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

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Two rare species representing the newly recorded subfamily Cyclothyadinae Lundblad, 1941 (Acari, Hydrachnidia, Hydryphantidae) from China

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Original research

ABSTRACT

Two species new to science, *i.e.* *Cyclothyas longipalpis* Li & Jin sp. nov. and *Cyclothyas smiti* Li & Guo sp. nov., are described in this paper, representing the newly recorded subfamily, Cyclothyadinae Lundblad, 1941, among hydryphantid mites from China. Detailed structures are illustrated and photographed by optical microscope. Meanwhile, observations of each peripheral sclerites are conducted to prove that its shape cannot be used for species identification, but the fused situation of the first pair of peripheral sclerites and glandularia could provide a basis.

Keywords water mites; new species; *Cyclothyas*; Tibet; Shaanxi

Zoobank <http://zoobank.org/018678F9-54D6-4831-9C53-56FE53BB5B4D>

Introduction

The Cyclothyadinae Lundblad, 1941 includes three species, *i.e.* *Cyclothyas mirabilis* Lundblad, 1941 (Burma), *Cyclothyas heterospinus* (Imamura, 1955) (Japan) and *Cyclothyas siskiyouensis* I.M. Smith, 1983 (North America) (Lundblad 1941, 1967; Imamura 1955; I.M. Smith 1983). This group has a unique character setting it apart from almost all hydryphantid mites and even the entire water mites, *i.e.* lateral glandularia surrounded by peripheral sclerites, and connected each other to form a solid ring around the edge of the body (Cook 1974). It is worth noting that the Australian genus, *Cyclohydryphantes* Lundblad, 1941 (with three species), from another subfamily, Pseudohydryphantinae K. Viets, 1926, also having the peripheral sclerites. But the presence of the middle eye and the number of acetabula can be used to distinguish two groups effectively (Harvey 1987; Smit 1998, 2020).


Among the total of 13 subfamilies known to Hydryphantidae Piersig, 1896, six subfamilies were reported from China (Li *et al.* 2024). After field surveys, two new species, *Cyclothyas longipalpis* Li & Jin sp. nov. from Shaanxi and *Cyclothyas smiti* Li & Guo sp. nov. from Tibet were discovered, which are the first records of the subfamily Cyclothyadinae Lundblad, 1941 for the Chinese fauna. Meanwhile, peripheral sclerites of every specimen were observed in detail.

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Material and methods

The collection, preservation of water mites and preparation of slides followed Gu *et al.* (2021). Specimens were examined and illustrated under a Leica DM3000 microscope. All photographs and illustrations were edited with Adobe Photoshop CS6. All measurements (given in μm) were made with a Nikon Ni-E (with Nikon DS-Ri2 camera). The measurement methods followed Li *et al.* (2024).

The terminology and abbreviations used were updated from Jin (1997): a.s.l. = above sea level, A_1 = preantennal glandularia, A_2 = postantennal glandularia, ACG = anterior coxal group (Cx-I+Cx-II), C_2 & C_4 = coxoglandularia 2 & 4, Cx-I-IV = coxae I-IV, D_1 - D_4 = dorsoglandularia 1-4, I-L-1-6, *etc.* = the first-sixth segment of the first leg, *etc.*, L = length, L_1 - L_4 = lateroglandularia 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), 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 Cyclothyadinae Lundblad, 1941

Genus *Cyclothyas* Lundblad, 1941

Cyclothyas longipalpis Li & Jin sp. nov. (Figures 1-6)

Zoobank: 3A438B37-7CC9-483D-BA9A-FA885A7568CC

Habitat

Brook with organic detritus, gravels and cobblestones.

Material examined

Holotype: adult male, Mount Tai bai, Shaanxi Province, P. R. China (34°05'27" N, 107°49'54" E, 1353 m a.s.l.), collected by Ze-Yu Wang, 18-VII-2012. Slide No. SX-HY-2012071801. Paratype: one female, same data as holotype, Slide No. SX-HY-2012071802.

Etymology

The new species is named due to its palp being relatively longer than in other species of the genus.

Diagnosis

Coxal groups with numerous setae; genital field partially enveloped in PCG; acetabula evenly distributed on the lateral side of the acetabular plate; C_4 between PCG and genital field; A_1 close to the first pair of peripheral sclerites but not fused; rostrum thick and short; palp slender.

Male — Genital plate with 24 acetabula and 13 setae on the left, 23 acetabula and 12 setae on the right.

Female — Genital plate with 16 acetabula and 12 setae on the left, 21 acetabula and 11 setae on the right.

Description

Male (n=1) — Membranous integument covered with papillae. In dorsal view: arrangement of D_1 - D_4 arc-shaped; peripheral sclerites connected to form a solid ring around the edge of the idiosoma (Figures 1A, 2A). In ventral view: coxal groups with numerous setae; genital field

