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NEW UROPODINA MITES (ACARI: MESOSTIGMATA) FROM A TAIWANESE *CRYPTOMERIA JAPONICA* (TAXODIACEAE) PLANTATION

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Three new Uropodina species (*Trichouropodella taiwanica*, *Uroobovella kozari* and *Uroobovella ornamenta* spp. nov.) are described and illustrated from specimens collected in a Tawanese *Cryptomeria japonica* (L. F.) D. Don plantation. The genus *Trichouropodella* is recorded for the first time in Taiwan.

Key words: Acari, Uropodina, new species, *Cryptomera japonica* plantation, Taiwan.

INTRODUCTION

Uropodina are small or medium-sized, soil dwelling, and widely distributed group of mites, of which currently more than 2000 species are described and named from over the world (Lindquist *et al.* 2009, Wiśniewski & Hirschmann 1993). Regarding the number of species of Uropodina mites in the different countries (Wiśniewski 1993) Taiwan is one of the poorly studied regions of the Earth, up to now only six species are reported from this island (Kontschán 2008). Compared with the European countries the Uropodina fauna of the tropical and subtropical natural areas are generally scarcely investigated, but the agricultural fields of these regions are almost unknown.

Taiwan lies on the border of tropics and subtropics. The majority of its area is covered by forests, located mostly on the hilly and mountaneous regions. Besides from the large native forested areas, monocultural plantations of *Cryptomeria japonica* (L. F.) D. Don were planted for commercial purposes (Kao *et al*. 1991) in the middle of the 20th century, however we know almost nothing about how these plantations affect the soil fauna.

Among the few studies on the Japanese Cedar (*Cryptomeria japonica*) plantations (Ito *et al*. 2003, Kodani 2006, Poorbabaei & Poorrahmati 2009), only Yuan *et al.* (2005) studied also the soil dwelling animals (small mammals and soil inhabiting arthropods) in a plantation located in North-central Taiwan (near Guanwu). In this study, mites were investigated as well, but only the number of the collected specimens (*ca* 50–60 individuals) was mentioned as "Acari" without any closer identification.

Some years ago, several collection trips were organized by the researchers of the Hungarian Natural History Museum and samples in a *Cryptomeria japonica* plantation were also collected. These samples, surprisingly, contained three Uropodina species new to science which are presented herein.

MATERIAL AND METHODS

Two moss samples were collected in the central region of Taiwan, Nantou county, Shuili, township of Renlun (Fig. 1), in an experimental forest area with *Cryptomeria japonica* plantation. The samples were put into plastic bags and after arriving in the laboratory of the Hungarian Natural History Museum mites were extracted using Berlese funels. The material was separated under stereo microscope. Uropodina specimens found then cleared by lactic acid, placed on deep and half covered slides, and identified under scientific microscope.

Types of the new species are stored in alcohol and deposited in the Soil Zoology Collection of the Hungarian Natural History Museum (HNHM) and in the Natural History Museum, Geneva (NHMG).

Illustrations were made with the aid of a drawing tube. Measurements are given in micrometers (μm), width of idiosoma was taken at the level of coxae IV. Abbreviations: *St*: sternal setae, *h*: hypostomal setae, *V*: ventral setae, *ad*: adanal setae.

Fig. 1. The collecting locality (☼) in Taiwan.

RESULTS

Trichouropodella taiwanica sp. n.
(Figs 2–16)

Material examined. Holotype. One female (HNHM) AS911, Taiwan T09-12, Taiwan, Nantou County, Shuili, township, Renlun (人倫), experimental forest area, ~3 km west to the Station, N23°43.694', E120°53.600', 1344 m, *Cryptomeria japonica* plantation, from moss, 09.X.2009, leg. L. Dányi & E. Lazányi. Paratype one male (NHMG), locality and date same as of holotype.

Diagnosis. Dorsal part of idisoma without ornamentation, majority of ventral part of idiosoma smooth, reticulate sculptural pattern situated only between pedofossae IV. Dorsal and ventral setae very long, thin and situated on small protuberances. Genital shield of female linguliform, with smooth surface. Setae *ad1* and *ad2* uniform in shape and length.

Description. Female. Length of idiosoma 1140 μm, width 950 μm (n = 1). Shape of idiosoma oval, posterior margin rounded, color brown, whole idiosoma strongly sclerotized.

Dorsal idiosoma (Fig. 2). Marginal and dorsal shields fused anteriorly. Marginal shield without ornamentation, only with numerous small protuberances on surface of dorsal shield. Small protuberances bearing short (*ca* 20–25 μm), very narrow and needle-like setae. Setae on marginal shield similar in shape and length to dorsal setae, ornamentation on marginal shield lacking.

Ventral idiosoma (Fig. 3). Sternal setae (*St1–4*) short (*ca* 8–10 μm), smooth and needle-like. *St1* situated near anterior margin of sternal shield, *St2* at level of central area of coxae II, *St3* at level of anterior margin of coxae III. *St4* situated at level of anterior margin of coxae IV, *St5* absent (Fig. 7). Surface of sternal shield smooth, but some oval pits can be seen between coxae III and IV. One pair of lyriform fissures situated near *St1*. Ventral shield neotrichous, bearing short (*ca* 25–30 μm), very thin needle-like setae (Figs 4–5). Preanal line present. Ventral shield smooth, some pit-like structures situated between pedofossae IV (Fig. 5) and small area of reticulate sculptural pattern placed anterior to preanal line. Posterior to preanal line three pairs of long (*ca* 40–45 μm) and needle-like setae (one pair of ventral setae and two pairs of adanal setae), and one short (*ca* 9 μm) and needle-like postanal seta (Fig. 6). Shape of anal opening oval. One pair of lyriform fissures placed near setae *ad1* (Fig. 6). Pedofossae deep, with smooth surface, separate furrows for tarsi IV absent.

Genital shield *ca* 330 μm long and *ca* 140 μm wide, its shape linguliform, with rounded anterior margin, its surface smooth. Genital shield situated between coxae II and IV (Fig. 7). Prestigmatid part of peritremes long and hook-like, poststigmatid part short, stigmata situated between coxae II and III. Tritosternum (Fig. 9) with narrow base, tritosternal lacinia basally pilose and apically divided into three long and pilose branches.

