochanters mostly smooth. Formula of leg setation (including famulus): I (1-5-3-4-18), II (1-5-2-4-15), III (1-3-1-3-15); IV (1-3-2-3-12); formula of solenidia: I (1-2-2); II (1-1-2); III (1-1-0); IV (0-1-0).

Material examined. Eight specimens (five females and three males): Mts. Mongol Altai, close to Lake Dayan, District Sagsai, Province Bayan-Ulgii, foliose or subfruticose lichens growing on bare rocks (*Xantoria candelaria*, *Melanelixia exasperatula*, *Parmelia sulcata*), N48°14', E88°57', elevation 2375 m a.s.l., 03 July 2010, Col. B. Bayartogtokh. Additional material: eleven specimens (five females and six males): Sevsuul valley, Eastern shore of the

Lake Hövsgöl, District Khankh, Province Hövsgöl, fruticose lichens (*Usnea* sp.) growing on larch trees (*Larix sibiricus* Ledebour, 1833), 51°16'N, 100°74'E, elevation 1680 m, 08 July 2007, Col. B. Bayartogtokh.

Remarks. The features of the Mongolian specimens correspond well with those of the European materials as described by Weigmann (2006, 2008). The only differences are the presence of six pairs of genital setae in the Mongolian specimens in contrast to five pairs in the European specimens, tutorium without long free tip in the present specimens (only some specimens have relatively short free tip of tutorium) as opposed long acute tip in the type specimens. Except for these points, all other characters of the Mongolian specimens match well with those of the European specimens. Therefore, I consider the above-mentioned differences as intraspecific variations of different populations of this Palaearctic species. It is worth to mention that I found distinct difference in body size between the female and male, as the latter was relatively smaller and slender than the former.

This is the first record of *C. berolina* in Asia. Among the monodactylous species of *Cultroribula*, *C. elongata* Fujikawa, 1972 known from Japan resembles *C. berolina* in general appearance of body, indentation of rostrum and club-shaped sensillus. However, the Japanese species has four pairs of genital setae in contrast to five or six pairs in *C. berolina*. On the other hand, *C. elongata* is poorly known in terms of morphological characters and the original description is not adequate for further detailed comparison (see Fujikawa 1972).

Discussion

According to Subías (2011), the family Astegistidae comprises now 10 nominal genera and one subgenus. The family placement and taxonomic status of some of these genera are, however, doubtful. For instance, the genus *Furcoppia* was erected by Balogh and Mahunka (1966) encompassing in Metrioppiidae as main characters fit to those of this family, but later Subías (2004) moved it to the Astegistidae. Some genera, e.g. *Multoribula* Balogh et Mahunka, 1966 and *Lamellozetes* Covarrubias, 1967 were only provisionally placed in the Astegistidae, as they show some of their characters different from the type of this family (Balogh & Mahunka 1966; Covarrubias 1967), but remained in the Astegistidae until today. Moreover, Mahunka (1983) described a new subgenus, *Furcoppia (Mexicoppia)* from Mexico, and Pérez-Iñigo and Sarasola (1995) proposed another subgenus of *Furcoppia*, *Monofurcoppia* from Uruguay, later, Subías (2004) separated *Monofurcoppia* as an independent genus.

However, in my opinion the differential diagnoses of these subgenera are insufficient; they differ from nominal genus as well as from each other by very slight features, which might be considered as species level characters. *Monofurcoppia* differs from *Furcoppia* only in the number of leg claws, while some genera of Astegistidae including *Cultroribula* contain both monodactylous and tridactylous species. The subgenus *Mexicoppia* differs from nominal subgenus, *Furcoppia*, by the shape of rostral teeth and development of humeral process of notogaster, but these characters are also variable among the species within some genera of

Astegistidae (e.g. *Cultroribula*, *Furcoppia*). Even Mahunka (1983, 1985) reported intraspecific variations of the size and the form of rostral teeth, the position and the shape of the adanal lyrifissure and the anal setae for some species of *Furcoppia*.

The subgenus *Mexicoppia* seems to be more closely related to *Cultroribula* than *Furcoppia* as already mentioned by Weigmann (2008). Its type species, *Furcoppia (Mexicoppia) hauseri* Mahunka, 1983 has a rostrum with three larger central and 6-8 smaller lateral teeth, a well-developed humeral process of notogaster, an anteriorly narrowed anal plate, a lamellar cusp with inner and outer teeth, a distally barbed fusiform sensillus, 10 pairs of notogastral setae and six pairs of genital setae, all of which are typical characters of *Cultroribula*. Therefore, I consider *Mexicoppia* as a junior synonym of *Cultroribula* (**syn. nov.**).

The status of several other genera of Astegistidae mentioned above also require further detailed study and critical revision, but these issues are beyond the scope of the present work. In addition, some of the known species of *Cultroribula* might be conspecific. For instance, three tropical species, *C. bicuspidata* Mahunka, 1978, *C. castriensis* Mahunka, 1985 and *C. zicsii* Balogh et Mahunka, 1981 seem conspecific to me, as all of them show sensilli with distally pointed clavate head and long peduncles, lamellae with smoothly ended narrow cusps, rostrum with single deep incision at the center, and the presence of five pairs of genital setae. The only noticeable difference is the larger body size of *C. castriensis* than in the other species. Examination of the type materials is required for clarification of the taxonomic status of these species.

In connection with the above-proposed synonymization, all species which were transferred to *Furcoppia (Mexicoppia)* by Subías (2004, 2008), namely *C. breviclavata* Aoki, 1984, *C. dentata* Willmann, 1950, *C. microdentata* Krivolutsky, 1962, *C. taigagica* Bayartogtokh, 2007 and *C. vtorovi* Krivolutsky, 1971 should be moved back to *Cultroribula*. In addition, the Mexican species should be included in this genus, therefore the new combination, *Cultroribula hauseri* (Mahunka, 1983) **comb. nov.** is proposed here. Including these six species and the two new species described in the present paper, the genus *Cultroribula* includes 34 species.

In the here accepted circumscription, *Cultroribula* has a world-wide distribution. Most *Cultroribula*-species, i.e. 23 species, were found in the northern hemisphere, whereas 11 species are limited to the tropical areas of the southern hemisphere. Only two species, *C. bicultrata* (Berlese, 1905) and *C. dentata* Willmann, 1950 have broad distributions in the Holarctic region with occurrences in Eurasia and North America (Krivolutsky 1962, 1975; Marshall *et al.* 1987).

