

The first records of the subfamily Euthyadinae K. Viets, 1931 (Acari, Hydrachnidia, Hydryphantidae) from China with description of one new species

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Original research

ABSTRACT

The first records of subfamily Euthyadinae K. Viets, 1931 are presented from China. Two species are reported from Anhui Province P. R. China, i.e. *Trichothyas* (*Lundbladia*) *feuerborni* (K. Viets, 1929) and *Trichothyas* (*Neothyas*) *zhangae* Li, Jin & Guo sp. nov., were discovered. Through observation with an optical microscope and SEM (scanning electron microscope), detailed structures are illustrated and photographed. Meanwhile, detailed statistics on *Trichothyas*-like species were conducted and the taxonomical problems of this group are discussed.

Keywords water mites; new record; new species; *Trichothyas*; SEM

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Introduction

Hydryphantidae Piersig, 1896 is a large group of water mites consisting of 13 subfamilies (Smit 2020). A study based on molecular data confirmed the viewpoints of previous acarologists that this family is of paraphyletic origin (Dabert *et al.* 2016). However, their phylogenetic relationship is still unclear. Therefore, the development of more species resources and intensive research are particularly important.

Previously, a total of 14 species, belonging to five genera (*Diplodontus* Dugès, 1834, *Hydryphantes* C.L. Koch, 1841, *Mamersa* Koenike, 1898, *Protzia* Piersig, 1896, and *Wandesia* Schechtel, 1912), in five subfamilies (Diplodontinae K. Viets, 1936, Hydryphantinae Piersig, 1896, Mamersinae K. Viets, 1931, Protziinae Koenike, 1909 and Wandesinae Schwoerbel, 1961), were recorded for the Chinese fauna (Jin 1997, 1998; Jin *et al.* 2010; Zhong *et al.* 2011; Li *et al.* 2021).

During a field survey of water mites from Anhui Province, a new species of *Trichothyas*, i.e. *T. (Neothyas) zhangae* Li, Jin & Guo sp. nov. and the first record of *Trichothyas* (*Lundbladia*) *feuerborni* (K. Viets, 1929) were discovered, which are the first records of the subfamily Euthyadinae K. Viets, 1931 for the Chinese fauna. Detailed structures are illustrated and photographed with the help of optical microscope and SEM (scanning electron microscope).

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Material and methods

The collection, preservation of water mites and preparation of slides follows Gu *et al.* (2021). Specimens were examined and illustrated under a Leica DM3000 microscope. In the illustrations, short curved lines on platelets indicate the muscle attachment scars. All photographs and illustrations were edited with Adobe Photoshop CS6. All measurements were made with a Nikon Ni-E (with Nikon DS-Ri2 camera) and are given in μm , and measuring methods can be found in Figure 1. The treatments of SEM (scanning electron microscope) refer to Li *et al.* (2022).

The terminology and abbreviations used were updated from Jin (1997) and Gerecke (2020): a.s.l. = above sea level, A_1 = preantennal glandularia, A_2 = postantennal glandularia, Ac-1–3 = acetabula 1–3, ACG = anterior coxal group (Cx-I+Cx-II), ACP = anterior central plate, C_2 & C_4 = coxoglandularia 2 & 4, CB = chelicera base, CC = chelicera claw, CP = centroventral plate, Cx-I–IV = coxae I–IV, D_1 – D_4 = dorsoglandularia 1–4, EP = excretory pore, FS = frontal shield, G = gnathosoma, GF = genital flap, Gp = gonopore, I = idiosoma, I-L-1–6, *etc.* = the first–sixth segment of the first leg, *etc.*, L = length, L_1 – L_4 = lateroglandularia 1–4, LP 1–4 = lateral plates 1–4, O_1 = preocularia, O_2 = postocularia, P-1–5 = the first–fifth segments of the palp (from most proximal to most distal), PCG = posterior coxal group (Cx-III+Cx-IV), PCP = posterior central plate, PS = pregenital sclerite, V_1 – V_4 = ventroglandularia 1–4, W = width.

The type series were deposited in the Institute of Entomology, Guizhou University, Guiyang, P. R. China (GUGC).

Systematics

Family Hydryphantidae Piersig, 1896

Subfamily Euthyadinae K. Viets, 1931

Genus *Trichothyas* K. Viets, 1926

Subgenus *Lundbladia* K. Viets, 1929

Trichothyas (*Lundbladia*) *feuerborni* (K. Viets, 1929) (Figures 2–8)

Habitat — Turbulent current with organic detritus, gravels and cobblestones in the mountain.

Material examined — 5 ♂♂, Mount Huangshan World Geopark, Anhui Province, P. R. China (30°04'41"N, 118°09'01"E, 530 m a.s.l.), collected by Xu Zhang, 20-V-2010. Slides No. AH-HY-2010052001–2010052005.

Diagnosis — *Male*. All dorsal plates widely separated; FS inverse isosceles trapezoid approximately; posterior edge of D_2 close to posterior edge of FS; middle margin of ACG with two rows of densely feathered setae; C_2 both rounded under optical microscope and SEM; trapezoidal PS with indentation at the frontal margin, GF touching third pair of acetabula, Gp extending to frontal margin of third acetabula; a round CP located anterior to V_3 ; a pair of V_1 separated; P-4 terminal with a seta-like protrusion; I-L-3 bearing two strong dorsal peg setae on one side.

Description — *Male* (n=5). Integument papillae bluntly pointed, interspaces with fine lineation (Figure 2A). In dorsal view: apical angles of Cx-I and Cx-II visible in dorsal view; all dorsal plates widely separated; FS inverse isosceles trapezoid approximately, with median eye, O_2 and five muscle attachments; posterior edge of D_2 close to posterior edge of FS; ACP with a muscle attachment in the middle; PCP with a pair of muscle attachment; all LP with a muscle attachment, LP 1 and 4 triangle, LP 2 and 3 trapezoidal (Figures 3A, 4A). In ventral view: middle margin of ACG with two rows of densely feathered setae (Figure 2B); C_2 both rounded under optical microscope and SEM (Figures 2C, 4B); trapezoidal PS with indentation at the frontal margin (Figure 4B), three pairs of acetabula arranged in two rows and closed (Figure 2D), GF touching third pair of acetabula, Gp relatively long, extending to frontal margin of