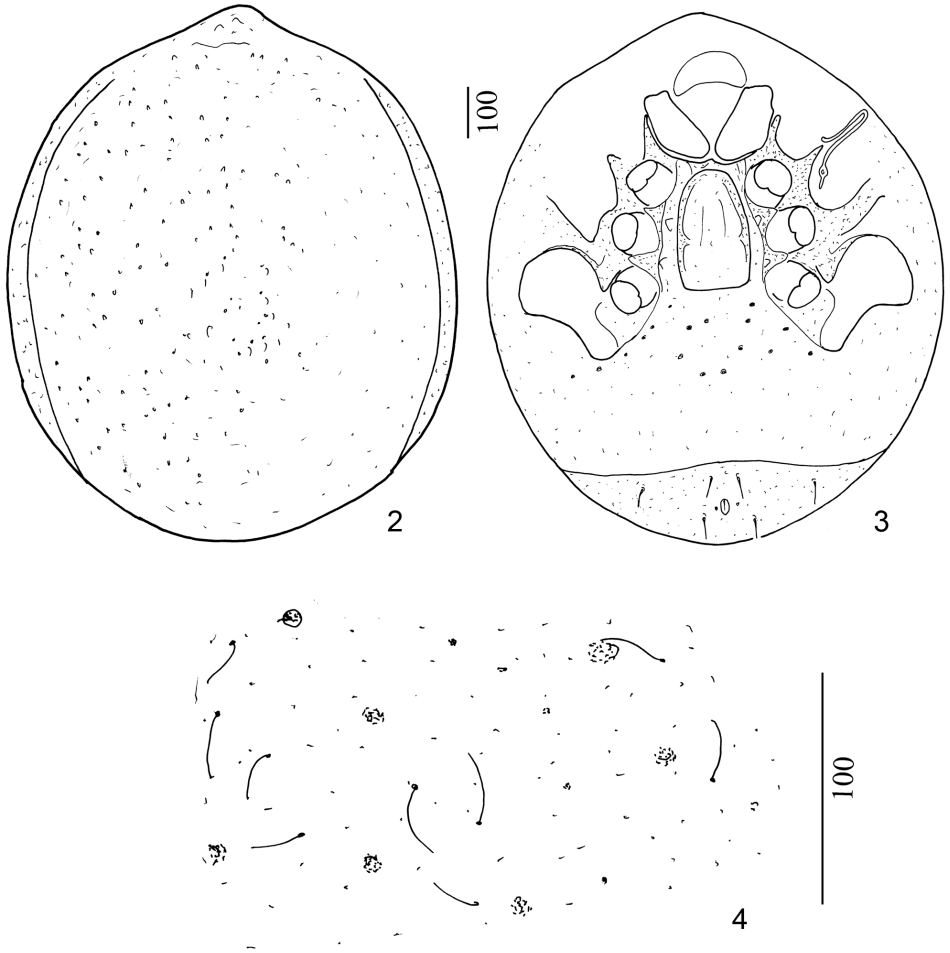
Gnathosoma (Fig. 10). Corniculi horn-like without tooth, internal malae wide, longer than corniculi and wide and apically bearing several finger-like processes. Hypostomal setae *h1* long (*ca* 65 μm), smooth and leaf-like. Setae *h2* long (*ca* 87 μm) and marginally serrate, *h3* similar to *h2* in shape, but *ca* 135 μm long, *h4* marginally serrate and *ca* 85 μm long. Whole chelicerae not clearly visible, movable digit as long as fixed digit, both digit bear-

ing numerous small teeth (Fig.12). Distal part of epistome marginally serrate and apically pilose (Fig. 11). Palps bearing smooth setae.

Legs. Legs I with small ambulacral claws (Fig. 13) and with smooth and needle-like setae, Legs II–IV with large lateral flaps on femurs (Figs 13–16).

Male. Length of idiosoma 1190 μm, width 1010 μm (n = 1). Shape and dorsal aspect of idiosoma as in female.

Ventral idiosoma (Fig. 8). Surface of sternal shield smooth but covered by some pit-like structures. Four pairs of smooth, short (*ca* 8–9 μm) and needle-like sternal setae present. *St1* placed near to anterior margin of sternal shield, *St2* at level of posterior margin of coxae II, *St3* near central area of genital shield, *St4* at level of posterior margin of genital shield. Position and shape of ventral setae and ornamentation of ventral shield as in



