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Trachyuropodid mites (Acari: Uropodina) from South-East Asia: catalog, new key and description of two new species

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Abstract: All trachyuropodid mites described from South-East Asia are presented in a new illustrated key. Two new species of *Bostocktrachys* (*B. surinensis* sp. nov. and *B. thailandica* sp. nov.) from Thailand are described and illustrated. Both new *Bostocktrachys* species differ from the other known species of this genus by the strongly sclerotized lines of the dorsal shield. Four new combinations are proposed: *Trachyuropoda* (*Leonardiella*) *imitans* Berlese, 1905 is transferred to the genus *Arculatatrachys*, *Trachyuropoda cistulata* Hirschmann, 1975 is placed in the genus *Leonardiella*, *Trachyuropoda micherdzinskii* Hirschmann, 1976 and *Trachyuropoda tuberculata* Berlese, 1913 in the genus *Bostocktrachys*.

Keywords: Turtle mites - taxonomy - zoogeography - Oriental region.

INTRODUCTION

The Uropodina family Trachyuropodidae consists of very unusual and unique mites. Species of this family have numerous particular characters, like the internal malae subdivided into several branches with fringed margins, hypostomal setae not situated in a longitudinal row, and the idiosoma strongly sclerotized and usually equipped with numerous elevated structures (grooves, lines, rings, etc.) on the dorsal shield (Kotschán, 2015).

Currently more than 100 trachyuropodid species are known from around the world (Wiśniewski & Hirschmann, 1993). The most intensively studied area is South America from where more than 30 species are known (Kotschán, 2011c; Kotschán & Starý, 2013). South-East Asia is a poorly-studied part of the world from a trachyuropodid point of view; only six species are listed from this region (Wiśniewski, 1993a; Kotschán, 2015).

New investigations of the Uropodina fauna of South-East Asia started in the last few years. Several new species were discovered and described from Thailand, Vietnam and Malaysia (Kotschán, 2008, 2010a, b, c, 2011a, b; Kotschán & Starý, 2011, 2012), but among them was only one trachyuropodid mite (Kotschán, 2015).

MATERIAL AND METHODS

Specimens of the two new species described here were sorted out from the Arachnida collection of the Natural History Museum in Geneva by the first author. They were cleared in lactic acid, investigated on half covered slides with a well, and illustrations were made with the aid of a drawing tube on a Leica 1000 scientific microscope. All specimens are stored in ethanol and deposited in the Muséum d'histoire naturelle de Genève (MHNG). Abbreviations of morphological structures: h = hypostomal setae, St = sternal setae, V = ventral setae. All measurements and the scales in the figures are given in micrometres (µm).

RESULTS

List of the known South-East Asian trachyuropodid mites

Arculatatrachys imitans (Berlese, 1905) comb. nov.

Trachyuropoda (*Leonardiella*) *imitans* Berlese, 1905: 159, fig. 14. – Wiśniewski & Hirschmann, 1993: 85. – Wiśniewski, 1993a: 278-278. – Wiśniewski, 1993b: 399.

Distribution: Indonesia (Java).

Justification: Judging from the large, kidney-shaped lateral depressions in the dorsal idiosoma which were illustrated by Berlese (1905), we transfer this species from the genus *Trachyuropoda* to the genus *Arculatatrachys*.

***Leonardiella cistulata* (Hirschmann, 1975) comb. nov.**

Trachyuropoda cistulata Hirschmann, 1975: 103-104, fig. 115.
– Wiśniewski & Hirschmann, 1993: 87. – Wiśniewski, 1993a: 276. – Wiśniewski, 1993b: 398.

Distribution: Sri Lanka.

Justification: Due to the triangular shape of the idiosoma and the presence of a ventral depression posterior to coxae IV (see Hirschmann, 1975) we transfer this species from the genus *Trachyuropoda* to *Leonardiella*.

***Trachyibana sarawakiensis* Kontschán, 2015**

Trachyibana sarawakiensis Kontschán, 2015: 273-277, figs 1-18.

Distribution: East Malaysia (Sarawak).

***Bostocktrachys micherdzinskii* (Hirschmann, 1976) comb. nov.**

Trachyuropoda micherdzinskii Hirschmann, 1976: 29-30, fig. 18. – Wiśniewski & Hirschmann, 1993: 86. – Wiśniewski, 1993a: 277. – Wiśniewski, 1993b: 399.

Distribution: Vietnam.

Justification: See the next species.

***Bostocktrachys tuberculata* (Berlese, 1913) comb. nov.**

Trachyuropoda tuberculata Berlese, 1913: 85, fig. 14.
– Hirschmann & Zirngiebl-Nicol, 1969: 131. – Wiśniewski & Hirschmann, 1993: 86. – Wiśniewski, 1993a: 277-278. – Wiśniewski, 1993b: 400.

Distribution: Vietnam and Indonesia (Java).

Justification: Both *B. tuberculata* and *B. micherdzinskii* have a horizontal furrow on the dorsal shield which is a diagnostic character of the genus *Bostocktrachys*, therefore we transfer these species to the genus *Bostocktrachys*.

