

Three new rotundabaloghid mites (Acari: Uropodina) from Hong Kong

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Abstract: Three new species of the family Rotundabaloghidae are described from Hong Kong. *Angulobaloghia staryi* sp. nov. differs from the other *Angulobaloghia* Hirschmann, 1979 species in the shape and ornamentation of the genital shield of the female. *Rotundabaloghia* (*Rotundabaloghia*) *hongkongensis* sp. nov. has three pairs of short setae (St1, V2 and V6) on the ventral idiosoma, which is unique in the subgenus *Rotundabaloghia* (*Rotundabaloghia*) Hirschmann, 1975a. The long, robust and curved setae in the big ventral cavity of *Depressorotunda* (*Depressorotunda*) *taurina* sp. nov. is a character so far unknown in the subgenus *Depressorotunda* (*Depressorotunda*) Kotschán, 2010a.

Keywords: East Asia - taxonomy - turtle-mites.

INTRODUCTION

The rotundabalogid mites are small, rounded, soil dwelling members of the suborder Uropodina, which have a typical circumtropical distribution. Rotundabaloghids can be found in South and Central America, Africa, South-East Asia and the Austral-Asian region (Kotschán, 2010b). Three taxa of the family [the genus *Angulobaloghia* Hirschmann, 1979 and the subgenera *Rotundabaloghia* (*Rotundabaloghia*) Hirschmann, 1975a and *Depressorotunda* (*Depressorotunda*) Kotschán, 2010a] occur only in the South-East Asian and Austral-Asian regions (Kotschán, 2010b, 2011; Kotschán & Stary, 2012). Several parts of these regions have been intensively investigated, but there are some areas from where no rotundabaloghid mites are known.

I spent some days in the Arachnida collection of the Natural History Museum in Geneva, where I separated several rotundabalogid mites. Here I present my first results of this visit, with the descriptions of three new species from Hong Kong.

MATERIAL AND METHODS

Specimens were cleared in lactic acid and drawings were made with the aid of a drawing tube. All specimens are stored in ethanol and deposited in the Natural History Museum in Geneva (MHNG). The nomenclature of the ventral setation, and the generic and subgeneric systems with the diagnoses of these taxa follow Kotschán (2010b). The chelicerae of Rotundabaloghidae are often hidden inside the body and in that case they cannot be observed without breaking the specimens. However, the

chelicerae do not have important characters for species identification within this family (chelicerae have a long and apically rounded fixed digit, and the internal sclerotized node is visible). Therefore, this character was not always studied in order not to cause undue damage to the type specimens. For the examined material, the original label data in French are given, this to avoid incorrect interpretations.

Abbreviations: h = hypostomal setae, St = sternal setae, im = internal malae, V = ventral setae. All measurements and the scales in the figures are given in micrometres (µm).

TAXONOMY

Angulobaloghia staryi sp. nov.

Figs 1-11

Holotype: MHNG, sample SBH-96/19; female; Hong Kong (New Territories), Tai Mo Shan Country Park, barrier ravine, petits îlots de forêt, prélèvement de sol entre les racines de *Machilus* sp. (Lauraceae), 750 m; 9.XII.1996; leg. B. Hauser (extraction par appareil Berlese à Genève).

Paratypes: MHNG; 1 female, 5 males; same data as for holotype.

Diagnosis: Genital shield subtriangular and its surface with oval pits. Setae V7 and V8 smooth and needle-like, situated near end of pedofossae IV. Setae on dorsal side of body smooth. The new species differs from the other known *Angulobaloghia* species by the shape (subtriangular and with wide basis) and pit-like

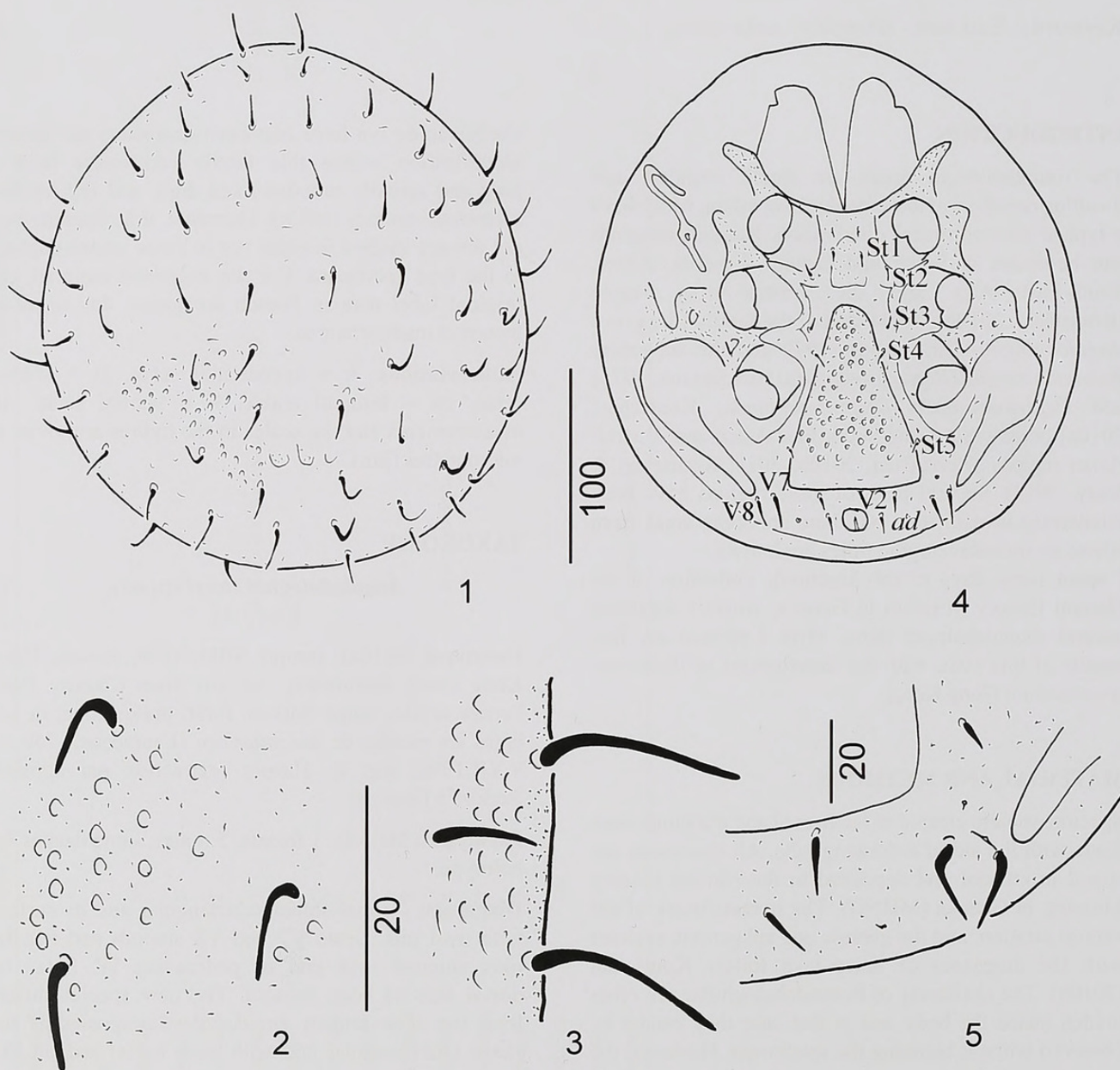
ornamentation of the genital shield in females and by the central position of setae V6 in both sexes.

