

Four new species of Euthyadinae Viets, 1931 (Acari, Hydrachnidia, Hydryphantidae) living in water-margin habitats in southern China

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<https://zoobank.org/7F17C9CE-7E05-406F-A37A-A0AD89E17006>

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Academic editor: Danilo Harms ♦ Received 29 April 2026 ♦ Accepted 28 June 2026 ♦ Published 14 July 2026

Abstract

In this paper, four hydryphantid water mites from southern China, i.e., *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, **sp. nov.**, *Deuterothyas crescentis* Zhan & Guo, **sp. nov.**, *Deuterothyas fulu* Zhan & Guo, **sp. nov.** and *Deuterothyas fujianensis* Zhan & Guo, **sp. nov.**, are described as new to science. The latter three species represent a newly recorded genus in the subfamily Euthyadinae Viets, 1931 for the Chinese fauna. Additionally, detailed documentation of their habitats, which consist of moss or green algae at the water margin, is provided. Furthermore, using scanning electron microscopy (SEM) and compound microscopy, secondary sclerotizations were discovered under the integument during adult maturation in the genus *Deuterothyas* Lundblad, 1941.

Key Words

Deuterothyas, morphology, *Panisopsis*, taxonomy, water mites

Introduction

The subfamily Euthyadinae Viets, 1931 contains 31 genera and has been recorded from all parts of the world except Antarctica (Smit 2020). In China, only eight species in three genera have been found, i.e., *Panisopsis* K. Viets, 1926, *Trichothyas* K. Viets, 1926, and *Parathyas* Lundblad, 1926 (Li et al. 2022; Zhong et al. 2024, 2025, 2026).

Most species of the euthyadin mites are dwellers of streams and ponds, with only small numbers occurring at the water margin (Cook 1974; Smit 2020). Mitchell (1960) identified some adaptive morphological characteristics of *Trichothyas* species that inhabit the water margin: (1) the coxae widen, with their margins and distal ends thickened and extended; (2) all leg segments are short and broad, accompanied by short, thick setae. In fact, these features are quite obvious in many euthyadin water mites, although most of them lack clear habitat records.

Therefore, it is particularly important to develop more species resources and conduct in-depth studies.

After field collections from southern China, detailed morphological characters were observed by integrating SEM and an optical microscope, and four new species were discovered, i.e., *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, **sp. nov.**, *Deuterothyas crescentis* Zhan & Guo, **sp. nov.**, *D. fulu* Zhan & Guo, **sp. nov.**, and *D. fujianensis* Zhan & Guo, **sp. nov.** This is the first investigation conducted on water-margin habitats in China, providing ideas for further exploration of this kind of habitat in the future.

Material and methods

Water mites were collected from moss or green algae that had been washed and soaked by stream water. Specimens were preserved in Koenike's solution; finally, the

dissected specimens were sealed and preserved in gelatin mounting solution (Gu et al. 2021). Micrographs of water mites were taken with a Canon EOS R8 digital camera with a Mitutoyo Plan NIR 10 lens, and a Godox MF12 flash was used as the light source. Helicon Focus (ver. 8.1.0) was used for image stacking. All compound microscope images and measurements (given in μm) were made with a Nikon Ni-E with a Nikon DS-Ri2 camera. The treatments for SEM followed Li et al. (2022). All images were modified and grouped into plates in Adobe Photoshop 2021.

The measurement methods for the idiosoma, ACG, PCG, genital field, acetabula, excretory pore, gnathosoma, chelicera, palp, and legs followed Li et al. (2024). The terminology and abbreviations used were updated from Jin (1997) and Cook (1974). A.s.l = above sea level; A_1 = preantennal glandularia; A_2 = postantennal glandularia; ACG = anterior coxal group (Cx-I+Cx-II); Ac_1 – Ac_3 = acetabula 1–3; C_2 and C_4 = coxoglandularia two and four; Cx-I–IV = coxae I–IV; D_1 – D_4 = dorsoglandularia 1–4; Dc1–5 = dorsocentralia 1–5; D11–4 = dorsolateralia 1–4; dL = dorsal length; I-L-1–6 = the first–sixth segment of the first leg; L_1 – L_4 = lateroglandularia 1–4; O_1 = preocularia; O_2 = postocularia; PCG = posterior coxal group (Cx-III+Cx-IV); P-1–5 = the first–fifth segment of the palp (from proximal to distal); So_1 – So_5 = slit organ 1–5; V_1 – V_4 = ventroglandularia 1–4.

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 *Panisopsis* K. Viets, 1926

Subgenus *Panisopsis* s. str.

***Panisopsis* (s. str.) *lixunae* Zhan & Guo, sp. nov.**

<https://zoobank.org/295B0C78-808D-4D56-973E-B53F8CB37430>

Figs 1–8

Type material. • **Holotype:** adult female, Wudaoshui Town, Sangzhi County, Zhangjiajie City, Hunan Province, P.R. China, leg. Zhu-Hui Ding & Xin-Yao Gu, 15-VII-2015, Slide No. HN-HYDRY-2016081501.



Figure 1. Habitats of *Panisopsis* (s. str.) *lixunae* Zhan & Guo, sp. nov. **A.** Shallow mountain streams of Hongyan Gorge, Huaxi District, Guiyang City, Guizhou Province; **B.** Stone emerging from the water with moss growing on it; **C.** Stone with the moss peeled back to reveal the substrate.



Figure 2. Micrographs of *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, sp. nov., paratype ♀ (GZ-HYDRY-2024100401), camera photographs. **A.** Dorsal view; **B.** Ventral view. Scale bars: 500 µm.

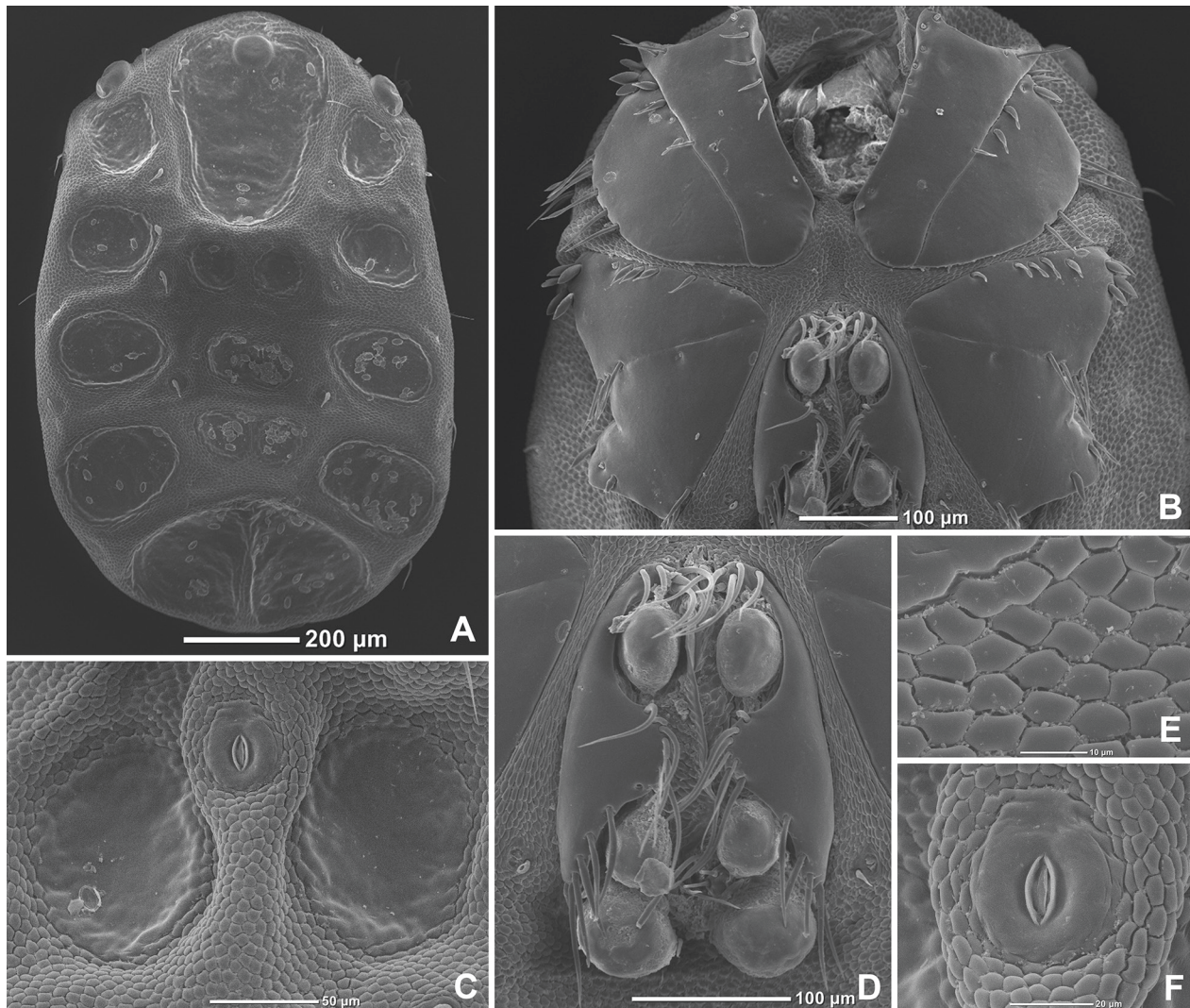


Figure 3. *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Dorsal view of idiosoma; **B.** ♀ Coxae; **C.** ♂ Excretory pore and ventral plates; **D.** ♀ Genital field; **E.** ♀ Integument papillae; **F.** ♂ Excretory pore.

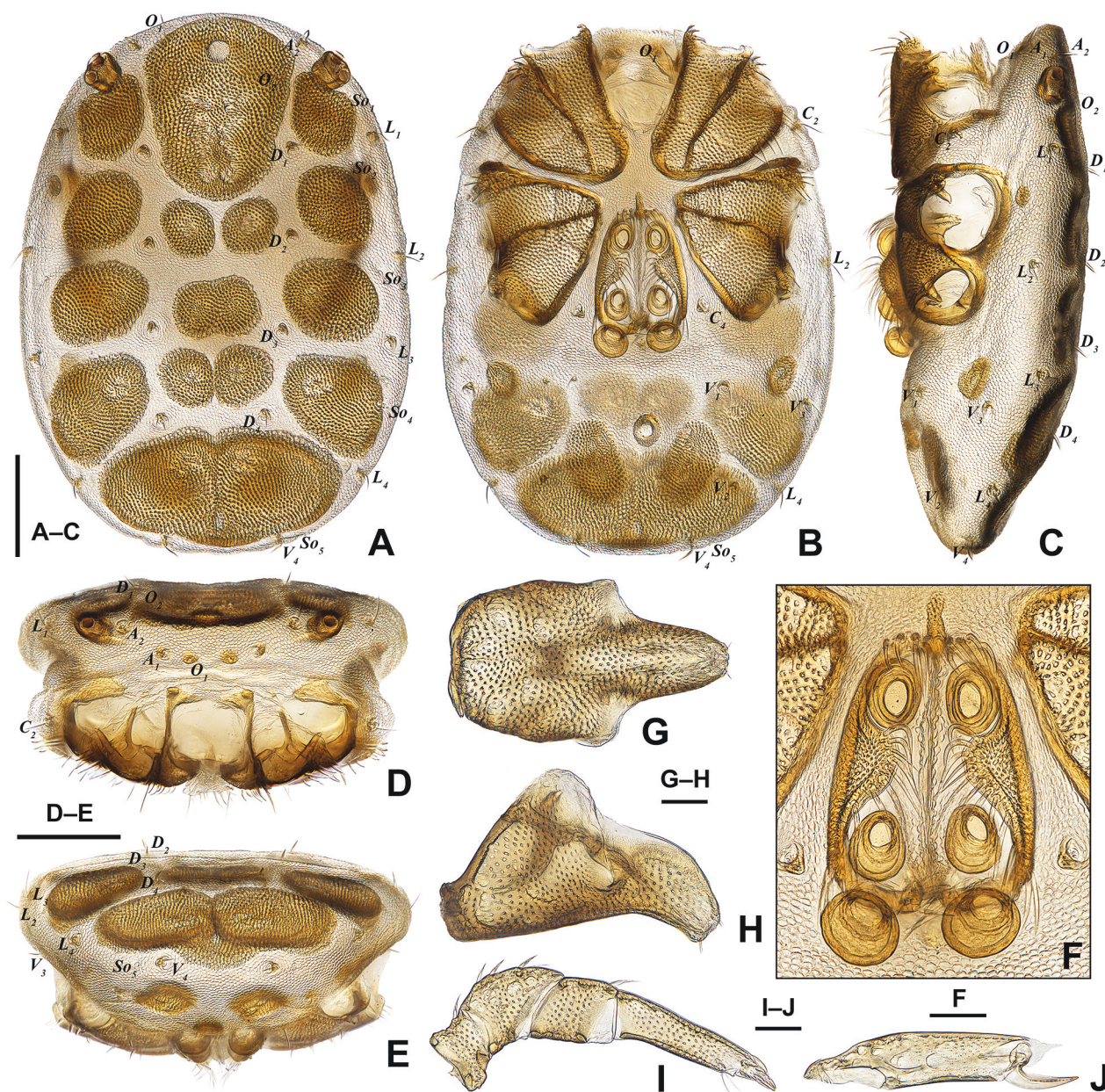


Figure 4. *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, sp. nov., holotype ♀ (HN-HYDRY-2016081501), optical photographs. **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Frontal view; **E.** Posterior view; **F.** Genital field; **G.** Ventral view of gnathosoma; **H.** Lateral view of gnathosoma; **I.** Lateral view of palp; **J.** Lateral view of chelicera. Scale bars: 200 µm (A–E); 50 µm (F–J).

• **Paratypes:** one adult male, same data as holotype, Slide No. HN-HYDRY-2016081502; five adult females and one adult male, Hongyan Gorge, Huaxi District, Guiyang City, Guizhou Province (26°19'07"N, 106°47'11"E; 1131 m a.s.l.), leg. Bao-Xiang Zhan & Xun Li, Slide No. GZ-HYDRY-2024100401–6.

Habitat. In shallow mountain streams, on stones partially exposed above the water surface, scoured by the swift currents and covered with moss. When the damp moss is lifted, mites can be seen crawling on the substrate (Fig. 1A–C).

Etymology. The specific epithet refers to the collector of the paratypes, Xun Li; the name is treated as an adjective.

Diagnosis. Integument papillae closely arranged, blunt and smooth. Well-developed median eye and O_2 located on the median eye plate, with the median eye positioned anterior to the connection line of O_2 . Dorsal plates large, with the edges and corners of each plate distinctly rounded. Postgenital sclerite very small and concealed between the Ac_3 . Gnathosomal base slightly short and approximately an isosceles right triangle in lateral view. III–IV–L–6 with a large number of lamellate setae at the ventral side of the middle rear to end. **Female.** Pregenital sclerite as a vertical short rod. **Male.** Pregenital sclerite very small and concealed between the Ac_1 .

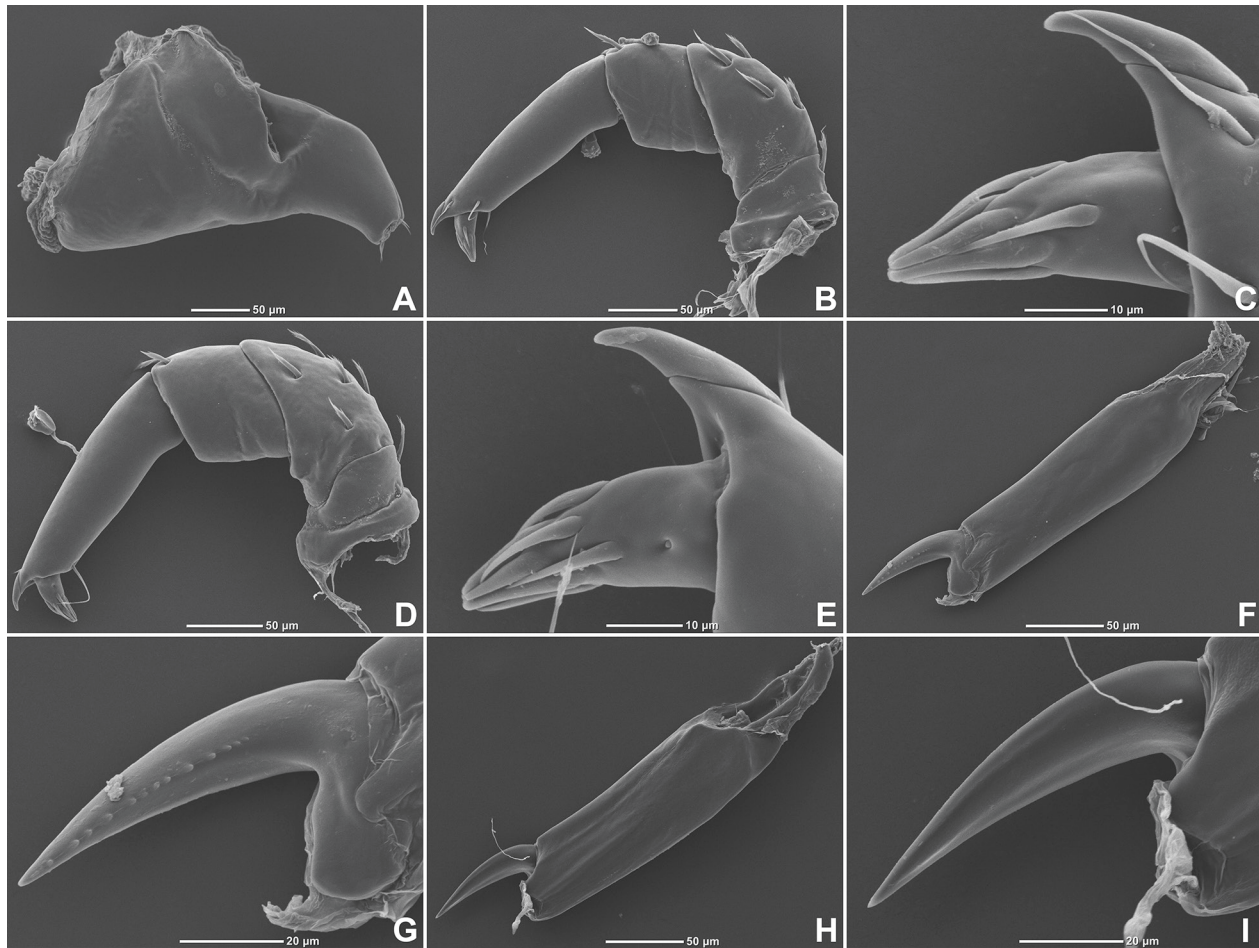


Figure 5. *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Lateral view of gnathosoma; **B.** ♀ Medial side of palp; **C.** ♀ Medial side of P-5; **D.** ♀ Lateral side of palp; **E.** ♀ Lateral side of P-5; **F.** ♀ Lateral side of chelicera claw; **G.** ♀ Lateral side of chelicera claw; **H.** ♀ Medial side of chelicera; **I.** ♀ Medial view of chelicera claw.