***Bostocktrachys surinensis* sp. nov.**

Figs 1-14

Holotype: MHNG, sample TL-15/09; female; Thailand, Surin Province & District, mixed evergreen-deciduous

forest near prison, 14°52'36"N, 103°27'24"E, 150 m, 9.VII.2014; leg. P. Schwendinger.

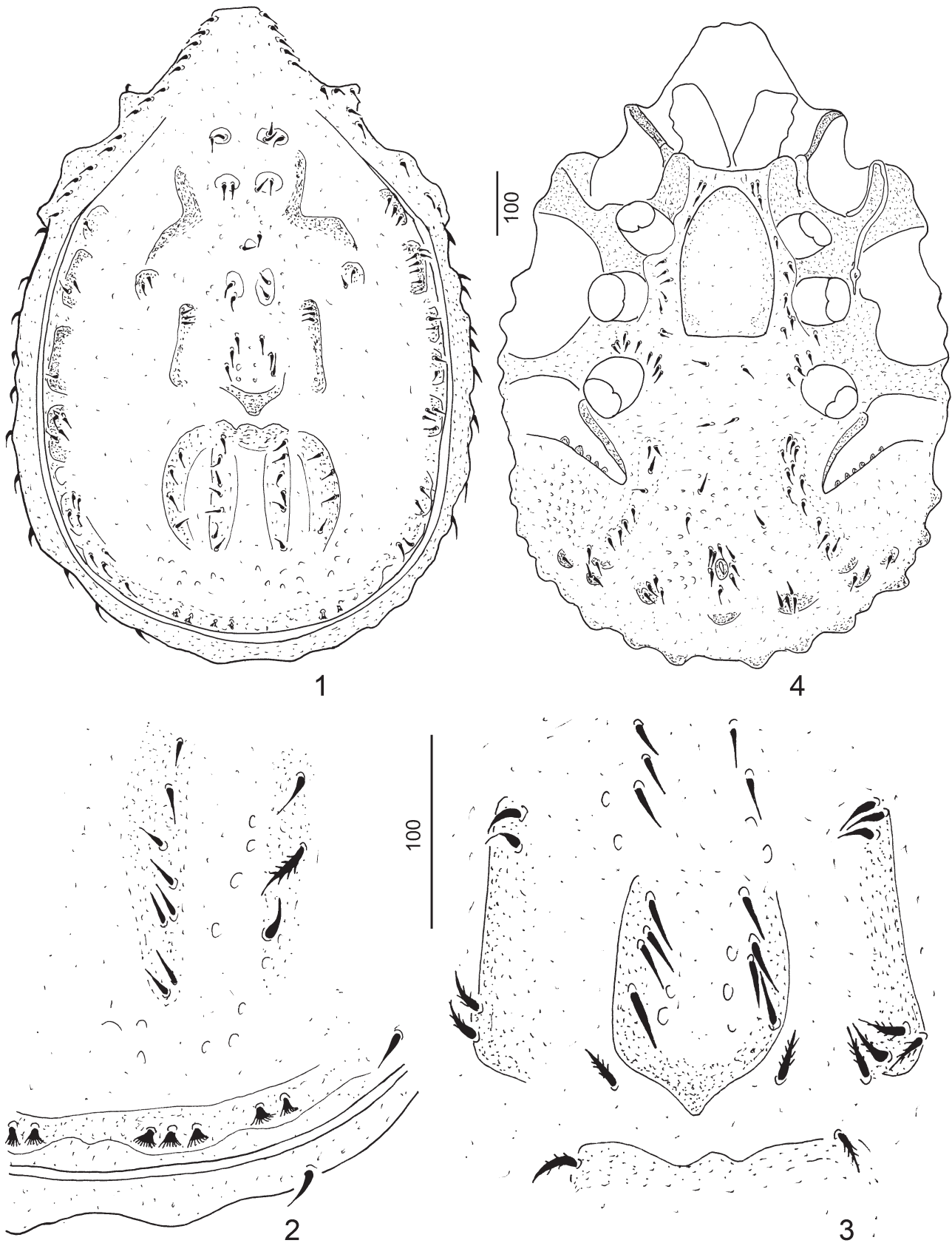
Paratypes: MHNG; two females and two males with same data as for the holotype.

Diagnosis: Distinguished from the other two known *Bostocktrachys* species by smooth and spiniform dorsal setae, except for five pairs of short and apically pilose setae situated close to posterior margin of dorsal shield. Four vertical grooves with a strongly sclerotized horizontal crossbar situated posterior to horizontal furrow. Surface of genital shield of female smooth. Position and shape of strongly sclerotized dorsal grooves and humps unique within the genus *Bostocktrachys*. Only one species in this genus (*B. micherdzinskii*) has short apically serrate caudal setae. Beside the dorsal characters, the most important differences between these two species is the sculptural pattern of the female genital shield, which is smooth in the new species and ornamented with oval pits in *B. micherdzinskii*.

