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Taxonomic Study of the Spider Family Pimoidae (Arachnida: Araneae) from China

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Xiang Xu and Shu-Qiang Li (2007) Taxonomic study of the spider family Pimoidae (Arachnida: Araneae) from China. *Zoological Studies* **46**(4): 483-502. The spider family Pimoidae from China is reviewed. Six pimoid species belonging to 2 genera are studied: *Pimoa anatolica* Hormiga, 1994, with the male reported for the first time, *Pimoa clavata* sp. nov., *P. reniformis* sp. nov., *P. trifurcata* sp. nov., *Weintrauboa chikunii* (Oi, 1979), and *W. megacanthus* sp. nov. Detailed morphological descriptions and illustrations of all 6 species are given. http://zoolstud.sinica.edu.tw/Journals/46.4/483.pdf

Key words: Araneae, Taxonomy, Pimoidae, New species, China.

Hormiga (1993) synonymized *Louisfagea* with *Pimoa*, raised *Pimoa* to family rank, and ended the history of pimoids being placed in different families. The Pimoidae is currently known to be a sister lineage of the Linyphiidae. "Linyphioid" is used for spiders of the families Linyphiidae and Pimoidae. As a relictual group, pimoids are mainly distributed on the west coast of North American, in Europe (the Alps, the Apennines, and the Cantabrian Mountains of northern Spain), the Himalayas, Japan, and China. Their disjunct pattern suggests a widespread ancestral Holarctic distribution, with subsequent extinction in the intervening areas (Hormiga, 1994 2003, Hormiga et al., 2005).

To the present, 26 pimoids have been described worldwide: three of them, *Pimoa anatolica* Hormiga, 1994, *P. lihengae* Griswold, Long and Hormiga, 1999, and *Weintrauboa yunnan* Yang, Zhu and Song, 2006 are known from China (Hormiga, 1994, Griswold et al., 1999, Yang et al., 2006, Platnick, 2006). In the current paper, 4 new species, 1 new species record, and the newly discovered male of *P. anatolica* are reported.

MATERIALS AND METHODS

Specimens were examined and measured under an Olympus (Tokyo, Japan) SZ40 stereomicroscope. Further details were studied under an Olympus BX41 compound microscope. All illustrations were made using an Olympus 1.00x drawing tube. Both the male palp and epigynum were examined and illustrated after they were dissected from the spiders' bodies. The male palp and the external structure of the female epigynum were immersed in a 75% alcohol solution for examination and illustration, but were not placed in a KOH solution for expansion. In order to illustrate the interior structure of the epigynum, the ventral and dorsal plates of the epigynum were cut off.

All measurements are given in millimeters. Somatic morphological measurements were taken with the stereomicroscope. Eye diameters were taken at the widest points. The total body length does not include the length of the chelicera or spinnerets. The length and width of the cephalothorax and abdomen were measured in dorsal view, but the height was measured in lateral view. Leg measurements are shown as total

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length (femur, patella + tibia, metatarsus, tarsus). Left structures (e.g., palp, legs, and chelicera) were measured and are described. The position of the metatarsal trichobothrium was expressed as in Millidge (1980). The terms used in the text and figures mainly follow Hormiga (1994 2003). Distribution maps of all species described in the current paper are provided. All of the specimens studied are deposited in the Institute of Zoology, Chinese Academy of Sciences (IZCAS), Beijing.

Abbreviations used in the text and figures include the following: ALE, anterior lateral eye; AME, anterior median eye; AME-ALE, distance between the AME and ALE; AS, alveolar sclerite; BH, basal hematodocha; C, conductor; CD, copulatory duct; CO, copulatory opening; CP, cymbial process; DP, dorsal plate of the epigynum; E, embolus; EF, embolic flap; FD, fertilization duct; MA, median apophysis; *n*, number of specimens examined; P, paracymbium; PCS, pimoid cymbial sclerite; PEP, pimoid embolic process; PER, posterior eye row; PLE, posterior lateral eye; PME, posterior median eye; PME-PLE, distance between the PME and PLE; S, spermatheca; SH, spermathecal head; and VP, ventral plate of epigynum.

TAXONOMY

Pimoidae Wunderlich, 1986
Pimoa anatolica Hormiga, 1994
(Figs. 1-15, Map 1)

Pimoa anatolica Hormiga 1994: 73, figs. 290, 300.

Material examined: 2 ♀♀, 4 ♂♂, Shuijidong Cave (25.1°N, 102.9°E, elevation 2257 m), Longtan Village, Shuanglong Town, Kunming, Yunnan Prov., China, 12 Dec. 2002, coll. Shuqiang Li.

Diagnosis: According to the illustrations of *P. lihengae* Griswold, Long and Hormiga, 1994, the male of this species is similar to *P. lihengae* in the shape of the conductor, the embolus, the pimoid cymbial sclerite (PCS) and the paracymbium, but can be distinguished by the presence of a very small and sharp branch on the pimoid embolic process (PEP) (Fig. 8), and by the presence of many more cuspules on the cymbial process (CP) (Figs. 6, 7). The female can be distinguished by the widely separated spermathecae and the broad copulatory ducts (Figs. 12-15).

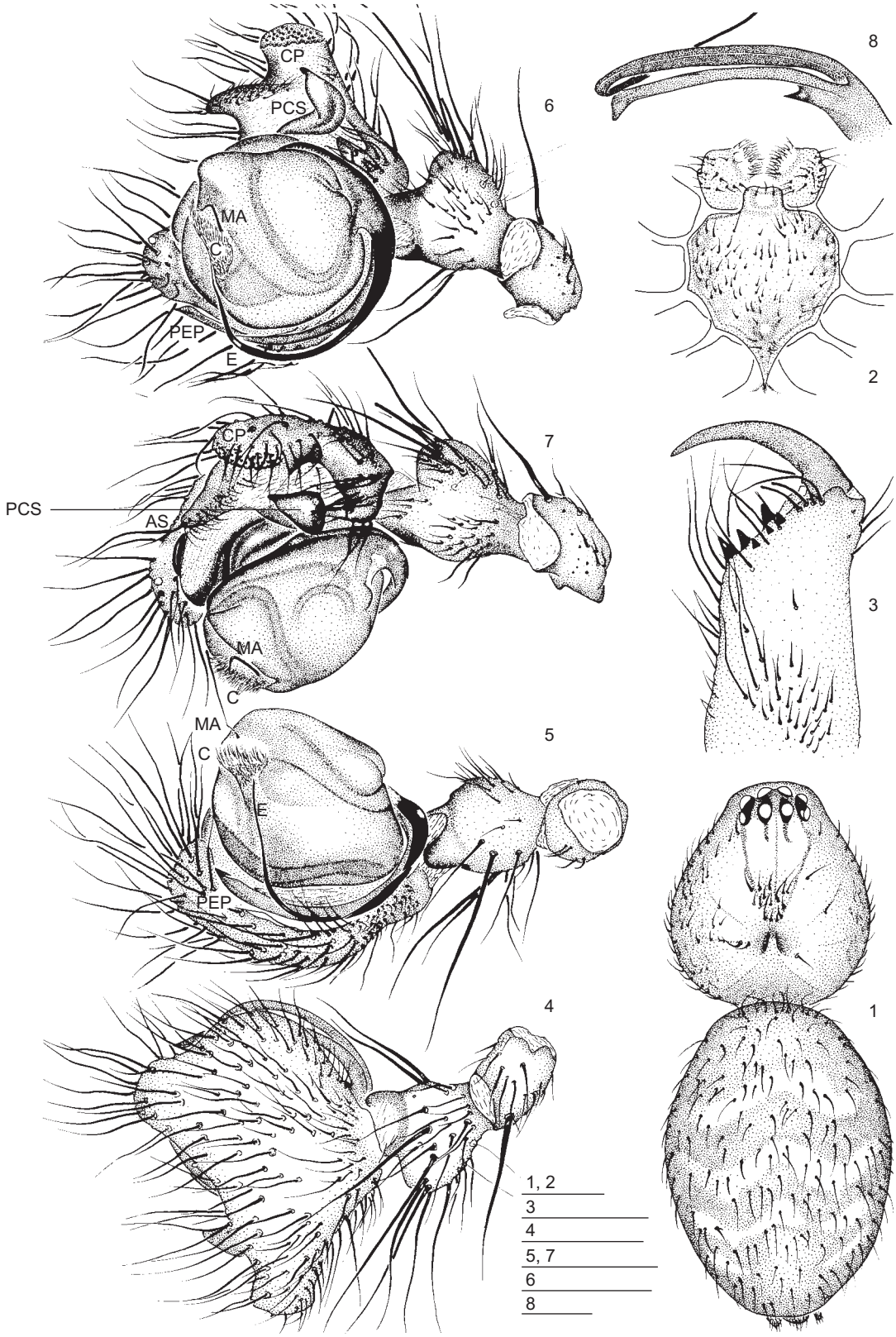
Male: Total length 7.83. Cephalothorax 3.48 long, 2.93 wide, 2.28 high; abdomen 4.35 long, 3.10 wide, 3.15 high. AME diameter 0.19. ALE 1.00, PME 1.06, PLE 1.13 times AME diameter. AME separation 0.50 times their diameter, PME separation 0.35 times their diameter. AME-ALE separation 0.55 times AME diameter, PME-PLE separation 0.71 times PME diameter. Clypeus height 1.50 times AME diameter. Cephalothorax yellowish-brown. Dark longitudinal band extending between PER and thoracic fovea (Fig. 1). Thoracic fovea deep. Sternum 2.17 long, 1.90 wide, with several black markings and sharp distal end (Fig. 2). Labium wider than long. Chelicerae with 3 prolateral teeth and 3 or 4 minute retrolateral teeth (Fig. 3). Cheliceral stridulatory striae conspicuous. Legs with brown annuli, especially distinct on legs III and IV. Femur I with a row of fewer than 10 setae on prolateral. Metatarsi I-IV with 1 trichobothrium dorsally, and Tm I 0.89. Tibiae I-IV with 2 rows of 5 or 6 trichobothria dorsally. Tarsal organ separated by less than 1/4 of tarsal length from tarsal claw. Lengths of legs:

I 26.30 (7.50+8.91+7.17+2.72),
II 23.58 (6.85+7.93+6.52+2.28),
III 15.10 (4.67+4.78+4.18+1.47),
IV 19.61 (5.76+6.52+5.54+1.79).

