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NEWLY DISCOVERED MALE OF *HETEROPODA LANGUIDA* SIMON, 1887 (ARANEAE: SPARASSIDAE) IN YUNNAN, CHINA

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ABSTRACT

Heteropoda spiders are an essential predator in tropical and subtropical areas because they trap and eat insects, cockroaches, and other domestic soft-bodied pests in crops. Pantropical huntsman spiders do not use webs to catch prey, like other stray spiders do. They catch the insects they eat using their powerful chelicerae (jaws) and quick movements. More than 140 individuals belonging to *Heteropoda languida* Simon, 1887 species were collected from Xishuangbanna Dai Autonomous Prefecture and brought back to lab, and then stored in 75% ethanol. Among which 36 individuals were males and 104 individuals were females. Our research findings provide previously unknown male of *Heteropoda languida* Simon, 1887 for the first time, and the female is re-described from Xishuangbanna Dai autonomous prefecture, Yunnan, China. Our results also adding a little knowledge to *Heteropoda* species distribution, and may help to study the biogeography and dispersal route of *Heteropoda* spiders. In this paper, we provide the diagnosis, description, illustration, and field photos with distribution map for both males and females.

1. INTRODUCTION

According to Singh and Borkotoki (2014), spiders are a successful and old group of invertebrate animals, and they are also known as poisonous arthropods (Perveen & Jamal, 2012). Some scientists thought that spiders evolved into two groups' later one without extensor leg muscles and the other with them in the water where they first appeared. It is estimated that spiders first appeared 400 million years ago. Spiders come in a variety of sizes, shapes, and behaviors and are members of the class Arachnida, order Araneae, and phylum Arthropoda. They construct nests and egg sacs out of the silk as well as use it to hang from and wrap their prey (Turnbull, 1973; Nyffeler & Benz, 1987). According to Sharma et al., (2010), a single spider can manufacture more than half a dozen different types of silk. They make use of a wide range of niches in almost every biome on earth and among the diverse Arthropoda. Some spider species weave webs to catch their prey, whereas others don't. Spiders exhibit a diversity of ecological niches, are markers of environmental change and community level diversity, and are taxonomically varied (James, 2004).

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About 40 spider species are thought to be capable of killing people, although *Heteropoda* species do not pose a threat.

Spiders are ferocious hunters, carnivores, and biological agents. Insect pests have been successfully managed by using natural predators like spiders and beetles, which is the most efficient method of management (Cave *et al.*, 2004). In agricultural settings, spiders are naturally occurring predators (Marc *et al.*, 1999; Nyffeler & Sunderland, 2003; Pearce & Zalucki, 2006). According to Tahir *et al.*, (2011) spiders also prey on eggs, larvae, and different stages of organisms in addition to adult insects. Insects that affect humans, such as mosquitoes and cockroaches, are also eaten by spiders. Spiders can consume hundreds of mosquitoes in their lifetime, which lowers the mosquito population (James, 2004). Given their significant function as predators in ecosystems, spiders are unquestionably an essential component of the world's biodiversity. One of the most prevalent groups of predators in the ecosystem, they hunt insects and other small invertebrates and control nuisance animals both inside and outside of our homes. Because of their capacity to create silk, most spiders spend their whole lives in a

single habitat and are prey for a variety of hunting animals, including insectivorous birds and reptiles (James, 2004).

The genus *Heteropoda* Latreille, 1804 is the largest genus of huntsman spiders belonging to subfamily Heteropodinae. It is almost exclusively distributed throughout the world, such as a worldwide invasive (*H. ventatoria*). Currently, 189 species are recorded globally, among which only 15 species are reported from China (World Spider Catalog, 2022). The *Heteropoda* species can be diagnosed by the sheath-like conductor, filiform embolus, and typical spiral windings of female copulatory ducts (Jäger, 2002b). They are widely distributed from tropical to sub-tropical areas, living on tree bark, leaf litter, under rocks, in caves and old houses (Jäger & Yin, 2001).

Xishuangbanna Dai autonomous prefecture (latitude 21°10′N–22°40′N, longitude 99°55′E–101°50′E) located in the southwestern part of China (Fig. 5), bordering Myanmar to the southwest and Laos to the southeast, with mild, warm and humid climate all year round with an annual average temperature from 18.6 to 22.9 °C, and an annual precipitation from 1347.4 to 1916.8 mm (Gao et al., 2020). Therefore, it is rich in animals and plants, belonging to Indo-Burma biodiversity hotspot (Liu *et al.*, 2010; Myers, 1988). Especially, Xishuangbanna Tropical Botanical Garden (XTBG) is a comprehensive research and education center engaged in scientific research, species preservation, popular science and scenic spot as well.