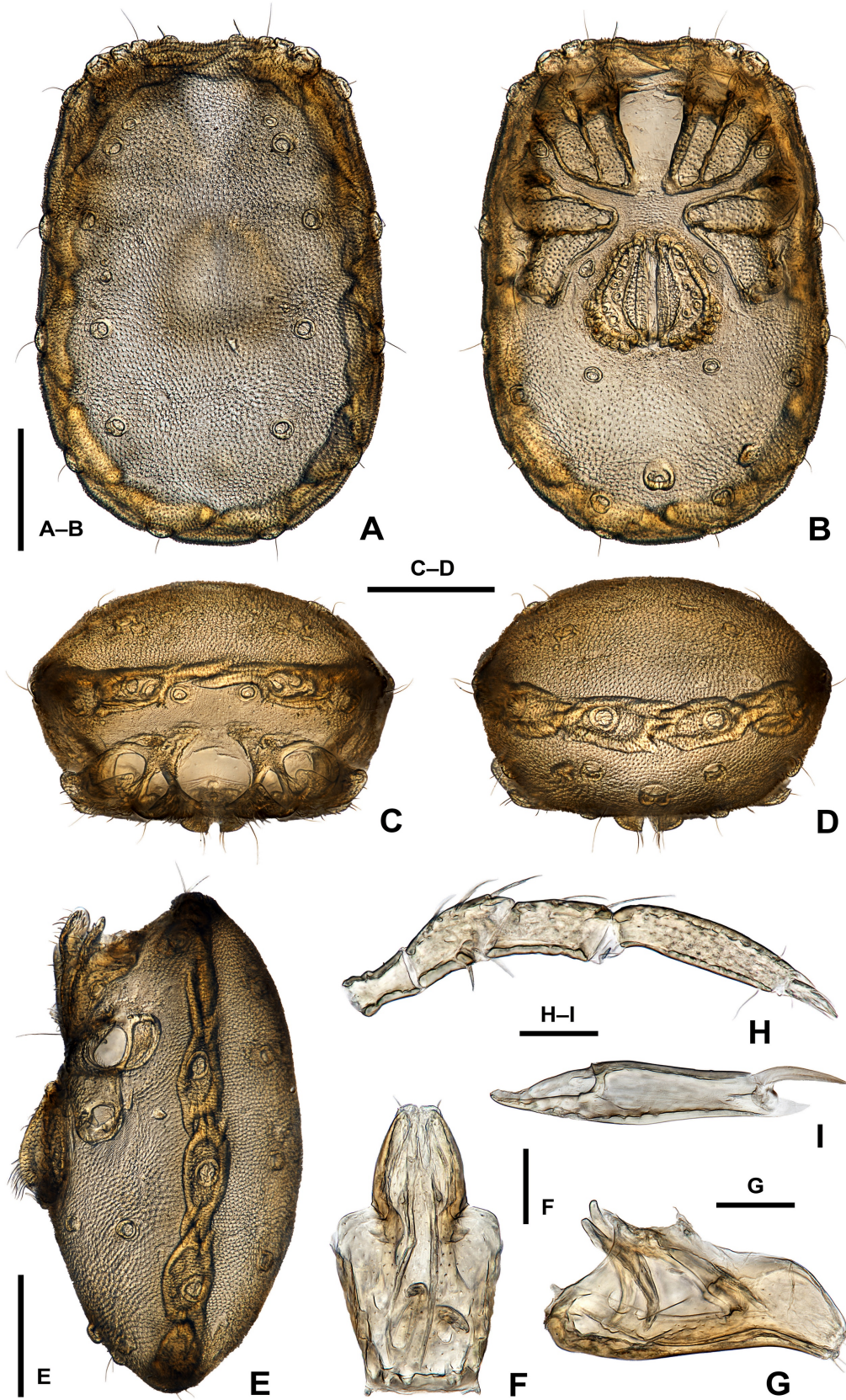


Figure 1 *Cyclothyas longipalpis* Li & Jin sp. nov., ♂, holotype (SX-HY-2012071801), optical microscope photographs: A – Dorsal view of idiosoma; B – Ventral view of idiosoma; C – Frontal view of idiosoma; D – Rear view of idiosoma; E – Lateral view of idiosoma; F – Ventral view of gnathosoma; G – Lateral view of gnathosoma; H – Lateral view of palp (detailed chaetotaxy is seen by the illustration); I – Lateral view of chelicera. Scale bars: A–B, C–D, E = 200 µm; F, G, H–I = 50 µm.

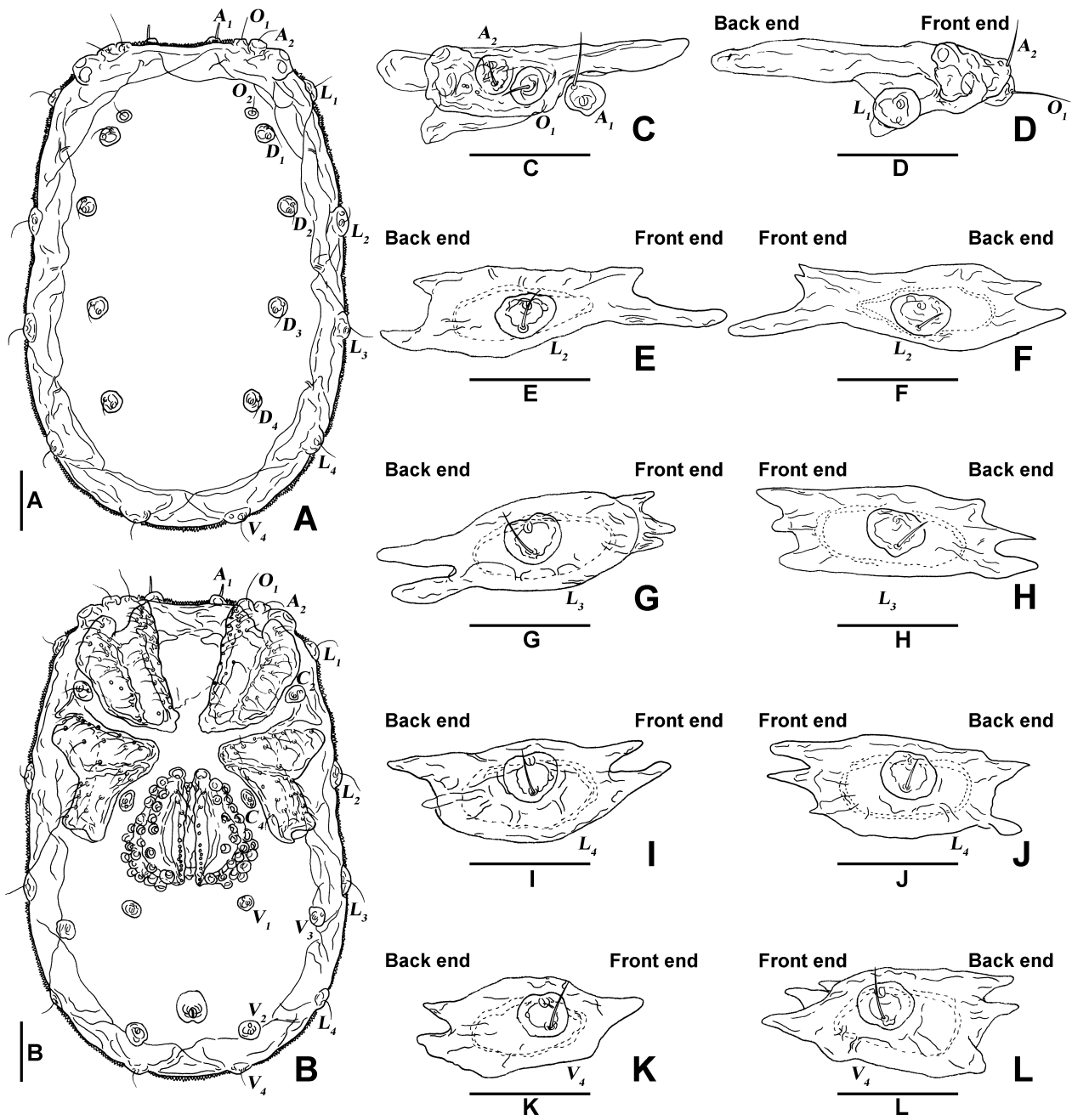


Figure 2 *Cyclothyas longipalpis* Li & Jin sp. nov., ♂, holotype (SX-HY-2012071801), illustrations: A – Dorsal view of idiosoma; B – Ventral view of idiosoma; C – Frontal view of the right 1th peripheral sclerite; D – Lateral view of the right 1th peripheral sclerite; E – Right 2th peripheral sclerite; F – Left 2th peripheral sclerite; G – Right 3th peripheral sclerite; H – Left 3th peripheral sclerite; I – Right 4th peripheral sclerite; J – Left 4th peripheral sclerite; K – Right 5th peripheral sclerite; L – Left 5th peripheral sclerite. All scale bars = 100 µm.