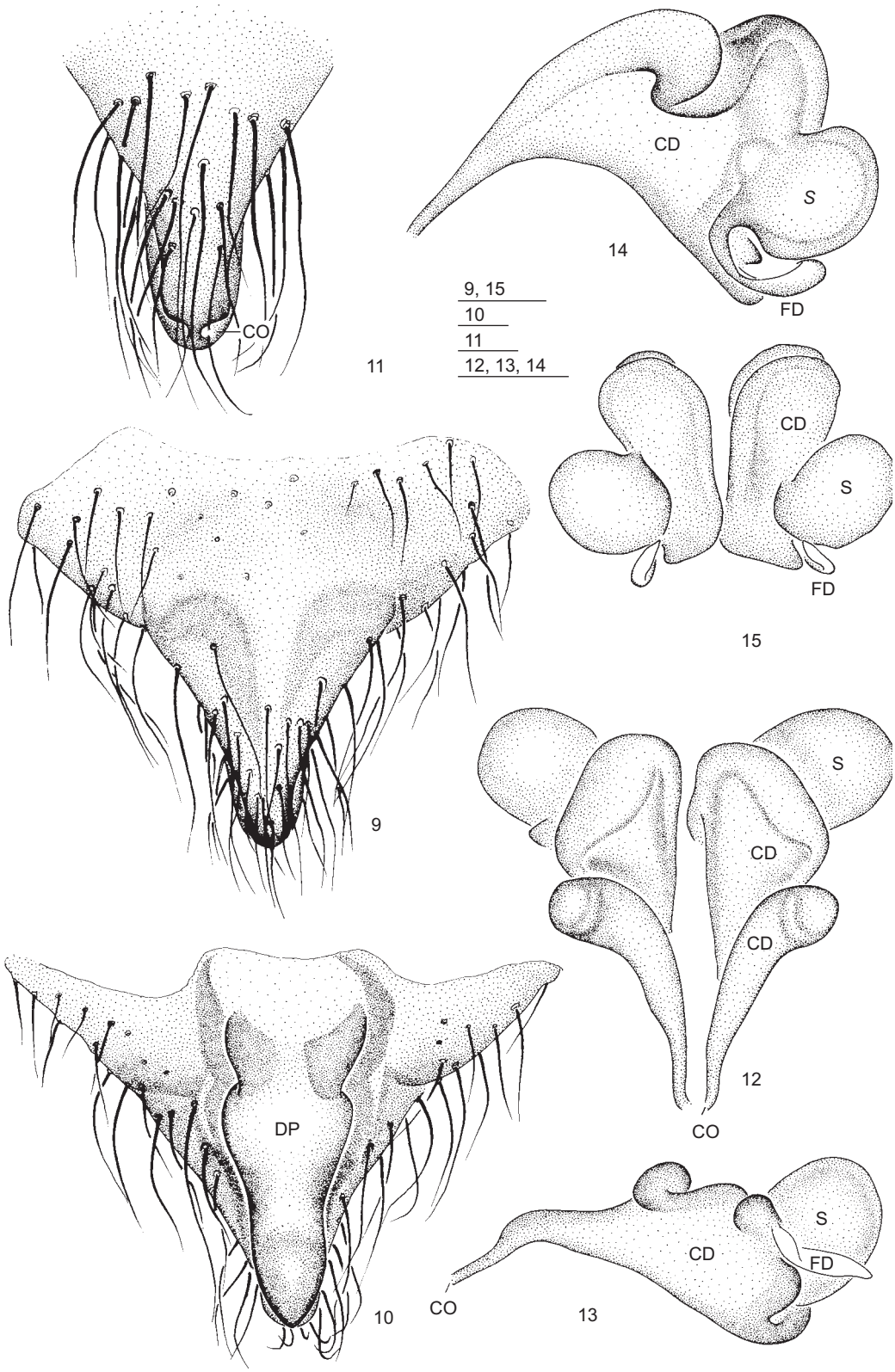
Legs I, II, III, IV. Femur I 2.16 times length of cephalothorax. Abdomen brown. Dorsum with 4 light transverse chevrons, of which anterior 3 entire across abdomen, 4th paired (Fig. 1). Venter with light paired longitudinal patterns.

Male palp: Patella with 1 retrolateral macroseta. Tibia longer than wide, with many macrosetae and a dorsal process, 3 retrolateral and 2 dorsal trichobothria (Figs. 4, 6, 7). Tarsal organ situated on the top of cymbium (Figs. 6, 7). Paracymbium distinct, hook-like (Figs. 6, 7). PCS spindle-shaped (Figs. 6, 7). CP broad, with more than 30 cuspules (Figs. 6, 7). Conductor broad and filiform (Figs. 6, 7). Median apophysis very slender, fish-hook-shaped and hidden under conductor (Figs. 6, 7). Embolus longer than PEP, with posterior 1/2 threadlike (Figs. 5, 6, 8). PEP with a short, sharp branch (Figs. 4, 8).

Female: Total length 9.78. Cephalothorax 4.13 long, 3.15 wide, 2.39 high; abdomen 5.65 long, 3.91 wide, 3.48 high. AME diameter 0.19. ALE 1.13, PME 1.13, PLE 1.25 times AME diameter. AME separation 0.44 times their diameter, PME separation 0.44 times their diameter. AME-ALE separation 0.75 times AME diameter, PME-PLE separation 0.89 times PME diameter. Clypeus height 2.13 times AME diameter. Sternum 2.50 long, 1.90 wide. Tm I 0.89. Tibae I-



Figs. 1-8. *Pimoa anatolica* (male). **1.** Body, dorsal view; **2.** Sternum, ventral view; **3.** Chelicera, posterior view; **4.** Palp, dorsal view; **5.** Same, prolateral view; **6.** Same, ventral view; **7.** Same, retrolateral view; **8.** Embolus and embolic process, dorsal view. Scale bars = 1.0 mm (Figs. 1-7), and 0.1 mm (Fig. 8).



Figs. 9-15. *Pimoa anatolica* (female). **9.** Epigynum, ventral view; **10.** Same, dorsal view; **11.** Same, top view; **12.** Vulva, ventral view; **13.** Left part of vulva, dorsal view; **14.** Vulva, ventral plate removed, longitudinal section; **15.** Vulva, anterior view. Scale bars = 0.2 mm (Figs. 9, 12-15), and 0.1 mm (Figs. 10, 11).

IV with 2 rows of 7 or 8 trichobothria. Lengths of legs:

I 23.48 (6.85+8.15+5.87+2.61),
II 20.32 (6.08+6.85+5.22+2.17),
III 14.24 (4.57+4.46+3.80+1.41),
IV 19.02 (5.98+6.30+5.00+1.74).

Legs I, II, III, IV. Femur I 1.66 times length of cephalothorax. Other characters similar to those of male.

Epigynum: Posterior 1/2 of epigynum markedly narrow (Figs. 9, 10). Dorsal plate of epigynum (DP) so fleshy that it is partly visible in ventral view (Figs. 9-11). Copulatory opening (CO) situated on distal end of epigynum (Fig. 11). Spermathecae globose, widely separated from each other (Figs. 12, 15). Copulatory ducts extraordinarily broad and with 1 strong turn (Figs. 12-14). Fertilization ducts anteriorly oriented (Figs. 13, 14).

Variation: Male cephalothorax ranging in length from 3.42 to 3.70 (*n* = 4), female from 3.59 to 4.13 (*n* = 2).

Distribution: China (Yunnan Prov.) (Map 1).

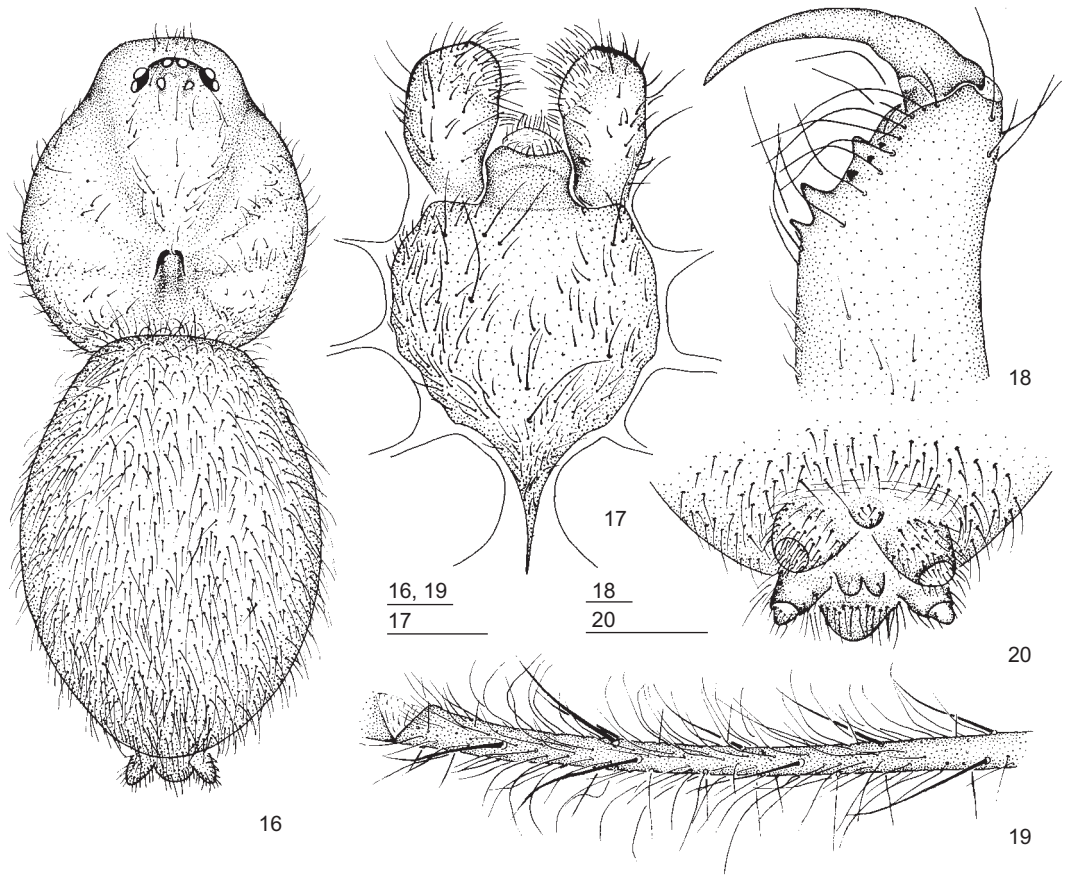
***Pimoa clavata* sp. nov.**
(Figs. 16-34, Map 1)

Holotype male: Bianfudong Cave, SW of old 108 National Highway, Hebei City (39.8°N, 115.9°E), Fangshan District, Beijing, China, 7 Dec. 2003, coll. Lihong Tu.