Description of female: Length of idiosoma 370-380 μm , width 340-350 μm ($n=2$). Shape circular, posterior margin rounded, color reddish brown.

Dorsal idiosoma (Fig. 1): Marginal and dorsal shields fused. Dorsal setae basally curved, margins smooth (about 17-23 μm long) (Figs 2-3). Surface with small oval pits (Figs 2-3).

Ventral idiosoma (Fig. 4): Sternal and ventral shields without sculptural pattern, but a linguliform, shallow depression present near setae St1. All sternal setae smooth, needle-like and short (about 5-6 μm long), St1 situated at level of central region of coxae II, St2 at level

of posterior margin of coxae II, St3 at level of posterior margin of coxae III, St4 at level of anterior margins of coxae IV, St5 situated at level of pedofossae IV. Ventral setae smooth and needle-like. V2 about 6-7 μm long, situated near basal line of genital shield. V7 and V8 about 15-17 μm long, situated near end of pedofossae IV. Setae *ad* similar in shape and length to V2 setae, situated laterally to anal opening. V6 setae absent. One pair of lyrifissures situated anterior to St1, one pair near St4, and two pairs of other sensory organs plus one pair of lyrifissures near V7 and V8. Stigmata situated between coxae II and III. Peritremes hook-shaped. Genital shield long and subtriangular, its surface with oval pits and its apical margin rounded. Base of tritosternum narrow, vase-like, tritosternal laciniae smooth, subdivided into three

