



## Research article

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# Five new species of *Meta* Koch, 1836 (Araneae: Tetragnathidae) from Gaoligong Mountains, China

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<sup>1</sup>[urn:lsid:zoobank.org:author:2DDF543A-06AC-4A44-95BE-FD32C1F85336](https://zoobank.org/author:2DDF543A-06AC-4A44-95BE-FD32C1F85336)

<sup>2</sup>[urn:lsid:zoobank.org:author:961EEB65-05F4-44F3-A3B4-693B62FAB48E](https://zoobank.org/author:961EEB65-05F4-44F3-A3B4-693B62FAB48E)

<sup>3</sup>[urn:lsid:zoobank.org:author:4EE226DB-D810-4907-A4B6-B04F4E4241AB](https://zoobank.org/author:4EE226DB-D810-4907-A4B6-B04F4E4241AB)

<sup>4</sup>[urn:lsid:zoobank.org:author:A3720D98-7B42-4C99-837C-264EBF3BC5E4](https://zoobank.org/author:A3720D98-7B42-4C99-837C-264EBF3BC5E4)

**Abstract.** Five new species of the genus *Meta* C.L. Koch, 1836 from the Gongligong Mountains, Yunnan are described: *Meta hamata* sp. nov. (♂♀), *M. longlingensis* sp. nov. (♂), *M. tangi* sp. nov. (♂♀), *M. yani* sp. nov. (♂♀) and *M. yinae* sp. nov. (♂♀). Detailed descriptions of somatic features and genitalic characters, photos of the body and genital organs, line drawings of the copulatory organs and distribution maps are provided.

**Keywords.** Description, illustration, taxonomy, Yunnan.

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## Introduction

The Gaoligong Mountains, located in western Yunnan, are a sub-range of the Hengduan Mountains with steep slopes, ranging in altitude from 645 to 4640 m. They form a spectacular vertical natural landscape and have a wide variety of climates. They cover a total area of 111 000 km<sup>2</sup> that is considered a part of the Indo-Burmese biodiversity hotspot (Li *et al.* 2000; Myers *et al.* 2000). The diversity of spiders in the Gaoligong Mountains is very high. Seven new species of the genus *Wolonia* Zhu *et al.*, 1997 and one new species of the genus *Leucauge* White, 1841 (Tetragnathidae) were reported by Wan & Peng

(2013a, 2013b); Wang *et al.* (2009, 2010) mentioned 71 species of Coelotinae (Agelenidae), 30 of which were new to science; Miller *et al.* (2009) described 36 new species of Symphytognathoidea. All these were added to the many endemic spider species that had already been reported in the last twenty years (Griswold *et al.* 1999; Yin *et al.* 2002, 2003a, 2003b, 2009; Xu *et al.* 2002).

The spider genus *Meta* C.L. Koch contains 24 species distributed worldwide (World Spider Catalog 2020), including five from China (Li & Lin 2016): *Meta mixta* O. P.-Cambridge, 1885; *M. nebulosa* Schenkel, 1936; *M. nigradorsalis* Tanikawa, 1994; *M. qianshanensis* Zhu & Zhu, 1983; and *M. shenae* Zhu *et al.*, 2003. *M. nebulosa* has not been reported again since it was described from a juvenile holotype by Schenkel (1936). Spiders of the genus *Meta* live mainly in the gullies of shady woods or in shallow caves, where they make flat webs and situate themselves in the center of the web. While examining the specimens collected from Gaoligong Mountains, five new species of the genus *Meta* were recognized and are described here.

## Material and methods

All specimens were preserved in 75% ethanol and examined, illustrated, photographed and measured using a Leica M205C stereo microscope equipped with a drawing tube, a Leica MC170 camera and LAS software (Ver. 4.8). Male palps and female epigynes were examined and illustrated after being dissected. Female genitalia were cleared in 90% lactic acid. Eye sizes were measured as the maximum dorsal diameter. Leg measurements are shown as: total length (femur, patella and tibia, metatarsus, tarsus). All measurements are in millimeters. Specimens are deposited at the College of Life Sciences, Hunan Normal University, Changsha, China (HNU). Morphological terminology for descriptions and figures follows Álvarez-Padilla & Hormiga (2011).

## Abbreviations

ALE	=	anterior lateral eye
AME	=	anterior median eye
CD	=	copulatory duct
CEP	=	cymbial ectobasal process
Co	=	conductor
Em	=	embolus
FD	=	fertilization duct
MEA	=	metaine embolic apophysis
MOA	=	median ocular area
Pa	=	paracymbium
PLE	=	posterior lateral eye
PME	=	posterior median eye
Sp	=	spermathecae

## Results

Class Arachnida Cuvier, 1812  
Order Araneae Clerck, 1757  
Family Tetragnathidae Menge, 1866  
Genus *Meta* C.L. Koch, 1836

*Meta hamata* sp. nov.

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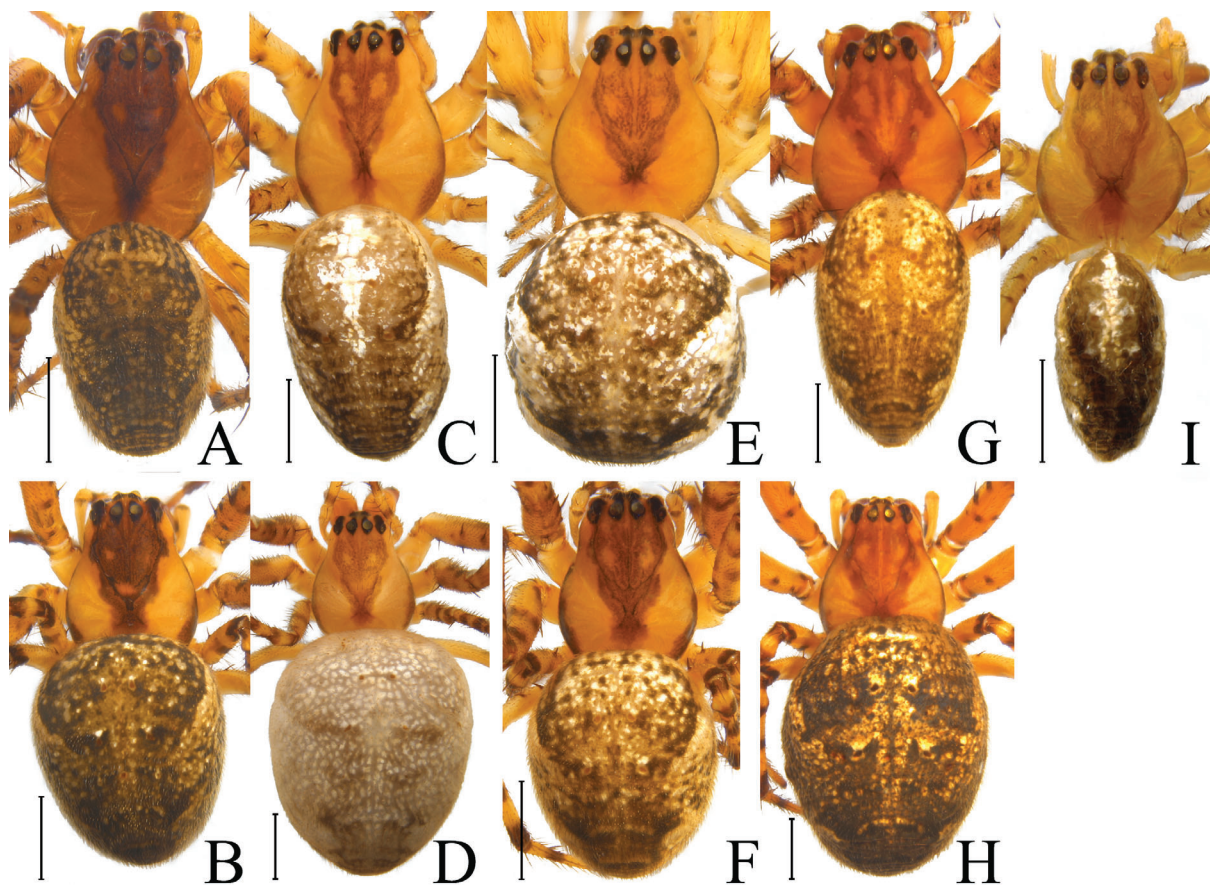
Figs 1A–B, 2–4

**Differential diagnosis.**

*Meta hamata* sp. nov. can be distinguished from the other Chinese *Meta* species by the strong, tongue-shaped metaine embolic apophysis, the wide conductor of the male palp (Figs 2, 4A–C) and the small spermathecae of the epigyne (Figs 3B, 4E). *Meta hamata* sp. nov. resembles *M. yani* sp. nov. (Figs 10–12), but can be distinguished from the latter by: metaine embolic apophysis tongue-shaped in ventral view in *M. hamata* sp. nov. (Figs 2D, 4B), but with a bifurcated tip in *M. yani* sp. nov. (Figs 10D, 12B); embolus hook-shaped in *M. hamata* sp. nov. (Figs 2A, 4A), spine-shaped in *M. yani* sp. nov. (Figs 10A, 12A); conductor shorter than embolus in prolateral view in *M. hamata* sp. nov. (Figs 2A, 4A), longer than embolus in *M. yani* sp. nov. (Figs 10A, 12A); cymbial ectobasal process without the spine-like apophysis found in that of *M. yani* in ventral view (Figs 2D, 4B, 11D, 12B); posterior margin of the epigynal plate almost round in *M. hamata* sp. nov. (Figs 3B, 4E), centrally incised in *M. yani* sp. nov. (Figs 11B, 12E).

**Etymology**

The specific name comes from the Latin adjective ‘*hamatus*’, meaning ‘hook-like’, referring to the shape of the embolus in the male palp.



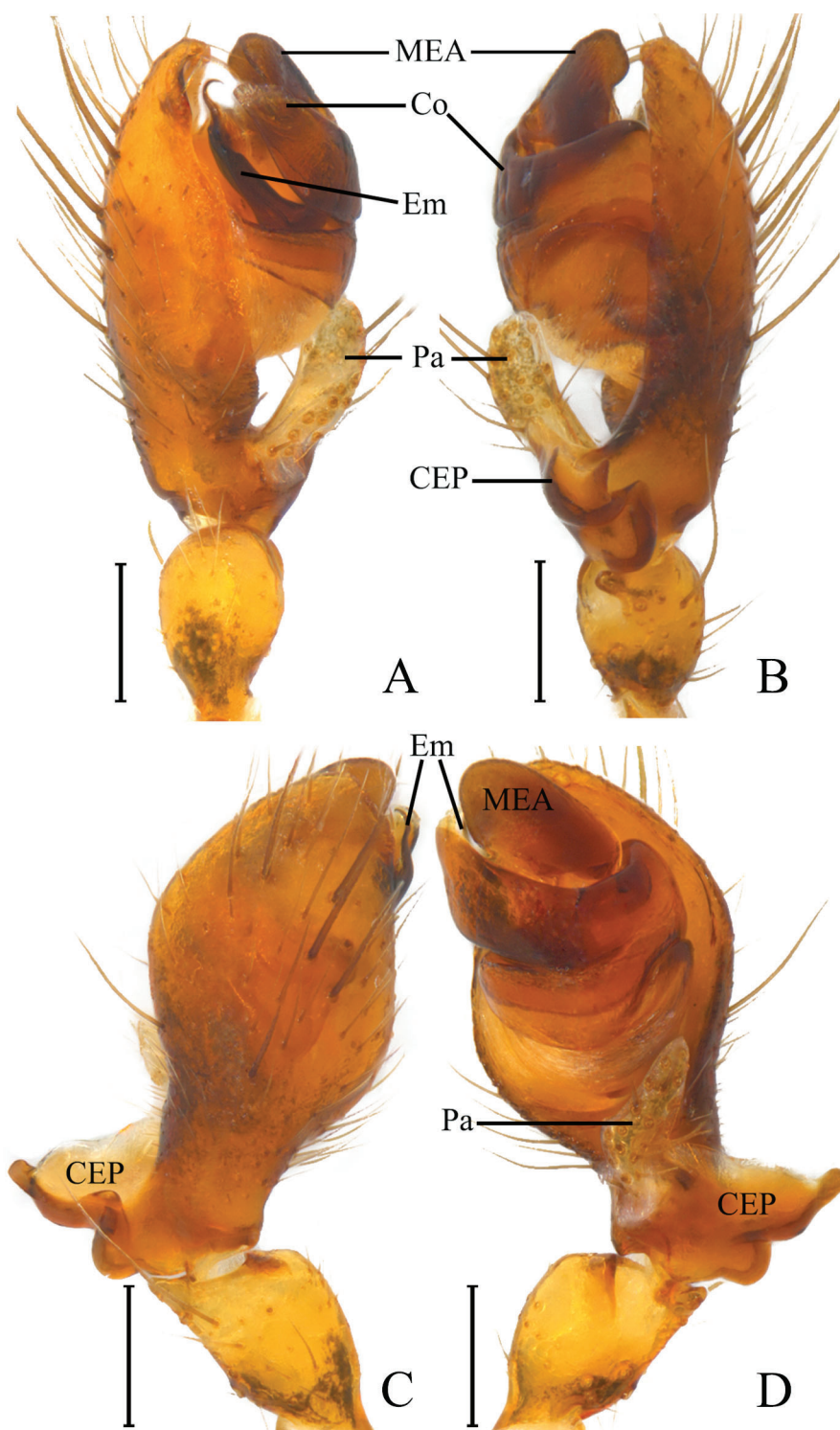
**Fig. 1.** *Meta hamata* sp. nov. (A–B), *Meta longlingensis* sp. nov. (I), *Meta tangi* sp. nov. (C–D), *Meta yani* sp. nov. (E–F), *Meta yinae* sp. nov. (G–H). A, C, E, G, I. Male holotype habitus, dorsal view. B, D, F, H. Female paratype habitus, dorsal view. Scale bars: 1 mm.