Description. Living habitus: idiosoma oval, red with a whitish margin, median and lateral eyes black; palps and legs orange (Fig. 2A, B). Integument papillae closely arranged, blunt and smooth (Fig. 3E). **Female** ($n = 6$). Dorsal view: apical angles of Cx-I and Cx-II invisible in dorsal view. Median eye plate approximately inverse trapezoidal, top and bottom edges convex, formed by the fusion of the prefrontalia, postfrontalia and Dc1, with three pairs of muscle attachment plates; well-developed median eye and O_2 located on the median eye plate, with the median eye positioned anterior to the connection line of O_2 . The remaining dorsalia large, with the edges and corners of each plate distinctly rounded; Dc2 may be separated or fused with each other, and this situation also occurs randomly among Dc3–5, resulting in various combinations of Dc, other plates widely separated; each pair of plates with a pair of muscle attachment. (Figs 3A, 4A) Ventral view: coxae in four groups; the anterior-median margin of Cx-I bears several pairs of sparse small setae, several pairs of short setae at its apex and two pairs of long setae at lateral margin; the apex of Cx-II with several pairs of short, thick setae, while the lateral

margins possess several pairs of long setae; the anterior margin of Cx-III bears several pairs of short setae, with thicker setae at its tip, and lateral margins with several pairs of long setae; the posterolateral region of Cx-IV with several pairs of short setae (Figs 3B, 4B). Pregenital sclerite as a vertical short rod; genital field with three pairs of acetabula; the genital flap tapers at both anterior and posterior ends, being wider in the middle, with 5–6 pairs of long setae above Ac1, approximately 12–18 pairs of long setae along the middle margin, and 3–4 pairs of long setae at the posterior end, located between Ac₂ and Ac₃; postgenital sclerite very small and concealed between Ac₃ (Figs 3D, 4F). Excretory pore circular, with thickened and sclerotized margin. Two pairs of ventral plates with muscle attachments. (Fig. 4B) Lateral view: idiosoma relatively flattened, with a plate located between the Cx-III and L_2 (Fig. 4C). Frontal view: O_1 plate extremely small and separated from A_1 (Fig. 4D). Posterior view: So_5 beside V_4 (Fig. 4E).

Gnathosomal base short and approximately an isosceles right triangle in lateral view (Figs 4G, H, 5A). Palp five-segmented; P-1 short, with one pinnate seta; P-2 with

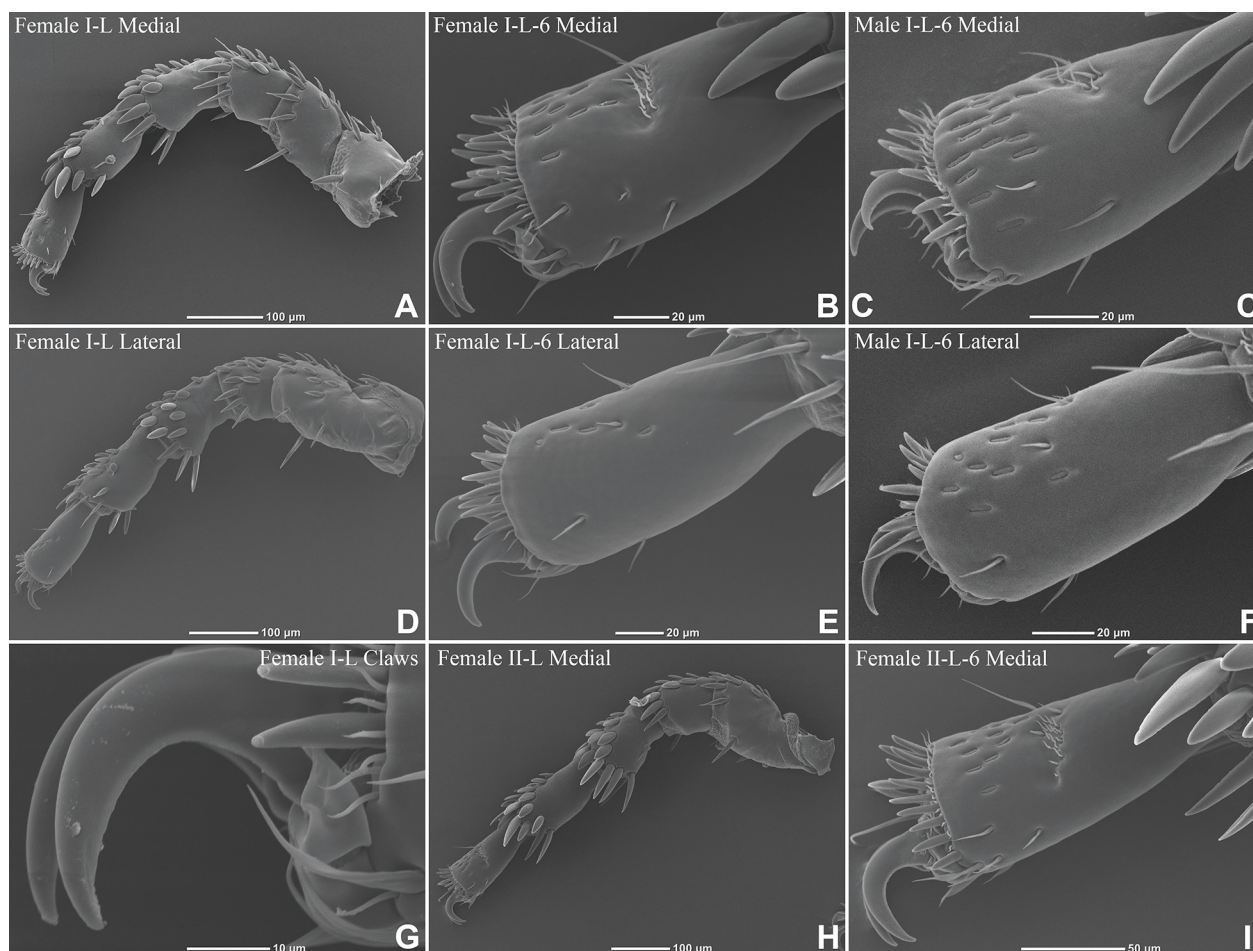


Figure 6. *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Medial side of I-leg; **B.** ♀ Medial side of I-leg-6; **C.** ♂ Medial side of I-leg-6; **D.** ♀ Lateral side of I-leg; **E.** ♀ Lateral side of I-leg-6; **F.** ♂ Lateral side of I-leg-6; **G.** ♀ Lateral side of I-leg-6 claws; **H.** ♀ Medial side of II-leg; **I.** ♀ Medial side of II-leg-6.

four dorsal and three lateral pinnate setae; P-3 with two dorsal pinnate setae; P-4 terminally with three fine setae and a seta-like protrusion; P-5 with some thick setae anteriorly (Figs 4I, 5B–E). Chelicera shape conventional, chelicera claw concave on lateral side, with a row of teeth on medial side (Figs 4J, 5F–I).

Legs robust; except for the sixth segments, all segments with a large number of short and thick setae; I–II–L-6 with evenly arranged both thick and thin short setae anteriorly, and near the dorsal margin in the centre with 2–3 rows of short, fine setae arranged vertically to the leg segments; III–IV–L-6 with a large number of lamellate setae at the ventral side from the centre to the anterior end (Figs 6A–B, D–E, H–I, 7B–C, F–I, K–N). Claws simple, the smooth surface without teeth (Figs 6G, 7E, J, O).

Male ($n = 2$). General characteristics similar to the female (Figs 3C, F, 8A–C, E–H). Pregenital sclerite very small and concealed between the Ac_1 (Fig. 8D). Ejaculatory complex anterior view: proximal arms well sclerotized, strong, heavy, almost parallel; distal arms well

sclerotized, short, bent at base (Fig. 8I). I–II–L-6 with more setae than female (Figs 6C, F, 7A, D).

Measurements. Male ($n = 2$) and female ($n = 6$). See Table 1 for details.

Remarks. *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, sp. nov. can be distinguished from most species in the genus by its approximately inverted trapezoidal median eye plate and large dorsal plates (Cook 1959; Di Sabatino et al. 2010). The new species is similar to *P. (s. str.) garzeensis* Zhong & Guo, 2024. However, the two species can be differentiated by the following characteristics: (1) in the new species, the median eye is positioned anterior to the connection line of O_2 , whereas in *P. garzeensis*, the median eye is located on the connection line of O_2 ; (2) the ventral platelets of *P. (s. str.) garzeensis* are relatively small, while those of the new species are comparatively larger; (3) compared to *P. garzeensis*, the gnathosomal base of the new species is shorter; (4) in the new species, III–IV–L-6 with a large number of lamellate setae on the ventral side from the center to the anterior end, but this feature is absent in *P. (s. str.) garzeensis* (Zhong et al. 2024).

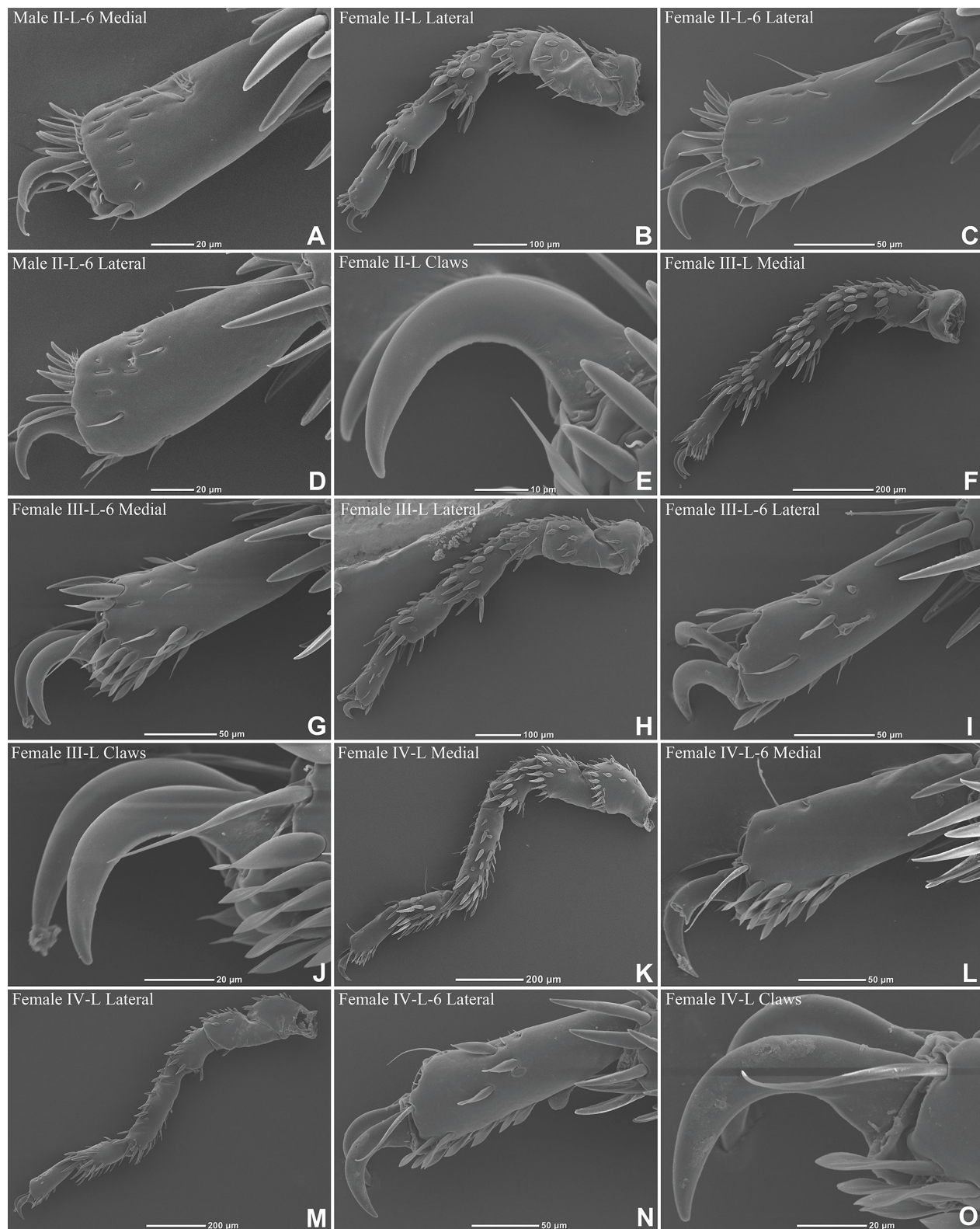


Figure 7. *Panisopsis (s. str.) lixunae* Zhan & Guo, sp. nov., SEM photographs. **A.** ♂ Medial side of II-leg-6; **B.** ♀ Lateral side of II-leg; **C.** ♀ Lateral side of II-leg-6; **D.** ♂ Lateral side of II-leg-6; **E.** ♀ Lateral side of II-leg-6 claws; **F.** ♀ Medial side of III-leg; **G.** ♀ Medial side of III-leg-6; **H.** ♀ Lateral side of III-leg; **I.** ♀ Lateral side of III-leg-6; **J.** ♀ Lateral side of III-leg-6 claws; **K.** ♀ Medial side of IV-leg; **L.** ♀ Medial side of IV-leg-6; **M.** ♀ Lateral side of IV-leg; **N.** ♀ Lateral side of IV-leg-6; **O.** ♀ Lateral side of IV-leg-6 claws.

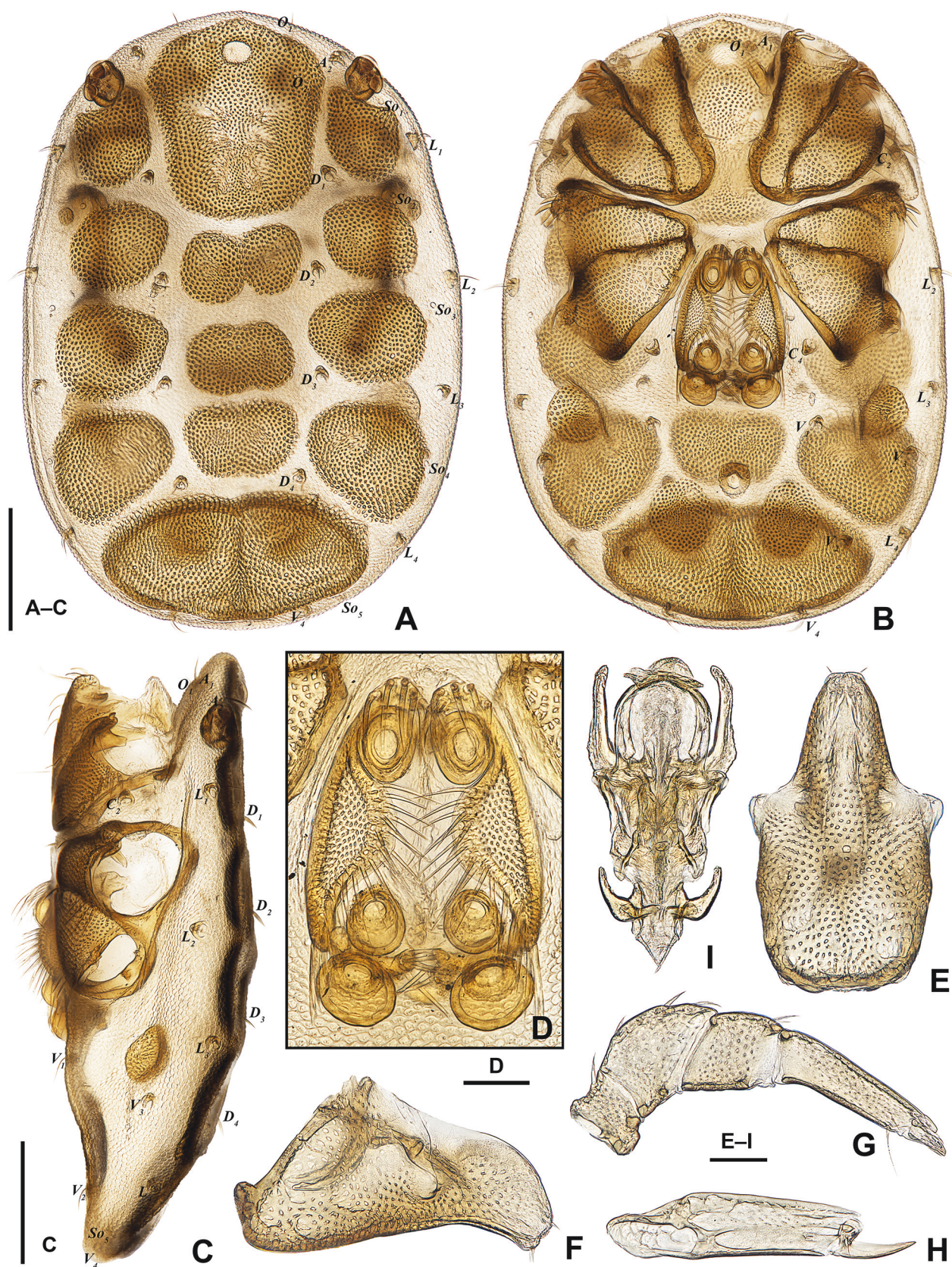


Figure 8. *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, sp. nov., paratype ♂ (HN-HYDRY-2016081502), optical photographs. **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Genital field; **E.** Ventral view of gnathosoma; **F.** Lateral view of gnathosoma; **G.** Lateral view of palp; **H.** Lateral view of chelicera; **I.** Ejaculatory complex. Scale bars: 200 µm (A–C); 50 µm (D–I).

Table 1. Measurements of *Panisopsis* (*s. str.*) *lixunae* Zhan & Guo, sp. nov.

	1 ♀	2 ♂	3 ♀	4 ♀	5 ♀	6 ♂	7 ♀	8 ♀
Idiosoma L/W	1067, 761	1008, 813	1202, 864	1009, 702	1108, 798	1070, 792	1133, 785	1052, 703
ACG L	300	272	315	295	329	299	302	308
PCG L	348	302	350	341	339	330	341	341
Gonopore L	209	191	246	224	243	217	210	213
Ac1 L	64, 63	55, 57	64, 66	53, 59	67, 66	63, 68	\, 66	66, 68
Ac2 L	60, 60	47, 48	56, 61	60, 59	60, 63	68, 66	\, 57	60, 61
Ac3 L	73, 69	63, 65	76, 76	66, 65	70, 67	71, \	70, 72	71, 75
Excretory pore L	67	54	72	62	69	61	64	68
Gnathosoma L	290	261	297	274	287	275	297	291
Chelicera base L	213	193	217	209	219	212	221	209
Chelicera claw L	74	77	83	70	82	79	87	81
P-1–5 dL	50, 116, 63, 159, 46	45, 112, 63, 144, 43	47, 116, 64, 156, 51	42, 116, 68, 141, 44	50, 113, 64, 149, 42	44, 112, 61, 158, 43	38, 120, 63, 156, 49	49, 120, 63, 148, 46
II-L-1–6 dL	98, 116, 99, 125, 147, 117	83, 138, 0, 108, 135, 128	99, 123, 105, 123, 158, 131	92, 142, 104, 145, 165, 151	69, 108, 87, 116, 139, 128	93, 107, 95, 121, 145, 124	95, 111, 102, 124, 143, 126	100, 105, 99, 125, 143, 120
III-L-1–6 dL	101, 143, 107, 144, 172, 145	91, 111, 95, 120, 123, 99	102, 138, 112, 135, 176, 163	103, 116, 98, 160, 162, 173	101, 124, 98, 140, 163, 150	94, 120, 103, 134, 161, 143	103, 112, 108, 138, 169, 151	108, 131, 95, 147, 168, 144
III-L-1–6 dL	108, 129, 111, 171, 184, 170	91, 101, 91, 144, 173, 159	123, 128, 107, 153, 199, 200	102, 116, 96, 147, 175, 164	98, 112, 94, 146, 174, 168	102, 106, 105, 160, 176, 172	104, 116, 103, 166, 186, 165	110, 111, 102, 168, 173, 161
IV-L-1–6 dL	221, 152, 159, 302, 178, 184	202, 141, 139, 265, 167, 175	234, 154, 153, 315, 188, 196	211, 151, 151, 293, 171, 178	220, 145, 146, 279, 161, 152	212, 145, 149, 289, 175, 195	212, 161, 154, 317, 184, 197	222, 151, 151, 296, 179, 188

Genus *Deuterothyas* Lundblad, 1941

Deuterothyas crescentis Zhan & Guo, sp. nov.