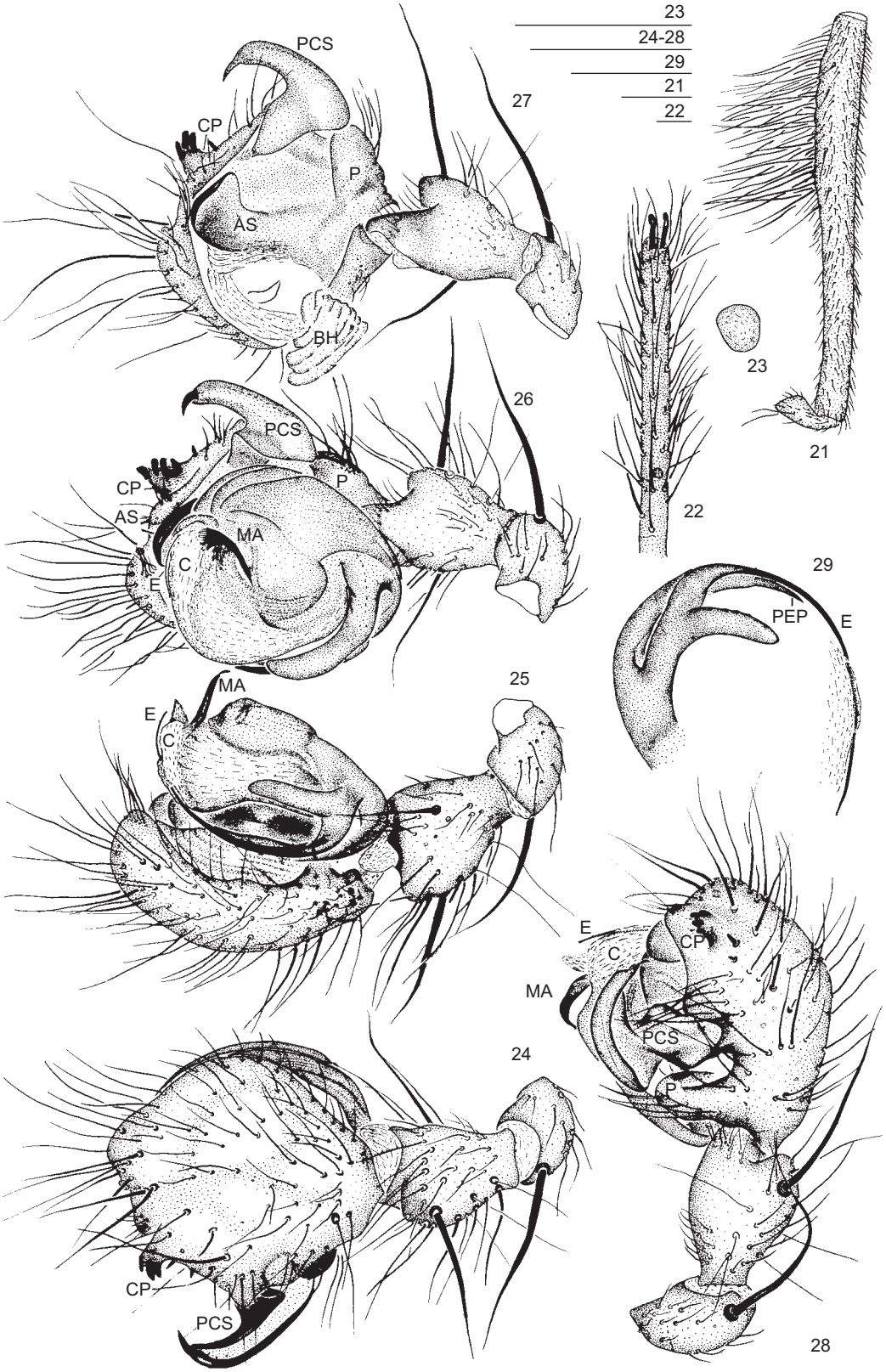
Paratypes: 2 ♀♀, 1 ♂, collected with holotype, coll. Shuqiang Li and Haifeng Chen; 2 ♀♀, Hebei Town (39.8°N, 115.9°E), Fangshan District, Beijing, China, 17 Feb. 2004, coll. Lihong Tu; 2 ♀♀, 1 ♂, Xianqidong Cave (39.7°N, 115.7°E), Dongguanshang Village, Zhangfang Town, Fangshan District, Beijing, China, 21 Nov. 2004, coll. Xiang Xu.

Etymology: The species epithet is derived from the Latin *clavatus*, meaning claviform, and refers to the shape of an embolic process.

Diagnosis: The male is similar to *P. sinuosa* Hormiga, 1994 in the presence of numerous long and thick setae on femur I (Fig. 21), but can be distinguished by the presence of another embolic



Figs. 16-20. *Pimoa clavata* sp. nov. (male). **16.** Body, dorsal view; **17.** Sternum, ventral view; **18.** Chelicera, posterior view; **19.** Tibia I, prolateral view; **20.** Spinnerets, ventral view. Scale bars = 0.5 mm (Figs. 16, 17, 19, 20), and 0.1 mm (Fig. 18).



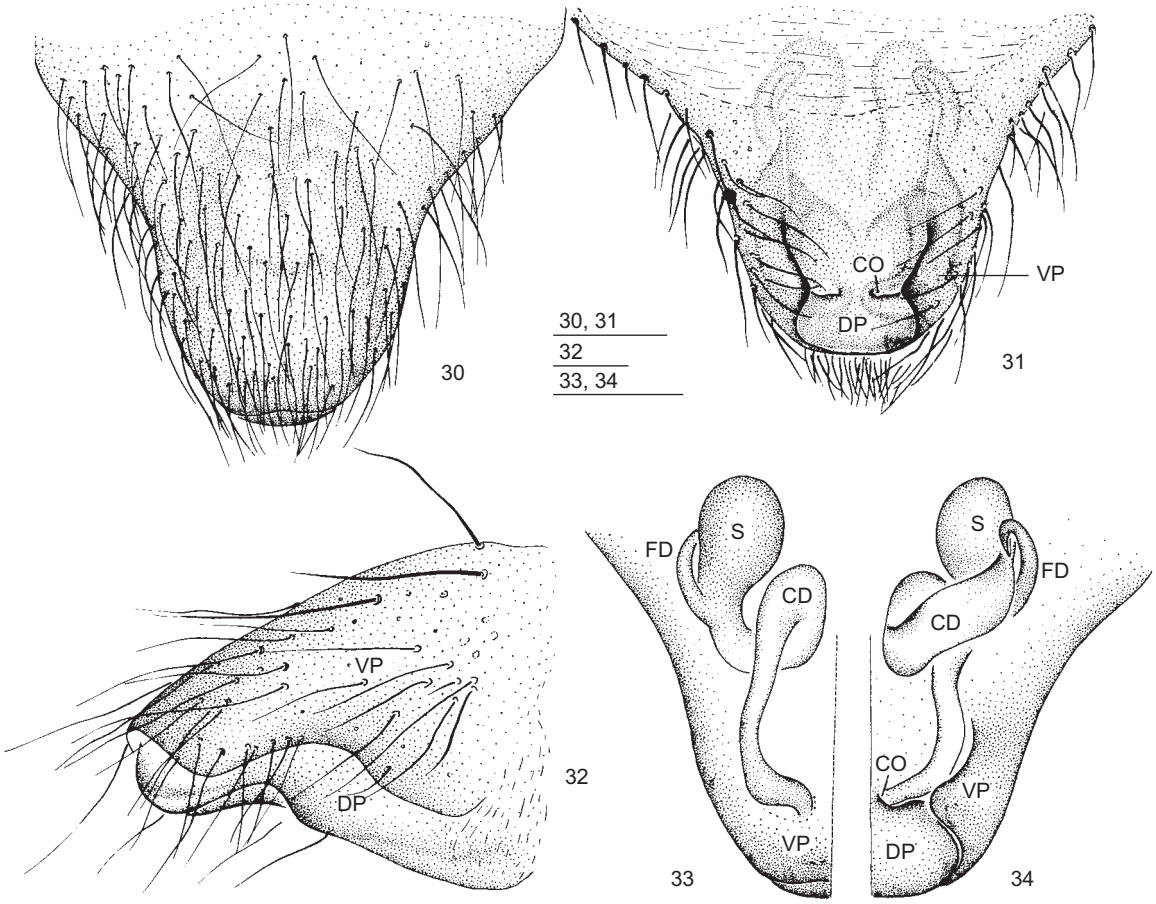
Figs. 21-29. *Pimoa clavata* sp. nov. (male). **21.** Femur I, prolateral view; **22.** Part of tarsus I, dorsal view; **23.** Tarsal organ I, enlarged; **24.** Palp, dorsal view; **25.** Same, prolateral view; **26.** Same, ventral view; **27.** Same, ventral view (genital bulb removed); **28.** Same, retrolateral view; **29.** Embolus and embolic process, prolateral view. Scale bars = 1.0 mm (Fig. 21), 0.1 mm (Figs. 22, 23), and 0.5 mm (Figs. 24-29).

process in addition to PEP (Figs. 25, 26, 29), by the presence of 3 or 4 very thick cuspules on CP (Figs. 24, 26, 27), and by the PCS modified with a concavity and a sharp distal end (Figs. 24, 26-28). The female can be distinguished by the CD with only 1 strong turn (Figs. 33, 34).

Male holotype: Total length 6.42. Cephalothorax 2.72 long, 2.28 wide, 1.30 high; abdomen 3.70 long, 2.39 wide, 2.28 high. AME diameter 0.10. ALE 1.25, PME 0.80, PLE 1.00 times AME diameter. AME separation 0.20 times their diameter, PME separation 2.00 times their diameter. AME-ALE separation 1.00 times AME diameter, PME-PLE separation 1.67 times PME diameter. Clypeus height 2.75 times AME diameter. Cephalothorax yellow. Thoracic fovea conspicuous, deep and prolonged posteriorly (Fig. 16). Sternum 1.75 long, 1.28 wide, with slightly dark margin and very sharp distal end (Fig. 17). Labium wider than long. Chelicerae with 3 prolateral teeth and 3 minute retrolateral denticles (Fig. 18); cheliceral stridulatory striae present. Leg long, yellow to orange-brown, with no annuli. Proximal 1/2 of femur I with numerous long, thick setae (Fig. 21). Metatarsi I-IV with 1 trichobothrium dorsally and Tm I 0.93. Tibiae I-IV with 2 rows of trichobothria dorsally, each row with 5 to 7 trichobothria. Tibiae I and II and metatarsi I and II with numerous long, slender hairs that have curved distal ends (Fig. 19). Four rows of short setae respectively situated on dorsal, ventral, prolateral, and retrolateral of tibiae I-IV and metatarsi I-IV. Tarsal organ distinct, situated on distal 1/2 of tarsus, more or less near tarsal claw. Lengths of legs:

I 22.25 (6.00+7.30+6.80+2.15),
II 19.40 (5.20+6.30+6.00+1.90),
III 13.80 (4.00+4.40+4.00+1.40),
IV 18.35 (5.00+6.70+5.05+1.60).

Legs I, II, III, IV. Femur I 2.40 times length of cephalothorax. Abdomen oval, light yellow, densely covered with long hair, lacking a pattern (Fig. 16). Colulus large and fleshy, with several setae (Fig. 20).



Figs. 30-34. *Pimoa clavata* sp. nov. (female). **30.** Epigynum, ventral view; **31.** Same, dorsal view; **32.** Same, lateral view; **33.** Left part of vulva, ventral view; **34.** Right part of vulva, ventral plate removed, dorsal view. Scale bars = 0.2 mm (Figs. 30, 31, 33, 34), and 0.1 mm (Fig. 32).