**Type material.**

**Holotype**

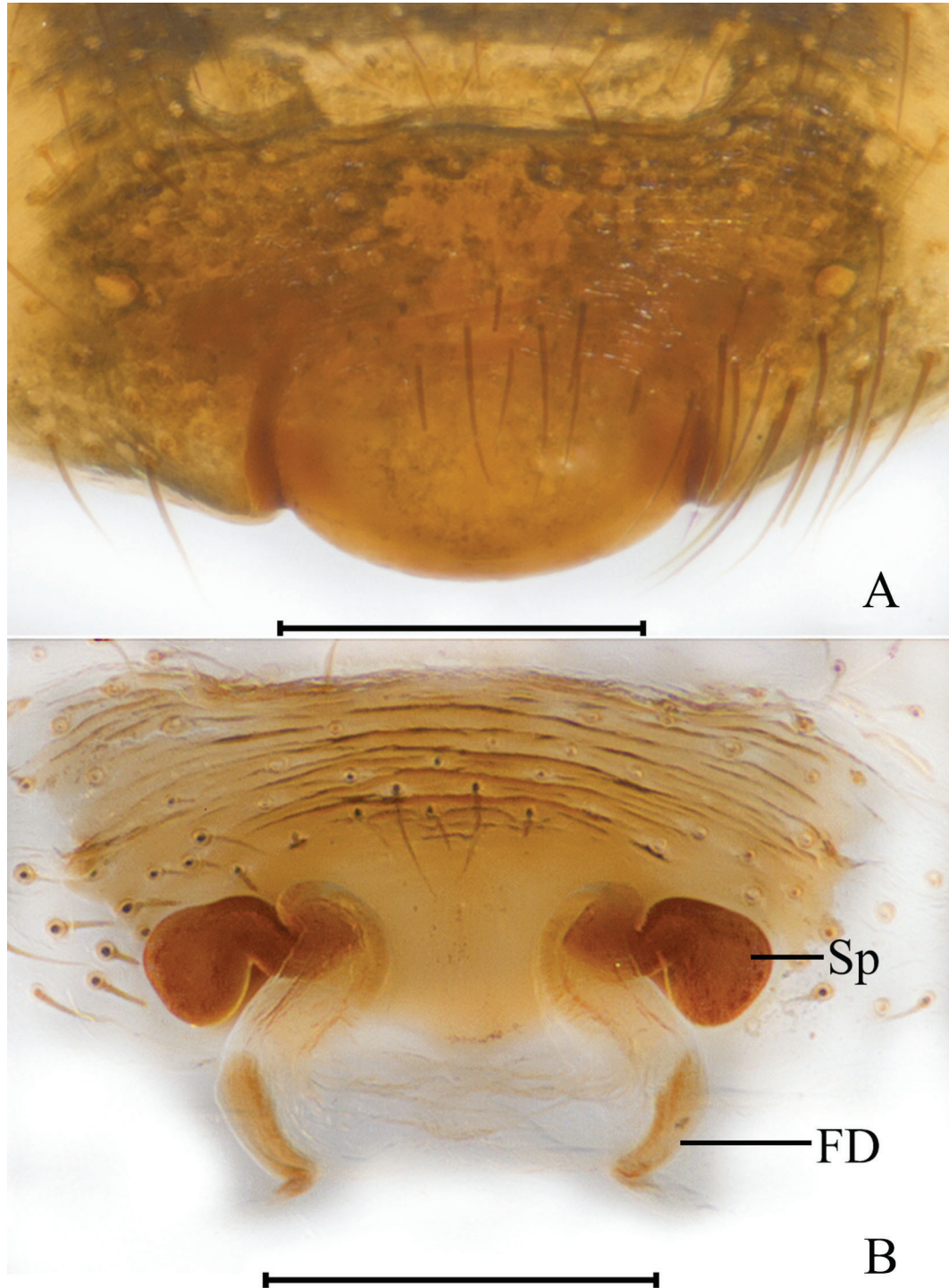
CHINA • ♂, Yunnan Province, Fugong County, Lumadeng Township, Shibali forest station; 27°09'55" N, 98°46'44" E; alt. 2525 m; 1–7 May 2004; C. Griswold and D.H. Kavanaugh leg.; HNU-CGY25.



**Fig. 2.** *Meta hamata* sp. nov. Left palp, ♂, holotype (HNU-CGY25): A. Prolateral view. B. Retrolateral view. C. Dorsal view. D. Ventral view. Scale bars: A–D = 0.2 mm.

**Paratypes** (16 ♂♂ and 26 ♀♀)

CHINA – Yunnan Province – Fugong County • 6 ♂♂, 6 ♀♀; same collection data as for holotype; HNU-CGY25 • 1 ♂, 2 ♀♀; Lumadeng Township, Yaping Village, 2 km up Shibali; 27°09'46" N, 98°47'24" E; alt. 2730 m; 1 May 2004; G.X. Peng leg.; HNU-20040501-2 • 1 ♂; 2 km down Shibali; 27°09'46" N, 98°47'24" E; alt. 2420 m; 2 May 2004; G.X. Peng leg.; HNU-20040502 • 2 ♂♂, 2 ♀♀;



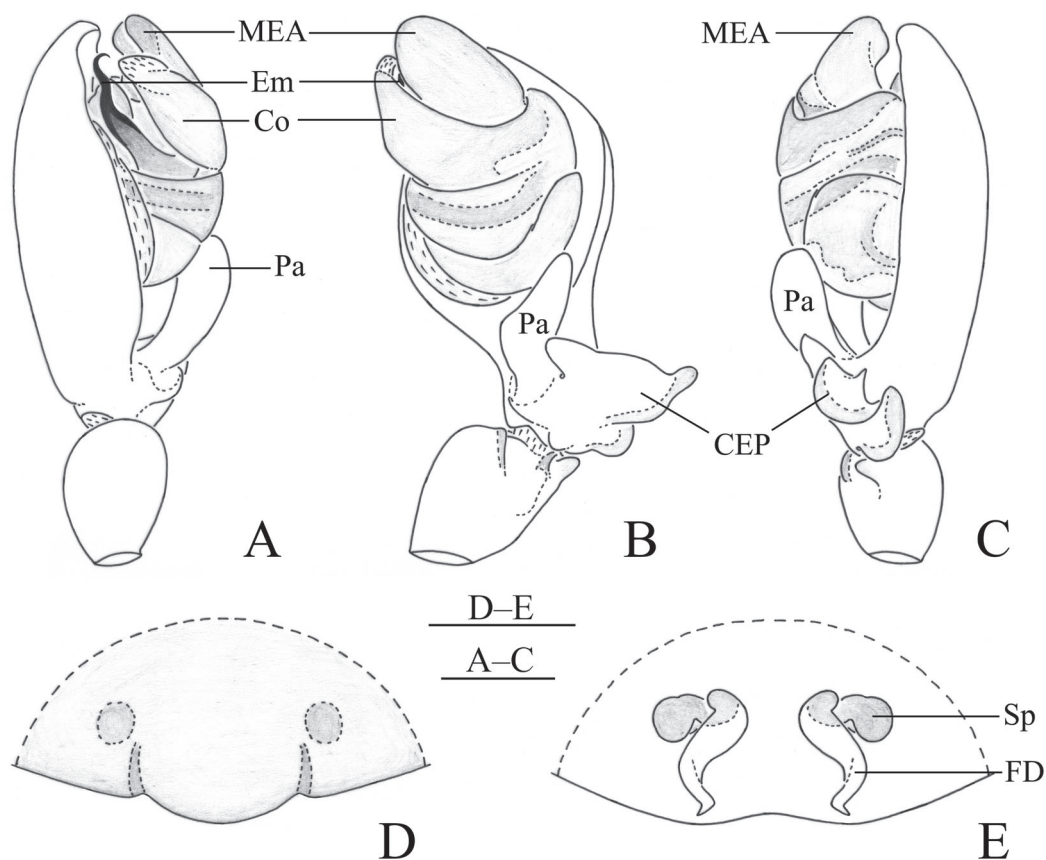
**Fig. 3.** *Meta hamata* sp. nov., paratype ♀ (HNU-CGY25). **A.** Epigyne, ventral view. **B.** Vulva, front view. Scale bars: 0,2 mm.

Lumadeng Township, Yaping Village, 3 km up Shibali; 27°10'39" N, 98°45'18" E; 2527 m; 4 May 2004; H.M. Yan and G.X. Peng leg.; HNU-20040504-2 • 1 ♂, 5 ♀♀; Lumadeng Township, Yaping Village, 7.2 km up of Shibali; 27°10'47" N, 98°43'35" E; alt. 3059 m; 4 May 2004; H.M. Yan and G.X. Peng leg.; HNU-20040504-3 • 1 ♀; Lumadeng Township, Yaping Village; 27°10'39" N, 98°45'18" E; alt. 2550 m; 5 May 2004; H.M. Yan leg.; HNU-20040505 • 3 ♂♂, 1 ♀; Lumadeng Township, 2 km Yaping to Fugong; 27°10'39" N, 98°45'18" E; alt. 2500 m; 7 May 2004; H.M. Yan leg.; HNU-20040507-1 • 1 ♀; Lumadeng Township, Yaping Village; 27°08'42" N, 98°48'52" E; alt. 2530 m; 7 May 2004; H.M. Yan leg.; HNU-20040507-2 • 1 ♂, 1 ♀; Lumadeng Township, near Shibali forest station; 27°10'08" N, 98°46'19" E; alt. 2650 m; 9 May 2004; Charles Griswold and H.M. Yan leg.; HNU-CGY41 • 1 ♂, 6 ♀♀; Shiyueliang Township, Lishadi; 27°06'19" N, 98°46'47" E; alt. 2530 m; 4–10 Aug. 2005; G. Tang leg.; HNU-Tang-05-02. – **Gongshan County** • 1 ♀; Qiqi Yakou; 27°41'48" N, 98°27'15" E; alt. 3675 m; 27 Sep. 2007; X.J. Peng leg.; HNU-20070927.

