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New insights into *Damarchus*: a new species and gynandromorph description from Thailand (Araneae: Bemmeridae)

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Abstract

The genus *Damarchus* Thorell, 1891, represents a relatively neglected group of mygalomorph spiders distributed across several Asian countries, including India, Indonesia, Malaysia, Myanmar, Singapore, and Thailand. This study describes a new species, *Damarchus inazuma* **sp. nov.**, discovered in Thailand. The male *D. inazuma* is identified by the presence of three diminutive spines on the tibial apophysis, whereas the female is characterized by an elongated spermathecal stalk that exhibits an inward curvature. Additionally, we report the identification of a gynandromorph specimen of *D. inazuma*, marking the first recorded instance of this condition within the family Bemmeridae.

Key words: New record, intersex, taxonomy, wishbone spider

Introduction

The family Bemmeridae Simon, 1903 encompasses four genera: *Atmetochilus* Simon, 1887; *Damarchus* Thorell, 1891; *Homostola* Simon, 1892; and *Spiroctenus* Simon, 1889 (World Spider Catalog 2025). Opatova *et al.* (2020) identified several distinctive morphological traits that can be used to recognize female Bemmerids, including an eye tubercle situated on a low mound, thick scopulae present on the tarsus and metatarsus, preening combs on the third leg, a labium adorned with dense cuspules, and a rastellum characterized by a series of thickened, blunt spines, and males having S-shaped row of claw teeth while females have two rows of claw teeth (Raven, 1985; Opatova *et al.* 2020). The genera *Homostola* and *Spiroctenus* are endemic to coastal regions of Southern Africa, while *Atmetochilus* and *Damarchus* are broadly distributed throughout South and Southeast Asia. The genus *Spiroctenus* exhibits the highest species diversity within Bemmeridae, a pattern attributed to extensive collecting and surveys conducted in the early 20th century; however, other Bemmerid genera, particularly the tropical Asian species of *Damarchus*, have received comparatively less attention in research.

The genus *Damarchus*, which belongs to the Bemmeridae family, includes nine species that are exclusively recorded from their respective type localities across India, Indonesia, Malaysia, Myanmar, Singapore, and Thailand (World Spider Catalog 2025). This genus represents one of the earlier taxa described, with its first species documented in the 19th century. Zonstein and Marusik (2014) proposed that the actual number of *Damarchus* species is likely underestimated, especially in Thailand, where several undescribed species have been reported (Schwendinger, 1996; Zonstein & Marusik, 2014). Supporting this hypothesis, Schwendinger & Hongpadharakiree (2023) documented three new species from Thailand, though it is probable that the number of undiscovered *Damarchus* species in the region is significantly higher than these three.

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Mygalomorph spiders including those of the genus *Damarchus* have two separate sexes, male and female, of which one individual normally contains only one sex. However, two sexes can occur in one animal individual, for example hermaphrodites and gynandromorphs. There is no report of a hermaphrodite in mygalomorphs while some gynandromorph cases have been reported. Gynandromorphism is a rare phenomenon characterized by the presence of both male and female traits distinctly manifested on opposite sides of an organism's body. This occurrence has been observed across a variety of animal taxa, including butterflies (Sourakov, 2015), bees (Wcislo, Gonzalez & Arneson, 2004), birds (Peer & Motz, 2014), and spiders (Suzuki, Kuramitsu & Yokoi, 2019). The majority of documented cases of gynandromorphy in spiders involve araneomorphs, with an estimated prevalence of one in about 17,000 individuals within the same species (Palmgren, 1979). In contrast, occurrences of gynandromorphism in mygalomorphs are exceedingly rare, with only two formal reports identified exclusively within the Theraphosidae family (Labordal & Pérez-Miles, 2017; Sherwood, 2020). As a result, information concerning gynandromorphs in mygalomorphs—particularly across other families—remains limited. This study presents the first recorded instance of a gynandromorph within the Bemmeridae family from Thailand, alongside a description of the newly identified species.

Material and methods

All type materials were generously provided by Mr. Patiphan Chamnanpa, Mr. Sarunphat Amuntaikul, and Mr. Surin Limrudee. Samples were collected from Nong Rong, Phanom Thuan, Kanchanaburi, located in the western region of Thailand (14°09'28.9"N; 99°34'11.6"E, elevation 67 m) (Fig 1A) where around area border was disturbed by vehicles (Fig 1B) while no-disturbed area located inside forest. All specimens were collected by excavating along with hand collecting from their burrow. Then, all type materials were preserved in 95% ethanol at -20°C in the Chulalongkorn University Museum of Natural History (CUMNH).

Measurements were conducted using a ZEISS Stemi DV4 stereomicroscope. The shape of eye row was taken from the line of the front edge of eyes. All measurements are given in millimeters, include total length (excluding chelicerae and spinnerets), the diameter and interdistance of all eyes, as well as the lengths of each leg segment and pedipalps, measured laterally (with the number of spines indicated following the segment abbreviation). Spinnerets were measured on the ventral side. The photographs were taken by using Canon 7D digital camera attached to a ZEISS Stemi 508 stereomicroscope.

Specimens were identified to genus and species by CK under the Morphological: typological species concept (Grene, Mendelsohn & Mayr, 1976; Novarino, 2012) by comparing spider morphologies with Raven (1985), Zonstein and Marusik (2014), and Schwendinger & Hongpadharakiree (2023).

Terminologies used here are adapted from Kunsete *et al*. (2020). “Eye to fovea” refers to the distance from center of eye group to center of thoracic fovea. Abbreviations utilized are as follows: ALE = anterior lateral eye; AME = anterior median eye; PLE = posterior lateral eye; PLS = posterior lateral spinneret; PME = posterior median eye; PMS = posterior median spinneret; d = dorsal; p = prolateral; r = retrolateral; v = ventral.

Results

Taxonomy

Bemmeridae Simon, 1903

Damarchus Thorell, 1891

Type species. *Damarchus workmani* Thorell, 1891 from Singapore, by monotypy.

Diagnosis. Differ from *Spiroctenus* by having the short procurved fovea. Differ from *Homostola* by the rastellum consisting of short or weak spines (several short blunt spines in *Homostola*). Similar to *Atmetochilus* but differ from *Atmetochilus* by having pairs of posterior sternal sigilla not centrally confluent (present in *Atmetochilus*).