Few other species, such as *C. lata* Aoki, 1961, *C. berolina*, *C. vtorovi* and *C. microdentata* Krivolutsky, 1962 have relatively wide ranges in the Palaearctic region. *Cultroribula lata* was recorded from Australia and New Zealand (Luxton 1985; Hunt *et al.* 1998), but was also found recently in Central Europe in the Alps (Schatz, personal communication). *Cultroribula berolina* might be widespread in the Palaearctic region; in addition to Germany and Mongolia, this species was recently found in Finland (Penttinen, personal communication), and might also occur in western Russia (see Weigmann 2008). The records of *C. vtorovi* in North America and *C. microdentata* in Mexico (Subías 2011) are questionable and need to be checked. Only two

known species, *C. divergens* and *C. magnifera* are restricted to North America (Marshall *et al.* 1987).

In addition to widespread species, such as *C. bicultrata*, *C. berolina*, *C. dentata*, *C. lata*, the following species, *C. juncta* (Michael, 1885), *C. confinis* Berlese, 1908, *C. tridentata* Mihelčič, 1958 were recorded in Europe. Records of European species *C. juncta* in North America, and the North American species *C. confinis* in Europe are questionable and need to be checked. The status of *C. tridentata* is problematic as the original description by Mihelčič (1958) is not sufficient to define the species (see Weigmann 2008).

Several species, namely *C. almagulae* Poltavskaja, 1994, *C. angulata* Aoki, 1984, *C. arctica* Poltavskaja, 1994, *C. breviclavata* Aoki, 1984, *C. elongata* Fujikawa, 1972, *C. ligulata* Grishina, 1980, *C. neominata* Subías, 2004, *C. shukuminensis* Nakatamari, 1982, *C. taigagica* Bayartogtokh, 2007 and *C. variolosa* Fujikawa, 1991 are distributed in central and/or eastern Asia (Fujikawa *et al.* 1993; Krivolutsky 1995; Bayartogtokh 2010). Recently, Shtanchaeva and Subías (2010) recorded one of these species, *C. neominata* in Caucasia, but this record requires further confirmation. Japan and Mongolia (with 6 species per country) show a higher diversity of *Cultroribula* species than any other region of Eurasia.

Concerning the faunas in tropical areas of the southern hemisphere, the Neotropical (*C. argentinensis* Balogh et Csiszar, 1963, *C. brasilensis* Pérez-Iñigo et Baggio, 1997, *C. castriensis* Mahunka, 1985, *C. hauseri* (Mahunka, 1983), *C. zicsii* Balogh et Mahunka, 1981), and Afrotropical regions (*C. bicuspidata* Mahunka, 1978, *C. humerata* Balogh et Mahunka, 1966, *C. laticuspis* Balogh, 1970, *C. tropica* Balogh, 1958) show a higher diversity of *Cultroribula* than those in the Indo-Malaysian (*C. diversa* Oudemans, 1915), and Australian regions (*C. quinqueneta* Balogh et Balogh, 1983), where only single species were recorded.

As for the habitat ecology of the Mongolian species of *Cultroribula*, most of them are inhabitants of litter and the upper layer soil of cool-temperate forests, organic debris under birch trees as well as the soil of mountain steppes or the alpine zone. Some species, i.e. *C. rarisetosa* **sp. nov.**, *C. berolina* are found on lichens growing on trunk bases and branches of larch trees or on bare rock. *Cultroribula berolina* was originally described from litter of a pine-oak stand based on single specimen, but later the species was abundantly found on epiphytic mosses growing on oak trees (Weigmann 2006, 2008). In addition to the specimens from foliose or subfruticose lichens growing on bare rocks in Altai Mountains, I also found some more specimens of this species on fruticose lichens growing on branches of larch trees in the Hövsgöl lake area of northern Mongolia. Recently, Penttinen (personal communication) found *C. berolina* on bark of spruce trees from different localities in Finland. They may also inhabit and feed on lichens growing on tree trunk. Thus, some species of *Cultroribula* seem to be typical inhabitants of epiphytic and saxicolous lichens and mosses.

It should be mentioned that since the pioneering study by Travé (1963), the lichens are widely recognized as habitat, shelter and food for oribatid mites. Colloff (1988) revealed that the thallus morphology of lichens has a definite influence on the species diversity of oribatid mites, but its effect on their abundance was equivocal. He found more species richness of mites in the

foliose and fruticose lichens than in crustose lichens, but the abundance of mites was considerably variable through different seasons. According to Byazrov and Melekhina (1992), oribatid mites found on lichens do not belong to the narrowly specialized feeding habit, i.e. they are capable of feeding on various types of food. Colloff (1988) also suggested that oribatid mite species with a high affinity for lichens tend not to be species-specific, and thus must possess adaptations to lichen microhabitats in general. This might be same for species of *Cultroribula* inhabiting the lichens in Mongolian Altai, as we found the food boluses in their gut consist mostly from fungal hyphae and fragments of plant materials.

The following key can be used to identify adults of known species of *Cultroribula* in Mongolia.

Key to the adults of *Cultroribula* in Mongolia

- 1 Legs tridactylous; lamellar cusp longer, but slightly narrower than basal part of lamella, with distal tooth ... 2
 - Legs monodactylous; lamellar cusp shorter, but wider than basal part of lamella, without distal tooth ... *C. berolina* Weigmann, 2006
- 2 Genital plates with five or six pairs of setae; if lamellar cusp with distal teeth, then median tooth conspicuously developed ... 3
 - Genital plates with four pairs of setae; lamellar cusp without inner tooth ... *C. rarisetosa* **sp. nov.**
- 3 Interlamellar seta long, extending tip of lamellar cusp ... 4
 - Interlamellar seta short, not reaching base of lamellar cusp ... 5
- 4 Tip of rostrum with large teeth deeply incised in-between; interlamellar seta barbed, reaching tip of rostrum; humeral process projected distally ... *C. taigagica* Bayartogtokh, 2007
 - Tip of rostrum with small teeth of similar size, without deep incision; interlamellar seta smooth, not reaching tip of rostrum; humeral process rounded ... *C. dentata* Willmann, 1950
- 5 Sensillus fusiform, with very long setiform tip; rostrum with 15–17 teeth, among them three central teeth much larger than lateral teeth ... *C. altaica* **sp. nov.**
 - Sensillus clavate or fusiform, without long setiform tip; rostrum with 17 teeth, among them five central teeth much larger than lateral teeth ... *C. vtorovi* Krivolutsky, 1971

