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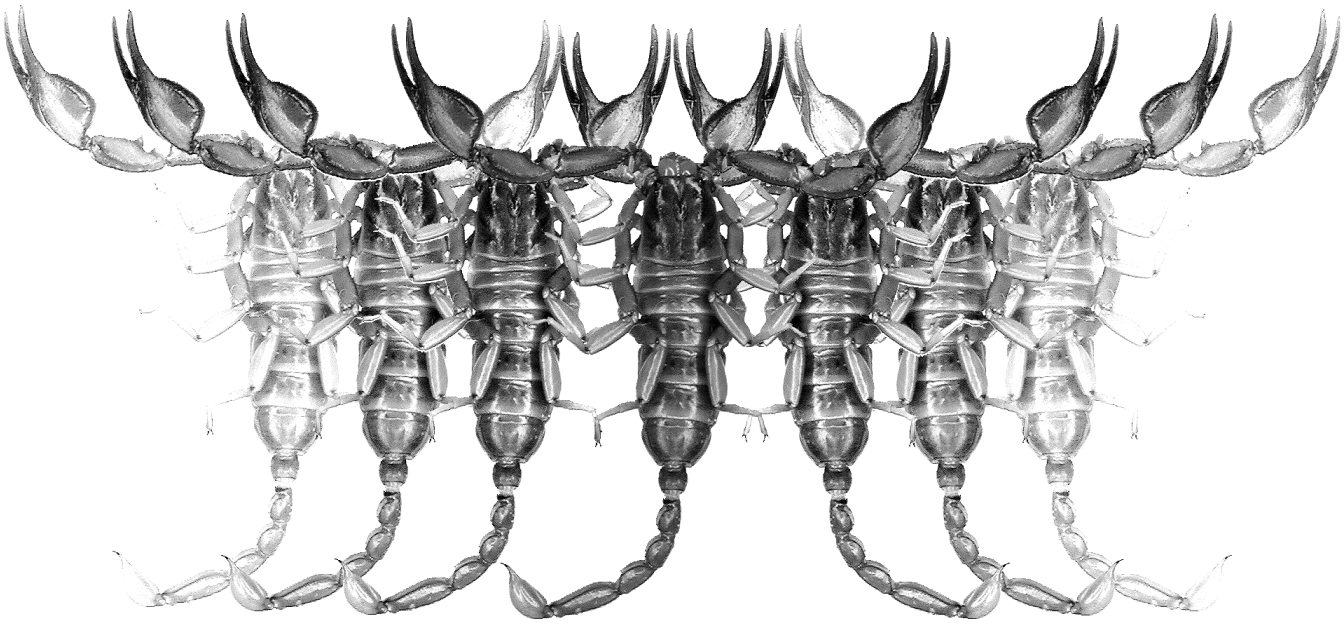

The Scorpions of Hainan Island, China (Arachnida: Scorpiones)

Zhi-Yong Di, Zhi-Jian Cao, Ying-Liang Wu, Lin Zhu, Hui Liu & Wen-Xin Li

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- **NTNU**, Norwegian University of Science and Technology, Trondheim, Norway
- **OUMNH**, Oxford University Museum of Natural History, Oxford, UK
- **NEV**, Library Netherlands Entomological Society, Amsterdam, Netherlands

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The scorpions of Hainan Island, China (Arachnida: Scorpiones)

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Summary

The redescriptions and illustrations of three species, *Isometrus* (*Isometrus*) *maculatus* (DeGeer, 1778), *Lychas mucronatus* (Fabricius, 1798) (Buthidae), and *Liocheles australasiae* (Fabricius, 1775) (Hemiscorpiidae) from Hainan Island, China are presented. Distribution data and updated key of Hainan scorpions are provided.

Introduction

Hainan Island is located at the northern margin of tropical zone. With area of about 33,210 km^2 (18°10'–20°10'N, 108°37'–111°03'E), it is the second largest of the Chinese islands. Hainan Island is separated from Leizhou Peninsula by Qiongzhou Strait, facing Vietnam to the west, Hongkong and Taiwan to the east, Philippines to the southeast, and Malaysia, Indonesia, and Singapore to the south. It has tropical monsoon climate, with constant high temperature, and abundant rainfall; wet, dry, and rainy seasons are distinct. The average annual temperature is 22–26°C. Hainan's weather is like spring all the year round, with a long summer and no winter. The plant communities are complex in Hainan Island. The middle of the island is high while the rest is low: the Five Fingers Mountain (Wuzhi Shan) and the Parrot Mountain (Yingge Ling) range is the central part, gradually descending outwards. Mountains and rugged hills make up 38.7% of the whole island, and are the main feature of Hainan Island's geography.

There are five scorpion species recorded in Hainan Island belonging to four genera of two families: Buthidae (*Isometrus*, *Lychas*, *Mesobuthus*) and Hemiscorpiidae (*Liocheles*). We did not find *I. (R) hainanensis* and *M. martensii hainanensis* in our study; maybe they are very rare; at the same time, we query the authenticity of the latter. Takashima (1951) suggested that *Heterometrus petersii* and *H. longimanus* (Scorpionidae) were found in Hainan but did not study any specimens of these species from this island. We did not find any species of genus *Heterometrus* in Hainan Island. The redescriptions of *I. maculatus*, *L. mucronatus*, and *L. australasiae*, based on Hainan specimens, are provided as additional information for their identification.

Material and Methods

Illustrations and measurements are produced using a Motic K-700L stereomicroscope with an Abbe drawing device and an ocular micrometer. Measurements (in mm) follow Sissom et al. (1990). Trichobothrial notation follows Vachon (1974) and morphological terminology mostly follows Hjelle (1990). Terminology of metasomal carination follows Vachon (1952), and terminology of pedipalp chelal carinae follows Prendini (2000) and Soleglad & Sissom (2001). Specimens are deposited in the Museum of Wuhan University, Wuhan, China (MWHU), and Biological specimens Herbarium of Dali College, Yunnan, China (BHDC). Other abbreviations of collections: MHBU: Museum of the College of Life Sciences, Hebei University, Baoding, China; MNHN: Muséum National d'Histoire Naturelle, Paris, France.

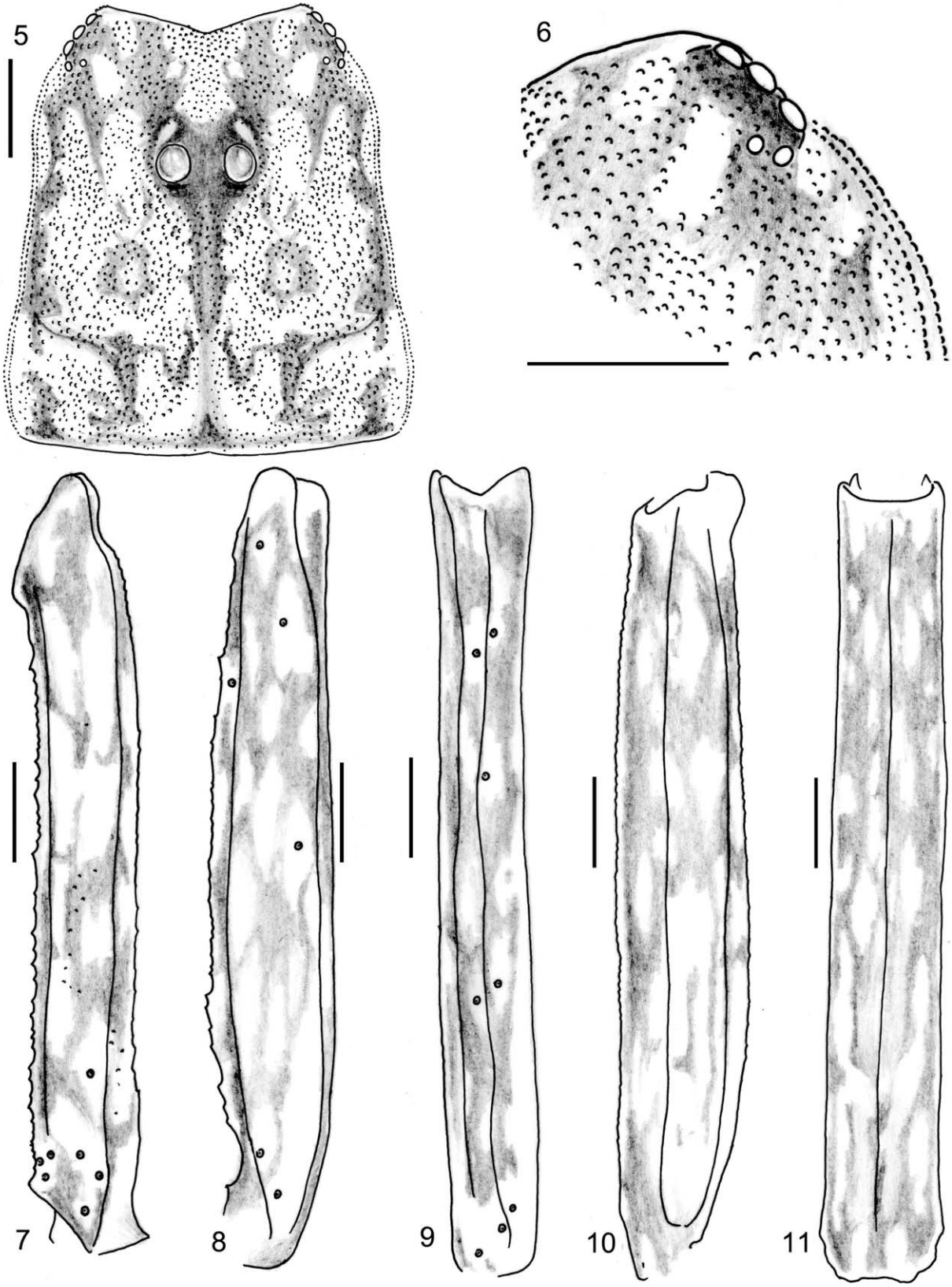
Systematics

Family **Buthidae** C. L. Koch, 1837

Genus ***Isometrus*** Ehrenberg, 1828

Isometrus: Thorell, 1876: 8; Tikader & Bastawade, 1983: 254; Sissom, 1990: 101; Fet & Lowe, 2000: 146; Kovařík, 2001: 41; Kovařík, 2003: 1–2; Lourenço, 2005: 57.

Figures 1–4: Habitus of *Isometrus maculatus*. **1–2.** Male (Ar.-MWHU-HNLS0701), dorsal and ventral views. **3–4.** Female (Ar.-MWHU-HNSY0701), dorsal and ventral views. Scale bars: 10.0 mm.



Figures 5–11: *Isometrus maculatus*. Male (Ar.-MWHU-HNLS0701). **5.** Carapace. **6.** Lateral eyes. **7.** Femur dorsal aspect. **8–9.** Patella dorsal and external aspects. **10–11.** Metasomal segment V, lateral and ventral aspects. Scale bars: 1.0 mm.

Type species: *Scorpio maculatus* DeGeer, 1778
Diagnosis: See Kovařík (2003).

Subgenus ***Isometrus*** Ehrenberg, 1829

Isometrus (*Isometrus*): Fet & Lowe, 2000: 146; Kovařík, 2003: 2.
Isometrus (*Raddyanus*): Tikader & Bastawade, 1983: 254 (in part).
= *Isometrus* (*Closotrichus*) Tikader & Bastawade, 1983: 311 (syn. by Kovařík, 1994: 201).

Type species: *Scorpio maculatus* DeGeer, 1778
Diagnosis: See Kovařík (2003).