## Description

### Male (holotype)

MEASUREMENTS. Total length 4.06. Prosoma 2.13 long, 1.66 wide; opisthosoma 2.29 long, 1.53 wide. Prosoma brown, with longitudinal dark brown band. Cervical grooves distinct, radial furrows indistinct (Fig. 1A). Eye sizes and interdistances: AME 0.14, ALE 0.16, PME 0.17, PLE 0.15; AME–AME 0.09, AME–ALE 0.11, PME–PME 0.08, PME–PLE 0.14, ALE–PLE 0.03. MOA anterior width 0.37, posterior width 0.41, length 0.42. Clypeus 0.10 high.



**Fig. 4.** *Meta hamata* sp. nov., left palp of holotype ♂ (A–C); epigyne (D) and vulva (E) of paratype ♀ (HNU-CGY25): **A.** Prolateral view. **B.** Ventral view. **C.** Retrolateral view. **D.** Epigyne, ventral view. **E.** Vulva, front view. Scale bars: 0.2 mm.



CHELICERAE. Strong, brown, with three promarginal and four retromarginal teeth.

GNATHOCOXAE. Dark brown, longer than wide.

LABIUM. Dark brown, as long as wide.

STERNUM. Dark brown, scutellate, with sparse dark brown hairs.

LEGS. Brown, with annuli. Length of legs: I, 11.05 (3.05, 3.83, 2.95, 1.22); II, 8.38 (2.46, 2.91, 2.10, 0.91); III, 4.47 (1.42, 1.36, 1.13, 0.56); IV, 6.05 (1.96, 1.88, 1.52, 0.69). Leg formula: 1243.

OPISTHOSOMA. Oval, with two pairs of sigillae. Both dorsum and venter yellowish brown, with black markings (Fig. 1A).

PALP (Figs 2, 4A–C). Cymbial ectobasal process simple, with two rounded ends in retrolateral view. Paracymbium finger-like, widest medially, with sparse long brown hairs. Metaine embolic apophysis tongue-shaped, extending forward.

EMBOLUS. Long, with hook-shaped tip. Conductor strong, arising meso-retrolaterally from bulb and extending clockwise, widest medially, with membranous end.

#### **Female (CGY25, Fig. 1B)**

MEASUREMENTS. Total length 4.55. Prosoma 2.04 long, 1.62 wide; opisthosoma 2.81 long, 2.32 wide. Eye sizes and interdistances: AME 0.13, ALE 0.15, PME 0.16, PLE 0.14; AME–AME 0.11, AME–ALE 0.13, PME–PME 0.09, PME–PLE 0.16, ALE–PLE 0.03. MOA anterior width 0.35, posterior width 0.40, length 0.42. Clypeus 0.08 high.

LEGS. Length of legs: I, 8.67 (2.45, 3.06, 2.08, 1.08); II, 6.78 (2.01, 2.34, 1.57, 0.86); III, 3.83 (1.19, 1.21, 0.87, 0.56); IV, 5.20 (1.66, 1.70, 1.23, 0.61). Leg formula: 1243. Other morphological characteristics same as in male.

EPIGYNE (Figs 3, 4D–E). Posterior margin of epigynal plate round, looks like smiling face in ventral view. Spermathecae small and like a boxing glove. Fertilization ducts thick, S-shaped.

#### **Variation**

The total length in male specimens examined ranges from 3.60 to 4.06, in female specimens from 4.26 to 4.90.

#### **Distribution**

China, Yunnan Province (Fugong, Gongshan) (Fig. 16).

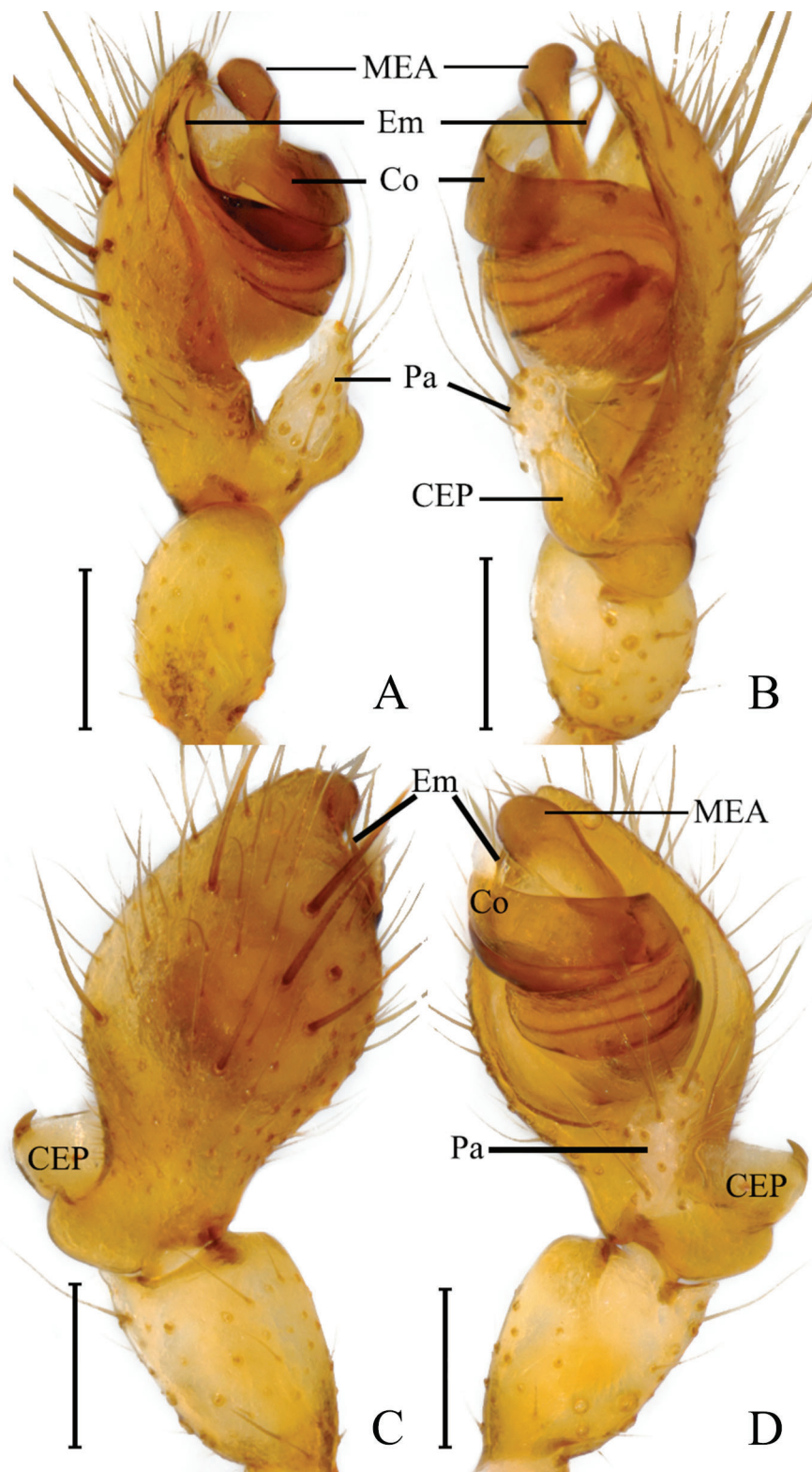
#### ***Meta longlingensis* sp. nov.**

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Figs 1I, 5–6

#### **Differential diagnosis**

*Meta longlingensis* sp. nov. can be distinguished from the other Chinese *Meta* species by the hook-shaped tip of the cymbial ectobasal process of the male palp (Figs 5–6). This new species resembles *M. yinae* sp. nov. (Figs 13–15), but can be distinguished from the latter by the following characters. Cymbial ectobasal process without the spine-like apophysis in ventral view found in that of *M. yinae*



**Fig. 5.** *Meta longlingensis* sp. nov. Left palp of holotype ♂ (HNU-Tang031029). **A.** Prolateral view. **B.** Retrolateral view. **C.** Dorsal view. **D.** Ventral view. Scale bars: 0.2 mm.



sp. nov. (Figs 5D, 6B, 13D, 15B). In prolateral view, terminal portion of embolus arc-shaped, slightly covered by conductor in *M. longlingensis* (Figs 5A, 6A), erect and passing through conductor in *M. yinae* sp. nov. (Figs 13A, 15A). In retrolateral view, metaine embolic apophysis wider anteriorly in *M. longlingensis* (Figs 5D, 6B), wider medially in *M. yinae* sp. nov. (Figs 13D, 15B).

### Etymology

The specific name refers to the type locality.

### Type material

#### Holotype

CHINA • 1 ♂; Yunnan Province, Longling County, Xiaoheishan Village (National 320 Road); 24°30'13" N, 98°27'25" E; alt. 2106 m; 29 Oct. 2003; G. Tang leg.; HNU-Tang031029.

### Description

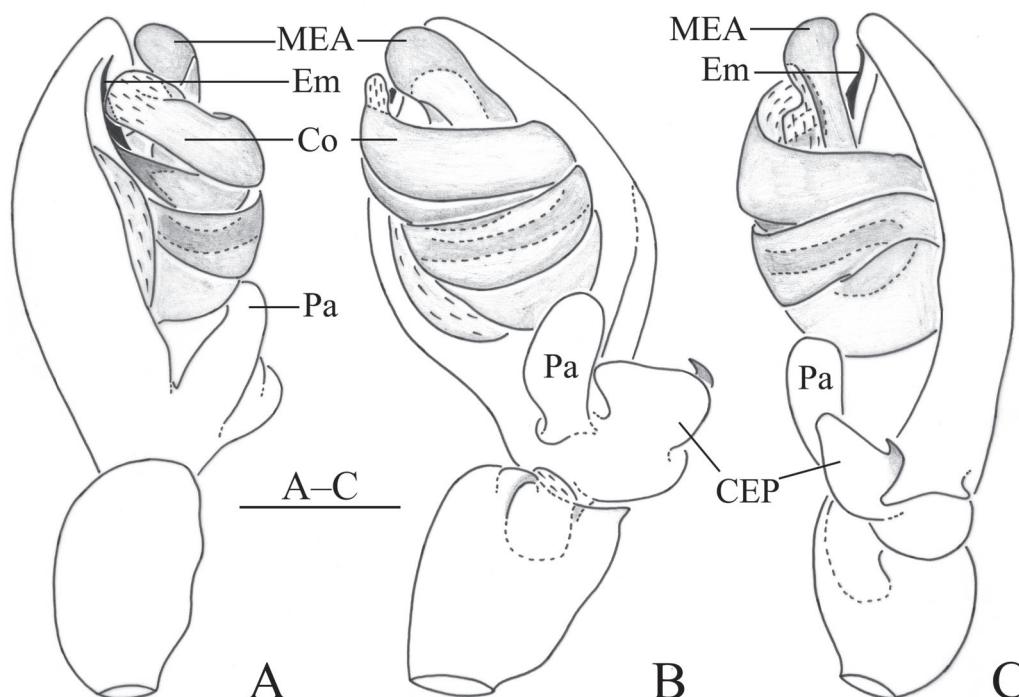
#### Male (holotype)

MEASUREMENTS. Total length 4.02. Prosoma 1.90 long, 1.48 wide; opisthosoma 2.08 long, 1.06 wide. Cervical groove distinct, radial furrows indistinct. Eye sizes and interdistances: AME 0.12, ALE 0.15, PME 0.16, PLE 0.13; AME–AME 0.11, AME–ALE 0.08, PME–PME 0.06, PME–PLE 0.12, ALE–PLE 0.04. MOA 0.40 long, front width 0.32, back width 0.39. Clypeus 0.09 high.

CHELICERAE. Strong, yellowish brown, with three promarginal and four retromarginal teeth.