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References

- Aoki, J. (1961) Beschreibungen von neuen Oribatiden Japans. *Japanese Journal of Applied Entomology and Zoology*, 5, 64–69.
- Aoki J. (1965) Neue Oribatiden von der Insel Sado (Acarina: Oribatei). *Japanese Journal of Zoology*, 14, 1–12.
- Aoki, J. (1984) New and unrecorded Oribatid mites from Kanagawa, Central Japan (I). *Bulletin of the Institute of Environmental Science and Technology, Yokohama National University*, 11, 107–118.
- Balogh, J. (1958) Oribatides nouvelles de l'Afrique tropicale. *Revue de Zoologie et de Botanique Africaines*, 58, 1–34.
- Balogh, J. (1961) Identification keys of world oribatid (Acari) families and genera. *Acta Zoologica Acadiae Scientiarum Hungaricae*, 7, 243–344.
- Balogh, J. (1970) New oribatids (Acari) from New Guinea II. *Acta Zoologica Acadiae Scientiarum Hungaricae*, 16, 291–344.
- Balogh, J. & Balogh, P. (1983) New oribatid mites from Australia (Acari: Oribatei). *Acta Zoologica Acadiae Scientiarum Hungaricae*, 29, 81–105.
- Balogh, J. & Csiszár, J. (1963) The zoological results of Gy. Topal's collectings in South Argentina. 5. Oribatei (Acarina). *Annales Historica-Naturales Musei Nationalis Hungarici*, 55, 463–485.
- Balogh, J. & Mahunka, S. (1966) New oribatids (Acari) from South Africa. *Acta Zoologica Acadiae Scientiarum Hungaricae*, 12, 1–23.
- Balogh, J. & Mahunka, S. (1981) New data to the knowledge of the oribatid fauna of Neogaea (Acari) VI. *Acta Zoologica Acadiae Scientiarum Hungaricae*, 27, 49–102.
- Bayartogtokh, B. (2007) Oribatid mites of the family Astegistidae (Acari: Oribatida) in Mongolia. *Zootaxa*, 1472, 55–68.
- Bayartogtokh, B. (2010) *Oribatid Mites of Mongolia (Acari: Oribatida)*. KMK Scientific Press, Moscow, 371 pp. (in Russian)
- Berlese, A. (1905) Acari nuovi. Materiali pel Manipulus V. *Redia*, 2: 231–238.
- Berlese, A. (1908) Elenco di generi e specie nuovi di Acari. *Redia*, 5: 1–15.

- Byazrov, L.G. & Melekhina, Ye.N. (1992) Oribatid mites in lichen consortiums of northern Scandinavia (based on the example of Varanger-fjorden). *Bulleten Moskovskogo Obshestva Ispytatelei Prirody, Otdelenie Biologii*, 97, 73–79. (in Russian)
- Colloff, M.J. (1988) Species, associations of oribatid mites in lichens on the island of Ailsa Craig, Firth of Glyde (Acari: Cryptostigmata). *Journal of Natural History*, 22, 1111–1119.
- Covarrubias, R. (1967) New oribatids (Acarina) from Chile. *Opuscula Zoologica Budapest*, 7, 89–116.
- Fujikawa, T. (1972) A contribution to the knowledge of the oribatid fauna of Hokkaido (Acari: Oribatei). *Insecta Matsumurana*, 35, 127–183.
- Fujikawa, T. (1991) Oribatid mites from *Picea glehni* forest at Mo-Ashoro, Hokkaido (5). Two new species of the family Astegistidae and Liacaridae. *Edaphologia*, 45, 7–14.
- Fujikawa, T., Fujita, M. & Aoki, J. (1993) Checklist of oribatid mites of Japan (Acari: Oribatida). *Journal of the Acarological Society of Japan*, 2(Supplement 1), 1–121.
- Grishina, L.G. (1980) New oribatid mites (Sarcoptiformes, Oribatei) from the Krasnoyarsk region. *Systematics and Ecology of Animals* (New and little known species of the fauna of Siberia). Nauka Press, Novosibirsk, pp. 40–48. (in Russian)
- Hunt, G.S., Colloff, M.J., Dallwitz, M.J. & Walter, D.E. (1998) The oribatid mites of Australia: information retrieval and interactive identification to family, genus and species levels. CD-ROM, CSIRO Publishing, Melbourne.
- Krivolutsky, D.A. (1962) Genus *Cultroribula* Berlese (Acariformes, Oribatei) and its representatives in USSR. *Zoologicheskii Zhurnal*, 46, 1893–1895. (in Russian)
- Krivolutsky, D.A. (1971) New species of Oribatei from eastern Kirgizia. *Zoologicheskii Zhurnal*, 50, 939–942. (in Russian)
- Krivolutsky, D.A. (1975) Superfamily Liacaroidea. In: Ghilarov, M.S. (Ed), *A Key to Soil Inhabiting Mites*. Nauka Press, Moscow, pp. 187–184. (in Russian)
- Krivolutsky, D.A. (1995) *Oribatid Mites: Morphology, Development, Phylogeny, Ecology, Methods of Research*. Nauka Press, Moscow, 224 pp. (in Russian)
- Krivolutsky, D.A., Druk, A.Ya., Eitminavichiute, I.S., Laskova, L.M. & Karppinen, E. (1990) *Fossil Oribatid Mites*. Mokslas Press, Vilnius, 110 pp. (in Russian)
- Luxton, M. (1985) Cryptostigmata (Arachnida: Acari) – a concise review. *Fauna of New Zealand*, 7, 1–106.
- Mahunka, S. (1978) Neue und interessante Milben aus dem Genfer Museum. XXXIV. A compendium of the Oribatid (Acari) fauna of Mauritius, Reunion and the Seychelles Islands II. *Revue Suisse de Zoologie*, 85, 307–340.
- Mahunka, S. (1983) Neue und interessante Milben aus dem Genfer Museum. 45. Oribatida Americana 6: Mexico II (Acari). *Revue Suisse de Zoologie*, 90, 269–298.
- Mahunka S. (1985) Mites (Acari) from St. Lucia (Antilles). 2. Oribatida. *Acta Zoologica Acadiae Scientiarum Hungaricae*, 31, 119–178.