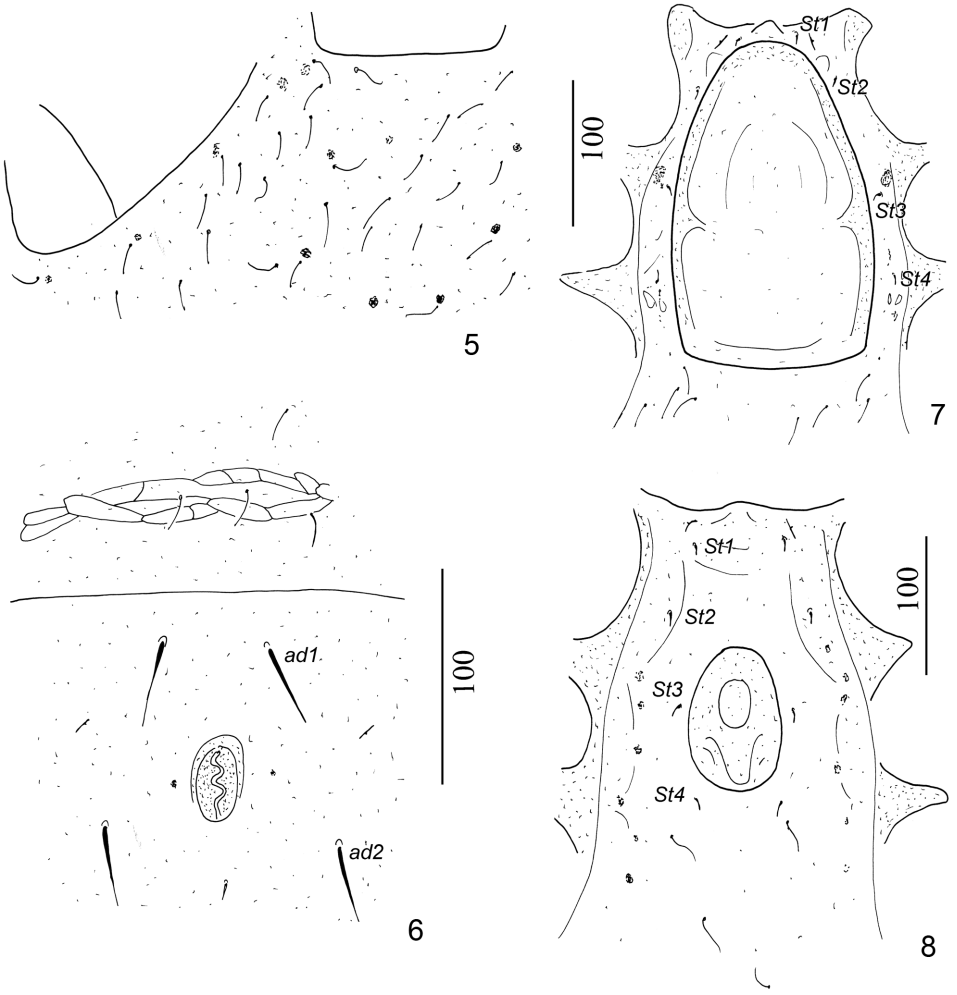
Figs 2–4. *Trichouropodella taiwanica* sp. n., female, holotype: 2 = dorsal view of idiosoma, 3 = ventral view of idiosoma, 4 = dorsal setae and ornamentation.

female. Genital shield oval (*ca* 100 μm long and *ca* 62 μm wide), without sculptural pattern, and situated between coxae III.

Nymphs and larvae unknown.

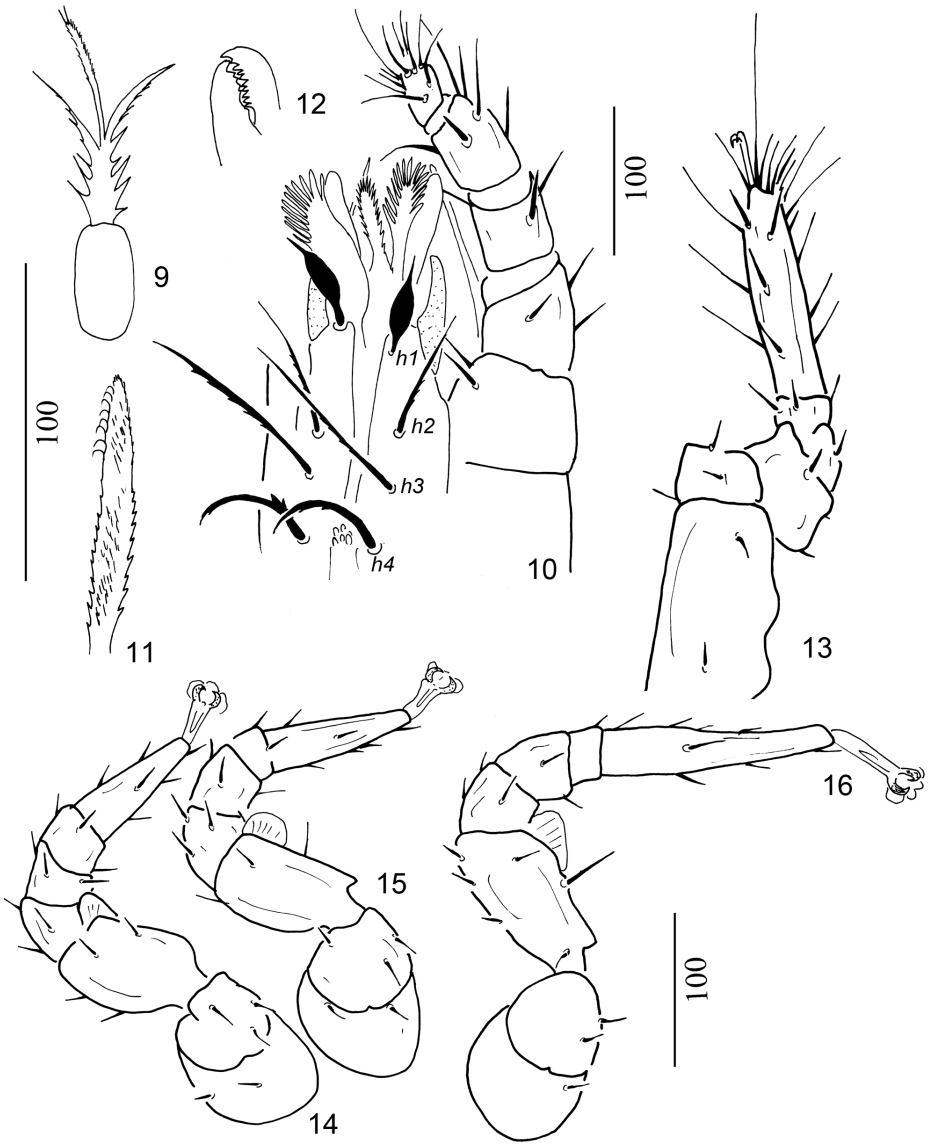
Etymology. This species is named after the island where it was collected.

Remarks. Currently only two *Trichouropodella* Hirschmann et Zirngiebl-Nicol, 1972 species are reported from Asia, *T. aoki* Hirmatsu, 1979 was described from Japan and the *T. vietnamensis* Hirschmann, 1983 was found in



Figs 5–8. *Trichouropodella taiwanica* sp. n., female, holotype: 5 = ventral setation and ornamentation, 6 = anal region, 7 = intercoxal area of female, 8 = intercoxal area of male paratype.