GNATHOCOXAE AND LABIUM. Yellowish brown, longer than wide.

STERNUM. Brown, scutellate, with sparse brown hairs.



**Fig. 6.** *Meta longlingensis* sp. nov. Left palp of holotype ♂ (HNU-Tang031029). A. Prolateral view. B. Ventral view. C. Retrolateral view. Scale bars: 0.2 mm.

LEGS. Brown, with annuli. Length of legs: I, 15.42 (4.19, 5.30, 4.53, 1.40); II, 10.56 (3.13, 3.59, 2.84, 1.00); III, 5.17 (1.71, 1.57, 1.28, 0.61); IV, 7.85 (2.41, 2.64, 2.07, 0.73). Leg formula: 1243.

OPISTHOSOMA. Oval.

DORSUM. With two pairs of sigillae, yellowish brown, proximally with a white band followed by irregular black markings posteriorly (Fig. 1I). Venter of opisthosoma yellowish brown, with black markings. Dorsum of prosoma yellowish brown, with longitudinal dark brown band (Fig. 1I).

PALP (Figs 5–6). Cymbial ectobasal process wider than long, with hook-shaped tip. Paracymbium bulb-like, with a narrow base and sparse long, brown hairs. Metaine embolic apophysis ventrally grooved, with broad, round end.

EMBOLUS. Long, distal portion needle-shaped, extending forward. Conductor longer than wide, slightly curved, arising meso-retrolaterally from bulb and extending clockwise, with a membranous end.

### Female

Unknown.

### Distribution

China, Yunnan Province (Longling) (Fig. 16).

*Meta tangi* sp. nov.

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Figs 1C–D, 7–9

### Differential diagnosis

*Meta tangi* sp. nov. can be distinguished from the other Chinese *Meta* species by having a thin and long embolus, a dagger-shaped cymbial ectobasal process of the male palp (Figs 7, 9A–C), and U-shaped spermathecae of its epigyne (Figs 8B, 9E). This new species resembles *M. hamata* sp. nov. (Figs 1A–B, 2–4), but can be distinguished by the following characters. Cymbial ectobasal process longer than wide with pointed end in ventral view in *M. tangi* sp. nov. (Figs 7D, 9B), wider than long in *M. hamata* sp. nov. (Figs 2D, 4B). Distal part of embolus thin and proximally covered by the conductor in prolateral view in *M. tangi* sp. nov. (Figs 7A, 9A), thick and not covered by the conductor in *M. hamata* sp. nov. (Figs 2A, 4A). Metaine embolic apophysis narrow in ventral view in *M. tangi* sp. nov. (Figs 7D, 9B), tongue-like in *M. hamata* sp. nov. (Figs 2D, 4B). Spermathecae U-shaped in *M. tangi* sp. nov. (Figs 8B, 9E), boxing glove-like in *M. hamata* sp. nov. (Figs 3B, 4E).

### Etymology

The specific name is a patronym dedicated to Mr. Guo Tang, one of the collectors of the type specimens.

### Type material

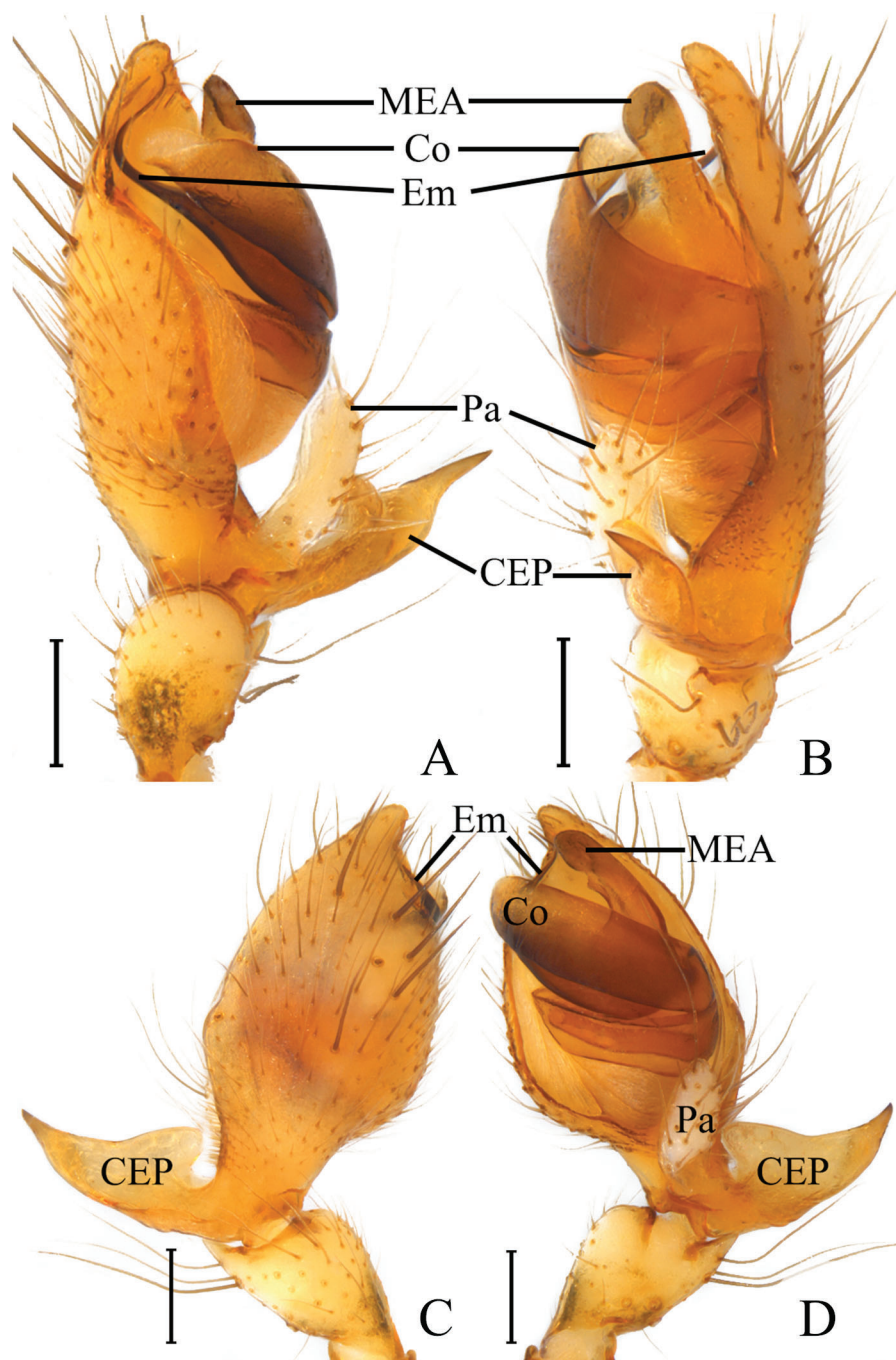
#### Holotype

CHINA • ♂; Yunnan Province, Baoshan City, Longyang District, Mangkuan Township, Baihualing; 25°18'13" N, 98°48'01" E; alt. 1624 m; 10 Oct. 2007; X.J. Peng leg.; HNU-20071010.

#### Paratypes (11 ♂♂ and 9 ♀♀)

CHINA – Yunnan Province • 1 ♂; same collection data as for holotype; HNU-20071010 • 2 ♀♀; Tengchong County, Jietou Township, Shaba Village, Lijiazai Group; 25°14'11" N, 98°25'16" E; alt.

1819 m; 23 Oct. 2003; G. Tang leg.; HNU-Tang031023 • 3 ♂♂; Baoshan City, Nankang Yakou (National 320 Road); 24°49'35" N, 98°45'58" E; alt. 2186 m; 26 Oct. 2003; G. Tang leg.; HNU-Tang031026 • 3 ♂♂, 6 ♀♀; Baoshan City, Nankang Yakou (National 320 Road); 24°49'35" N, 98°45'58" E; alt. 2186 m; 30 Oct. 2003; G. Tang leg.; HNU-Tang031030 • 3 ♂♂; Baoshan City, Nankang Yakou (National 320 Road); 24°49'35" N, 98°45'58" E; alt. 2186 m; 31 Oct. 2003; G. Tang leg.; HNU-Tang031031 • 1 ♀; Tengchong County, Jietou Township, No. 8 Boundary Post of Yakou; 25°48'32" N, 98°37'15" E; alt. 2890 m; 23 May 2006; X.J. Peng, X.P. Wang and P. Hu leg.; HNU-Wang060523 • 1 ♂; Longyang



**Fig. 7.** *Meta tangi* sp. nov. Left palp of holotype ♂ (HNU-20071010). **A.** Prolateral view. **B.** Retrolateral view. **C.** Dorsal view. **D.** Ventral view. Scale bars: 0.2 mm.

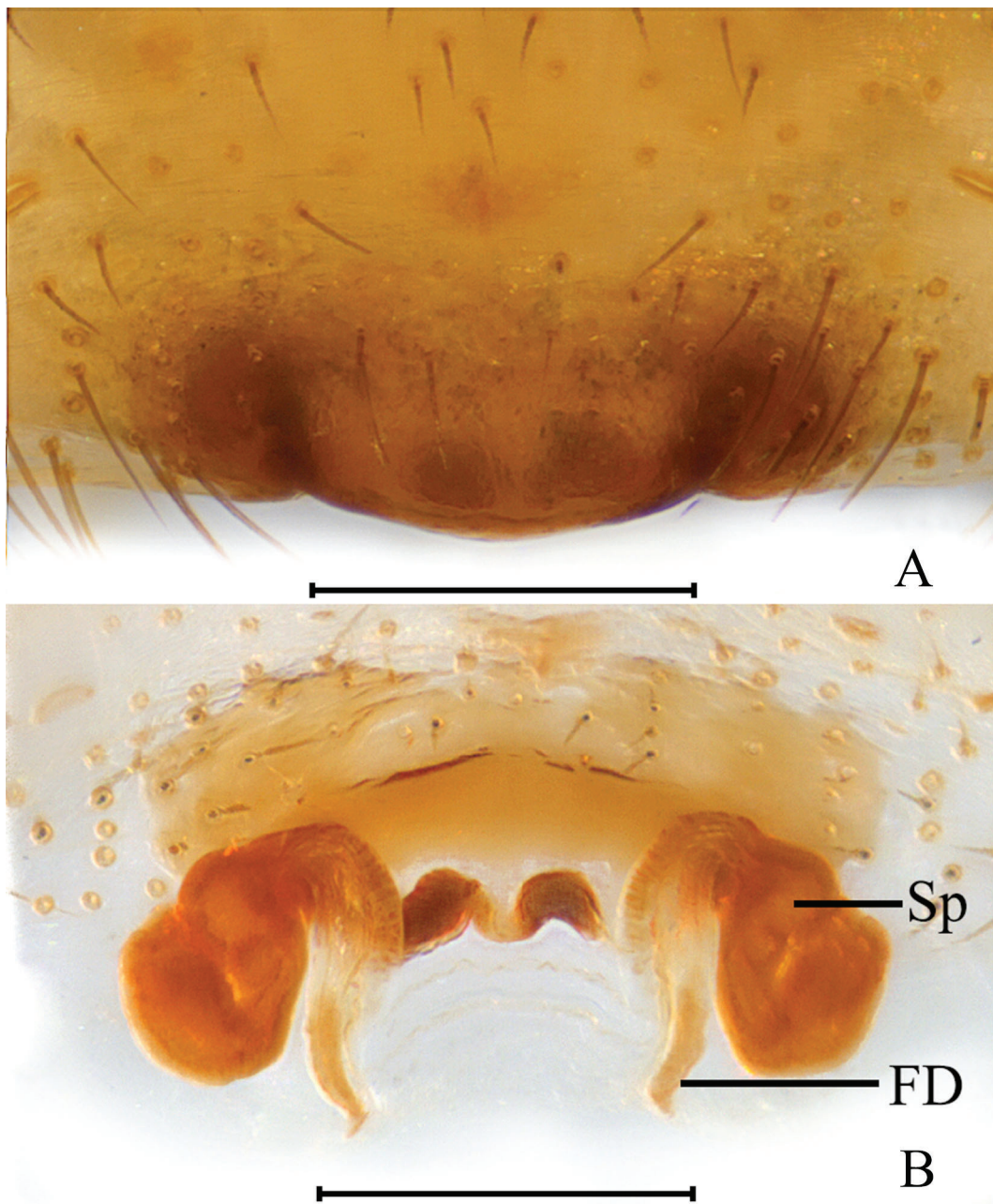


District, Mangkuan Township, Baihualing; 25°18'1" N, 98°47'14" E; alt. 1995 m; 11 Oct. 2007; X.J. Peng leg.; HNU-20071011.