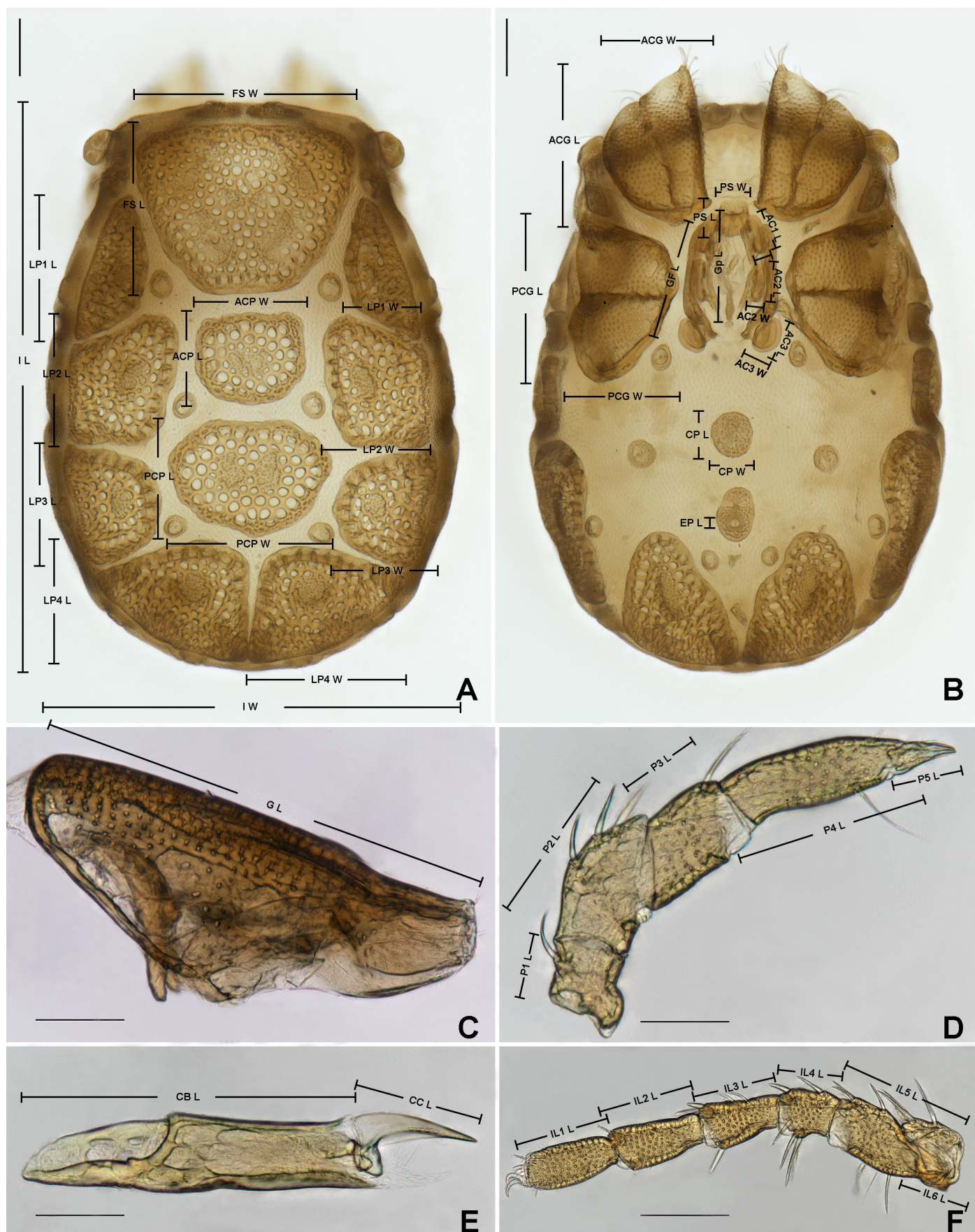


Figure 1 Measurement methods of species in *Trichothyas*. *Trichothyas* (*Neothyas*) *zhangae* Li, Jin & Guo sp. nov., ♂: A – Dorsal features; B – Ventral features; C – Gnathosoma; D – Palp; E – Chelicera; F – I-Leg-1–6.

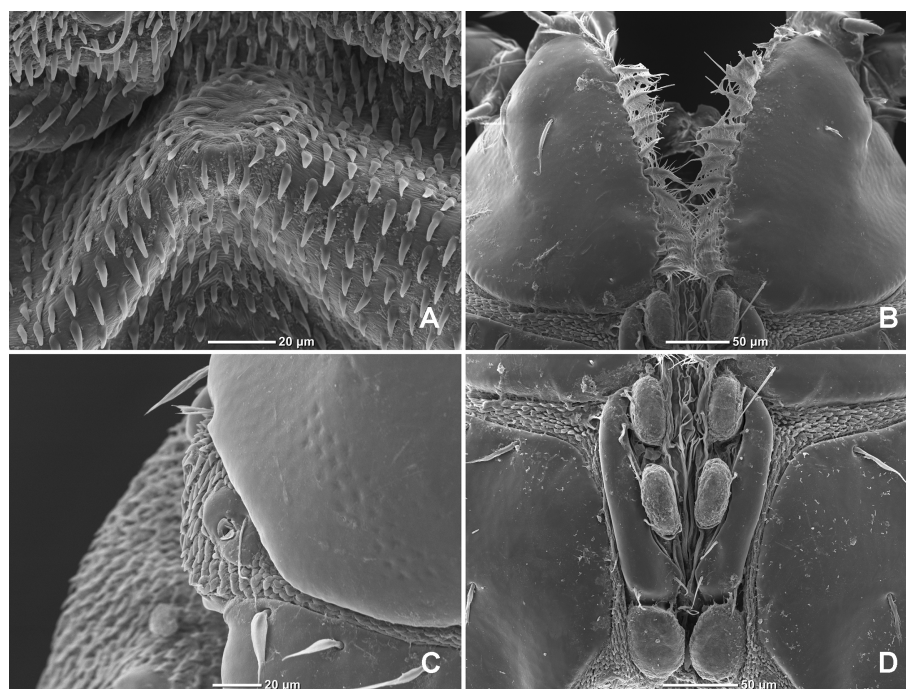


Figure 2 *Trichothyas (Lundbladia) feuerborni* (K. Viets, 1929), ♂ (AH-TR-2010052004), SEM photographs: A – Papillary integument; B – Anterior coxal group (ACG); C – Coxoglandularia 2 (C_2); D – Genital field.

third acetabula, a round CP located anterior to V_3 , a pair of V_1 separated (Figures 3B, 4B). In lateral view: except L_1 and L_4 , four sclerotized plates with varying shapes near the body axis and separated from each other (Figures 3C, 4C). In frontal view: A_1 fused with a triangular plate, lateral eyes attached to O_1 platelets (Figures 3D, 4D). In rear view: V_4 separated with LP 4 (Figures 3E, 4E).

Gnathosomal base long and slender (Figure 5A). Chelicera base relatively long; chela with teeth on one side (Figure 5B–D). Palp five-segmented (Figure 6A, C); P-1 short, with two feathered setae; P-2 with three dorsal and two lateral feathered setae; P-3 with two dorsal feathered setae; P-4 terminal with three fine setae and a seta-like protrusion (Figure 6B, D); venter of P-5 with a very small seta on one side (Figure 6B, D).

Legs robust (Figures 7–8): I-L-3 bearing two strong dorsal peg setae on one side (Figure 7A); IV-L slenderer than other legs obviously (Figure 8C–D).

Female. Not collected.

Measurements — *Male* (n=5). I L/W 873–944/665–708; FS L/W 271–327/316–366; ACP L/W 118–146/141–177; PCP L/W 155–187/218–245; LP 1–4 L/W 198–233/120–152, 192–196/174–204, 164–187/148–182, 155–190/229–242. ACG L/W 251–290/194–221; PCG L/W 257–294/208–218; PS L/W 48–62/65–77; Gp L 146–182; GF L 175–216; Ac-1–3 L/W 50–61/28–34, 58–68/21–25, 64–68/43–45; EP L 12–13; CP L/W 37–43/33–43. G L 246–270; CB L 161–189, CC L 61–67; Palp segments L: P-1–5 26–33, 70–79, 41–45, 90–100, 34–38. Leg segments L: I-L-1 67–70, I-L-2 102–125, I-L-3 54–63, I-L-4 76–86, I-L-5 85–100, I-L-6 90–100; II-L-1 73–80, II-L-2 124–153, II-L-3 55–68, II-L-4 85–110, II-L-5 108–117, II-L-6 133–140; III-L-1 95–109, III-L-2 134–144, III-L-3 58–72, III-L-4 93–106, III-L-5 102–113, III-L-6 118–130; IV-L-1 132–149, IV-L-2 152–173, IV-L-3 103–121, IV-L-4 168–205, IV-L-5 134–152, IV-L-6 132–143.

Remarks — So far, a total of 11 species (subspecies) of the subgenus *Lundbladia* K. Viets, 1929 have been recorded worldwide, so far males of eight species have been described