partially enveloped in PCG, with 24 acetabula and 13 setae on the left, and 23 acetabula and 12 setae on the right, acetabula evenly distributed on the lateral side of the genital plate; C_4 between PCG and genital field; V_1 in front of V_3 (Figures 1B, 2B, 3C). In lateral view: five pairs of peripheral sclerites (beneath integument) tightly connected, each of these sclerites variable in shape; L_2 – L_4 fused with peripheral sclerites but L_1 not (Figures 1E, 2D–J). In frontal view: A_1 close to the first pair of peripheral sclerites but not fused, eye capsules, O_1 and A_2 fused with the first pair of peripheral sclerites (Figures 1C, 2C). In rear view: V_4 fused with the

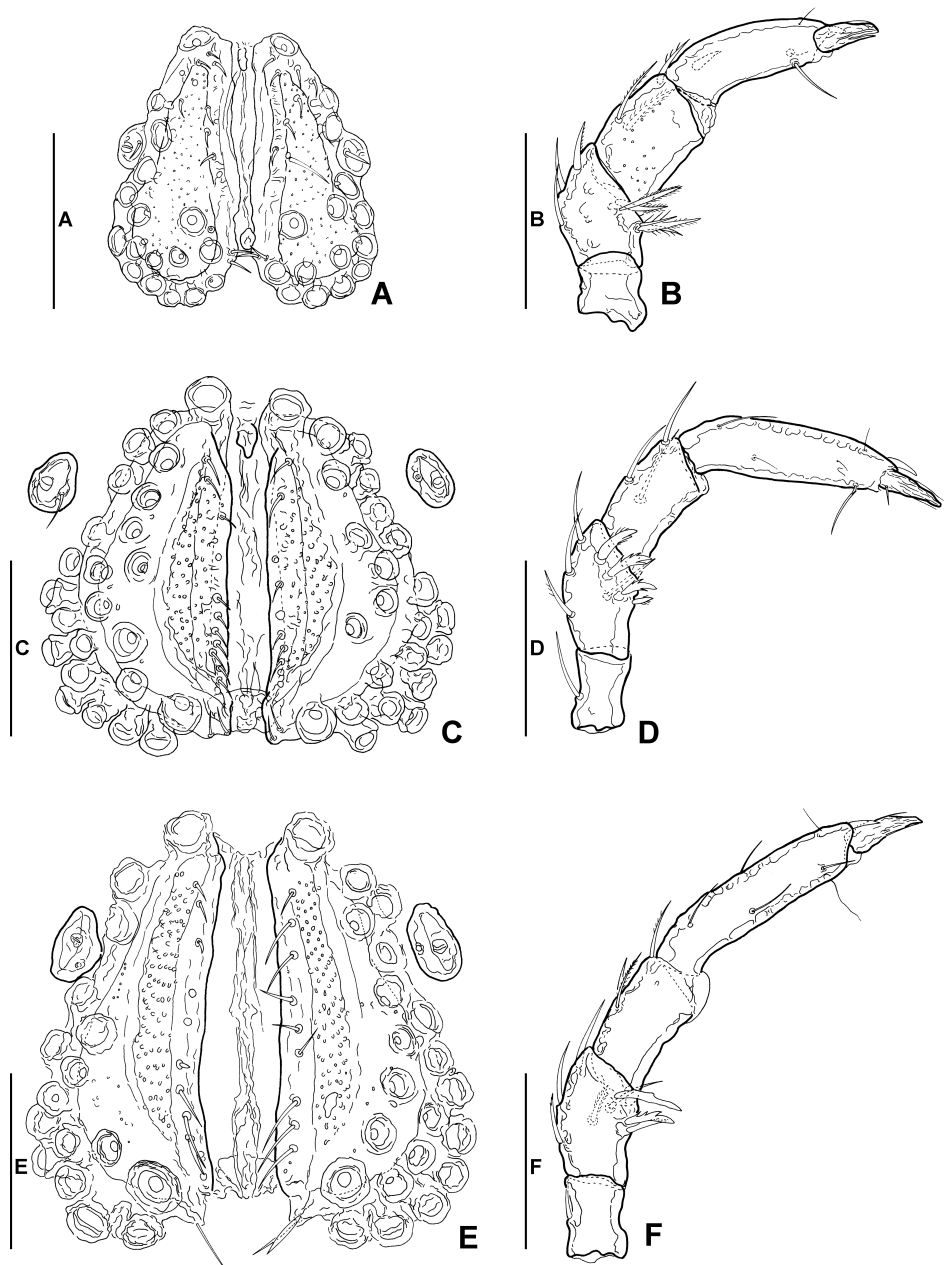


Figure 3 A–B: *Cyclothyas smiti* Li & Guo sp. nov., ♂, holotype (XZ-HY-2022062801), A – Genital field; B – Palp. C–D: *Cyclothyas longipalpis* Li & Jin sp. nov., ♂, holotype (SX-HY-2012071801), C – Genital field; D – Palp. E–F: *Cyclothyas longipalpis* Li & Jin sp. nov., ♀, paratype (SX-HY-2012071802), E – Genital field; F – Palp. All scale bars = 100 µm.

fifth pair of peripheral sclerites (Figures 1D, 2K–L).

Gnathosomal base inverted trapezoidal in ventral view, rostrum thick and short (Figure 1F–G). Chelicera two-segmented, chela with teeth on one side (Figure 1I). Slender palp five-segmented: P-1 long and with a seta near the middle of dorsal margin; P-2 with three setae on dorsal margin and five feathered setae near anterior margin; P-3 with three setae, two on dorsal margin and another on medial side; P-4 terminal with a stout seta on dorsal margin and a seta on ventral margin; P-5 with three fine setae (Figures 1H, 3D).