### Description

**Male** (holotype, Fig. 1C)

MEASUREMENTS. Total length 5.33. Prosoma 2.52 long, 1.86 wide; opisthosoma 3.10 long, 2.02 wide. Eye sizes and interdistances: AME 0.12, ALE 0.15, PME 0.14, PLE 0.14; AME–AME 0.14, AME–ALE 0.16, PME–PME 0.11, PME–PLE 0.18, ALE–PLE 0.05. MOA 0.41 long, front width 0.39, back width 0.44. Clypeus height 0.13.



**Fig. 8.** *Meta tangi* sp. nov. Paratype ♀ (HNU-20071010). **A.** Epigyne, ventral view. **B.** Vulva, front view. Scale bars: 0,2 mm.

CHELICERAE. Strong, yellowish brown, three promarginal and four retromarginal teeth.

GNATHOCOXAE AND LABIUM. Brown, longer than wide. Sternum brown, scutellate, with sparse dark brown hairs.

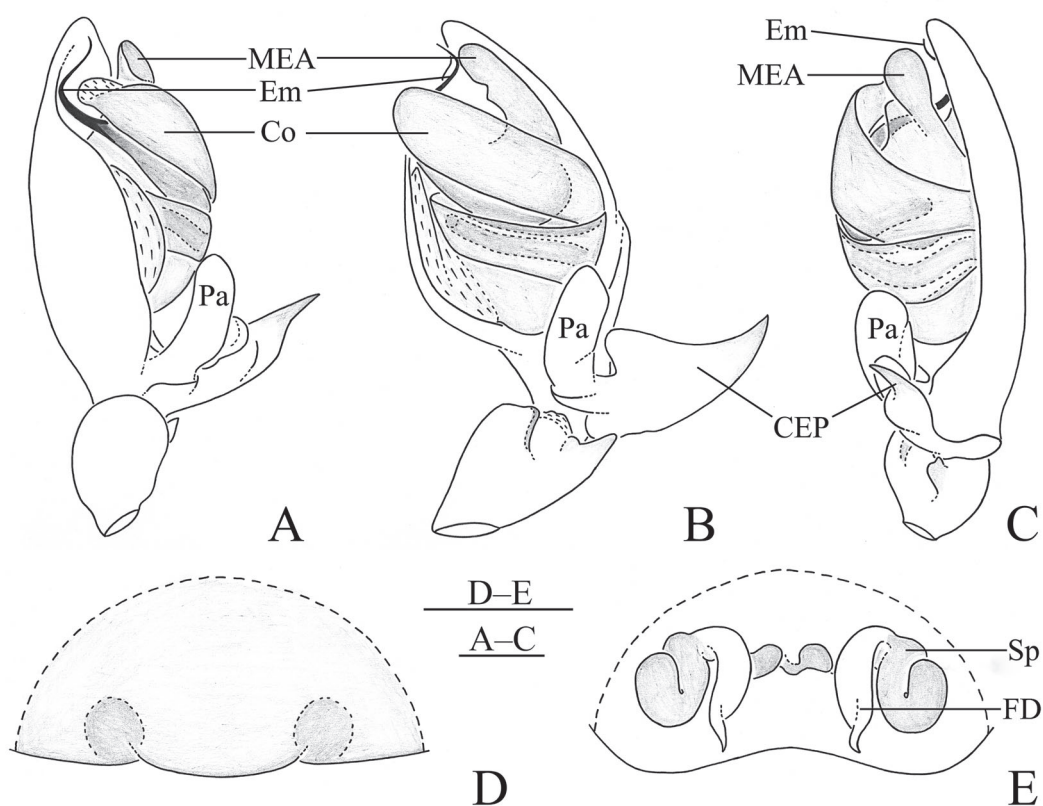
LEGS. Yellowish brown, with annuli. Length of legs: I, 16.77 (4.45, 6.01, 4.70, 1.61); II, 12.07 (3.57, 4.26, 3.16, 1.08); III, 5.96 (1.92, 1.91, 1.47, 0.66); IV, 8.77 (2.73, 2.74, 2.46, 0.84). Leg formula: 1243.

OPISTHOSOMA. Oval.

DORSUM. With two pairs of sigillae, yellowish brown, proximally with a white band followed by irregular black markings posteriorly (Fig. 1C). Venter of opisthosoma yellowish brown, with black markings. Dorsum of prosoma yellowish brown, with longitudinal dark brown band. Cervical groove distinct, radial furrows indistinct (Fig. 1C).

PALP (FIGS 7, 9A–C). Cymbial ectobasal process dagger-like. Paracymbium rod-like and curved, with sparse long, brown hairs. Metaine embolic apophysis long, narrow, finger-like.

EMBOLUS. Long, thin, most of proximal portion covered by conductor. Conductor arising meso-retrolaterally from bulb, extending clockwise, with a membranous end.



**Fig. 9.** *Meta tangi* sp. nov. Left palp of holotype ♂ (A–C); epigyne (D) and vulva (E) of paratype ♀ (HNU-20071010). A. Prolateral view. B. Ventral view. C. Retrolateral view. D. Epigyne, ventral view. E. Vulva, front view. Scale bars: 0.2 mm.

**Female** (Tang031023, Fig. 1F)

MEASUREMENTS. Total length 5.50. Prosoma 2.03 long, 1.59 wide; opisthosoma 3.73 long, 3.09 wide (Fig. 1D). Eye sizes and interdistances: AME 0.11, ALE 0.15, PME 0.15, PLE 0.14; AME–AME 0.10, AME–ALE 0.11, PME–PME 0.09, PME–PLE 0.13, ALE–PLE 0.04. MOA 0.40 long, front width 0.34, back width 0.40. Clypeus 0.07 high.

LEGS. Length of legs: I, 10.26 (3.08, 3.48, 2.62, 1.08); II, 7.76 (2.30, 2.74, 1.80, 0.92); III, 4.28 (1.33, 1.33, 1.02, 0.60); IV, 6.28 (2.11, 1.97, 1.51, 0.69). Leg formula: 1243. Other morphological characteristics same as in male.

EPIGYNE (Figs 8, 9D–E). Spermathecae U-shaped. Fertilization ducts long, thick, sickle-shaped.

**Variation**

The total length in male specimens examined ranges from 4.82 to 5.33, in female specimens from 5.50 to 6.67.

**Distribution**

China, Yunnan Province (Baoshan, Tengchong) (Fig. 16).

***Meta yani* sp. nov.**

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Figs 1E–F, 10–12

**Differential diagnosis**

*Meta yani* sp. nov. can be distinguished from the other Chinese *Meta* species by the wide and bifurcated metaine embolic apophysis of the male palp (Figs 10D, 12B) and the long fertilization ducts of its epigyne (Figs 11B, 12E). *Meta yani* sp. nov. resembles *M. yinae* sp. nov. (Figs 13–15), but can be distinguished from the latter by the following characters. Metaine embolic apophysis bifurcated in ventral view in *M. yani* sp. nov. (Figs 10D, 12B), not bifurcated in *M. yinae* sp. nov. (Figs 13D, 15B). The spine-like apophysis of the cymbial ectobasal process arises from the median portion of CEP and is pointed towards the cymbium in *M. yani* sp. nov. (Figs 10B, 12C), whereas it forms the top of CEP and is pointed towards the genital bulb in *M. yinae* sp. nov. (Figs 13B, 15C). The posterior margin of the epigynal plate is centrally incised in *M. yani* sp. nov. (Figs 11A, 12D), whereas it is almost round in *M. yinae* sp. nov. (Figs 14A, 15D). Spermathecae horizontal, with boxing glove-like shape in *M. yani* sp. nov. (Figs 11B, 12E), longitudinal in *M. yinae* sp. nov. (Figs 14B, 15E).

**Etymology**

The specific name comes from the family name of the collector, Prof. Yan Heng-mei; noun.

**Type material**

**Holotype**

CHINA • 1 ♂; Yunnan Province, Gongshan County, Cikai Township, Dabadi to Gongshan, along Pula river; 27°47'40" N, 98°30'25" E; 3025–3990 m; 4 Oct. 2002; H.M. Yan leg.; HNU-Yan021004.

**Paratypes**

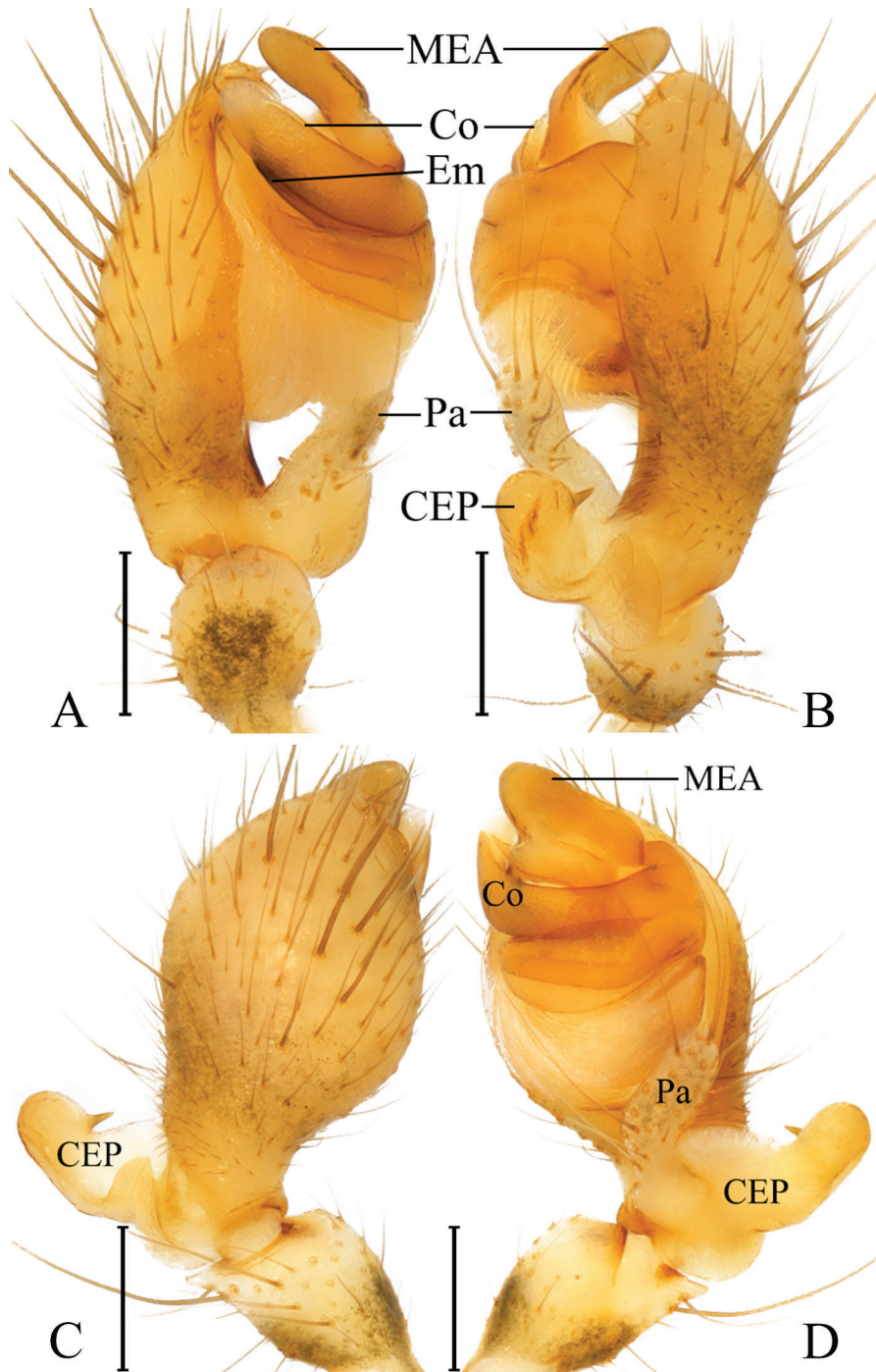
CHINA • 2 ♂♂, 5 ♀♀; same collection data as for holotype; HNU-Yan021004.