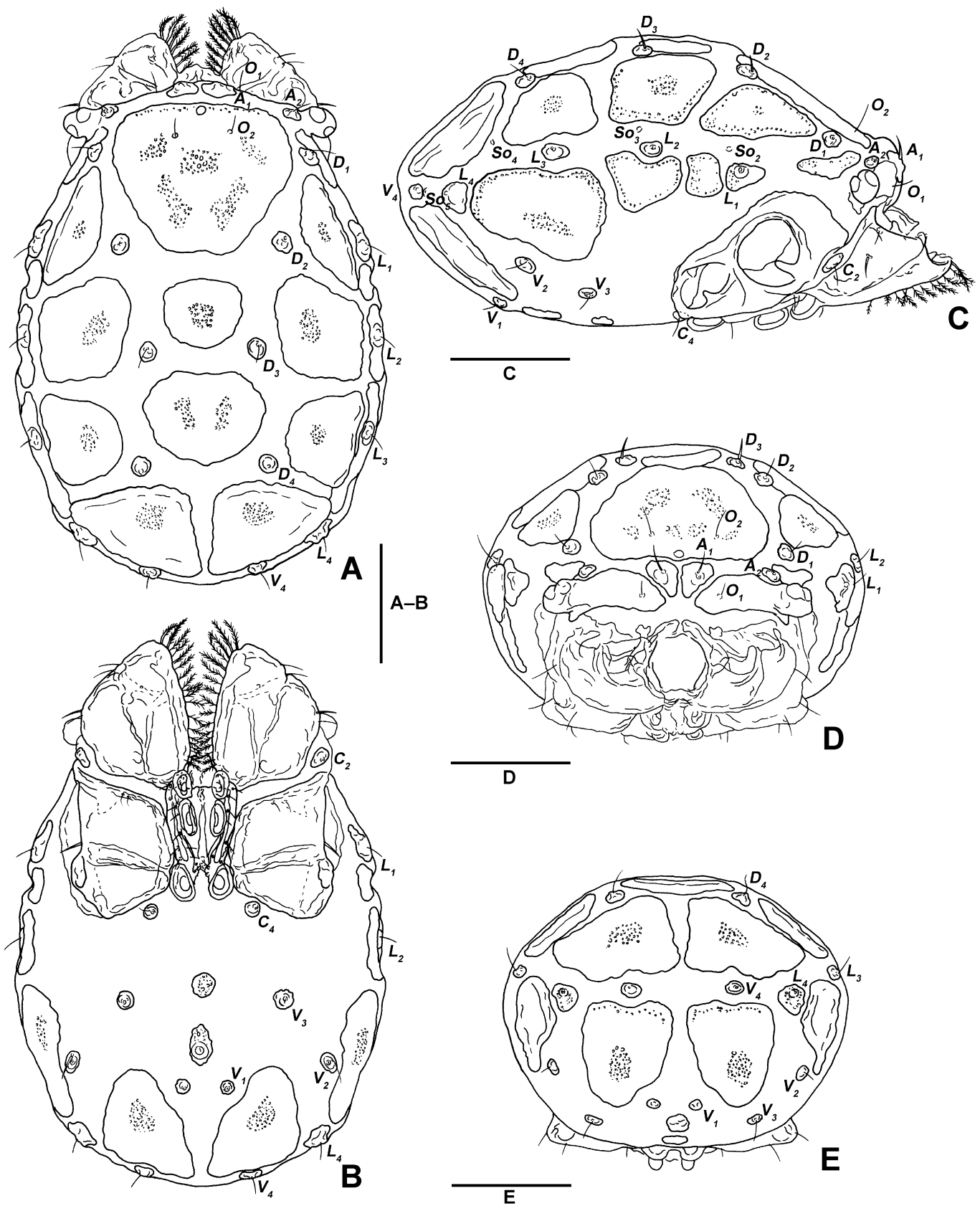


Figure 3 *Trichothyas (Lundbladia) feuerborni* (K. Viets, 1929), ♂ (AH-TR-2010052001): A – Dorsal view; B – Ventral view; C – Lateral view; D – Frontal view; E – Rear view. Scale bars = 200 µm.

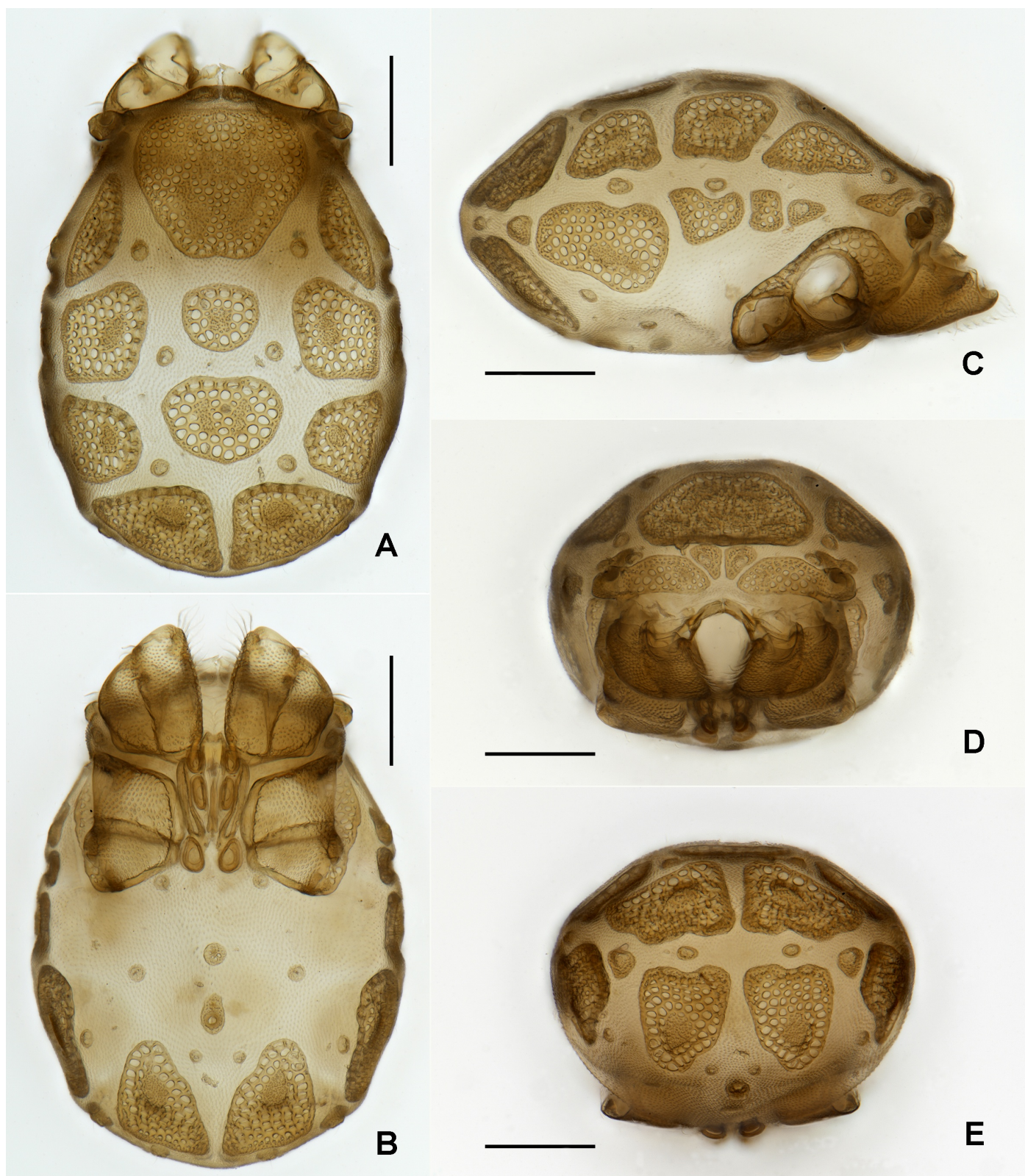


Figure 4 *Trichothyas (Lundbladia) feuerborni* (K. Viets, 1929), ♂ (AH-TR-2010052001), optical microscope photographs: A – Dorsal view; B – Ventral view; C – Lateral view; D – Frontal view; E – Rear view. Scale bars = 200 μm .

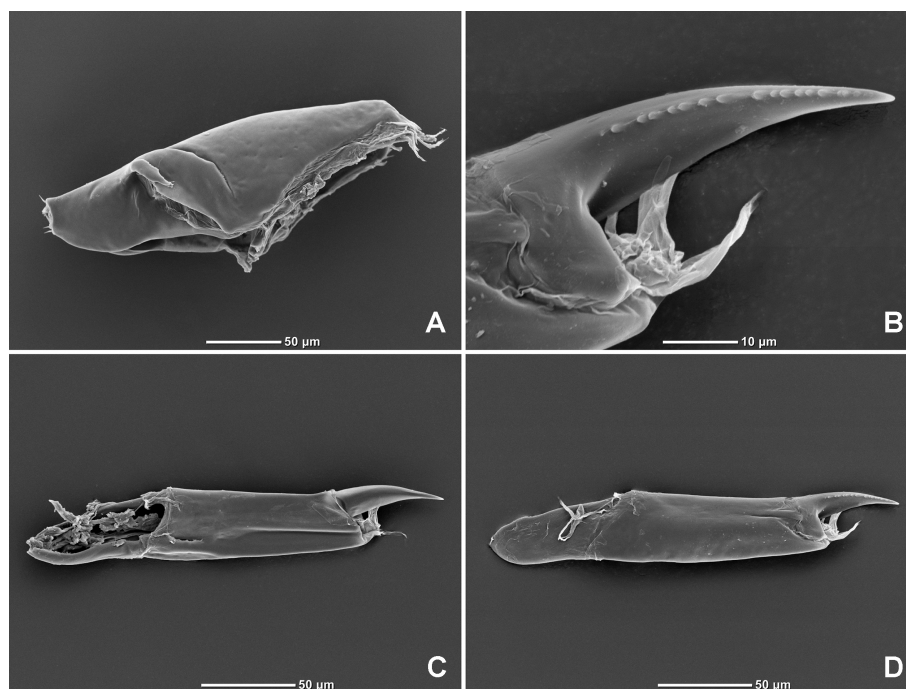


Figure 5 *Trichothyas (Lundbladia) feuerborni* (K. Viets, 1929), ♂ (AH-TR-2010052004), SEM photographs: A – Gnathosoma; B – Chela of chelicera; C – One side of chelicera; D – Another side of chelicera.