- Marshall, V.G., Reeves, R.M. & Norton, R.A. (1987) Catalogue of the Oribatida (Acari) of Continental United States and Canada. *Memoirs of the Entomological Society of Canada*, 139, 1–418.
- Michael, A.D. (1885) New British Oribatidae. *Journal of the Royal Microscopical Society*, 2, London, 5, 385–397.
- Mihelčič, F. (1958) Algunas descripciones de Oribátidos hallados en yacimientos húmedos. *Revista Española de Entomología*, 34, 55–68.
- Nakatamari, S. (1982) Three new species of oribatid mites (Acari: Oribatei) from Okinawa in Japan. *Acta Arachnologica*, 30, 97–104.
- Norton, R.A. & Behan-Pelletier, V. (2009) Chapter 15, Oribatida. In: Krantz, G.W. & Walter, D.E. (Eds), *A Manual of Acarology*, 3rd Edition. *Texas Tech. University Press*, Lubbock, pp. 421–564.
- Oudemans, A.C. (1915) Acarologische Aanteekeningen, LVII. *Entomologische Berichte*, 4, 192–200.
- Pérez-Iñigo, C. & Baggio, D. (1997) Oribates édaphiques du Bresil (X): Quelques oribates de l'État de Pará. *Acarologia*, 38, 403–413.
- Pérez-Iñigo, C. & Sarasola, M. (1995) Soil oribatid mites from Uruguay (I) (Acari, Oribatei) Three new species from the department of Cerro Largo. *Acarologia*, 36, 65–73.
- Poltavskaja, M.P. (1994) Two new species of oribatid mites of the genus *Cultroribula* (Acari, Oribatei). *Zoologicheskii Zhurnal*, 73, 171–175. (in Russian)
- Shtanchaeva, U.Ya. & Subías, L.S. (2010) Catalogue of Oribatid Mites of the Caucasus. Dagestan Scientific Center, Russian Academy of Sciences, Makhachkala, 276 pp. (in Russian)
- Subías, L.S. (2004) Listado sistemático, sinonímico y biogeográfico de los Ácaros Oribátidos (Acariformes, Oribatida) del mundo (1748–2002). *Graellsia*, 60: 3–305.
- Subías, L.S. (2006) Listado sistemático, sinonímico y biogeográfico de los ácaros oribátidos (Acariformes: Oribatida) del mundo (excepto fósiles). 536 pp. Available from: <http://www.ucm.es/info/zoo/Artropodos/Catalogo.pdf> (accessed in July 2006)
- Subías, L.S. (2008) Listado sistemático, sinonímico y biogeográfico de los ácaros oribátidos (Acariformes: Oribatida) del mundo (excepto fósiles). Available from: <http://www.ucm.es/info/zoo/Artropodos/Catalogo.pdf> (accessed in June 2008)
- Subías, L.S. (2011) Listado sistemático, sinonímico y biogeográfico de los ácaros oribátidos (Acariformes: Oribatida) del mundo (excepto fósiles). Available from: <http://www.ucm.es/info/zoo/Artropodos/Catalogo.pdf> (accessed in July 2011)
- Travé, J. 1963. Ecologie et biologie des Oribates (Acariens) saxicoles et arboricoles. *Vie et Milieu*, supplement 14, 267 pp.
- Travé, J. & Vachon, M. (1975) François Grandjean, 1882–1975 (Notice biographique et bibliographique). *Acarologia*, 17, 1–19.
- Weigmann, G. (2006) *Die Tierwelt Deutschlands, Teil 76: Hornmilben (Oribatida)*. Goecke & Evers, Keltern, 520 pp.

- Weigmann, G. (2008) Re-description of *Cultroribula berolina* Weigmann, 2006 (Acari, Oribatida, Astegistidae) from Germany with a key for the European species. *Soil Organisms*, 80, 145–151.
- Willmann, C. (1950): Milben aus Mineralquellen (2. Mitteilung). *Zoologischer Anzeiger*, 145, 186–195.

Figure captions

Figure 1. *Cultroribula altaica* **sp. nov.** (A) Dorsal view of idiosoma; (B) Ventral view of idiosoma; (C) Lateral view of prodorsum and anterior part of notogaster. A and B to same scale.

Figure 2. *Cultroribula altaica* **sp. nov.** (A) Leg I, right, paraxial view; (B) Leg II, right, paraxial view; (F) Leg III, left, antiaxial view. All to same scale.

Figure 3. *Cultroribula altaica* **sp. nov.** (A) Palp, left, antiaxial view; (B) Chelicera, left, antiaxial view; (C) Subcapitulum; (D) Leg IV, left, antiaxial view; (E) Rostrum in lateral view. B–E to same scale.

Figure 4. *Cultroribula rarisetosa* **sp. nov.** (A) Dorsal view of idiosoma; (B) Variation of rostrum, dorso-frontal view; (C) Rostrum, ventral view; (D) Cusp of lamella; (E) Lateral view of prodorsum and anterior part of notogaster; (F) Ventral view of idiosoma. B–E to same scale.

Figure 5. *Cultroribula vtorovi* Krivolutsky, 1971. (A) Dorsal view of idiosoma; (B) Ventral view of idiosoma; (C) Rostrum, dorso-frontal view; (D) Lateral view of prodorsum and anterior part of notogaster; (E) Rostral seta; (F) Lamella with cusp and lamellar seta. C–F to same scale.

Figure 6. *Cultroribula berolina* Weigmann, 2006. (A) Dorsal view of idiosoma, female; (B) Dorsal view of idiosoma, male; (C) Lateral view of prodorsum and anterior part of notogaster, female. A & B to same scale.

Figure 7. *Cultroribula berolina* Weigmann, 2006. (A) Ventral view of idiosoma, female; (B) Lateral view of prodorsum and anterior part of notogaster, male.