However, few *Heteropoda* spiders were reported and taken photos in this region with only *H. tetrica* Thorell, 1897 recorded by Liu *et al.*, (2010). During surveys on huntsman spiders, lots of individuals of *Heteropoda languida* were collected by the colleagues of Hubei University in Dai Autonomous Prefecture of Xishuangbanna. The male of *H. languida* is reported for the first time, and female is described as new record from China.

2. MATERIALS AND METHODS

Taxonomic description

The specimens were stored in 75% ethanol and examined with an Olympus SZX16 stereomicroscope. The details were further studied using the Olympus BX51 compound microscope. After dissection from spider body, male palp and the female reproductive organs were examined and illustrated. Epigynes were exposed with Proteinase K, habitus photos were taken with Leica 205C stereomicroscope and Olympus BX51 equipped with a Micropublisher 3.3 RTV camera (QImaging, Surrey, BC, Canada).

Leg formula is given as follows total length (femur, patella, tibia, metatarsus, tarsus). The number of spines each segment is listed in the following order: prolateral, dorsal, retrolateral, ventral (in femora and patellae, ventral spines are absent and the fourth digit is omitted in the spination formula). The used terms and figure legends followed Li *et al.*, (2013). All measurements are in millimetres. The following abbreviation are used in the text and figures are given below:

Abbreviations

Depository institution

CBEE = Centre for Behavioural Ecology and Evolution, College of Life Sciences, Hubei University, Wuhan, China

Somatic morphology

ALE = anterior lateral eyes
AME = anterior median eyes
AW = anterior width of prosoma
BL = body length
CH = clypeus height
OL = opisthosoma length
OW = opisthosoma width
PLE = posterior lateral eyes
PME = posterior median eyes
PL = prosoma length
PW = prosoma width
Leg formula = I, II, III, IV–legs I to IV

3. RESULTS AND DISCUSSION

Family Sparassidae Bertkau, 1872
Subfamily Heteropodinae Thorell, 1873

Genus *Heteropoda* Latreille, 1804
***Heteropoda languida* Simon, 1887**
Figures (1–3, 4, 5)

See World Spider Catalog Version 23.0 (2022) for detailed taxonomic history of this species.

Material Examined: CHINA: Yunnan Province: 31 males & 82 females (CBEE), Xishuangbanna Dai Autonomous Prefecture, Mengla County, Menglun Town, Tropical Botanical Garden (21°55′41"N, 101°15′21"E, 550 m), 22–24 November 2019, J. Chen, J. Liu, Z.C. Li & B. Liang leg. (CBEE); 1 female (CBEE), Xishuangbanna Dai Autonomous Prefecture, Menghai County, Menghai Town, Xiding Village, Xianrenjiaoji (21°58′55"N, 100°28′38"E, 1340 m), 26 July 2020, R. Zhong, Z.C. Li, Z.W. Deng, W. Zhang & Y.T. Zhang leg. (CBEE); 4

males & 19 females (CBEE), Xishuangbanna Dai Autonomous Prefecture, Jinghong City, Mengyang Town, Primitive Forest Park (22°1′53"N, 100°53′27"E, 810 m), 6 August 2020, R. Zhong, Z.C. Li, Z.W. Deng, W. Zhang & Y.T. Zhang leg. (CBEE); 1 female (CBEE), Xishuangbanna Dai Autonomous Prefecture, Menghai County, Mengsong Township, Central Primary School (22°41′4"N, 100°33′55"E, 1340 m), 1 August 2020, R. Zhong, Z.C. Li, Z.W. Deng, W. Zhang & Y.T. Zhang leg. (CBEE); 1 female (CBEE), Xishuangbanna Dai Autonomous Prefecture, Menghai County, Bulang Township, Bulang Mountain (21°35′1"N, 100°24′60"E, 1250 m), 28 July 2020, R. Zhong, Z.C. Li, Z.W. Deng, W. Zhang & Y.T. Zhang leg. (CBEE); 1 male & 1 female (CBEE), Xishuangbanna Dai Autonomous Prefecture, Mengla County, Xiangming Yi Township, Anle Village, Kongming Mountain (22°5′30"N, 101°11′31"E, 1410 m), 9 August 2020, R. Zhong, Z.C. Li, Z.W. Deng, W. Zhang & Y.T. Zhang leg. (CBEE).