<https://zoobank.org/CEA10A16-A3F3-4F02-A734-74D05DE9ADB9>

Figs 9A–D, 10–18

Type material. • **Holotype:** male, Tangxia Village, Xiongjiang Town, Minqing County, Fuzhou City, Fujian Province, P.R. China (26°16'43"N, 118°42'15"E; 302 m a.s.l.), leg. Bao-Xiang Zhan, Lan Ja & Dong-Mei Liu, 06-VII-2024, Slide No. FJ-HYDRY-2024070601.

• **Paratypes:** 4♂, 4♀, same locality and data as holotype, Slide No. FJ-HYDRY-2024070602–2024070609; 1♂, same locality as holotype, leg. Bao-Xiang Zhan, 09-IX-2025, Tube No. FJ-HYDRY-2025090901.

Habitat. Subtropical evergreen broad-leaved forest, with green algae on the banks of a rapid stream. (Fig. 9A–D).

Etymology. “*crescentis*” comes from Latin, meaning “growth,” the new species is named for the secondary sclerotization that grows under its integument as it matures.

Diagnosis. Integument papillae ends rounded, with folds between papillae. Prefrontalia, postfrontalia, Dc1 and Dc2 fused to median eye plate; Dc3 fused with each other, and this situation also occurs randomly among Dc4–5. Genital flaps divided into three pairs, the first and third pairs small, the second pair triangular; post-genital sclerite small. **Male.** Fully mature adult with a

large porous secondary sclerotization appeared under the integument, extending from the frontal margin to posterior margin of the idiosoma, but not enclosing the eye capsules, D_I – D_4 , V_4 and slit organs; pregenital sclerite small. **Female.** The porous secondary sclerotization under the fully mature adult integument grow from the median eye plate and Dc3–5 and extend outward laterally; pregenital sclerite arrow-shaped.

Description. Living habitus: Idiosoma color red, with the sclerotized structure under the integument, sometimes with green algae attached to the dorsal integument; lateral eyes red; palps and legs orange (Fig. 10A–F). Integument papillae rounded, with folds between the papillae (Fig. 11E–G). **Male ($n = 6$).** Dorsal view: median eye plate approximately shield-shaped, formed by the fusion of the prefrontalia, postfrontalia, Dc1 and Dc2; median eye and O_2 located on the median eye plate, with the median eye positioned anterior to the connection line of O_2 ; Dc3 fused with each other, and this situation also occurs randomly among Dc4–5; D11–4 large, nearly rounded (Figs 11A, 12A). Young adult only with dorsalia at the idiosoma surface, while a large porous secondary sclerotization appeared under the integument of the fully mature adult. The two sides of the secondary structure almost parallel, extending from the frontal margin to the posterior margin of the idiosoma, but not enclosing the eye capsules, D_I – D_4 , V_4 and slit



Figure 9. Habitats of the genus *Deuterothyas* Lundblad, 1941; **A–D.** Habitats of *D. Crescentis* Zhan & Guo, sp. nov., *D. Fulu* Zhan & Guo, sp. nov. and *D. Fujianensis* Zhan & Guo, sp. nov.; **A.** Subtropical evergreen broad-leaved forest in Tangxia Village, Xiongjiang Town, Minqing County, Fuzhou City, Fujian Province; **B.** Rapid streams; **C.** Moist green algae; **D.** *D. Crescentis* and *D. Fulu* on the green algae; **E.** Habitat of *D. Fujianensis* Zhan & Guo, sp. nov.

organs (Figs 12A, 13A). Ventral view: coxae in four groups; the tip of coxae with several pairs of short, thick setae; posterolateral corners of Cx-II and Cx-III with several pairs of long, thick setae; excretory pore circular, with a thickened and sclerotized margin; a pair of ventral plates lateral to the excretory pore (Figs 12B, 13B). Pregenital sclerite and postgenital sclerite small; genital field with three pairs of acetabula; genital flaps divided into three pairs; the first pair small, located on the an-

teromedial side of Ac_1 and with two pairs of setae; the second pair triangular, located on the medial side of Ac_2 and with 7–11 pairs of setae; third pair very small, located on the medial side of Ac_3 and with 1–3 pairs of setae (Figs 11C, 12F, 13E). Lateral view: So_1 – So_3 located on the front side of Dc1–Dc3; So_4 on the side of Dc4, So_5 in front of Dc5 (Figs 12C, 13C). Frontal view: A_2 located lateral to the eye capsules (Figs 12D, 13D). Posterior view: So_5 lateral to V_4 (Fig. 12E).

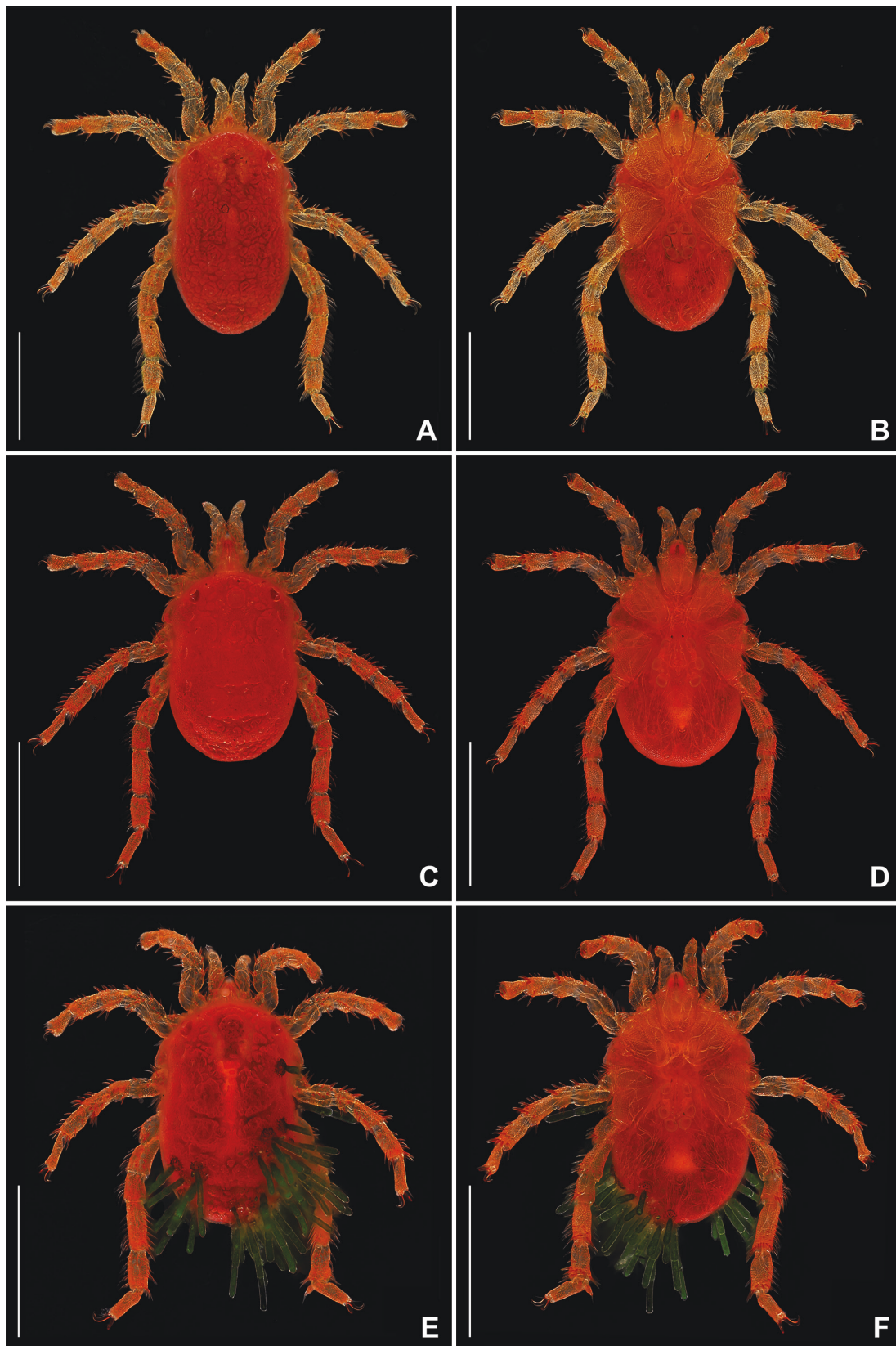


Figure 10. Micrographs of *Deuterothyas crescentis* Zhan & Guo, sp. nov., camera photographs. **A.** Paratype ♂ (FJ-HY-DRY-2025090901), dorsal view; **B.** Paratype ♂ (FJ-HYDRY-2025090901), ventral view; **C.** Paratype ♀ (FJ-HYDRY-2024070607), dorsal view; **D.** Paratype ♀ (FJ-HYDRY-2024070607), ventral view; **E.** Paratype ♀ (FJ-HYDRY-2024070606), dorsal view; **F.** Paratype ♀ (FJ-HYDRY-2024070606), ventral view. Scale bars: 500 μ m.

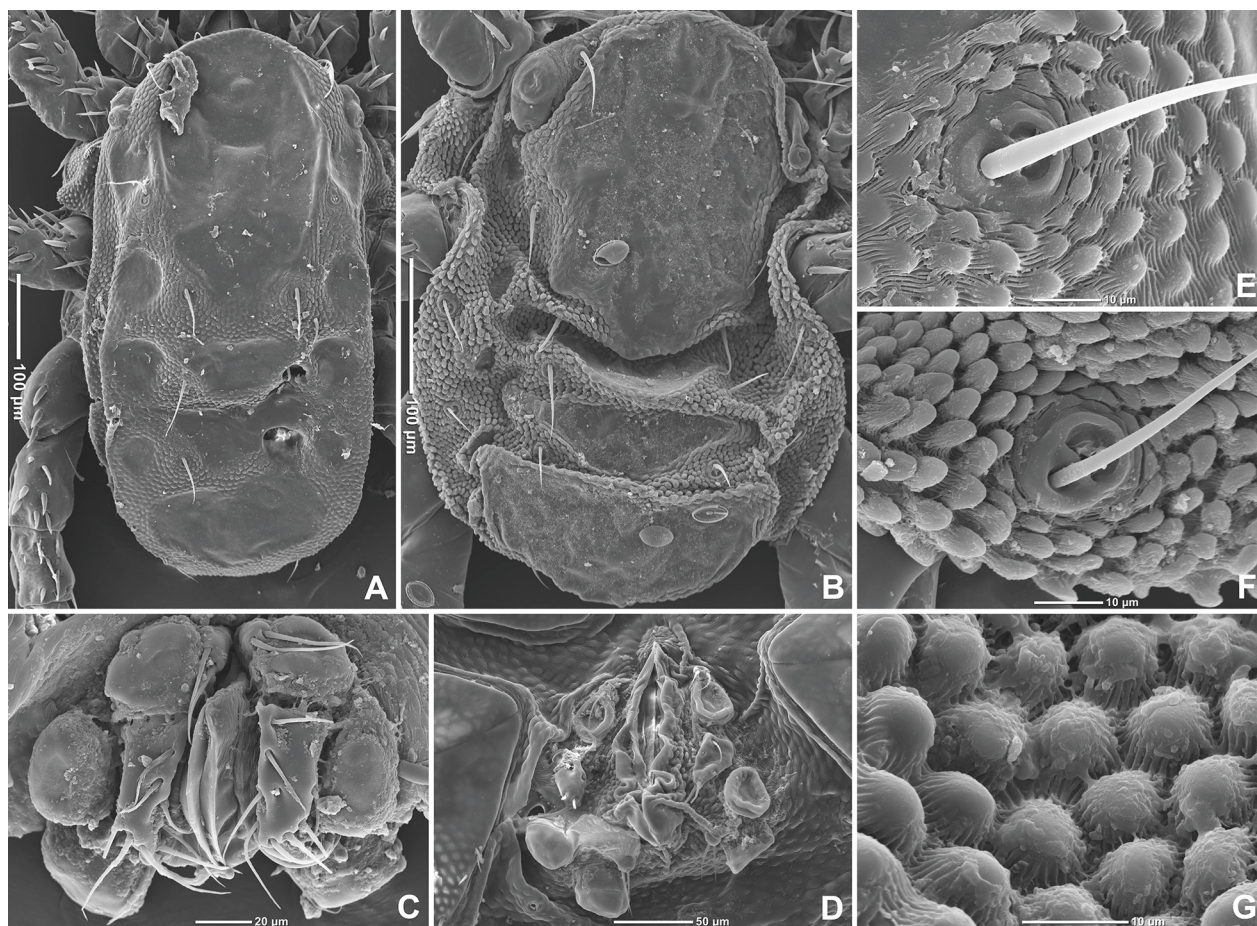


Figure 11. *Deuterothyas crescentis* Zhan & Guo, sp. nov., SEM photographs. **A.** ♂ Dorsal view of idiosoma; **B.** ♀ Dorsal view of idiosoma; **C.** ♂ Genital field; **D.** ♀ Genital field; **E.** ♂ D₂ and surrounding integument papillae; **F.** ♀ L₃ and surrounding integument papillae; **G.** ♀ Integument papillae.

Gnathosoma with a short rostrum and two pairs of setae (Figs 12G–H, 13F–G, 14A). Palp five-segmented; P-1 short, with one dorsal seta; P-2 with four dorsal and one lateral pinnate setae; P-3 with two dorsal pinnate setae; P-4 terminal with three fine setae and a seta-like protrusion; P-5 short, with some thick setae anteriorly (Figs 12I, 13H, 14B–E). Chelicera shape conventional, chelicera claw concave on lateral side, with a row of teeth on medial side (Figs 12J, 13I, 14F–I).

Legs robust; except for the sixth segments, all segments with a large number of short and stout setae; I–II–L-6 with both stout and fine short setae anteriorly, and near the dorsal margin in centre with one row of short, fine setae arranged vertically to the leg segments; III–IV–L-6 with a few long setae anteriorly (Figs 15A, B, D, E, H, I, K, L, 16C–F). Claws simple, with a smooth surface without teeth, but lateral and medial sides both with a groove (Fig. 15G).

Female ($n = 4$). General characteristics similar to the male (Figs 17A–H, 18A–J). However, the porous secondary sclerotization under the integument of the fully mature adult female is different from the male: the porous secondary sclerotization under the female integument grows from the median eye plate and Dc3–5 and

extends laterally (Figs 11B, F, G, 17A–C, E–H, 18A–E, G–L). Genital field longer than in male; pregenital sclerite arrow-shaped (Figs 11D, 17D, 18F). Legs similar to male except I–II–L-6 with less setae (Figs 15C, F, J, 16A–B, G–L).

Measurements. Male ($n = 4$) and female ($n = 4$). See Table 2 for details.

Remarks. Adults of *Deuterothyas crescentis* Zhan & Guo, sp. nov. develop porous secondary sclerotized structures under the integument as they mature. For the fully mature adults, this characteristic can easily distinguish the new species from other species of the genus. However, the young adult with not-yet-developed secondary sclerotization is somewhat similar to *Deuterothyas variabilis* Lundblad, 1941, but these two species can be differentiated by the following characteristics: (1) in the new species, the median eye plate is formed by the fusion of the prefrontalia, postfrontalia, Dc1, and Dc2, whereas in *D. variabilis*, the median eye plate does not comprise Dc2; (2) compared to the latter species, the male genital field of the new species is shorter; (3) the second pair of genital flaps is triangular in the new species, while in *D. variabilis* it is approximately trapezoidal (Lundblad 1969; Cook 1974).

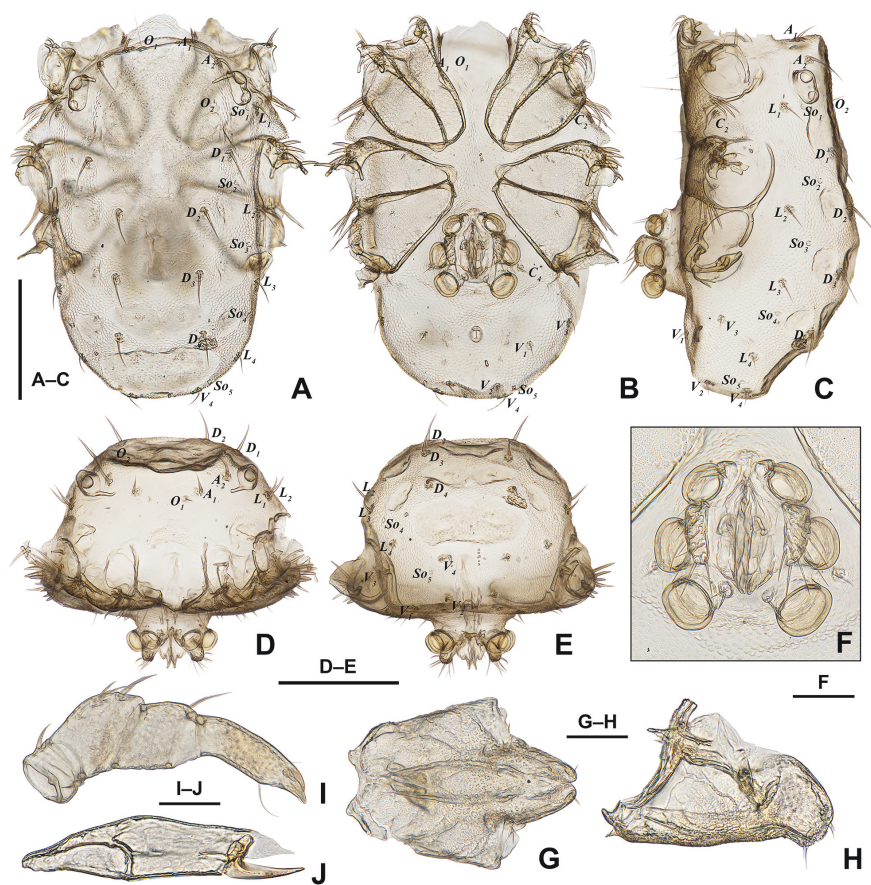


Figure 12. The newly emerged adult of *Deuterothyas crescentis* Zhan & Guo, sp. nov., paratype ♂ (FJ-HYDRY-2024070602), optical photographs. **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Frontal view; **E.** Posterior view; **F.** Genital field; **G.** Ventral view of gnathosoma; **H.** Lateral view of gnathosoma; **I.** Lateral view of palp; **J.** Lateral view of chelicera. Scale bars: 200 μm (**A–E**); 50 μm (**F–J**).

Table 2. Measurements of *Deuterothyas crescentis* Zhan & Guo, sp. nov.