Male palp: Patella short, with 1 retrolateral macroseta. Tibia longer than wide, with 1 dorsal and 1 prolateral macroseta, 3 retrolateral and 2 dorsal trichobothria (Figs. 24-27), with indistinct tibial apophysis (Figs. 27, 28). Tarsal organ situated on the top of cymbium (Figs. 26-28). Cymbium with a complex PCS that has a conspicuous concavity facing dorsal side and a very sharp end (Figs. 24, 26-28). CP small, with 3 or 4 thick cuspules and 1 or 2 small cuspules (Figs. 24, 26-28). From retrolateral view, paracymbium turning back to inner side of cymbium, and connecting with base of a palmate alveolar sclerite (AS). AS situated on anterior of cymbium ventrally (Fig. 27). Conductor white, membranous, very broad (Figs. 25, 26). Median apophysis black, hooked, and adjacent to base of conductor (Figs. 25, 26, 28). Embolus curving clockwise, and with broad base and slender distal end (Figs. 25, 29). PEP about 1/2 of embolic length, with sharp distal end. Besides PEP, embolus with another embolic process which is strong and claviform (Figs. 25, 26, 29).

Female: Total length 6.30. Cephalothorax 2.80 long, 2.10 wide, 1.36 high; abdomen 3.50 long, 2.20 wide, 2.07 high. AME diameter 0.10. ALE 1.20, PME 0.80, PLE 1.00 times AME diameter. AME separation 0.25 times their diameter, PME separation 2.00 times their diameter. AME-ALE separation 1.25 times AME diameter, PME-PLE separation 1.87 times PME diameter. Clypeus height 3.30 times AME diameter. Sternum 1.70 long, 1.30 wide. Palp with 2 dorsal, 1 ventral, and 3 prolateral spines on tibia; tarsus of palp with numerous spines, and tarsal organ situated on prolateral side. Proximal 1/2 of femur I normal and without numerous long, thick spines. Metatarsi I-IV with 1 trichobothrium dorsally, Tm I 0.92. Tibiae I-V with 2 rows of trichobothria dorsally, each row with 6 to 7 trichobothria. Lengths of legs:

I 21.85 (5.90+7.40+6.40+2.15),
II 19.35 (5.40+6.55+5.60+1.80),
III 14.00 (4.35+4.50+3.85+1.30),
IV 18.05 (5.30+6.10+5.05+1.60).

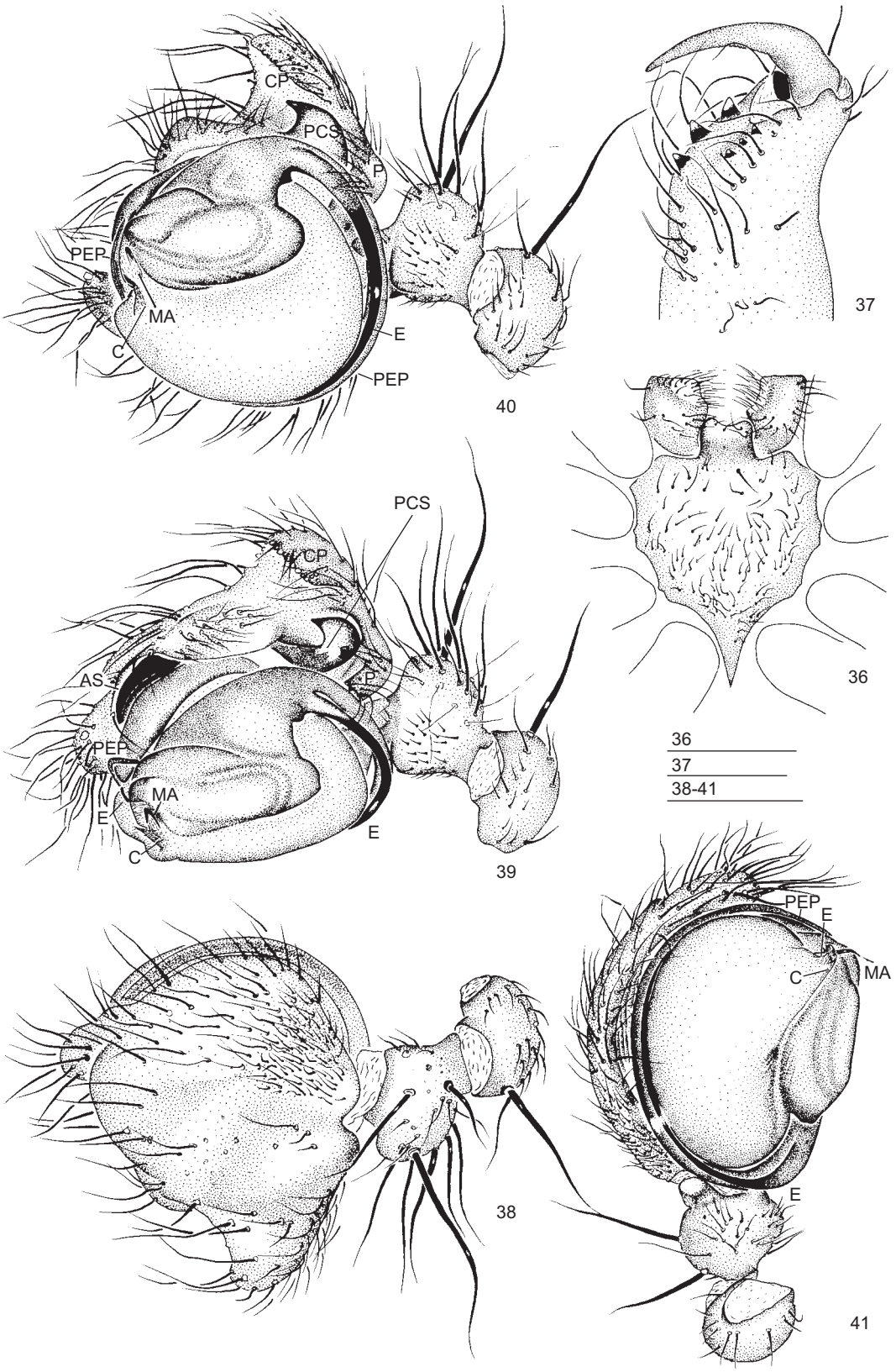
Legs I, II, III, IV. Femur I 2.11 times length of cephalothorax. Other characters similar to those of male.

Epigynum: Distal end of epigynum broad, more than 1/4 epigynal length (Figs. 30, 31). From dorsal view, a pair of copulatory openings distinct (Fig. 31). Spermathecae oval. Copulatory ducts moderately long, with a strong turn. Fertilization ducts anteriorly oriented (Figs. 33, 34).

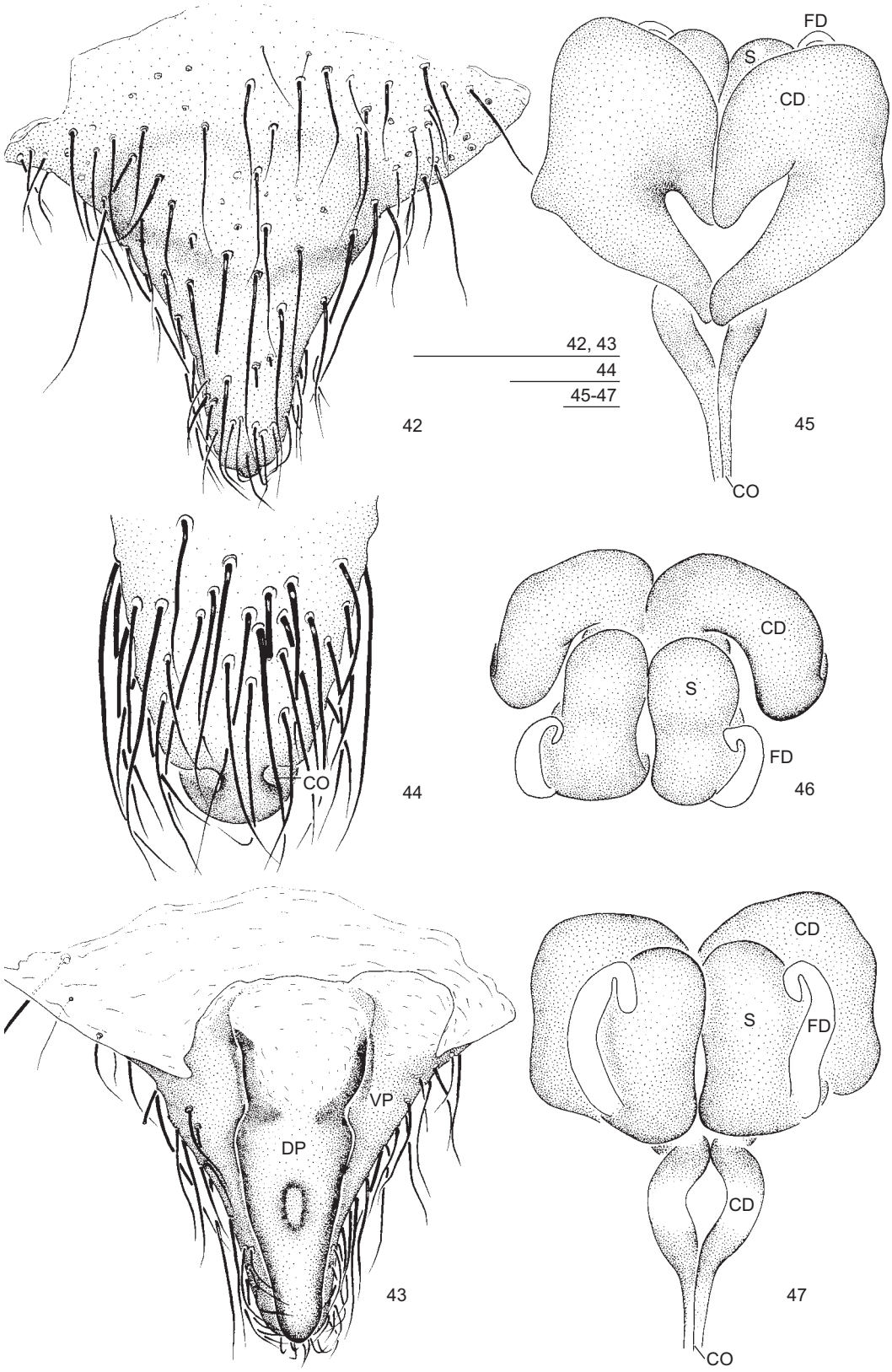
Variation: Male cephalothorax ranges in length from 2.28 to 2.93 (n = 3), female from 2.72 to 3.48 (n = 6).

Distribution: China (Beijing) (Map 1).

Fig. 35. *Pimoa reniformis* sp. nov., female from Sichuan, China (by Dr. Peter Jaeger).



Figs. 36-41. *Pimoa reniformis* sp. nov. (male). **36.** Sternum, ventral view; **37.** Chelicera, posterior view; **38.** Palp, dorsal view; **39.** Same, retrolateral view; **40.** Same, ventral view; **41.** Same, prolateral view. Scale bars = 1.0 mm (Figs. 36-41).



Figs. 42-47. *Pimoa reniformis* sp. nov. (female). **42.** Epigynum, ventral view; **43.** Same, dorsal view; **44.** Same, top view; **45.** Vulva, ventral view; **46.** Vulva, ventral plate removed, anterior view; **47.** Vulva, dorsal view. Scale bars = 0.5 mm (Figs. 42,43), and 1.0 mm (Figs. 44-47).