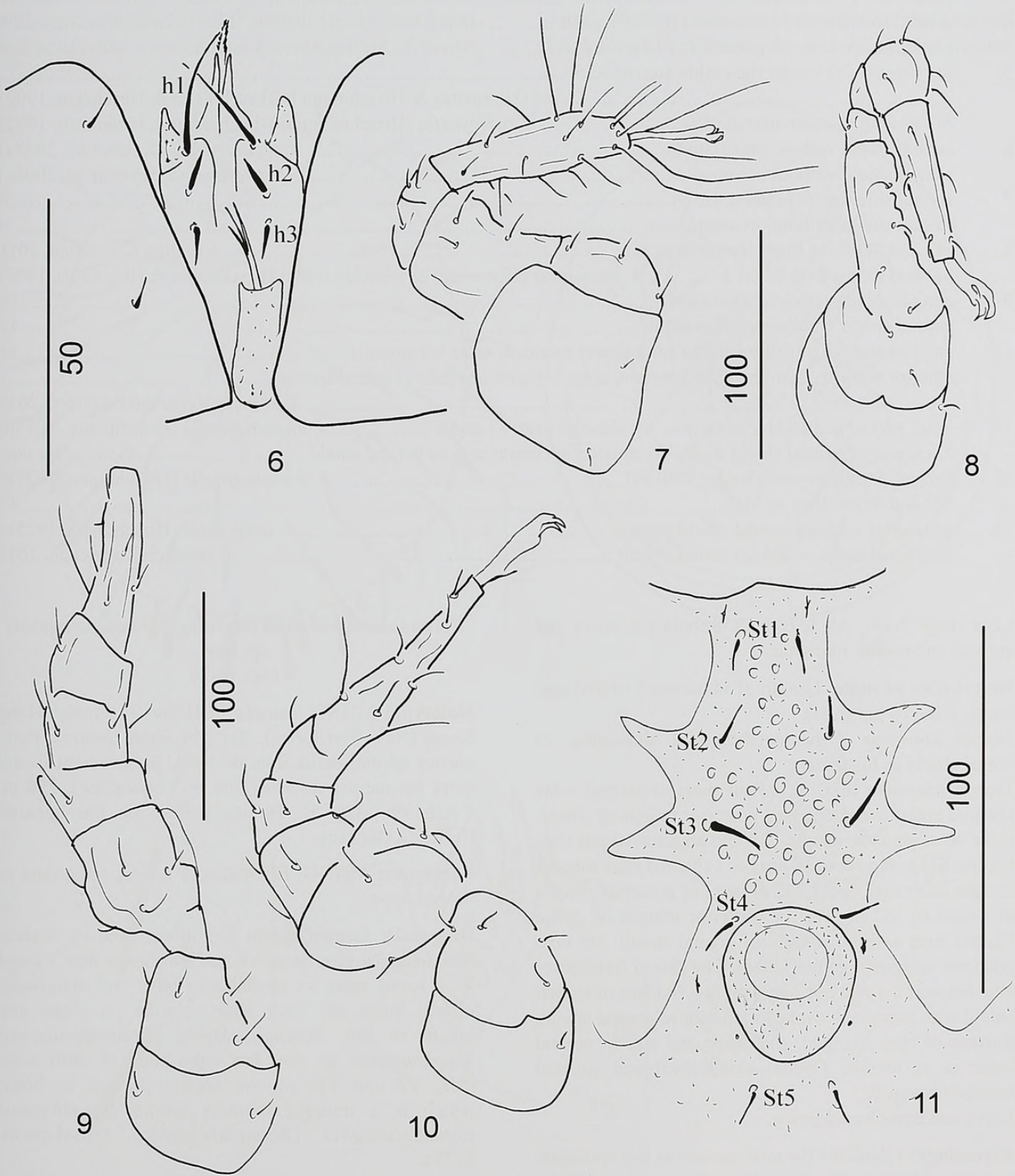


Figs 1-5. *Angulobaloghia staryi* sp. nov., female holotype. (1) Body in dorsal view. (2) Setae and ornamentation in central area of dorsal shield. (3) Setae and ornamentation in lateral part of dorsal shield. (4) Body in ventral view. (5) Ventral setae.

smooth branches in its distal half (Fig. 6). Pedofossae deep, their surface smooth, separated furrows for tarsi IV present.

Gnathosoma (Fig. 6): Corniculi horn-like, internal malae smooth and longer than corniculi. Hypostomal setae as

follows: h1 long (about 22-23 μm), smooth and needle-like, h2 and h3 short (about 6-7 μm), smooth and needle-like, h4 marginally serrate and short (about 5-6 μm). Apical part of epistome marginally pilose. Palp with smooth setae. Chelicerae not clearly visible.



Figs 6-11. *Angulobaloghia staryi* sp. nov., female holotype (6-10) and male paratype (11). (6) Ventral view of gnathosoma, tritosternum and coxae I. (7) Ventral view of leg I. (8) Ventral view of leg II. (9) Ventral view of leg III. (10) Ventral view of leg IV. (11) Ventral view of intercoxal area of male.

Key to the species of *Angulobaloghia* (modified, after Kontschán, 2010b, 2011):

- 1 ventral shield ornamented..... *A. aokii* (Hiramatsu, 1977)
- ventral shield smooth..... 2
- 2 genital shield of female semi-circular *A. danyii* (Kontschán, 2008a)
- genital shield of female triangular 3
- 3 peritremes mushroom-shaped..... 4
- peritremes hook-shaped..... 7
- 4 genital shield with pattern 5
- genital shield without pattern 6
- 5 St3 three times longer than other sternal setae *A. cuyi* (Hiramatsu & Hirschmann in Hirschmann & Hiramatsu, 1992)
- St3 as long as other sternal setae *A. pyrigynella* (Hirschmann in Hirschmann & Hiramatsu, 1992)
- 6 sternal shield with ornamentation..... *A. vietnamensis* (Kontschán, 2008a)
- sternal shield without ornamentation *A. triangulata* (Kontschán, 2008a)
- 7 sternal shield with ornamentation..... 8
- sternal shield without ornamentation 9
- 8 St2 and St3 three times longer than St1 *A. indica* Kontschán, 2011
- St2 and St3 as long as St1..... *A. luzonensis* (Hiramatsu & Hirschmann in Hirschmann & Hiramatsu, 1992)
- 9 genital shield with ornamentation 10
- genital shield without ornamentation 12
- 10 anterior margin of genital shield smooth and rounded, setae V6 smooth 11
- anterior margin of genital shield serrate, setae V6 with one pair of lateral spines..... *A. scrobia* Kontschán & Starý, 2011
- 11 basal part of genital shield narrow, V6 situated near V7 and V8 *A. angustigynella* (Hirschmann, 1975b)
- basal part of genital shield wide, V6 situated in central area of ventral shield *A. staryi* sp. nov.
- 12 St2 and St3 three times longer than St1 *A. angullogynella* (Hirschmann, 1975b)
- St2 and St3 as long as St1..... 13
- 13 additional setae on sternal shield present *A. latigynella* (Hirschmann, 1975b)
- additional setae on sternal shield absent *A. tamilica* Kontschán, 2011

Legs (Figs 7-10). All legs with ambulacral claws and smooth and needle-like setae.

Description of male: Length of idiosoma 370-410 µm, width 340-370 µm (n=5).

Dorsal idiosoma: Ornamentation and chaetotaxy of dorsal shield as for female.

Ventral idiosoma (Fig. 11): Four pairs of sternal setae situated anterior and one pair posterior to genital shield, these setae smooth, needle-like and about 8-10 µm long (except St3 being about 14 µm). St1 situated near anterior margin of sternal shield, St2 at level of posterior margin of coxae II, St3 at level of posterior margin of coxae III, St4 near anterior margin of genital shield, St5 near posterior margin of genital shield. One pair of lyrifissures situated near St1 and one pair near St4. Surface of sternal shield with numerous oval pits anterior to genital shield. Surface of ventral shield, and shape and size of ventral setae as in female. Genital shield oval and situated between coxae IV.

Larva and nymphs unknown.

Etymology: I dedicate the new species to my colleague and dear friend, to Dr. Josef Starý (Biology Centre AS CR, Institute of Soil Biology, České Budějovice, Czech Republic).

***Rotundabaloghia (Rotundabaloghia) hongkongensis*
sp. nov.**

Figs 12-20

Holotype: MHNG, sample SBH-96/19; female; Hong Kong (New Territories), Tai Mo Shan Country Park, barrier ravine, petits îlots de forêt, prélèvement de sol entre les racines de *Machilus* sp. (Lauraceae), 750 m; 9.XII.1996; leg. B. Hauser (extraction par appareil Berlese à Genève).

Paratypes: MHNG; 6 females, 5 males; same data as for holotype.