	1 ♀	2 ♀	3 ♀	4 ♀	5 ♂	6 ♂	7 ♂	8 ♂
Idiosoma L/W	563, 450	530, 429	719, 524	896, 619	689, 513	748, 531	751, 527	699, 508
ACG L	230	217	225	225	198	211	224	220
PCG L	219	209	243	255	217	247	253	230
Gonopore L	152	129	166	199	109	112	120	83
Ac1 L	42, 43	39, 39	45, 43	44, 42	37, 41	47, 41	54, 41	44, 40
Ac2 L	46, 44	42, 40	40, 39	42, 44	43, 46	49, 46	45, 44	45, 47
Ac3 L	51, 48	50, 45	48, 44	46, 45	46, 47	45, 44	47, 49	41, 39
Excretory pore L	28	29	35	33	30	37	30	39
Gnathosoma L	196	190	198	203	174	188	195	178
Chelicera base L	175	173	177	179	157	167	164	166
Chelicera claw L	68	69	66	72	64	66	66	60
P-1–5 dL	28, 85, 45, 88, 34	28, 68, /, /, /	32, 91, 44, 91, 30	31, 94, 48, 91, 32	24, 84, 45, 84, 30	29, 87, 47, 92, 31	30, 85, 47, 93, 32	29, 81, 40, 88, 31
II-L-1–6 dL	59, 79, 69, 85, 88, 81	61, 80, 64, 79, 94, 85	61, 70, 77, 79, 97, 82	62, 95, 70, 90, 98, 90	70, 78, 59, 88, 90, 93	64, 97, 67, 86, 99, 92	81, 87, 69, 89, 102, 100	69, 84, 62, 79, 93, 93
III-L-1–6 dL	48, 82, 89, 100, 107, 105	59, 73, 73, 97, 115, 101	61, 89, 80, 101, 109, 105	72, 89, 81, 105, 113, 107	78, 89, 67, 87, 109, 99	60, 91, 74, 103, 113, 108	72, 96, 77, 107, 111, 109	70, 82, 84, 114, 1121, 131
IV-L-1–6 dL	70, 83, 78, 117, 129, 132	62, 83, 78, 113, 125, 127	61, 82, 86, 124, 135, 134	71, 86, 74, 121, 134, 144	68, 89, 79, 110, 124, 105	67, 93, 73, 118, 133, 128	70, 82, 82, 125, 134, 122	65, 87, 76, 121, 126, 118
	131, 113, 92, 174, 125, 149	115, 125, 93, 176, 129, 148	119, 116, 95, 184, 121, 114	143, 116, 99, 192, 137, 157	114, 110, 96, 177, 98, 117	147, 117, 102, 187, 125, 115	149, 117, 107, 201, 111, 124	122, 100, 98, 177, 118, 109

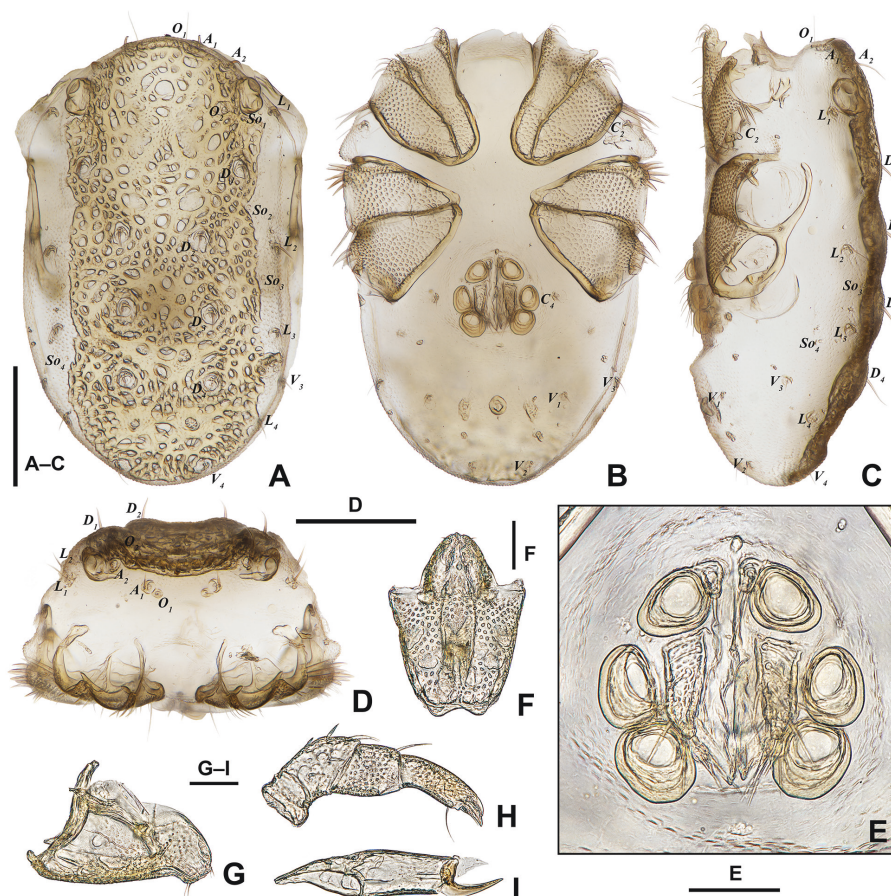


Figure 13. *Deuterothyas crescentis* Zhan & Guo, sp. nov., holotype ♂ (FJ-HYDRY-2024070601), optical photographs. **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Frontal view; **E.** Genital field; **F.** Ventral view of gnathosoma; **G.** Lateral view of gnathosoma; **H.** Lateral view of palp; **I.** Lateral view of chelicera. Scale bars: 200 µm (A–E); 50 µm (F–I).

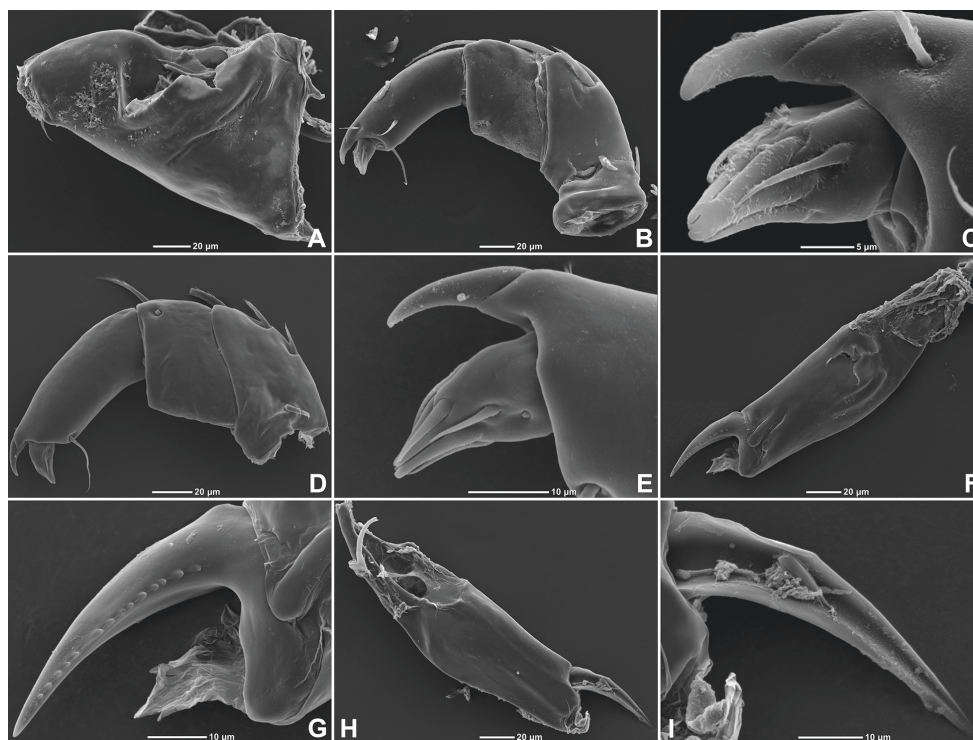


Figure 14. *Deuterothyas crescentis* Zhan & Guo, sp. nov., SEM photographs. **A.** ♂ Lateral view of gnathosoma; **B.** ♀ Medial side of palp; **C.** ♀ Medial side of P-5; **D.** ♂ Lateral side of palp; **E.** ♂ Lateral side of P-5; **F.** ♂ Lateral side of chelicera claw; **G.** ♂ Lateral side of chelicera claw; **H.** ♂ Medial side of chelicera; **I.** ♂ Medial view of chelicera claw.

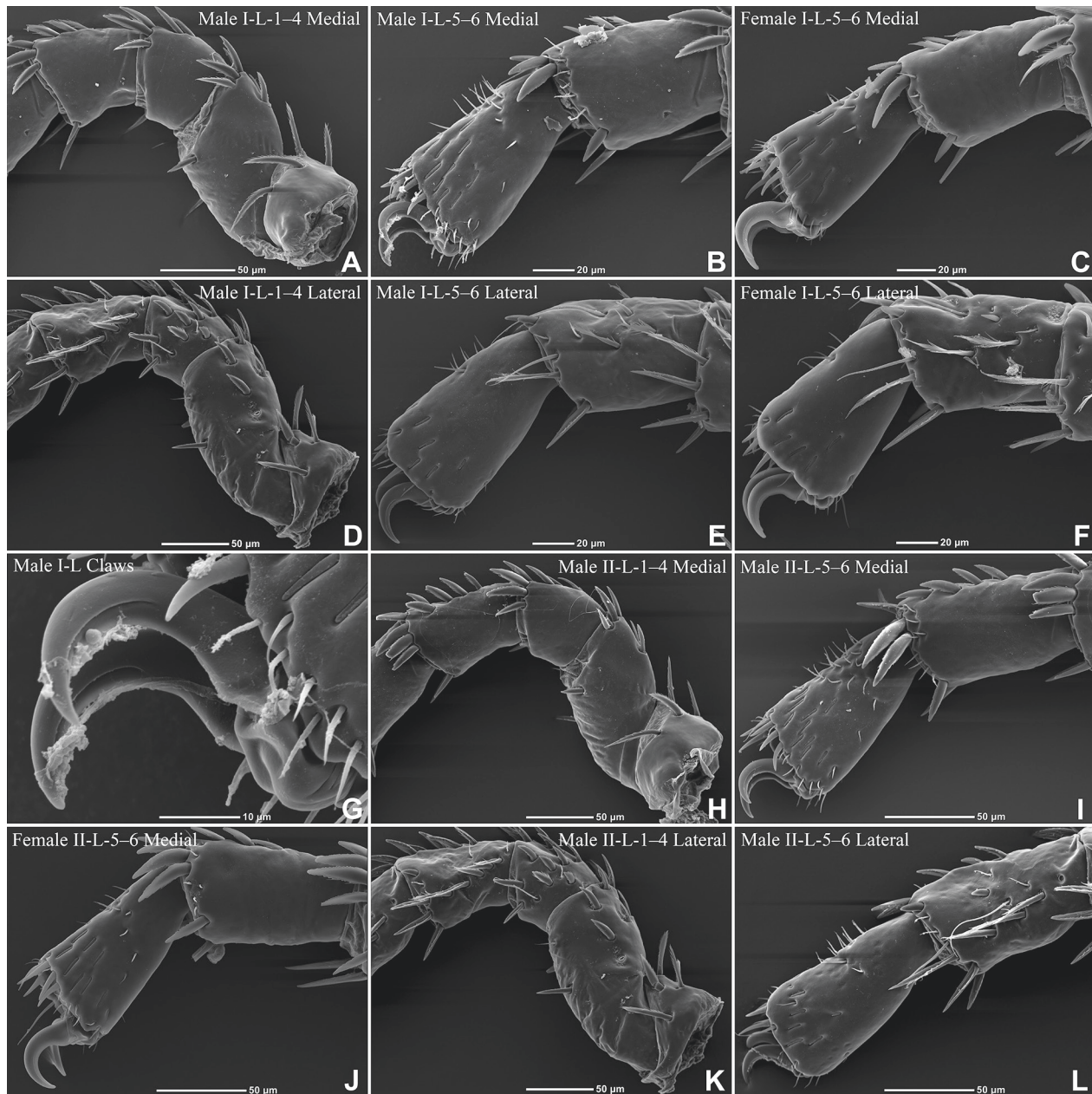


Figure 15. *Deuterothyas crescentis* Zhan & Guo, sp. nov., SEM photographs. **A.** ♂ Medial side of I-leg-1–4; **B.** ♂ Medial side of I-leg-5–6; **C.** ♀ Medial side of I-leg-5–6; **D.** ♂ Lateral side of I-leg-1–4; **E.** ♂ Lateral side of I-leg-5–6; **F.** ♀ Lateral side of I-leg-5–6; **G.** ♂ Lateral side of I-leg claws; **H.** ♂ Medial side of II-leg-1–4; **I.** ♂ Medial side of II-leg-5–6; **J.** ♀ Medial side of II-leg-5–6; **K.** ♂ Lateral side of II-leg-1–4; **L.** ♂ Lateral side of II-leg-5–6.

***Deuterothyas fulu* Zhan & Guo, sp. nov.**

<https://zoobank.org/B6782CA1-5637-420D-B906-7D15AAB83576>

Figs 9A–D, 19–26

Type material. • **Holotype:** female, Tangxia Village, Xiongjiang Town, Minqing County, Fuzhou City, Fujian Province, P.R. China (26°16'43"N, 118°42'15"E; 302 m a.s.l.), leg. Bao-Xiang Zhan, Lan Ja & Dong-Mei Liu, 06-VII-2024, Slide No. FJ-HYDRY-2024070611.

• **Paratypes:** 6♂, 4♀, same locality and data as holotype, Slide No. FJ-HYDRY-2024070612–2024070621.

Habitat. Subtropical evergreen broad-leaved forest, with green algae on the banks of rapid streams. (Fig. 9A–D).

Etymology. The new species is named for the secondary sclerotization under its dorsal integument, which resembles the “fulu” in Chinese Taoism. The name is a noun in apposition.

Diagnosis. Integument papillae rounded, with folds between papillae. Prefrontalia, postfrontalia and Dc1 fuse to median eye plate; dorsal and lateral plates small, nearly rounded. Genital flap divided into three pairs, the first and third pairs small, the second pair narrow, located between Ac₁ and Ac₂; postgenital sclerite small. The lateral ventral surface of IV-L-5 extends terminally, with two thick spines at the end. With interconnected secondary sclerotized structures under the median eye plate, D11 and Dc2. **Female.** The secondary sclerotized

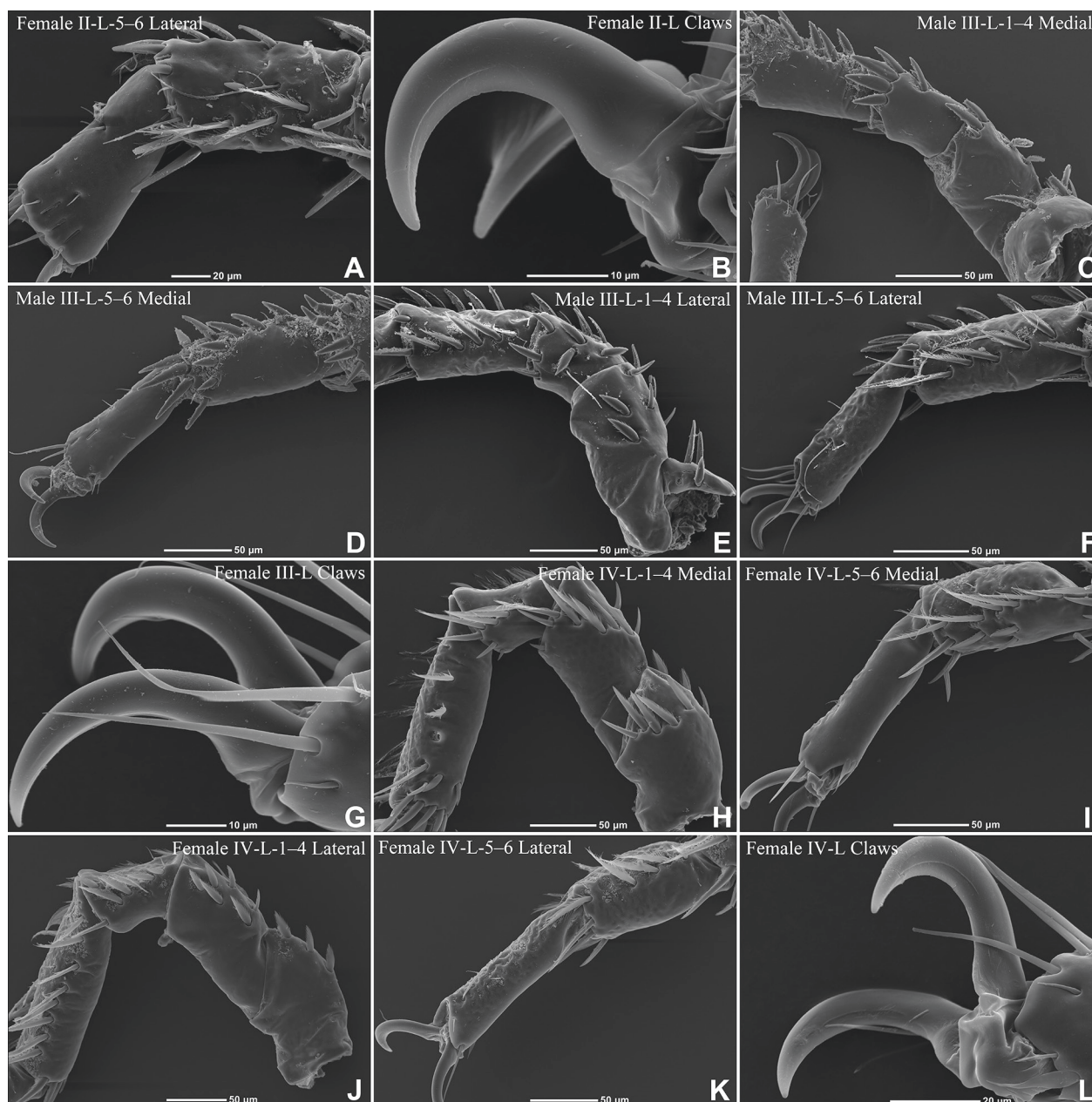


Figure 16. *Deuterothyas crescentis* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Lateral side of II-leg-5–6; **B.** ♀ Lateral side of II-leg claws; **C.** ♂ Medial side of III-leg-1–4; **D.** ♂ Medial side of II-leg-5–6; **E.** ♂ Lateral side of III-leg-1–4; **F.** ♂ Lateral side of III-leg-5–6; **G.** ♀ Lateral side of III-leg claws; **H.** ♂ Medial side of IV-leg-1–4; **I.** ♂ Medial side of IV-leg-5–6; **J.** ♂ Lateral side of IV-leg-1–4; **K.** ♂ Lateral side of IV-leg-5–6; **L.** ♀ Lateral side of IV-leg claws.

structure under other plates small; pregenital sclerite wedge-shaped. **Male.** The secondary sclerotization under the D12 and D13 separated or connected; the secondary sclerotization under the D14, Dc4 and Dc5 is connected in various ways; pregenital sclerite small.