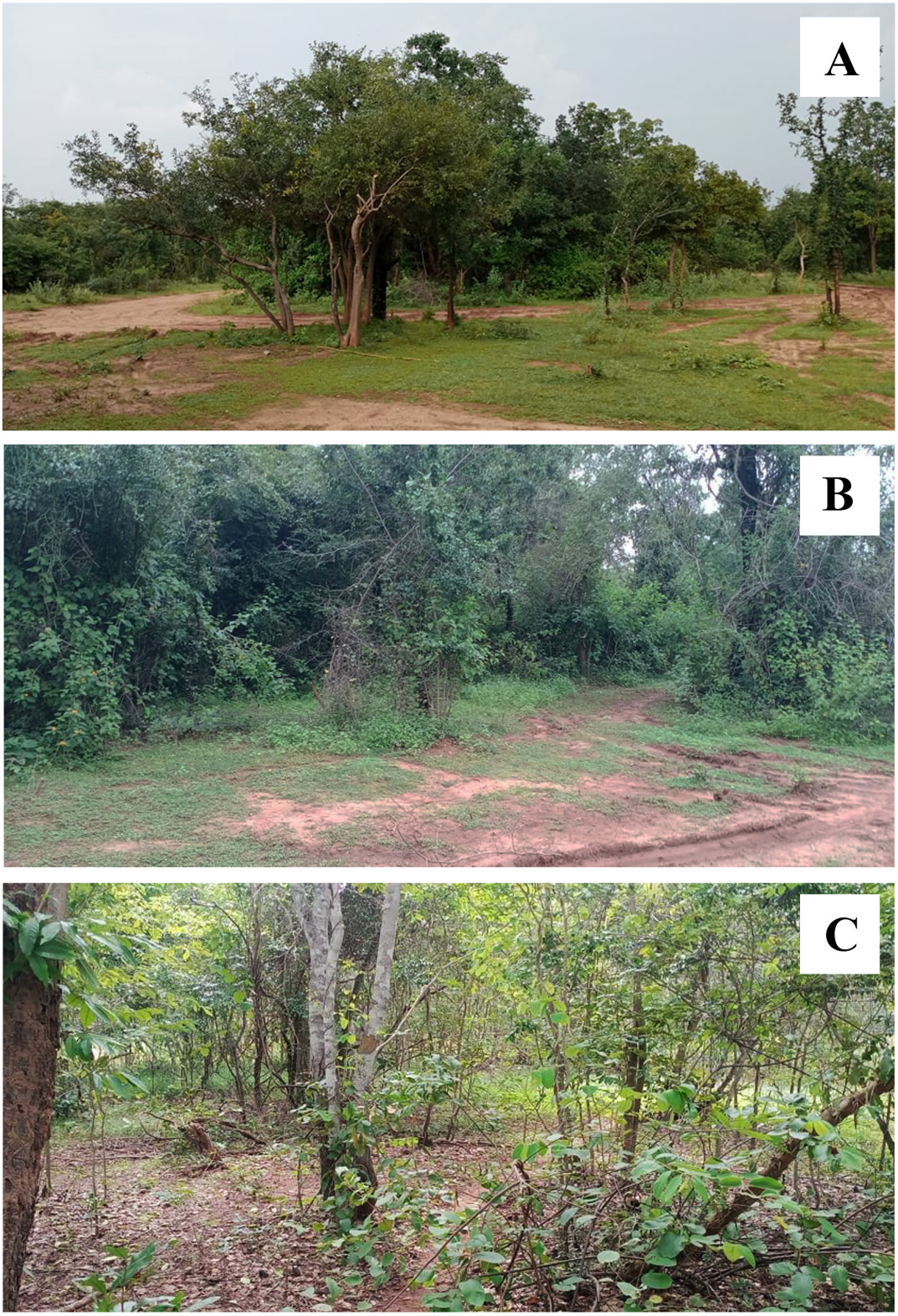

FIGURE 1. Location of the type locality for this study: Nong Rong, Phanom Thuan, Kanchanaburi, in western Thailand (14°09'28.9"N; 99°34'11.6"E, elevation 67 m). **A** general habitat; **B** human-disturbed habitat; **C** habitat inside forest. Photos were taken by Mr. Patiphan Chamnanpa.

Description. Fovea short, U-shaped. Eyes on tubercle. ALE are largest (except *D. montanus*). No or few cuspules on labium. Maxillary serrula absent; *ca*. 30 cuspules on proximal anterior margin of maxillae in both sexes; in male, maxillary cuspules normally smaller than in female, incipient. Posterior sternal sigilla large; anterior and medial sigilla smaller. Females palpal tarsus of females with one or two spines; no spines on any leg tarsi of males or females. Males with one sigmoidal (S-shaped) row of teeth on all paired claws; females with 2 rows of teeth on all paired claws; female palp claw with one tooth row on promargin. Preening comb normally present on metatarsi III and IV. Cymbium without spines. Four spinnerets: PMS broad, short and straight; PLS long, apical segment as long as median segment, basal segment longest. Palpal bulb simple and pyriform; embolus relatively long. Distal tibia I of males with ventral spur and 1–3 megaspines. Spermathecae are divided into two lobes.

Species included. *D. montanus* (Thorell, 1890), *D. workmani* Thorell, 1891, *D. oatesi* Thorell, 1895, *D. assamensis* Hirst, 1909, *D. cavernicola* Abraham, 1924, *D. bifidus* Gravely, 1935, *D. dao* Schwendinger and Hongpadharakiree, 2023, *D. lanna* Schwendinger and Hongpadharakiree, 2023, and *D. pylorus* Schwendinger and Hongpadharakiree, 2023.

Damarchus inazuma Kunsete & Warrit, sp. nov.

(Figs 2–7; Tables 1–3)

Material Examined

Holotype. THAILAND •1♂; Nong Rong, Phanom Thuan, Kanchanaburi, 14°09'28.9"N; 99°34'11.6"E, altitude 67 m., CUMNH; [ARA–2021–271 4/12/2019]

Paratypes. THAILAND •4♀; Same data as for holotype; [ARA–2021–267 1/11/2021], [ARA–2021–268 1/11/2021], [ARA–2021–269 1/11/2021], [ARA–2021–272 4/12/2019]. THAILAND •1 gynandromorph; Same data as for holotype; [ARA–2021–273 4/12/2021].

Etymology. The species is named after Inazuma, a character from the Japanese manga 'One Piece', known for the ability to change sex between male and female. The Inazuma style is characterized by bilateral asymmetry, presenting distinct coloration with orange on the left side and white on the right side. This color arrangement closely mirrors the sexual dimorphism observed in this species, with males exhibiting white coloration and females displaying orange (see Figs 2C, 4A, 6A).

Diagnosis. The male of *Damarchus inazuma* can be distinguished from those of *D. assamensis*, *D. bifidus*, and *D. oatesi* by the presence of three straight adjacent spines, grouped in a single row at the tip of the coupling spur on leg I. It also differs from those of *D. lanna* and *D. pylorus* due to the elongated, curved embolus and the absence of a paraembolic apophysis. In contrast, the female of *D. inazuma* is differentiated from those of *D. cavernicola* and *D. workmani* by the incurved stalks of the spermathecae. Additionally, it shows a distinct difference from *D. montanus* by the shape of the eye group, where in *D. montanus*, the anterior median eyes (AME) are the largest and closely spaced. While *D. inazuma* shares similarities with *D. dao*, the male can be differentiated by the curvature of the embolus, which is relatively straight in *D. dao*, and the female *D. inazuma* lacks secondary receptacles on the spermathecae.

Description. Male (holotype): Body (Fig 2) length 17.00.