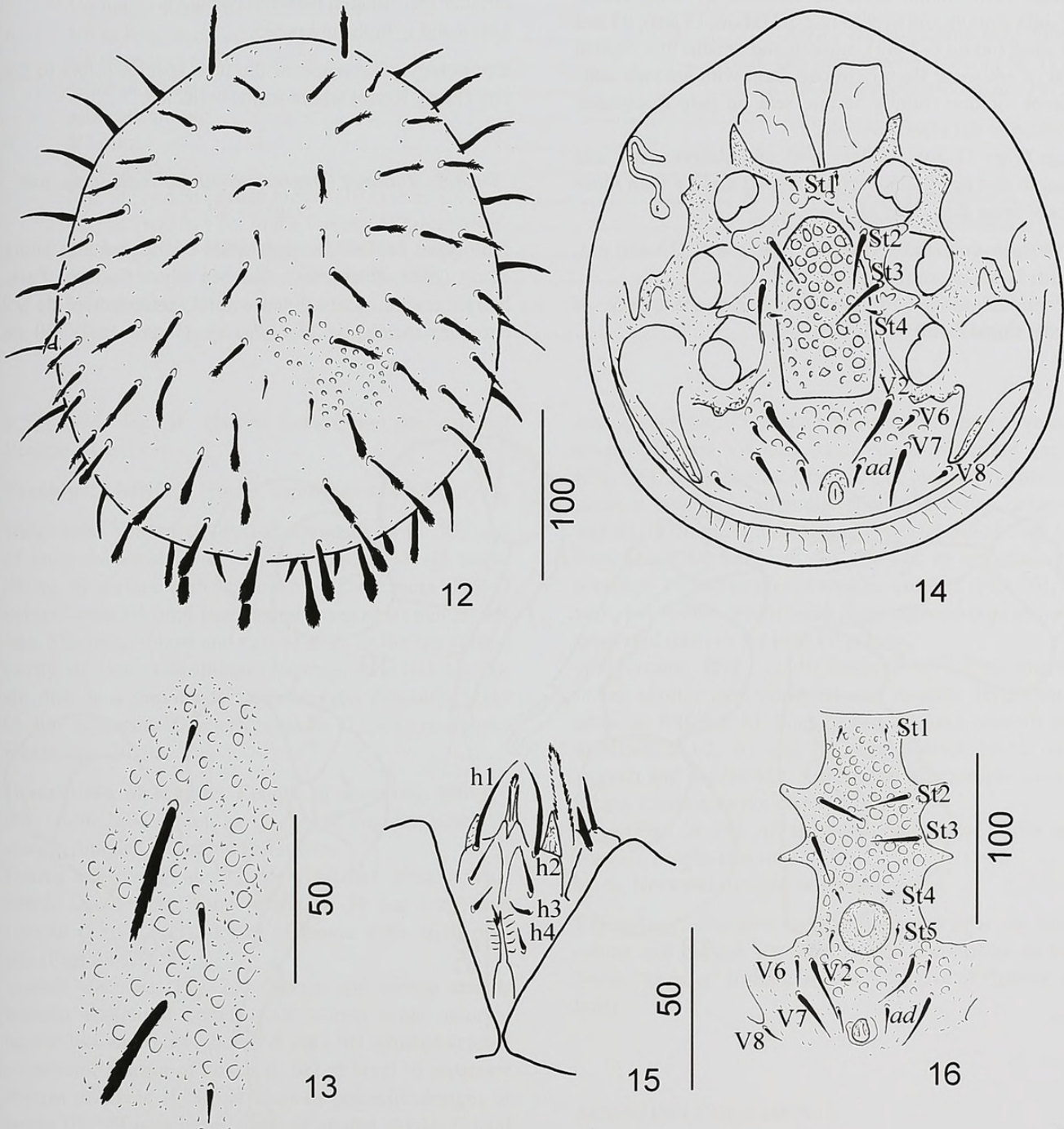
Diagnosis: Genital shield linguliform and its surface with irregular pits. Setae V6 and V8 shorter than V2 and V7. Dorsal setae on caudal area wide and marginally pilose. Setae St1 very short, similar in shape and length to St4. *Rotundabaloghia (Rotundabaloghia) hongkongensis* sp. nov. has three pairs of short setae (St1, V2 and V6) on the ventral part of its body, which is a unique character within the subgenus *Rotundabaloghia (Rotundabaloghia)* Hirschmann, 1975a.

Description of female: Length of idiosoma 370-380 µm, width 340-350 µm (n=2). Shape of idiosoma circular, posterior margin rounded, color reddish brown.

Dorsal idiosoma (Fig. 12): Marginal and dorsal shields fused. Three pairs of setae in row j short, smooth and needle-like (about 12–13 μm), other setae on dorsal idiosoma slightly pilose (Fig. 13) (about 27–30 μm), setae in caudal area of dorsal part wide and spatuliform (about 30–31 μm). Dorsal idiosoma with oval pits (Fig. 13).

Ventral idiosoma (Fig. 14): Sternal and ventral shields with some oval pits. Setae St1 smooth, short (about 8 μm) and needle-like, situated near anterior margin of sternal

shield, St2 smooth and long (about 29 μm), situated at level of posterior margin of coxae II, St3 smooth and long (about 31 μm), at level of central area of coxae III, St4 similar in shape and length to St1, at level of anterior margins of coxae IV. St5 absent. Ventral setae smooth and needle-like. V2 and V6 situated near posterior margin of coxae IV, V2 long (about 44–46 μm), V6 short (about 13–14 μm). V8 short (about 14–15 μm) and situated near end of pedofossae IV. V7 long (about 35–37 μm) and situated



Figs 12–16. *Rotundabaloghia* (*Rotundabaloghia*) *hongkongensis* sp. nov., female holotype (12–15) and male paratype (16). (12) Body in dorsal view. (13) Dorsal setae and ornamentation. (14) Ventral view of body. (15) Ventral view of gnathosoma, tritosternum and coxae I. (16) Ventral view of intercoxal area of male.

between V8 and *ad*. Setae *ad* similar in shape and length to V6, lateral to anal opening. Stigmata situated between coxae II and III. Peritremes hook-shaped. Genital shield long and linguliform, surface with irregular pits, its apical margin rounded. Base of tritosternum narrow, tritosternal laciniae smooth, subdivided into three smooth branches (Fig. 15). Pedofossae deep, their surface smooth, separated furrows for tarsi IV present.