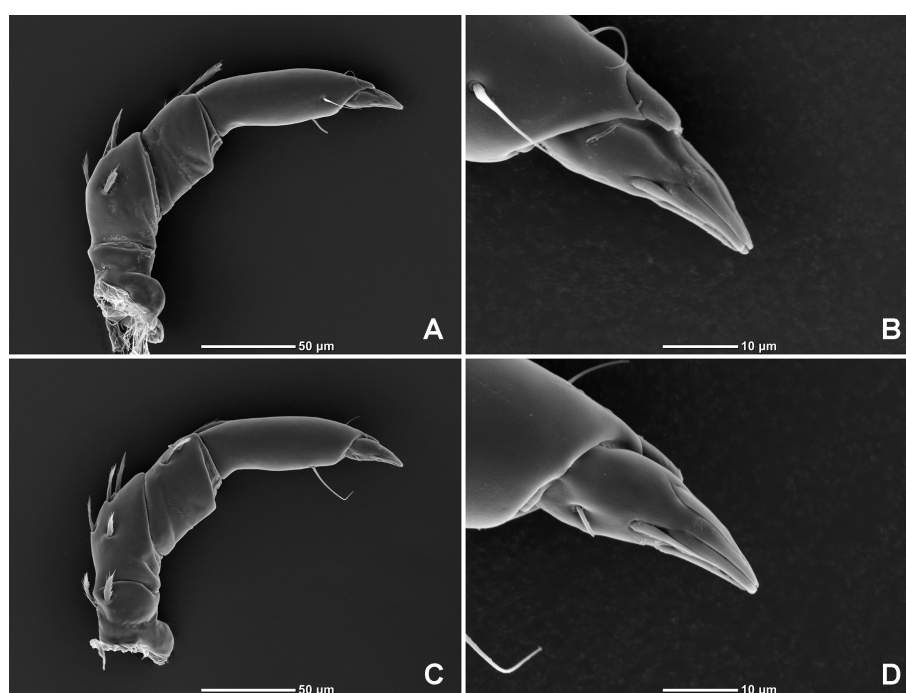


Figure 6 *Trichothyas (Lundbladia) feuerborni* (K. Viets, 1929), ♂ (AH-TR-2010052004), SEM photographs: A – One side of palp; B – One side of P-5; C – Another side of palp; D – Another side of P-5.

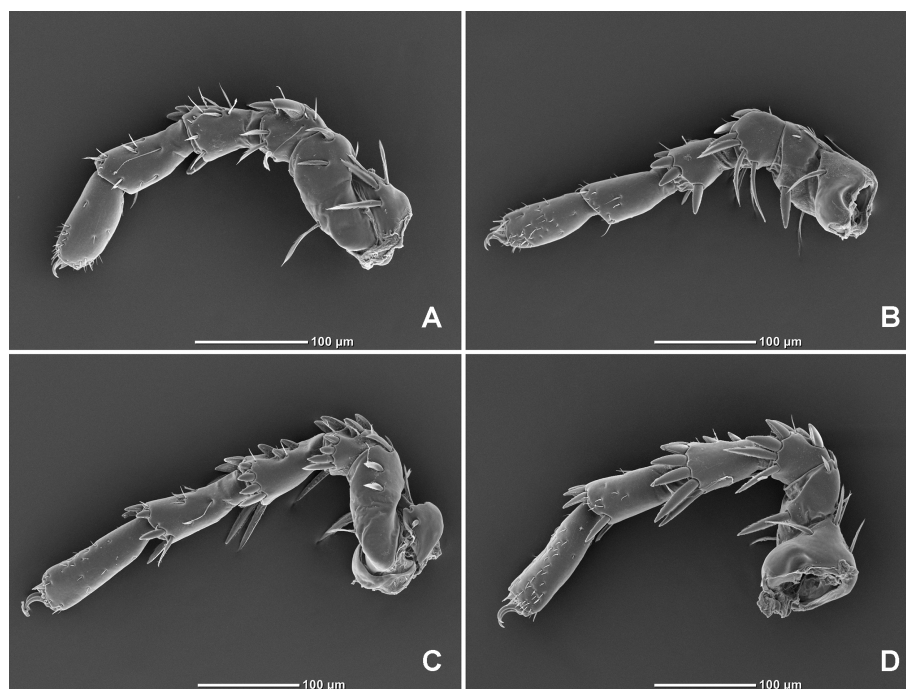


Figure 7 *Trichothyas (Lundbladia) feuerborni* (K. Viets, 1929), ♂ (AH-TR-2010052004), SEM photographs: A – Outer side of I-Leg-1–6; B – Inner side of I-Leg-1–6; C – Outer side of II-Leg-1–6; D – Inner side of II-Leg-1–6.

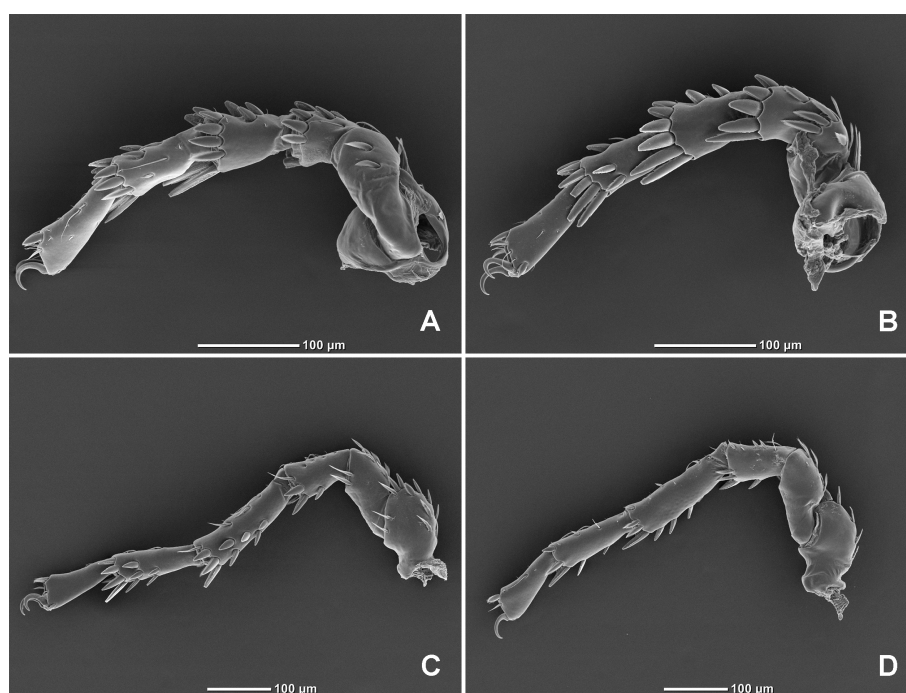


Figure 8 *Trichothyas (Lundbladia) feuerborni* (K. Viets, 1929), ♂ (AH-TR-2010052004), SEM photographs: A – Outer side of III-Leg-1–6; B – Inner side of III-Leg-1–6; C – Outer side of IV-Leg-1–6; D – Inner side of IV-Leg-1–6.

(Table 1). The males from Anhui can well be distinguished from *T. (L.) alborzensis* Bader & Sepasgozarian, 1979 by the shape of FS and genital field (Bader & Sepasgozarian 1979). Membranous strips between dorsal sclerites of *T. (L.) compressa* K. Viets, 1953 and *T. (L.) muscicola* (Mitchell, 1953) are narrower than in the males from Anhui (Goldschmidt & Gerecke 2003; Mitchell 1953). Gp of the males from Anhui are relatively long and extend to the frontal margin of third acetabula, while in *T. (L.) paracunctans* Gerecke, 2020 the gonopore extends to the second acetabula (Gerecke 2020).

Due to a similar genital field structure (especially PS) and the position of the dorsal sclerites we assigned the males from Anhui to *T. (L.) feuerborni* (K. Viets, 1929). There are some small differences, however, between the specimens from Java and China. The posterior margin of Cx-IV is convex in the male from Java, but straight in the male from Anhui. Moreover, the plate

Table 1 List of global *Trichothyas*-like species.