## Description

**Male** (holotype, Fig. 1E)

MEASUREMENTS. Total length 4.14. Prosoma 1.92 long, 1.58 wide; opisthosoma 2.41 long, 2.29 wide. Eye sizes and interdistances: AME 0.08, ALE 0.11, PME 0.12, PLE 0.11; AME–AME 0.14, AME–ALE 0.14, PME–PME 0.12, PME–PLE 0.18, ALE–PLE 0.06. MOA 0.37 long, front width 0.32, back width 0.36. Clypeus 0.09 high.

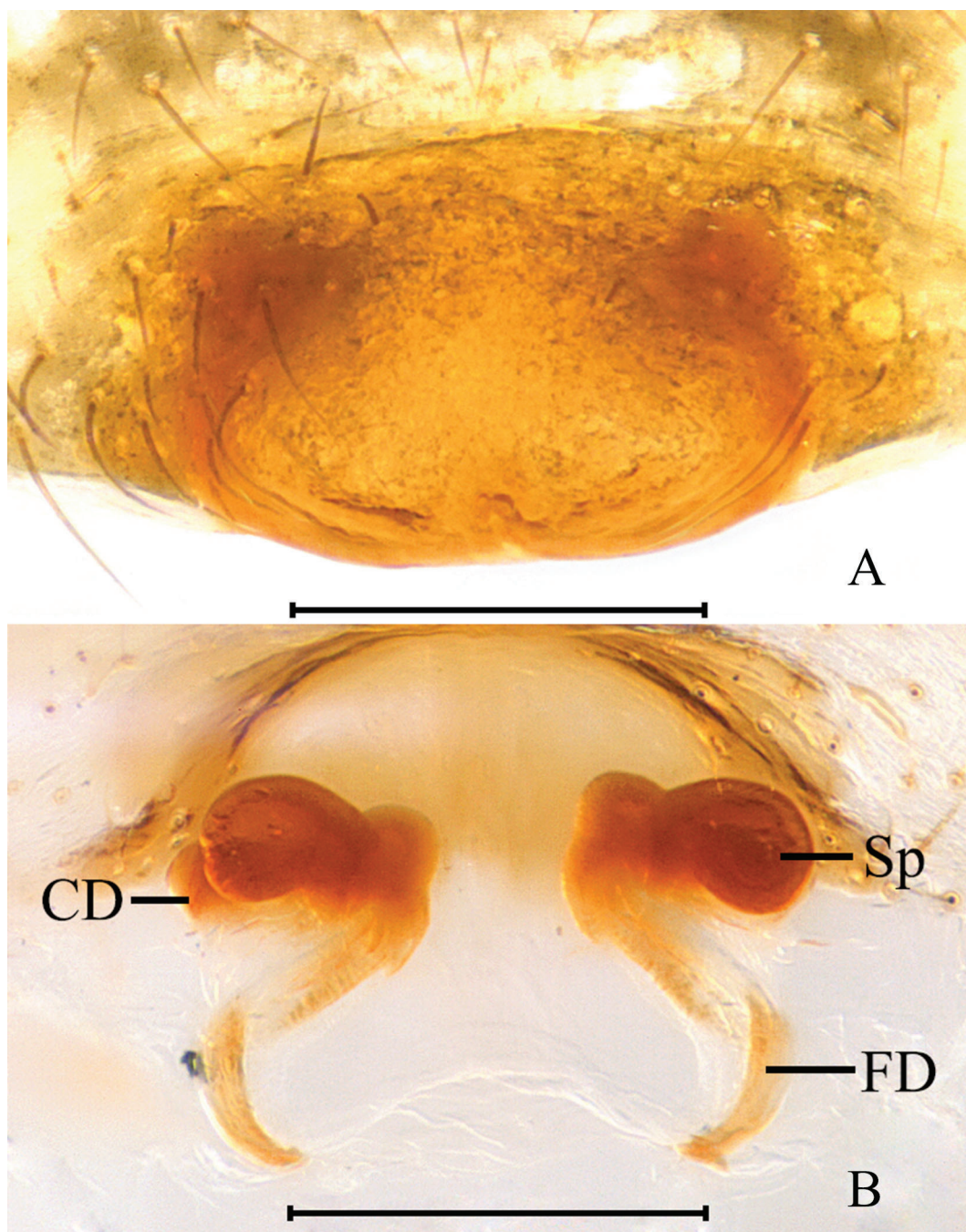


**Fig. 10.** *Meta yani* sp. nov. Left palp of holotype ♂ (HNU-Yan021004). **A.** Prolateral view. **B.** Retrolateral view. **C.** Dorsal view. **D.** Ventral view. Scale bars: 0.2 mm.

CHELICERAE. Strong, yellowish brown, three promarginal and four retromarginal teeth.

GNATHOCOXAE AND LABIUM. Gray brown, longer than wide. Sternum gray brown, scutellate, with sparse brown hairs.

DORSUM OF PROSOMA. Yellowish brown, with longitudinal dark brown band. Cervical groove distinct, radial furrows indistinct (Fig. 1E).



**Fig. 11.** *Meta yani* sp. nov. Paratype ♀ (HNU-Yan021004). **A.** Epigyne, ventral view. **B.** Vulva, front view. Scale bars: 0.2 mm.

LEGS. Yellowish brown, with annuli. Length of legs: I, 10.00 (2.79, 3.51, 2.64, 1.06); II, 7.72 (2.24, 2.68, 1.93, 0.87); III, 4.36 (1.39, 1.39, 1.00, 0.58); IV, 5.61 (1.80, 1.78, 1.42, 0.61). Leg formula: 1243.

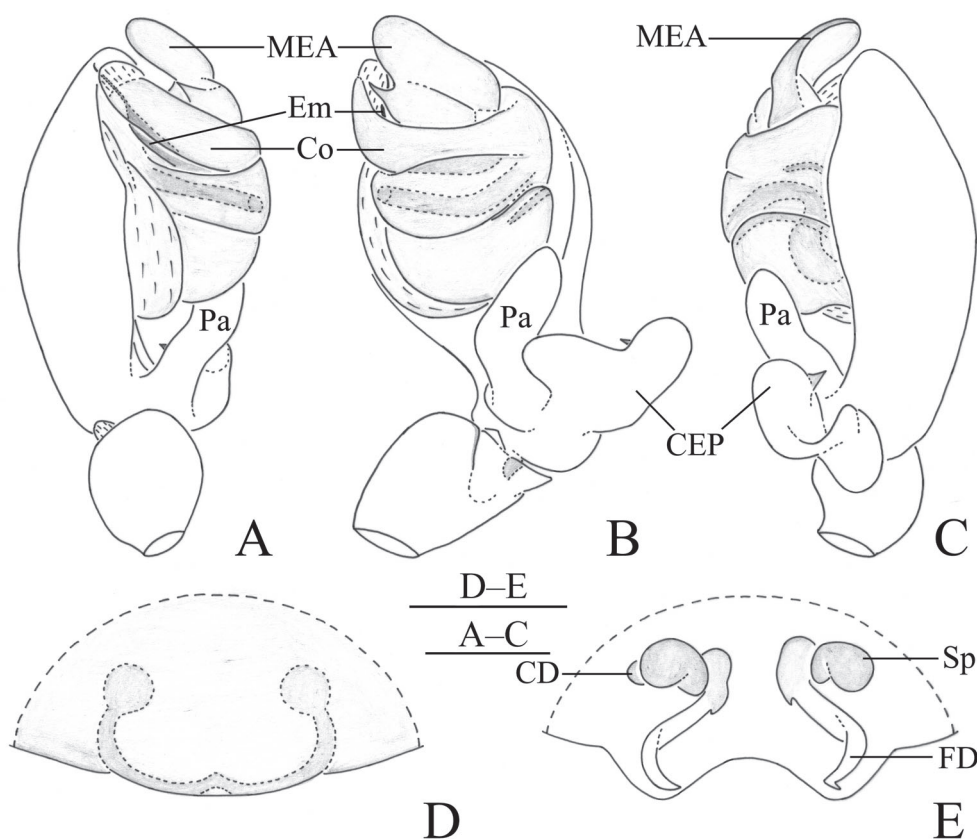
OPISTHOSOMA. Ovate, dorsum with two pairs of sigillae, yellowish brown, with irregular black and white markings (Fig. 1E). Venter of opisthosoma yellowish brown, with black markings.

PALP (Figs 10, 12A–C). Cymbial ectobasal process Y-shaped, with a small tooth ventro-laterally. Paracymbium short, rod-like, with sparse long, brown hairs. Metaine embolic apophysis bifurcated in ventral view. Embolus long, thin, most of proximal portion covered by conductor. Conductor longer than wide, arising meso-retrolaterally from bulb, extending clockwise, with a membranous end.

**Female (Yan021004, Fig. 1F)**

MEASUREMENTS. Total length 4.00. Prosoma 1.85 long, 1.46 wide; opisthosoma 2.35 long, 1.96 wide (Fig. 1F). Eye sizes and interdistances: AME 0.12, ALE 0.14, PME 0.14, PLE 0.14; AME–AME 0.08, AME–ALE 0.10, PME–PME 0.08, PME–PLE 0.13, ALE–PLE 0.03. MOA 0.38 long, front width 0.31, back width 0.37. Clypeus 0.07 high.

LEGS. Length of legs: I, 7.71 (2.18, 2.67, 1.92, 0.94); II, 6.05 (1.77, 2.00, 1.50, 0.78); III, 3.66 (1.13, 1.18, 0.79, 0.56); IV, 4.83 (1.54, 1.59, 1.11, 0.59). Leg formula: 1243. Other morphological characteristics same as in male except lightly colored.



**Fig. 12.** *Meta yani* sp. nov. Left palp of holotype ♂ (A–C); epigyne (D) and vulva (E) of paratype ♀ (HNU-Yan021004). A. Prolateral view. B. Ventral view. C. Retrolateral view. D. Epigyne, ventral view. E. Vulva, front view. Scale bars: 0.2 mm.



EPIGYNE (Figs 11, 12D–E). Spermathecae small, shape boxing glove-like. Fertilization ducts long, slightly curved.

### Variation

The total length in male specimens examined ranges from 4.11 to 4.56, in female specimens from 3.57 to 4.34.

### Distribution

China, Yunnan Province (Gongshan) (Fig. 16).

*Meta yinae* sp. nov.