Vietnam (Wiśniewski & Hirschmann 1993). The surface of the female genital shield is smooth in the new species, but it is ornamented by oval pits in *T. aoki*; setae *ad1* and *ad2* are similar in length in the new species, in contrary, setae *ad1* are three times shorter than *ad2* in the *T. vietnamensis* species.



Figs 9–16. *Trichouropodella taiwanica* sp. n., female, holotype: 9 = tritosternum, 10 = ventral view of gnathosoma and palp, 11 = apical region of epistome, 12 = apical part of chelicera, 13 = leg I, 14 = leg II, 15 = leg III, 16 = leg IV (legs in ventral view).

Uroobovella kozari sp. n.
(Figs 17–31)

Material examined. Holotype. One female (HNHM) AS911, Taiwan T09-12, Taiwan, Nantou County, Shuili, township, Renlun (人倫), experimental forest area, ~3 km west to the Station, N23°43.694', E120°53.600', 1344 m, *Cryptomeria japonica* plantation, from moss, 09.X.2009, leg. L. Dányi & E. Lazányi. Paratypes: five females and three males (3 females and two males in HNHM, two females and one male in NHMG), locality and date same as of holotype.

Diagnosis. Dorsal and ventral parts of idisoma without ornamentation,. Dorsal and ventral setae very smooth and needle-like. Genital shield of female linguliform, with smooth surface and without anterior process. Setae *h2* smooth and robust, *h1* and *h3* similar in length. Setae *ad1* and *ad2* uniform in shape and length.

Description. Female. Length of idiosoma 350–360 μm, width 310–320 μm (n=3). Shape of idiosoma circle, posterior margin rounded, color brown, whole idiosoma strongly sclerotized.

Dorsal idiosoma (Fig. 17). Marginal and dorsal shields fused anteriorly. Marginal shield without ornamentation, marginal setae smooth, short (*ca* 7–9 μm) and needle-like (Fig. 18). Dorsal shield neotrichous, dorsal setae similar in shape and length to marginal setae, dorsal shield without ornamentation, only some muscles scar can be seen on central area of dorsal shield.

Ventral idiosoma (Fig. 19). Sternal setae (*St1–7*) short (*ca* 7–8 μm), smooth and needle-like. *St1* situated near anterior margin of sternal shield, *St2* at level of anterior margin of coxae II, *St3* at level of central area of coxae II. *St4* situated at level of anterior margin of coxae III, *St5* at level of central area of coxae III, *St6* at level of anterior margin of coxae IV, *St7* at level of central area of coxae IV. Surface of sternal shield smooth. One pair of lyriform fissures situated near *St1,* other one pair situated near *St7*. Ventral setae short (*ca* 7–8 μm), thin and needle-like setae (Fig. 20). Ventral shield without sculptural pattern. Adanal setae similar in shape and length to ventral setae, postanal seta absent. One pair of lyriform fissures situated near podofossae IV (Fig. 20). Pedofossae deep, with smooth surface and separate furrows for tarsi IV.

Genital shield *ca* 100–105 μm long and *ca* 73–75 μm wide, its shape linguliform, with rounded anterior margin and smooth surface. Genital shield situated between coxae II and IV (Fig. 21). Prestigmatid part of peritremes long and hook-like, poststigmatid part short, stigmata situated between coxae II and III. Tritosternum (Fig. 22) with narrow base, tritosternal lacinia divided into three branches.

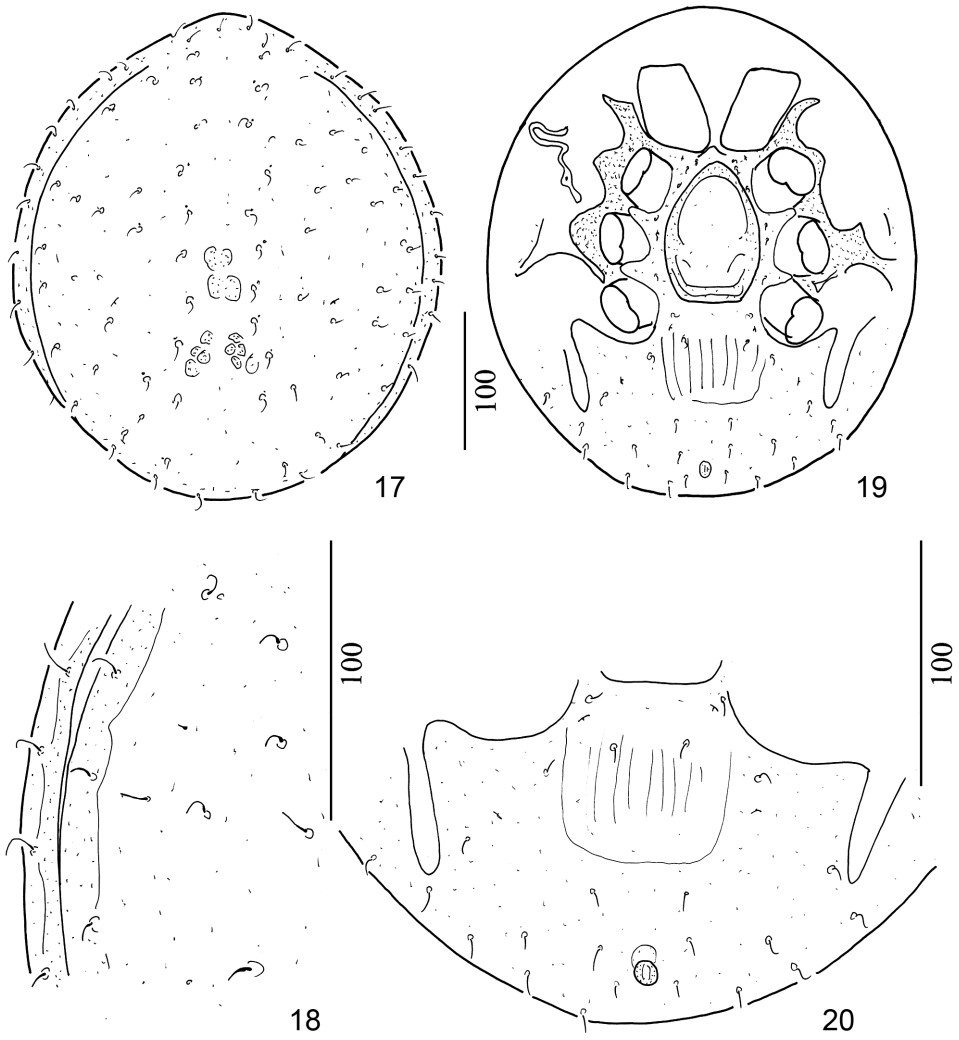
Gnathosoma (Fig. 23). Corniculi horn-like, internal malae longer than corniculi and apically pilose. Hypostomal setae *h1* long and (*ca* 40 μm), smooth. Setae *h2* short (*ca* 15 μm), smooth and robust, *h3* similar to *h1* in shape, but shorter, *ca* 21 μm long, *h4* marginally serrate and *ca* 17 μm long. All parts of chelicerae not visible, fixed digit of chelicerae longer than movable digit and bearing a pointed finger-like apical process (Fig. 24). Apical region of epistome marginally serrate and apically pilose (Fig. 23). Palp trochanter bearing ventral serrate setae, other setae on palp smooth, apothele (Fig. 25) with a short supplementary tine.