Color in nature: Carapace, chelicerae, and legs covered with white layer (unknown material) and abdomen dark grey. Abdomen covered by pale white spots and ventral abdomen and spinnerets pale white overall.

Color in alcohol: Carapace, chelicerae and legs reddish brown. Abdomen dorsally pale gray and covered with pale white spots, ventral abdomen and spinnerets pale white overall.

Carapace (Fig 7A): 9.30 long, 7.60 wide. Chelicerae 4.70 long. Eyes (Fig 7B): tubercle 2 rows with low mound, 4 eyes in each row; anterior row procurved; posterior row slightly recurved, almost straight. Eye sizes and interdistances: AME 0.36, AME-AME 0.15, ALE 0.48, ALE-ALE 1.14, PME 0.24, PME-PME 0.75, PLE 0.45, PLE-PLE 1.29, AME-ALE 0.18, AME-PME 0.12, AME-PLE 0.36, ALE-PME 0.27, ALE-PLE 0.33, PME-PLE 0.09. Eye to fovea 6.30. Fovea (Fig 7A): strongly procurved to U-shaped. Three rows of setae on fovea. Rastellum of about 23 robust downward-curved setae on anterior margin of chelicerae. Cheliceral furrow with 9 promarginal teeth in one row, 10 mesobasal denticles. Fang aserrate. Stridulating strikers absent. Labium (Fig 7C): 1.59 long, 0.78 wide, without cuspules. Maxillae (Fig 3D): 4.20 long, 4.05 wide; serrula absent; 40–45 tiny cuspules each on posterior lobe, absent on heel. Sternum (Fig 7D) 4.20 long, 4.05 wide, posterior and medial sternal sigilla large but not confluent, anterior sigilla small, oval, on anterior margin.

Spination: Tarsi I–IV aspinose. Leg I: femur, p1; patella, 0; tibia, p1 r2; metatarsus, p1 r3. Coupling spur and metatarsus (Fig 3D–F): leg I with small group of short velvet-like setae on middle of the segment with subbasal bulge, coupling spur, ventral, opposing tip distally unsclerotized; coupling spur stalk-shaped with 3 slightly curved long spines (2–3 times longer than wide and not intact) on wide digitiform or long triangular spines tip of the stalk (Fig 3G). Leg II: metatarsus scopulate, p1 v4. Leg III: tibia, d1 p2 v6; metatarsus, r5 v10. Leg IV: tibia, p5 r2 v4, metatarsus, p9 r1 v4. Preening comb on retrolateral of distal tibia IV with four spines. Legs measurements (Table 1); formula: 4123.

TABLE 1. *Damarchus inazuma* **sp. nov.**, holotype male, length of pedipalp and leg segments (N=1).

Segment / Appendage	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Palp	3.90	1.90	3.40		1.50	10.70
Leg I	7.50	3.90	5.40	5.80	3.80	26.40
Leg II	5.40	3.60	4.92	5.34	2.88	22.14
Leg III	5.90	3.20	4.20	5.70	2.40	21.40
Leg IV	7.80	3.90	6.00	8.70	5.40	31.80

Scopula: entire on tarsi I–IV, distal 1/3 on metatarsus I and distal 1/2 on metatarsus II, not divided; elsewhere absent.

Trichobothria: one zigzag row with 12–18 per row on tarsi I–IV. One row with 6–10 on metatarsi I–IV and two rows of 10 on palpal tibia and tibiae I, III. None elsewhere. Palpal tibia, and tibiae I–IV.

Claws: S-shaped row of teeth with 10 teeth per row on all paired claws.

Palp (Fig 3A–C): Cymbium aspinose, 2.07 long, 1.36 wide with long setae on anterior edge. Bulb 2.60 long, spherical, narrow on tip, embolus 1.60 , long, tapered, pointed and slightly curved.

Spinnerets: PMS: 1.25 long, 0.20 diameter, PLS: 4.50 long, 0.40 maximal diameter, length of basal, medial, and apical segments 1.32, 0.9, 1.11, respectively. Apical segment digitiform.

Description. Female (paratypes), measurements were measured and average from all paratypes (N=4). Illustrations were collected from the specimen ARA–2021–272.

Female (paratype): Body (Fig 4) length 22.68±0.95.

Color in nature: Carapace, chelicerae, legs orange and abdomen black. Abdomen covered by pale white spots and ventral abdomen and spinnerets pale white overall.

Color in alcohol: Carapace, chelicerae and legs bright orange. Abdomen dorsally pale gray and covered with pale yellow spots, ventral abdomen, and spinnerets pale yellow overall.

Carapace (Fig 7E): 10.30±0.74 long, 8.57±0.27 wide. Chelicerae 4.55±0.66 long. Eyes (Fig 7F): tubercle 2 rows with low mound; anterior row procurved; posterior row slightly recurved, almost straight. Eye sizes and interdistances: AME 0.33±0.03, AME-AME 0.14±0.03, ALE 0.47±0.08, ALE-ALE 1.36±0.01, PME 0.29±0.05, PME-PME 0.75±0.04, PLE 0.34±0.04, PLE-PLE 1.43±0.07, AME-ALE 0.29±0.02, AME-PME 0.08±0.03, AME-PLE 0.38±0.02, ALE-PME 0.32±0.04, ALE-PLE 0.41±0.08, PME-PLE 0.08±0.11 (contiguous). Eye to fovea 6.27±0.41. Fovea (Fig 7E): strongly procurved to U-shaped. Three rows of setae on fovea. Rastellum of about ca. 23 robust downward-curved setae on anterior margin of chelicerae. Cheliceral furrow with 9 promarginal teeth in one row, 10 mesobasal denticles. Fang aserrate. Stridulating strikers absent. Labium (Fig 7G): 1.17±0.20 long, 1.85±0.71 wide, without cuspules. Maxillae (Fig 7G): 4.30±0.41 long, 2.12±0.26 wide; serrula absent; ca.45 tiny cuspules each on posterior lobe, absent on heel. Sternum (Fig 7H) 4.79±0.13 long, 4.79±0.16 wide, posterior and medial sternal sigilla large, not centrally confluent, Teardrop-shaped. anterior sigilla small, oval, on anterior margin.

Spination: Palp: tibia p2 v2, tarsus v2. Leg I: metatarsus v5. Leg II: femur p1, patella p1, tibia p2 v2, metatarsus p1 r3 v7. Leg III: patella r2, tibia d6 r2 v6. Leg IV: tibia p3 r2 v6, metatarsus r2 v6. Preening comb on retrolateral of distal metatarsus III, IV with four spines. Legs measurements (Table 2); formula: 4123.

FIGURE 2. *Damarchus inazuma* **sp. nov.** male holotype (ARA–2021–271). **A** dorsal; **B** ventral; **C** living male holotype in nature. Scale bar: 1 cm (**A**, **B**). Photo 2C was taken by Mr. Sarunphat Amuntaikul.