Description of female: Length of idiosoma 1000, width 700. Shape oval, with vertex slightly elongated; posterior margin rounded. Color reddish brown.

Dorsal idiosoma (Fig. 1): Dorsal and marginal shields fused anteriorly. Dorsal shield neutrichous, majority of dorsal setae spiniform (about 21-27 long) some of them pilose, others smooth (Figs 2-3). Ten short (about 8-10 long) and apically pilose setae in four groups (2-3-3-2) situated close to caudal margin of dorsal shield. Surface of dorsal shield bearing numerous strongly sclerotized structures. Numerous short, strongly sclerotized grooves situated close to margins of dorsal shield. One pair of large L-shaped grooves in anterior area of dorsal shield, one pair of C-shaped grooves located near end of L-shaped structures. A deep transversal furrow situated in central area of dorsal shield, anterior to furrow with one pair of long strongly sclerotized grooves and a V-shaped strongly sclerotized structure. Four longitudinal grooves anteriorly connected by a strongly sclerotized transversal crossbar situated posterior to transversal furrow. Surface of dorsal shield with some oval pits. Marginal shield without sculptural pattern; with spiniform setae (about 24-31 in length).

Ventral idiosoma (Fig. 4): Tritosternum with narrow and oval basis; laciniae with two smooth inner and two apically pilose outer branches (Fig. 6). Sternal shield without sculptural pattern and bearing smooth, short (about 16-20 in length) and needle-like setae. Numerous setae visible close to coxae IV. One pair of lyriform fissures situated close to anterior margin of sternal shield. Genital shield scutiform (about 235 long and about 145 wide) its surface smooth (Fig. 5). Ventral shield with oval pits, bearing smooth and needle like seta (about 24-28 long). Numerous setae situated in a horizontal row posterior to coxae IV, some setae placed on three



Figs 1-4. *Bostocktrachys surinensis* sp. nov., female holotype. (1) Dorsal idiosoma. (2) Setae on caudal margin and caudal part of dorsal shield. (3) Area posterior and anterior to transversal dorsal furrow. (4) Ventral idiosoma.

strongly sclerotized humps close to caudal margin. Setae around anal opening similar in shape and length to other ventral setae. Stigmata situated between coxae II and III. Prestigmatic part of peritremes long and hook-shaped, poststigmatic part short (Fig. 4). Pedofossae deep, their surface smooth, only some denticles visible on posterior margins of pedofossae IV.

Gnathosoma (Fig. 7): Corniculi horn-like, internal malae longer than corniculi and divided into four fringed branches. Hypostomal setae h1 short (about 28-30 in length) and smooth, h2-h4 marginally serrate, h2 and h4 short (about 50-55 in length), h3 long (about 93-95 in length), h3 situated close to h2. Deutosternal region smooth. Palpal trochanter with one short and smooth, and one long and marginally serrate seta. Other setae on palp smooth and needle-like, except for one pilose seta on dorsal side of femur; palpal claw bifurcate. Epistome subtriangular and deeply serrate on anterior margin (Fig. 8). Chelicerae with one tooth on movable and fixed digit, fixed digit longer than movable digit, pilus dentilis absent, internal sclerotized node present, one dorsal seta present (Fig. 9).

Legs (Figs 11-14): Leg I 400-410 long, leg II 345-350, leg III 365-375, leg IV 420-430. Legs I-IV each with a pair of claws at tip of ambulacral prolongation; claws of legs I smallest. Most setae on legs needle-like, several robust and serrate setae situated on all legs. Flap-like processes present on femora II-IV and coxa I.

Description of male: Length of idiosoma 960-1000, width 660-700 (n=3). Shape same as in females.

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

Ventral idiosoma: Ornamentation and chaetotaxy of ventral shield as in female. Sternal shield without sculptural pattern (Fig. 10). Positions of sternal setae as in Fig. 10. Sternal setae smooth and needle-like (about 15-20 long), one pair of lyriform fissures situated close to first sternal setae. Genital shield rounded (about 53-55 × 62-65 in dimension) and placed between coxae III. Other characters same as in female.

Nymph and larva unknown.

Etymology: The name of the new species refers to the province where the type specimens were collected.

***Bostocktrachys thailandica* sp. nov.**

Figs 15-27

Holotype: MHNG, sample 24-Th-79; female; Thailand, Bangkok, soil sample from base of tree; Berlese-extraction in Geneva; 17.VIII.1979; leg. J. Robert.

Paratypes: MHNG; two females and one male with same data as for holotype.