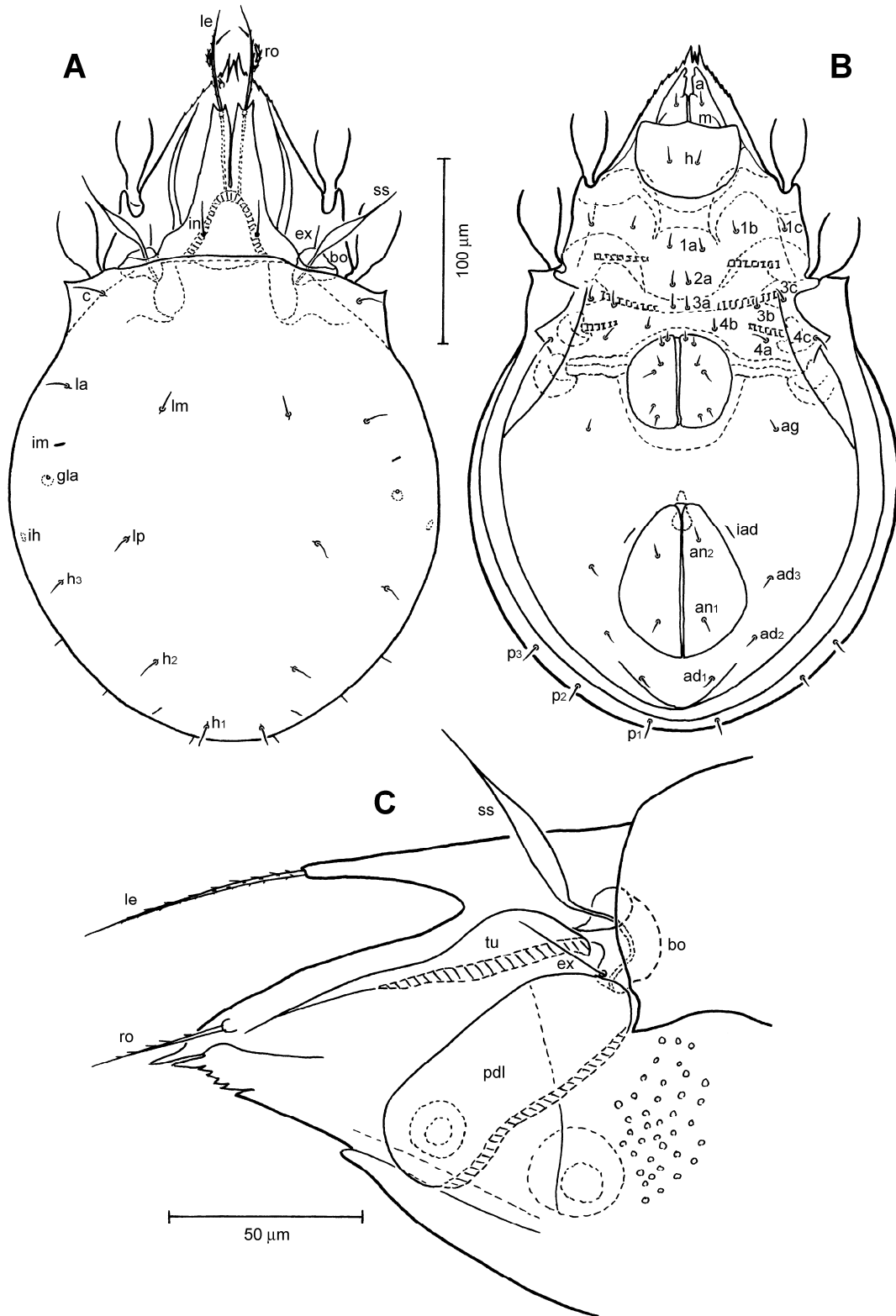


Figure 1. *Cultroribula altaica* sp. nov. (A) Dorsal view of idiosoma; (B) Ventral view of idiosoma; (C) Lateral view of prodorsum and anterior part of notogaster. A and B to same scale.

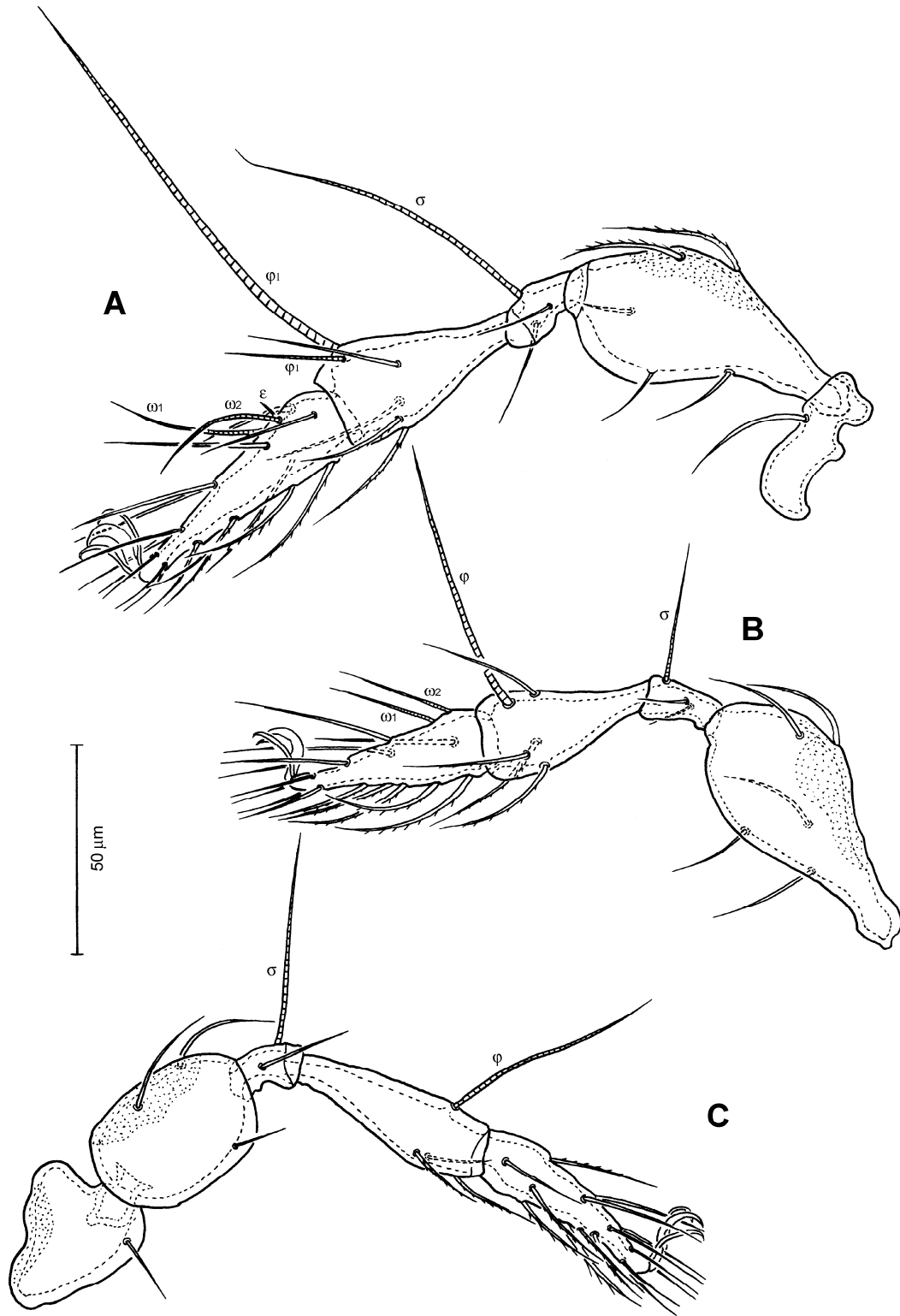


Figure 2. *Cultroribula altaica* sp. nov. (A) Leg I, right, paraxial view; (B) Leg II, right, paraxial view; (F) Leg III, left, antiaxial view. All to same scale.