Isometrus* (*Isometrus*) *maculatus (DeGeer, 1778)
(Figures 1–29; Tables 1–2)

Isometrus maculatus: Thorell, 1876: 8; Vachon, 1982: 90; Kovařík, 1997: 362.
Isometrus (*Isometrus*) *maculatus*: Vachon, 1972: 177; Vachon, 1976: 38; Kovařík, 1994: 197; Kovařík, 1995: 187; Kovařík, 1997: 8; Fet & Lowe, 2000: 147; Kovařík, 2003: 2–4.
Isometrus (*Isometrus*) *madagassus*: Vachon, 1972: 177; Vachon, 1976: 38; Vachon, 1982: 90; Kovařík, 1994: 202.
Isometrus (*Raddyanus*) *europaeus*: Tikader & Bastawade, 1983: 286.

Type locality and type repository: "Suriname and Pennsylvania"; NHRS.

Material examined: Hainan: Lingshui District, IV/2007, Hui Liu and Yi-Bao Ma leg., 24 adult and 5 immature males, 41 adult females (MWHU, Ar.-MWHU -HNLS0701–70); Sanya, VIII/2006, Hui Liu and Ying-Liang Wu leg., 5 adult females, 1 juvenile (MWHU, Ar.-MWHU-HNSY0601–06).

Diagnosis: Moderate to large size, measuring up to 60 mm in adult male and about 50 mm in adult females. General coloration yellowish to pale yellow with symmetrical blackish-brown patterns in both adults and juveniles. Carinae and granulations moderately marked. Carapace strongly emarginate, with an open V-shaped angle. Pectines moderately long; pectinal tooth count 16–19 in both sexes. Dentate margins of fixed and movable fingers of pedipalp chela with 7 almost linear rows of granules. Trichobothrium *db* on chela of pedipalp situated between trichobothria *dt* and *et*. Subaculear tubercle strongly developed and triangular, with two ventral granules.

Relationships: In its general morphology and coloration, *Isometrus* (*Isometrus*) *maculatus* resembles *Isometrus* (*Reddyanus*) *hainanensis*, described from Southeast region in Hainan Island. It can be distinguished from the latter species by the following characters: (i) trichobothrium *db* on chela of pedipalp situated between trichobothria *dt* and *et*, while in *I.* (*R.*) *hainanensis* it is situated between trichobothria e*t* and *est*; (ii) subaculear tubercle with two ventral granules, while in *I.* (*R.*) *hainanensis* subaculear tubercle has five ventral granules; and (iii) the total length of adult males about 60 mm and 50 mm in adult females, while in *I.* (*R.*) *hainanensis* it is about 50–55 mm and 30–35 mm, respectively.

Description: Based on male specimens from Lingshui District (Hainan Island).

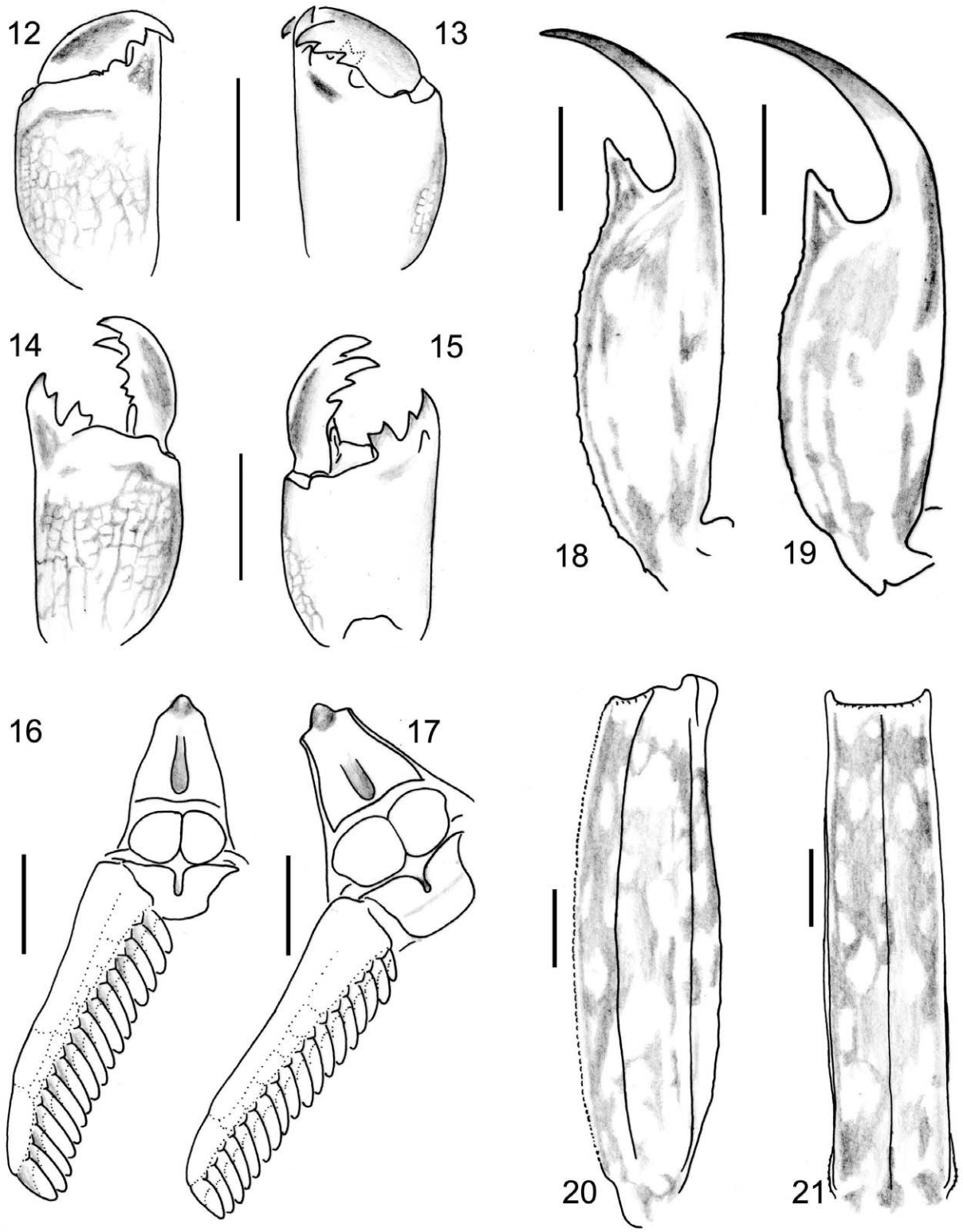
Coloration: Generally yellowish to pale yellow. Prosoma: Carapace yellowish with blackish-brown patterns; eyes surrounded by black pigment (Figs. 1, 5, 6). Mesosoma: Tergites yellowish with symmetrical blackish-brown stripes; Sternum, genital operculum, sternites III–VI, pectines yellowish, sternites III–VII yellowish with symmetrical brown patterns. Metasomal segments pale yellow, with some diffuse, brownish spots. Vesicle pale yellow; aculeus yellowish at base and reddish-brown at tip. Chelicerae pale yellow with brownish variegated spots; base of fingers pale yellow, rest of fingers blackish-brown, teeth reddish. Pedipalps pale yellow with brownish spots; chela fingers reddish-brown; rows of granules on dentate margins of fingers dark reddish. Legs yellowish with diffuse spots.

Prosoma: Tegument coarse. Surface of carapace coarsely granular with a few smooth patches. Anterior margin of carapace strongly emarginate, with an open V-shaped angle. Carapace carinae weakly developed. Median ocular tubercle anterior to the centre of the carapace with granules; median eyes separated by one ocular diameter. Three pairs of lateral eyes present on anterior-lateral portion with granular lateral ocular tubercles (some specimens with two eyespot pairs dorso-posteriorly and posteriorly respectively, see in Figs. 5–6).

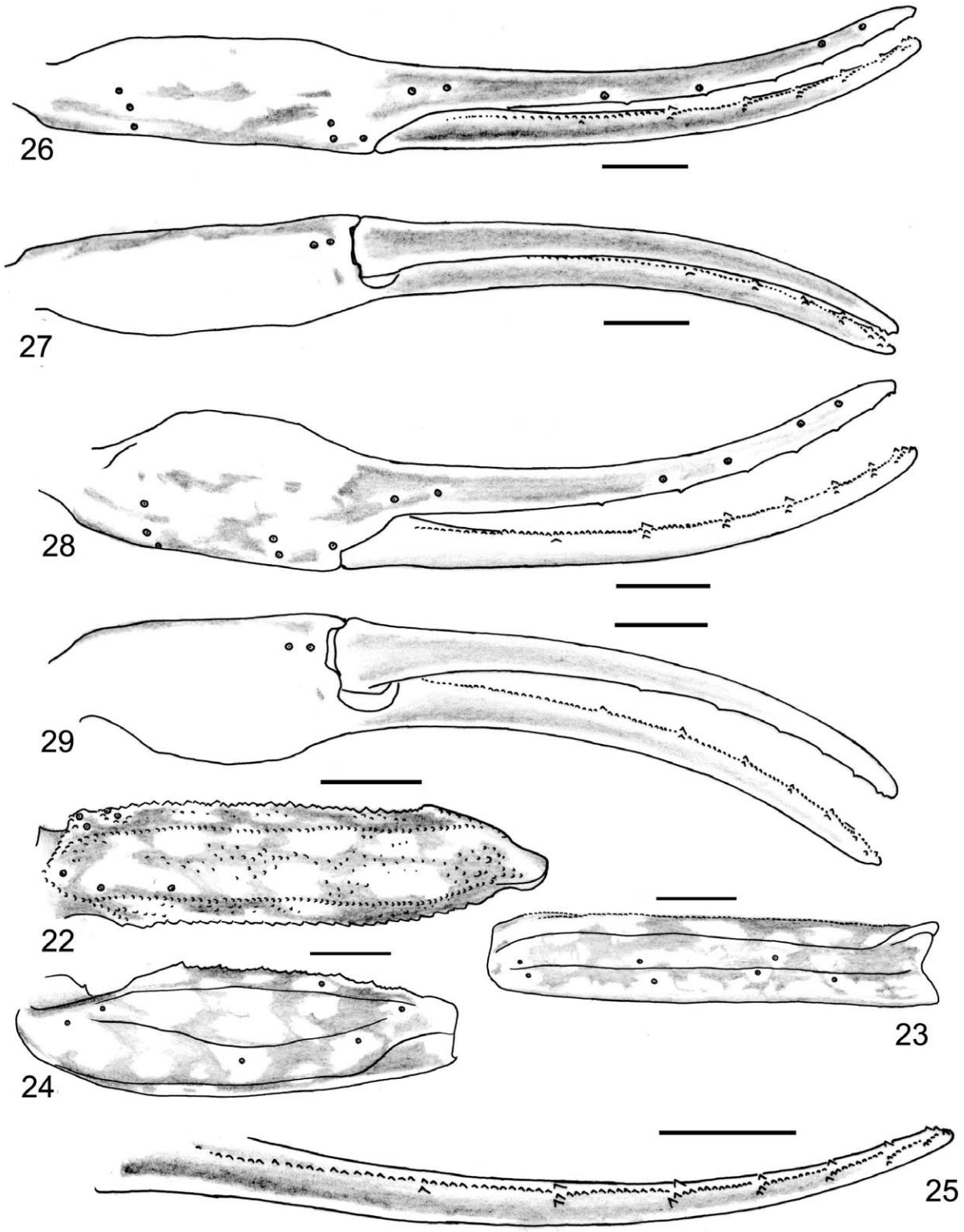
Mesosoma: Tegument coarse. Tergites I–VI with a median carina; weak on I, weak to moderate on II–VI. Tergite VII with two lateral pairs of carinae moderate to strong; median carinae present in proximal half, moderately developed. Intercarinal spaces moderately granular. Sternum pentagonal with a genital operculum subtriangular. Sternites smooth and shiny. Pectines moderately long, tooth count 16–17 in the male, fulcra marked (Fig. 16). Sternites III to VI smooth; VII with four granular carinae.