Legs. All legs with small ambulacral claws (Fig. 27) and with smooth and needle-like setae (Figs 27–30).

Male. Length of idiosoma 370-380 μm, width 300-310 μm (n=3). Shape and dorsal aspect of idiosoma as in female.

Ventral idiosoma (Fig. 26). Surface of sternal shield smooth. Eight pairs of smooth, short (*ca* 7–8 μm) and needle-like sternal setae present. *St1* placed near to anterior margin of sternal shield, *St2* and *St3* at level of central area of coxae II, *St4-St5* at level of central area of coxae III, *St6* at level of posterior margin of coxae III, *St7–St8* near posterior margin of genital shield. Position and shape of ventral setae and ornamentation of ventral shield as in female. Genital shield oval (*ca* 43–46 μm long and *ca* 36–38 μm wide), without sculptural pattern. It situated between coxae IV. Femur of leg I with a ventral flap (Fig. 31).

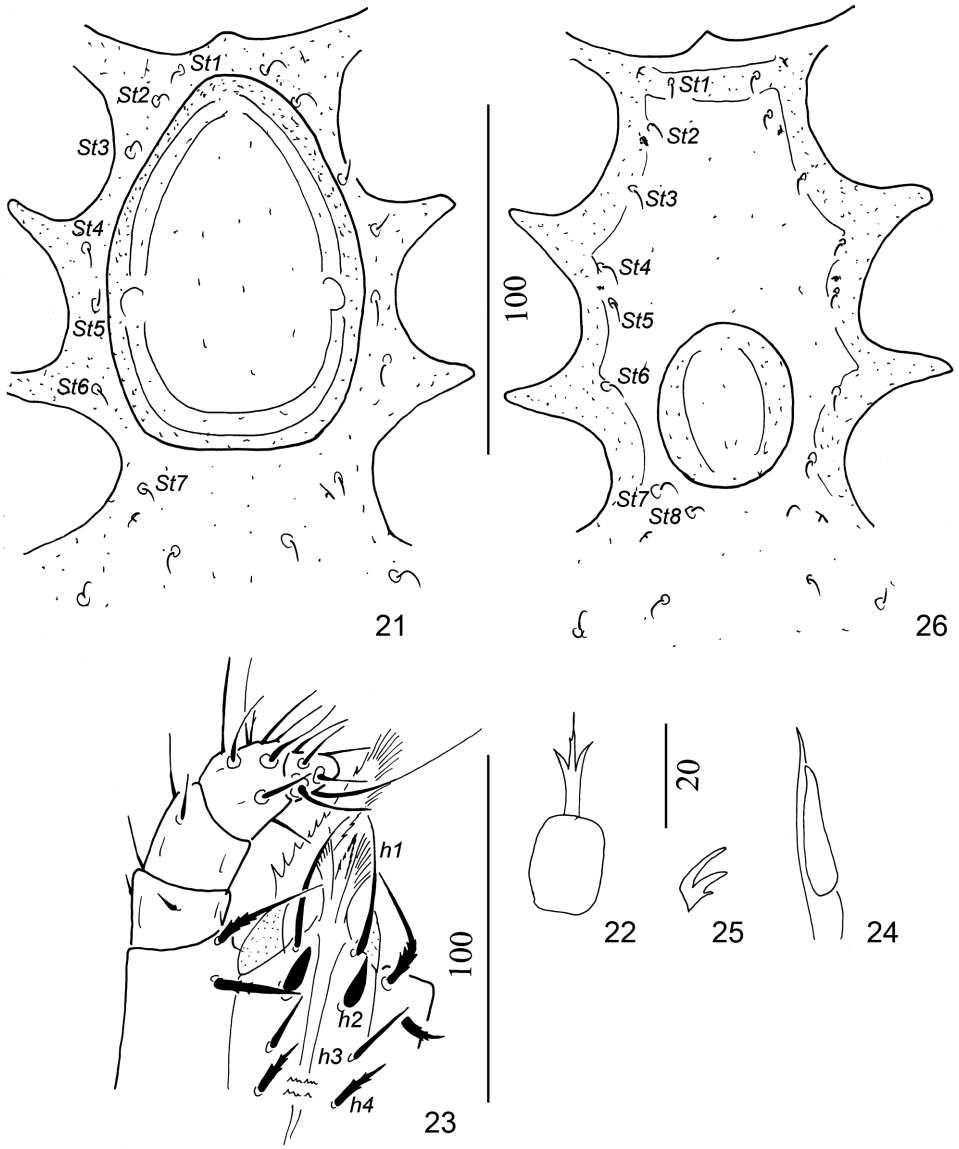
Nymphs and larvae unknown.



Figs 17–20. *Uroobovella kozari* sp. n., female, holotype: 17 = dorsal view of idiosoma, 18 = dorsal and marginal setae, 19 = ventral view of idiosoma, 20 = ventral setae.