***Pimoa reniformis* sp. nov.**
(Figs. 35-47, Map 1)

Holotype male: Hailuogou Valley, Luding Co. (29.9°N, 102.2°E), Sichuan Prov., China, 22 July 2004, coll. Lihong Tu.

Paratypes: 2 ♀♀, same data as for holotype; 2 ♀♀, 1 ♂, road from Yerenhai to Qisehai, Kangding Co. (30.0°N, 101.9°E), Sichuan Prov., China, 14 July 2004; 1 ♀, Yajiageng Valley, Moxi Town (29.6°N, 102.1°E), Luding Co., Sichuan Prov., China, 20 July 2004; 2 ♀♀, Wuxuhai Nature Reserve, Jiulong Co. (29.0°N, 101.5°E), Sichuan Prov., China, 26 July 2004; 2 ♀♀, Changpinggou Valley, Mt. Siguniang (31.1°N, 102.9°E), Xiaojin Co., Sichuan Prov., China, 1 Aug. 2004. All paratypes collected by Xiang Xu, Shuqiang Li, and Zhengtian Zhang.

Etymology: The species epithet is derived from the Latin *reniformis*, meaning kidney-like, and refers to the shape of the spermathecae.

Diagnosis: The male is similar to *P. nematoides* Hormiga, 1994 in the shape of the embolus and PEP, but can be distinguished by the absence of a sclerotized cymbial region between the paracymbium and the external margin of the cymbium, and by the presence of many more cuspules on the broad CP (Figs. 39, 40). The female can be distinguished from *P. indiscreta* Hormiga, 1994 by the copulatory ducts not being fused (Figs. 45, 47).

Male holotype: Total length 7.72. Cephalothorax 3.36 long, 3.29 wide, 1.91 high; abdomen 4.36 long, 3.00 wide, 3.09 high. AME diameter 0.15. ALE, PME, and PLE all 0.94 times AME diameter. AME separation 1.00 times their diameter, PME separation 1.00 times their diameter. AME-ALE separation 0.62 times AME diameter, PME-PLE separation 1.15 times PME diameter. Clypeus height 1.47 times AME diameter. Cephalothorax brown. Thoracic fovea deeply concave. Sternum 1.90 long, 1.63 wide, with sharp distal end (Fig. 36). Labium wider than long. Chelicerae with 3 prolateral teeth and 3 small retrolateral teeth (Fig. 37). Cheliceral stridulatory striae present. Femora and tibiae of all legs with brown annuli. On ventral femur I with about 50 or more short setae mesally. Metatarsi I-IV with 1 trichobothrium dorsally and Tm I 0.86. Tibiae I-IV with 2 rows of trichobothria dorsally, each row with 6 or 7 trichobothria. Lengths of legs:

I 22.82 (6.41+6.96+6.52+2.93),
II 19.78 (5.65+6.41+5.49+2.23),
III 13.75 (4.24+4.13+3.80+1.58),
IV 17.16 (5.16+5.43+4.78+1.79).

Legs I, II, III, IV. Femur I 1.91 times length of cephalothorax. Abdomen brown, dorsum with a pair of indistinct muscle marks, and with transverse light patterns which are continuous or discontinuous (Fig. 35).

Male palp: Patella short, with 1 retrolateral macroseta. Tibia wider than long, with 2 dorsal and several retrolateral macrosetae, 3 retrolateral and 2 dorsal trichobothria (Figs. 38-41). Tarsal organ situated on the top of cymbium (Figs. 39, 40). PCS shaped like a pig's ear (Figs. 39, 40). CP strong and broad, with about 30 cuspules (Figs. 39, 40). A conspicuous concavity formed among PCS, CP, and paracymbium (Figs. 39, 40). Embolus together with PEP circling bulb, forming about 3/4 of a circle (Fig. 40). Embolus long, with thread-shaped distal end. PEP longer than embolus (Fig. 39). Conductor membranous, very small. Median apophysis black, hooked, and adjacent to base of conductor (Figs. 39-41).

Female: Total length 7.27. Cephalothorax 3.00 long, 2.38 wide, 1.55 high; abdomen 4.27 long, 3.09 wide, 3.45 high. AME diameter 0.18. ALE, PME, and PLE all 0.95 times AME diameter. AME separation 0.54 times their diameter, PME separation 0.71 times their diameter. AME-ALE separation 0.74 times AME diameter, PME-PLE separation 1.14 times PME diameter. Clypeus height 1.89 times AME diameter. Sternum 2.12 long, 1.83 wide. Femur I without ventral setae, but with several dorsal and prolateral setae. Metatarsi I-IV with 1 trichobothrium dorsally and Tm I 0.86. Tibiae I-IV with 2 rows of trichobothria dorsally, each row with 6-8 trichobothria. Lengths of legs:

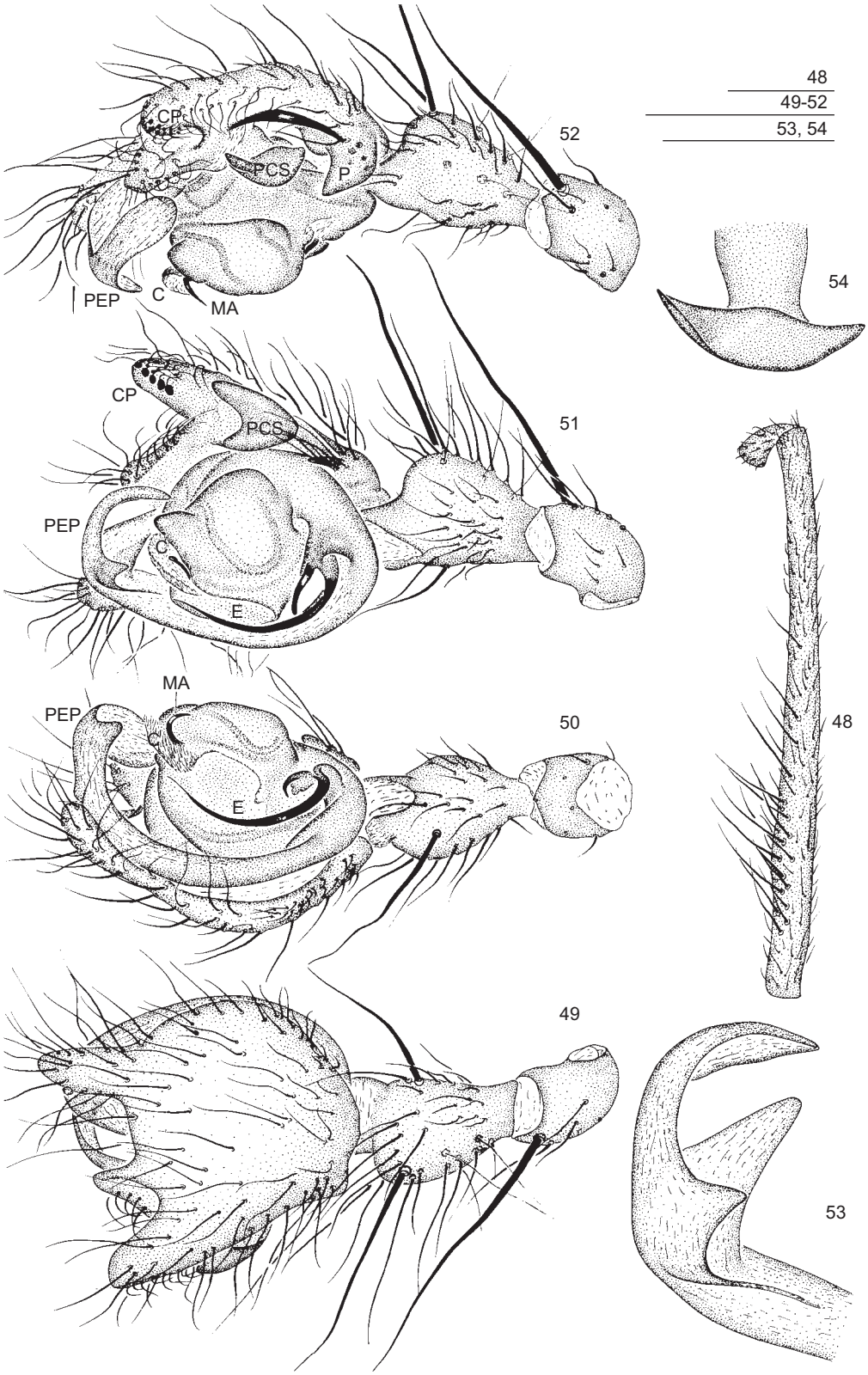
I 20.55 (5.98+6.96+5.11+2.50),
II 18.38 (5.33+5.98+5.11+1.96),
III 12.82 (4.02+4.02+3.26+1.52),
IV 16.52 (5.22+5.43+4.24+1.63).

Legs I, II, III, IV. Femur I 1.99 times length of cephalothorax. Other characters similar to those of male.

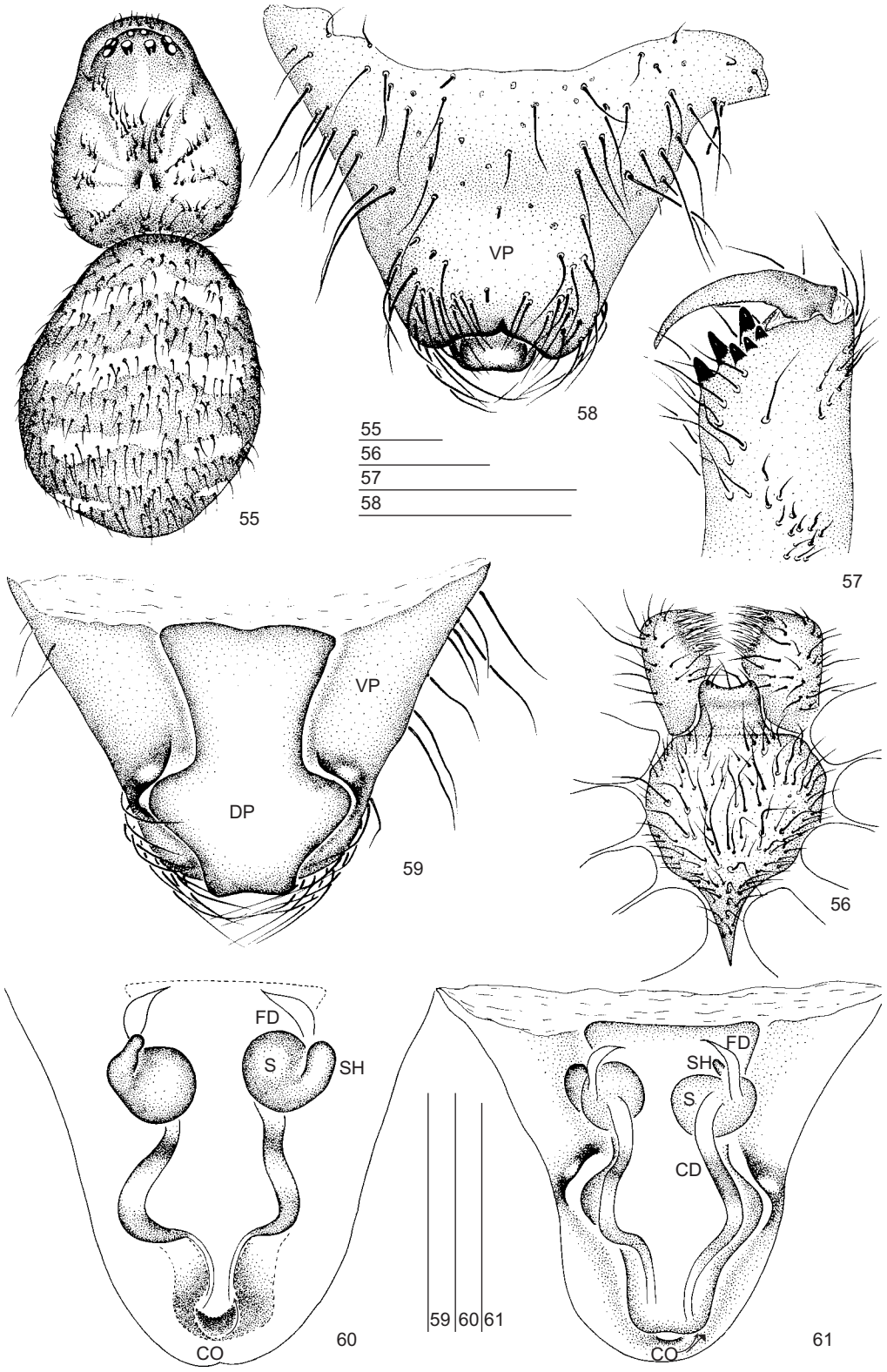
Epigynum: Posterior 1/2 obviously narrower than anterior 1/2 (Figs. 42, 43). Ventral plate connecting with dorsal plate at distal end of epigynum where a pair of copulatory openings are distinct (Fig. 44). Spermathecae kidney-shaped (Figs. 46, 47). Copulatory ducts with 2 strong turns and with posterior part narrower than 1/4 width of anterior part (Figs. 45, 47). Fertilization ducts oriented mesally (Figs. 46, 47).