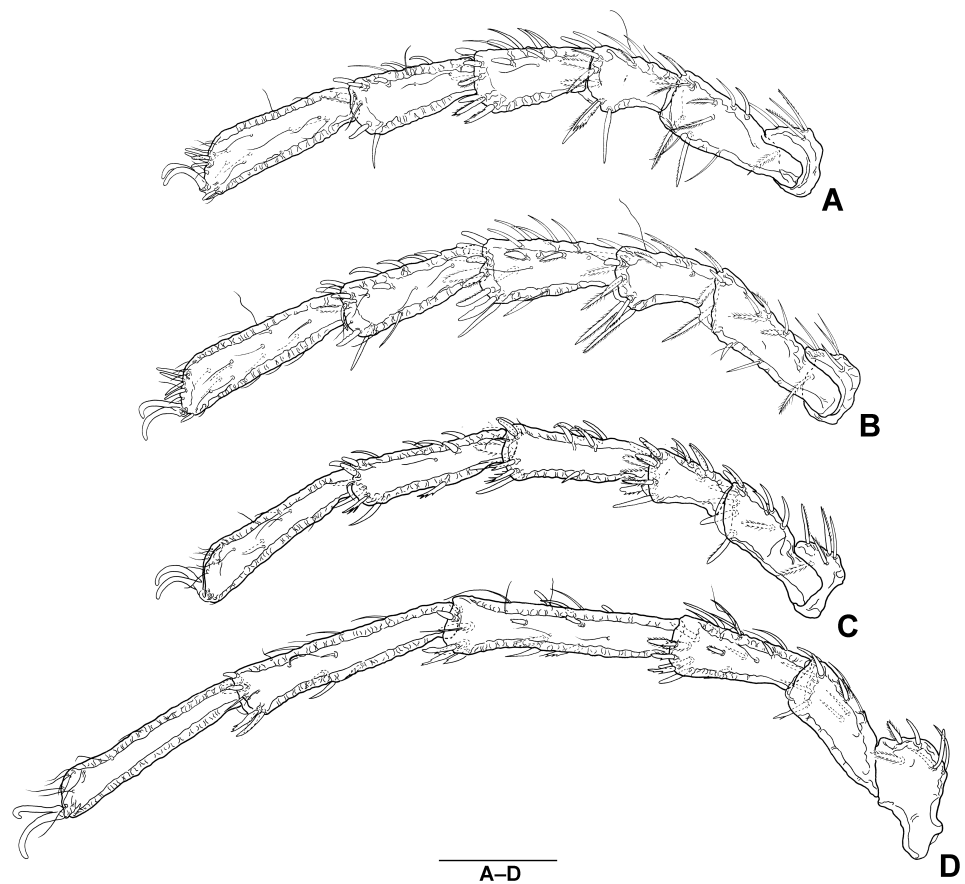


Figure 4 *Cyclothyas longipalpis* Li & Jin sp. nov., ♂, holotype (SX-HY-2012071801), illustrations: A – Lateral view of I-L-1–6; B – Lateral view of II-L-1–6; C – Lateral view of III-L-1–6; D – Lateral view of IV-L-1–6. Scale bar = 100 μ m.

Legs without swimming setae, first and second pairs stout, fourth pair longer than others; claws of all legs simple (Figure 4).

Female (n=1) — Similar to the male, but genital field larger, left genital plate with 16 acetabula and 12 setae, right with 21 acetabula and 11 setae, acetabula evenly distributed on the lateral side of the genital plate (Figures 3E–F, 5–6).

Measurements

Male (n=1) — Idiosoma L/W 838/582; ACG L 233; PCG L 213; genital plate L 209, gonopore L 158; excretory pore L 20, excretory plate L 56. Gnathosoma L 177, rostrum L 77; chelicera base L 168, chelicera claw L 58; palp segments L/W: P-1–5 43/32, 72/41, 63/36, 122/31, 37/11. Leg segments L: I-L-1 52, I-L-2 133, I-L-3 79, I-L-4 102, I-L-5 113, I-L-6 148; II-L-1 46, II-L-2 151, II-L-3 84, II-L-4 118, II-L-5 133, II-L-6 162; III-L-1 49, III-L-2 114, III-L-3 76, III-L-4 124, III-L-5 146, III-L-6 154; IV-L-1 90, IV-L-2 116, IV-L-3 121, IV-L-4 200, IV-L-5 202, IV-L-6 185.

Female (n=1) — Idiosoma L/W 888/623; ACG L 240; PCG L 228; genital plate L 249, gonopore L 188; excretory pore L 22, excretory plate L 69. Gnathosoma L 197, rostrum L 93; chelicera base L 172, chelicera claw L 64; palp segments L/W: P-1–5 43/36, 72/46, 66/38, 134/30, 45/14. Leg segments L: I-L-1 61, I-L-2 139, I-L-3 86, I-L-4 104, I-L-5 120, I-L-6 140; II-L-1 60, II-L-2 152, II-L-3 87, II-L-4 126, II-L-5 141, II-L-6 159; III-L-1 58, III-L-2 132,