Metasoma: Tegument coarse with few granules. Segments I and II with 10 carinae, crenulate; III–IV with 8 carinae, crenulate. Segment V with five carinae. Dorsal furrows of all segments developed, smooth; intercarinal spaces very weakly granular to smooth. Telson very weakly granular, almost smooth with one vestigial ventral carina; subaculear tubercle marked and triangular, with 2 granules on the ventral surface.

Pedipalps: Tegument almost smooth. Femora with all carinae marked crenulate, intercarinal spaces without



Figures 12–21: *Isometrus maculatus*. Male (Ar.-MWHU-HNLS0701): **12–13.** Chelicera, dorsal and ventral aspects. **16.** Sternum, genital operculum and pectines. **18.** Telson, lateral aspect. Female (Ar.-MWHU-HNSY0701): **14–15.** Chelicera, dorsal and ventral aspects. **17.** Sternum, genital operculum and pectines. **19.** Telson, lateral aspect. **20–21.** Metasomal segment V, lateral and ventral aspects. Scale bars: 1.0 mm.



Figures 22–29: *Isometrus maculatus*. Male (Ar.-MWHU-HNLS0701): **25.** Dentate margin of movable finger, showing rows of granules. **26–27.** Chela, dorsal and ventral aspects. Female (Ar.-MWHU-HNSY0701): **22.** Femur dorsal aspect. **23–24.** Patella external and dorsal aspects. **28–29.** Chela dorsal and ventral aspects. Scale bars: 1.0 mm.

granules in ventral aspect and other aspects with few granules. Patella with seven crenulate carinae. Chela with obsolete carinae. Dentate margins on fixed and movable fingers composed of six linear rows of granules (Fig. 25). Trichobothrial pattern type A, orthobothriotaxic (Figs. 26, 27). For the position and distribution of trichobothria of the femur, patella and chela of pedipalps see Figs. 7–9, 22–24, 26–29.

Chelicerae: Tegument smooth. Tibiae with reticulated pattern, with dentition characteristic of buthids (Figs. 12, 13); two small basal teeth on dorsal aspect of movable finger.

Legs: Tegument smooth except dorsal aspect of femora with granules. Femora with 2 granular carinae in internal aspect, 2 granular carinae in external aspect and 1 granular carina in dorsal aspect. Patellae with 1 dentate carina in internal, 1 granular carina in dorsal aspect and 3 granular carinae in dorsal aspect. Tibiae with few setae, without spurs. Basitarsi with some setae and two lateral pedal spurs. Tarsi ventrally with two rows of short setae. Tarsal ungues curved and hook-like.

Variation: Females coloration very similar to males. Sexual dimorphism: females differ from males (Figs. 3–4, 19–21, 22–26) in having bigger mesosoma, shorter pedipalps and metasoma. Measurements, see Table 1. Pectinal tooth counts, see Table 2.

Habitat: Under stones or bark.

Distribution: See Fet & Lowe (2000).

Subgenus ***Reddyanus*** Vachon, 1972

Isometrus (*Reddyanus*) Vachon, 1972: 177; Vachon, 1976: 38; Vachon, 1982: 90; Kovařík, 1994: 202; Fet & Lowe, 2000: 150.
Isometrus (*Raddyanus*): Tikader & Bastawade, 1983: 255 (in part).

Type species: *Isometrus acanthurus* Pocock, 1899 (see Fet & Lowe, 2000: 150)

Diagnosis: See Kovařík (2003)

Isometrus* (*Reddyanus*) *hainanensis Lourenço, Qi et Zhu, 2005
(Figures 30–47)

Isometrus (*Reddyanus*) *hainanensis* Lourenço, Qi & Zhu, 2005: 57–63.

Type material: 1 male holotype, 1 female paratype. China, Hainan Island, Southeast region, 24/XI/1931 (collector unknown). L. Fage det. as *Isometrus vittatus* Pocock. Deposited in the Muséum national d'Histoire naturelle, Paris (MNHN, RS-1175).

Diagnosis and relationships: See Lourenço, Qi & Zhu, 2005.

Description, illustration, variation, and measurements: See Lourenço, Qi & Zhu, 2005.

Habitat: Under stones, under the bark of trees, or in the soil gaps.

Distribution: China (Hainan).

Genus ***Lychas*** C. L. Koch, 1845

Lychas: Tikader & Bastawade, 1983: 40; Kovařík, 1997: 312–314.

Type species: *Lychas scutilus* C.L. Koch, 1845.

Diagnosis: See Kovařík (1997).

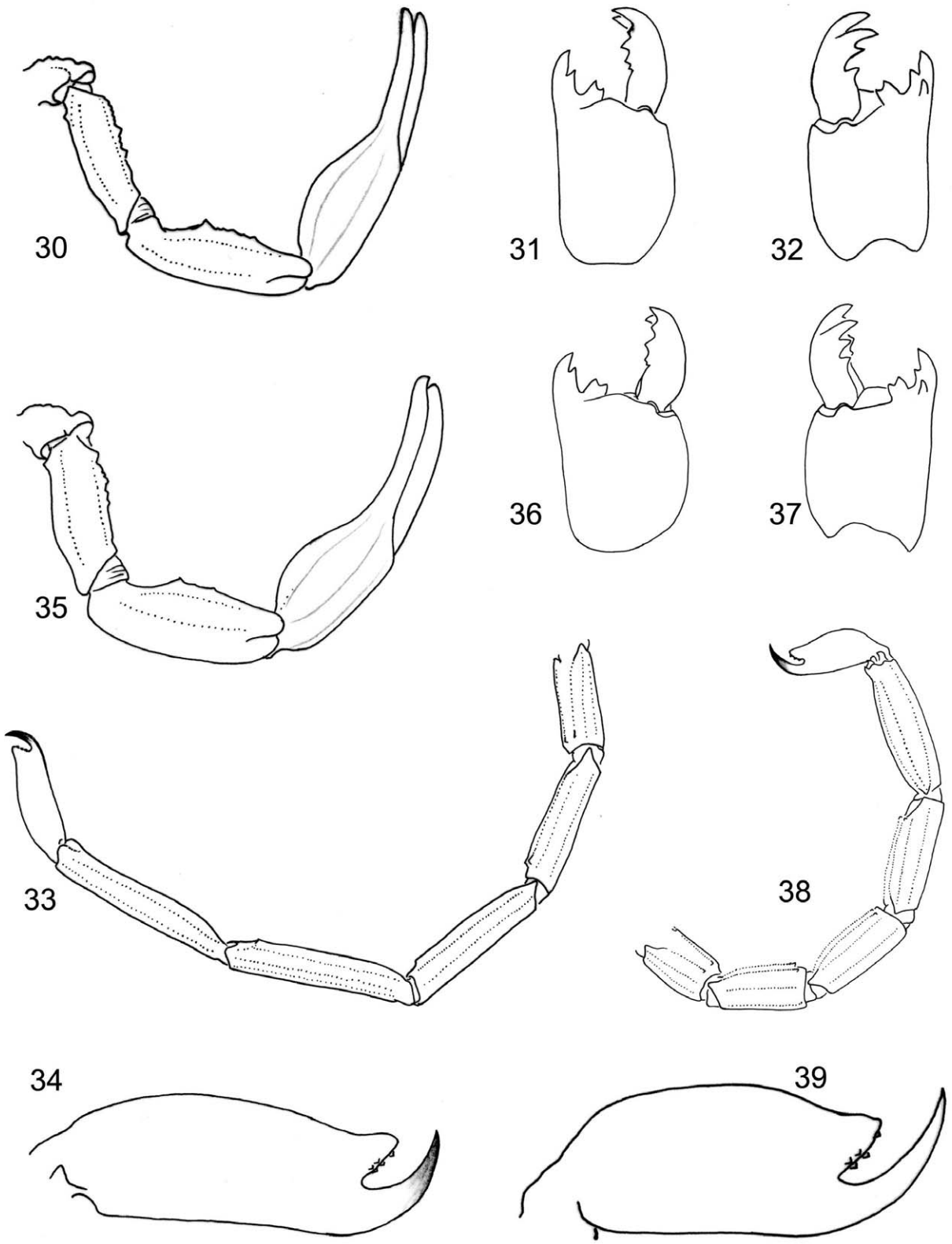
***Lychas mucronatus* (Fabricius, 1798)**
(Figures 48–69, 90; Tables 1–2)

Lychas mucronatus: Pocock, 1900: 36–37; Kovařík, 1997: 341–344, figs. 10, 12, 29, 31, 80–82, 93, 98; Fet & Lowe, 2000: 164, 165.

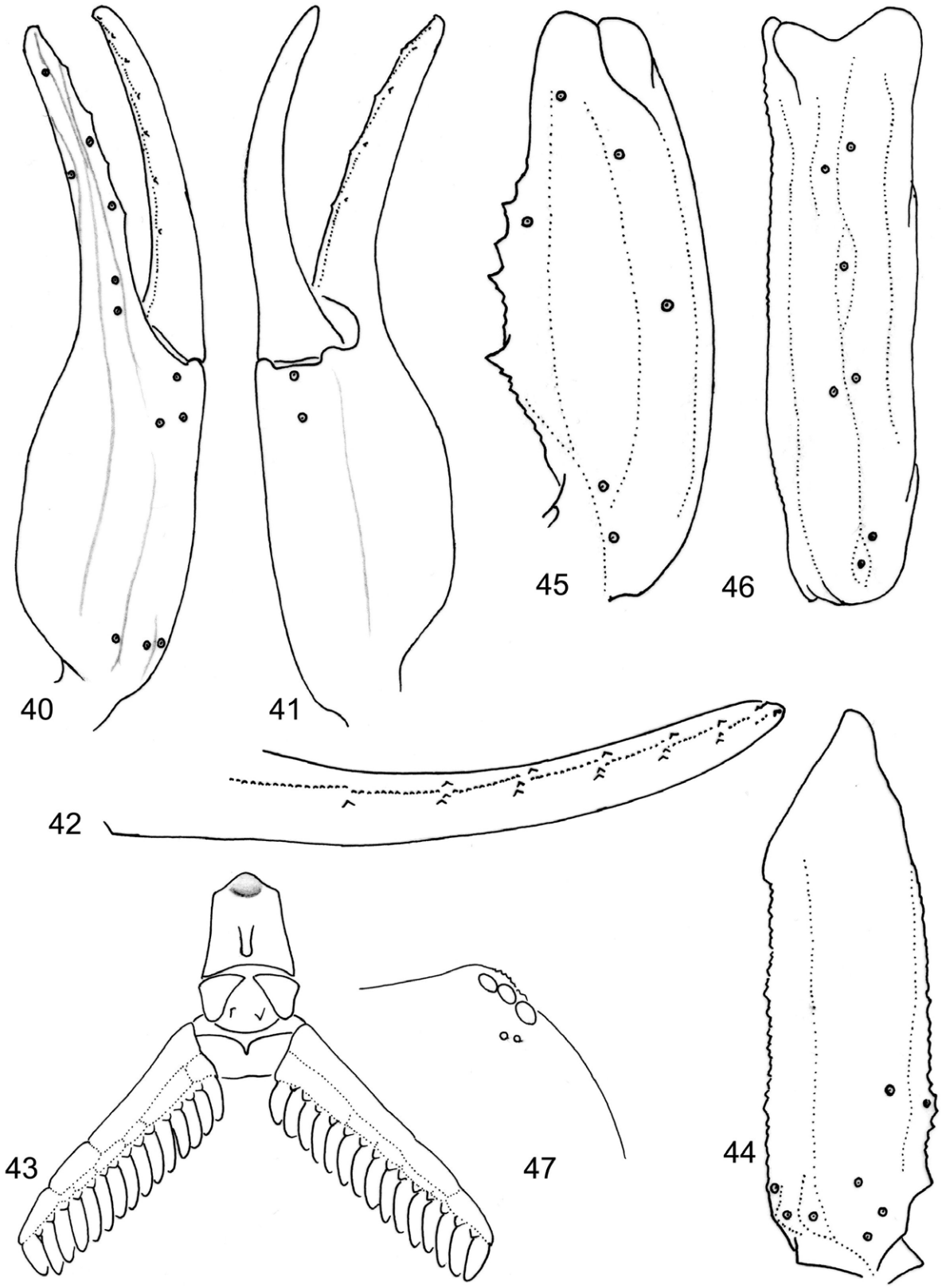
Type locality: "India oriental", UZMD.