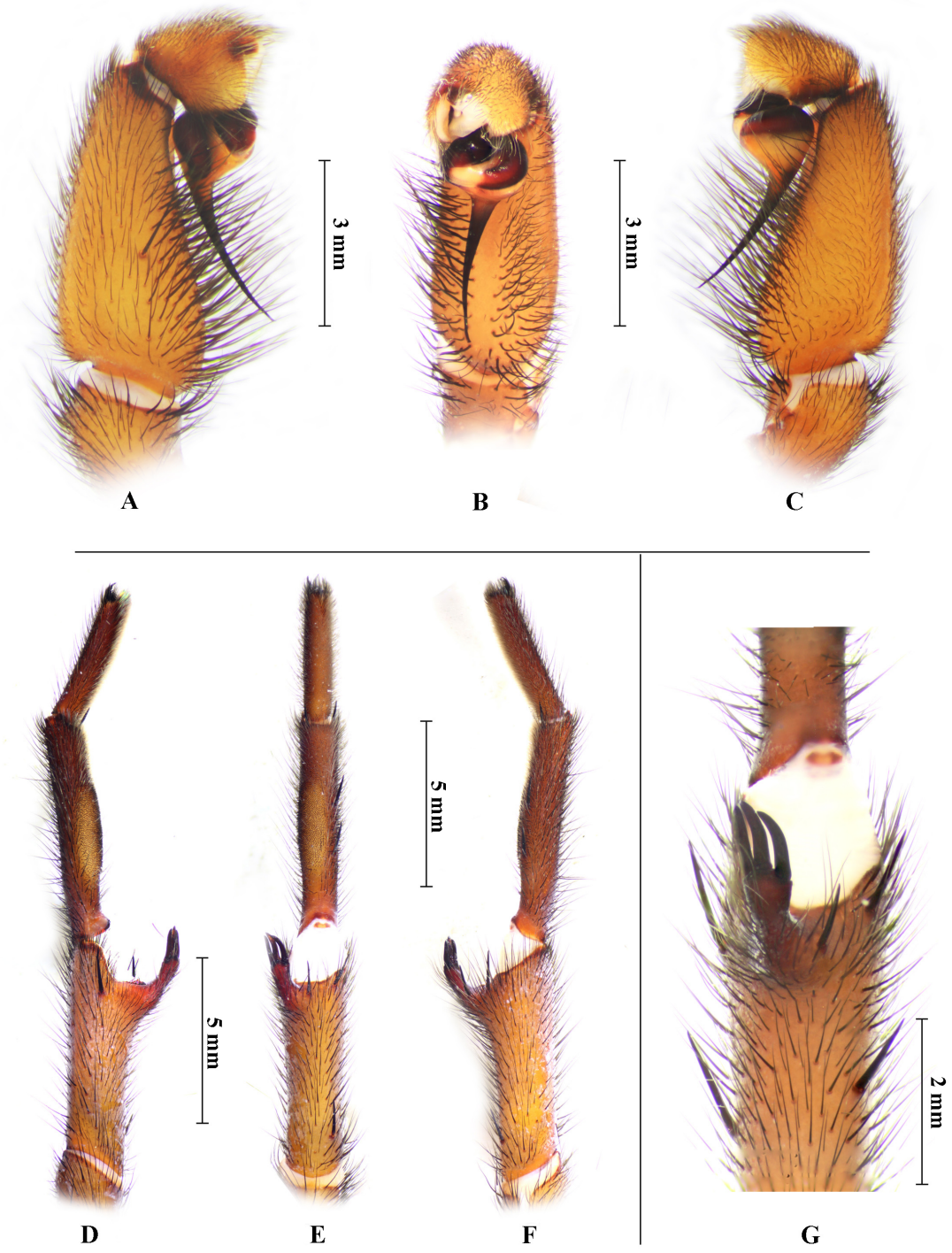

FIGURE 3. Sexual structures of *Damarchus inazuma* **sp. nov.** male Holotype (ARA–2021–271). **A–C** pedipalp; **A** prolateral; **B** ventral; **C** retrolateral. **D–F** Leg I; **D** prolateral; **E** ventral; **F** retrolateral; **G** ventral of coupling spur. Scale bars: 3 mm (**A**, **B**, **C**); 5 mm (**D**, **E**, **F**); 2 mm (**G**).