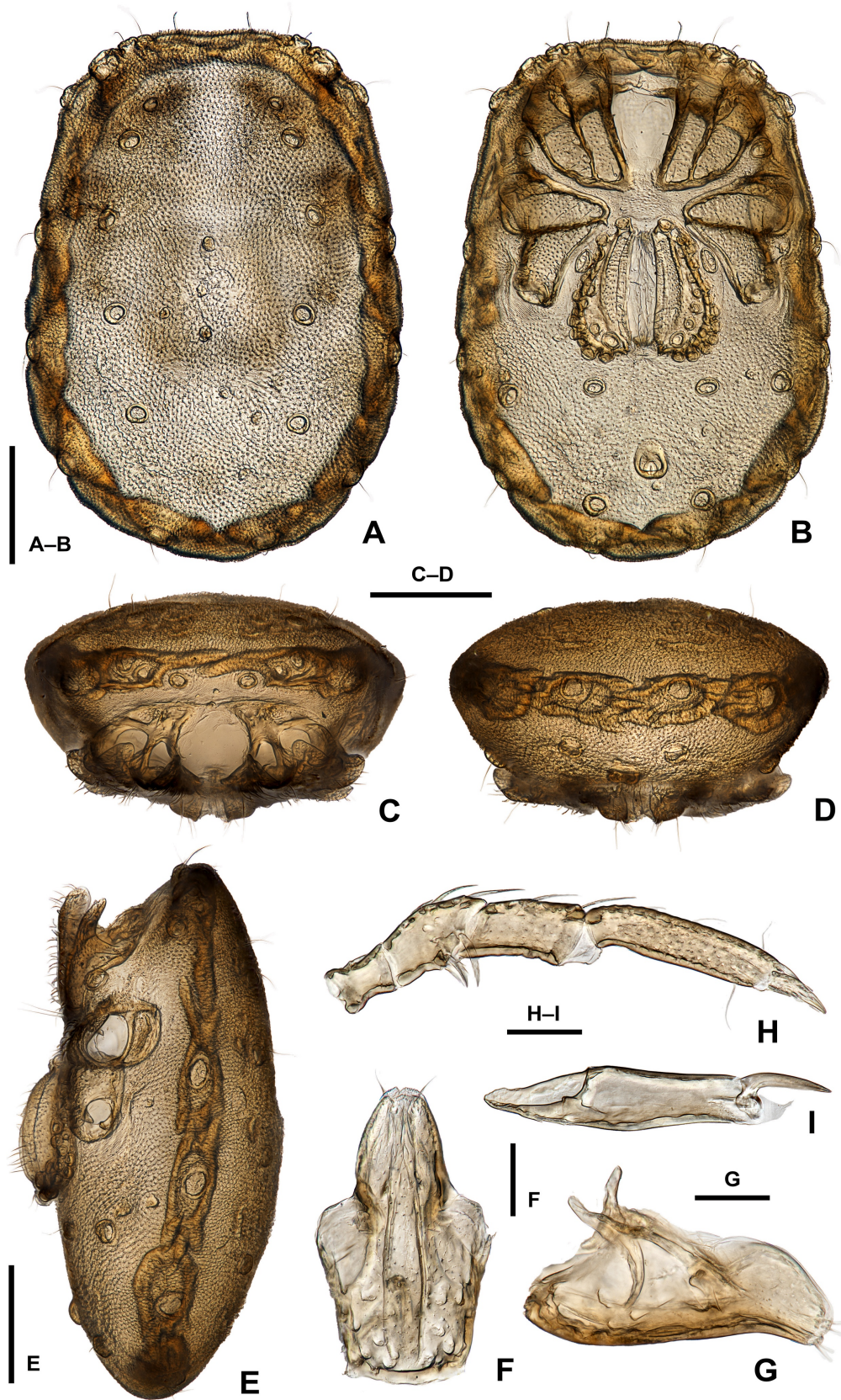


Figure 5 *Cyclothyas longipalpis* Li & Jin sp. nov., ♀, paratype (SX-HY-2012071802), optical microscope photographs: A – Dorsal view of idiosoma; B – Ventral view of idiosoma; C – Frontal view of idiosoma; D – Rear view of idiosoma; E – Lateral view of idiosoma; F – Ventral view of gnathosoma; G – Lateral view of gnathosoma; H – Lateral view of palp (detailed chaetotaxy is seen by the illustration); I – Lateral view of chelicera. Scale bars: A–B, C–D, E = 200 µm; F, G, H–I = 50 µm.

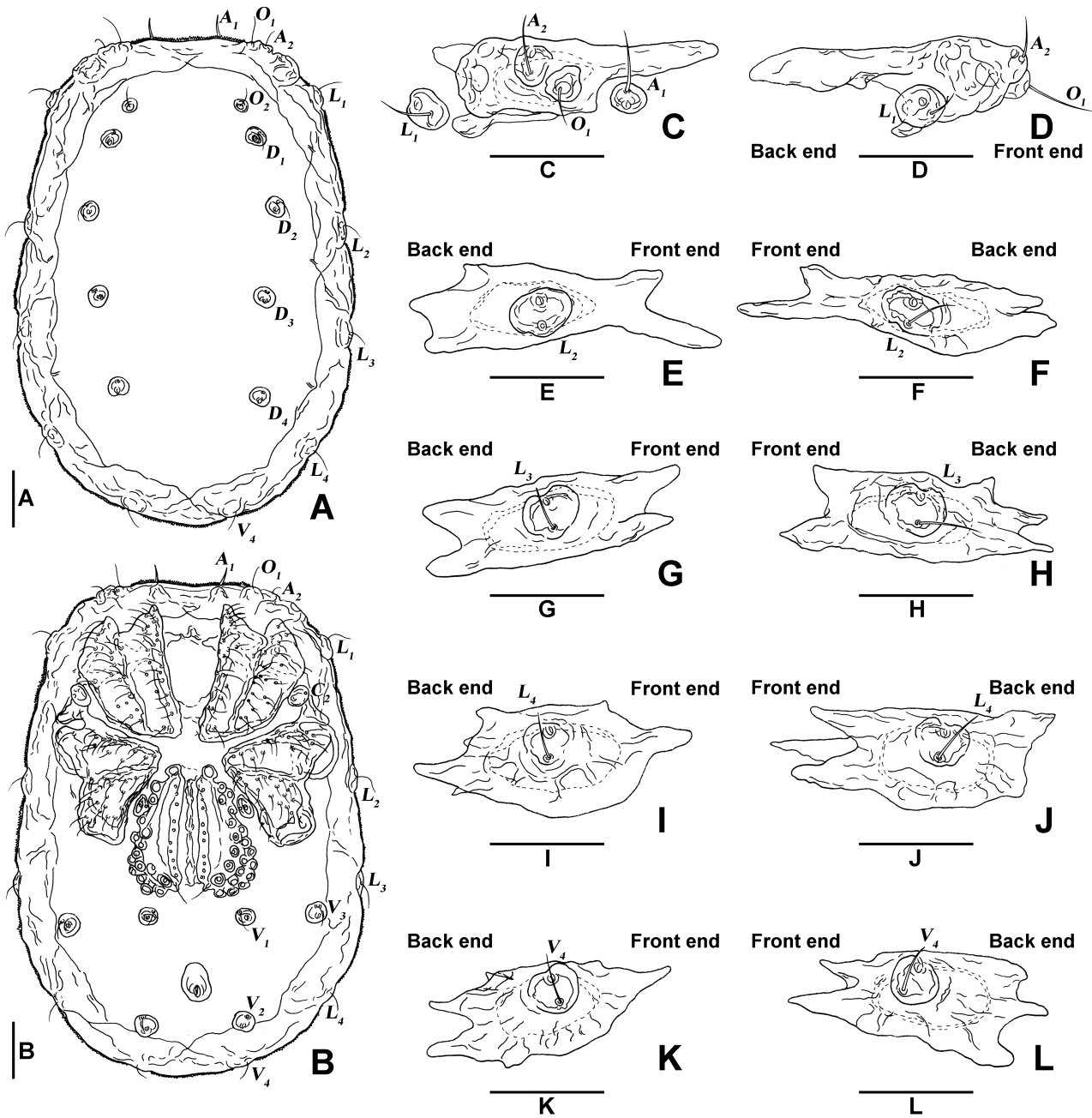


Figure 6 *Cyclothyas longipalpis* Li & Jin sp. nov., ♀, paratype (SX-HY-2012071802), illustrations: A – Dorsal view of idiosoma; B – Ventral view of idiosoma; C – Frontal view of the right 1th peripheral sclerite; D – Lateral view of the right 1th peripheral sclerite; E – Right 2th peripheral sclerite; F – Left 2th peripheral sclerite; G – Right 3th peripheral sclerite; H – Left 3th peripheral sclerite; I – Right 4th peripheral sclerite; J – Left 4th peripheral sclerite; K – Right 5th peripheral sclerite; L – Left 5th peripheral sclerite. All scale bars = 100 µm.