Genus	Subgenus	Species	Subspecies	Distribution	Type Series	Reference
<i>Almuerzothyas</i> Goldschmidt & Gerecke, 2003		<i>A. casado</i> Goldschmidt & Gerecke, 2003		Costa Rica	♀	Goldschmidt and Gerecke 2003
		<i>A. comalensis</i> I.M. Smith & Cook, 2009		America (Texas)	♂/♀	I.M. Smith and Cook 2009
<i>Dacothyas</i> Motas, 1959		<i>D. kandilliensis</i> Oezkan & Bader, 1988		Turkey	♂	Oezkan and Bader 1988
		<i>D. savulescui</i> Motas, 1959		Romania	♂/♀	Cook 1974; Smit 2020
<i>Heterothyas</i> Lundblad, 1941		<i>H. africana</i> Lundblad, 1941		South Africa	♂/♀	Lundblad 1941; Cook 1974; Smit 2020
		<i>J. cornipes</i> Cook, 1967		India	♂/♀/N	Cook 1967; Cook 1974; Smit 2020
<i>Javathyas</i> K. Viets, 1929		<i>J. nasipalpis</i> Gerecke, 2020		Madagascar	♀/N	Gerecke 2020
		<i>J. neocaledonicus</i> Smit, 2009		New Caledonia	♀	Smit 2009
<i>Trichothyas</i> K. Viets, 1926	<i>Kashmirothyas</i> Lundblad, 1934	<i>J. triumvirorum</i> K. Viets, 1929		Indonesia (Java)	♂/♀	K. Viets 1935
		<i>T. (K.) akguli</i> Özkan & Boyaci, 1992		Turkey	♂/♀	Özkan and Boyaci 1992
<i>Lundbladia</i> K. Viets, 1929		<i>T. (K.) hutchinsoni</i> (Lundblad, 1934)		Kashmir	♂/♀	Cook 1974; Smit 2020
		<i>T. (K.) jadranae</i> Pešić, 2018		Montenegro	♀	Pešić <i>et al.</i> 2018
<i>Neothyas</i> Lundblad, 1941		<i>T. (L.) alborzensis</i> Bader & Sepasgozarian, 1979		Iran (Elburz Mountains)	♂/♀	Bader and Sepasgozarian 1979; Pesic <i>et al.</i> 2005; Pešić
		<i>T. (L.) anatolica</i> Boyaci & Gülle, 2014		Turkey	♀	Boyaci and Gülle 2014
<i>Plesiothyas</i> K. Viets, 1935		<i>T. (L.) compressa</i> K. Viets, 1953		El Salvador, Costa Rica	♂/♀/N	Goldschmidt and Gerecke 2003
		<i>T. (L.) cunctans</i> (Lundblad, 1951)		Tanzania, Kenya	♂/♀	Gerecke 2020
<i>Trichothyas</i> K. Viets, 1926		<i>T. (L.) duplicata</i> (K. Viets, 1954)		France (Corsica); Italy (Sardegna)	♂/♀/N	Gerecke 1996
		<i>T. (L.) feuerborni</i> (K. Viets, 1929)		Indonesia (Java)	♂/♀/N	K. Viets 1935
<i>T. (s.s.) pennata</i> (K. Viets, 1913)		<i>T. (L.) japonica</i> (Uchida & Imamura, 1953)		Japan	♀	Uchida and Imamura 1953
		<i>T. (L.) muscicola</i> (Mitchell, 1953)		America (Illinois)	♂/♀/N/L	Mitchell 1953
<i>T. (L.) p. rutae</i> (Lundblad, 1941)		<i>T. (L.) paracunctans</i> Gerecke, 2020		Madagascar	♂/♀/N	Gerecke 2020
		<i>T. (L.) petrophila</i> (Michael, 1895)		Algeria; England; Yugoslavia; France; Portugal (Madeira); Spain (Canary Islands)	♂/♀/N/L	K. Viets 1953; Gerecke 1996; Smit 2020
<i>Neothyas</i> Lundblad, 1941		<i>T. (L.) p. rutae</i> (Lundblad, 1941)		Indonesia (Java)	?	K. Viets 1953; Gerecke 1996
		<i>T. (N.) hygroptetica</i> (Lundblad, 1941)		Ivory Coast	♂	Lundblad 1941; Cook 1974; Smit 2020
<i>Plesiothyas</i> K. Viets, 1935		<i>T. (P.) multipora</i> Walter, 1935		Cameroon	♀	Cook 1974; Smit 2020
		<i>T. (s.s.) pennata</i> (K. Viets, 1913)			♂/♀	Cook 1974; Smit 2020

lateral to L_2 is divided in the male from Java, but complete in the male from Anhui. Possibly, larval parasitism on tipulids dipterans allow populations to keep gene flow over wide areas with their aerial drifting hosts (Mitchell 1953).

Distribution — Java (K. Viets 1935); Subfamily and Genus are new records for China (this study).

Subgenus *Neothyas* Lundblad, 1941

Trichothyas (Neothyas) zhangae Li, Jin & Guo sp. nov. (Figures 9–15)

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Habitat — Turbulent current with organic detritus, gravels and cobblestones in the mountain.

Material examined — Holotype: adult male, Mount Huangshan World Geopark, Anhui Province, P. R. China (30°04'41"N, 118°09'01"E, 530 m a.s.l.), collected by Xu Zhang, 20-V-2010. Slides No. AH-HY-2010052006. Allotype: adult female, same data as holotype, slides No. AH-HY-2010052007. Paratype: four adult males and two adult females, same data as holotype, Slides No. AH-HY-2010052008–2010052013.

Etymology — This new species is named after Dr Xu Zhang (P. R. China) in appreciation of providing the specimens and her brilliant contribution on water mites taxonomy.

Diagnosis — All dorsal plates separated; D_2 slightly behind posterior edge of FS; middle margin of ACG with two rows of feathered setae; C_2 rounded under SEM, but with sclerotization beneath integument under optical microscope; PCG widely separated; genital field with three pairs of acetabula, GF extended from the middle of Ac-1 to Ac-3, Gp relatively long, extending to frontal margin of third acetabula; a round CP bigger than V_3 ; EP with sclerotized extension; a pair of V_1 separated; P-4 terminal with a seta-like protrusion; I-L-3 without two strong dorsal peg setae. *Male*. PS trapezoidal. *Female*. PS triangular.

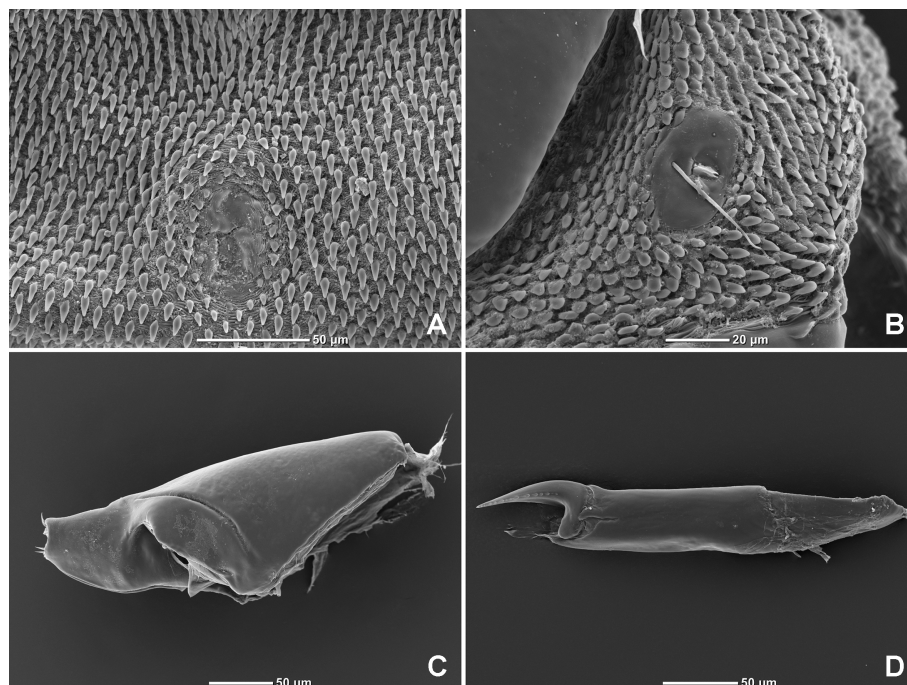


Figure 9 *Trichothyas (Neothyas) zhangae* Li, Jin & Guo sp. nov., ♂ (AH-TR-2010052008), SEM photographs: A – Papillary integument; B – Coxoglandularia 2 (C_2); C – Gnathosoma; D – One side of chelicera.