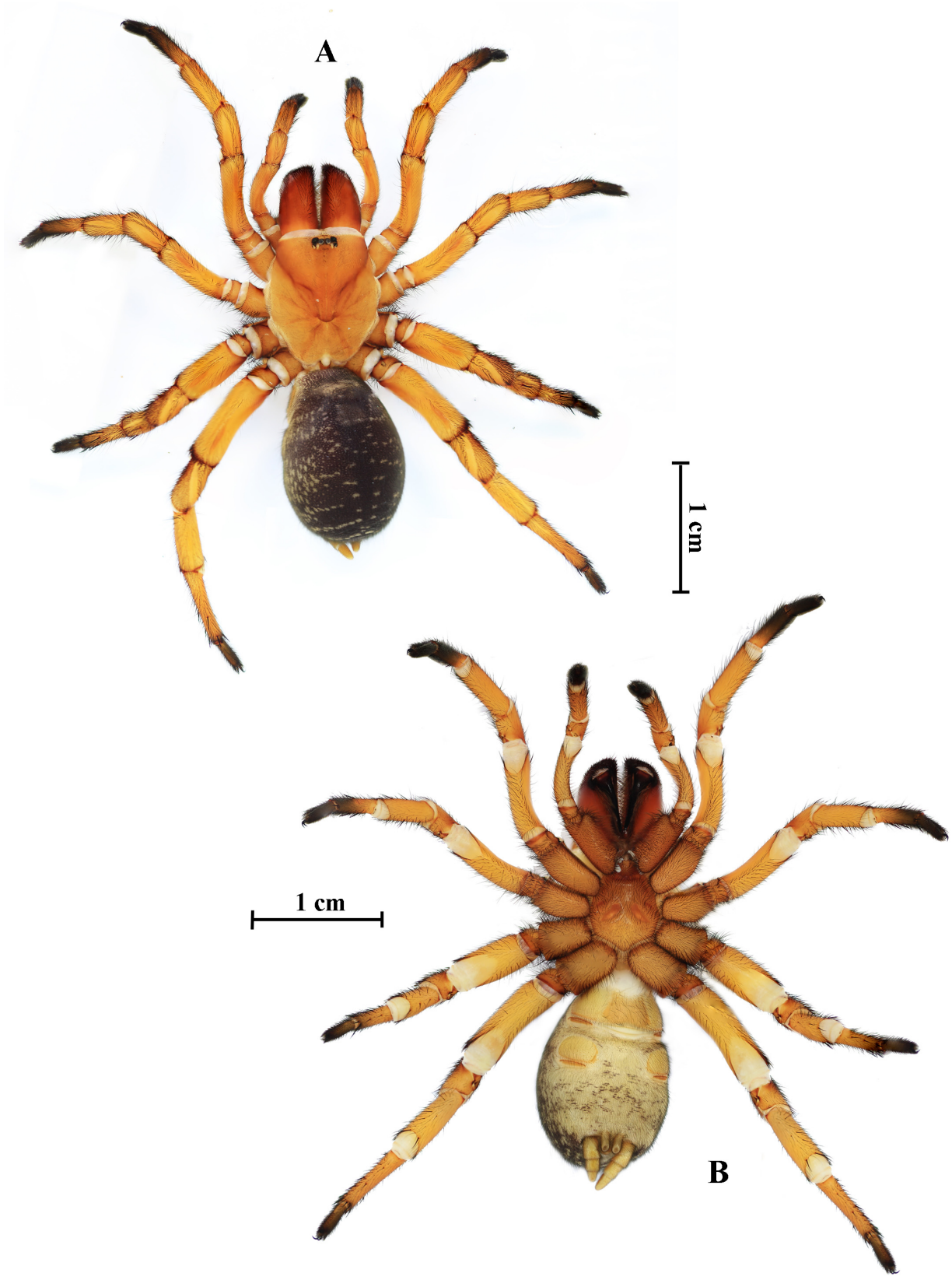

FIGURE 4. *Damarchus inazuma* **sp. nov.** female paratype (ARA–2021–272). **A** dorsal; **B** ventral. Scale bars: 1 cm (**A**, **B**).

TABLE 2. *Damarchus inazuma* **sp. nov.**, paratype female, length of pedipalp and leg segments (N=4).

Segment / Appendage	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Palp	3.92±0.23 (3.60–4.08)	2.28±0.10 (2.16–2.39)	2.37±0.45 (1.92–2.80)		2.13±0.39 (1.84–2.70)	14.12±1.13 (11.70–19.44)
Leg I	5.68±0.68 (5.04–6.64)	3.80±0.15 (3.60–3.92)	3.97±0.51 (1.92–5.60)	3.43±0.47 (2.88–4.00)	2.27±0.43 (1.80–2.80)	19.14±1.99 (20.72–26.70)
Leg II	5.24±0.68 (4.80–6.24)	3.37±0.27 (3.04–3.68)	3.35±0.29 (3.04–3.68)	3.21±0.45 (2.80–3.84)	2.10±0.48 (1.50–2.64)	17.26±1.88 (18.72–24.30)
Leg III	4.74±0.31 (4.56–5.20)	2.88±0.52 (2.40–3.36)	2.46±0.45 (2.04–3.04)	3.48±0.36 (3.04–3.92)	2.00±0.41 (1.60–2.56)	15.55±1.09 (15.42–20.48)
Leg IV	6.26±0.83 (5.64–7.44)	3.77±0.17 (3.60–4.00)	3.96±0.54 (3.24–4.56)	5.50±0.89 (4.80–6.80)	2.54±0.49 (2.08–3.20)	22.01±2.64 (23.20–29.70)

Scopula: entire on palpal tarsus, tarsi I, II, metatarsus I,distal 1/2 of metatarsus II, not divided; absent on tarsi and metatarsi III–IV.

Trichobothria: one zigzag row with 15–18 per row on tarsi I–IV, one row with 5–8 on metatarsi I–IV and two rows of 6–10 on tibiae II, III, IV; None on elsewhere.

Claws: two rows of teeth with 3–4 teeth on outer claws and 1–3 teeth on inner claws.

Spinnerets: PMS: 1.19±0.06 long, 0.53±0.14 diameter, PLS: 1.87±0.63 long, 0.86±0.16 diameter, length of basal, medial, and apical segments 1.63±0.39, 1.08±0.14, 1.24±0.10, respectively; apical segment digitiform.

Spermathecae: Divided into two long spermathecae. Each spermathecae form incurved stalk which narrowed apically. Spermathecal head is mushroom-shaped or semicircled. No secondary receptacles parts (Fig 5A).

Variation: Variation present on spermathecae in size and shape (Figs 5B–C).

Description. Gynandromorph (paratype): Body (Fig 6) length 24.67. Remark: Pedipalp and leg I on the right side of spider are lost.

Color in nature: (right) Carapace, chelicerae, legs covered with white layer (unknown material) and abdomen dark grey with ventral abdomen and spinnerets pale white overall. (left) Carapace, chelicerae, legs are orange and abdomen black. Abdomen covered by pale white spots; ventral abdomen and spinnerets pale white overall (right abdomen darker).

Color in alcohol: (right) Carapace, chelicerae and legs reddish brown. Abdomen dorsally pale gray and covered with pale white spots, ventral abdomen and spinnerets pale white overall. (left) Carapace, chelicerae and legs bright orange. Abdomen dorsally pale gray and covered with pale white spots, ventral abdomen and spinnerets pale white overall (right side of abdomen darker).

Carapace (Fig 7I): (right) 8.45 long, 3.77 wide; (left) 9.10 long, 4.03 wide. Chelicerae (right) 3.00 long, (left) 4.05 long. Eyes (Fig 7J): tubercle with 2 rows on low mound; anterior row procurved; posterior row slightly recurved, almost straight. Eye size and interdistances: (right) AME 0.33, ALE 0.42, PME 0.18, PLE 0.24, AME-ALE 0.15, AME-PME 0.09, AME-PLE 0.24, ALE-PME 0.24, ALE-PLE 0.12, PME-PLE 0 (contiguous), (left) AME 0.45, ALE 0.54, PME 0.29, PLE 0.39, AME-ALE 0.24, AME-PME 0.15, AME-PLE 0.21, ALE-PME 0.21, ALE-PLE 0.18, PME-PLE 0 (contiguous), ALE-ALE 1.26, AME-AME 0.15, PME-PME 0.81, PLE-PLE 1.38. Eye to fovea 6.93. Fovea (Fig 7I): strongly procurved to U-shaped. Three rows of setae on fovea. Rastellum of about ca. 23 robust downward-curved setae on anterior margin of chelicerae. Cheliceral furrow with 9 promarginal teeth in one row, 10 mesobasal denticles. Fang aserrate. Stridulating strikers absent. Labium (Fig 7K): 1.20 long, 0.60 wide, without cuspules. Maxillae (Fig 7K): (right) 3.45 long, 1.35 wide; serrula absent; ca. 45 cuspules each on posterior lobe, absent on heel, (left) 4.10 long, 2.00 wide; serrula absent; ca.70 cuspules each on posterior lobe, absent on heel. Sternum (Fig 7L) 4.08 long, 4.38 wide, posterior and medial sternal sigilla large, not centrally confluent, teardrop-shaped. anterior sigilla small, oval, on anterior margin.

Spination: (right) Palp: tibia p2 v2, tarsus v2. Leg I: metatarsus v5. Leg II: femur p1, patella p1, tibia p2 v2, metatarsus p1 r3 v7. Leg III: patella r2, tibia d6 r2 v6. Leg IV: tibia p3 r2 v6, metatarsus r2 v6. Preening comb

present on retrolateral of distal tibia IV with four spines. Legs (Table 3), formula: unidentified. (left) Palp: tibia p2 v2, tarsus v2. Leg I: metatarsus v5. Leg II: femur p1, patella p1, tibia p2 v2, metatarsus p1 r3 v7. Leg III: patella r2, tibia d6 r2 v6. Leg IV: tibia p3 r2 v6, metatarsus r2 v6. Preening comb on retrolateral of distal metatarsi III, IV with four spines. Legs measurements (Table 3), formula: 4123.