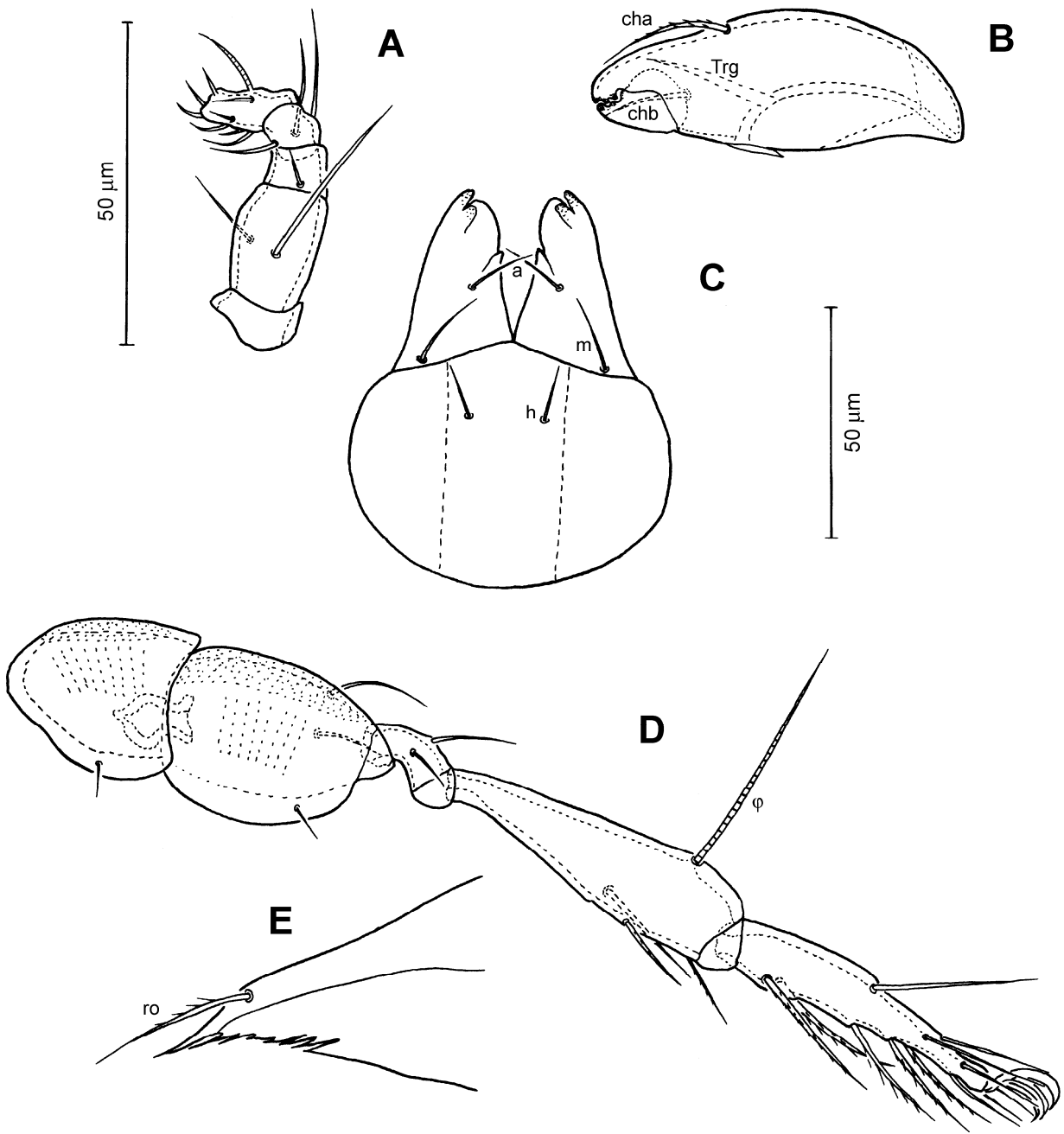


Figure 3. *Cultroribula altaica* sp. nov. (A) Palp, left, antiaxial view; (B) Chelicera, left, antiaxial view; (C) Subcapitulum; (D) Leg IV, left, antiaxial view; (E) Rostrum in lateral view. B–E to same scale.

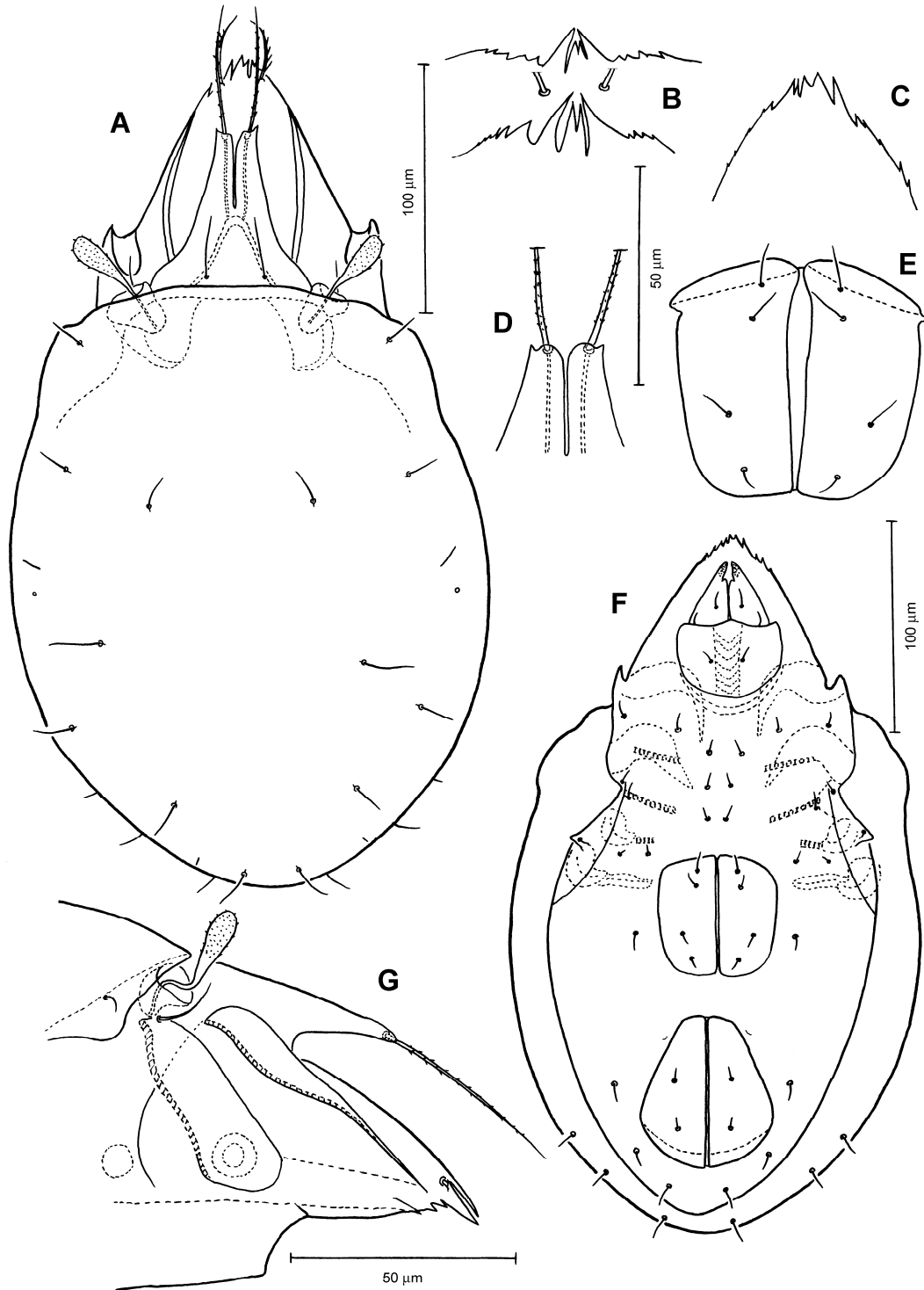


Figure 4. *Cultroribula rarisetosa* **sp. nov.** (A) Dorsal view of idiosoma; (B) Variation of rostrum, dorso-frontal view; (C) Rostrum, ventral view; (D) Cusp of lamella; (E) Lateral view of prodorsum and anterior part of notogaster; (F) Ventral view of idiosoma. B–E to same scale.