Gnathosoma (Fig. 15): Corniculi horn-like, internal malae longer than corniculi and smooth. Labrum apically pilose. Hypostomal setae as follows: h1 long (about 27 μm), smooth and needle-like, h2 (about 13 μm), h3 and h4 short (about 6-7 μm), smooth and needle-like. Apical part of epistome slightly pilose. Palp with smooth setae except for one slightly serrate seta on palp trochanter. Chelicerae not clearly visible.

Legs (Figs 17-20). All legs with ambulacral claws and smooth and needle-like setae, tarsi III and IV with more robust setae than other articles.

Description of male: Length of idiosoma 370-410 μm , width 340-370 μm (n=5).

Dorsal idiosoma: Ornamentation and chaetotaxy of dorsal shield as for female.

Ventral idiosoma (Fig. 16): Four pairs of sternal setae situated anterior to genital shield, these setae smooth, needle-like. St1, St4 and St5 short (about 7-9 μm), St2 and St3 long (about 29-30 μm). St1 situated near anterior margin of sternal shield, St2 situated at level of posterior margin of coxae II, St3 at level of central area of coxae III, near anterior margin of genital shield, St5 near lateral margin of genital shield. Surface of sternal shield with numerous oval pits. Surface of ventral shield, and shape and size of ventral setae as in female. Genital shield circular and situated between coxae IV.

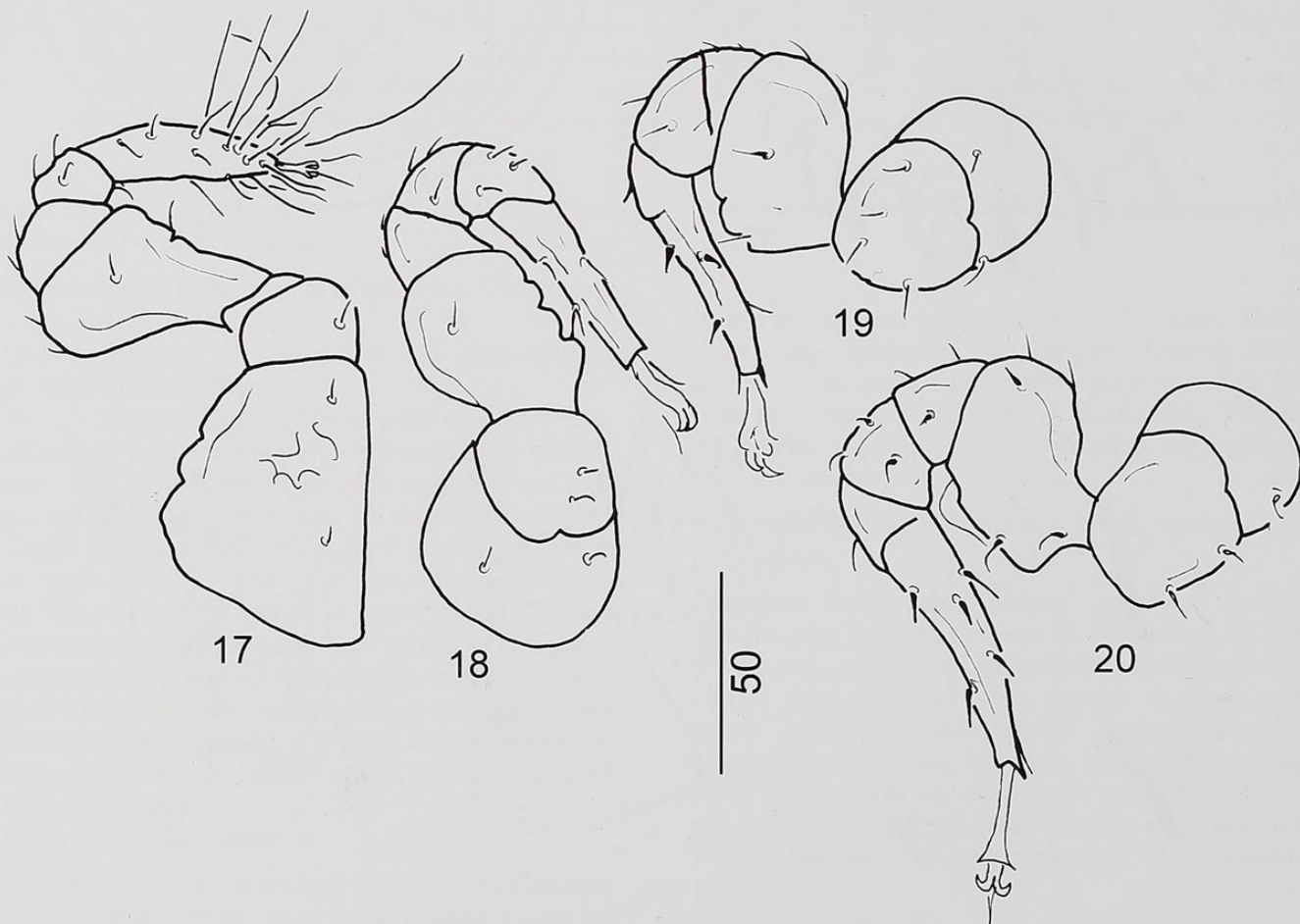
Larva and nymphs unknown.

Etymology: The name of the new species refers to the city (Hong Kong) where it was collected.