Variation: Male cephalothorax ranging in length from 3.36 to 3.82 (n = 2), female from 3.00 to 3.82 (n = 9).

Distribution: China (Sichuan) (Map 1).



Figs. 48-54. *Pimoa trifurcata* sp. nov. (male). **48.** Femur I, prolateral view; **49.** Palp, dorsal view; **50.** Same, prolateral view; **51.** Same, ventral view; **52.** Same, retrolateral view; **53.** PEP, enlarged, ventral view; **54.** PCS, enlarged, retrolateral view. Scale bars = 1.0 mm (Fig. 48), 0.5 mm (Figs. 49-52), and 0.2 mm (Figs. 53, 54).



Figs. 55-61. *Pimoa trifurcata* sp. nov. (female). **55.** Body, dorsal view; **56.** Sternum, ventral view; **57.** Chelicera, posterior view; **58.** Epigynum, ventral view; **59.** Same, dorsal view; **60.** Vulva, ventral plate removed, ventral view; **61.** Vulva, dorsal view. Scale bars = 1.0 mm (Figs. 55-57), and 0.5 mm (Figs. 58-61).

Pimoa trifurcata sp. nov.
(Figs. 48-61, Map 1)

Holotype male: Hailuogou National Glacier Forest Park (29.6°N, 102.0°E), Luding Co., Sichuan Prov., China, 2-7 Oct. 2005, coll. Xiang Xu, Xiufeng Zhang.

Paratypes: 14 ♀♀, collected together with holotype; 2 ♀♀, Yerenhai (30.2°N, 101.9°E), Mugecuo Forest Park, Kangding Co., Sichuan Prov., China, 14 July 2004, coll. Xiang Xu.

Etymology: The species epithet is derived from the Latin *trifurcates*, meaning trifurcated, and refers to the PEP with the trifurcated apex.

Diagnosis: The new species resembles *P. clavata* sp. nov. in the presence of another embolic process in addition to the PEP, but can be distinguished by the shape of the PEP and CP, the additional embolic process in the male (Figs. 50-53), and by the presence of a spermathecal head in the female (Figs. 60, 61).

Male holotype: Total length 4.90. Cephalothorax 2.30 long, 1.70 wide, 1.15 high; abdomen 2.60 long, 1.80 wide, 1.70 high. AME diameter 0.13. ALE 1.20, PME 1.10, and PLE 1.20 times AME diameter. AME separation 0.80 times their diameter, PME separation 0.73 times their diameter. AME-ALE separation 0.60 times AME diameter, PME-PLE separation 0.73 times PME diameter. Clypeus height 1.00 times AME diameter. Sternum 1.30 long, 1.12 wide. Labium wider than long. Chelicerae with 3 prolateral teeth and 3 retrolateral teeth. Cheliceral stridulatory striae present. Femur I with long setae prolaterally (Fig. 48). Metatarsi I-IV with 1 trichobothrium dorsally and Tm I 0.93. Lengths of legs:

I 20.80 (5.80+6.90+5.90+2.20),
II 16.75 (4.60+5.55+4.90+1.70),
III 11.50 (3.30+3.40+3.10+1.70),
IV 15.55 (4.30+4.70+4.00+2.55).

Legs I, II, III, IV. Femur I 2.52 times length of cephalothorax. Abdomen brown, dorsum with 4 light transverse chevrons, anterior three of which extending entirely across abdomen, 4th paired.

Male palp: Patella with 1 retrolateral macroseta. Tibia with 1 dorsal and 1 retrolateral macroseta, 3 retrolateral and 2 dorsal trichobothria (Figs. 49, 51, 52). Tarsal organ situated on top of cymbium (Fig. 52). PCS broad (Figs. 51, 52, 54). CP extended longitudinally, with 5 large and 3 small cuspules (Fig. 58). Paracymbium distinct. Embolus short. PEP broad, strong, membranous, with trifurcate apex (Figs. 50-53). Besides PEP, embolus with another process which is slender and short (Fig. 51). Conductor membranous, distinct. Median apophysis black, hooked, adjacent to base of conductor (Figs. 50-52).

Female: Total length 7.27. Cephalothorax 3.36 long, 2.44 wide, 1.82 high; abdomen 3.91 long, 2.64 wide, 2.45 high. AME diameter 0.14. ALE 1.00, PME 1.00, PLE 0.94 times AME diameter. AME separation 0.67 times their diameter, PME separation 0.83 times their diameter. AME-ALE separation 0.83 times AME diameter, PME-PLE separation 1.10 times PME diameter. Clypeus height 2.17 times AME diameter. Cephalothorax yellowish-brown. Thoracic fovea deep (Fig. 55). Sternum 1.96 long, 1.47 wide, with sharp distal end (Fig. 56). Chelicerae with 3 prolateral teeth and 3 retrolateral teeth (Fig. 57). Tibiae I-IV with 2 rows of trichobothria dorsally, each row with 6 or 7 trichobothria. Metatarsi I-IV with 1 trichobothrium dorsally and Tm I 0.92. Tarsal organ separated from tarsal claw by less than 1/3 of tarsal length. Lengths of legs:

I 17.01 (4.91+5.82+4.55+1.73),
II 14.72 (4.27+5.00+4.00+1.45),
III 10.81 (3.36+3.45+2.91+1.09),
IV 14.28 (4.73+4.55+3.64+1.36).

Legs I, II, III, IV. Femur I of paratype 1.69 times length of cephalothorax. Other characters similar to those of male.

Epigynum: From ventral view, dorsal plate of epigynum partly visible (Fig. 58). From dorsal view, dorsal plate widest in middle (Fig. 59). Spermathecae globose, with conspicuous spermathecal heads (Figs. 60, 61). Fertilization ducts anteriorly oriented (Figs. 60, 61).

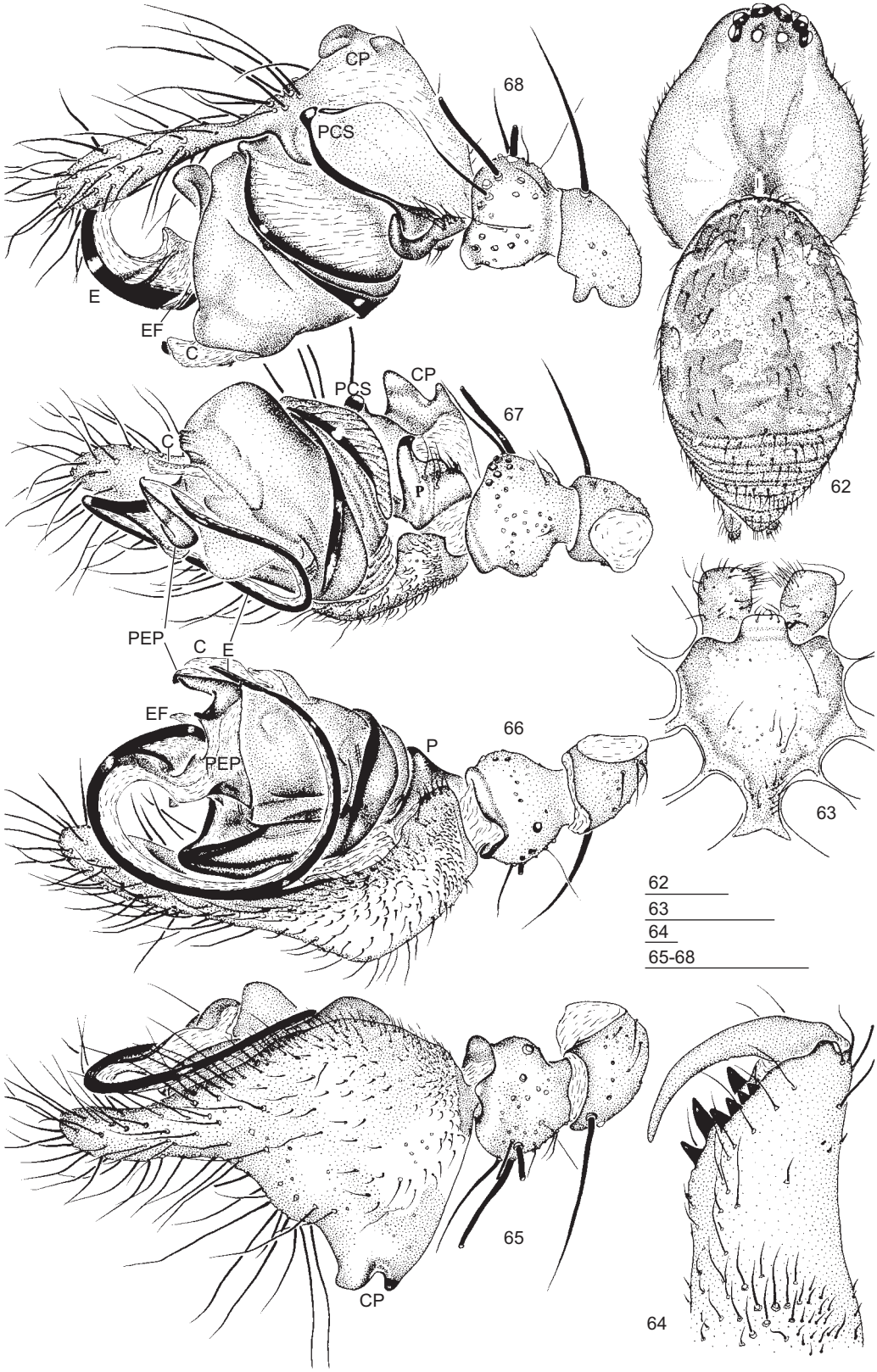
Variation: Female cephalothorax ranges in length from 2.91 to 3.36 (n = 16).