Description. Living habitus: Idiosoma red; lateral eyes red; palps and legs orange (Fig. 19A–D). Integument papillae rounded, with folds between papillae (Fig. 20F, G). **Female** ($n = 5$). Dorsal view: median eye plate formed by the fusion of the prefrontalia, postfrontalia and Dc1; median eye and O_2 located on the median eye plate, with the median eye positioned anterior to

the connection line of O_2 ; the remaining dorsalia small, nearly rounded (Fig. 20A, E). With an interconnected secondary sclerotized structures under the median eye plate, D11 and Dc2; the secondary sclerotized structure under other plates small (Fig. 21A). Ventral view: coxae in four groups, margins with few setae, and the tip of Cx-III with several pairs of short, stout setae; excretory pore circular, with thickened and sclerotized margin (Fig. 21B). Pregenital sclerite wedge-shaped, postgenital sclerite small; genital field with three pairs of acetabula; genital flaps divided into three pairs; the first pair small, located anterior to Ac_1 , with 2–4 pairs of setae; second pair narrow,

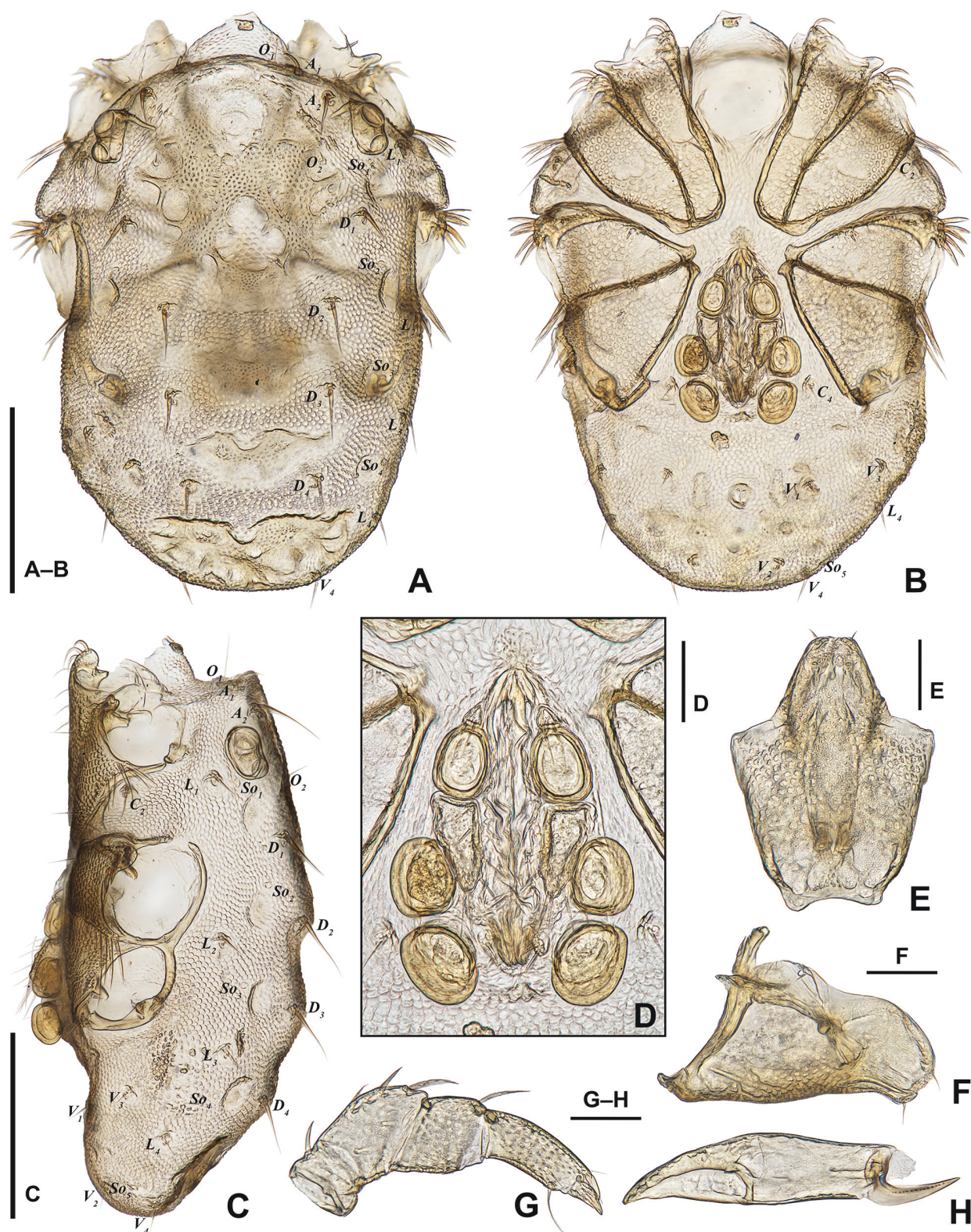


Figure 17. The newly emerged adult of *Deuterothyas crescentis* Zhan & Guo, sp. nov., paratype ♀ (FJ-HYDRY-2024070607), optical photographs. **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Genital field; **E.** Ventral view of gnathosoma; **F.** Lateral view of gnathosoma; **G.** Lateral view of palp; **H.** Lateral view of chelicera. Scale bars: 200 µm (A–E); 50 µm (F–H).

located between Ac_1 and Ac_2 , with 7–10 pairs of setae; third pair very small, located medially to Ac_3 , with 1–3 pairs of setae (Figs 20C, 21F). Lateral view: So_1 anterior

to $Dc1$; So_5 near $Dc5$ (Fig. 21C). Frontal view: A_2 located lateral to the eye capsules (Fig. 21D). Posterior view: So_5 lateral to V_4 (Fig. 21E).

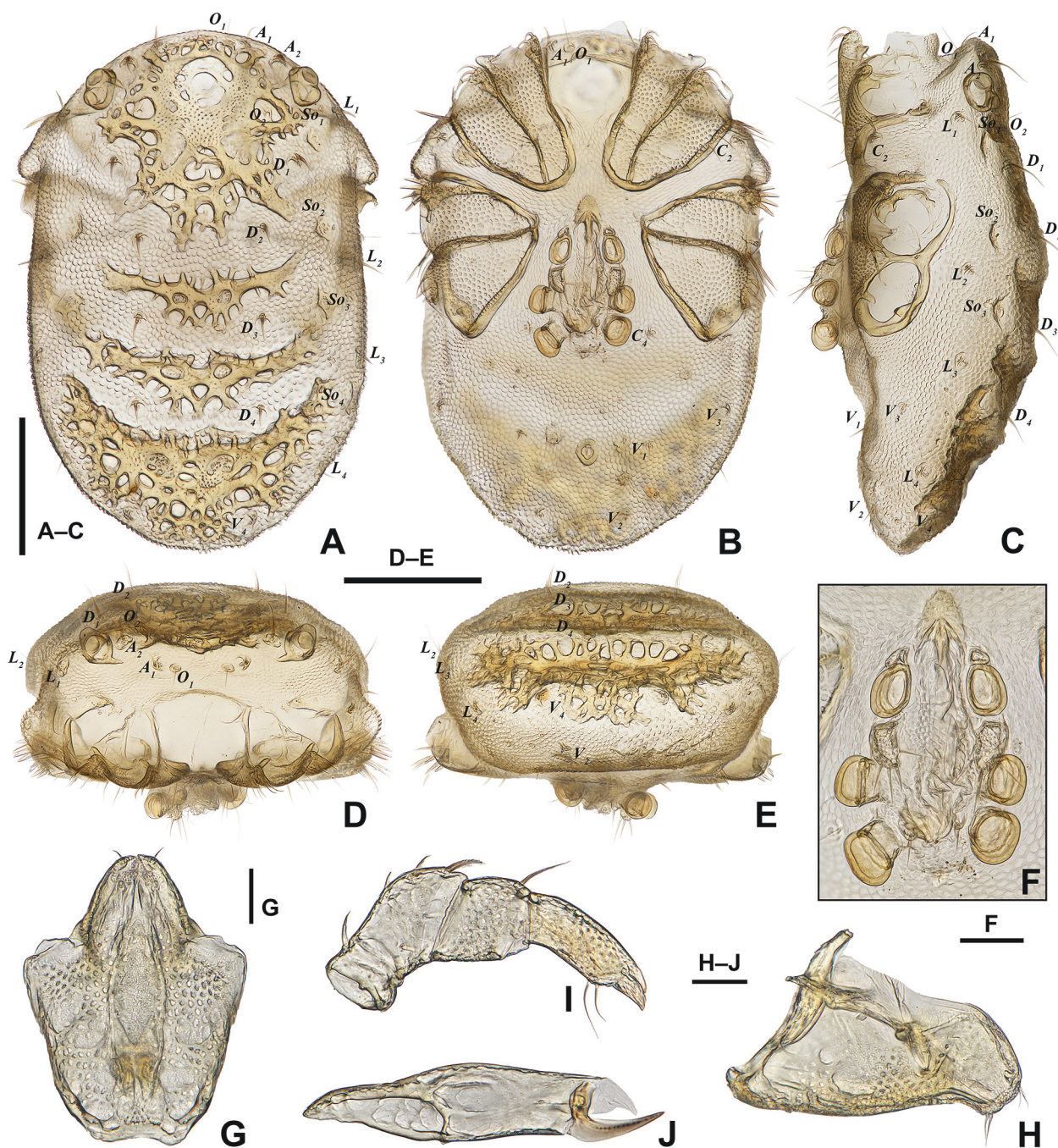


Figure 18. *Deuterothyas crescentis* Zhan & Guo, sp. nov., paratype ♀ (FJ-HYDRY-2024070606), optical photographs. **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Frontal view; **E.** Posterior view; **F.** Genital field; **G.** Ventral view of gnathosoma; **H.** Lateral view of gnathosoma; **I.** Lateral view of palp; **J.** Lateral view of chelicera. Scale bars: 200 µm (A–E); 50 µm (F–J).

Gnathosoma with a short rostrum and two pairs of setae (Figs 21G–H, 22A). Palp five-segmented; P-1 short, with one dorsal seta; P-2 with four dorsal and one lateral pinnate setae; P-3 with two dorsal pinnate setae; P-4 terminal with three fine setae and short ventral extension with one seta; P-5 short, with some stout setae anteriorly (Figs 21I, 22B–E). chelicera shape conventional, chelicera claw concave on lateral side, with a row of teeth on medial side (Figs 21J, 22F–I).

Legs robust; except for the sixth segments, all segments with a large number of short and stout setae; I–II–L-6 dorsally with short setae, laterally and medially with short fine setae anteriorly; III–IV–L-6 with with a few long setae anteriorly; The lateral ventral surface of IV-L-5 extends terminally, with two thick spines at the end (Figs 23A–B, D–E, H–I, K–L, 24C–F, H–K). Claws simple, lateral and medial side both with a groove; I–III–L

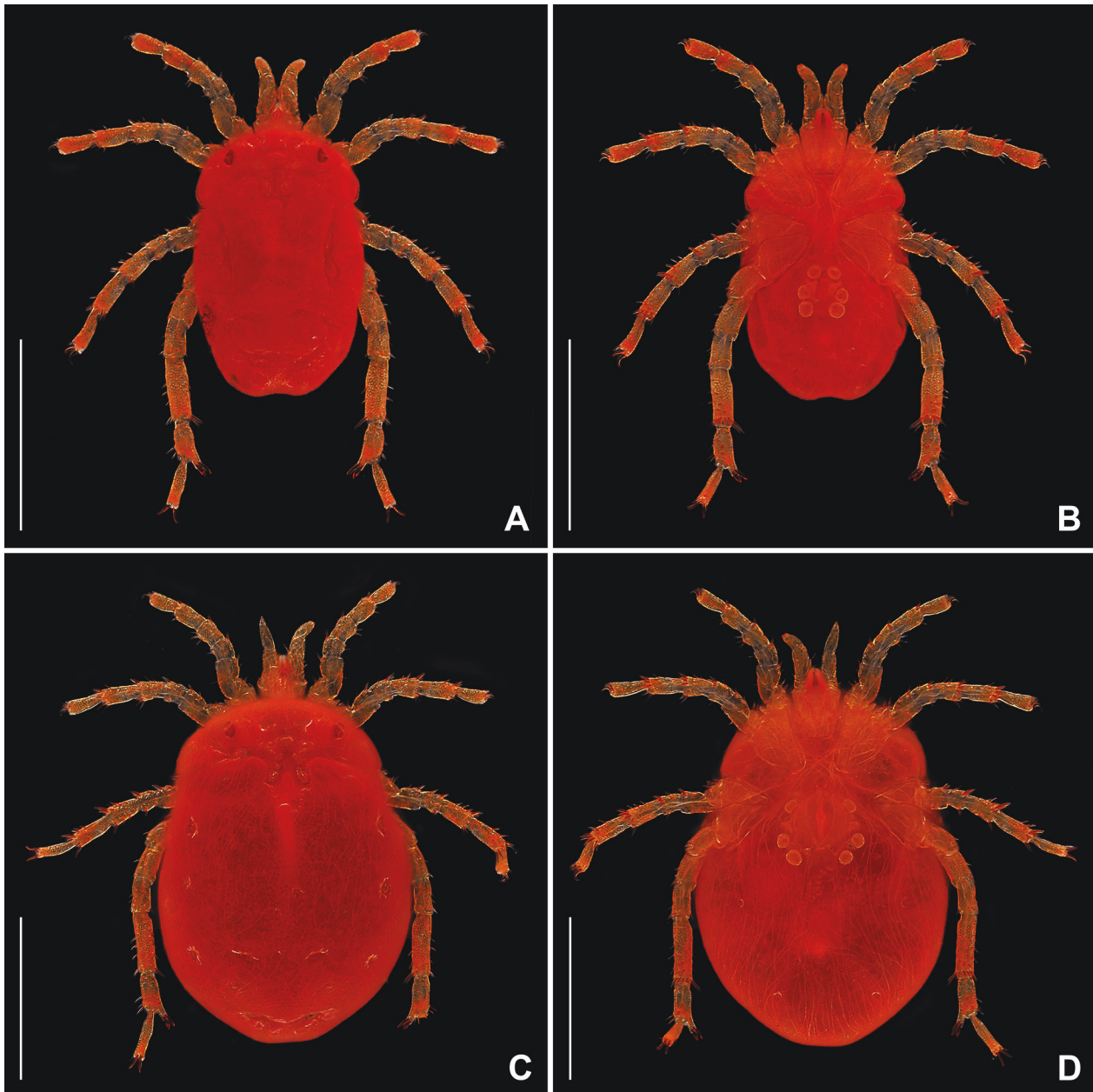


Figure 19. Micrographs of *Deuterothyas fulu* Zhan & Guo, sp. nov., camera photographs. **A.** ♂ Dorsal view; **B.** ♂ Ventral view; **C.** ♀ Dorsal view; **D.** ♀ Ventral view. Scale bars: 500 μ m.

claws laterally with a row of small teeth, but not in IV-L claws (Figs 23G, 24B, G, L).

Male ($n = 6$). General characteristics similar to the female (Figs 20B, 25A–H). However, the secondary sclerotization under the integument is different from the female: the secondary sclerotization under DI2 and DI3 is connected; and the secondary sclerotization under DI4, Dc4 and Dc5 separated or connected in various ways (Figs 25A, 26A–D). Genital field shorter than female; pregenital sclerite small (Figs 20D, 25D). I–II-L-6 with more setae than in female (Figs 23C, F, J, 24A).

Measurements. Male ($n = 4$) and female ($n = 4$). See Table 3 for details.

Remarks. *Deuterothyas fulu* Zhan & Guo, sp. nov. is assigned to the genus *Deuterothyas* Lundblad, 1941 because of its genital flaps divided into three parts (Cook 1974; Smit 2020). The new species can be distinguished from other species of the genus in the following aspects: (1) the new species has dorsal and lateral plates that are significantly smaller than those of other species in the genus; (2) in the new species, the lateral ventral surface of IV-L-5 extends terminally, with two thick spines at the end, but other species of this genus lack this feature; (3) the second pair of genital flaps is narrower than those of other species in this genus.

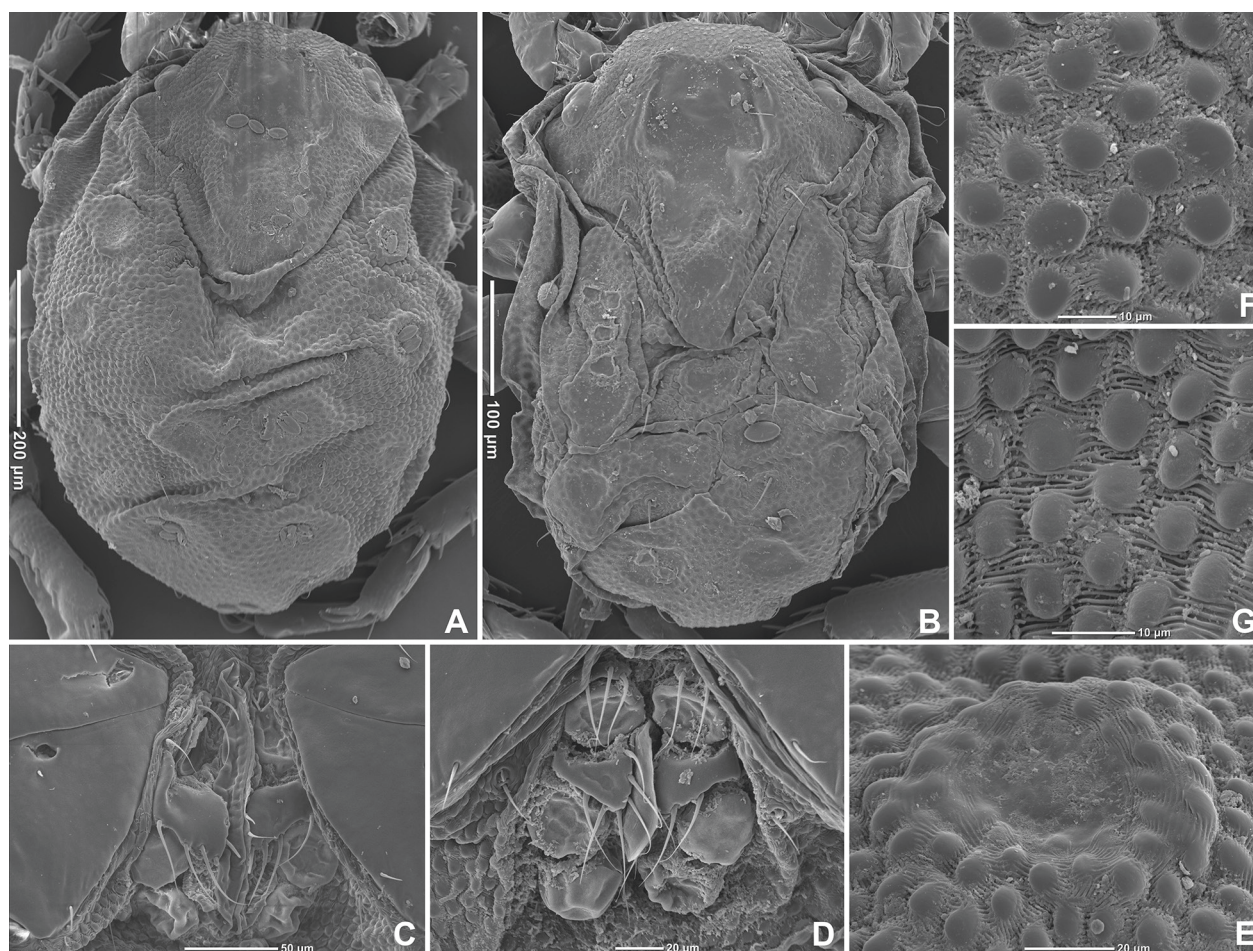


Figure 20. *Deuterothyas fulu* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Dorsal view of idiosoma; **B.** ♂ Dorsal view of idiosoma; **C.** ♀ Genital field; **D.** ♂ Genital field; **E.** ♀ Integument papillae; **F.** ♀ Integument papillae; **G.** ♀ D13.

Table 3. Measurements of *Deuterothyas fulu* Zhan & Guo, sp. nov.