III-L-3 81, III-L-4 136, III-L-5 149, III-L-6 165; IV-L-1 100, IV-L-2 131, IV-L-3 131, IV-L-4 213, IV-L-5 209, IV-L-6 184.

Remarks

The female of *Cyclothyas longipalpis* Li & Jin sp. nov. is similar to *C. mirabilis* Lundblad, 1941 (male unknown) in two points: (1) genital field partially enveloped in PCG; (2) numerous acetabula evenly distributed on the lateral side of the acetabular plate. However, the present

new species differs from *C. mirabilis* in following aspects: (1) the number of acetabula of *Cyclothyas longipalpis* Li & Jin sp. nov. is much less than in *C. mirabilis*; (2) P-4 terminal with a stout seta on dorsal margin in *Cyclothyas longipalpis* Li & Jin sp. nov., but the terminal of P-4 with a dorsal protrusion in *C. mirabilis*; (3) gnathosomal base of *Cyclothyas longipalpis* Li & Jin sp. nov. inverted trapezoidal in ventral view, but rectangular in *C. mirabilis* (Lundblad 1941, 1967).

Distribution

China (Shaanxi); only known from the *locus typicus*.

Cyclothyas smiti Li & Guo sp. nov. (Figures 7–10)

Zoobank: [B475F795-A1C2-40E7-A968-329AC07B5152](https://zoobank.org/B475F795-A1C2-40E7-A968-329AC07B5152)

Habitat

Brook with organic detritus, gravels and cobblestones (Figure 7).

Material examined

Holotype: adult male, Yigong Town, Bomi County, Xizang Autonomous Region, P. R. China (30°15'06" N, 94°99'04" E, 2034 m a.s.l.), collected by Hai-Tao Li and Yu-Lin Zheng, 28-VI-2022. Slide No. XZ-HY-2022062801.

Etymology

This new species is named after Dr Harry Smit (the Netherlands) in appreciation to his brilliant contribution to water mite taxonomy



Figure 7 Habitats of *Cyclothyas smiti* Li & Guo sp. nov., Yigong Township, Bomi County, Xizang Autonomous Region, P. R. China.

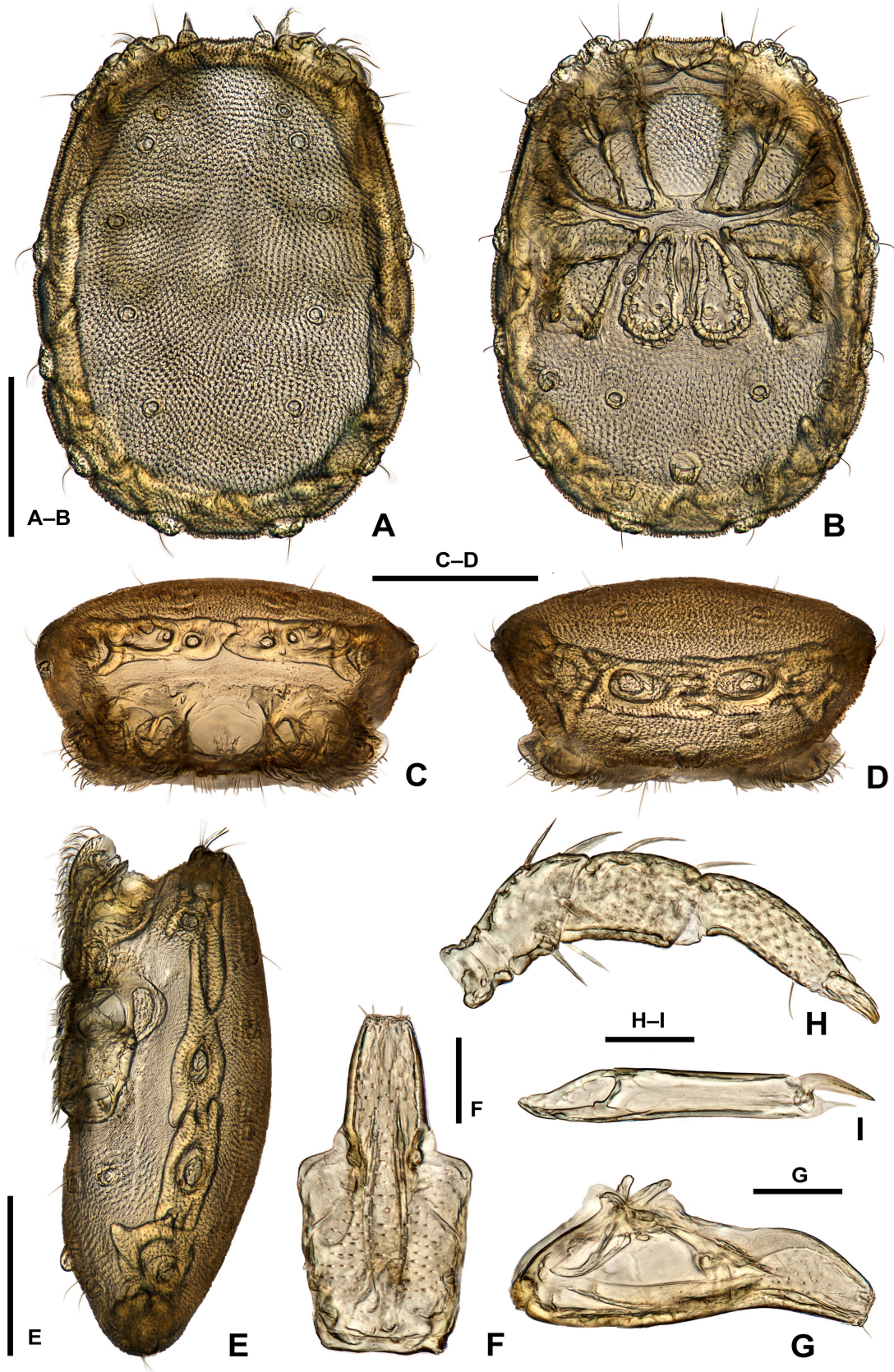


Figure 8 *Cyclothys smiti* Li & Guo sp. nov., ♂, holotype (XZ-HY-2022062801), optical microscope photographs: A – Dorsal view of idiosoma; B – Ventral view of idiosoma; C – Frontal view of idiosoma; D – Rear view of idiosoma; E – Lateral view of idiosoma; F – Ventral view of gnathosoma; G – Lateral view of gnathosoma; H – Lateral view of palp (detailed chaetotaxy is seen in the illustration); I – Lateral view of chelicera. Scale bars: A–B, C–D, E = 200 μm; F, G, H–I = 50 μm.