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Figs 1G–H, 13–15

### Differential diagnosis

*Meta yinae* sp. nov. can be distinguished from the other Chinese *Meta* species by the wide conductor, the Y-shaped cymbial ectobasal process of the male palp (Figs 13, 15A–C), and the bean-shaped spermathecae of the epigyne (Figs 14B, 15E). *Meta yinae* sp. nov. resembles *M. yani* sp. nov. (Figs 10–12), but can be distinguished from the latter by the following characters. Metaine embolic apophysis not bifurcated in ventral view in *M. yinae* sp. nov. (Figs 13D, 15B), bifurcated in *M. yani* sp. nov. (Figs 10D, 12B). The spine-like apophysis of the cymbial ectobasal process arises from the top of CEP and points towards the genital bulb in *M. yinae* sp. nov. (Figs 13B, 15C), it forms the median portion of CEP and points towards the cymbium in *M. yani* sp. nov. (Figs 10B, 12C). The posterior margin of the epigynal plate almost round in *M. yinae* sp. nov. (Figs 14A, 15D), centrally incised in *M. yani* sp. nov. (Figs 11A, 12D). Spermathecae longitudinal, present posteriorly in *M. yinae* sp. nov. (Figs 14B, 15E), whereas horizontal, present anteriorly in *M. yani* sp. nov. (Figs 11B, 12E).

### Etymology

The specific epithet is taken from the family name of Prof. Changmin Yin, in honour of her great contribution to Chinese arachnology; noun.

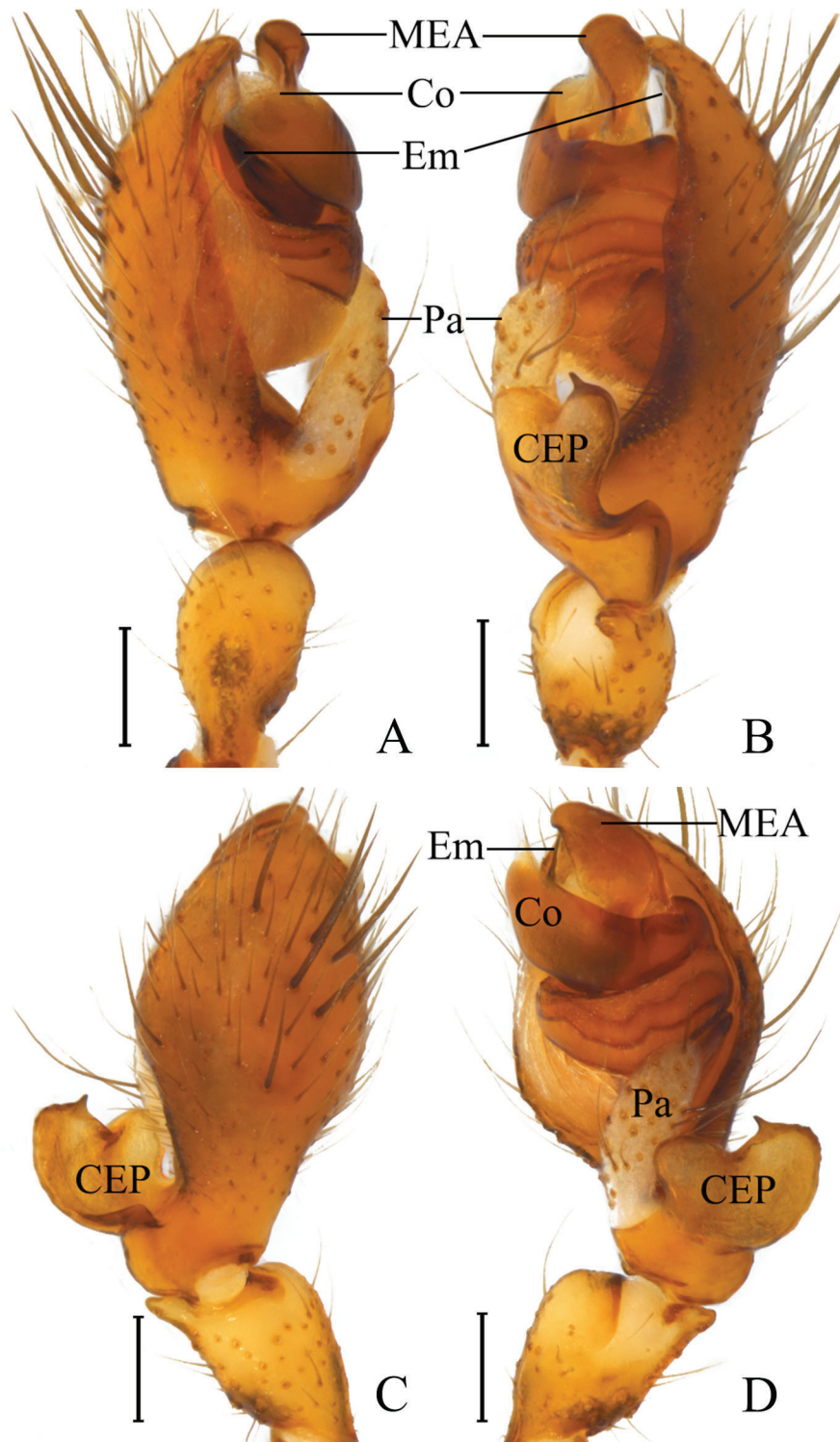
### Type material

#### Holotype

CHINA • ♂; Yunnan Province, Fugong County, Pihe Township, Yueliangtian Village; 26°34'04" N, 98°54'32" E; alt. 1520 m; 20–24 Aug. 2005; G. Tang leg.; HNU-Tang-05-08.

#### Paratypes (15 ♂♂ and 18 ♀♀)

CHINA – **Yunnan Province** – **Fugong County** • 7 ♂♂, 13 ♀♀; same collection data as for holotype; HNU-Tang-05-08 • 1 ♂; Lumadeng Township, Yaping Village, 7.2 km up of Shibali; 27°10'47" N, 98°43'35" E; alt. 3059 m; 4 May 2004; H.M. Yan and G.X. Peng leg.; HNU-20040504-3 • 1 ♂, 3 ♀♀; 10.1–11.5 km from Shibali to Yaping; 27°12'02" N, 98°42'49" E–27°12'24" N, 98°43'03" E; alt. 3225–3290 m; 8 May 2004; C. Griswold and D.H. Kavanaugh leg.; HNU-CGY40 • 1 ♀; Lumadeng Township, Yaping Village, Yaping Yakou; 27°10'47" N, 98°43'35" E; alt. 3280–3100 m; 8 May 2004; H.M. Yan leg.; HNU-20040508. – **Lushui County** • 2 ♂♂; Luzhang Township, Yaojiaping Forest Station; 25°58'31" N, 98°42'36" E; alt. 2515 m; 20 May 2005; K.J. Guo leg.; HNU-GKJ013. – **Longyang County** • 1 ♂; Bawan Township, Sancha River, Luoshuidong area; 24°55'33" N, 98°45'29" E; alt. 2300 m; 3 June 2005; Charles Griswold leg.; HNU-CGY137. – **Tengchong County** • 1 ♂; Jietou Township, No. 8 Boundary Post of Yakou; 25°48'32" N, 98°37'15" E; alt. 2890 m; 23 May 2006; X.J. Peng, X.P.

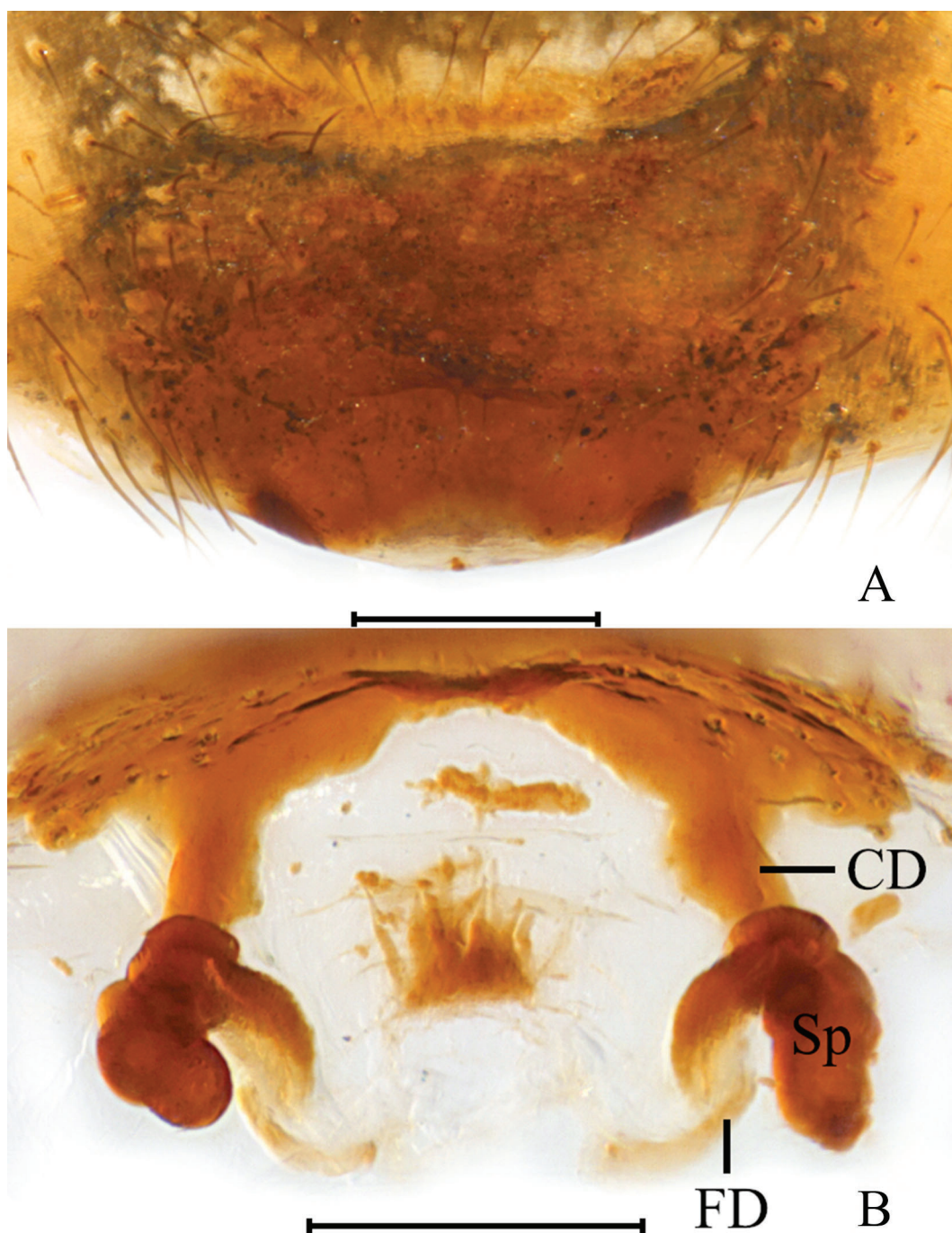


**Fig. 13.** *Meta yinae* sp. nov. Left palp of holotype ♂ (HNU-Tang-05-08). **A.** Prolateral view. **B.** Retrolateral view. **C.** Dorsal view. **D.** Ventral view. Scale bars: 0.2 mm.

Wang and P. Hu leg.; HNU-Wang060523-2. – **Gongshan County** • 1 ♀; Cicai Township, Dahaituo; 27°47'04" N, 98°27'37" E; alt. 3363 m; 13 Aug. 2006; P. Hu leg.; HNU-Hu060813 • 1 ♂; Qiqi No. 12 bridge; 27°42'59" N, 98°30'11" E; alt. 2738 m; 28 Sep. 2007; X.J. Peng leg.; HNU-20070928 • 1 ♂; Qiqi Dongshaofang; 27°41'43" N, 98°29'07" E; alt. 3208 m; 29 Sep. 2007; X.J. Peng leg.; HNU-20070929.

### Description

**Male** (holotype, Fig. 1G)



**Fig. 14.** *Meta yinae* sp. nov. Paratype ♀ (HNU-Tang-05-08). **A.** Epigyne, ventral view. **B.** Vulva, front view. Scale bars: 0.2 mm.