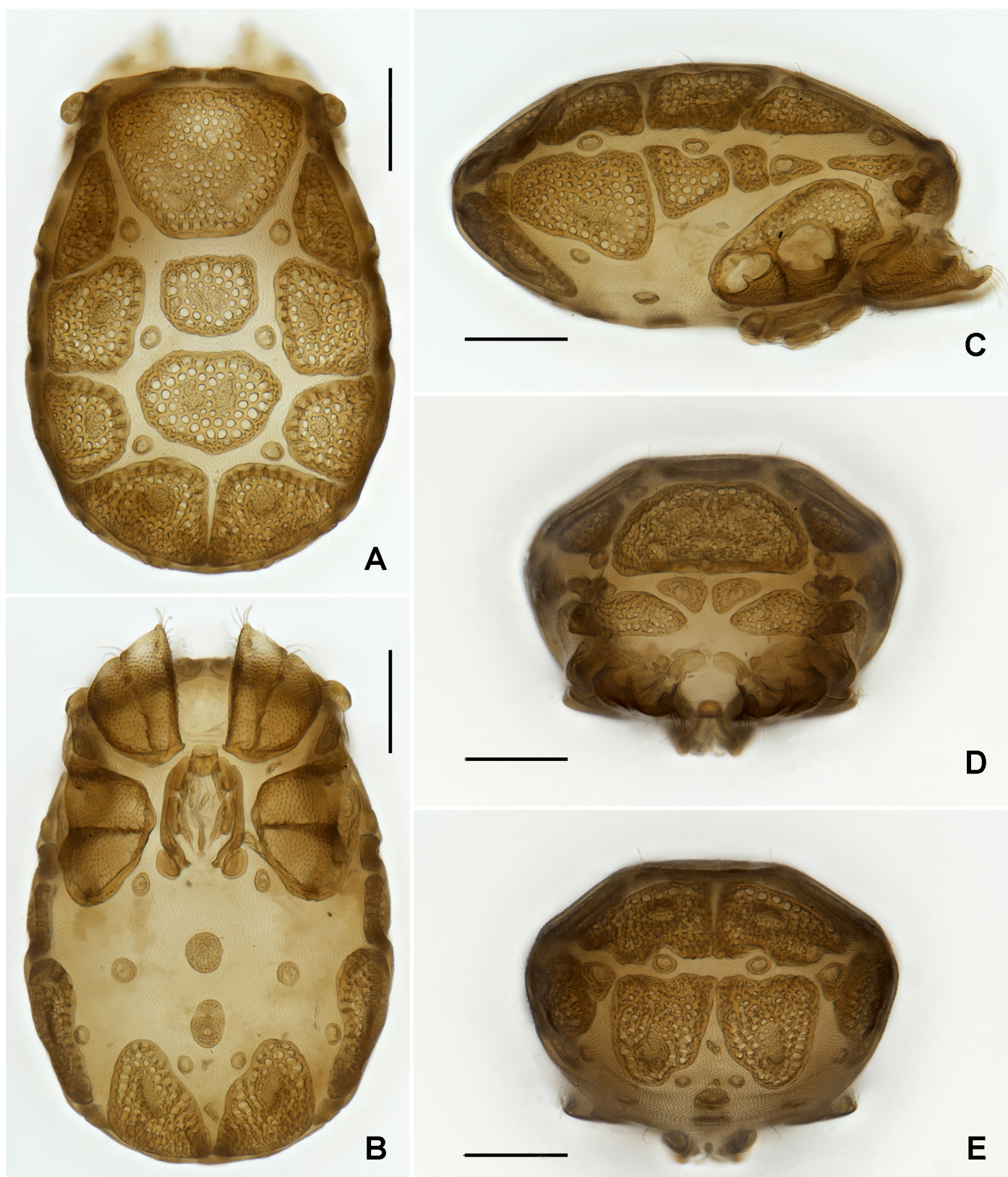


Figure 10 *Trichothyas (Neothyas) zhangae* Li, Jin & Guo **sp. nov.**, ♂, holotype (AH-TR-2010052006), optical microscope photographs: A – Dorsal view; B – Ventral view; C – Lateral view; D – Frontal view; E – Rear view. Scale bars = 200 μm.

Description — *Male* (n=5). Integument papillae bluntly pointed, interspaces with fine lineation (Figure 9A). In dorsal view: apical angles of Cx-I and Cx-II visible in dorsal view; all dorsal plates separated; FS inverse isosceles trapezoid, with median eye, O_2 and five muscle attachments; D_2 slightly behind posterior edge of FS; ACP with a muscle attachment in the middle; PCP with a pair of muscle attachment; all LP with a muscle attachment, LP 1 and 4 triangle, LP 2 and 3 trapezoidal (Figure 10A). In ventral view: middle margin of ACG with two rows of feathered setae most dense near the base of ACG (Figure 11A–B); C_2 rounded under SEM, but with sclerotization beneath integument under optical microscope (Figures 9B, 10B); PCG widely separated (Figure 10B); genital field with three pairs of acetabula, PS trapezoidal, GF extended from the middle of Ac-1 to Ac-3, Gp relatively long, extending to frontal margin of third acetabula (Figure 10B); a round CP bigger than V_3 ; EP with sclerotized extension; a pair of V_7 separated (Figure 10B). In lateral view: except L_1 and L_4 , four sclerotized plates with varying shapes near the body axis close to each other (Figure 10C). In frontal view: A_1 fused with a triangular plate, lateral eyes attached to O_1 platelets (Figure 10D). In rear view: V_4 close to LP 4 but not fused (Figure 10E).

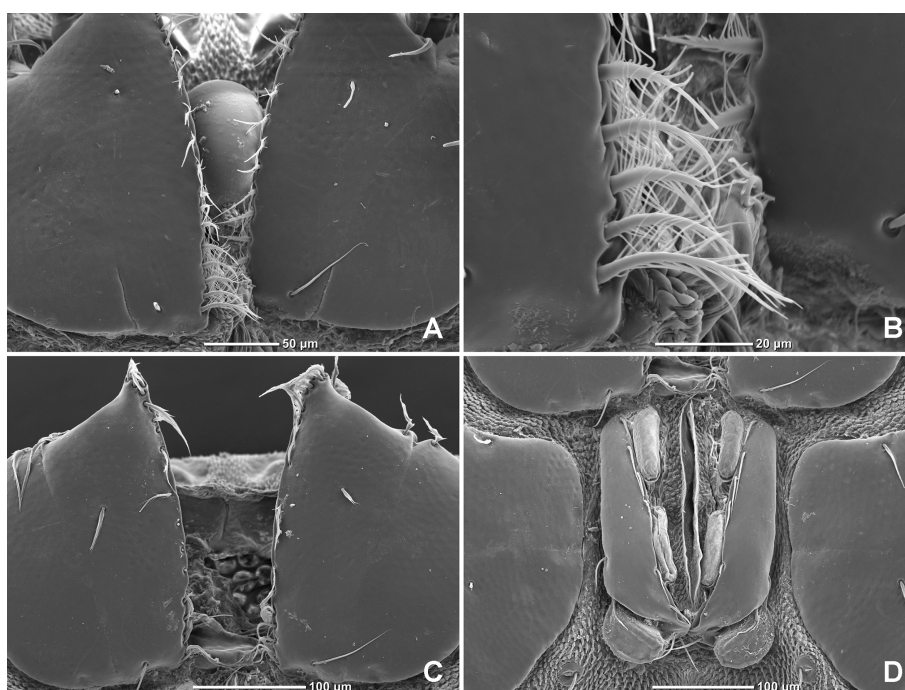


Figure 11 *Trichothyas (Neothyas) zhangae* Li, Jin & Guo **sp. nov.**, SEM photographs: A – ♂ (AH-TR-2010052008), anterior coxal group (ACG); B – ♂ (AH-TR-2010052008), feathered setae on the middle margin of ACG; C – ♀ (AH-TR-2010052012), anterior coxal group (ACG); D – ♀ (AH-TR-2010052012), genital field.

Gnathosomal base long and slender (Figure 9C). Chelicera base relatively long; chela with teeth on one side (Figure 9D). Palp five-segmented (Figure 12A, C); P-1 short, with two feathered setae; P-2 with three dorsal and two lateral feathered setae; P-3 with two dorsal feathered setae; P-4 terminal with three setae and a seta-like protrusion (Figure 12B, D); venter of P-5 with a mini seta on one side (Figure 12B, D).

Legs robust: I-L-3 without two strong dorsal peg setae.

Female (n=3). Similar to the male except larger idiosoma and PS wider (Figures 11C–D, 13–15).

Measurements — *Male* (n=5). I L/W 964 (874–964)/714 (670–714); FS L/W 300 (251–300)/378 (363–378); ACP L/W 160 (144–164)/186 (165–186); PCP L/W 196 (178–198)/283

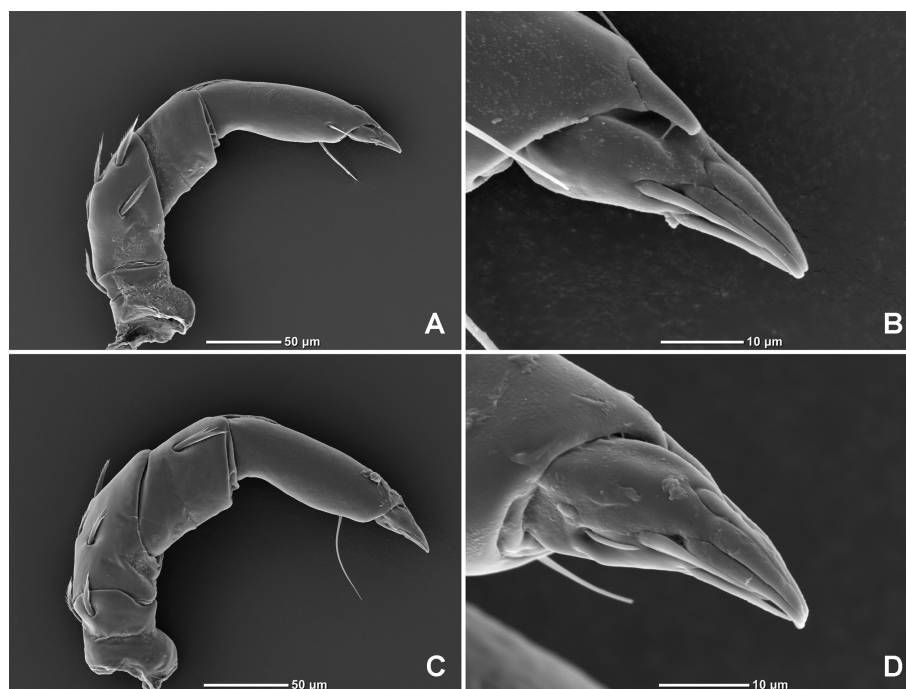


Figure 12 *Trichothyas (Neothyas) zhangae* Li, Jin & Guo **sp. nov.**, ♂ (AH-TR-2010052008), SEM photographs: A – One side of palp; B – One side of P-5; C – Another side of palp; D – Another side of P-5.