Material examined: Hainan: Dongfang District, VIII/2006, Hui Liu and Ying-Liang Wu leg., 2 adult males, 7 adult and 1 immature females (MWHU, Ar.-MWHU-HNDF0601–10); Ling-Shui District , IV/2007, Hui Liu and Yi-Bao Ma leg., 6 adult males, 4 adult females (MWHU, Ar.-MWHU-HNLS0771–80); Ledong District, VIII/2006, Hui Liu and Ying-Liang Wu leg., 1 adult and 1 immature males, 2 adult and 2 immature females (MWHU, Ar.-MWHU-HNLD0601–06); Baoting District, Shenling Tsown, VIII/2006, Hui Liu and Ying-Liang Wu leg., 2 adult males, 13 adult females (MWHU, Ar.-MWHU-HNSL0601–15); Baoting District, Nanlin town, VIII/2006, Hui Liu and Ying-Liang Wu leg., 2 adult and 1 immature males, 13 adult females (MWHU, Ar.-MWHU-HNNL0601–16); Lingao District, VIII/2006, Hui Liu and Ying-Liang Wu leg., 4 adult and 2 immature males, 2 adult and 2 immature females, 4 juveniles (MWHU, Ar.-MWHU-HNLG0601–14); Qionghai, VIII/2006, Hui Liu and Ying-Liang Wu leg., 3 adult males, 6 adult females 1 juvenile (MWHU, Ar.-MWHU-HNQH0601–10); Danzhou, VIII/2006, Hui Liu and Ying-Liang Wu leg., 1 adult males 9 adult females (MWHU, Ar.-MWHU-HNDZ0601–10); Wenchang, VII I/2006, Hui Liu and Ying-Liang Wu leg., 2 adult and 2 immature males, 4 adult females, 3 juveniles (MWHU, Ar.-MWHU-HNWC0601–11); Jianfeng mountain, VIII /2006, Hui Liu and Ying-Liang Wu leg., 2 adult and 1 immature males, 5 adult and 2 immature females, 1 juvenile (MWHU, Ar.-MWHU-HNJF0601–11).

Other material examined: Yunnan Province: Shidian District , 17/ VIII/2010, Da-He Jiang, Chao-Wu Yang and Zhi-Yong Di leg., 11 adult females, 3 adult males, 2 juveniles (MWHU, Ar.-MWHU-YNSD1010–



Figures 30–39: *Isometrus hainanensis* (after Lourenço, Qi & Zhu, 2005). **30–34.** male holotype. 30. Pedipalp, lateral aspect. **31–32.** Chelicera, dorsal and ventral aspects. **33.** Metasoma. **34.** Telson, lateral aspect. **35–39.** female paratype. **35.** Pedipalp, lateral aspect. **36–37.** Chelicera, dorsal and ventral aspects. **38.** Metasoma. **39.** Telson, lateral aspect. Scale bars: 1.0 mm.



Figures 40–47: *Isometrus hainanensis* (after Lourenço, Qi & Zhu, 2005). Male holotype. **40–41.** Chela, dorsal and ventral aspects. **42.** Dentate margin of movable finger, showing rows of granules. **43.** Sternum, genital operculum and pectines. **44.** Femur, dorsal aspect. **45–46.** Patella external and dorsal aspects. **47.** Lateral eyes. Scale bars: 1.0 mm.

Figures 48–51: Habitus of *Lychas mucronatus*. **48–49.** Male (Ar.-MWHU-HNDF0601), dorsal and ventral views. **50–51.** Female (Ar.-MWHU-HNDF0602), dorsal and ventral views. Scale bars: 10.0 mm.

	Isometrus (I.) maculatus		*Isometrus (R.) hainanensis*		*Lychas mucronatus*		*Liocheles australasiae*	
Sex	Male	Female	Male	Female	Male	Female	Female	Female
Total length	60.2	50.1	58.8	38.4	40.2	49.4	30.1	30.9
Carapace (Length/A-Width/P-Depth)	4.8/3.1/4.6	5.2/3.4/5.0	4.9/2.9/2.6	4.6/2.8/2.6	4.8/3.1/4.5	5.4/3.6/5.7	4.6/2.8/4.9	5.0/2.8/4.9
Mesosoma Length	10.7	14.3	-	-	9.7	14.5	13.6	13.5
Metasomal Segment I (Length/Width/Depth)	4.6/2.0/1.8	4.0/2.4/2.1	4.7/1.8/-	3.1/2.0/-	3.1/2.7/2.4	3.6/3.3/2.5	1.5/1.1/1.2	1.6/1.1/1.2
Metasomal Segment II (Length/Width/Depth)	5.8/1.7/1.7	4.5/2.0/2.0	-/-/-	-/-/-	3.5/2.7/2.3	4.0/3.0/2.6	1.8/1.0/1.1	1.9/1.0/1.3
Metasomal Segment III (Length/Width/Depth)	6.6/1.6/1.6	4.8/1.9/2.0	-/-/-	-/-/-	3.9/2.6/2.5	4.1/3.0/2.5	1.8/1.0/1.2	1.8/1.0/1.3
Metasomal Segment IV (Length/Width/Depth)	7.7/1.5/1.5	5.6/1.8/1.9	-/-/-	-/-/-	4.6/2.6/2.3	5.1/3.0/2.5	2.1/0.9/1.2	2.2/1.01.2
Metasomal Segment V (Length/Width/Depth)	9.3/1.4/1.6	6.8/1.5/1.9	8.5/1.3/1.5	5.4/1.4/1.6	6.4/2.6/2.4	6.8/2.9/2.7	2.3/0.9/1.1	2.4/0.9/1.1
Telson (Length/Width/Depth)	5.8/1.4/1.5	5.0/1.3/1.5	-/1.4/1.5	-/1.2/1.4	5.4/1.9/1.9	6.1/2.2/1.9	2.6/0.9/1.1	2.7/1.0/1.0
Pedipalp Femur (Length/Width/Depth)	8.1/1.2/1.1	5.7/1.3/1.2	4.9/1.5/-	4.0/1.3/-	4.6/1.3/1.3	5.0/1.4/1.4	4.1/1.9/1.3	4.2/2.0/2.3
Pedipalp Patella (Length/Width/Depth)	8.2/1.4/1.1	6.1/1.9/1.2	5.5/2.0/-	4.7/1.9/-	5.3/1.8/1.3	5.7/2.0/1.5	4.4/2.6/1.4	4.4/2.7/1.5
Pedipalp Chela (Length/Width/Depth)	10.8/1.3/1.2	8.9/1.6/1.4	8.4/2.1/1.8	7.4/1.8/1.4	8.3/1.9/1.8	9.2/1.7/1.7	8.3/3.2/1.6	8.0/3.3/1.7
Movable Finger Length	6.7	6.4	4.5	4.3	5.3	6.0	3.7	4.2
Pectinal Teeth	16/17	18/18	15/15	14/14	21/21	18/18	6/7	7/8

Table 1: Measurements (in mm) of *Isometrus (I.) maculatus* (Ar.-MWHU-HNLS0701 and Ar.-MWHU-HNSY0701), *Isometrus (R.) hainanensis* (after Lourenço, Qi & Zhu 2005), *Lychas mucronatus* (Ar.-MWHU-HNDF0601 and Ar.-MWHU-HNDF0602) and *Liocheles australasiae* (Ar.-MWHU-HNSL0616 and Ar.-MWHU-HNNL 0617). A-Width = anterior width, P-Width = posterior width.

Species	Collection lot number	Sex	n	Pectinal Teeth (left/right)
Isometrus maculatus (11 ♂, 15 ♀)	HNLS0701–11	♂	11	17/17 (1), 17/18 (2), 18/17 (2), 18/18 (5), 19/18 (1)
	HNLS0755–66	♀	10	17/18 (4), 18/17 (2), 18/18 (3), 19/19 (1)
	HNSY0601–05	♀	5	17/18 (1), 18/18 (4)
Lychas mucronatus (12 ♂, 34 ♀)	HNDF0601–02	♂	2	21/20 (1), 21/21 (1)
	HNDF0603–09	♀	7	18/18 (1), 19/18 (1), 19/20 (2), 20/19 (1), 20/20 (1), 21/21 (1)
	HNSL0601–02	♂	2	20/20 (1), 22/22 (1)
	HNSL0603–15	♀	13	18/19 (1), 18/20 (1), 19/19 (1), 20/19 (2), 20/20 (3), 20/21 (1), 21/20 (2), 21/21 (1), 22/22 (1)
	HNNL0601–02	♂	2	22/22 (2)
	HNNL0604–11	♀	8	18/18 (1), 18/19(1), 19/19 (1), 20/19 (2), 20/20 (2), 20/21 (1)
	YNLL1001–06	♂	6	20/20 (1), 20/21 (1), 21/21 (3), 22/22 (1)
	YNLL1008–19	♀	6	21/21 (3), 21/22 (1), 22/20 (1), 21/23 (1)
Liocheles australasiae (7 ♀)	HNSL0616	♀	1	6/7
	HNNL0617–18	♀	2	7/8 (1), 8/7 (1)
	HNLD0607–10	♀	4	6/6 (2), 6/7 (1), 7/6 (1)

Table 2: Pectinal teeth counts of Hainan Island scorpion species.

15); Shidian District, VIII/2008, Heng Xiao leg., 7 adult females 7 adult males, 6 juveniles (MWHU, Ar.-MW HU-YNSD0801–20); Longling District, 18/VIII/2010, Wen-Xin Li, Hui Liu, Xiao-Hua He and Zi-Zhong Yang leg., 14 adult females, 3 adult males, 4 juveniles (MWHU, Ar.-MWHU-YNLL1001–21, incorrect in Di et al., 2011); Gengma District, 6/VIII/2004, Zi-Zhong Yang and Yuhua Yang leg., 2 adult males (BHDC, Ar.-BHDC-YNGM0401–02); Yun District, 21/ VII /2003, Zi-Zhong Yang and Ben-Yong Mao leg., 2 adult males (BHDC, Ar.-BHDC-YNYX0301–02); Yongde District, 20/VII/ 2009, Ben-Yong Mao leg., 1 adult female, 3 adult males (BHDC, Ar.-BHDC-YNYD0901–04).