MEASUREMENTS. Total length 5.29. Prosoma 2.45 long, 2.00 wide; opisthosoma 3.28 long, 1.95 wide. Eye sizes and interdistances: AME 0.14, ALE 0.16, PME 0.15, PLE 0.16; AME–AME 0.09, AME–ALE 0.13, PME–PME 0.09, PME–PLE 0.19, ALE–PLE 0.03. MOA 0.44 long, front width 0.37, back width 0.42. Clypeus 0.11 high.

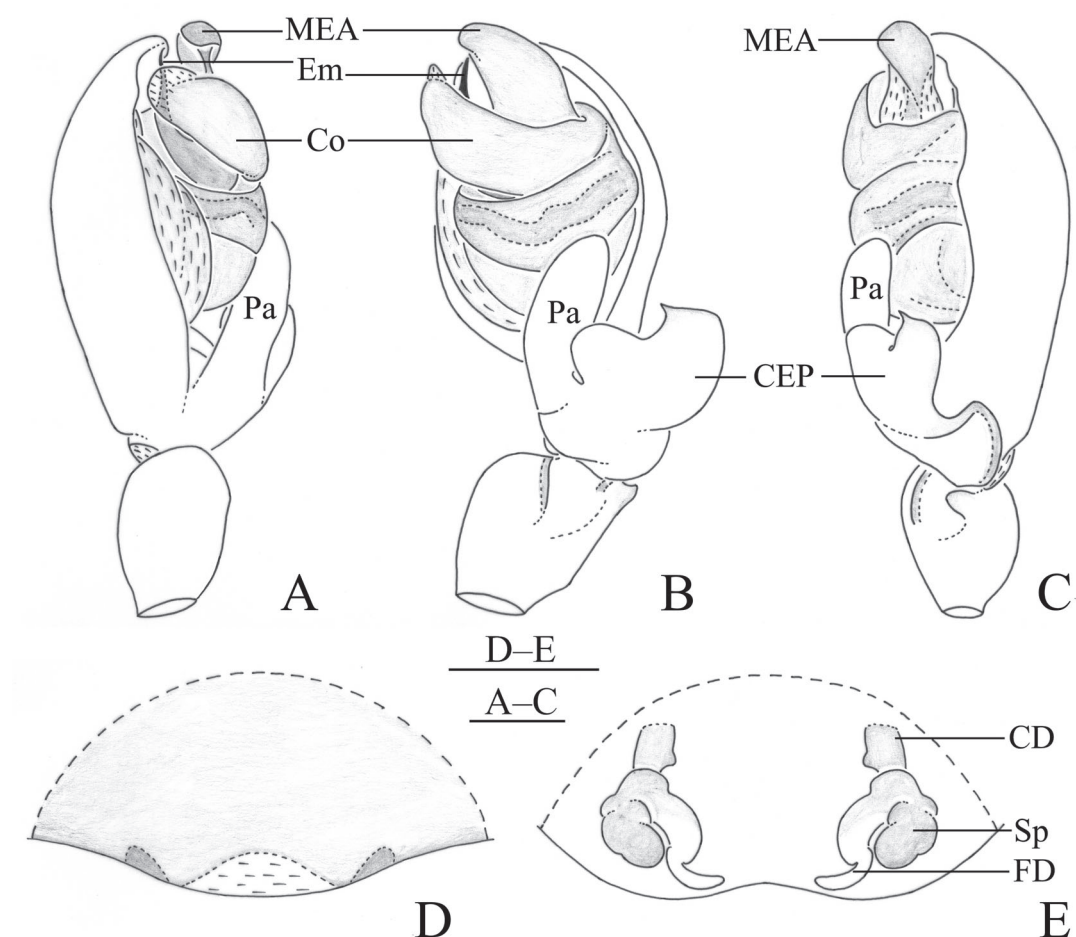
CHELICERAE. Strong, brown, with three promarginal and four retromarginal teeth.

GNATHOCOXAE AND LABIUM. Brown, longer than wide.

DORSUM OF PROSOMA. Yellowish brown, with longitudinal dark brown band. Cervical groove distinct, radial furrows indistinct (Fig. 1G).

STERNUM. Brown, scutellate, with sparse brown hairs.

LEGS. Brown, with annuli. Length of legs: I, 13.40 (3.82, 4.68, 3.41, 1.49); II, 10.48 (3.02, 3.73, 2.51, 1.22); III, 6.00 (2.01, 1.89, 1.39, 0.71); IV, 7.71 (2.50, 2.45, 1.91, 0.85). Leg formula: 1243.



**Fig. 15.** *Meta yinae* sp. nov. Left palp of holotype ♂ (A–C); epigyne (D) and vulva (E) of paratype ♀ (HNU-Tang-05-08). A. Prolateral view. B. Ventral view. C. Retrolateral view. D. Epigyne, ventral view. E. Vulva, front view. Scale bars: 0.2 mm.

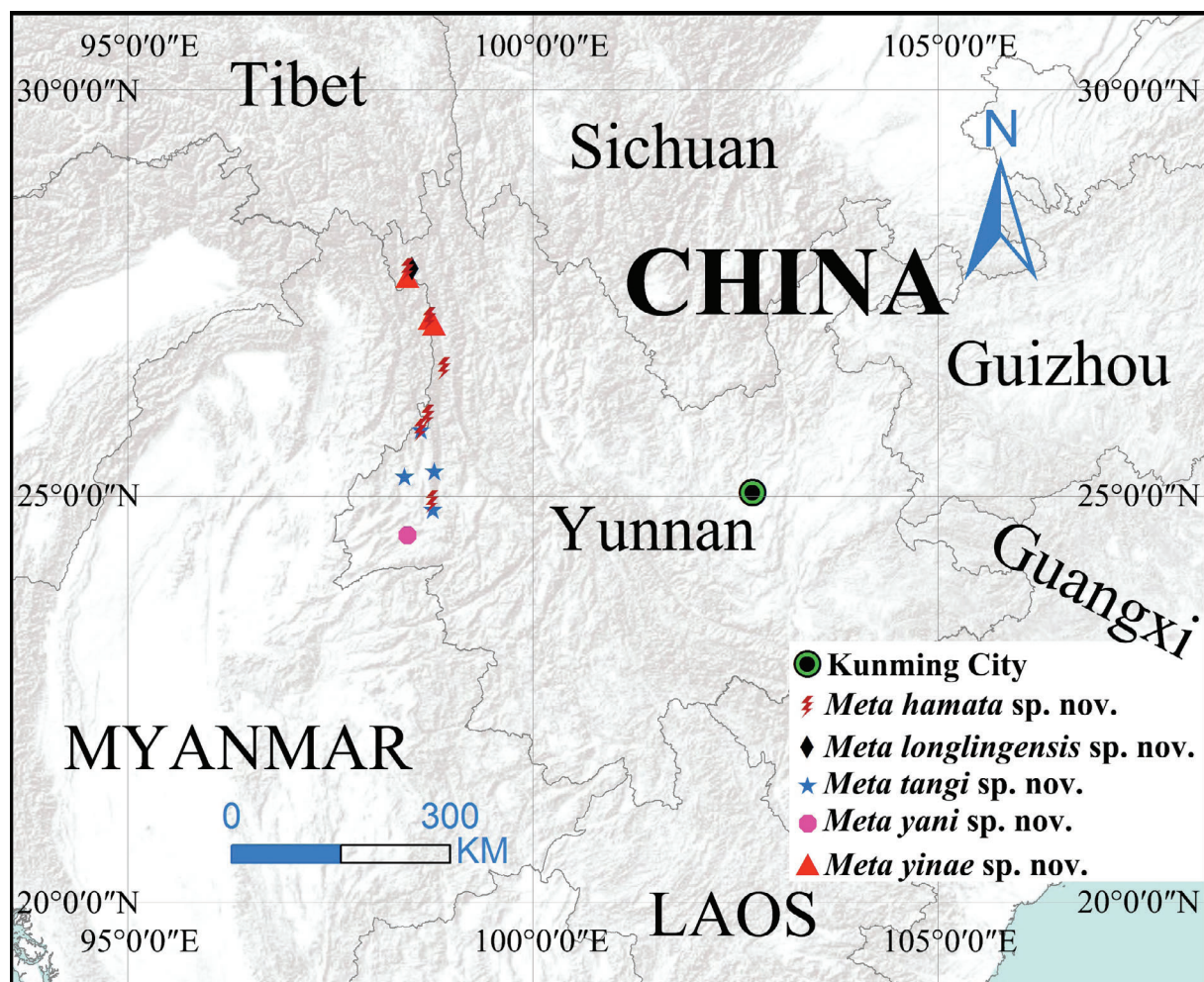
OPISTHOSOMA. Oval, dorsum with two pairs of sigillae, yellowish brown, with several irregular black markings (Fig. 1G). Venter of opisthosoma yellowish brown, with black markings.

PALP (Figs 13, 15A–C). Cymbial ectobasal process Y-shaped, with hook-shaped tip. Paracymbium strong and rod-like, with sparse long, brown hairs. Metaine embolic apophysis longer than wide, tongue-shaped. Embolus long, thin, proximally covered by conductor. Conductor longer than wide, slightly curved, arising meso-retrolaterally from bulb, extending clockwise, with a membranous end.

**Female** (HNU-Tang-05-08, Fig. 1H)

MEASUREMENTS. Total length 6.17. Prosoma 2.44 long, 2.09 wide; opisthosoma 4.25 long, 3.38 wide. Eye sizes and interdistances: AME 0.15, ALE 0.18, PME 0.17, PLE 0.16; AME–AME 0.09, AME–ALE 0.14, PME–PME 0.10, PME–PLE 0.18, ALE–PLE 0.04. MOA anterior width 0.39, posterior width 0.45, anterior width 0.46. Clypeus 0.12 high.

LEGS. Leg measurements: I, 11.06 (3.20, 3.86, 2.73, 1.27); II, 8.53 (2.52, 3.01, 2.03, 0.97); III, 5.07 (1.63, 1.68, 1.10, 0.66); IV, 7.18 (2.35, 2.45, 1.65, 0.73). Leg formula: 1243. Other morphological characteristics same as in male.



**Fig. 16.** Distribution records of five new species of the genus *Meta* Koch, 1836 in Gaoligong Mountains, Yunnan, China.

EPIGYNE (Figs 14, 15D–E). Copulatory ducts thick and short. Spermathecae bean-shaped, present posteriorly. Fertilization ducts relatively long and thick.

### Variation

The total length in male specimens examined ranges from 4.79 to 5.29, in female specimens from 4.95 to 6.74.

### Distribution

China, Yunnan Province (Fugong, Lushui, Longyang, Tengchong, Gongshan) (Fig. 16).

### Discussion

The genus *Meta* resembles *Metellina* Chamberlin & Ivie, 1941 and *Metleucauge* Levi, 1980, but can be distinguished by the following characters. *Meta* fertilization ducts cross over the spermathecae and the metaine embolic apophysis is fused to the embolus base (Álvarez-Padilla & Hormiga 2011, figs 58c–f, 60a–c), whereas *Metellina* fertilization ducts originate on the anterior surface of the spermathecae (Álvarez-Padilla & Hormiga 2011, figs 68c, 70d). The *Metleucauge* epigynum is flat with two deep atria, the male palpal trochanter has a large distal apophysis, and the male palpal femora and tibia are longer than four times its width (Álvarez-Padilla & Hormiga 2011, fig. 79a, b). The copulatory openings of *Meta* open posteriorly, apparently the only metaine that does so (Kallal & Hormiga 2018). The CEP of *Meta* is wider than in *Metellina* and has a little spike on the surface. *Zhinu* has a near-circular gap in the cymbium, the palp is much larger, and the CEP is complex and sclerotized (Kallal & Hormiga 2018). Moreover, the five new species fit the basic characteristics of *Meta*.

The members of genus *Meta* can be found in dark cliffs around cave entrances or among large stones in forest gullies. Due to the specific and isolated habitats of *Meta* species, the existence of species endemic to individual caves is expected. Continued exploration of the Gongligong Mountains will no doubt lead to the discovery of new species of the long-jawed orbweavers.

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