(241–283); LP 1–4 L/W 246 (232–246)/132 (129–138), 229 (179–229)/213 (190–213), 198 (198–215)/180 (145–180), 210 (202–210)/258 (221–258). ACG L/W 272 (247–272)/205 (182–205); PCG L/W 273 (239–273)/221 (211–221); PS L/W 60 (53–62)/62 (47–62); Gp L 201 (193–210); GF L 209 (183–209); Ac-1–3 L/W 76 (63–76)/30 (24–30), 74 (71–74)/24 (24–30), 63 (57–66)/53 (43–53); EP L 15 (15–16); CP L/W 79 (57–79)/70 (48–70). G L 265 (246–265); CB L 185 (170–185), CC L 73 (68–73); Palp segments L: P-1–5 32 (27–32), 89 (83–89), 48 (41–48), 106 (106–111), 38 (38–39). Leg segments L: I-L-1 68 (67–71), I-L-2 144 (136–144), I-L-3 68 (68–70), I-L-4 90 (90–92), I-L-5 105 (102–105), I-L-6 103 (99–103); II-L-1 76 (76–80), II-L-2 159 (146–159), II-L-3 74 (69–74), II-L-4 106 (106–111), II-L-5 122 (117–122), II-L-6 137 (137–148); III-L-1 80 (80–95), III-L-2 146 (138–146), III-L-3 68 (64–68), III-L-4 92 (92–102), III-L-5 107 (107–112), III-L-6 127 (127–131); IV-L-1 150 (142–150), IV-L-2 181 (172–181), IV-L-3 112 (109–112), IV-L-4 184 (184–188), IV-L-5 140 (140–143), IV-L-6 134 (132–139).

Female (n=3). I L/W 1018 (1018–1082)/771 (771–885); FS L/W 302 (302–360)/377 (377–409); ACP L/W 170 (170–183)/192 (192–209); PCP L/W 202 (202–230)/301 (301–318); LP 1–4 L/W 239 (239–259)/172 (172–187), 230 (230–238)/236 (236–264), 216 (216–237)/204 (204–207), 216 (198–216)/275 (275–285). ACG L/W 271 (271–287)/201 (201–206); PCG L/W 271 (271–282)/235 (235–258); PS L/W 44 (42–44)/89 (89–97); Gp L 224 (224–236); GF L 218 (218–232); Ac-1–3 L/W 71 (71–79)/36 (30–36), 83 (79–83)/29 (29–32), 76 (75–76)/48 (48–49); EP L 19 (18–19); CP L/W 49 (49–52)/48 (44–48). G L 260 (260–284); CB L 197 (192–197), CC L 75 (75–88); Palp segments L: P-1–5 33 (33–40), 91 (91–97), 47 (47–58), 114 (114–120), 38 (38–39). Leg segments L: I-L-1 73 (73–88), I-L-2 134 (134–144), I-L-3 66 (66–72), I-L-4 90 (90–106), I-L-5 104 (102–104), I-L-6 102 (102–107); II-L-1 73 (73–89), II-L-2 155 (155–178), II-L-3 67 (67–77), II-L-4 110 (110–129), II-L-5 120 (120–140), II-L-6 143 (143–154); III-L-1 78 (78–82), III-L-2 142 (142–155), III-L-3 69 (69–71), III-L-4 104 (104–114), III-L-5 114 (114–126), III-L-6 134 (134–149); IV-L-1 146 (146–169), IV-L-2 184

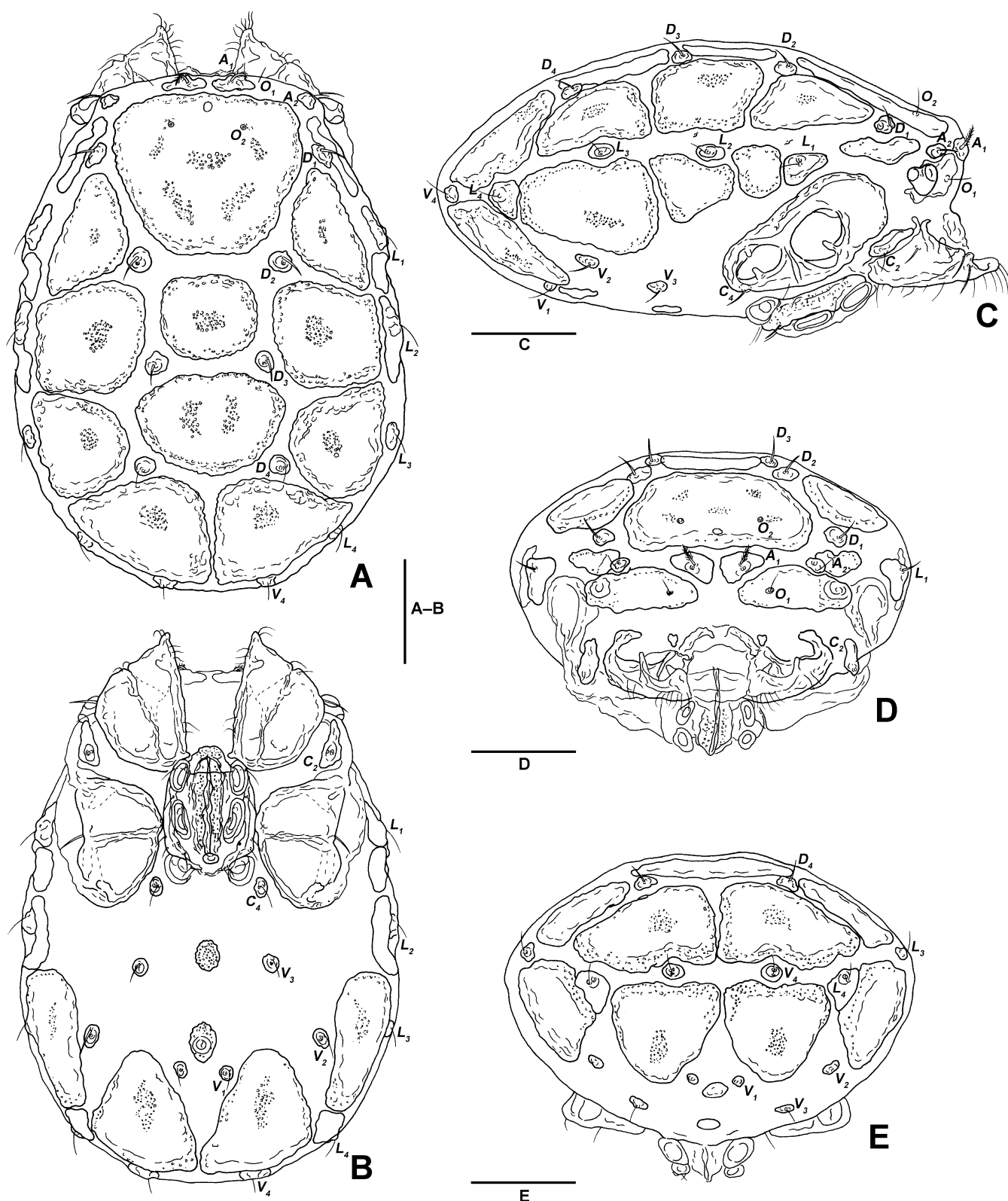


Figure 13 *Trichothyas (Neothyas) zhangae* Li, Jin & Guo **sp. nov.**, ♀, allotype (AH-TR-2010052007): A – Dorsal view; B – Ventral view; C – Lateral view; D – Frontal view; E – Rear view. Scale bars = 200 µm.