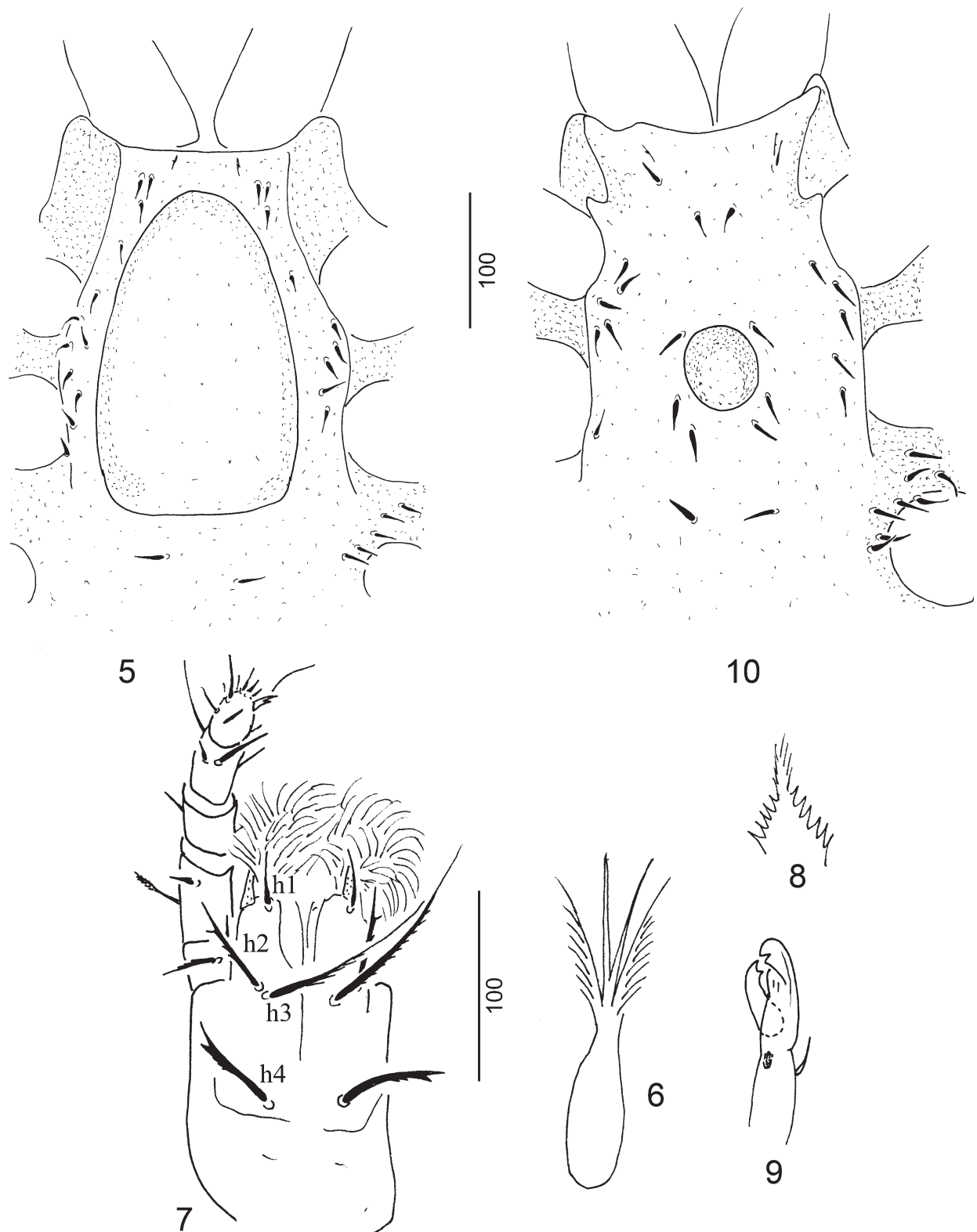
Diagnosis: Distinguished from the other congeneric species by most of dorsal setae smooth and spiniform. Anterior margin of furrow borders wide, elevated area

with strongly sclerotized and V-shaped posterior margin. Anterior parts of elevated area forming one pair of L-shaped, strongly sclerotized structures with deep pits at their corners. Deep horizontal furrow bordered in posterior part with a wide U-shaped sclerotized area. Only *Bostocktrachys tuberculata* has similar strongly sclerotized dorsal structures. In *B. tuberculata* the elevated area posterior to the furrow is rounded and narrower than the elevated area anterior to the furrow, whereas in the new species it is quadrangular and as wide as the elevated area anterior to the furrow. The posterior margin of the elevated area anterior to the transversal furrow also differs: it is straight in *B. tuberculata*, but slightly bent in the new species.

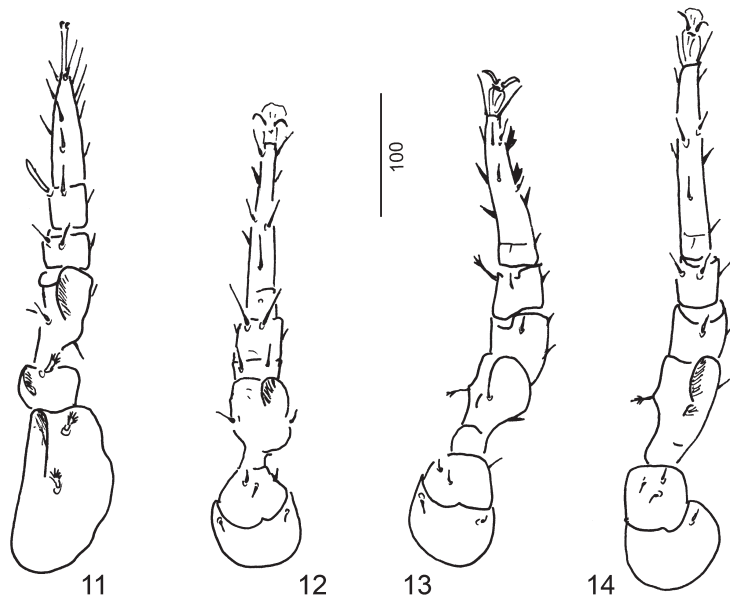
Description of female: Length of idiosoma 1065-1120, width 700-795 (n=3). Shape oval, with vertex slightly elongated, posterior margin rounded. Color reddish brown.