TABLE 3. *Damarchus inazuma* **sp. nov.**, gynandromorph paratype, length of pedipalp and leg segments (NA = not available) (N=1).

Segment / Appendage	Femur		Patella		Tibia		Metatarsus		Tarsus		Total	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Palp	NA	3.90	NA	2.60	NA	3.38			NA	4.29	NA	14.17
Leg I	NA	7.80	NA	4.03	NA	5.20	NA	5.20	NA	3.90	NA	26.13
Leg II	7.67	7.54	4.03	4.16	5.46	4.29	6.50	4.41	3.90	3.25	27.56	23.65
Leg III	6.11	6.11	3.25	3.12	4.16	3.12	6.50	5.07	3.38	2.47	23.40	19.89
Leg IV	8.19	8.84	4.29	4.55	6.50	5.20	9.62	7.80	3.90	3.90	32.50	30.29

Scopula: (right) entire on tarsi II–IV, distal 1/2 on metatarsus II, not divided, absent on metatarsi III–IV (palp and Leg I lost). (left) entire on palpal tursus, tarsi I–IV, metatarsus I, distal 1/2 on metatarsus II, not divided, absent on tarsi and metatarsi III–IV.

Trichobothria: (right) one zigzag row with 12–18 per row on tarsi I–IV. One row with 6–10 on metatarsi I–IV and two rows of 10 on palpal tibia and tibiae I, III. (left) one zigzag row with 15–18 per row on tarsi I–IV, one row with 5–8 on metatarsi I–IV and two rows of 6–10 on tibiae II, III, IV; None on elsewhere.

Claws: (right) S–shaped row of teeth with 10 teeth per row on paired claws Leg II–IV. (left) two rows of teeth with 3–4 teeth on outer claw and 1–3 teeth on all claws.

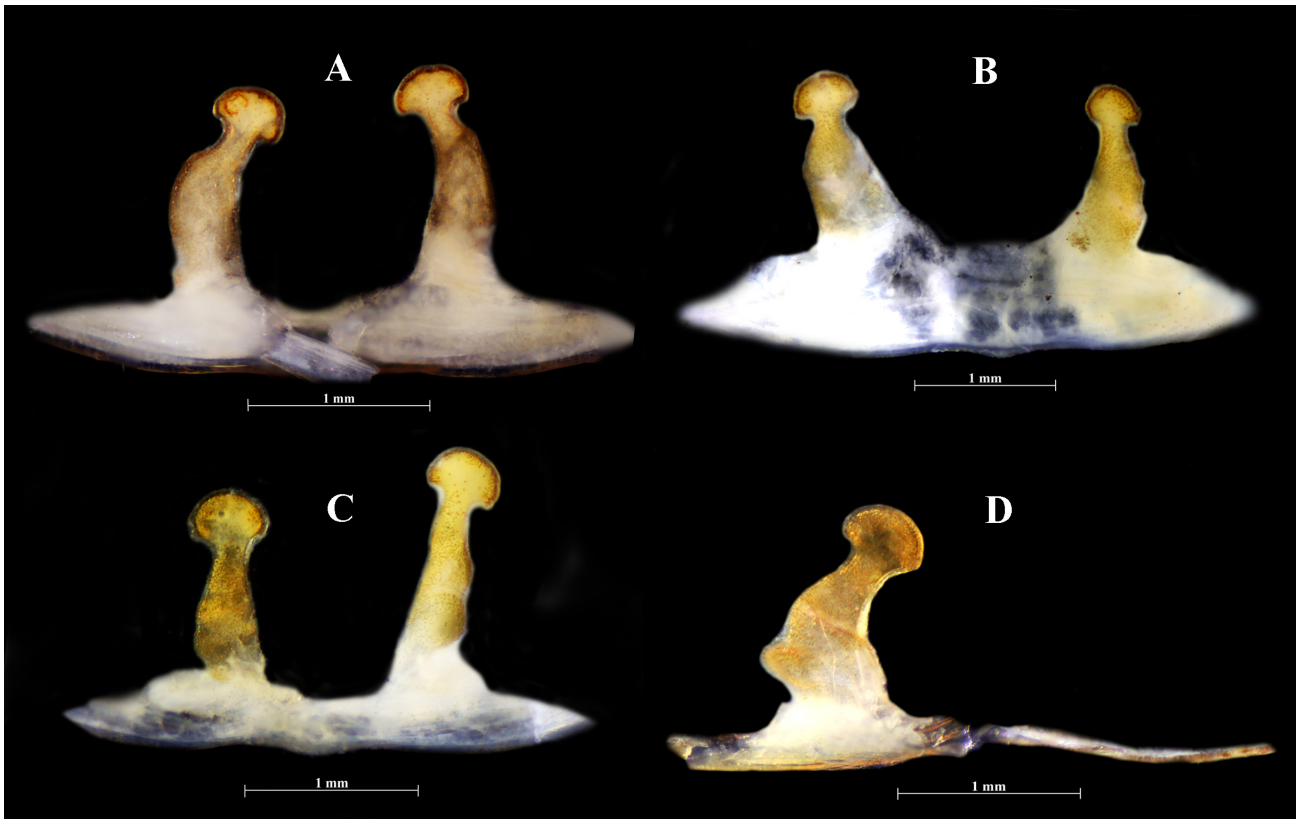

FIGURE 5. Spermathecae of *Damarchus inazuma* **sp. nov.** paratype. **A** ARA–2021–272; **B** ARA–2021–269; **C** ARA–2021–268; **D** ARA–2021–273 (gynandromorph). Scale bars: 1 mm (**A**, **B**, **C**, **D**).