***Depressorotunda (Depressorotunda) taurina* sp. nov.**

Figs 21-29

Holotype: MHNG, sample SBH-96/19; female; Hong Kong (New Territories), Tai Mo Shan Country Park, barrier ravine, petits îlots de forêt, prélèvement de sol entre les racines de *Machilus* sp. (Lauraceae), 750 m;



Figs 17-20. *Rotundabaloghia (Rotundabaloghia) hongkongensis* sp. nov., female holotype. (17) Ventral view of leg I. (18) Ventral view of leg II. (19) Ventral view of leg III. (20) Ventral view of leg IV.

Key to the species of *Rotundabaloghia* (*Rotundabaloghia*) species (modified, after Kontschán, 2010b):

1	V8 setae smooth.....	2
–	V8 setae not smooth	7
2	V8 shorter than other ventral setae	5
–	V8 as long as V2, V6 and <i>ad</i>	3
3	V7 longer than other ventral seta.	<i>R. (R.) kaszabi</i> Hirschmann, 1975b
–	V7 as long as other ventral setae	4
4	ornamentation between V7 present	<i>R. (R.) makilingoides</i> Hirschmann & Hiramatsu, 1992
–	ornamentation between V7 absent.....	<i>R. (R.) makilingensis</i> Hirschmann & Hiramatsu, 1992
5	V6 as long as V8.....	<i>R. (R.) hongkongensis</i> sp. nov.
–	V6 longer than V8	6
6	V8 as long as <i>ad</i>	<i>R. (R.) korsosi</i> Kontschán, 2008b
–	V8 shorter than <i>ad</i>	<i>R. (R.) hirschmanni</i> Hiramatsu, 1977
7	setae <i>ad</i> pilose.....	<i>R. (R.) baloghi</i> Hirschmann, 1975b
–	setae <i>ad</i> smooth.....	8
8	V7 pilose	9
–	V7 smooth.....	10
9	St1, St2 and St3 much longer (10×) than St4	<i>R. (R.) macroseta</i> Hirschmann, 1975b
–	St1, St2 and St3 not much longer (4×) than St4	<i>R. (R.) mahunkai</i> Hirschmann, 1975b
10	St1 longer and wider than St2 and St3	<i>R. (R.) monomacroseta</i> Hirschmann, 1975b
–	St1 not longer and wider than St2 and St3	11
11	V7 two times longer than <i>ad</i>	<i>R. (R.) kaszabisimilis</i> Hirschmann, 1975b
–	V7 as long as <i>ad</i>	<i>R. (R.) pilosa</i> Hirschmann, 1975b

9.XII.1996; leg. B. Hauser (extraction par appareil Berlese à Genève).

Paratype: MHNG; 1 female; same data as for holotype.

Diagnosis: Ventral cavity quadrangular, with one pair of long, robust and curved setae. Genital shield linguiform, its surface with shallow pits. Three pairs of short ventral setae situated near lateral margins of ventral cavity. The long, robust and curved setae in the big ventral cavity in *Depressorotunda* (*Depressorotunda*) *taurina* sp. nov. is a previously not observed character within the subgenus *Depressorotunda* (*Depressorotunda*) Kontschán, 2010a.

Description of female: Length of idiosoma 290–310 µm, width 260–270 µm (n=2). Shape circular, posterior margin rounded, color reddish brown.

Dorsal idiosoma (Fig. 21): Marginal and dorsal shields fused. Dorsal setae long (about 27–33 µm long) and smooth (Figs 22–23), dorsal idiosoma with small oval pits (Figs 22–23).

Ventral idiosoma (Fig. 24): Sternal and ventral shields without sculptural pattern. All sternal setae smooth, needle-like and short (about 7–9 µm), St1 situated at level of anterior margin of coxae II, St2 at level of posterior margin of coxae II, St3 at level of posterior margin of coxae III, St4 near basal edges of genital shield. Dorsal cavity large, quadrangular, wider (about 75–76 µm) than long (about 34–35 µm). Ventral setae smooth and needle-like. V1 placed in ventral cavity, long (about 34–35 µm), robust and curved. V2, V3 and V4 short (about 9–10 µm)

and needle-like. V2 situated near anterior edges of ventral cavity, V3 and V4 near basal edges of ventral cavity (Fig. 25). Adanal setae absent. One pair of lyrifissures situated near St4. Stigmata situated between coxae II and III. Peritremes hook-shaped. Genital shield long and linguiform, surface with shallow pits, its apical margin rounded. Tritosternum covered by coxae I (Fig. 26), its parts not visible. Pedofossae deep, their surface smooth, separated furrows for tarsi IV present.

Gnathosoma (Fig. 26): Corniculi horn-like, internal malae shorter than corniculi and smooth. Hypostomal setae as follows: h1 long (about 27 µm), smooth and needle-like, h2, h3 and h4 short (about 12–15 µm), smooth and needle-like. Apical part of epistome weakly pilose. Chelicerae not clearly visible.