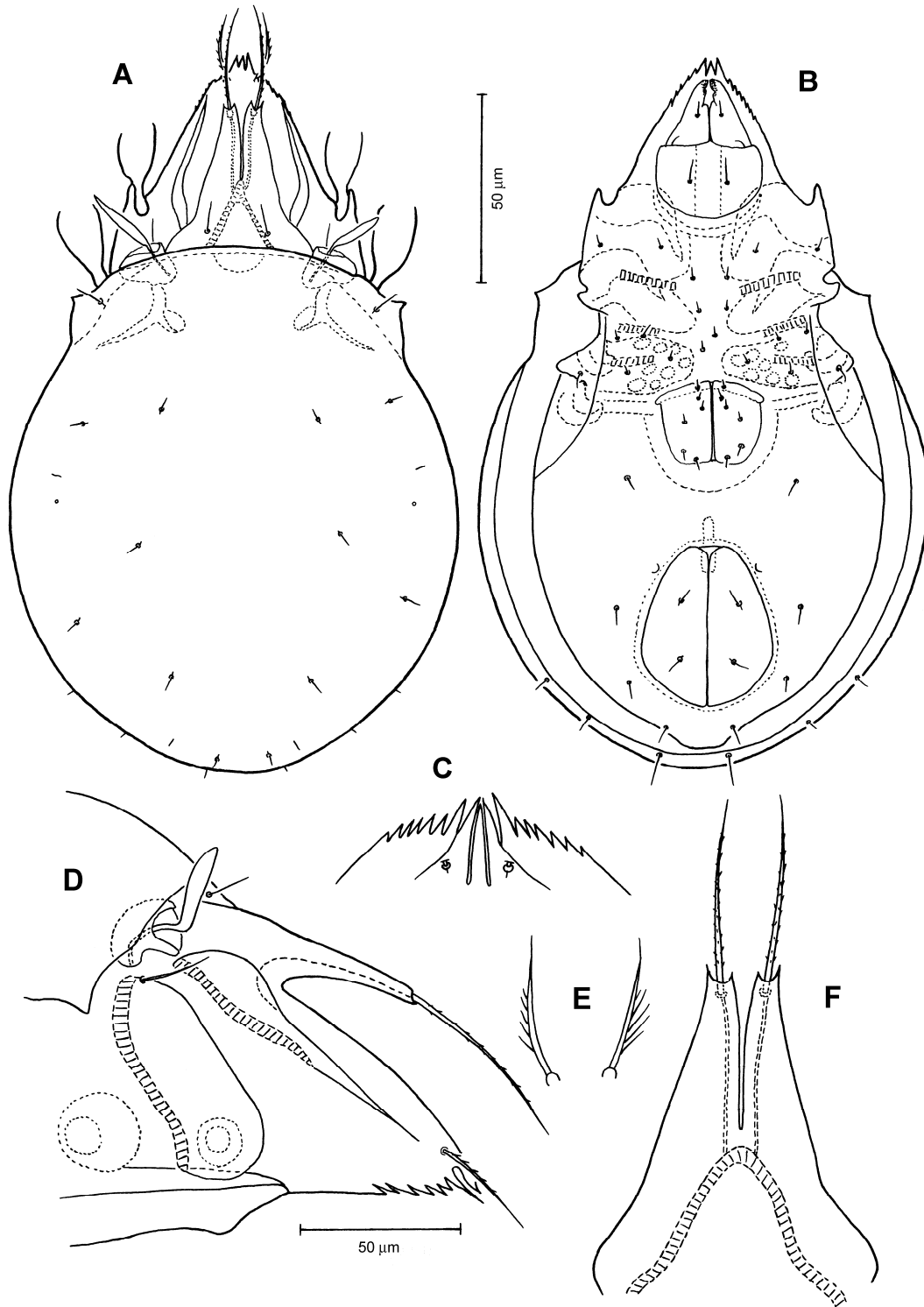


Figure 5. *Cultroribula vtorovi* Krivolutsky, 1971. (A) Dorsal view of idiosoma; (B) Ventral view of idiosoma; (C) Rostrum, dorso-frontal view; (D) Lateral view of prodorsum and anterior part of notogaster; (E) Rostral seta; (F) Lamella with cusp and lamellar seta. C–F to same scale.