	1 ♂	2 ♂	3 ♂	4 ♂	5 ♀	6 ♀	7 ♀	8 ♀
Idiosoma L/W	782, 487	663, 496	678, 454	568, 390	1064, 818	1073, 761	765, 515	819, 543
ACG L	207	201	198	193	238	268	241	243
PCG L	218	216	212	203	239	265	216	240
Gonopore L	81	76	70	62	241	245	196	167
Ac1 L	37, 41	40, 38	34, 34	33, 27	43, 42	50, 47	45, 39	48, 51
Ac2 L	33, 36	38, 35	41, 37	34, 35	47, 50	47, 44	39, 48	52, 45
Ac3 L	38, 39	42, 40	36, 36	36, 35	48, 44	50, 42	42, 48	51, 51
Excretory pore L	41	35	33	28	52	53	39	38
Gnathosoma L	196	185	187	169	228	246	234	235
Chelicera base L	166	162	158	151	216	222	198	215
Chelicera claw L	68	65	66	61	90	97	85	91
P-1-5 dL	30, 82, 45, 95, 35	28, 85, 43, 90, 33	26, 80, 43, 89, 32	28, 80, 43, 84, 29	39, 95, 48, 103, 37	33, 96, 50, 111, 37	30, 94, 46, 99, 36	311, 93, 48, 101, 36
II-L-1-6 dL	62, 66, 60, 79, 96, 93	53, 59, 96, 73, 91, 91	48, 60, 55, 80, 94, 88	53, 60, 58, 67, 88, 86	66, 76, 78, 86, 105, 100	64, 83, 81, 113, 111, 164	59, 72, 70, 86, 101, 95	69, 78, 70, 83, 106, 100
III-L-1-6 dL	60, 776, 65, 81, 115, 113	64, 69, 58, 84, 104, 110	48, 71, 64, 82, 109, 102	56, 64, 56, 82, 97, 101	61, 90, 76, 100, 123, 112	67, 86, 80, 104, 129, 132	58, 87, 71, 90, 118, 119	67, 85, 71, 95, 123, 130
IV-L-1-6 dL	70, 75, 66, 103, 121, 121	62, 68, 66, 96, 117, 119	58, 67, 62, 97, 120, 112	58, 63, 65, 95, 109, 103	68, 78, 74, 114, 141, 146	77, 79, 85, 116, 142, 150	66, 72, 68106, 134, 137	69, 83, 70, 112, 139, 142
IV-L-1-6 dL	124, 117, 102, 192, 114, 148	131, 109, 91, 175, 107, 139	122, 112, 96, 180, 103	126, 94, 92, 167, 98, 128	142, 128, 111, 222, 123, 174	166, 135, 117, 225, 145, 193	154, 110, 113, 207, 124, 171	156, 122, 111, 217, 132, 165

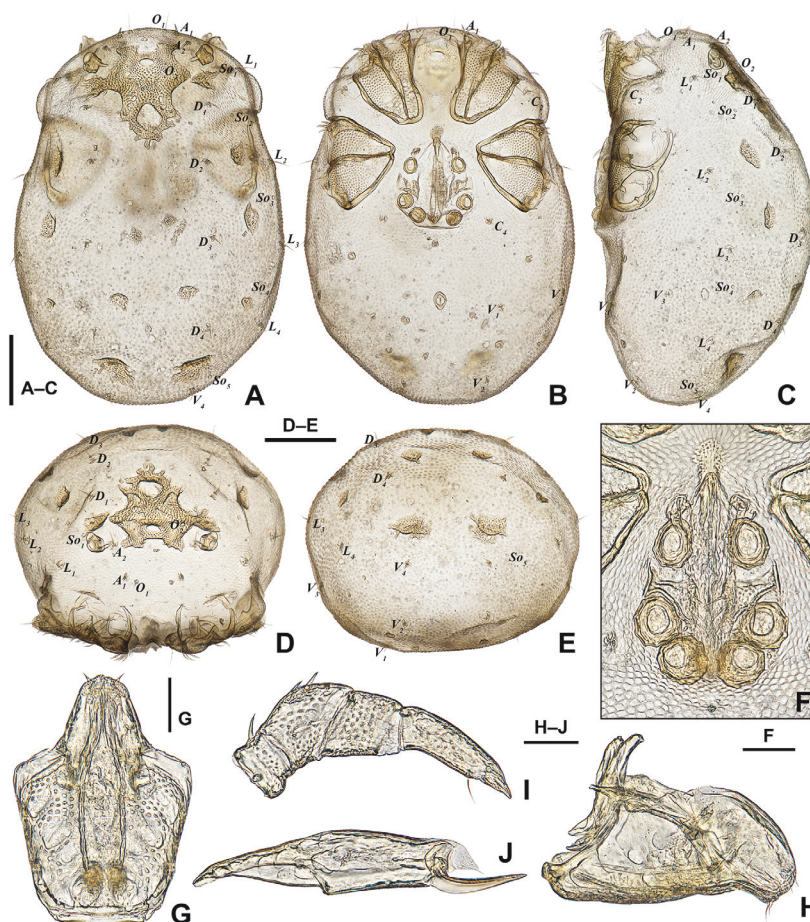


Figure 21. *Deuterothyas fulu* Zhan & Guo, sp. nov., optical photographs: A–E, G–J. Holotype ♀ (FJ-HYDRY-2024070611); A. Dorsal view; B. Ventral view; C. Lateral view; D. Frontal view; E. Posterior view; G. Ventral view of gnathosoma; H. Lateral view of gnathosoma; I. Lateral view of palp; J. Lateral view of chelicera; F. Paratype ♀ (FJ-HYDRY-2024070614), genital field. Scale bars: 200 µm (A–E); 50 µm (F–J).

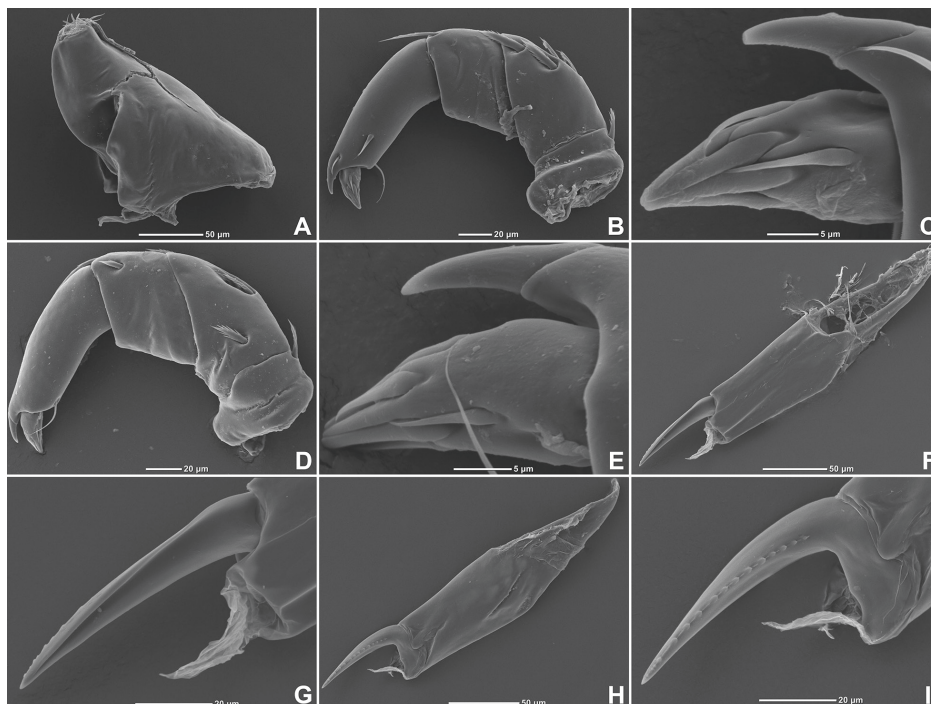


Figure 22. *Deuterothyas fulu* Zhan & Guo, sp. nov., SEM photographs. A. ♀ Lateral view of gnathosoma; B. ♀ Medial side of palp; C. ♀ Medial side of P-5; D. ♀ Lateral side of palp; E. ♀ Lateral side of P-5; F. ♀ Lateral side of chelicera claw; G. ♀ Lateral side of chelicera claw; H. ♀ Medial side of chelicera; I. ♀ Medial view of chelicera claw.

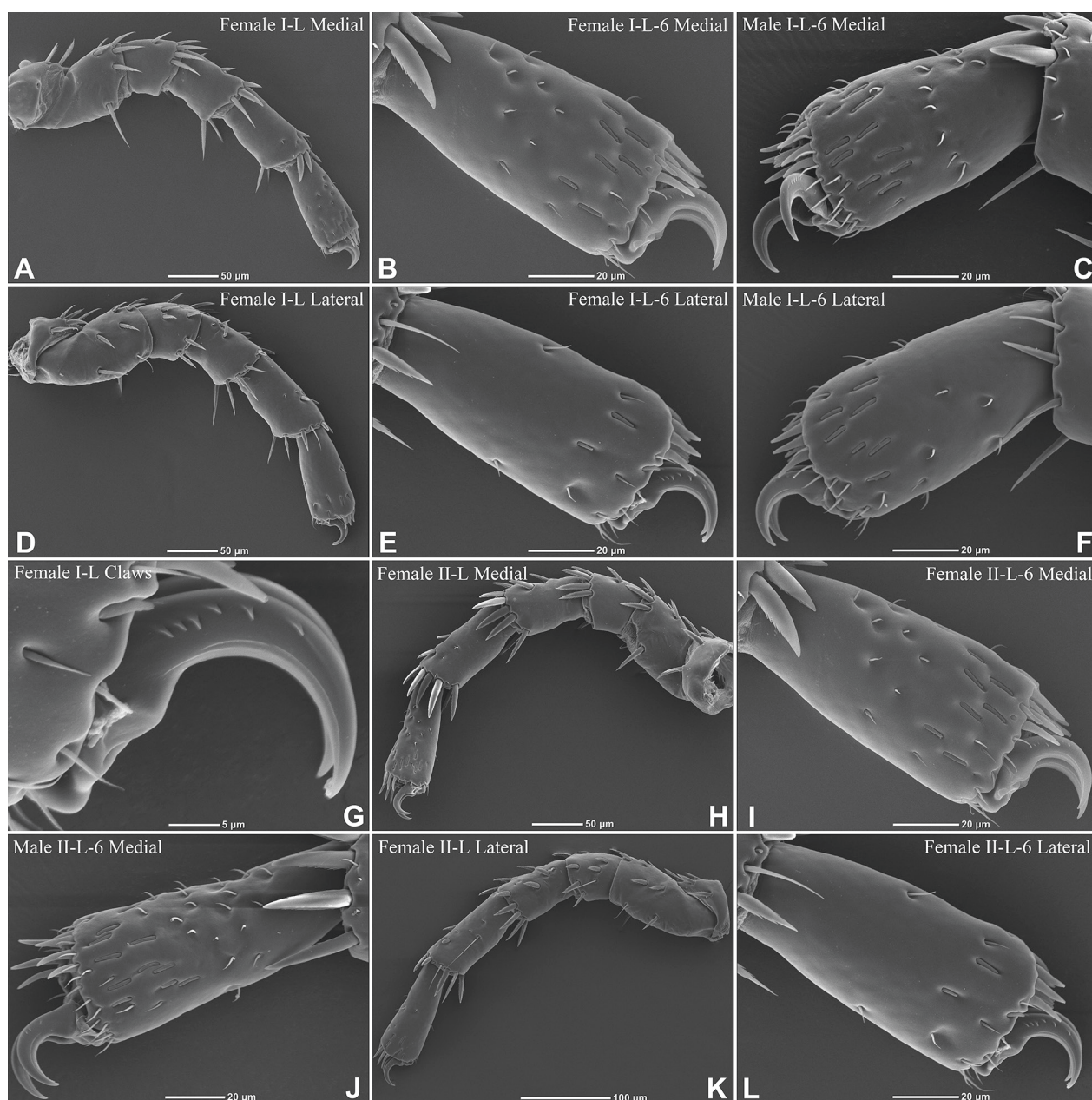


Figure 23. *Deuterothyas fulu* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Medial side of I-leg; **B.** ♀ Medial side of I-leg-6; **C.** ♂ Medial side of I-leg-6; **D.** ♀ Lateral side of I-leg; **E.** ♀ Lateral side of I-leg-6; **F.** ♂ Lateral side of I-leg-6; **G.** ♀ Lateral side of I-leg claws; **H.** ♀ Medial side of II-leg; **I.** ♀ Medial side of II-leg-6; **J.** ♂ Medial side of II-leg-6; **K.** ♀ Lateral side of II-leg; **L.** ♀ Lateral side of II-leg-6.

***Deuterothyas fujianensis* Zhan & Guo, sp. nov.**

<https://zoobank.org/1274B559-8D14-4016-B855-7A62D6749062>

Figs 9A–E, 27–32

Type material. • **Holotype:** female, Kengdilou Village, Zhuguanlong Town, Shouning County, Ningde City, Fujian Province, P.R. China (26°16'43"N, 118°42'15"E; 393.8 m a.s.l.), leg. Bao-Xiang Zhan, Lan Ja & Dong-Mei Liu, 18-VII-2024, Slide No. FJ-HYDRY-2024071801. • **Paratypes:** 3♂, 2♀, same data as holotype, Slide No. FJ-HYDRY-2024071802–2024071806; 1♀, Tangxia Village, Xiongjiang Town, Minqing County, Fuzhou City, Fujian Province, P.R. China (26°16'43"N, 118°42'15"E;

302 m a.s.l.), leg. Bao-Xiang Zhan, Lan Ja & Dong-Mei Liu, 06-VII-2024, Slide No. FJ-HYDRY-2024070631.

Habitat. Subtropical evergreen broad-leaved forest, with green algae on the banks of rapid streams. (Fig. 9A–D).

Etymology. The specific epithet refers to the holotype locality: Fujian Province, China; the name is treated as an adjective.

Diagnosis. Integument papillae rounded, with folds between the papillae. Prefrontalia, postfrontalia and Dc1 fused to median eye plate; the median eye plate with a porous thickening structure underneath the integument. Genital flaps divided into three pairs, the first and third pairs small, the second pair approximately trapezoidal,

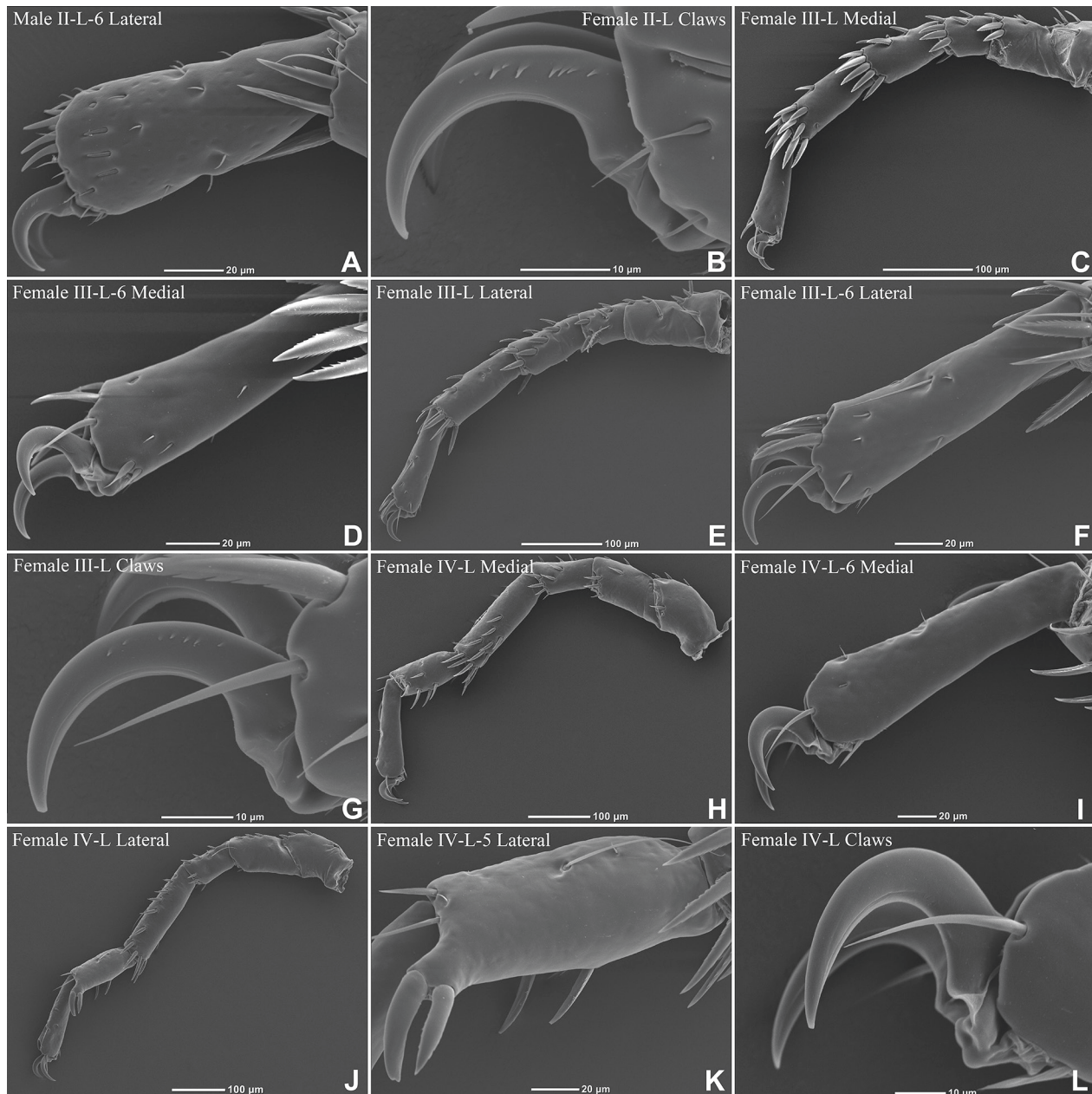


Figure 24. *Deuterothyas fulu* Zhan & Guo, sp. nov., SEM photographs. **A.** ♂ Lateral side of II-leg-6; **B.** ♀ Lateral side of II-leg claws; **C.** ♀ Medial side of III-leg; **D.** ♀ Medial side of II-leg-6; **E.** ♀ Lateral side of III-leg; **F.** ♀ Lateral side of III-leg-6; **G.** ♀ Lateral side of III-leg claws; **H.** ♀ Medial side of IV-leg; **I.** ♀ Medial side of IV-leg-6; **J.** ♀ Lateral side of IV-leg; **K.** ♀ Lateral side of IV-leg-5; **L.** ♀ Lateral side of IV-leg claws.

located between Ac_1 and Ac_2 ; postgenital sclerite small. **Male.** Pregenital sclerite small. **Female.** Pregenital sclerite realively large, somewhat mushroom-shaped.

Description. Integument papillae rounded, with folds between papillae (Fig. 27G). **Female** ($n = 4$). Dorsal view: median eye plate formed by the fusion of the prefrontalia, postfrontalia and Dc_1 ; median eye and O_2 located on the median eye plate, with the median eye positioned anterior to the connection line of O_2 ; the remaining dorsalia obvious, nearly rounded (Fig. 27A). Median eye plate with a porous thickening structure underneath (Fig. 28A). Ventral view: coxae in four groups, margin with few setae; excretory pore circular, with thickened and sclerotized

margin; a pair of ventral plates lateral to the excretory pore (Figs 27E–F, 28B). Pregenital sclerite relatively large, somewhat mushroom-shaped, postgenital sclerite distinct, located posterior to the genital field; genital field with three pairs of acetabula; genital flaps divided into three pairs; the first pair small, located anterior to Ac_1 with 3–4 pairs of setae; second pair approximately trapezoidal, located between Ac_1 and Ac_2 , with 8–15 pairs of setae; third pair very small, located medially to Ac_3 , with 2–3 pairs of setae (Figs 27C, 28F). Lateral view: So_1 – So_2 located anterior to Dc_1 – Dc_2 ; So_3 – So_4 lateral to Dc_3 – Dc_4 (Fig. 28C). Frontal view: A_2 located lateral to the eye capsules (Fig. 28D). Posterior view: So_5 lateral to V_4 (Fig. 28E).