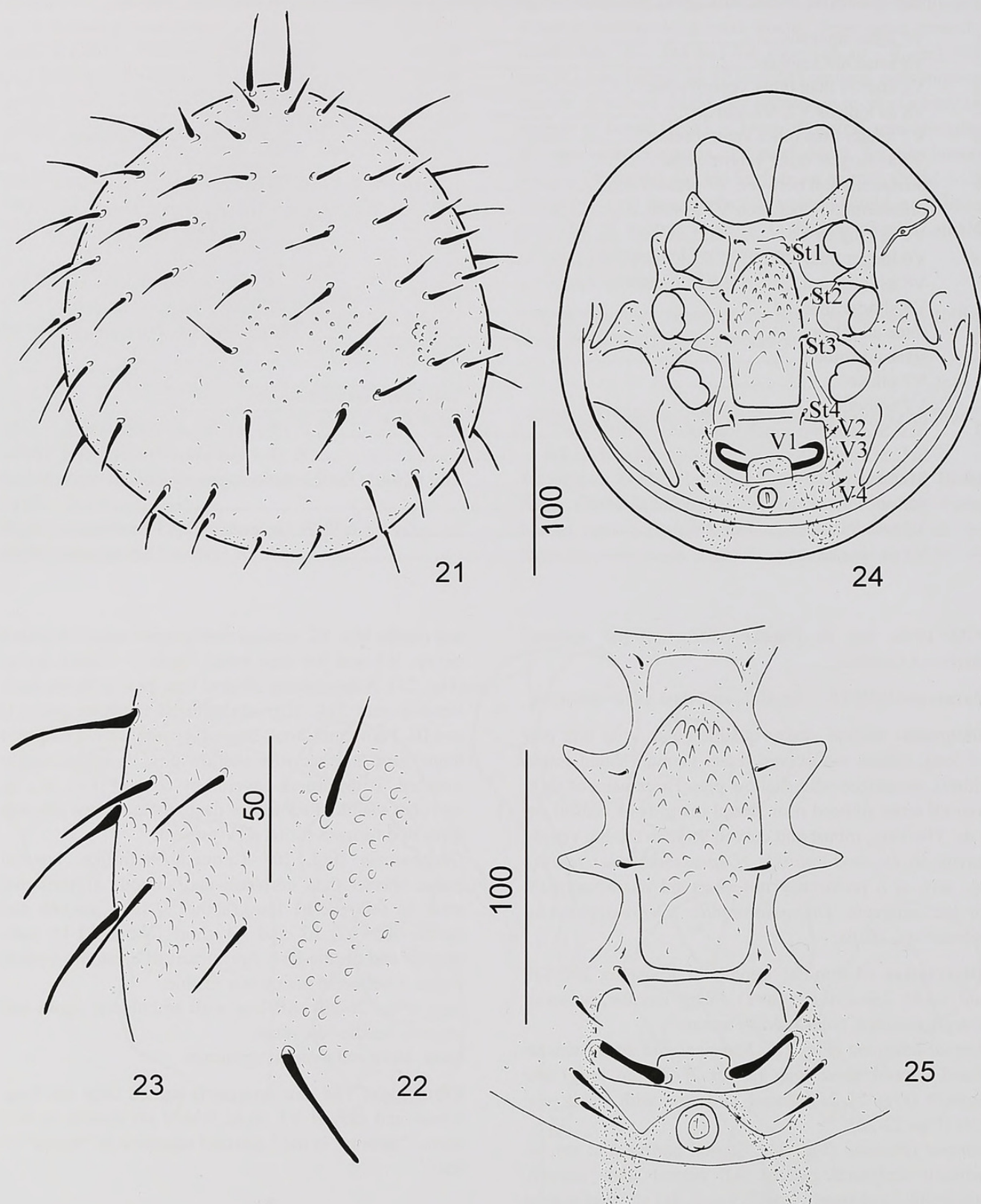
Legs (Figs 26–29). All legs with ambulacral claws and smooth, needle-like setae.

Male, larva and nymphs unknown.

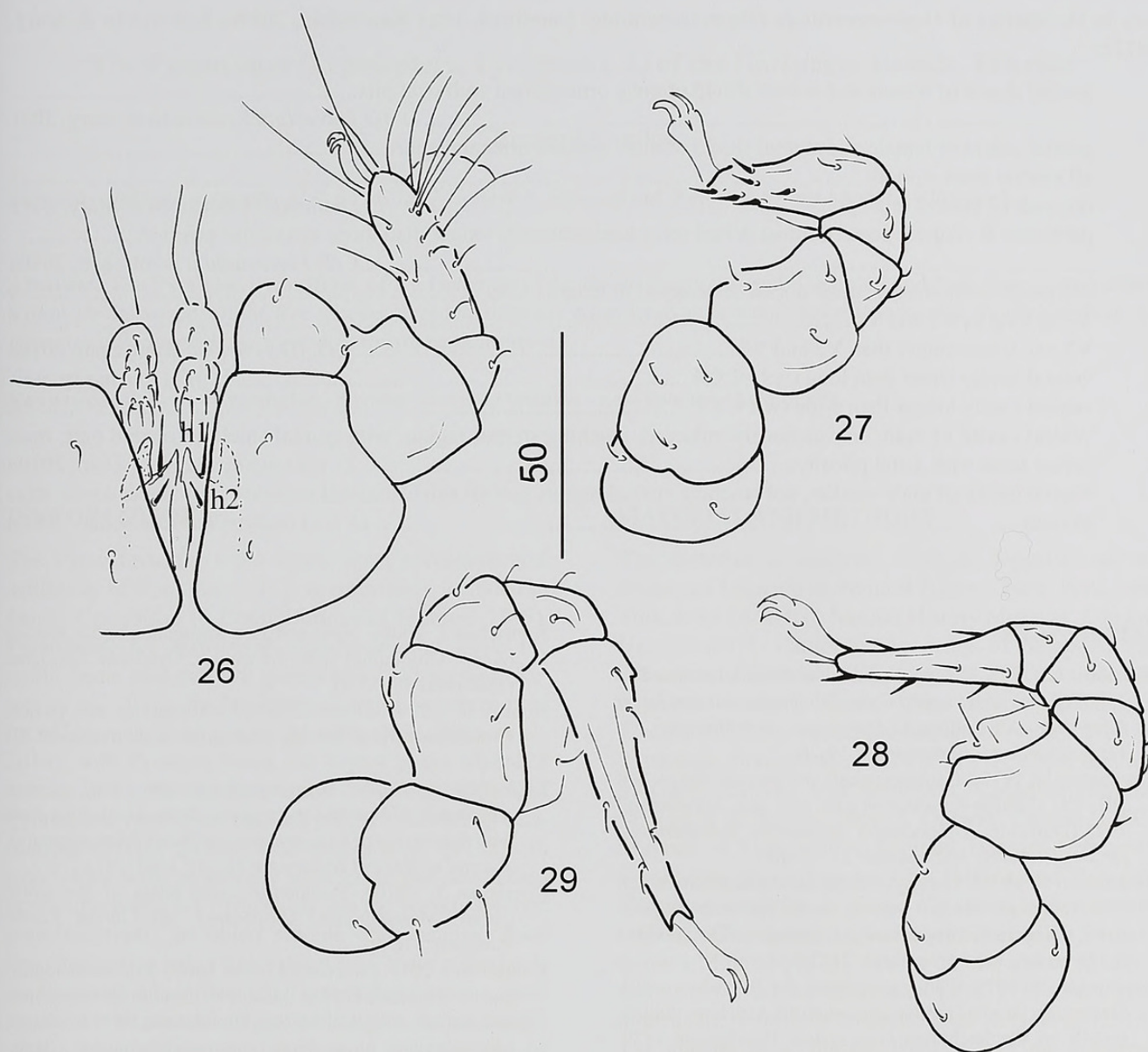
Etymology: The new species is named after the long, robust and curved V1 setae, which are similar to bull horns; “*taurina*” is the Latinized adjective of “*taurus*” (= bull).