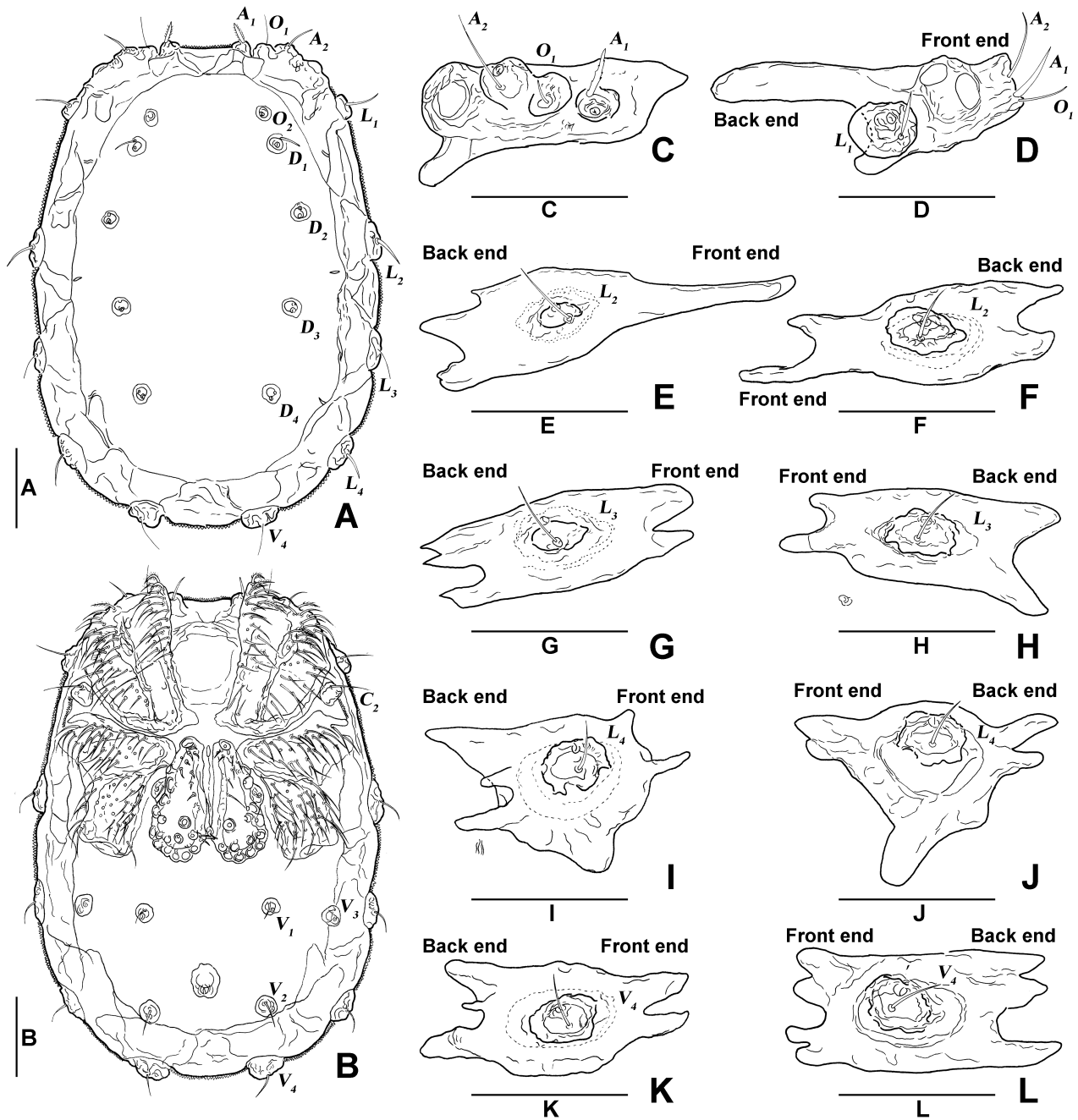


Figure 9 *Cyclothyas smiti* Li & Guo sp. nov., ♂, holotype (XZ-HY-2022062801), illustrations: A – Dorsal view of idiosoma; B – Ventral view of idiosoma; C – Frontal view of the right 1th peripheral sclerite; D – Lateral view of the right 1th peripheral sclerite; E – Right 2th peripheral sclerite; F – Left 2th peripheral sclerite; G – Right 3th peripheral sclerite; H – Left 3th peripheral sclerite; I – Right 4th peripheral sclerite; J – Left 4th peripheral sclerite; K – Right 5th peripheral sclerite; L – Left 5th peripheral sclerite. All scale bars = 100 µm.

Diagnosis

Male — Coxal groups with dense setae; genital field completely enveloped in PCG, anterior centre of genital plate not occupied by acetabula, with 17 acetabula and 10 setae on the left, and with 15 acetabula and 10 setae on the right; *C*₄ fused with acetabular plate; eye capsules, *A*₁, *O*₁ and *A*₂ fused with the first pair of peripheral sclerites together; rostrum long; palp stocky.