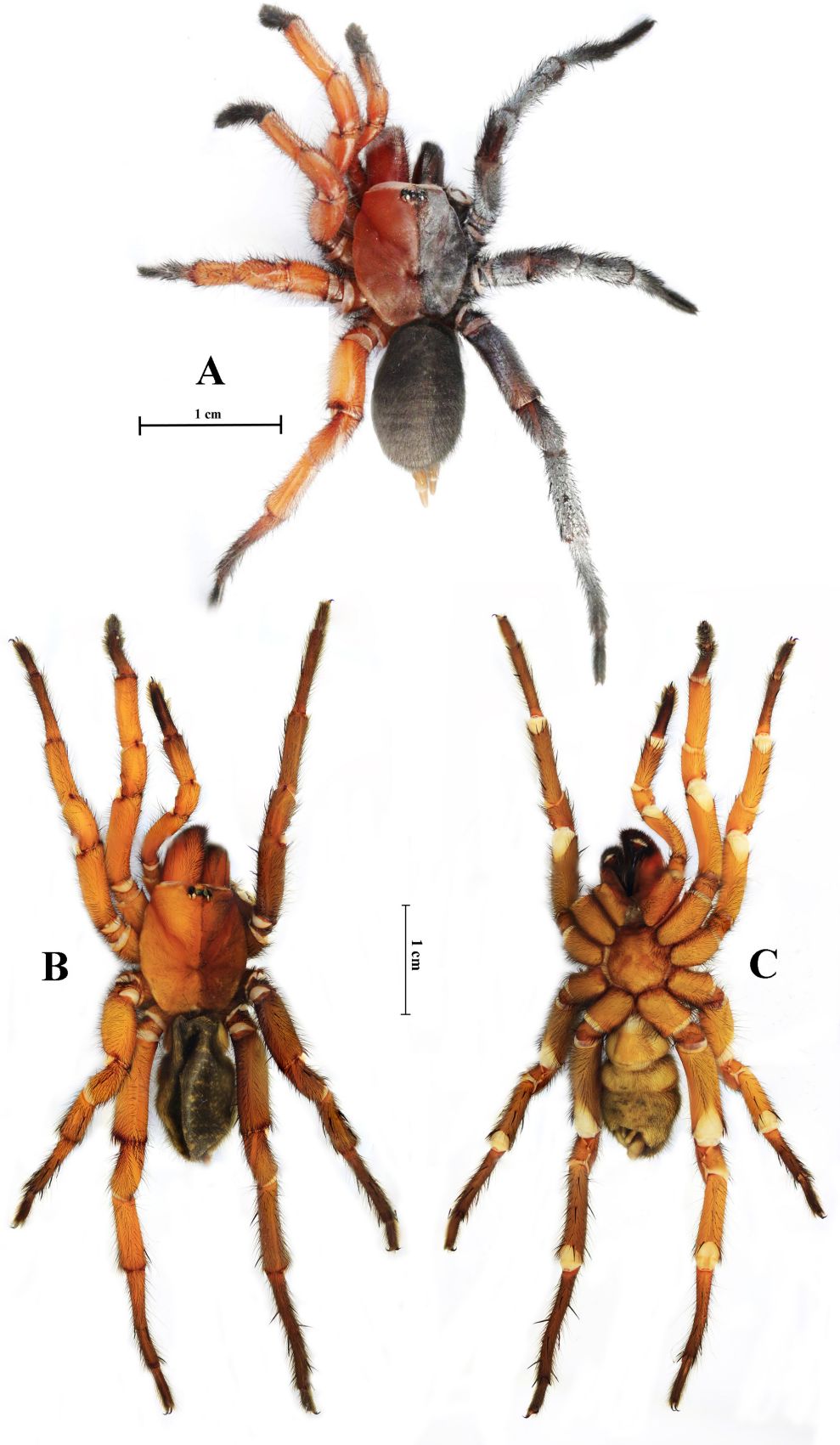

FIGURE 6. *Damarchus inazuma* **sp. nov.** gynandromorph (ARA–2021–273). **A** dorsal habitus (live); **B** dorsal habitus (preserved); **C** ventral habitus (preserved). Scale bars: 1 cm (**A**, **B**, **C**).

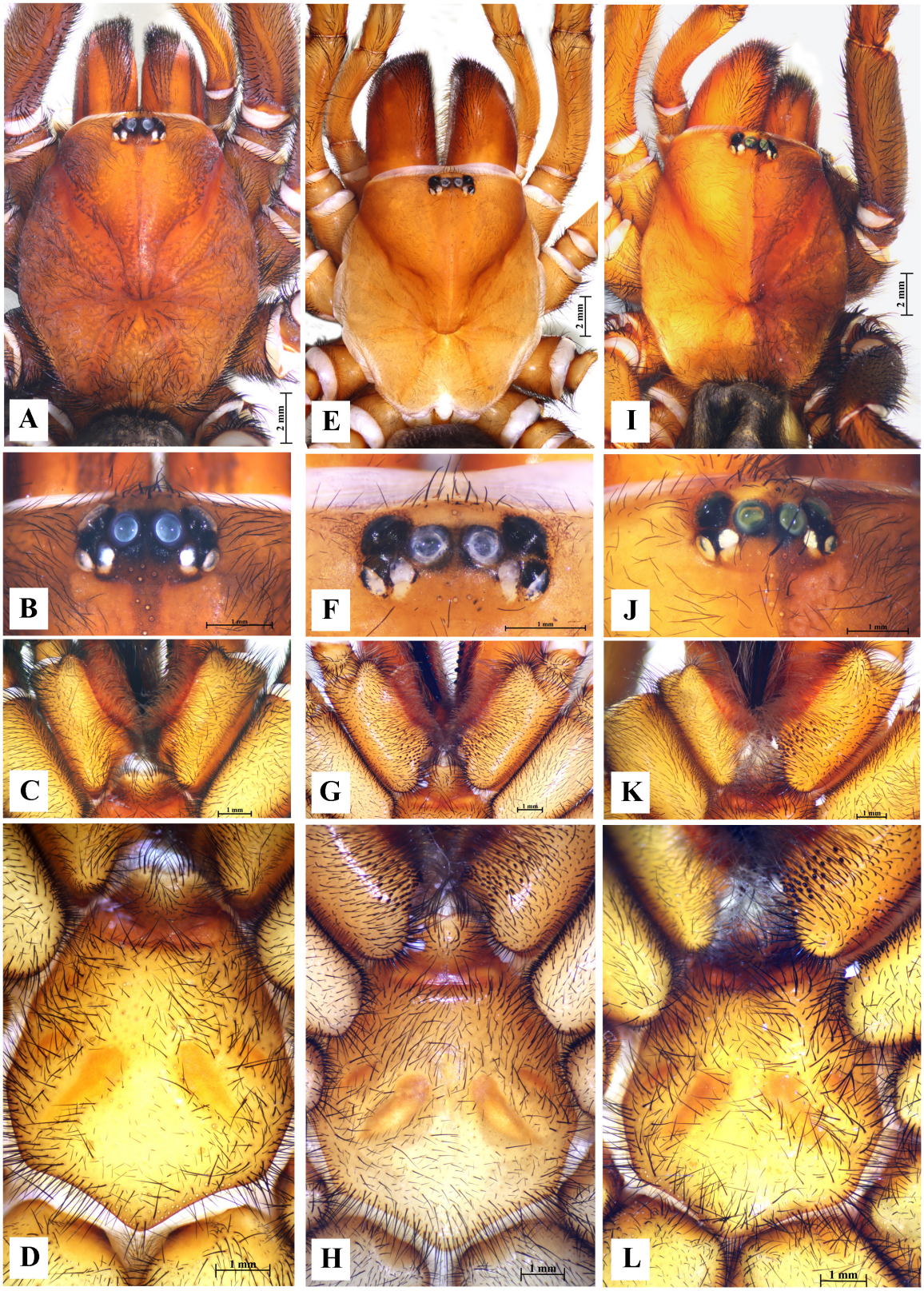

FIGURE 7. Carapace, eye tubercle, Maxillae and sternum of *Damarchus inazuma* **sp. nov. A–D** holotype (ARA–2021–271); **E–H** female paratype (ARA–2021–272); **I–L** gynandromorph (ARA–2021–273); **A, E, I** carapace; **B, F, J** eyes; **C, G, K** Maxillae; **D, H, L** sternum. Scale bars: 2 mm (**A**, **E**, **I**); 1 mm (**B**, **C**, **D**, **F**, **G**, **H**, **J**, **K**, **L**).