Diagnosis: This species is similar to *Heteropoda helge* Jäger, 2008 in having same arising point of embolus and conductor, slightly double S-shaped sperm duct, internal duct system with only one winding, glandular pores situated in the center of first winding, and anterior part of the internal duct system partly covering the posterior part (Jäger, 2008d: Figs 22–53), but can be distinguished from the latter by the following characters: both sexes: Two obvious dark-spots located in the anterior part of abdomen (Fig. 4A–D)**.** Male: 1. Embolus moderately long and slightly extending beyond the cymbial margin in this species, but relatively small and not extending in *H. helge*; 2. dRTA thick and slightly hook-shaped in this species, but thin and sharp in *H. helge*; 3. vRTA with distinct hump in this species, but almost reduced in *H. helge*. Female: 1. Median septum long and narrow in this species, but significantly small and wide in *H. helge***;** 2. Median margins of septum almost running straight in this species, but running laterally in *H. helge* (Figs 1–2A–C, 3A–B).

Description: Male. Measurements: BL 15.4, PL 7.4, PW 7.1, AW 0.2, OL 7.8, OW 5.0. Eyes: AME 0.30, ALE 0.54, PME 0.35, PLE 0.49, AME–AME 0.39, AME–ALE 0.18, PME–PME 0.49, PME–PLE 0.56, AME–PME 0.62, ALE–PLE 0.52, CH AME 0.72, CH ALE 0.66. Spination: Palp: 210, 000, 1210; Fe I-II 231, III 211, IV 121; Pa I-IV 201; Ti I-II 2401, III-IV 2312; Mt I-IV 0120. Measurements of palp and legs: Palp 11.5 (3.7, 1.7, 2.4,-, 3.5), I 32.7 (7.1, 4.1, 9.4, 9.4, 2.5), II 36.3 (7.9, 4.7, 10.2, 10.5, 2.8), III 24.8 (7.0, 3.3, 7.6, 4.8, 1.8), IV 28.9 (6.2, 2.8, 6.8, 10.0, 2.9). Leg formula: II-I-IV-III. Cheliceral furrow with 3 anterior, 4 posterior teeth and ca. 35 denticles.

Palp as in diagnosis: The length of cymbium is about one and half times as long as tibia. RTA arising distally on tibia, dRTA thick and hook-shaped, vRTA short. Embolus moderately long, arising from tegulum at a 5:30-o'clock-position, running a semi-circle and slightly extending beyond cymbial margin. Sperm duct slightly S-shaped in ventral view. Conductor short, arising in a 10:30-o'clock-position on tegulum, slightly extending beyond cymbial margin (Fig. 1–2A–C).

Colouration in ethanol: Dorsal shield of prosoma yellowish-brown to reddish-brown, with bright transversal crescent submarginally located at posterior part. Labium, sternum and gnathocoxae are yellowish-brown to light reddish-brown. Opisthosoma ventrally yellowish-brown, with two obvious markings located at the anterior part of abdomen and a dark marking located at posterior part of abdomen. Opisthosoma dorsally yellowish-brown, with V-shaped light marking located near to the spinnerets (Fig. 1D–E).

Description: Female. Measurement: BL 13.12, PL 6.7, PW 6.5, AW 3.6, OL 7.5, OW 5.3. Eyes: AME 0.32, ALE 0.44, PME 0.33, PLE 0.45, AME–AME 0.26, AME–ALE 0.12, PME–PME 0.43, PME–PLE 0.59, AME–PME 0.49, ALE–PLE 0.51, CH AME 0.39, CH ALE 0.52. Spination: Palp 131, 101, 2121, 1014; Fe I-III 323, IV 321; Pa I-IV 101; Ti I-II 1018, III -IV 2026; Mt I-II 0004, III 1014, IV 3036. Measurements of palp and legs: Palp 11.6 (3.4, 1.8, 2.2,-, 4.0), I 38.8 (9.9, 3.8, 10.6, 11.1, 3.3), II 43.8 (11.7, 4.2, 11.8, 12.8, 3.1), III 31.4 (8.8, 3.5, 8.1, 8.4, 2.5), IV 35.2 (9.4, 3.1, 9.2, 10.6, 2.8). Leg formula: II-I-IV-III. Cheliceral furrow with 3 anterior, 4 sposterior teeth and ca. 33 denticles.

Copulatory organ as in diagnosis: Epigynal field with short anterior bands. Median septum with almost rounded but not triangular subseptal pocket. Lateral lobes almost touching each other at posterior margin. Anterior part of internal duct system partly covering the posterior part with just one winding. Glandular pores are situated in the center of first winding, and posteriad. Fertilization ducts are separated by less than one width and visible in dorsal view (Fig. 3A–B).

Colouration in ethanol: Dorsal shield of prosoma reddish-brown, with dark-bright transversal crescent submarginally located at posterior part. Labium, sternum and gnathocoxae are yellowish-brown to reddish-brown. Opisthosoma ventrally yellowish-brown, with two obvious markings located at anterior part of abdomen and a light-dark marking located at posterior-abdomen. Opisthosoma dorsally yellowish-brown, with V-shaped light marking located near to the spinnerets (Fig. 3C–D).