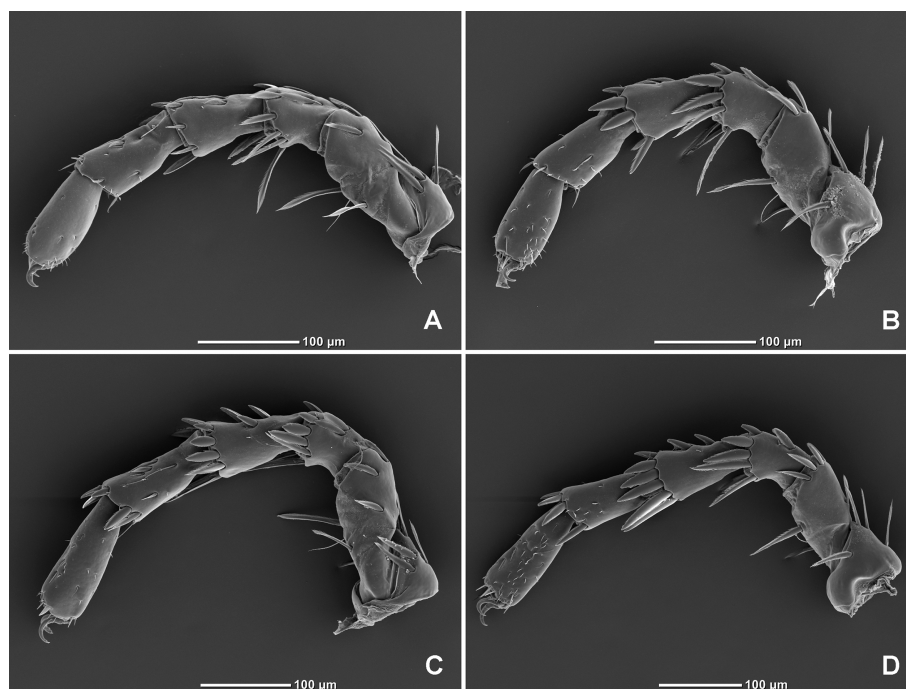


Figure 14 *Trichothyas (Neothyas) zhangae* Li, Jin & Guo **sp. nov.**, ♀ (AH-TR-2010052012), SEM photographs: A – Outer side of I-Leg-1–6; B – Inner side of I-Leg-1–6; C – Outer side of II-Leg-1–6; D – Inner side of II-Leg-1–6.

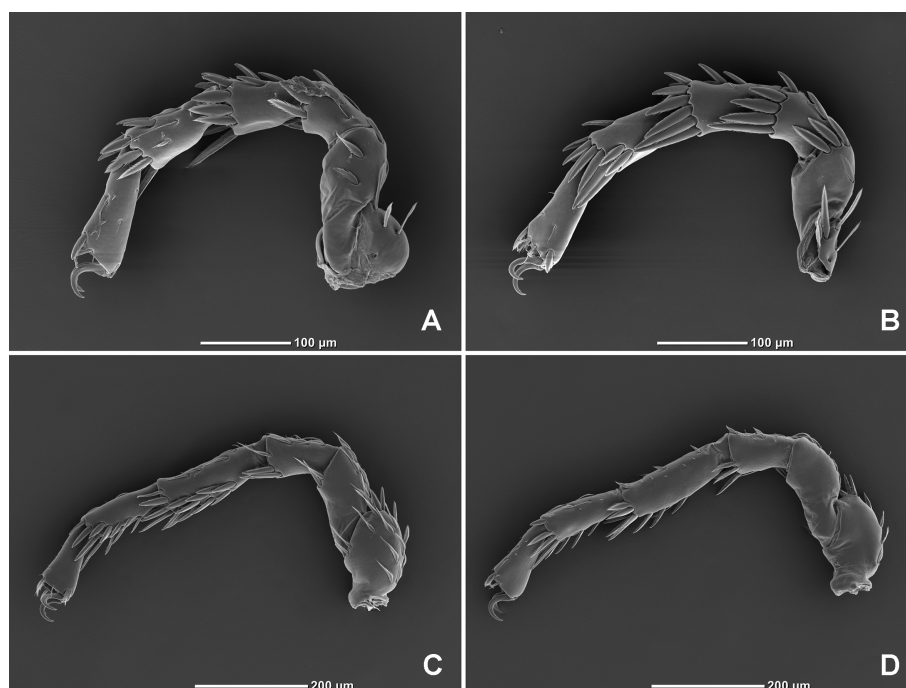


Figure 15 *Trichothyas (Neothyas) zhangae* Li, Jin & Guo **sp. nov.**, ♀ (AH-TR-2010052012), SEM photographs: A – Outer side of III-Leg-1–6; B – Inner side of III-Leg-1–6; C – Outer side of IV-Leg-1–6; D – Inner side of IV-Leg-1–6.

(184–195), IV-L-3 107 (107–132), IV-L-4 193 (193–224), IV-L-5 142 (142–161), IV-L-6 140 (140–155).

Remarks — Previously, only one species of the subgenus *Neothyas* was known, i.e. *Trichothyas* (*Neothyas*) *hygropetrica* Lundblad, 1941 from Indonesia (Table 1). Unfortunately, the female *T. (N.) hygropetrica* was not described by Lundblad (1941). Therefore, only males of the two species are compared here. *Trichothyas zhangae* sp. nov. from Anhui differs from *T. hygropetrica* in the following characters: (1) PS of *T. (N.) zhangae* Li, Jin & Guo sp. nov. is bigger than *T. (N.) hygropetrica*; (2) GF extends from the middle of Ac-1 to Ac-3 in *T. (N.) zhangae* Li, Jin & Guo sp. nov., while the anterior margin of GF is behind Ac-1 in *T. (N.) hygropetrica*; (3) Round CP of *T. (N.) zhangae* Li, Jin & Guo sp. nov. is relatively bigger than irregularly shaped CP of *T. (N.) hygropetrica*; (4) EP is with sclerotized extension in *T. (N.) zhangae* Li, Jin & Guo sp. nov., but not existed in *T. (N.) hygropetrica* (Lundblad 1941; Cook 1974; Smit 2020).

Distribution — China; only known from the locus typicus.

Discussion

There are quite a number of similarities in some genera of Euthyadinae K. Viets, 1931, especially *Almuerzothyas* Goldschmidt & Gerecke, 2003, *Dacothyas* Motas, 1959, *Heterothyas* Lundblad, 1941, *Javathyas* K. Viets, 1929, and *Trichothyas* K. Viets, 1926. These genera have a similar idiosomal plate pattern, palps, gnathosoma and legs. But their relationship is much confused. Cook (1974) discussed the four genera, and called them *Trichothyas*-like mites. Later on, another similar genus, i.e. *Almuerzothyas* Goldschmidt & Gerecke, 2003 was described from Costa Rica by Goldschmidt & Gerecke (2003). So far, a total of five genera, five subgenera and 26 species (subspecies) are recorded in *Trichothyas*-like group (Table 1).

When Cook (1974) and Smit (2020) wrote the key to the genera and subgenera of Euthyadinae, *Trichothyas* was divided into two parts to differentiate from other *Trichothyas*-like genera. This obvious contradiction inevitably raises doubts about the rationality of the taxonomy. Adults of *Almuerzothyas* has five important characteristics: (1) idiosomal plates relatively small and widely separated; (2) a single small V_I (rarely a fused pair) posterior to excretory pore; (3) genital field of males separated into anterior and posterior parts, and with genital flaps reduced to fragments behind Ac-2; (4) CP long and slender; (5) I-L-3 of males bearing two strong dorsal peg-like setae on outer side (Goldschmidt & Gerecke 2003; I.M. Smith & Cook 2009). Adults of *Dacothyas* has four important characteristics: (1) idiosomal plates adjacent to each other; (2) genital field with four pairs of acetabula; (3) genital field of males separated into anterior and posterior parts and with genital flaps reduced to fragments; (4) first leg of male highly modified, I-L-3 with a large seta (Cook 1974; Oezkan & Bader 1988; Smit 2020). Adults of *Heterothyas* have four important characteristics: (1) genital field with numerous acetabula; (2) genital field of males separated into anterior and posterior parts and with genital flaps reduced behind second acetabular group; (3) CP much wider than long; (4) I-L-3 of males with two heavy setae (Smit 2020). Adults of *Javathyas* has two important characteristics: (1) genital field of males separated into anterior and posterior parts, and with genital flaps reduced to fragments; (2) first leg of male highly modified, I-L-3 with a large seta (K. Viets 1935; Cook 1967, 1974; Smit 2009, 2020; Gerecke 2020).

However, these characteristics (the space between the idiosomal plates, the number of acetabula, the shape of CP, and the modification of male first leg) can also be found in *Trichothyas*. Therefore, the above characteristics are more like the result of independent species evolution, rather than the differences to distinguish the genera these species presented from *Trichothyas*.

On the other hand, all males of the four *Trichothyas*-like genera have a divided genital field, but only *Trichothyas* has a slight indication of separation. This characteristic indicates that *Trichothyas*-like genera seem to have a completed independent evolution.

In summary, there may be three possibilities for the taxonomy of this enigmatic group: (1) four *Trichothyas*-like genera belong to *Trichothyas*; or: (2) four *Trichothyas*-like genera merge into an independent genus as a sister group of *Trichothyas*; or: (3) *Trichothyas* is a paraphyletic group, and its subgenera should be independent genera. Traditional morphological research is clearly no longer sufficient, and molecular data should be utilized as soon as possible to solve this problem.

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