Diagnosis: See Kovařík (1997).

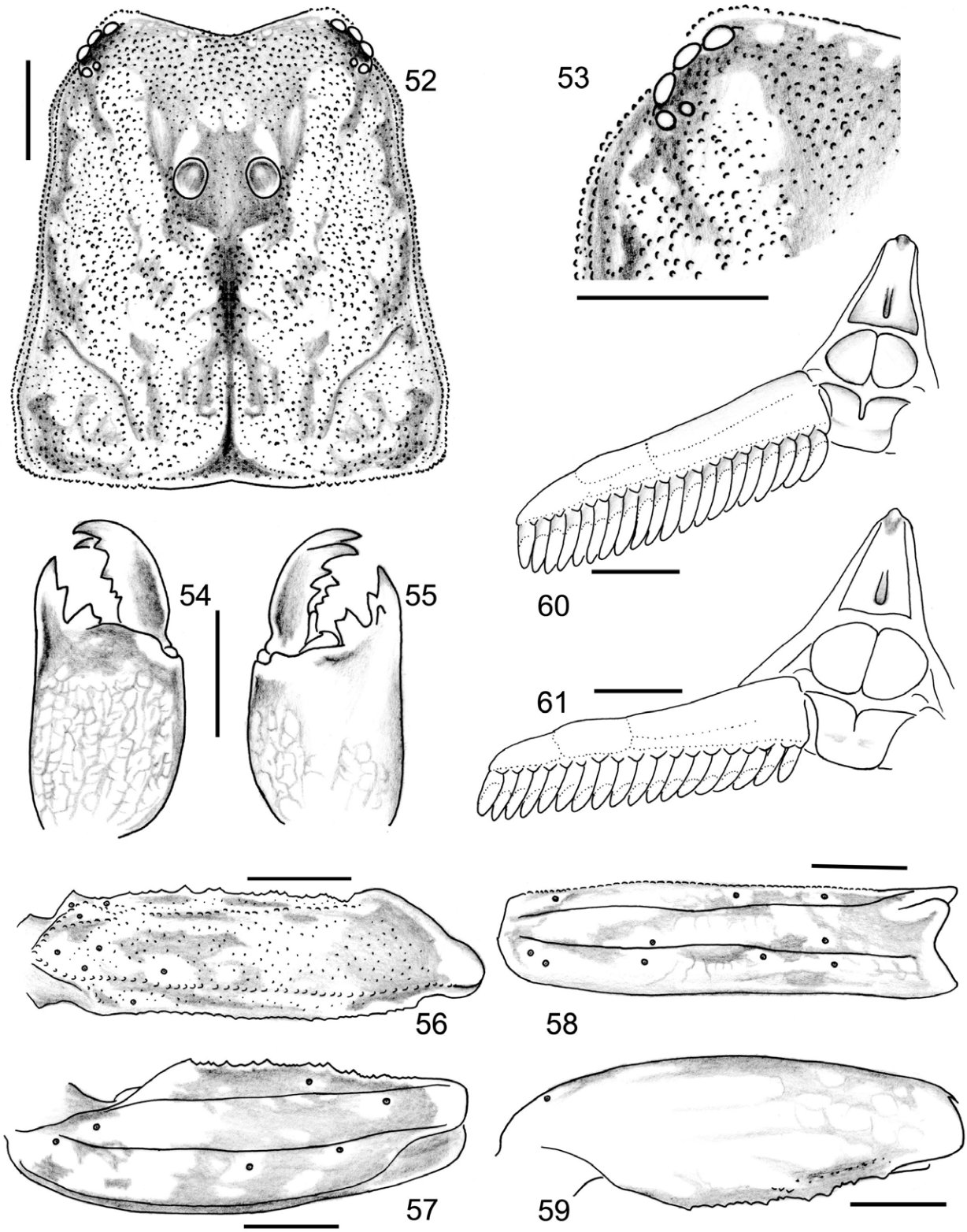
Relationships: See Kovařík (1997).

Description: Based on male specimens from Dongfang District (Hainan Island).

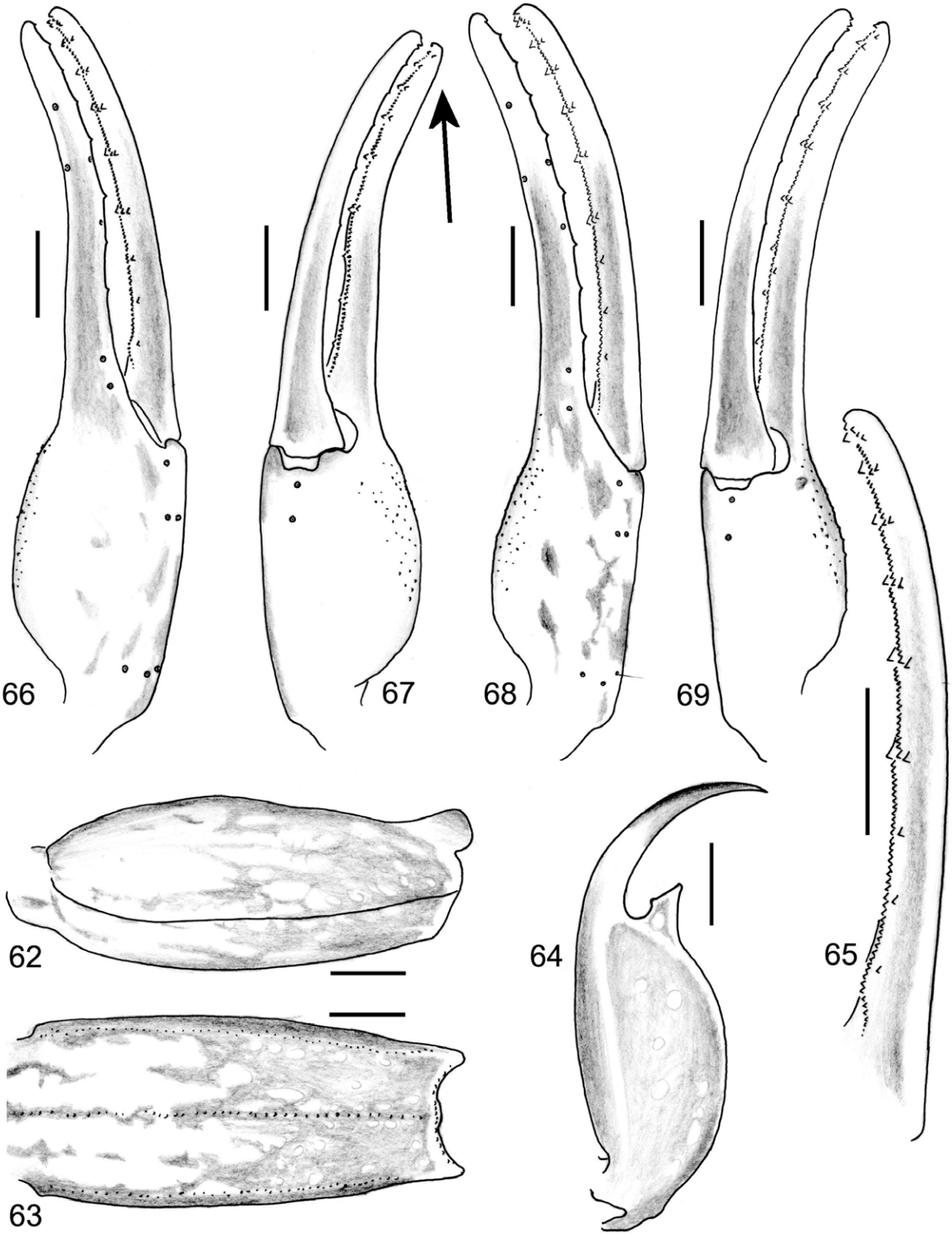
Coloration: Generally reddish-yellow to reddish-brown with intense blackish variegated pigmentation (Figs. 48–51). Prosoma: reddish-yellow, globally covered with blackish pigmented zones; eyes surrounded by black pigment. Mesosoma: tergites reddish-yellow with several blackish spots forming approximately three longitudinal stripes. Venter yellowish, sternites VI–VII with few variegated dark spots. Metasoma: segments reddish-yellow to reddish-brown intensely marked with blackish brown variegated spots. Ventral aspect of segments IV and V reddish-brown. Vesicle reddish-yellow with marked yellowish spots; aculeus reddish-brown at the base and black reddish-brown at its extremity. Chelicerae yellowish, intensely marked with blackish variegated spots, which cover its entire surface; teeth reddish-brown. Pedipalps: yellowish to reddish-yellow; femur and patella intensely marked with variegated blackish spots; chela yellowish with few blackish spots; rows of granules on dentate margins of the fingers reddish. Legs yellowish intensely marked with brownish variegated spots.

Prosoma: Tegument coarse, anterior margin of carapace moderately to strongly emarginate (Fig. 52). Carapace carinae moderate to weak; anterior median and posterior median carinae moderately developed; other carinae weak to obsolete. Intercarinal spaces moderately granular. Median ocular tubercle anterior to the centre of the carapace; median eyes separated by one ocular diameter. Five pairs of lateral eyes (Fig. 53).

Mesosoma: Tegument coarse, tergites I–VI with a median carina; weak to obsolete on I, moderate on II–VI. Tergite VII with lateral pairs of carinae moderate to strong; median carinae present in proximal half, moderately developed. Intercarinal spaces with a moderately to strongly marked granulation. Sternum pentagonal. Operculum subtriangular. Pectines moderately long; pectinal tooth count 20–21 in males (18–21



Figures 52–61: *Lychas mucronatus*. Male (Ar.-MWHU-HNDF0601). **52.** Carapace. **53.** Lateral eyes. **54–55.** Chelicera, dorsal and ventral aspects. **56.** Femur dorsal aspect. **57–59.** Patella, dorsal, external and ventral aspects. **60.** Sternum, genital operculum and pectines. **61.** Female (Ar.-MWHU-HNDF0602). Sternum, genital operculum and pectines. Scale bars: 1.0 mm.



Figures 62–69: *Lychas mucronatus*. Male (Ar.-MWHU-HNDF0601). **62–63.** Metasomal segment V, lateral and ventral aspects. **64.** Telson, lateral aspect. **65.** Dentate margin of movable finger, showing rows of granules. **66–67.** Chela, dorsal and ventral aspects. **68–69.** Female (Ar.-MWHU-HNDF0602). Chela, dorsal and ventral aspects. Scale bars: 1.0 mm.

for females); fulcra absent (Figs. 60–61). Sternites III–VI smooth; spiracles suturiform; VII granulated and with four carinae.

Metasoma: Tegument coarse, segments I and II with ten carinae, crenulate; III and IV with eight carinae, crenulate. Segment V with five carinae; absence of any posterior spinoid granule on the dorsal and dorsolateral carinae of segments I–IV. Dorsal furrows of all segments weakly developed and with some thin granulations; intercarinal spaces moderately granular. Telson elliptic and weakly granular, with one ventral carinae; aculeus moderately curved; subaculear tubercle moderate and triangular, with 2 granules on the ventral surface.

Pedipalps: Tegument coarse, Femur pentacarinate; internal carina with big granules, other carinae moderately crenulate. Patella with seven carinae, internal carina with few big granules, other weakly crenulate. Chela with obsolete carinae, with many granules in ventral aspect. Intercarinal spaces weakly granular on femur and patella; almost smooth on chela. Dentate margins on movable and fixed fingers composed of 6 linear rows of granules; three very conspicuous external accessory granules next to the most basal row of granules (Fig. 65). Trichobothrial pattern type A, orthobothriotaxic (Vachon, 1974); dorsal trichobothria of femur in β configuration (Vachon, 1975). For the position and distribution of trichobothria of the femur, patella and chela of pedipalps see Figs 56–59, 66–69.