Etymology. I dedicate the new species in memory of my dear colleague and friend, the excellent scale insect specialist Ferenc Kozár (1943–2013).

Remarks. The new species belongs to the *Uroobovella minima*-group on the basis of the shape and size of the idiosoma and the number of the sternal and



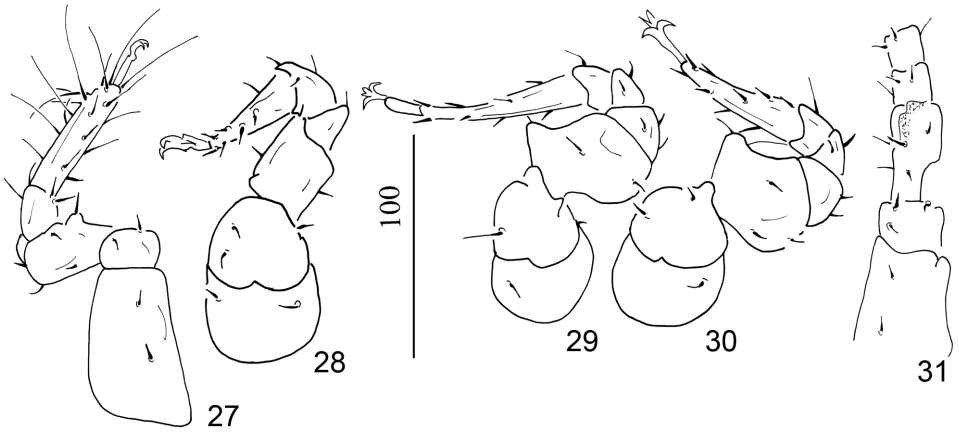
Figs 21–26. *Uroobovella kozari* sp. n., female, holotype: 21 = intercoxal area of female, 22 = tritosternum, 23 = ventral view of gnathosoma and palp, 24 = ventral view of chelicerae, 25 = palp apothele, 26 = intercoxal area of male paratype.

ventral setae. Numerous species from this group were reported from Asia, but there are several differences between the new species and the previously described ones. *Uroobovella nitida* Hiramatsu, 1981 from New Guinea, *U. cavernosa* Hiramatsu, 1979, and *U. okinawaensis* Hiramatsu, 1979 from Japan have ornamented genital shield in females, but the genital shield of the new species is smooth. The hypostomal setae *h2* is smooth and robust in the species *U. kozari*, but it is marginally serrate in the species *U. japanovarians* Hiramatsu et Hirschmann, 1978, *U. japanocrenelata* Hiramatsu et Hirschmann, 1978 from Japan and *U. ceylonivarians* Zirngiebl-Nicol et Hirschmann, 1975 from Sri Lanka. Besides these differences, the species *U. japanovarians* and *U. japanocrenelata* have anterior process on genital shield, which is missing in the new one; setae *h1* and *h3* are uniform in length in the species *U. ceylonivarians,* in contrary these setae have different length in the new species. The adanal setae are longer than the ventral setae in the species *Uropoda vietnamvarians* Hirschmann, 1981 from Vietnam, but these setae are uniform in size in the new species.

Uroobovella ornamenta sp. n.
(Figs 32–42)

Material examined. Holotype. One female (HNHM) AS911, Taiwan T09-12, Taiwan, Nantou County, Shuili, township, Renlun (人倫), experimental forest area, ~ 3 km west to the Station, N23°43.694', E120°53.600', 1344 m, *Cryptomeria japonica* plantation, from moss, 09.X.2009, leg. L. Dányi & E. Lazányi. Paratypes one female (NHMG) and two males (one in NHMH, other one in NHMG), locality and date same as of holotype.

Diagnosis. Dorsal and ventral parts of idisoma without ornamentation, but some tile-like ornamentation present near inner end of metapodal line.



Figs 27–31. *Uroobovella kozari* sp. n., female, holotype: 27 = leg I, 28 = leg II, 29 = leg III, 30 = leg IV, 31 = leg I of male (legs in ventral view).

Dorsal and ventral setae smooth and needle-like. Genital shield of female linguliform, its surface smooth, but ornamented by some oval pits on lateral parts at level of coxae III and IV.

Description. Female. Length of idiosoma 540–550 μm, width 390–400 μm (n=2). Shape of idiosoma oval, color brown, whole idiosoma strongly sclerotized.

Dorsal idiosoma (Fig. 32). Marginal and dorsal shields fused anteriorly. Marginal shield without ornamentation, all marginal setae smooth and needle-like (*ca* 18–23 μm). Dorsal shield without sculptural pattern, only three pairs of conspicuous muscles scars situated on caudal area of dorsal shield. Dorsal setae similar in shape and length to marginal setae.

Ventral idiosoma (Fig. 33). Sternal setae *St1–3* short (*ca* 8–12 μm), *St4* longer (*ca* 16 μm), all setae smooth and needle-like. *St1* situated near anterior margin of sternal shield, *St2* at level of anterior margin of coxae III, *St3* at level of anterior margin of coxae IV and. *St4* situated near basal edges of genital shield. Surface of sternal shield without ornamentation. One pair of lyriform fissures situated near *St1*, other one pair near *St4*. Ventral shield bearing short (*ca* 18–22 μm), thin and needle-like setae. Adanal setae and postanal seta similar in shape and length to ventral setae. Metapodal line present, some tile-like ornamentation present (Fig. 34) near inner end of metapodal line. Other area of ventral shield smooth. One pair of lyriform fissures placed near setae *ad2* and near setae *V2* (Fig. 34). Pedofossae deep, with smooth surface and with separate furrows for tarsi IV.

Genital shield *ca* 149–150 μm long and *ca* 83–85 μm wide, its shape linguliform, with rounded acuminate anterior margin, its surface smooth, but it ornamented by some oval pits on lateral parts at level of coxae III and IV. Genital shield situated between coxae II and IV (Fig. 37). Prestigmatid part of peritremes long and hook-like, poststigmatid part short, stigmata situated between coxae II and III. Tritosternum (Fig. 35) with narrow base, tritosternal lacinia with a single and marginally serrate branch.