Dorsal idiosoma (Fig. 15): Dorsal and marginal shields fused anteriorly. Dorsal shield neutrichous, majority of dorsal setae spiniform (about 32-44 long), some of them pilose, others smooth. Surface of dorsal shield with oval pits and bearing numerous strongly sclerotized structures. A deep transversal furrow situated in central area of dorsal shield. One pair of strongly sclerotized rings visible at lateral ends of furrow. Anterior margin of furrow borders forming a wide and elevated area with strongly sclerotized and V-shaped posterior margin. Anterior parts of elevated area forming one pair of L-shaped, strongly sclerotized structures with deep pits at their corners. Deep transversal furrow bordered in posterior part by a wide U-shaped sclerotized area bearing pilose setae on margins and smooth setae in central area. Numerous C-shaped humps situated close to lateral and caudal margins of dorsal shield, these humps bearing smooth setae. Marginal shield without sculptural pattern and bearing spiniform setae (about 33-42 long).

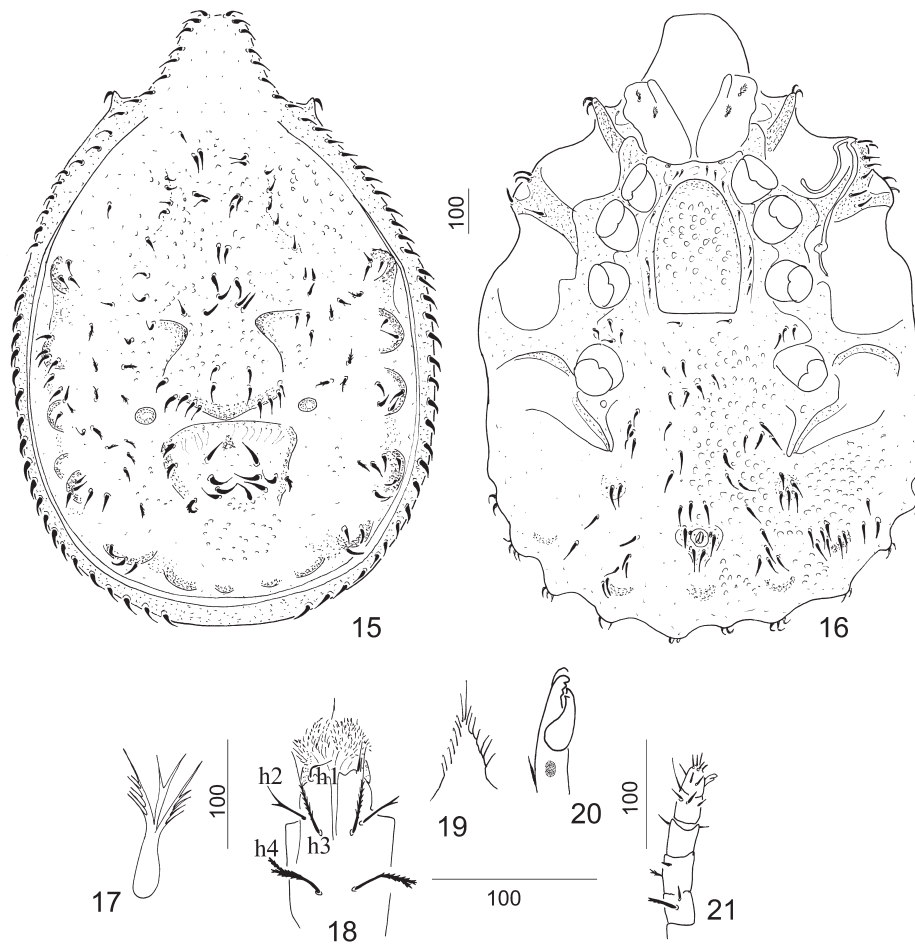
Ventral idiosoma (Fig. 16): Tritosternum with narrow and oval basis; laciniae with two smooth inner and two apically pilose outer branches (Fig. 17). Sternal shield without sculptural pattern. First three pairs of sternal setae serrate, others smooth and needle-like, all sternal setae short (about 18-21 in length). Numerous setae visible close to coxae IV. One pair of lyriform fissures situated close to anterior margin of sternal shield, another pair situated in central area of sternal shield, a third pair at level of posterior margin of coxae III and a fourth pair at level of central area of coxae IV. Genital shield scutiform (about 260-270 long and 170-180 wide), its surface with oval pits (Fig. 22). Ventral shield ornamented with oval pits, bearing smooth and needle-like setae, shape similar to sternal setae but longer (about 30-36). Numerous setae situated in a transversal row posterior to coxae IV; in central section of each row one pair of humps carrying numerous setae. Similar humps with setae situated close to caudal margin of ventral idiosoma. Anal opening