Colouration in field: Dorsal shield of prosoma, palps and legs are reddish-brown. Dorsal shield of prosoma with

significantly sub-marginal and horizontal dark-band located posteriorly. Opisthosoma yellowish brown to dark brown, with two distinct anterior-dorsal black markings, with one obvious white marking located posteriorly in some individuals (Fig. 4A–D).

Variation: There are some individuals with obvious white marking (Fig. 4C) located in the posterior-dorsal abdomen for both male and female. While the marking is absent in most individuals (Fig. 4A–B, D).

Distribution: China (Yunnan Province, Fig. 5), Myanmar.

Discussion: The long and narrow median septum with roughly parallel lateral margins, the narrow first winding with sub-parallel margins and the posteriad glandular pores situated in the center of the first winding indicate our individuals should belong to *H. languida* though we did not check the holotype. The *H. languida* female was first recorded and reported from Tavoy or presently called Dawei as the type locality, which is located in the Southern part of Myanmar (Simon, 1887; Jäger, 2014b). Dawei is situated about 928km far away from Xishuangbanna Tropical Botanical Garden, and it may fit into the distribution range of this species. We, here reported the male of *H. languida* for the first time. The *H. languida* male and female individuals were collected on the ground, mountains and old houses in Xishuangbanna Dai Autonomous Prefecture.

4. CONCLUSION

Heteropoda Latreille, 1804 is the most diverse genus in the spider family Sparassidae, and widely distributed in tropical and subtropical regions of south and Southeast Asia. The most effective form of management for insect pests has been the use of natural predators like spiders and beetles. Spiders are naturally occurring predators in agricultural environments. In this study, we reported a previously undiscovered male of *Heteropoda languida* for the first time, and redescribed the female from Xishuangbanna Dai autonomous prefecture, Yunnan, China. Additionally, we noticed that some *Heteropoda languida* individuals had clear white markings located in the posterior-dorsal abdomen (Fig. 4C). While the marking is absent in most individuals (Fig. 4A-B, D).

5. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interests regarding the publication of this article.

6. ACKNOWLEDGEMENTS

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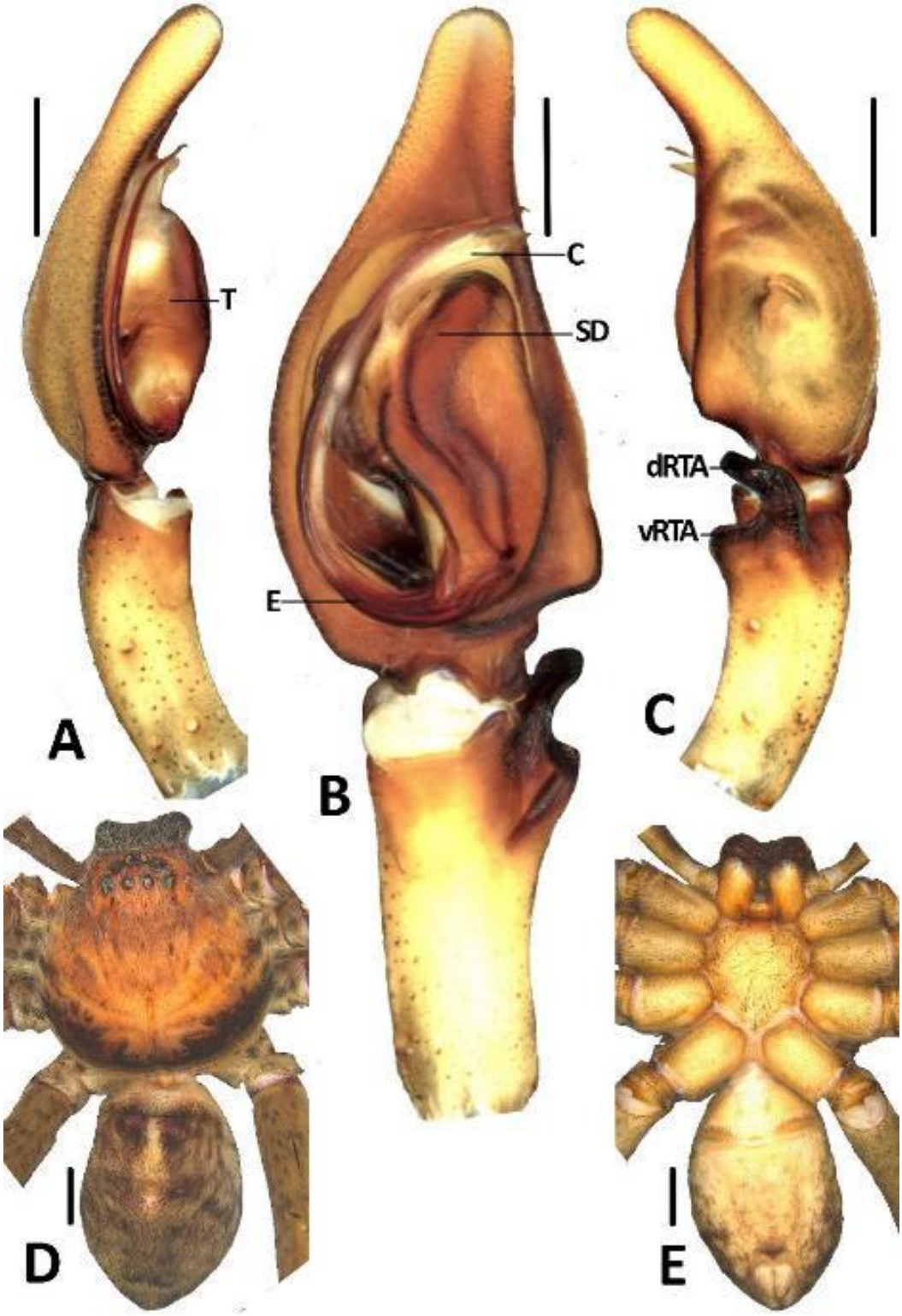