Distribution: China (Sichuan) (Map 1).

Weintrauboa chikunii (Oi, 1979)
(Figs. 62-74, Map 2)

Labulla contortipes chikunii Oi 1979: 330, figs. 9-12; Chikuni 1989: 48, fig. 12.
Labula chikunii Eskov 1992: 53.
Weintrauboa chikunii Hormiga 2003: 276, figs. 2A-D, 3I, J, 6A-D.

Material examined: 1 ♂, Yanzigou Valley (29.7°N, 102.0°E), Luding Co., Sichuan Prov., China, 21 July 2004; 1 ♂, 1 ♀, the same locality, 9 Oct. 2005; 7 ♂♂, 8 ♀♀, Hailuogou National Glacier Forest Park (29.6°N, 102.0°E), Luding Co., Sichuan Prov., China, 2-9 Oct. 2005; Moxi Town (29.6°N, 102.1°E), Luding Co., Sichuan Prov., China, 8 Oct. 2005; 1 ♂, Yaoji Town (30.8°N, 102.7°E), Baoxin Co., Sichuan Prov.,

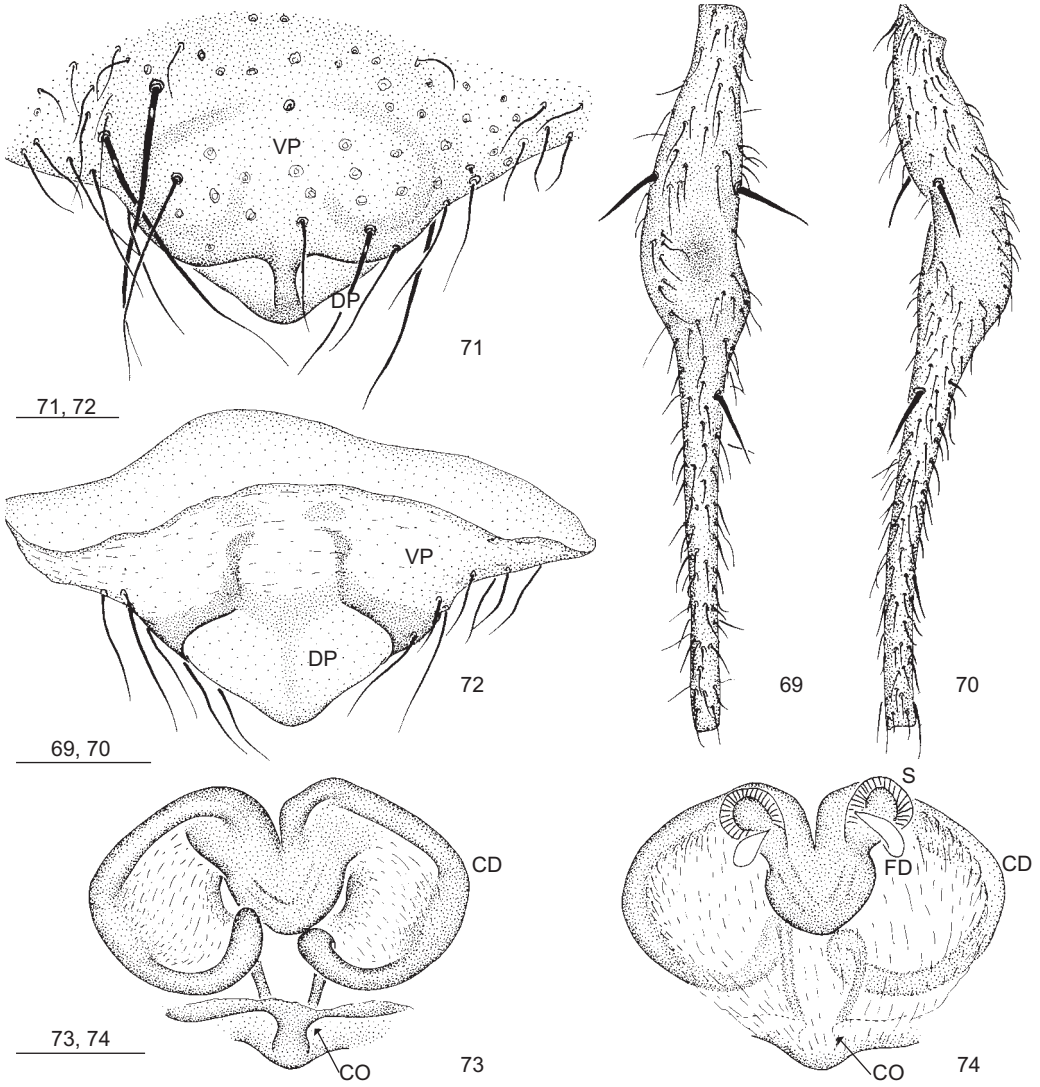


Figs. 62-68. *Weintrauboa chikunii* (male). **62.** Body, dorsal view; **63.** Sternum, ventral view; **64.** Chelicera, posterior view; **65.** Palp, dorsal view; **66.** Same, prolateral view; **67.** Same, ventral view; **68.** Same, retrolateral view. Scale bars = 1.0 mm (Figs. 62, 63), 0.1 mm (Fig. 64), and 0.5 mm (Figs. 65-68).

China, 4 July 2004; 3 ♂♂, 5 ♀♀, Yele Nature Reserve (28.9°N, 102.2°E), Mianning Co., Sichuan Prov., China, 25 July 2004; 7 ♂♂, 5 ♀♀, Yele Nature Reserve (28.9°N, 102.2°E), Mianning Co., Sichuan Prov., China, 22 Oct. 2005; 1 ♂, Paoma Mt. (30.0°N, 102.0°E), Kangding Co., Sichuan Prov., China, 12 Oct. 2005. All specimens collected by Xiang Xu, Xiufeng Zhang, and Lihong Tu.

Diagnosis: *Weintrauboa chikunii* differs from *W. contortipes* (Karsch, 1881) by the large and complex PEP in the male (Figs. 66, 67), and by the completely different morphology of the ventral epigynum in the female (Fig. 71).

Male: Total length 7.27. Cephalothorax 3.18 long, 2.68 wide, 1.73 high; abdomen 4.09 long, 2.55 wide, 1.73 high. AME diameter 0.19. ALE 0.81, PME 0.88, PLE 0.88 times AME diameter. AME separation 0.50 times their diameter, PME separation 0.79 times their diameter. AME-ALE separation 0.38 times AME diameter, PME-PLE separation 1.14 times PME diameter. Clypeus height 1.50 times AME diameter. Cephalothorax brown, with dark median and lateral region (Fig. 62). Thoracic fovea deeply concave. Sternum 1.82 long, 1.62 wide, distal end slightly broad (Fig. 63). Labium wider than long. Chelicerae with 3 prolateral teeth and 4 retrolateral teeth (Fig. 64). Cheliceral stridulatory striae absent. Femora, patellae, and tibiae of all legs with annuli. Tibiae I-



Figs. 69-74. *Weintrauboa chikunii*. **69.** Male metatarsus I, dorsal view; **70.** Same, retrolateral view; **71.** Female epigynum, ventral view; **72.** Same, dorsal view; **73.** Vulva, ventral plate removed, ventral view; **74.** Same, dorsal view. Scale bars = 0.5 mm (Figs. 69, 70), and 0.2 mm (Figs. 71-74).

IV with 2 rows of 2-6 trichobothria dorsally. Metatarsi I-IV with a trichobothrium dorsally and Tm I 0.23. Lengths of legs:

I 23.41 (6.23+7.64+7.09+2.45),
II 21.04 (5.68+6.91+6.36+2.09),
III 13.36 (4.00+4.18+3.82+1.36),
IV 15.50 (4.36+4.82+4.68+1.64).

Legs I, II, III, IV. Femur I 1.96 times length of cephalothorax. Dorsum of abdomen with black and silvery-white patterns (Fig. 62). Abdomen shriveled posteriorly (Fig. 62). Venter of abdomen also with black and silvery-white patterns.

Male palp: Tibia with several macrosetae, 2 retrolateral and 1 dorsal trichobothria (Figs. 66, 68). Paracymbium hook-like (Figs. 67, 68). PCS broad, with a rounded protuberance (Fig. 68). CP bifurcated ectally (Figs. 65, 67, 68). Embolus long, always with membrane from base to distal end (Figs. 66, 67). PEP broad, extending from base of embolic, partly keratinized, forming a concavity at distal end (Figs. 66, 67). Conductor membranous, moderately big (Figs. 66-68). Embolic flap present, small (Figs. 66, 68).

Female: Total length 7.70. Cephalothorax 2.50 long, 2.32 wide, 1.80 high; abdomen 5.20 long, 3.82 wide, 3.90 high. AME diameter 0.20. ALE 1.00, PME 0.88, PLE 0.88 times AME diameter. AME separation 0.25 times their diameter, PME separation 0.57 times their diameter. AME-ALE separation 0.25 times AME diameter, PME-PLE separation 0.71 times PME diameter. Clypeus height 1.55 times AME diameter. Sternum 1.60 long, 1.40 wide. Metatarsi I-IV with 1 trichobothrium dorsally and Tm I trichobothrium 0.23. Lengths of legs:

I 13.25 (3.60+4.50+3.50+1.65),
II 11.80 (3.30+3.90+3.10+1.50),
III 9.05 (2.75+2.80+2.35+1.15),
IV 11.05 (3.20+3.50+3.00+1.35).

Legs I, II, III, IV. Femur I 1.44 times length of cephalothorax. Other characters similar to those of male.

Epigynum: From ventral view, dorsal plate distinct, distal margin of ventral plate extended mesally and separating a pair of copulatory openings (Fig. 71). Spermathecae globose. Copulatory ducts extended laterally, with a strong turn before reaching copulatory openings (Figs. 73, 74).

Variation: Male cephalothorax ranging in length from 2.91 to 3.18 (n = 21); female from 2.40 to 2.80 (n = 19). Among the specimens examined in this study, most males had a normal or slightly modified metatarsus I, and only 2 males had a strongly modified metatarsus I forming a conspicuous basal process (Figs. 69, 70). In addition, the specimens studied here lacked cymbial cuspules on the dorsal cymbium, but those specimens described by Hormiga in 2003 have cymbial cuspules.

Distribution: China (Sichuan) (Map 2), Japan, Russia.

***Weintrauboa megacanthus* sp. nov.**

(Figs. 75-81, Map 2)

Holotype male: Yajiageng Valley, Moxi Town (29.6°N, 102.1°E), Luding Co., Sichuan Prov., China, 20 July 2004, coll. Yanfeng Tong.