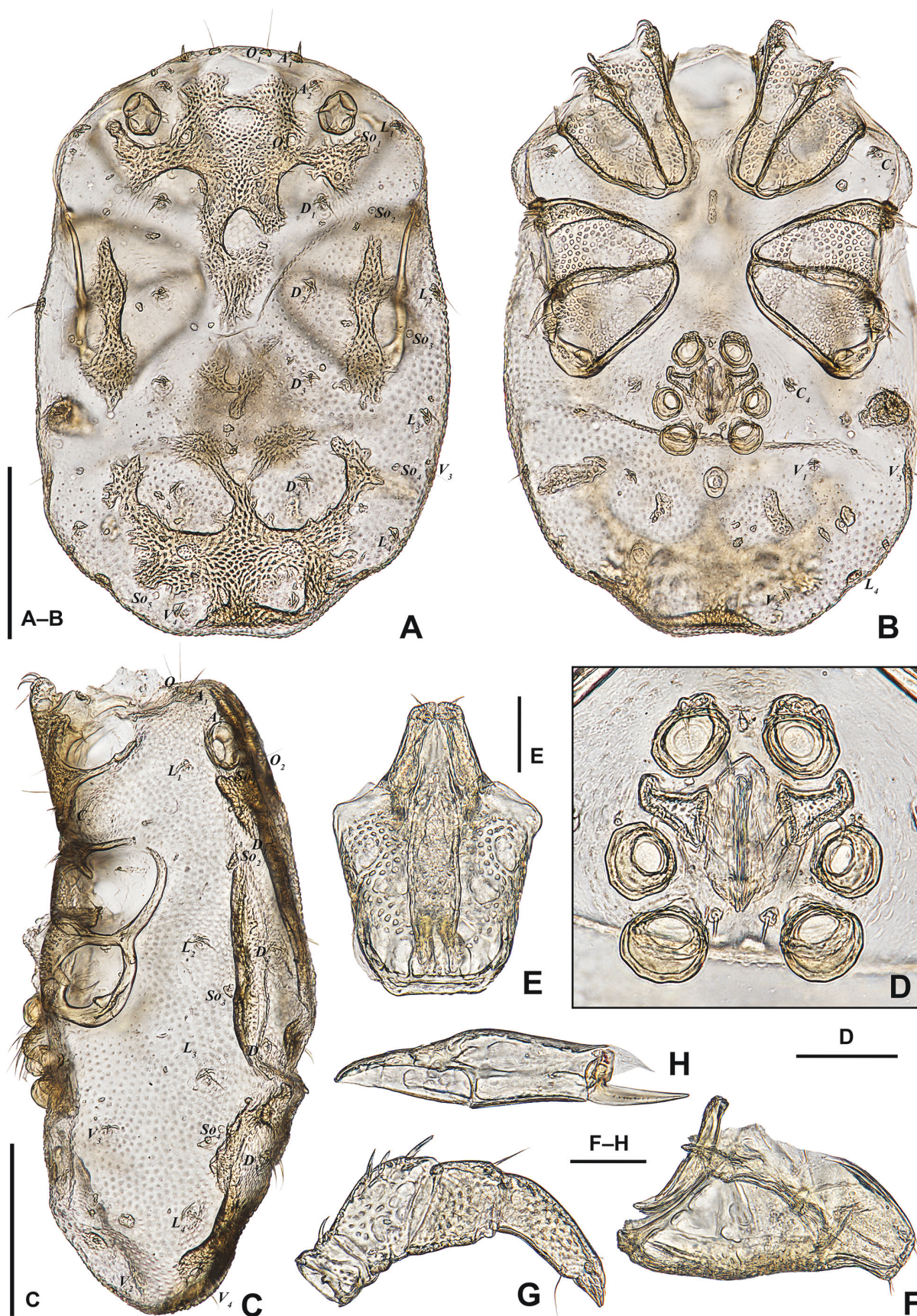


Figure 25. *Deuterothyas fulu* Zhan & Guo, sp. nov., optical photographs: A–D. Paratype ♂ (FJ-HYDRY-2024070617); A. Dorsal view; B. Ventral view; C. Lateral view; D. Genital field; E–H. Paratype ♂ (FJ-HYDRY-2024070616); E. Ventral view of gnathosoma; F. Lateral view of gnathosoma; G. Lateral view of palp; H. Lateral view of chelicera. Scale bars: 200 µm (A–C); 50 µm (E–G).

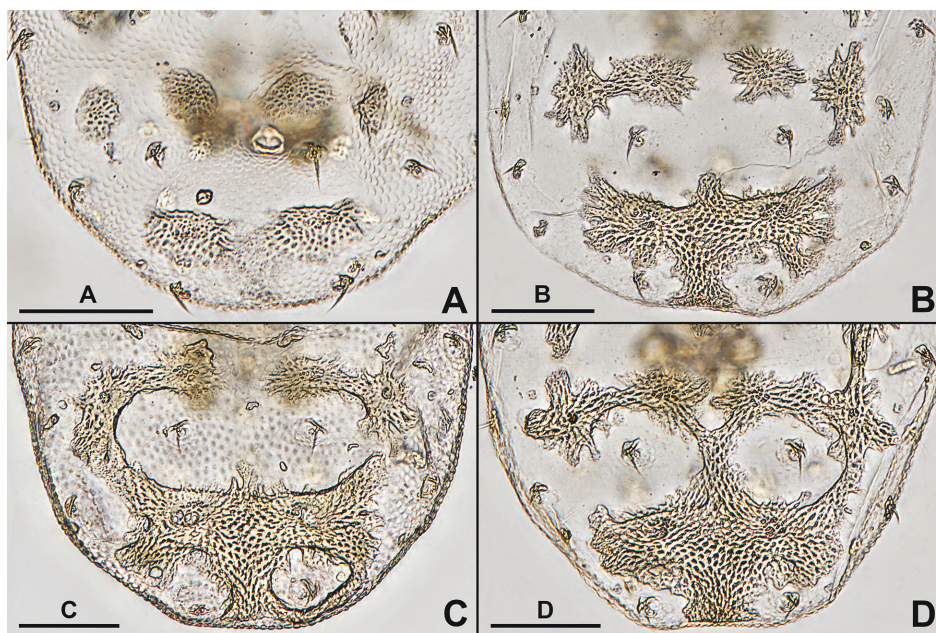


Figure 26. *Deuterothyas fulu* Zhan & Guo, sp. nov., optical photographs, dorsal view of the posterior idiosoma. **A.** Paratype ♂ (FJ-HYDRY-2024070619); **B.** Paratype ♂ (FJ-HYDRY-2024070620); **C.** Paratype ♂ (FJ-HYDRY-2024070616); **D.** Paratype ♂ (FJ-HYDRY-2024070621). Scale bars: 200 μm (A–D).

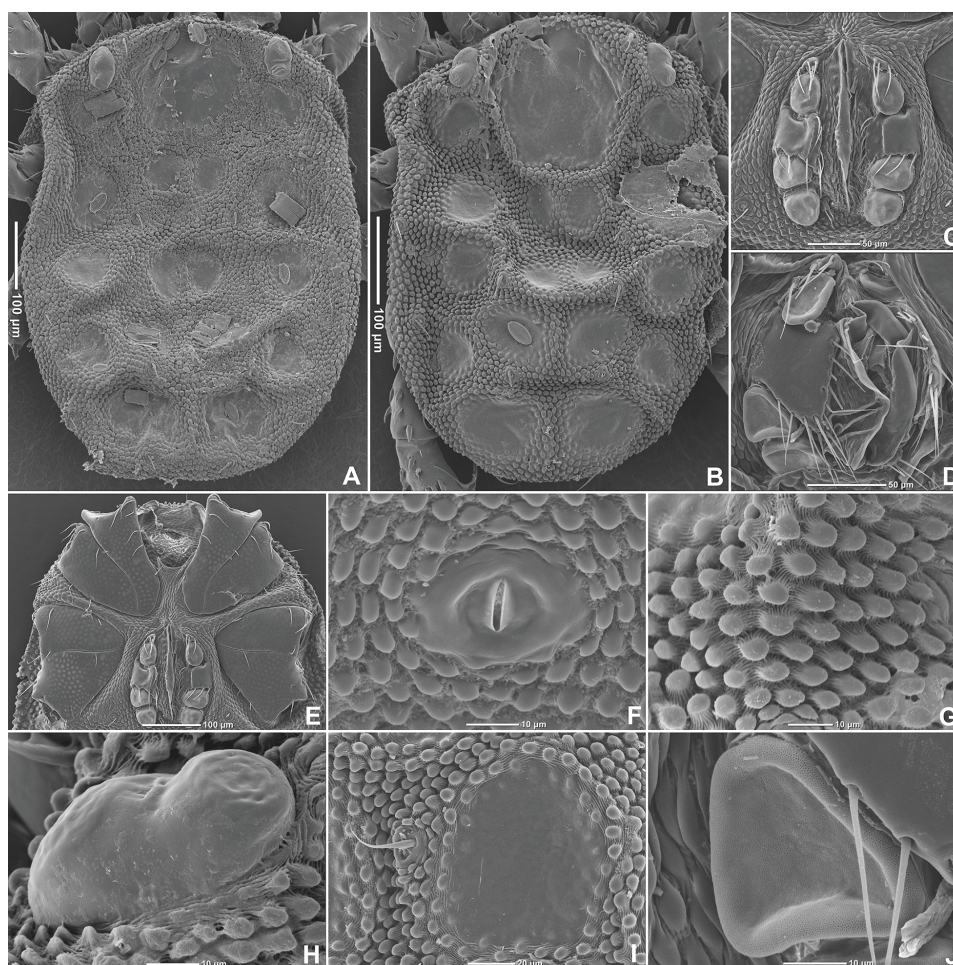


Figure 27. *Deuterothyas fujianensis* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Dorsal view of idiosoma; **B.** ♂ Dorsal view of idiosoma; **C.** ♀ Genital field; **D.** ♂ Genital field; **E.** ♀ Coxae; **F.** ♀ Excretory pore; **G.** ♂ Integument papillae; **H.** ♂ Lateral eye capsule; **I.** ♂ Dc₄; **J.** ♂ Ac₂.

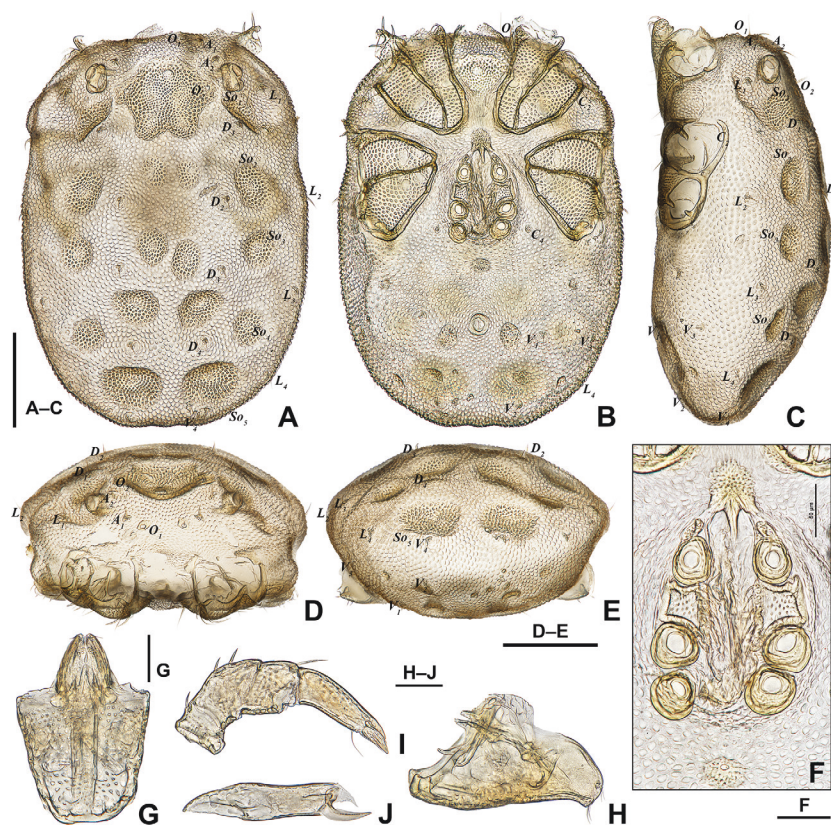


Figure 28. *Deuterothyas fujianensis* Zhan & Guo, sp. nov., holotype ♀ (FJ-HYDRY-2024071801), optical photographs. **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Frontal view; **E.** Posterior view; **F.** Genital field; **G.** Ventral view of gnathosoma; **H.** Lateral view of gnathosoma; **I.** Lateral view of palp; **J.** Lateral view of chelicera. Scale bars: 200 µm (A–E); 50 µm (F–J).

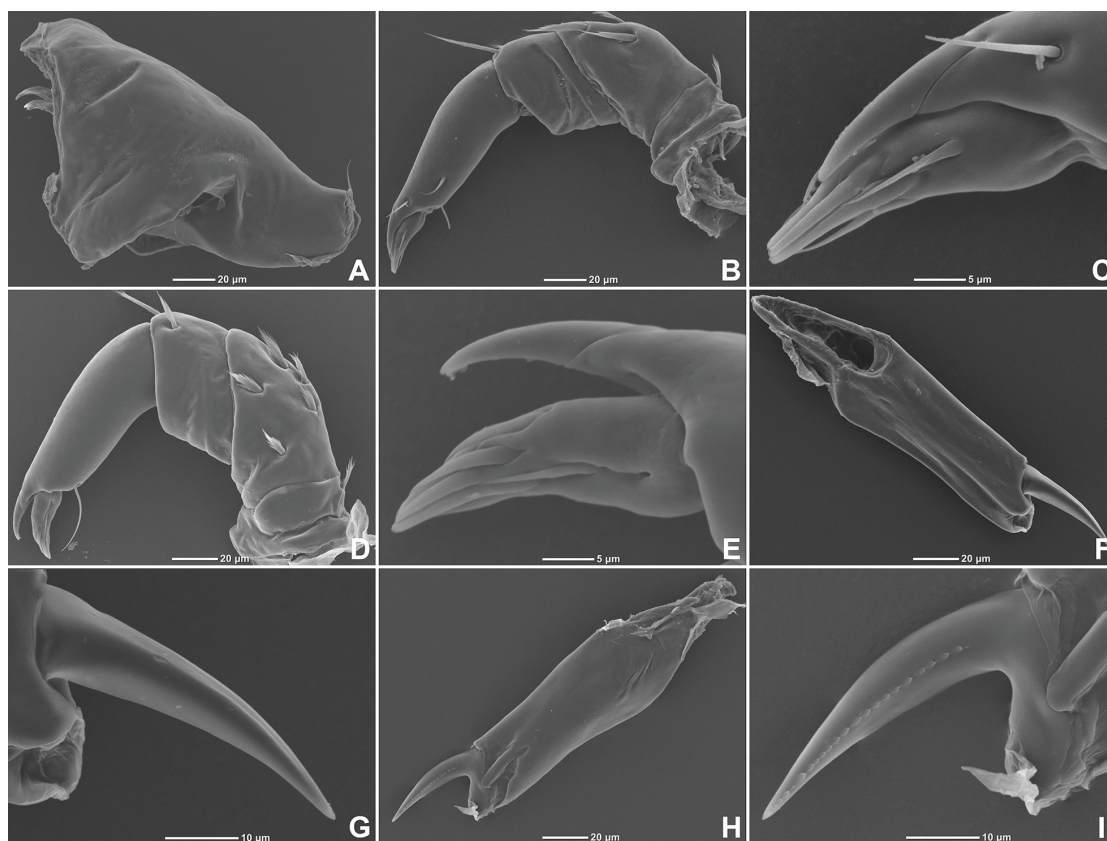


Figure 29. *Deuterothyas fujianensis* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Lateral view of gnathosoma; **B.** ♂ Medial side of palp; **C.** ♂ Medial side of P-5; **D.** ♀ Lateral side of palp; **E.** ♀ Lateral side of P-5; **F.** ♀ Lateral side of chelicera claw; **G.** ♀ Lateral side of chelicera claw; **H.** ♀ Medial side of chelicera; **I.** ♀ Medial view of chelicera claw.

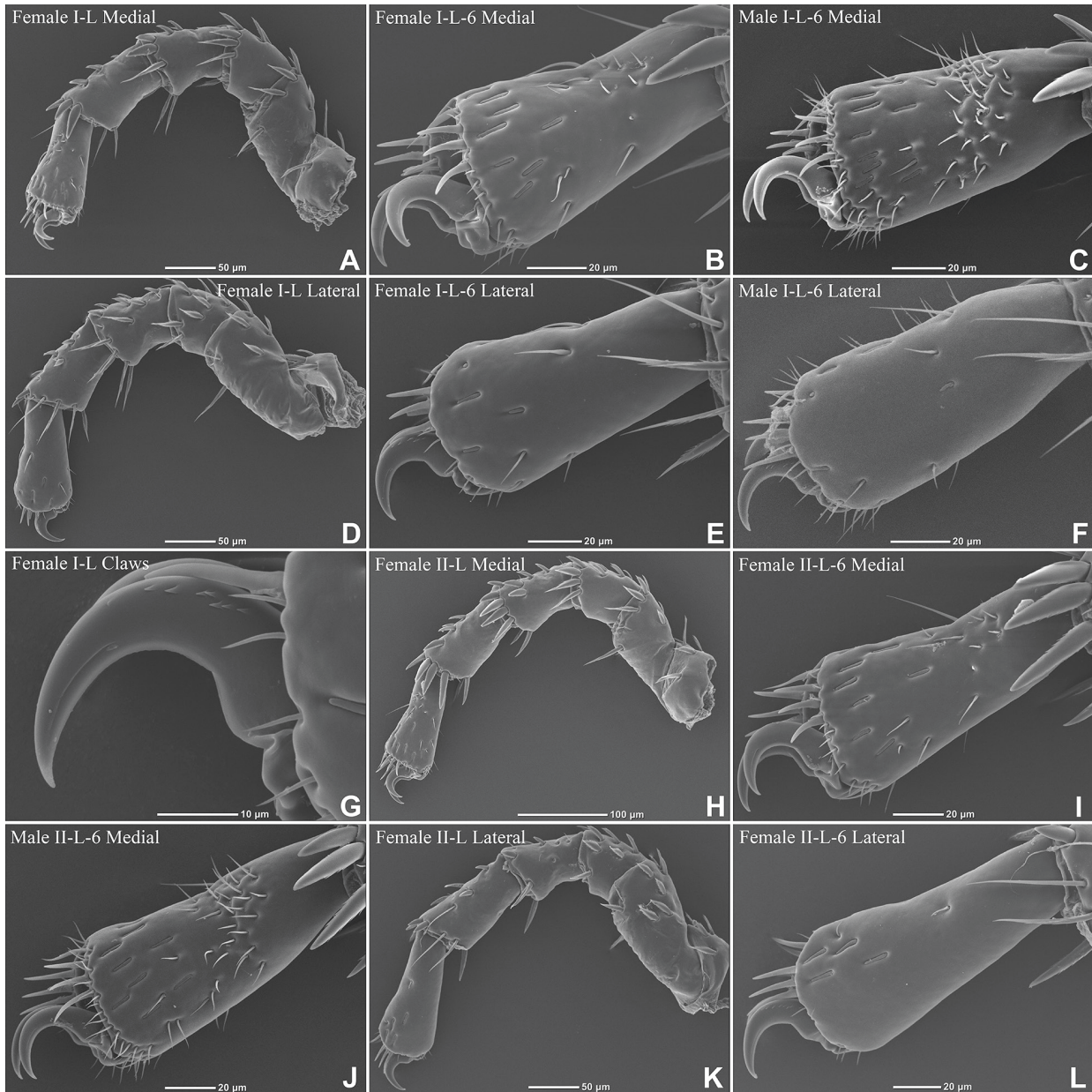


Figure 30. *Deuterothyas fujianensis* Zhan & Guo, sp. nov., SEM photographs. **A.** ♀ Medial side of I-leg; **B.** ♀ Medial side of I-leg-6; **C.** ♂ Medial side of I-leg-6; **D.** ♀ Lateral side of I-leg; **E.** ♀ Lateral side of I-leg-6; **F.** ♂ Lateral side of I-leg-6; **G.** ♂ Lateral side of I-leg claws; **H.** ♀ Medial side of II-leg; **I.** ♀ Medial side of II-leg-6; **J.** ♂ Medial side of II-leg-6; **K.** ♀ Lateral side of II-leg; **L.** ♀ Lateral side of II-leg-6.