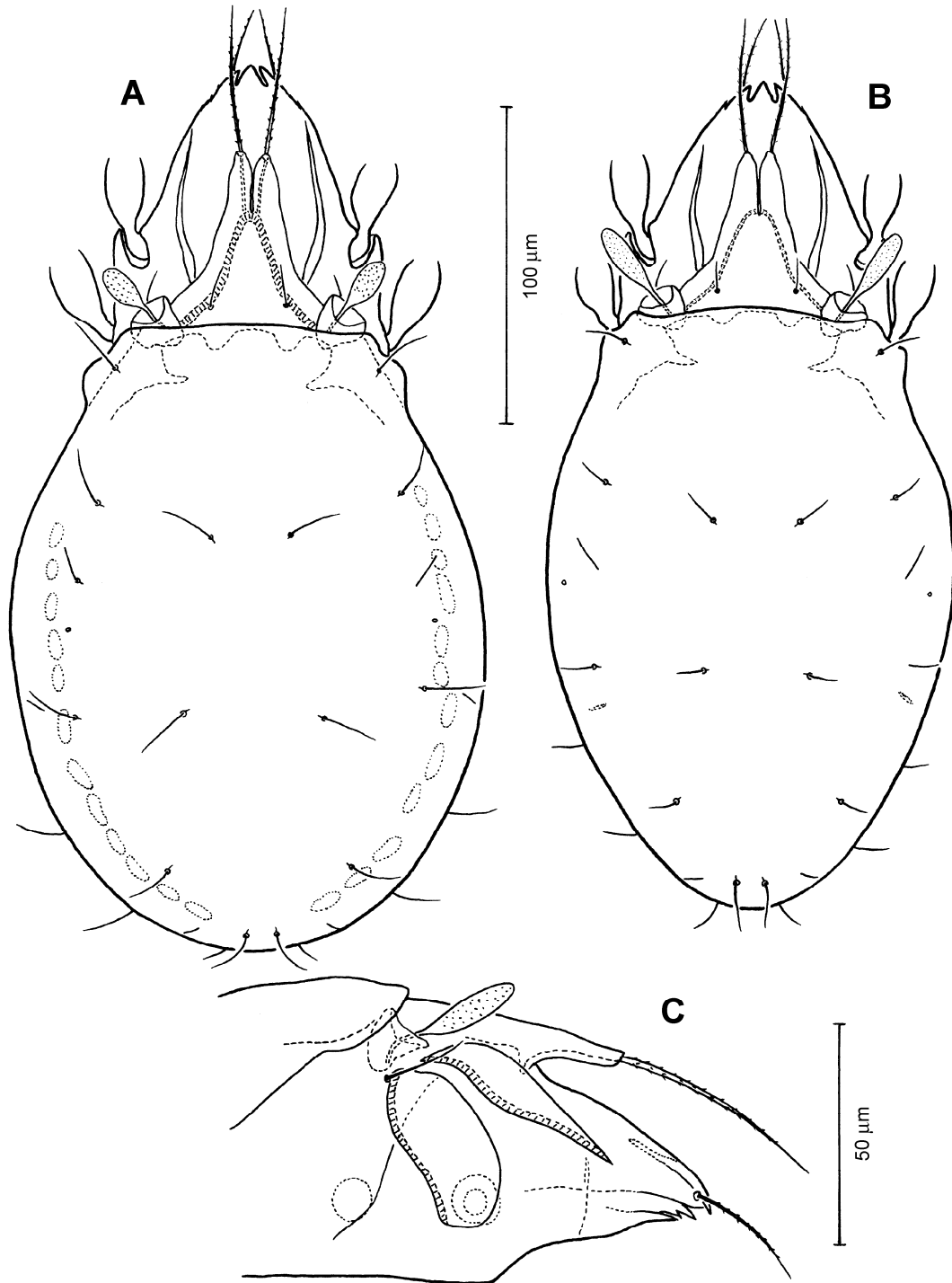


Figure 6. *Cultroribula berolina* Weigmann, 2006. (A) Dorsal view of idiosoma, female; (B) Dorsal view of idiosoma, male; (C) Lateral view of prodorsum and anterior part of notogaster, female. A & B to same scale.

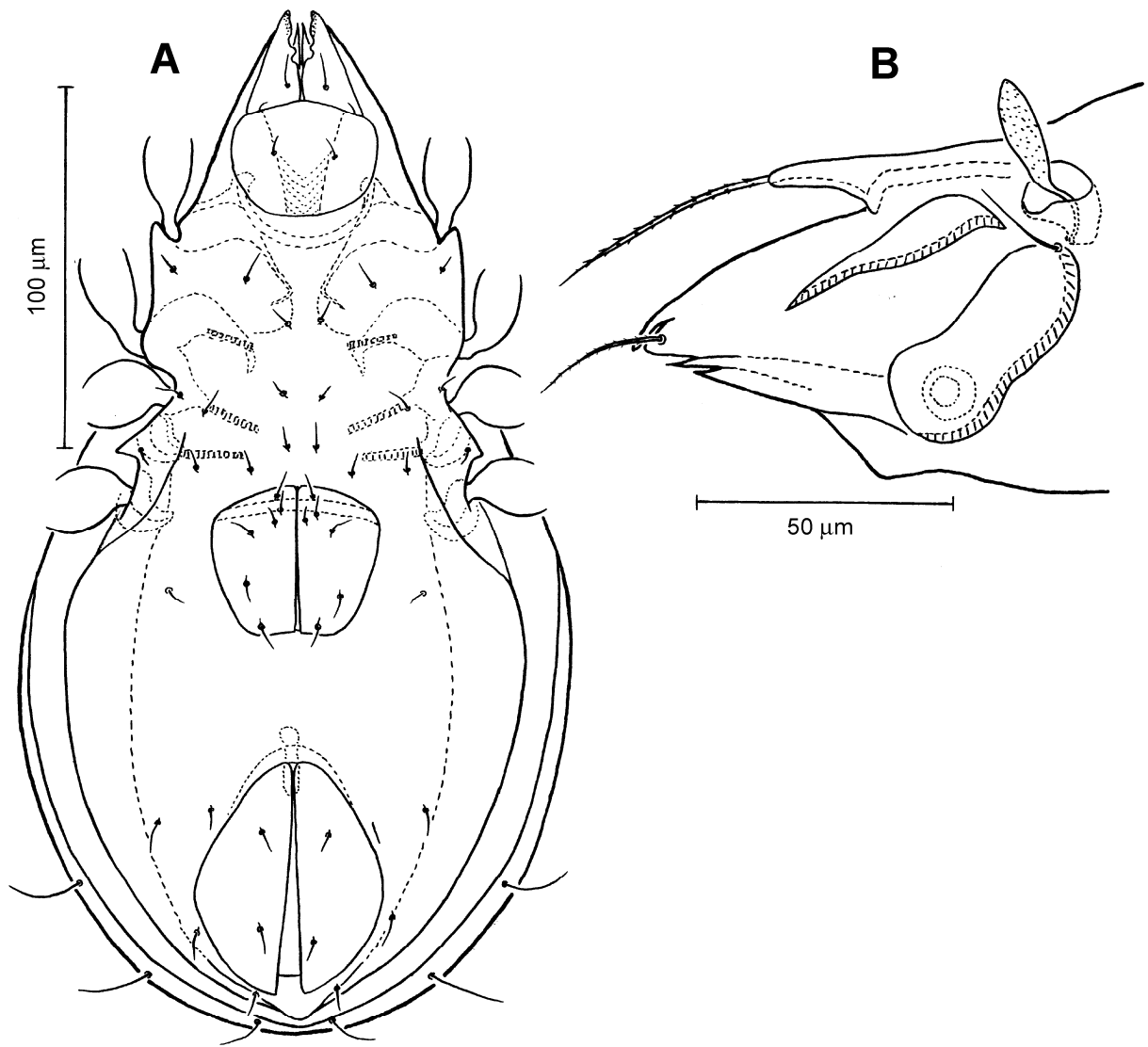


Figure 7. *Cultroribula berolina* Weigmann, 2006. (A) Ventral view of idiosoma, female; (B) Lateral view of prodorsum and anterior part of notogaster, male.