Chelicerae: Tegument smooth, with the dentition characteristic of the buthids (Vachon, 1963); two small but well distinct basal teeth on movable finger (Figs. 54–55).

Legs: Tegument smooth except dorsal aspect of femora with granules. Femora with two granular carinae in internal aspect, one granular carina in dorsal aspect and one granular carina in external aspect. Patellae with one dentate carina in internal, one granular carina in dorsal aspect and three granular carinae in dorsal aspect. Tibiae with few setae and with one spur. Basitarsi with some setae and 2 lateral pedal spurs. Tarsi ventrally with many short setae. Tarsal ungues curved and hook-like.

Variation: Females coloration and morphology very similar to males (Figs. 50–51). Sexual dimorphism: females with bigger mesosoma, smaller chela and thinner metasoma, fingers are straight (Figs. 50–51, 68–69). The fourth and fifth lateral eyes degenerate in some specimens from Hainan and Yunnan. Measurements, see Table 1. Pectinal tooth counts, see Table 2.

Habitat: Under stones or in the bark or soil.

Distribution: See Fet & Lowe (2000).

Genus ***Mesobuthus*** Vachon, 1950

Mesobuthus: Sun, Zhu & Lourenço, 2010: 35.

Type species: *Androctonus eupeus* C.L. Koch, 1839.

Diagnosis: See Sun, Zhu & Lourenço (2010).

Distribution: See Fet & Lowe (2000).

***Mesobuthus martensii hainanensis* (Birula, 1904)**

Buthus confucius hainanensis Birula, 1904: 27.
Mesobuthus martensii hainanensis: Fet & Lowe, 2000: 178.

Distribution: China (Hainan).

Notes: Birula (1904) described this subspecies, but did not provide a detailed description or illustrations; he did not report the gender or discuss relationship between this species and nominotypic *M. martensii*. We have not found any *Mesobuthus* species in Hainan, and we question the authenticity of this record. Birula (1904) studied specimens labeled "Hainan" and collected by Alfred Otto Herz (St. Petersburg, Russia) who conducted entomological expeditions in the 1890s to China, Korea, Japan, and Siam. Herz did indeed visit Hainan; his collections of reptiles and insects from Hainan were among the first made by the Europeans. However, *Mesobuthus martensii hainanensis* could be a case of a mistaken label (V. Fet, pers. comm.). Shi et al. (2007) confirmed the range of *Mesobuthus martensii* in China by extensive field surveys and predictive models, and found this species restricted to latitudes south of 43°N and the north side of the Yangtze River, bordered by the Helan Mountains and the Tengger and Mo Us sand desert in the west and limited by the sea in the east.

Family **Hemiscorpiidae** Pocock, 1893

Genus ***Liocheles*** Sundevall, 1833

Liocheles: Monod & Volschenk, 2004: 677.

Diagnosis: See Monod & Volschenk (2004).

***Liocheles australasiae* (Fabricius, 1775)**
(Figures 70–88; Tables 1–2)

Hormurus australasiae: Wu, 1936: 121–123, fig. 4; Tikader & Bastawade, 1983: 501–505, figs. 1362–1375.
Liocheles australasiae: Koch, 1977: 161–166, figs. 17, 46, 80, 81; Monod & Volschenk, 2004: 677.
Liocheles australasiae australasiae: Fet, 2000: 397.

Material examined: Hainan Island: Baoting District, Shenling Town, VIII/2006, Hui Liu and Ying-Liang Wu leg., 1 female (MWHU, Ar.-MWHU-HNSL 0616); Baoting District, Nanlin town, VIII/2006, Hui Liu and Ying-Liang Wu leg., 1 female, 1 juv (MWHU,

Figures 70–71: Habitus of *Liocheles australasiae*. Female (Ar.-MWHU-HNSL0616), dorsal and ventral views. Scale bars: 10.0 mm.

Ar.-MWHU-HNNL0617–18); Ledong District, VIII/2006, Hui Liu and Ying-Liang Wu leg., 4 immature females (MWHU, Ar.-MWHU-HNLD0607–10).

Diagnosis and **Relationships**: See Kovařík (2000).

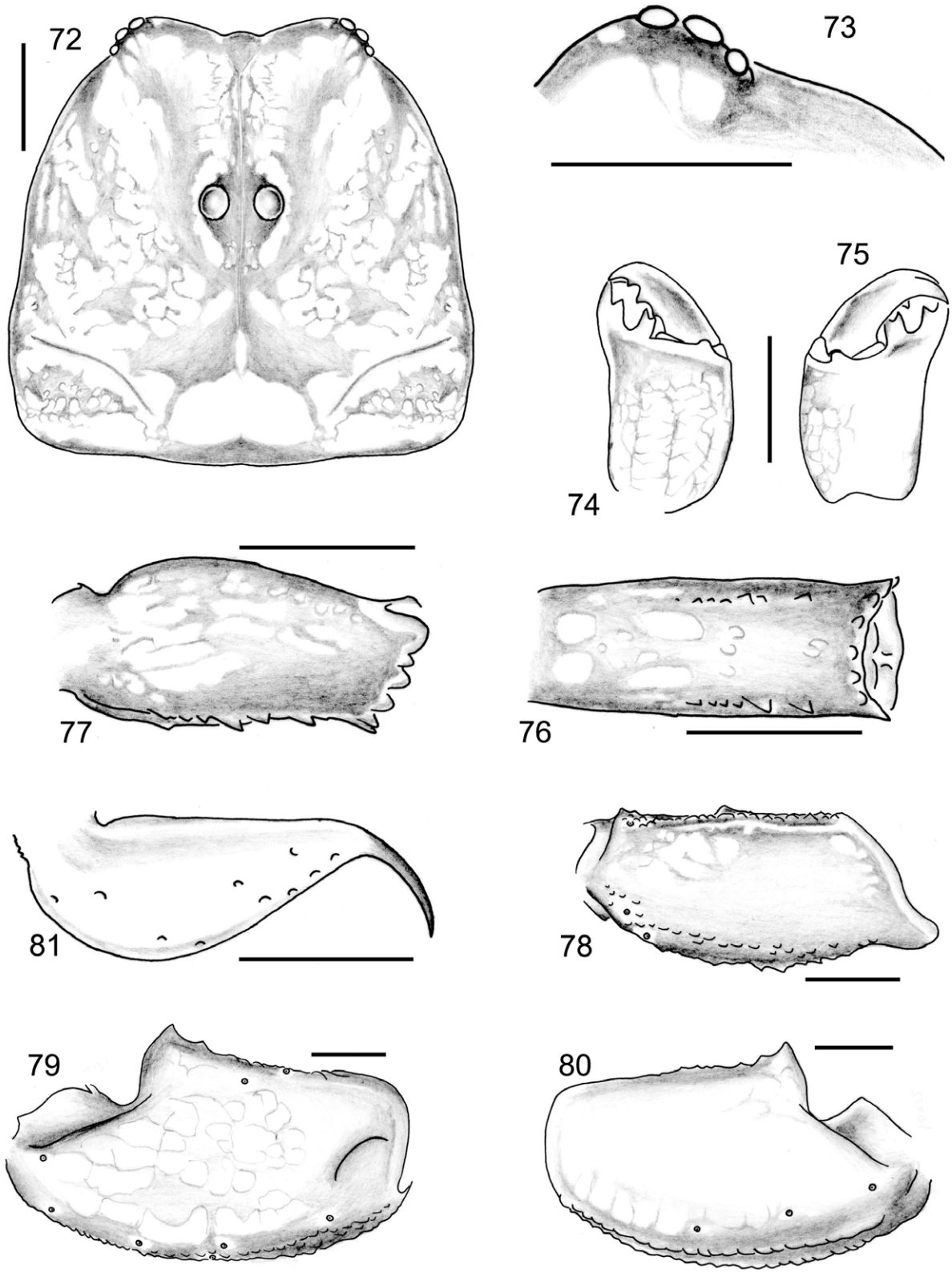
Description: Based the female material from Shenling Town in Baoding District (Hainan Island).

Coloration. Mainly tan-brown and lustrous (Figs. 70–71). Prosoma. Carapace mostly uniformly tan-brown and symmetrical yellow spots, with black brown markings on anterior margin part; posterior and lateral surfaces with faint to distinctive brown reticulate markings; median and lateral ocular tubercle black. Mesosoma. Tergite coloration tan-brown with yellow markings, similar to or slightly lighter and faint than those on carapace. Genital operculum and pectines yellowish. Pedipalp reddish-brown with dark brown carinae, chela fingers dark red brown. Sternum and sternites yellowish-brown. Chelicerae yellowish tan; manus with fine dark reticulation with large distal brown patch extending onto basal half of fixed finger. Legs yellow to yellow brown, tarsal ungues yellowish brown. Metasoma. blackish-brown with numerous yellowish-brown markings, anus yellow with red brown tip.

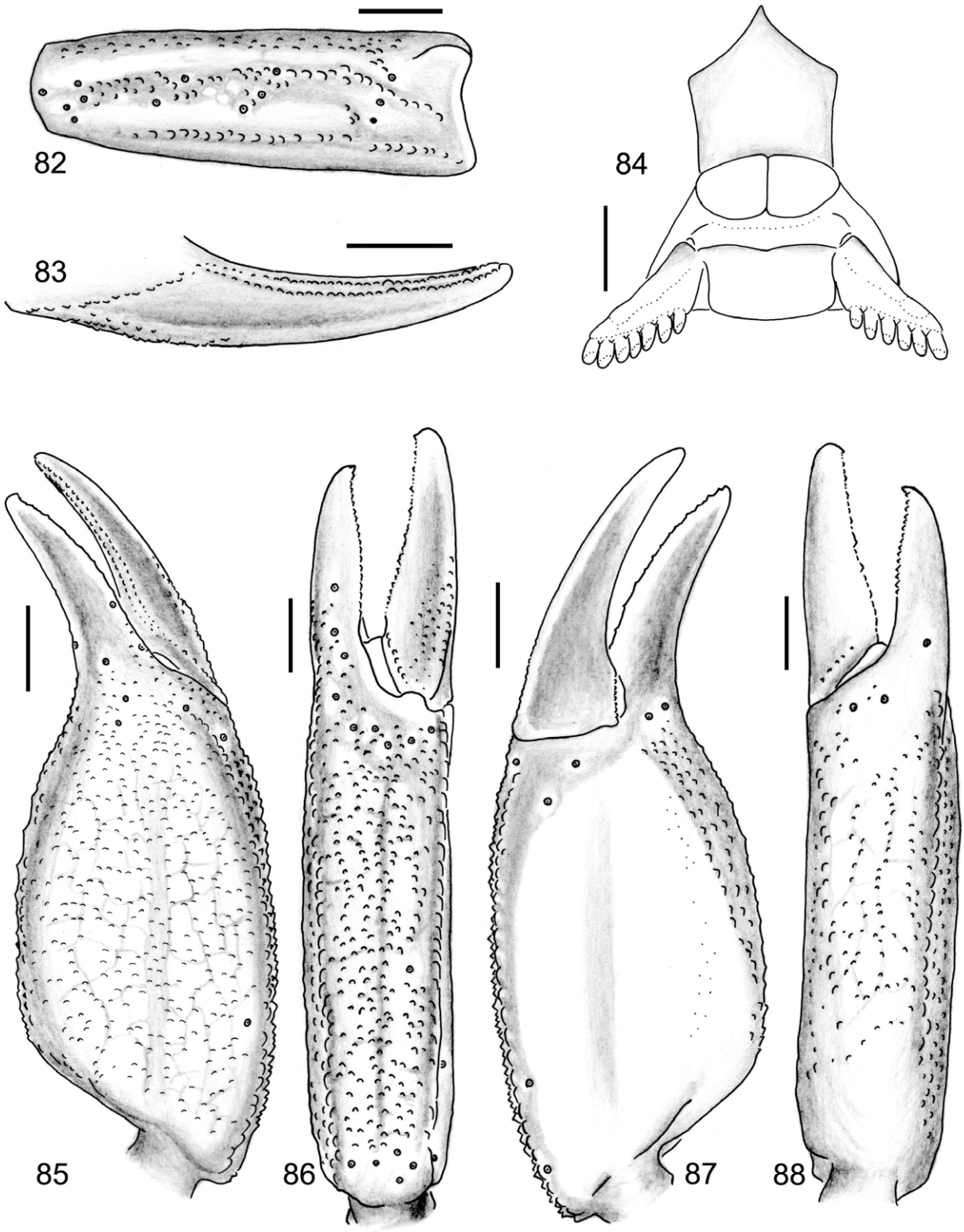
Morphology: Tegument mainly smooth and the granules smooth.