Gnathosoma with a short rostrum and two pairs of setae (Figs 28G–H, 29A). Palp five-segmented; P-1 short, with one dorsal pinnate seta; P-2 with five dorsal and two lateral pinnate setae; P-3 dorsally with two pinnate setae; P-4 terminally with three fine setae and a short ventral extension with a seta; P-5 with some stout setae anteriorly (Figs 28I, 29D–E). Chelicera shape conventional, chelicera claw concave on lateral side, with a row of teeth on medial side (Figs 28J, 29F–I).

Legs robust; except for the sixth segments, all segments with a large number of short fine seta and stout setae; I-L-4–5 ventrally with long pinnate setae; I-II-L-6 with a large seta, and with a few short setae dorsally; III–IV-L-6 with a few long setae anteriorly (Figs 30A–B, D–E, H–I, K–L, 31C–F, H–K). Claws simple, lateral

and medial side both with a groove; I-II-L claws lateral with a row of small teeth, but none in III–IV-L claws (Figs 30G, 31B, G, L).

Male ($n = 3$). General characteristics similar to the female (Figs 27B, G–J, 32A–H). Genital field shorter than in female; pregenital sclerite small and concealed between Ac_1 (Figs 27D, 32D). I–II-L-6 with more setae than in female (Figs 30C, E, J, 31A).

Measurements. Male ($n = 3$) and female ($n = 4$). See Table 4 for details.

Remarks. *Deuterothyas fujianensis* Zhan Guo, sp. nov. is very similar to *Deuterothyas variabilis*, but can be distinguished by the following features: (1) D2 of *Deuterothyas variabilis* is located lateral to Dc2, but D2 of *D. fujianensis* is located posterior to Dc2; (2) Cx-III and

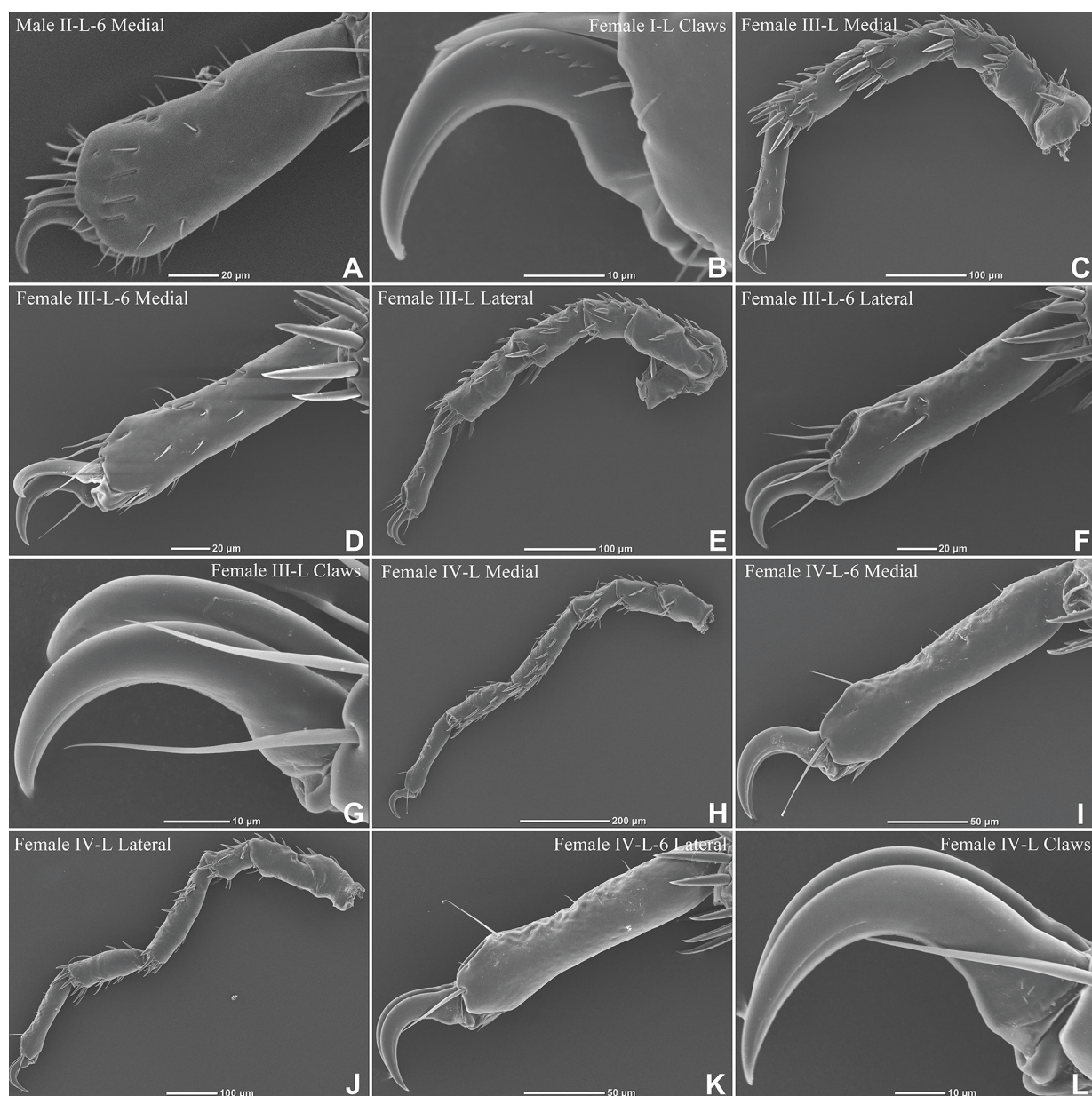


Figure 31. *Deuterothyas fujianensis* Zhan & Guo, sp. nov., SEM photographs. **A.** ♂ Lateral side of II-leg-6; **B.** ♀ Lateral side of II-leg claws; **C.** ♀ Medial side of III-leg; **D.** ♀ Medial side of II-leg-6; **E.** ♀ Lateral side of III-leg; **F.** ♀ Lateral side of III-leg-6; **G.** ♀ Lateral side of III-leg claws; **H.** ♀ Medial side of IV-leg; **I.** ♀ Medial side of IV-leg-6; **J.** ♀ Lateral side of IV-leg; **K.** ♀ Lateral side of IV-leg-6; **L.** ♀ Lateral side of IV-leg claws.

Cx-IV of the new species are more angular, while those of *D. variabilis* are more rounded; (3) compared to *D. variabilis*, the second pair of genital flaps of the new species is smaller and has fewer setae (Lundblad 1969; Cook 1974).

Discussion

Within the subfamily Euthyadinae, the genera *Paniscus* Koenike, 1896, *Panisopsis* K. Viets, 1926, and *Deuterothyas* Lundblad, 1941 exhibit significant similarities in the idiosomal plate pattern, coxae, palps, gnathosoma, and legs. However, they differ in the shape of the genital field, and Cook (1974) considered the relationships among these three genera to be very close.

Panisopsis (s. str.) *lixunae* Zhan & Guo, sp. nov. described in this study matches the diagnosis of the genus. However, the dorsal plates of *D. crescentis* Zhan & Guo, sp. nov. differ from the genus diagnosis given by Cook (1974). In Cook's description, the median eye plate of *Deuterothyas* is composed of the fused prefrontalia, postfrontalia, Dc1, and the postocularia; and the remaining dorsalia are large, with a tendency for Dc3 or the greatly enlarged Dc5 to fuse medially. In contrast, the median eye plate of *D. crescentis* is formed by the fusion of the prefrontalia, postfrontalia, Dc1, and Dc2, while Dc3–5 fuse medially. Nevertheless, the new species can be classified in *Deuterothyas* based on its three pairs of genital flaps.

Upon comparing SEM photographs and optical photographs, it was found that the "porous dorsalia" of *Deuterothyas*

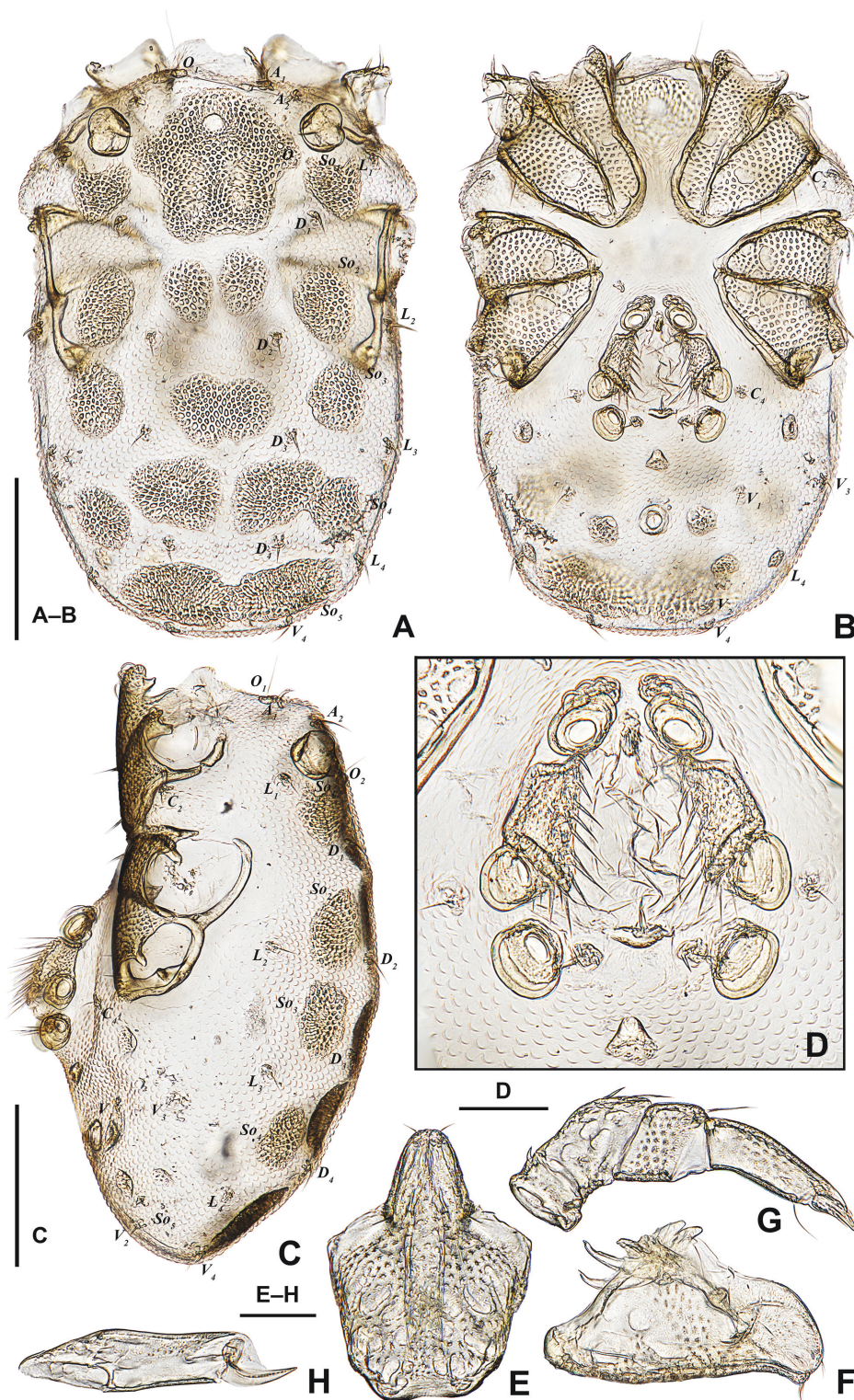


Figure 32. *Deuterothyas fujianensis* Zhan & Guo, sp. nov., paratype ♂ (FJ-HYDRY-2024071804), optical photographs. **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Genital field; **E.** Ventral view of gnathosoma; **F.** Lateral view of gnathosoma; **G.** Lateral view of palp; **H.** Lateral view of chelicera. Scale bars: 200 µm (A–C); 50 µm (D–H).

observed under the compound microscope are actually secondary sclerotizations that lie beneath the integument, rather than actual dorsalia at the idiosoma surface. This secondary sclerotization also occurs in the same subfamily species, *Thyopsis cancellata* (Protz, 1896), and the family Teratomyadidae K. Viets, 1929 (Gerecke and Schwoerbel 1992; Zhan et al. 2025). Furthermore, in *Deuterothyas* species, this

sclerotization does not appear in young adults but forms as a secondary sclerotization during the maturation process to adult mites. This secondary sclerotization initiates formation beneath the dorsalia and typically extends to the surroundings. In *D. crescentis* Zhan & Guo, sp. nov., it even connects with other surrounding secondary sclerotizations and extends from the frontal margin to the posterior margin of the

Table 4. Measurements of *Deuterothyas fujianensis* Zhan & Guo, sp. nov.

	1 ♂	2 ♂	3 ♀	4 ♀	5 ♀	6 ♀	7 ♂
Idiosoma L/W	642, 448	623, 448	835, 617	668, 485	829, 594	844, 572	624, 444
ACG L	216	195	236	197	211	229	198
PCG L	213	200	234	198	233	227	193
Gonopore L	127	126	188	174	189	210	126
Ac1 L	45, 43	38, 37	47, 43	43, 45	\, 44	47, 55	39, 41
Ac2 L	36, 44	40, 38	45, 48	42, 40	43, 42	49, 49	40, 41
Ac3 L	44, 43	36, 37	44, 45	45, 41	55, 50	49, 50	40, 41
Excretory pore L	\	27	46	32	39	48	33
Gnathosoma L	179	166	207	169	189	192	166
Chelicera base L	131	121	143	124	146	150	122
Chelicera claw L	53	50	57	51	48	51	46
P-1–5 dL	25, 81, 40, 89, 36	/, 73, 34, 80, 30	33, 87, 42, 98, 41	31, 75, 39, 87, 33	26, 80, 40, 92, 35	32, 80, 41, 99, 34	29, 70, 43, 89, 28
II-L-1–6 dL	49, 79, 73, 84, 96, 108	58, 71, 63, 79, 90, 109	72, 89, 85, 93, 110, 104	59, 72, 67, 80, 98, 97	71, 77, 68, 82, 101, 99	68, 83, 70, 84, 103, 109	57, 70, 61, 76, 91, 102
III-L-1–6 dL	69, 90, 80, 100, 118, 123	59, 77, 75, 89, 101, 117	79, 93, 94, 108, 126, 124	57, 76, 78, 93, 110, 110	72, 91, 87, 101, 122, 128	69, 86, 74, 90, 117, 133	59, 76, 71, 86, 106, 114
IV-L-1–6 dL	62, 83, 78, 110, 132, 159	62, 70, 71, 103, 119, 147	80, 86, 90, 129, 143, 168	65, 79, 64, 107, 133, 145	\, 86, 85, 119, 140, 160	74, 91, 86, 119, 139, 166	64, 67, 67, 99, 121, 136
IV-L-1–6 dL	125, 113, 102, 229, 158, 190	122, 92, 90, 200, 144, 177	140, 114, 114, 246, 167, 199	122, 90, 102, 211, 151, 157	140, 115, 106, 232, 164, 169	123, 122, 99, 229, 154, 184	116, 94, 91, 184, 146, 158

idiosoma. Interestingly, this secondary sclerotization tends to exclude glandularia, eye capsules, and slit organs. Generally, the secondary sclerotization in males is larger and more complex than that in females, but there is no gender difference in the actual dorsalia observed in SEM photographs.

Acknowledgments

The authors are indebted to Zhu-Hui Ding (Anshun University, China), Lan Ja, Dong-Mei Liu, and Xun Li (all Guizhou University, China) for specimen collection.

References

- Cook DR (1959) Studies on the Thyasinae of North America (Acarina: Hydryphantidae). The American Midland Naturalist 62(2): 402–428. <https://doi.org/10.2307/2422535>
- Cook DR (1974) Water mite genera and subgenera. Memoirs of the American Entomological Institute 21: 1–860.
- Di Sabatino A, Gerecke R, Gledhill T, Smit H (2010) Chelicerata: Acari II. In: Gerecke R (Ed.) Chelicerata: Araneae, Acari I. Süßwasserfauna von Mitteleuropa. München: Elsevier Spektrum Akademischer Verlag 7(2-2): 1–134. https://doi.org/10.1007/978-3-8274-2266-8_1
- Gerecke R, Schwoerbel J (1992) Untersuchungen zur Variabilität und Synonymie der Wassermilbe *Thyopsis cancellata* (Protz, 1896) (Acari, Actinedida, Hydryphantidae). Spixiana 15(3): 239–248.
- Gu XY, Jin C, Guo JJ (2021) Collection and preservation of water mites and preparation of slide specimens. Bio-101: e1010676. [in Chinese] <https://doi.org/10.21769/BioProtoc.1010676>
- Jin DC (1997) Hydrachnellae-Morphology Systematics: A Primary Study of Chinese Fauna. Guiyang, Science and Technology Publishing House, 356 pp. [in Chinese]
- Li HT, Jin DC, Guo JJ (2022) *Acucapito hainanensis* sp. nov., the first record of the family Acucapitidae Wiles, 1996 (Acari, Hydrachnidia) from China. Acarologia 62(1): 250–261. <https://doi.org/10.24349/h7mp-06fx>
- Li HT, Smit H, Gu XY, Jin DC, Guo JJ (2024) The first records of the subfamily Euthyadinae K. Viets, 1931 (Acari, Hydrachnidia, Hydryphantidae) from China with description of one new species. Acarologia 64: 105–122. <https://doi.org/10.24349/eahs-q4xf>
- Lundblad O (1969) Indische Wassermilben, hauptsächlich aus Hinterindien. Arkiv för Zoologi 22(10): 1–126.
- Mitchell R (1960) The Evolution of Thermophilous Water Mites. Evolution 14(3): 361–377. <https://doi.org/10.1111/j.1558-5646.1960.tb03098.x>
- Smit H (2020) Water mites of the world: with keys to the families, subfamilies, genera and subgenus. Monografieën van de Nederlandse Entomologische Vereniging 12: 1–774.
- Zhan BX, Li HT, Gu XY, Ding ZH, Guo JJ (2025) First Chinese record of the family Teratothyadidae K. Viets, 1929 (Acari, Hydrachnidia), with the description of one new species. International Journal of Acarology 51: 594–603. <https://doi.org/10.1080/01647954.2025.2593947>
- Zhong H, Gu XY, Guo JJ (2024) Description of two new species of subfamily Euthyadinae K. Viets, 1931 (Acari: Hydryphantoidea: Hydryphantidae) from China. International Journal of Acarology 51(1): 18–24. <https://doi.org/10.1080/01647954.2024.2413506>
- Zhong H, Gu XY, Li P, Hu ZY, Guo JJ (2025) The first record of the water mite genus *Parathyas* Lundblad, 1926 (Acari: Hydryphantoidea: Hydryphantidae) from China with description of two new species. Systematic and Applied Acarology 30(2): 233–242. <https://doi.org/10.11158/saa.30.2.4>
- Zhong H, Guo JJ, Jin DC, Li HT, Gu XY (2026) Description of two new species of the genus *Parathyas* Lundblad, 1926 (Acari: Hydryphantoidea: Hydryphantidae: Euthyadinae) from China. European Journal of Taxonomy 1034: 259–270. <https://doi.org/10.5852/ejt.2026.1034.3155>

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Artificial Intelligence (AI) use

The authors accept full responsibility for the content of the manuscript, including the disclosure of any use of AI.

No AI tools were used in the preparation of this manuscript.

Funding

This research was supported by the National Natural Science Foundation of China [32260125] and the Guizhou Province High-level Innovative Talent Project (Qiankehe Pingtai Rencai-GCC [2022] 029-2).

Author contributions

Bao-Xiang Zhan participated in species collection, specimen processing, plate preparation, species identification, and manuscript writing. Harry Smit and Hai-Tao Li contributed to species identification and manuscript writing. Xin-Yao Gu assisted with species collection. Jian-Jun Guo supervised and coordinated the entire project.

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Data availability

All of the data that support the findings of this study are available in the main text.