Figs 5-10. *Bostocktrachys surinensis* sp. nov., female holotype (5-9) and male paratype (10). (5, 10) Intercoxal area. (6) Tritosternum. (7) Ventral view of gnathosoma and palp. (8) Epistome. (9) Lateral view of chelicera.



Figs 11-14. *Bostocktrachys surinensis* sp. nov., female holotype. (11) Ventral view of leg I. (12) Ventral view of leg II. (13) Ventral view of leg III. (14) Ventral view of leg IV.



Figs 15-21. *Bostocktrachys thailandica* sp. nov., female holotype. (15) Dorsal idiosoma. (16) Ventral idiosoma. (17) Tritosternum. (18) Ventral view of gnathosoma. (19) Epistome. (20) Lateral view of chelicera. (21) Ventral view of palp.

situated in a drop-shaped area bearing four setae similar in shape and length to other ventral setae plus one pair of lyriform fissures. Stigmata situated between coxae II and III. Prestigmatic part of peritremes long and hook-shaped, poststigmatic part short. Pedofossae deep, their surface smooth.

Gnathosoma (Fig. 18): Corniculi horn-like, internal malae longer than corniculi and divided into four fringed branches. Hypostomal setae h1 short (about 25-27 in length) and smooth, h2 and h4 apically bifurcated, h2 smooth, h3 and h4 marginally serrate, h2 and h4 short (about 45-55), h3 long (about 75-80), h3 situated close to h2. Palpal trochanter with one short and smooth, and one long and serrate ventral seta. Other setae on palp smooth and needle-like, except for one pilose seta on dorsal side of femur (Fig. 21). Epistome subtriangular and strongly serrate on lateral margins (Fig. 19). Chelicerae with one tooth each on movable and fixed digit, fixed digit longer than movable digit, pilus dentilus absent, internal sclerotized node and one dorsal seta present (Fig. 20).

Legs (Figs 23-26): Leg I 460-465 long, leg II 400-410, leg III 420-430, leg IV 460-465. Legs I-IV each with a pair of claws at tip of ambulacral process, claws of legs I smallest. Most setae on legs needle-like, some robust and serrate setae situated on all legs. Flap-like processes on femora II-IV.

Description of male: Length of idiosoma 1120, width 745 (n=1). Shape same as in females.

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

Ventral idiosoma: Ornamentation and chaetotaxy of ventral shield as in female. Sternal shield without sculptural pattern (Fig. 27). Sternal setae smooth and needle-like (about 17-20 long), situated close to margins of sternal shield and around genital opening (Fig. 27). Genital shield rounded (about 47×50 in dimension) and situated between coxae III-IV. Other characters as in female.

Nymph and larva unknown.

Etymology: The name of the new species refers to the country where the type specimens were collected.

DISCUSSION

The majority of trachyuropodid mites were collected in association with ants, often from the hole of anthills. This was very often the case in European species (Mašán, 2001), whereas numerous non-European species were found without ants, in moss, soil and leaf litter (Kontschán, 2011c). The fact that the two new *Bostocktrachys* species described here were collected from soil and leaf litter is thus not unusual. These species either live without an association with ants or they were extracted from leaf litter samples which contained very small ant nests.