Prosoma: Carapace flattened; median ocular tubercle weakly developed; sides nearly parallel in the posterior half, convergent in anterior half; frontal concavity or notch moderately developed; anterior lobes rounded; lateral ocular tubercles with 3 ocelli of equal size (Fig. 72–73). Carapace with numerous fine punctations; anteromedian furrow narrow, suturiform, anteriorly bifurcated; median longitudinal furrow shallow, continuous from the anterior suture furcation, running through ocular tubercle posteriorly into a shallow, smooth and shiny triangular depression; posterolateral furrow shallow, smooth and shiny; mesolateral furrow weekly developed, almost absent.

Mesosoma: Tergites I–VI with median carina surrounded by a pair of shallow, submedian depressions; lateral carinae absent. Tergite VII with median carina and submedian depressions weakly pronounced, almost absent; lateral and sublateral carinae absent. Surface of tergites with numerous fine punctations as carapace. Sternum sub-pentagonal, smooth and minutely pitted. Operculum subtriangular. Pectines short and weak; pectinal tooth count 6–8; fulcra present and marked.



Figures 72–81: *Liocheles australasiae*. Female (Ar.-MWHU-HNSL0616). **72.** Carapace. **73.** Lateral eyes. **74–75.** Chelicera, dorsal and ventral aspects. **76–77.** Metasomal segment V, ventral and lateral aspects. **78.** Femur dorsal aspect. **79–80.** Patella dorsal and ventral aspects. **81.** Telson, lateral aspect. Scale bars: 1.0 mm.



Figures 82–88: *Liocheles australasiae*. Female (Ar.-MWHU-HNSL0601). **82.** Patella, external aspect. **83.** Dentate margin of movable finger, showing rows of granules. **84.** Sternum, genital operculum and pectines. **85–88.** Chela dorsal, external, ventral and internal aspects. Scale bars: 1.0 mm.

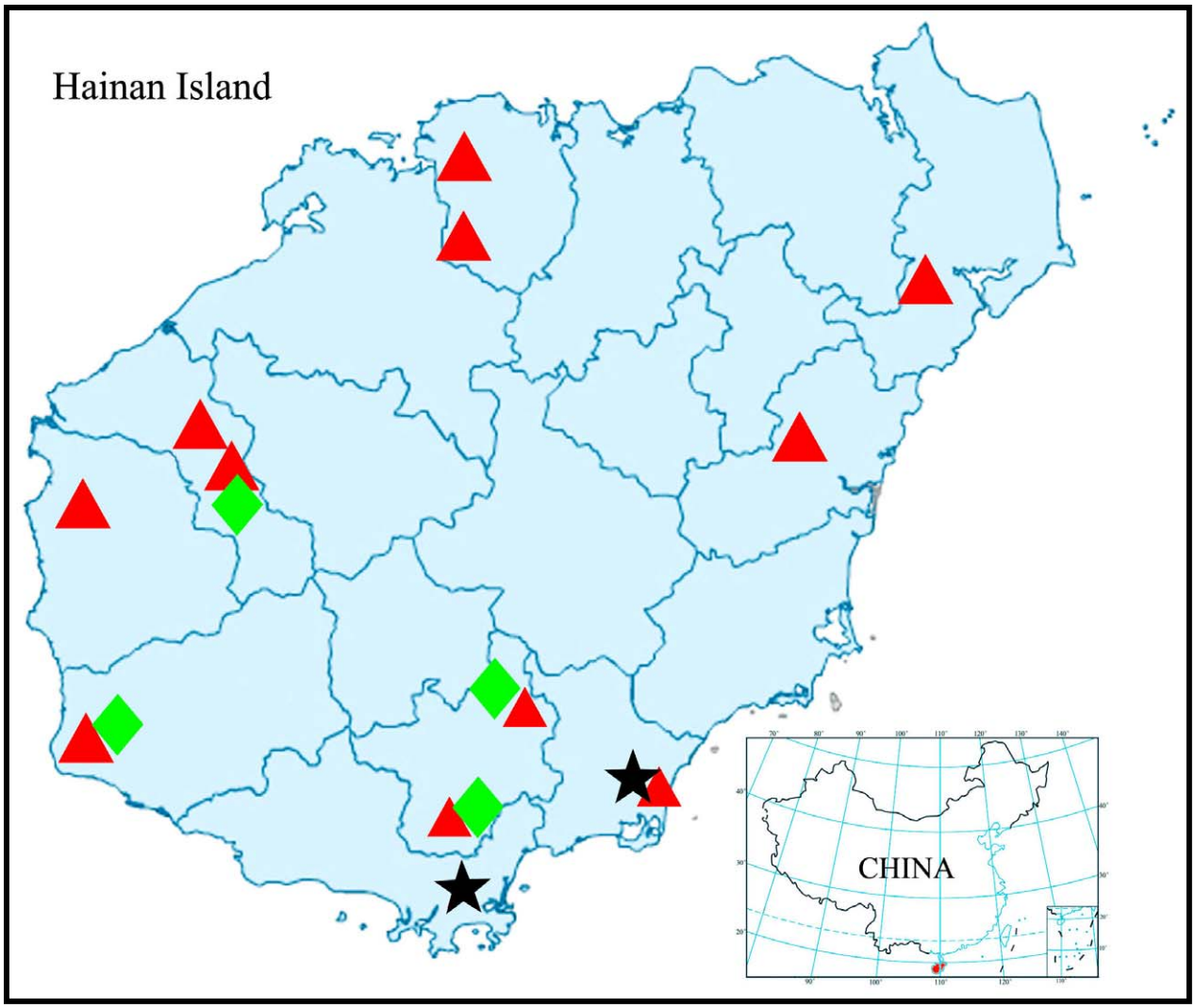


Figure 89: Map of Hainan Island, showing the localities of scorpion species (triangle, *Lychas mucronatus*; rhombus, *Liocheles australasiae*; star, *Isometrus maculatus*).

Spiracles elliptical. Sternites with shallow anterior furrow, with two elliptical depressions, and minutely pitted.

Metasoma: Short and narrow, with weak punctations and few small granules and few long setae. Segments I–V with longitudinal dorsomedian furrow and without dorsal, dorsolateral and lateral carinae. Segment I: ventrolateral carinae absent, paired ventral carinae reduced to smooth ridges with tuberculate granules in posterior half. Segment II: ventrolateral carinae just with two or three smooth ridges with tuberculate granules on posterior half. Segments III–IV without ventrolateral carinae; paired ventral carinae reduced to ridges along whole length of segment. Segment V: ventrolateral carinae with rows of few scattered granules; without ventromedian carina (Fig. 76–77). Telson: vesicle elliptical or ovate; ventrolateral furrows absent; ventromedian ridge absent; lateral surfaces smooth, non-granular and without minutely pitted. Aculeus stout, moderately curved (Fig. 81).

Pedipalp: Strong and short, with granules and weak punctations. Coxa with internoventral margin strongly granular. Femur with four distinct carinae; internodorsal and internoventral carinae developed as a strongly and densely granular ridge, granules smooth; externodorsal carina reduced to a slightly raised row of scattered coarse granules; externoventral carina developed as a weakly granular ridge with few strongly developed spiniform granules; dorsal surface with finely and densely granular and weak punctations, distal end smooth without granules; internal surface sparsely granular; external surface with few weak punctations; ventral surface weakly punctuate without granules. Patella with four carinae present and distinct; internodorsal and internoventral carinae developed as a

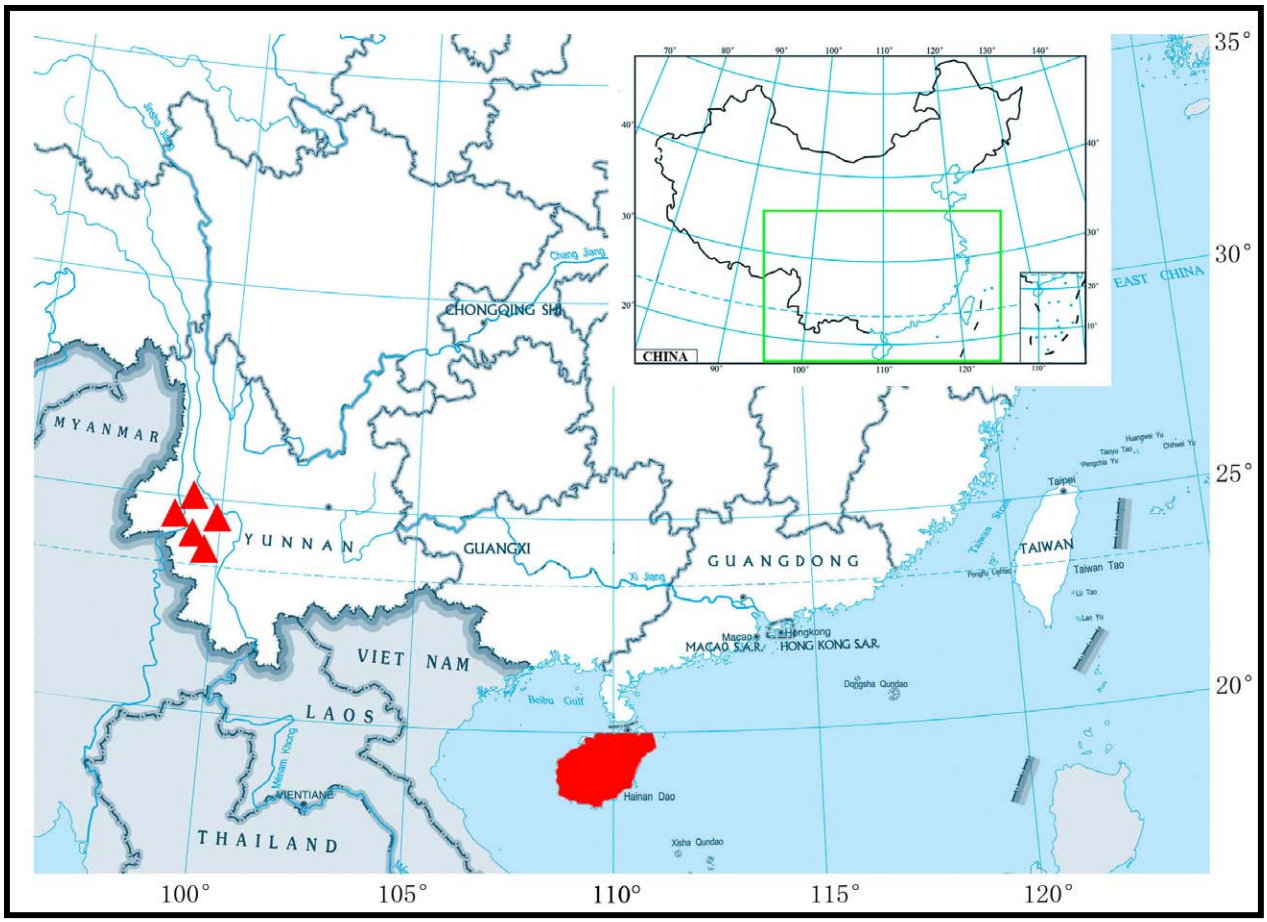


Figure 90: Map of southern China, showing the localities of *Lychas mucronatus*.