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I am very grateful to Dr. Peter Schwendinger (MHNG) for his kind hospitality during my stay in Geneva, and to Dr. Jerzy Błoszyk (University of Poznan, Poland) for commenting on an earlier version of the manuscript.



Figs 21-25. *Depressorotunda (Depressorotunda) taurina* sp. nov., female holotype. (21) Body in dorsal view. (22) Setae and ornamentation in central area of dorsal shield. (23) Setae and ornamentation in lateral part of dorsal shield. (24) Body in ventral view. (25) Intercoxal area and ventral cavity in ventral view.



Figs 26-29. *Depressorotunda (Depressorotunda) taurina* sp. nov., female holotype. (26) Ventral view of leg I and gnathosoma. (27) Ventral view of leg II. (28) Ventral view of leg III. (29) Ventral view of leg IV.

Key to the species of *Depressorotunda* (*Depressorotunda*) (modified, after Kontschán, 2010b, Kontschán & Starý, 2012):

- 1 genital shield of female and sternal shield of male ornamented with oval pits *D. (D.) alveolata* Kontschán & Starý, 2011
- genital shield of female and sternal shield of male without ornamentation 2
- 2 all ventral setae smooth 3
- one pair of ventral setae pilose *D. (D.) batuensis* Kontschán & Starý, 2012
- 3 peritreme R-shaped, posteriormost dorsal setae conspicuously longer than those in anterior position *D. (D.) seticaudata* Kontschán, 2010a
- peritreme hook-shaped, most dorsal setae equal in length 4
- 4 V3 as long as V2 and V4 5
- V3 two times longer than V2 and V4 *D. (D.) mirifica* Kontschán, 2010a
- 5 ventral cavity wider than long (w:l = 1:0.4) *D. (D.) taurina* sp. nov.
- ventral cavity longer than wide (w:l = 1:2) 6
- 6 ventral cavity of male conspicuously enlarged, reaching sternal region, with genital shield in medial part; most dorsal setae with distal pilosity *D. (D.) malayana* Kontschán, 2010a
- ventral cavity of male smaller, not reaching sternal region, genital shield situated outside cavity; most dorsal setae smooth *D. (D.) thailandica* Kontschán, 2010a

REFERENCES

- Hiramatsu N. 1977. Gangsystematik der Parasitiformes. Teil 239. Teilgang einer neuen *Rotundabaloghia*-Art aus Japan (Dinychini, Uropodinae). *Acarologie, Schriftenreihe für Vergleichende Milbenkunde* 23: 19-20.
- Hirschmann W. 1975a. Gangsystematik der Parasitiformes. Teil 201. Die Gattung *Rotundabaloghia* nov. gen. Hirschmann 1975 (Dinychini, Uropodinae). *Acarologie, Schriftenreihe für Vergleichende Milbenkunde* 21: 23-26.
- Hirschmann W. 1975b. Gangsystematik der Parasitiformes. Teil 203. Teilgänge, Stadien von 16 neuen *Rotundabaloghia*-Arten (Dinychini, Uropodinae). *Acarologie, Schriftenreihe für Vergleichende Milbenkunde* 21: 28-34.
- Hirschmann W. 1979. Stadiensystematik der Parasitiformes I. Stadienfamilien und Stadiengattungen der Atrichopygidiina, erstellt im Vergleich zum Gangsystem Hirschmann 1979. *Acarologie, Schriftenreihe für Vergleichende Milbenkunde* 26: 75-70.
- Hirschmann W., Hiramatsu N. 1992. 34 *Rotundabaloghia*-Arten aus Asien (Japan, Neuguinea, Philippinen, Borneo) (Dinychini, Uropodinae). *Acarologie, Schriftenreihe für Vergleichende Milbenkunde* 39: 9-25.
- Kontschán J. 2008a. New and rare *Rotundabaloghia* species (Acari: Uropodina) from the tropics. *Opuscula Zoologica (Budapest)* 38: 15-41.
- Kontschán J. 2008b. *Rotundabaloghia korsosi* sp. nov. (Acari: Uropodina) from Taiwan. *Collection and Research* 21: 45-51.
- Kontschán J. 2010a. *Depressorotunda* gen. nov., a new remarkable Uropodina mite genus from South-East Asia with description of four new species (Acari: Mesostigmata). *Journal of Natural History* 44(23-24): 1461-1473.
- Kontschán J. 2010b. Rotundabaloghiid mites of the world (Acari: Mesostigmata: Uropodina). *Ad Librum Kiadó, Budapest*, 116 pp.
- Kontschán J. 2011. First record of the family Rotundabaloghiidae Hirschmann, 1975 in India, with description of two new species of *Angulobaloghia* Hirschmann, 1975 (Acari: Mesostigmata: Uropodina). *Opuscula Zoologica (Budapest)* 42(2): 121-124.
- Kontschán J., Starý J. 2011. Uropodina species from Vietnam (Acari: Mesostigmata). *Zootaxa* 2807: 1-28.
- Kontschán J., Starý J. 2012. New Uropodina species and records from Malaysia (Acari: Mesostigmata). *Acta Zoologica Academiae Scientiarum Hungaricae* 58(2): 177-192.



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