Figure. 1. *Heteropoda languida* Simon, 1887, male from Xishuangbanna Dai Autonomous Prefecture. A–C left male palp (A prolateral, B ventral, C retrolateral); D–E male habitus (D dorsal, E ventral). Abbreviations: C, conductor; dRTA, dorsal part of retrolateral tibial apophysis; E, embolus; SD, sperm duct; vRTA, ventral part of retrolateral tibial apophysis; T, tegulum. Scale bars: A–C 0.5 mm, D–E 2 mm.

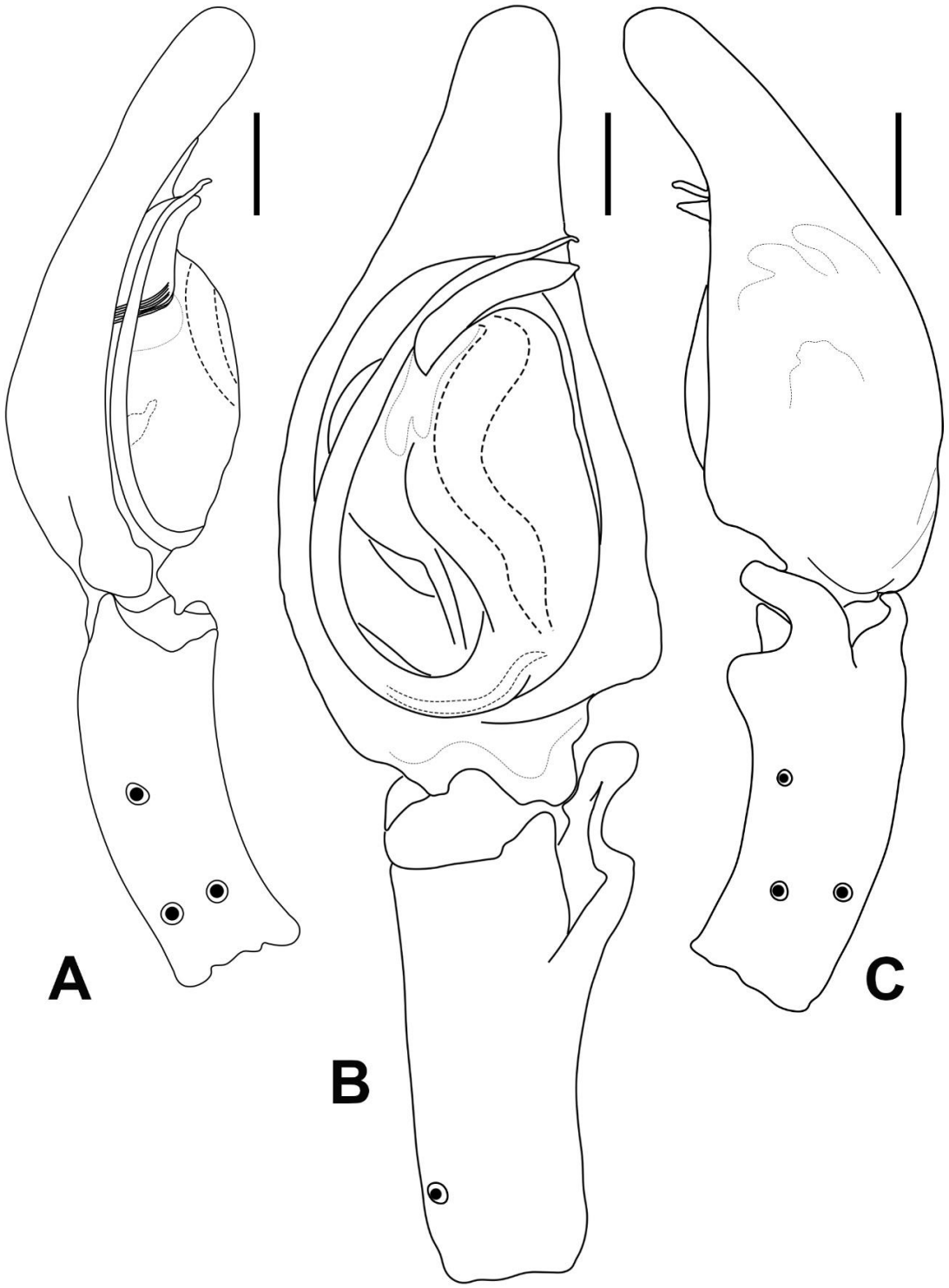

Figure.2. *Heteropoda languida* Simon, 1887, male from Xishuangbanna Dai Autonomous Prefecture. A–C left male palp (A prolateral, B ventral, C retrolateral).