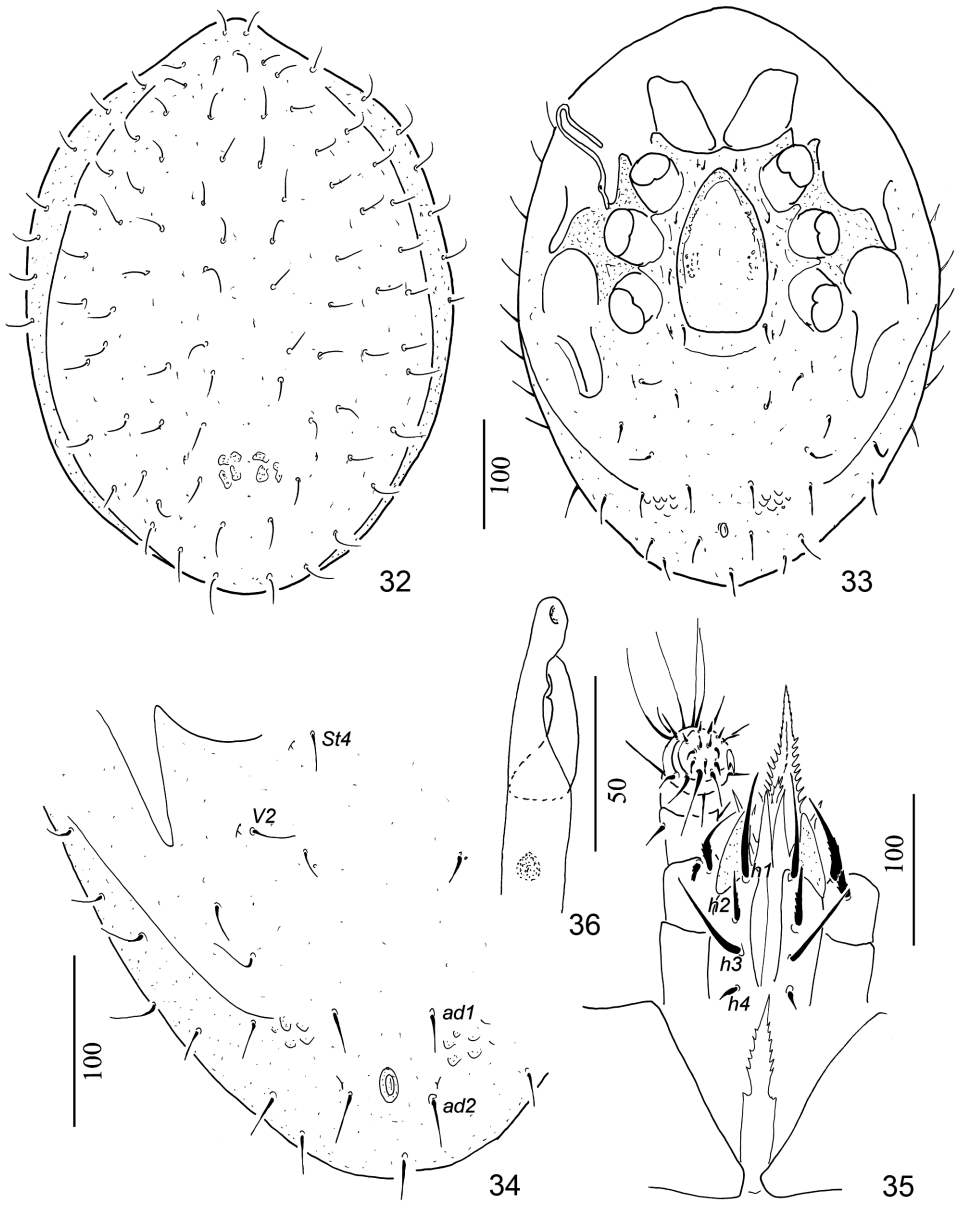
Gnathosoma (Fig. 35). Corniculi horn-like, internal malae wide, slightly longer than corniculi and apically smooth. Hypostomal setae *h1* long (*ca* 70 μm), smooth and needle-like. Setae *h2* shorter (*ca* 38 μm) and marginally serrate, *h3* similar to *h1* in shape, but *ca* 61 μm long, *h4* smooth and short (*ca* 10 μm). Chelicerae with internal sclerotized node, fixed digit longer than movable digit, bearing one central teeth. Apical part of fixed digit has a hole-like sensory organ (Fig. 36). Epistome marginally serrate and apically pilose (Fig. 35). Palps bearing two marginally serrate setae on trachanter, other setae on palp segments smooth and needle-like.

Legs. All legs with small ambulacral claws and with smooth and needle-like setae, but robust setae situated on tarsi III and IV. Leg II–IV with large lateral flaps on femurs (Figs 39–42).