Spinnerets: (right) PMS: 1.00 long, 0.32 diameter, PLS: 2.52 long, 1.36 diameter, length of basal, medial, and apical segments 0.80, 0.80, 0.92; apical segment digitiform. (left) PMS: 1.20 long, 0.52 diameter, PLS: 3.40 long, 1.60 diameter, length of basal, medial, and apical segments 1.12, 1.08, 1.20; apical segment digitiform.

Spermathecae: Present only on the left side (Fig 5D). Similar to paratype spermathecae but more incurved of spermathecal stalk. (see Fig 5A–C).

Variation: No bilaterally symmetrical. Male characters present on right side and female characters present on left side.

Discussion

Taxonomy ambiguity of *Damarchus*

According to recent records in World Spider Catalog (2025), the genus *Damarchus* is assigned to the family Bemmeridae. Previously associated with the subfamily Bemmerinae of Nemesiidae, which included *Atmetochilus*, *Damarchus*, *Pionothele*, and *Spiroctenus* (Raven, 1985), this classification was revised in 2020. Opatova *et al*. (2020) studied phylogenomics of mygalomorph relationships and identified *Homostola* and *Spiroctenus* as representatives of the subfamily, forming a monophyletic clade characterized by shared morphological traits. Consequently, it was concluded that Bemmerinae should be elevated to family status, comprising only *Homostola* and *Spiroctenus*. The inclusion of *Atmetochilus* and *Damarchus* within Bemmerinae was noted by Raven (1985) and Kunsete *et al*. (2020), who classified them under Nemesiidae at that time. Thus, with the revision of subfamilial change, *Damarchus* and similar genera were subsequently assigned to Bemmeridae (World Spider Catalog, 2022), while *Pionothele* was reclassified under Pycnothelidae. However, in 2022, *Atmetochilus* and *Damarchus* were placed into *Incertae Sedis*, indicating that they could not be assigned to any known family (Montes de Oca, 2022). Recently, three new species of *Damarchus* from Thailand have been described within the family Bemmeridae (Schwendinger & Hongpadharakiree, 2023). Accordingly, in light of current research, *D. inazuma* **sp. nov.** is classified within Bemmeridae. Although *Damarchus* is categorized under this family, its classification remains unconfirmed by comprehensive molecular data.

Similarity of coupling spur across genera in Bemmeridae

The coupling spur of *D. inazuma* **sp. nov.** exhibits distinctive characteristics that set it apart from nearly all described species in the family Bemmeridae, with the exception of *D. dao*. Notably, it features three apical megaspines on the coupling spur, a trait reminiscent of *Atmetochilus songsangchotei*. However, upon examining the descriptions of closely related families, including Barychelidae and Theraphosidae (Opatova *et al*. 2020), reveals morphological similarities in the coupling spur among various closely related genera, such as *Synothele*/*Ozicrypta* (Raven, 1994, figs 96G, 131K) and *Stichoplastoris*/*Aphonopelma* (Schmidt, 2003, fig 82; Hamilton, Hendrixson and Bond, 2016, fig 89I). These shared features in the coupling spur may indicate a potential close phylogenetic relationship between *Damarchus* and *Atmetochilus*.

Confirmation of gynandromorphism in a specimen of *D. inazuma* sp. nov.

Most spider species exhibit sexual dimorphism, characterized by morphological differences between the sexes. Variations between sexes typically manifest in color patterns, size, and external features. To confirm the presence of gynandromorphism, traits of both sexes, such as genitalia, must be present within the same individual, usually displaying bilateral asymmetry. In the family Bemmeridae, a notable distinguishing characteristic between sexes is the pattern of teeth on the tarsal claw, where an S-shaped row of teeth is evident in males and two pairs of teeth are present in females (Raven, 1985).

In this study, we demonstrate that *D. inazuma* **sp. nov.** exhibits sexual dimorphism, including differences in body coloration (females display a reddish-brown body, while males are white), tarsal claw morphology (an S-

shaped row of teeth in males compared to two pairs in females), and maxillary cuspules (tiny cuspules in males and typical cuspules in females). Among our specimens, we identified one gynandromorphic individual (ARA–2021–273) that displays characteristics of the two sexes on either side (see Table 4), with the spermathecae present solely on the female side (Fig 5D). Unfortunately, the right palpal appendages, which should contain male bulb, were lost, likely due to accidental damage during excavation, thus preventing further description of male traits. Nevertheless, the presence of sex-specific characteristics divided by bilateral asymmetry aligns with the features reported in other gynandromorphic mygalomorphs (Labordal & Pérez-Miles, 2017; Sherwood, 2020). We conclude that ARA–2021–273 represents a gynandromorph of *D. inazuma* **sp. nov.**

TABLE 4. Sexual dimorphic characteristics in *D. inazuma* (including a gynandromorph).

Characters	Male (holotype)	Female (paratype)	Gynandromorph (paratype)	
			right	left
S–shape row of teeth	present	absent	present	absent
Pair teeth	absent	present	absent	present
Maxillae cuspule normal	absent	present	absent	present
Maxillae cuspule tiny	present	absent	present	absent
Carapace color (live)	white	orange	white	orange
Carapace color (dead)	reddish brown	bright orange	reddish brown	bright orange
Sex conclusion	male	female	male	female

Record of gynandromorph in mygalomorph

Gynandromorphy is a rare phenomenon observed in the animal kingdom. While numerous instances have been documented in araneomorph spiders, occurrences within mygalomorphs are relatively infrequent, and no reports exist for the Mesothelae. The first formally documented case of gynandromorphism in mygalomorphs was noted in *Pterinochilus murinus* Pocock, 1897 in 2017: it exhibited bilateral asymmetry and featured half spermathecae, similar to the characteristics observed in our specimen. Additionally, the male genitalia displayed the typical morphology of the species. However, during a subsequent molt four months later, abnormalities were noted in the male palpal organ, while the coupling spur retained a normal appearance (Labordal & Pérez-Miles, 2017). A second instance of gynandromorphy was identified in the exuviae of *Theraphosa blondi* (Latreille, 1804) in 2020, characterized by a partially developed palpal bulb on the left side and half spermathecae on the right (Sherwood, 2020).

Based on reported cases, it can be inferred that our specimen of gynandromorph corresponds similarly to the first case described, characterized by bilateral asymmetry and the manifestation of both sexes on opposite sides. However, the definitive cause of this gynandromorphism remains uncertain. Kaston (1961) suggested that gynandromorphism may arise from the loss of two or more sexual X chromosomes (a chromosomal disorder) in the female zygote, potentially induced by various natural factors, including nematode infections (Roberts, 1973).

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