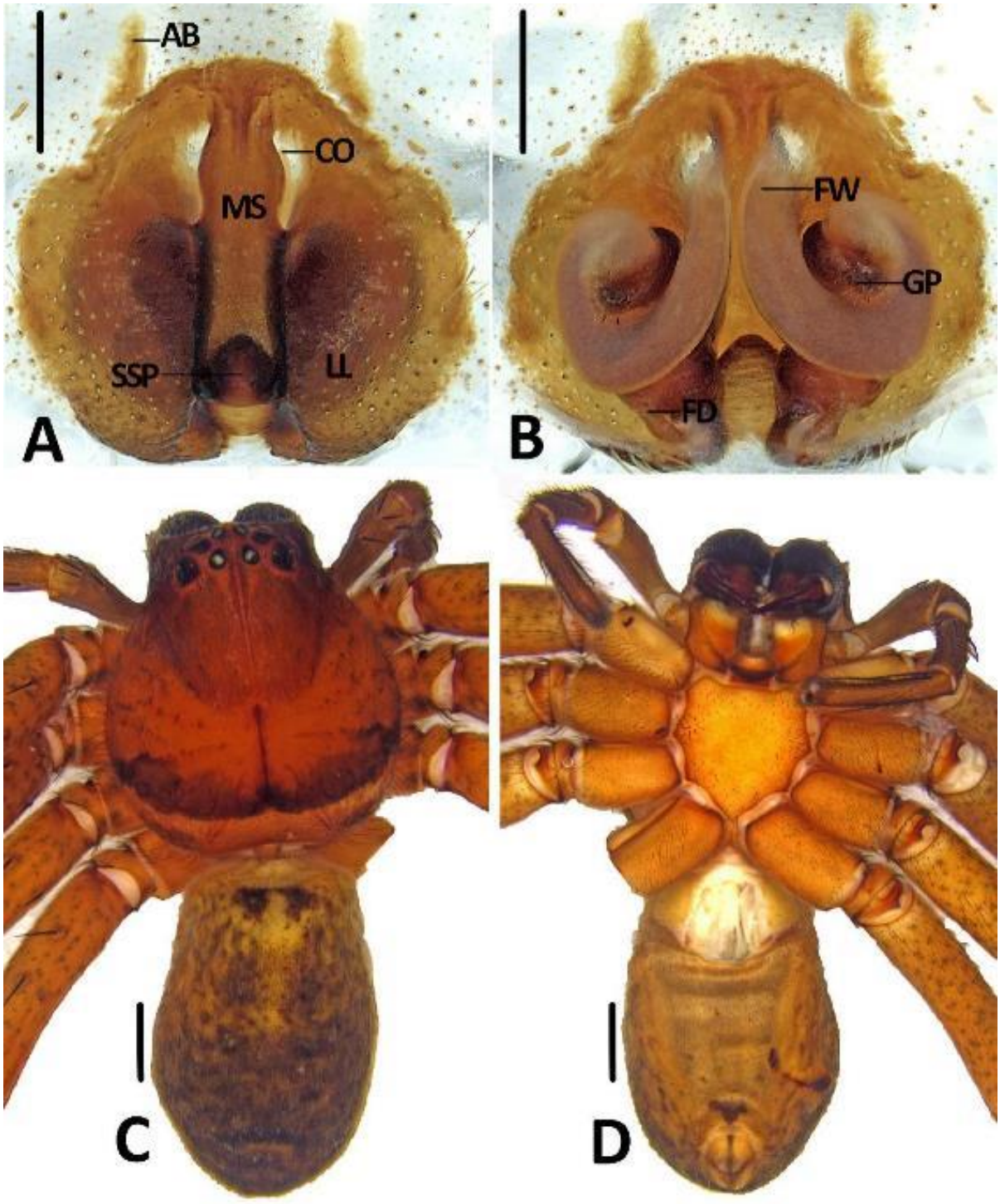

Figure. 3. *Heteropoda languida* Simon, 1887, female from Xishuangbanna Dai Autonomous Prefecture. A–B (A epigyne, ventral; B vulva, dorsal); C–D female habitus (C dorsal, D ventral). Abbreviations: AB, anterior bands; CO, copulatory openings; MS, median septum; LL, lateral lobes; SSP, subseptal