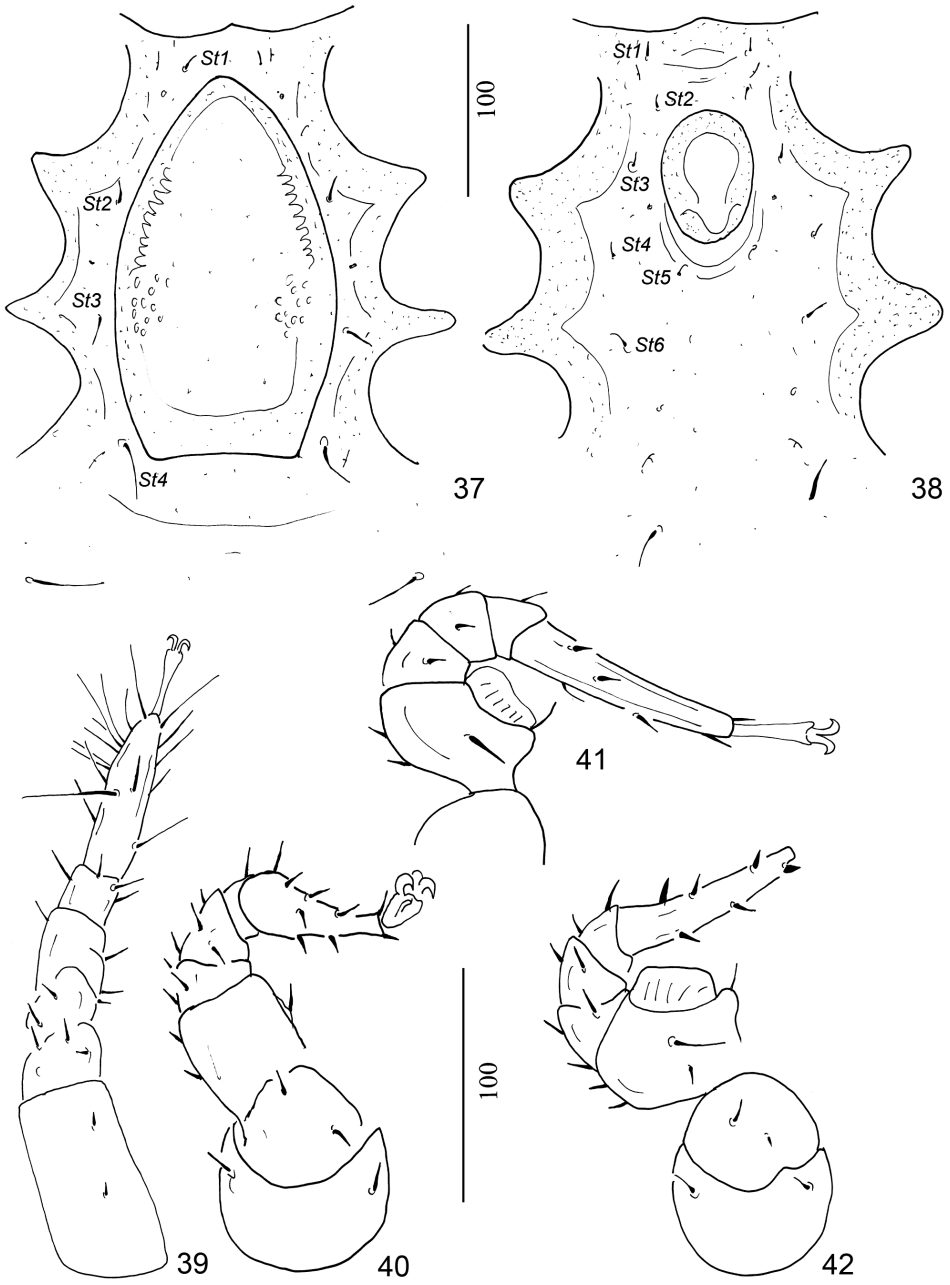
Male. Length of idiosoma 510–530 μm, width 370–380 μm (n=2). Shape and dorsal aspect of idiosoma as in female.

Ventral idiosoma (Fig. 38). Surface of sternal shield without sculptural pattern. Six pairs of smooth, short (*ca* 7–8 μm) and needle-like sternal setae present. *St1* placed near to anterior margin of sternal shield, *St2* at level of anterior margin of coxae II, *St3* at level of central area of coxae II, *St4* at level of central area of coxae III, *St5* near posterior margin of genital shield and *St6* at level of anterior margin of coxae IV. One pair lyriform fissures situated between *St1* and *St2*, another pair of lyriform fissures can be seen at level of posterior margin of coxae IV. Position and shape of ventral setae and ornamentation of ventral shield as in female. Genital shield oval (*ca* 77–79 μm long and *ca* 55–56 μm wide), without sculptural pattern andsituated between coxae II and III. Euanal setae absent.

Nymphs and larvae unknown.



Figs 32–36. *Uroobovella ornamenta* sp. n., female, holotype: 32 = dorsal view of idiosoma, 33 = ventral view of idiosoma, 34 = anal and preanal areas, 35 = ventral view of gnathosoma and palp, 36 = chelicera.



Figs 37–42. *Uroobovella ornamenta* sp. n., female, holotype: 37 = intercoxal area of female, 38 = intercoxal area of male paratype, 39 = leg I, 40 = leg II, 41 = leg III, 42= leg IV (legs in ventral view, claw of leg IV not illustrated).

Etymology. This species is named after the ornamentation of genital shield in female specimens.

Remarks. The new species belongs to the *Uroobovella iphidis*-group on the basis of the shape of peritremes, shape of genital shield of females and presence of the metapodal line. Recently numerous species are placed into this group, but only nine species are listed from South-East Asia, six species (*U. aokii* Hiramatsu, 1979; *U. iketzakii* Hiramatsu et Hirschmann, 1978; *U. itoi* Hiramatsu et Hirschmann, 1977; *U. minagawai* Hiramatsu, 1981; *U. sugiyamai* Hiramatsu, 1979 and *U. yasumanensis* Hiramatsu, 1981) are described from Japan, one species was found in the Philippines (*U. luzonensis* Hiramatsu et Hirschmann, 1992), one species from Laos (*U. laotana* Wiśniewski et Hirschmann, 1992, but this species was described on the basis of nymphs), and one species is collected in Taiwan (*U. nantouensis* Hiramatsu et Hirschmann, 1992). The previously described species have smooth surface of the genital shield of female, but the genital shield of the new species has ornamentation on lateral regions, and the till-like sculptural pattern near the inner end of the metapodal line, which can be seen in the new species, were not observed in the other known species.

DISCUSSION

The genus *Trichouropodella* occurs in the Neotropical Region and South-East Asia (Kontschán 2010*a*), which represents a tropical American–Asiatic distribution type (or amphipacific distribution type). A similar phenomenon can be found in plants (van der Hammen & Cleef 1983) and also in other animals (Uschakov 1971) including Uropodina mites as well (Kontschán 2010*b*). On the other hand, it is possible that this genus is represented in Africa too, but it has not yet been recorded.

The two new *Uroobovella* species belong to two widely distributed groups of this genus; therefore their presence in Taiwan is not surprising. However, it is interesting to remark that the samples were collected in an agricultural area. This suggests that the natural fauna can survive even in a disturbed forest plantation; therefore studying such regions seems to be important in the Uropodina (and other soil-fauna) researches as well.

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