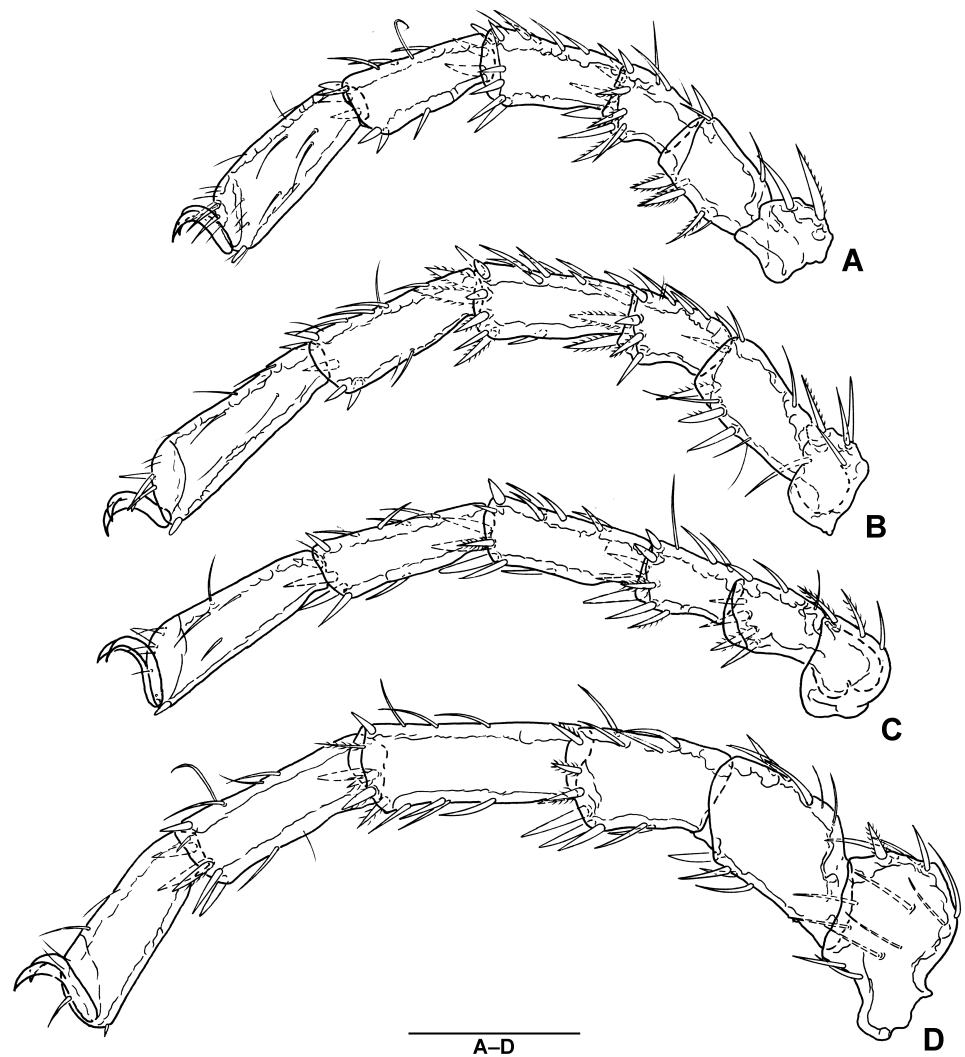


Figure 10 *Cyclothyas smiti* Li & Guo sp. nov., ♂, holotype (XZ-HY-2022062801), illustrations: A – Lateral view of I-L-1-6; B – Lateral view of II-L-1-6; C – Lateral view of III-L-1-6; D – Lateral view of IV-L-1-6. Scale bar = 100 μ m.

Description

Male (n=1) — Papillae scattered on the membranous integument. In dorsal view: arrangement of D_1 – D_4 arc-shaped; peripheral sclerites connected each other, and forming a solid ring around the edge of the body (Figures 8A, 9A). In ventral view: coxal groups with dense setae; genital field completely enveloped in PCG, anterior centre of acetabular plate not occupied by acetabula, with 17 acetabula and 10 setae on the left, and with 15 acetabula and 10 setae on the right; C_4 fused with genital plate on one side but free on the other side (Figures 3A, 8B, 9B). In lateral view: five pairs of peripheral sclerites (beneath integument) tightly connected, each of these sclerites variable in shape; all lateroglandularia fused with peripheral sclerites except L_1 (Figures 8E, 9D–J). In frontal view: eye capsules, A_1 , O_1 and A_2 fused with the first pair of peripheral sclerites (Figures 8C, 9C). In rear view: V_4 fused with the fifth pair of peripheral sclerites (Figures 8D, 9K–L).

Anterior portion of gnathosomal base slightly wider than posterior in ventral view, rostrum long (Figure 8F–G). Chelicera base slender, chela with teeth on one side (Figure 8I). Palp

stocky: P-1 with a seta at the middle portion of dorsal margin; P-2 with three setae on dorsal margin and five feathered setae near anterior margin; P-3 with three feathered setae, two on dorsal margin and another on inner medial surface; P-4 short, terminal with a stout seta on dorsal margin and a long seta on ventral margin (Figures 3B, 8H).

Legs without swimming setae, the fourth pair longer than others; claws of all legs simple (Figure 10).

Female — Not collected.

Measurements

Male (n=1) — Idiosoma L/W 615/453; ACG L 206; PCG L 174; genital plate L 160, gonopore L 88; excretory pore L 10, excretory plate L 42. Gnathosoma L 189, rostrum L 79; chelicera base L 147, chelicera claw L 45; palp segments L/W: P-1–5 22/37, 73/50, 61/51, 91/32, 36/13. Leg segments L: I-L-1 44, I-L-2 101, I-L-3 57, I-L-4 80, I-L-5 92, I-L-6 108; II-L-1 41, II-L-2 107, II-L-3 64, II-L-4 97, II-L-5 104, II-L-6 125; III-L-1 44, III-L-2 93, III-L-3 56, III-L-4 98, III-L-5 106, III-L-6 120; IV-L-1 96, IV-L-2 105, IV-L-3 92, IV-L-4 132, IV-L-5 129, IV-L-6 118.

Remarks

Cyclothyas smiti Li & Guo sp. nov. differs from all other species by following characteristics, *i.e.* the setae on coxal groups extremely dense, genital field completely enveloped in PCG, and C_4 fused with acetabular plate (Imamura 1955; Lundblad 1967; I.M. Smith 1983).

Distribution

China (Xizang); only known from the *locus typicus*.

Discussion

After comparing all species in Cyclothyadinae, high similarities were found in some important characters, *e.g.* overall dorsal characters, chaetotaxy of palp, which brought certain difficulties to the species identification. In order to obtain more information to make the identified results more objective, our sight was focused on the peripheral sclerites, whose characters are very rare in the hydrophantid mites. It is regrettable that less attention was received before. Through a detailed examination of the two new species involved in this article, we had found the following points: (1) both species with five pairs of peripheral sclerites; (2) all shapes of peripheral sclerites variable, not only manifested between different individuals, but also on the left and right sides of the same individual; (3) A_1 separated with the first pair of peripheral sclerites in *Cyclothyas longipalpis* Li & Jin sp. nov., but fused in *Cyclothyas smiti* Li & Guo sp. nov. Therefore, we could make a judgment that the shape of each peripheral sclerites cannot be used for species identification, but the fused situation of the first pair of peripheral sclerites and glandularia could provide a basis.

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