pocket; FW, first winding; GP, glandular pores; FD, fertilization duct. Scale bars: A–B 0.5 mm, C–D 2 mm.

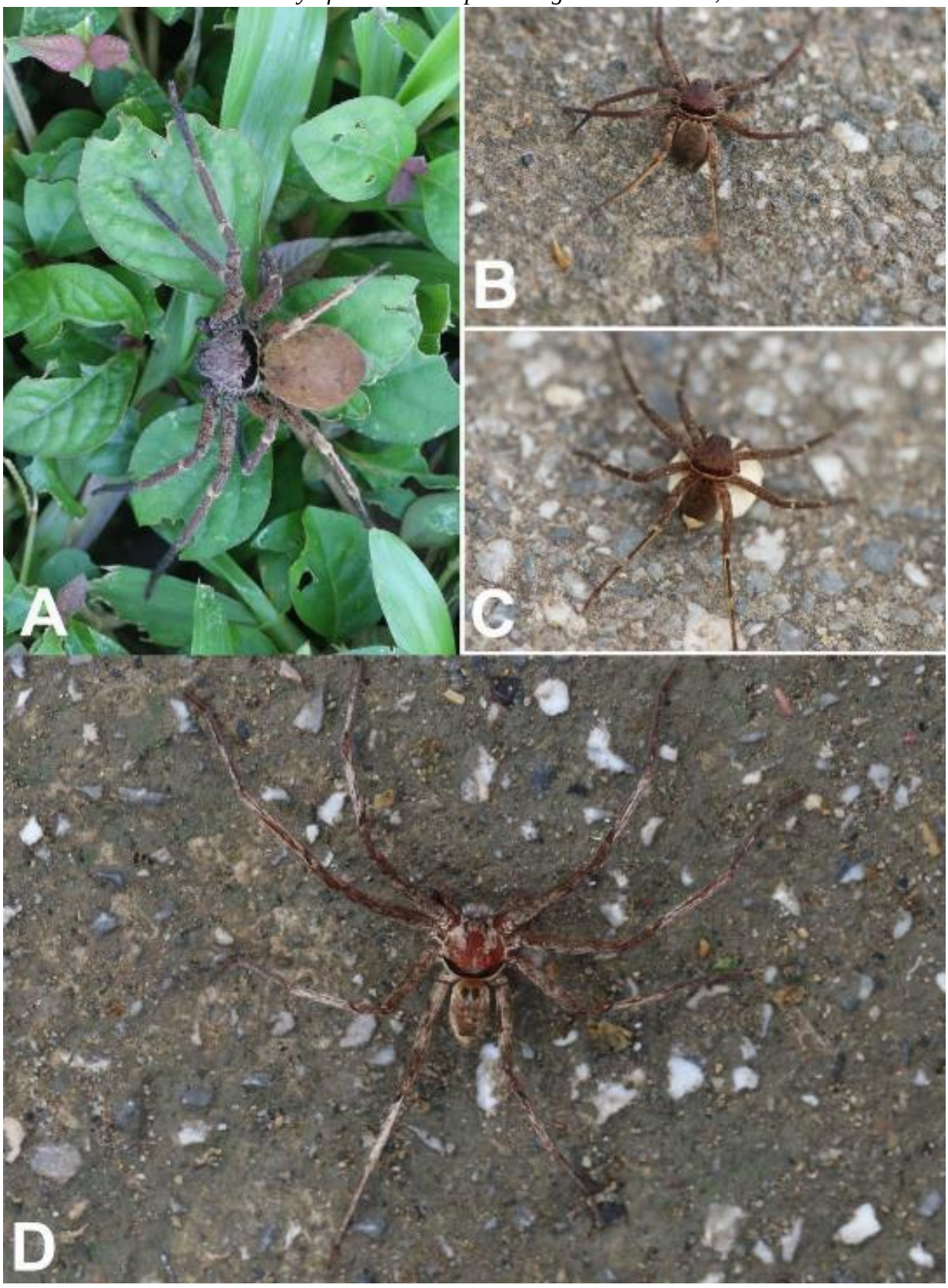

Figure. 4. *H. languida* Simon, 1887 from Xishuangbanna Dai Autonomous Prefecture, Tropical Botanical Garden, Yunnan, China, habitus: female (A–C); male (D), photos by Liang Bing.