The trachyuropodid fauna of South-East Asia remains

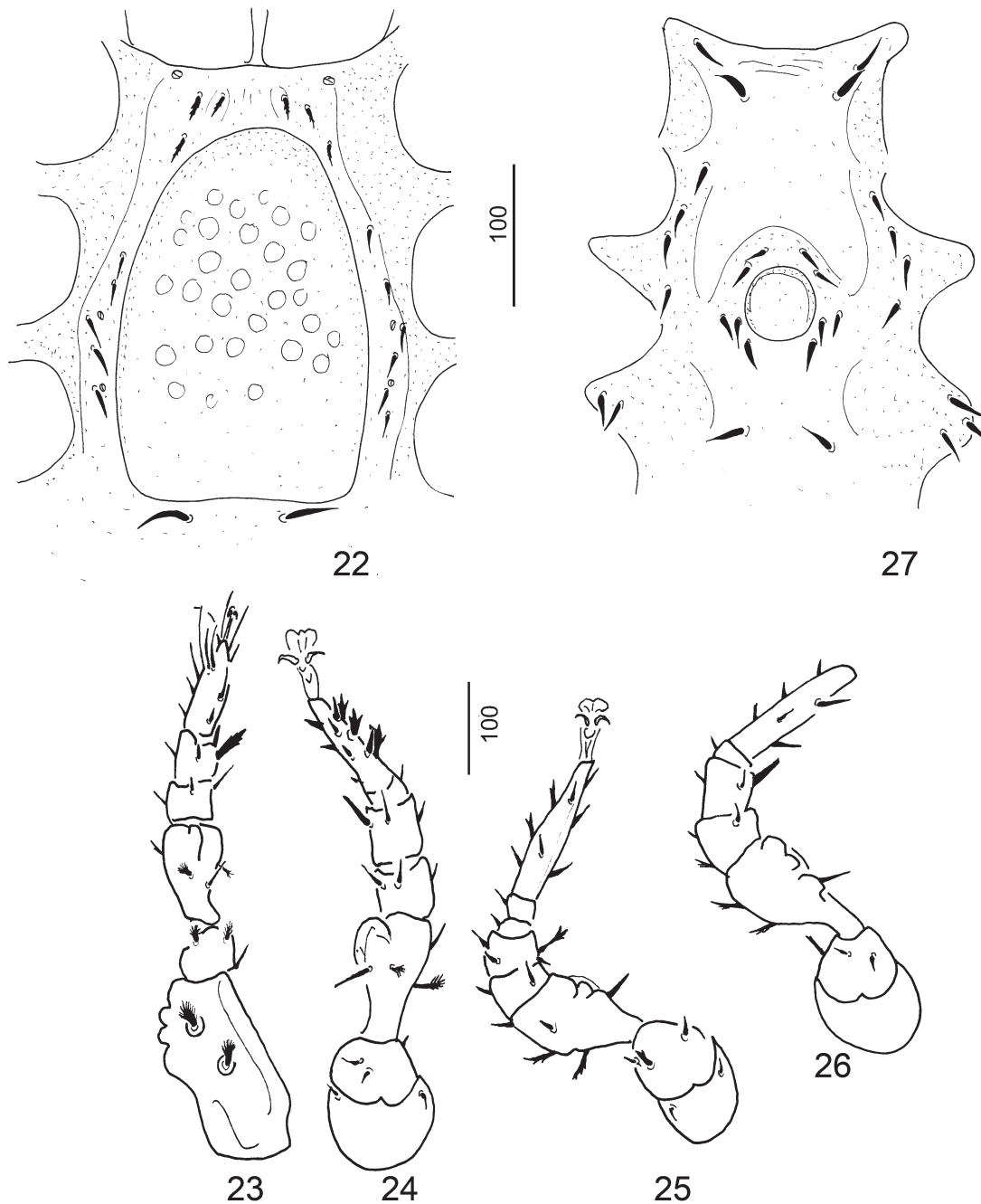
Key to females of the South-East Asian species of trachyuropodid mites

- | | | |
|----|--|---|
| 1A | Dorsal shield without deep pits, depressions or strongly sclerotized structures (grooves, humps, etc.) (Figs 29-30) | 2 |
| 1B | Dorsal shield with deep pits, depressions or strongly sclerotized structures (grooves, humps, etc.) (Figs 28, 31-34) | 3 |
| 2A | Idiosoma oval, wide and lemon-shaped, anterior area of marginal shield narrow (Fig. 30) (genus <i>Trachyibana</i>).... | |
| | <i>Trachyibana sarawakiensis</i> Kontschán, 2015 | |
| 2B | Idiosoma narrow, anteriorly pointed, anterior part of marginal shield broad (Fig. 29) (genus <i>Leonardiella</i>) | |
| | <i>Leonardiella cistulata</i> (Hirschmann, 1975) | |
| 3A | One pair of kidney-shaped lateral depressions situated on dorsal shield (Fig. 28) (genus <i>Arculatatrachys</i>)..... | |
| | <i>Arculatatrachys imitans</i> (Berlese, 1905) | |
| 3B | Dorsal shield without pair of kidney-shaped lateral depressions but with strongly sclerotized structures (grooves, humps, etc.) and with a central furrow (Figs 31-34) (genus <i>Bostocktrachys</i>)..... | 4 |
| 4A | Four strongly sclerotized longitudinal grooves situated posterior to central transversal furrow (Fig. 33) | |
| | <i>Bostocktrachys surinensis</i> sp. nov. | |
| 4B | Without four strongly sclerotized longitudinal grooves posterior to central transversal furrow | 5 |
| 5A | Strongly sclerotized margin of elevated area anterior to transversal furrow in the shape of an inverted omega (Figs 31 and 34) | 6 |
| 5B | Strongly sclerotized margin of elevated area anterior to transversal furrow in the shape of a wide and inverted pentagon (Fig. 32)..... | |
| | <i>Bostocktrachys micherdzinskii</i> (Hirschmann, 1976) | |
| 6A | Elevated area posterior to transversal furrow recurved-rounded and narrower than elevated area anterior to furrow (Fig. 31) | |
| | <i>Bostocktrachys tuberculata</i> (Berlese, 1913) | |
| 6B | Elevated area posterior to transversal furrow recurved-angular and as wide as elevated area anterior to furrow (Fig. 34) | |
| | <i>Bostocktrachys thailandica</i> sp. nov. | |