Etymology: The species epithet is from the Latin *megacanthus*, meaning macroseta, and refers to a very strong macroseta near the paracymbium.

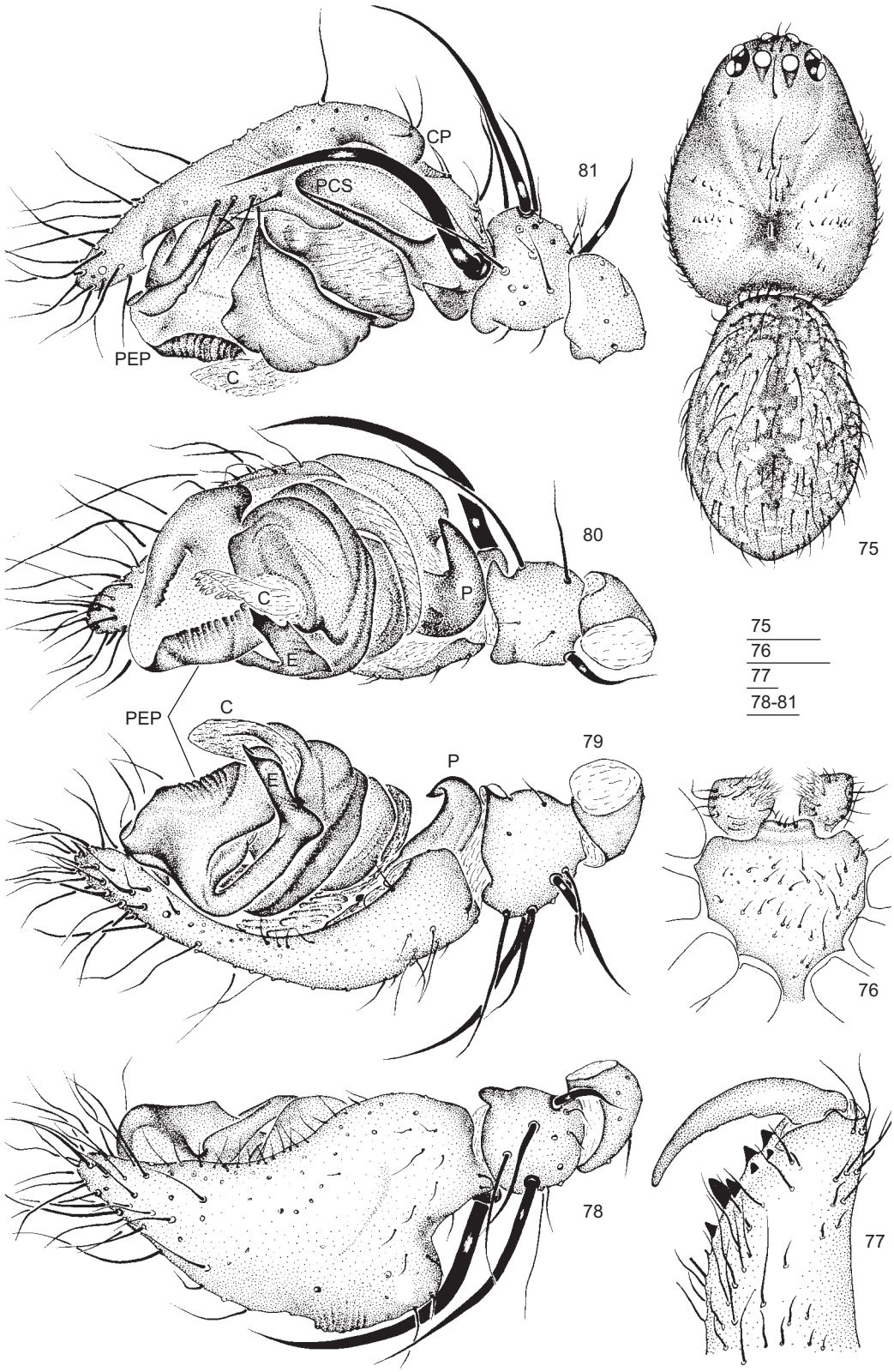
Diagnosis: The male can easily distinguished from known *Weintrauboa* species by the presence of a very strong macroseta near the paracymbium (Figs. 78, 80, 81), of a broad, short embolus (Figs. 79, 80), and of a dorsal apophysis of the PEP (Figs. 79-81), and by the absence of an embolic flap.

Male holotype: Total length 4.27. Cephalothorax 2.09 long, 1.59 wide, 1.25 high; abdomen 2.18 long, 1.36 wide, 1.27 high. AME diameter 0.12. ALE, PME, and PLE all 1.00 times AME diameter. AME separation 0.40 times their diameter, PME separation 0.60 times their diameter. AME-ALE separation 0.60 times AME diameter, PME-PLE separation 1.00 times PME diameter. Clypeus height 1.60 times AME diameter. Cephalothorax brown. Thoracic fovea longitudinal, shallow (Fig. 75). Sternum 2.36 long, 2.36 wide, with distal end slightly broadened (Fig. 76). Labium wider than long. Chelicerae with 4 prolateral teeth and 3 retrolateral teeth (Fig. 77). Cheliceral stridulatory striae absent. Leg yellowish-brown, with brown annuli. Tibiae I-IV with 2 rows of 3 or 4 trichobothria. Metatarsi I-IV with 1 trichobothrium dorsally and Tm I 0.32. Lengths of legs:

I 13.41 (3.45+4.27+4.04+1.65),
II 10.00 (2.73+3.18+2.82+1.27),
III 6.91 (2.00+2.18+3.82+1.82),
IV 8.36 (2.36+2.73+2.27+1.00).

Legs I, II, III, IV. Femur I 1.65 times length of cephalothorax. Abdomen covered with long hair. Marked black patterns and white dots situated on dorsum (Fig. 75).

Male palp: Tibia with 1 retrolateral trichoboth-



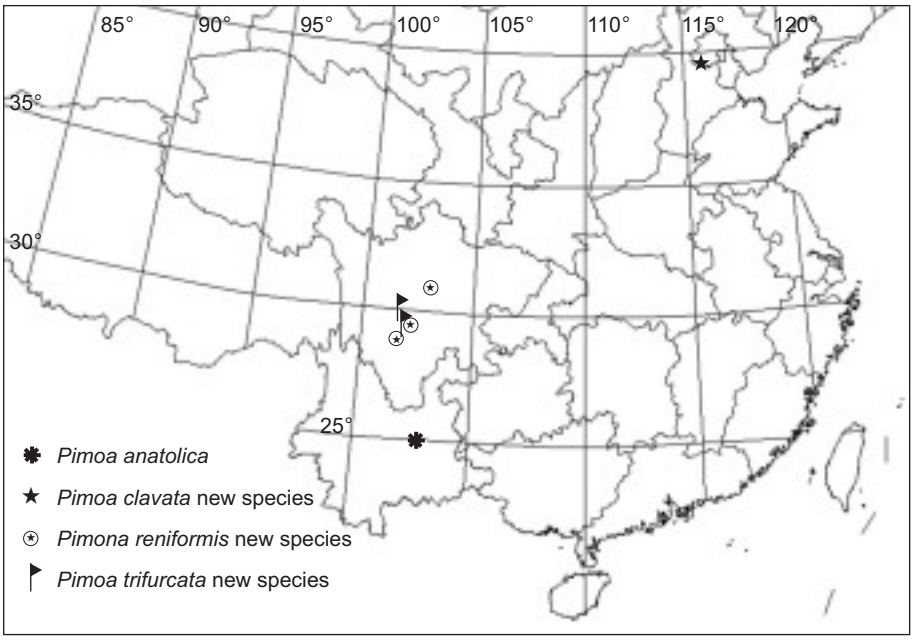
Figs. 75-81. *Weintrauboa megacanthus* sp. nov. (male). **75.** Body, dorsal view; **76.** Sternum, ventral view; **77.** Chelicera, posterior view; **78.** Palp, dorsal view; **79.** Same, prolateral view; **80.** Same, ventral view; **81.** Same, retrolateral view. Scale bars = 1.0 mm (Fig. 75), 0.5 mm (Fig. 76), and 0.1 mm (Figs. 77-81).

rium (Fig. 81), dorsal trichobothria not visible. Paracymbium strong, hook-like, with an extraordinarily large seta near paracymbium (Figs. 80, 81). PCS without protuberance (Fig. 81). CP rounded (Figs. 78, 81). Embolus short, broad (Figs. 79, 80). PEP extraordinarily broad, strongly modified to form a deep and broad concavity, with dorsal apophysis and crinkly margin (Figs. 79-81). Conductor membranous, broad (Figs. 79-81). Embolic flap absent.

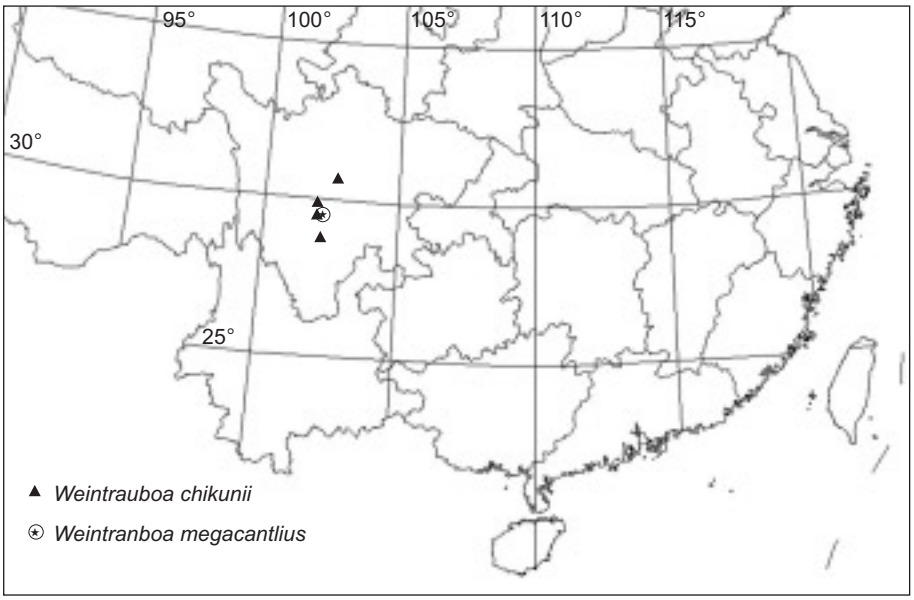
Female: Unknown.

Distribution: China (Sichuan) (Map 2).

Remarks: The PEP of this new species greatly differs from the typical PEP of *Weintrauboa* in morphology, and it seems more reasonable to call it a radix, which is a structure between an embolus and tegulum in the Linyphiidae. But this new species has a distinct PCS, CP, and conductor, leading the authors to place it in the Pimoidae. Obviously it is more similar to species of



Map 1. Collection localities of 4 *Pimoa* species in China.



Map 2. Collection localities of 2 *Weintrauboa* species in China.

Weintrauboa than to those of *Pimoa*; therefore, we tentatively place it in *Weintrauboa*.

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