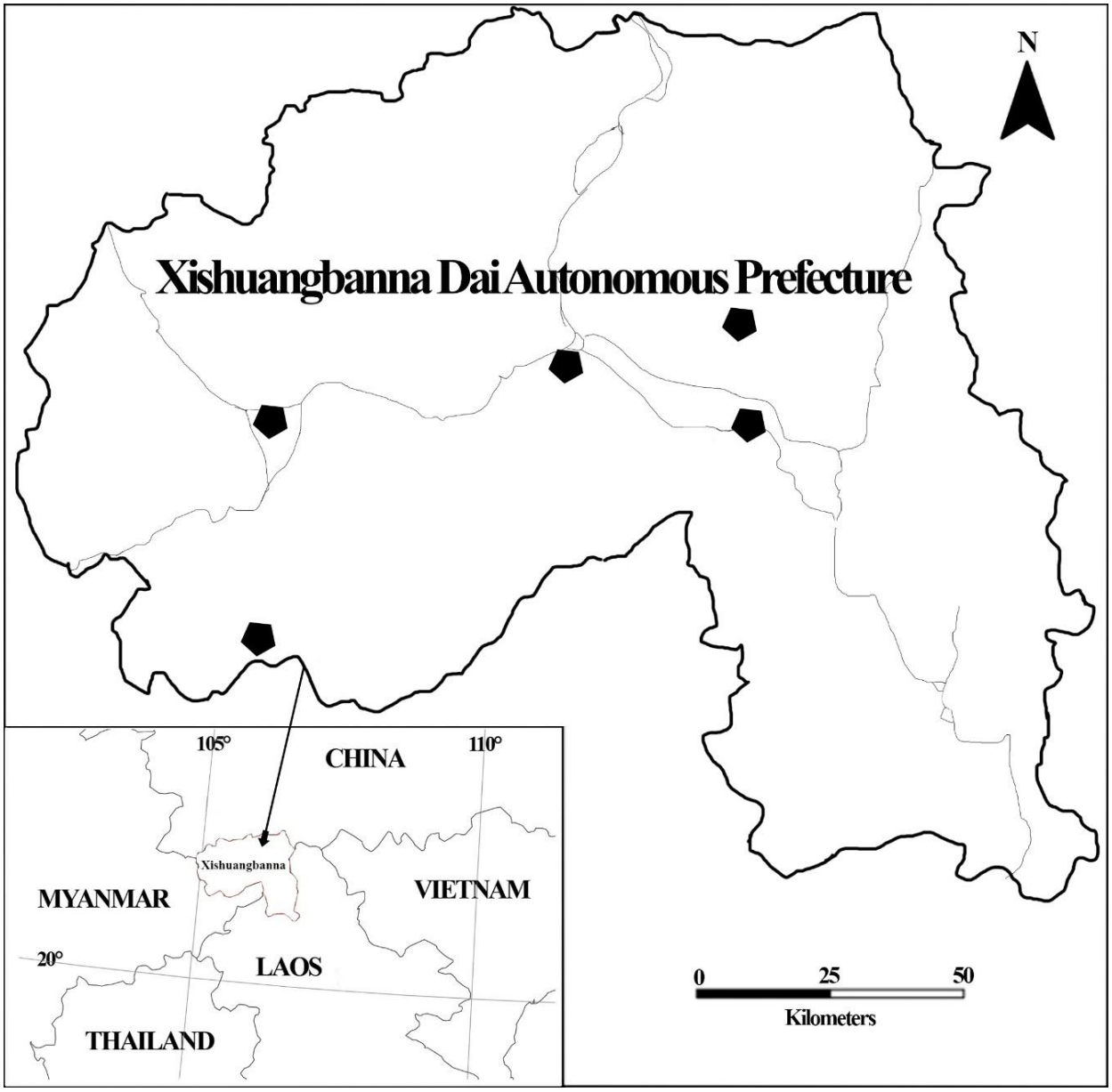

Figure. 5. Locality records for *H. languida* Simon, 1887 from Xishuangbanna Dai Autonomous Prefecture.