strongly and but sparsely granular ridge, granules smooth; externodorsal carina, externoventral developed as a strongly granular ridge; dorsal with smooth granules and weak punctations; internal surface finely granular; external surface with a few scattered granules; ventral surface smooth and shiny with weak punctations, without granules; internal protuberance pronounced. Chela with five clear carinae; internodorsal and internoexternal carinae discontinuous with low spiniform granules; externodorsal carina strongly granular ridge of smooth granules; digital carina well-developed, granules extending from externodorsal carina onto fixed finger; dorsal secondary carina absent; internoventral carina continuous, visible as a row of scattered coarse granules; externoventral carina continuous, crenulate with well developed granules, running parallel to longitudinal axis of chela; ventromedian carina absent; internal (internomedian) carina and external (externomedian) carina absent. Dorsal surface smooth and shiny, with densely granular and weak punctations; internal surface sparsely granular; external surface with dense subulate granules; ventral surface smooth, with weak punctations, without granules. For the position and distribution of trichobothria of the femur, patella and chela of pedipalps see Figs. 79–80, 82, 85–88. Pedipalp chela fingers (Fig. 83): dorsal surface with basal half of fingers granular, distal half smooth, shiny, with a few punctations; ventral surface predominantly smooth, shiny and minutely pitted; tips of fingers with pronounced distal hook; two longitudinal rows granules and each including 7–8 linear small rows.

Chelicerae (Figs. 74–75): Tooth arrangement as given by Vachon (1963) for Scorpionidae; fixed finger with median and basal teeth bifid; movable finger with one subdistal tooth and one basal tooth in external series.

Legs: Dorsal surfaces of trochanter, femur, and patella sparsely granular; ventral surface smooth, shiny and minutely pitted. Tibiae with few setae, without spurs. Basitarsi with few setae and one pedal spur. Tarsi ventrally with two rows of few long spines. Tarsal ungues curved and hook-like.

Variation: Immature and juvenile females light-colored with few spots. *Liocheles australasiae* is parthenogenetic; we did not find any males.

Measurements, see Table 1. Pectinal tooth counts, see Table 2.

Habitat: Under stones or in the bark.
Distribution: See Fet (2000).

Key to scorpion species from Hainan Island (China)
(Geographic distribution, see Fig. 89)

1. Trichobothria Type C configuration, chela strong …… ***Liocheles australasiae*** (Fabricius, 1775)
- Trichobothria in a type A configuration, chela slender ……..……..……..……..2

2. Without subaculear tubercle…… ***Mesobuthus martensii hainanensis*** (Birula, 1904)*
- Subaculear tubercle marked ……....…..……..3

3. Five lateral eyes; metasoma of both sexes has same length …….. ***Lychas mucronatus*** (Fabricius, 1798)
- Three lateral eyes; metasoma of male much longer than that of female ……..……4

4. Trichobothrium *db* on chela of pedipalp situated between trichobothria *et* and *est*; subaculear tubercle with five granules on the ventral surface; pedipalps are of same shape in both sexes……***Isometrus* (*Reddyanus*) *hainanensis*** Lourenço, Qi et Zhu, 2005
- Trichobothrium *db* on chela of pedipalp situated between trichobothria *dt* and *et*, subaculear tubercle with two granules on the ventral surface; pedipalps much slender in males .....…….....…..…… …. ***Isometrus* (*Isometrus*) *maculatus*** (DeGeer, 1778)

*Note: We did not see the type material and have not found any *Mesobuthus* in Hainan Island.

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References

BASTAWADE, D. B. 1986. New species of scorpion of the genus *Lychas* from Nasik District, Maharashtra, India. *Journal of the Bombay Natural History Society*, 83: 634–637.

BIRULA, A. A. 1904. Miscellanea scorpiologica. VI. Ueber einige *Buthus*-Arten Centralasiens nebst ihrer geographischen Verbreitung. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Pétersbourg*, 9: 20–27.

DI, Z.-Y, Y.-W. HE, Y.-L. WU, Z.-J. CAO, H. LIU, D. H. JIANG & W.-X. LI. 2011. The scorpions of Yunnan (China): updated identification key, new record, and distributions (Arachnida: Scorpiones). *ZooKeys*, 82: 1−33.

FET, V. 2000. Family Ischnuridae Simon, 1879. Pp. 383–408 *in*: Fet, V., W.D. Sissom, G. Lowe & M.E. Braunwalder (eds). *Catalog of the Scorpions of the World* (1758–1998). New York: The New York Entomological Society.

FET, V. & G. LOWE. 2000. Family Buthidae C.L. Koch, 1837. Pp. 54–286 *in*: Fet, V, W.D. Sissom, G. Lowe & M.E. Braunwalder (eds). *Catalog of the Scorpions of the World* (1758–1998). New York: The New York Entomological Society.

HJELLE, J. T. 1990. Anatomy and morphology. Pp. 9–63 *in*: Polis, G.A. (ed.). *The Biology of Scorpions*. Stanford: Stanford University Press.

KOCH, L. E. 1977. The taxonomy, geographic distribution and evolutionary radiation of Australo-Papuan scorpions. *Records of the Western Australian Museum*, 5 (2): 83–367.

KOVAŘÍK, F. 1994. *Isometrus zideki* sp. n. from Malaysia and Indonesia, and a taxonomic position of *Isometrus formosus*, *I. thurstoni* and *I. sankariensis* (Arachnida: Scorpionida: Buthidae). *Acta Societatis Zoologicae Bohemicae*, 58: 195– 203.

KOVAŘÍK, F. 1995. Review of Scorpionida from Thailand with descriptions of *Thaicharmus mahunkai* gen. et sp. n. and *Lychas krali* sp. n. (Buthidae). *Acta Societatis Zoologicae Bohemicae*, 59: 187–207.

KOVAŘÍK, F. 1997. Revision of the genera *Lychas* and *Hemilychas*, with description of six new species (Scorpiones: Buthidae). *Acta Societas Zoologicae Bohemicae*, 61: 311–371.

KOVAŘÍK, F. 2001. *Lanzatus somalicus* gen. et sp. n. (Scorpiones: Buthidae) from Somalia. *Acta Societatis Zoologicae Bohemicae*, 65: 41–44.

KOVAŘÍK, F. 2003. A review of the genus *Isometrus* Ehrenberg, 1828 (Scorpiones: Buthidae) with des-

criptions of four new species from Asia and Australia. *Euscorpius*, 10: 1–19.

LOURENÇO, W. R., J.-X. QI & M.-S. ZHU. 2005. Description of a new species of *Isometrus* Ehrenberg, 1828 (Scorpiones, Buthidae) from the Island of Hainan, China. *Boletin de la Sociedad Entomológica Aragonesa*, 36: 57–63.

MONOD, L. & E. S. VOLSCHENK. 2004. *Liocheles litodactylus* (Scorpiones: Liochelidae): An unusual new *Liocheles* species from the Australian wet tropics (Queensland). *Memoirs of the Queensland Museum*, 49(2): 675–687.

POCOCK, R. I. 1900. *The Fauna of British India, including Ceylon and Burma*. Arachnida. Taylor and Francis, London, 294 pp.

PRENDINI, L. 2000. Phylogeny and classification of the superfamily Scorpionoidea Latreille, 1802 (Chelicerata, Scorpiones): An exemplar approach. *Cladistics*, 16: 1–78.

SHI, C.-M., Z.-S. HUANG, L. WANG, L.-J. HE, Y.-P. HUA, L. LENG, & D.-X. ZHANG. 2007. Geographical distribution of two species of *Mesobuthus* (Scorpiones, Buthidae) in China: insights from systematic field surveys and predictive models. *Journal of Arachnology*, 35: 215–226.

SISSOM, W. D., G. A. POLIS & D. D. WATT. 1990. Laboratory and field methods. Pp. 445–461 *in*: Polis, G.A. (ed.). *The Biology of Scorpions*. Stanford: Stanford University Press.

SOLEGLAD, M. E. & W. D. SISSOM. 2001. Phylogeny of the family Euscorpiidae Laurie, 1896: a major revision. Pp. 25–111 *in* Fet, V. & P. A. Selden (eds.). *Scorpions 2001. In memoriam Gary A. Polis*. Burnham Beeches, Bucks: British Arachnological Society.

SUN, D., M.-S. ZHU & W. R. LOURENÇO. 2010. A new species of *Mesobuthus* (Scorpiones: Buthidae) from Xinjiang, China, with notes on *Mesobuthus songi*. *Journal of Arachnology*, 38: 35–43.

THORELL, T. 1876. On the classification of scorpions. *Annals and Magazine of Natural History*, 4(17): 1–15.

TIKADER, B. K. & D. B. BASTAWADE. 1983. *Scorpions (Scorpionida: Arachnida). In: The Fauna of India*, Vol. 3. (Edited by the Director). Calcutta: Zoological Survey of India, 671 pp.

VACHON, M. 1952. *Etudes sur les Scorpions*. Alger: Institut Pasteur d'Algérie, 482 pp.

VACHON, M. 1963. De l'utilité, en systématique, d'une nomenclature des dents des chélicères chez les scorpions. *Bulletin du Muséum National d'Histoire Naturelle*, Paris, 35: 161–166.

VACHON, M. 1972. Remarques sur les Scorpions appartenant au genre *Isometrus* H. et E. (Buthidae) à propos de l'espèce *Isometrus maculatus* (Geer) habitant l'île de Paques. *Cahiers Pacifique*, 16: 169–180.

VACHON, M. 1974. Étude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en Arachnologie, Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum National d'Histoire Naturelle*, Paris, (3), 140 (Zool. 104), mai-juin 1973: 857–958

VACHON, M. 1975. Sur l'utilisation de la trichobothriotaxie du bras des pédipalpes des Scorpions (Arachnides) dans le classement des genres de famille des Buthidae Simon. *Comptes Rendus des Séances de l'Académie des Sciences*, (D), 281(21): 1597–1599.

VACHON, M. 1976. *Isometrus* (*Reddyanus*) *heimi*, nouvelle espece de Scorpions Buthidae habitant la Nouvelle-Calédonie. *Cahiers Pacifique*, 19: 29–45.

VACHON, M. 1982. Les scorpions de Sri Lanka (Recherches sur les scorpions appartenant ou déposés au Muséum d'Histoire naturelle de Genéve III.). *Revue suisse de Zoologie*, 89: 77–114.

WU, H. W. 1936. A review of the scorpions and whip-Scorpions of China. *Sinensia*, 7(2): 113–127.