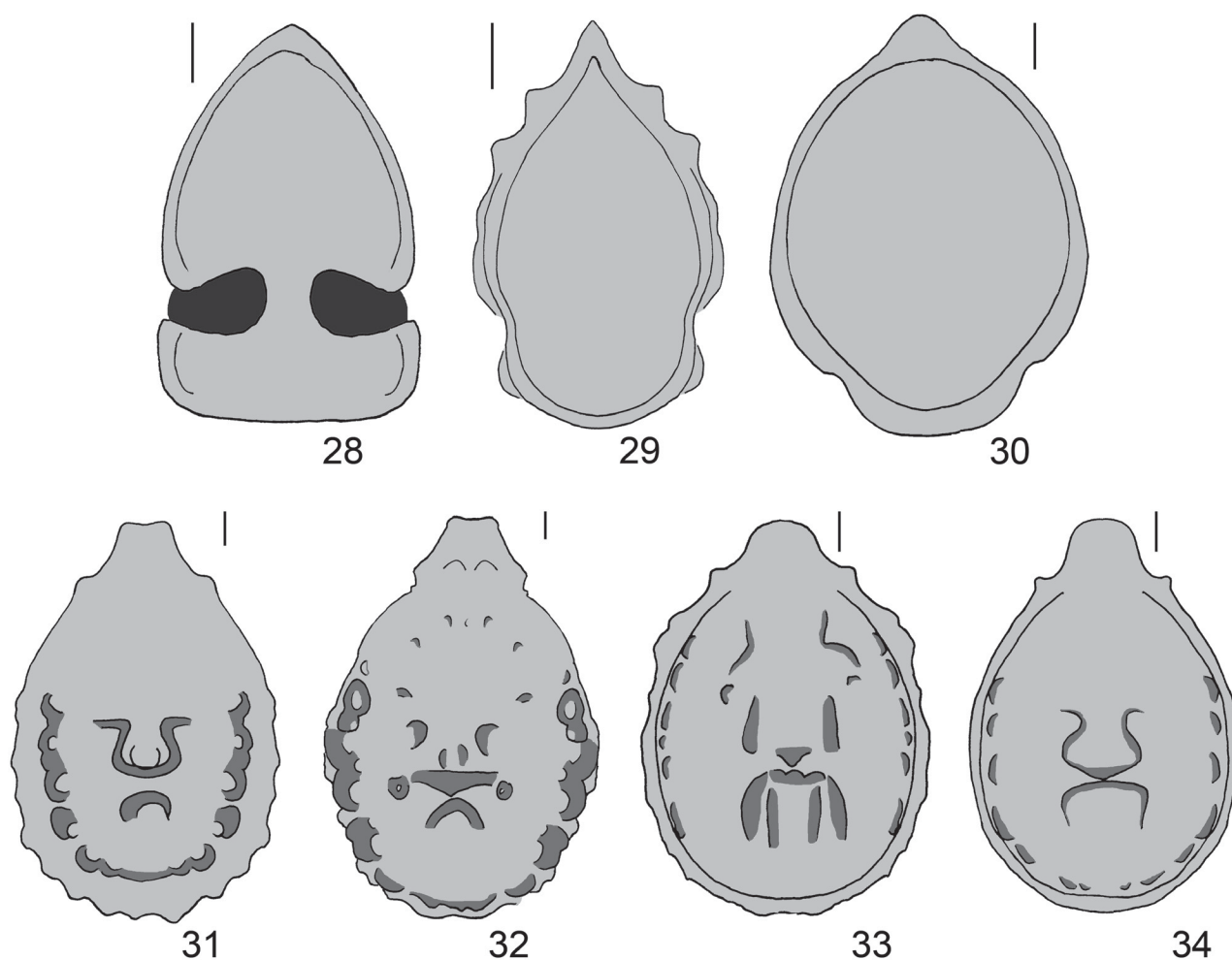
poorly investigated, but judging from the number of known European (see Mařán, 2001) and Neotropical (see Kontschán, 2011c) trachyuropodid species we assume that many more new species from this region will be discovered and described in the future.

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Figs 22-27. *Bostocktrachys thailandica* sp. nov., female holotype (22-26) and male paratype (27). (22) Intercoxal area. (23) Ventral view of leg I. (24) Ventral view of leg II. (25) Ventral view of leg III. (26) Ventral view of leg IV. (27) Intercoxal area of male paratype.



Figs 28-34. Schematic illustrations of dorsal aspect of South-East Asian trachyuropodid mites (Scale bars: 100). (28) *Arculatrachys imitans* (Berlese, 1905). (29) *Leonardiella cistulata* (Hirschmann, 1975). (30) *Trachyibana sarawakiensis* Kontschán, 2015. (31) *Bostocktrachys tuberculata* (Berlese, 1913). (32) *Bostocktrachys micherdzinskii* (Hirschmann, 1976). (33) *Bostocktrachys surinensis* sp. nov. (34) *Bostocktrachys thailandica* sp. nov.

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