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On the spider genus *Weintrauboa* (Araneae, Pimoidae), with a description of a new species from China and comments on its phylogenetic relationships

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Abstract

Weintrauboa yele new species (Pimoidae) is described and illustrated based on specimens collected in China. The taxonomic status and distribution of *Weintrauboa insularis* (Saito, 1935) new combination and of *W. chikunii* (Oi, 1979) are discussed and the former species is illustrated based on specimens from the Sakhalin islands. Parsimony analysis of morphological characters provides support for the monophyly of *Weintrauboa* and for its sister group relationship to the genus *Putaoa* Hormiga and Tu, 2008. Some comments on the phylogenetic placement of the recently erected family "Sinopimoidae" are provided.

Key words: Phylogeny, Taxonomy, Morphology, Araneoidea, Linyphiidae

Introduction

The spider family Pimoidae comprises four genera and thirty one extant species (Platnick, 2008; Hormiga & Tu, 2008). Pimoids are known from Western North America (14 species in two genera, from California through Alaska), Southern Europe (two species in one genus, from Spain, France and Italy) and Asia (15 species in three genera, from the Himalayas area, China, Japan and the Sakhalin islands). Several species of pimoids from China (Griswold and Hormiga, unpublished) and California (Hormiga and Lew, unpublished) remain to be described. The diversity and distribution of pimoids suggests that this family is a relictual group which had a broader Holarctic distribution in the past (Hormiga, 1994a, 2003; Wang et al. 2008). So far six fossil species of pimoids, all of them in the genus *Pimoa*, have been described from Baltic amber (Wunderlich, 2004).

The genus *Weintrauboa* was originally described to include two species from Japan and the Sakhalin islands (Hormiga, 2003): *W. contortipes* (Karsch, 1881), the type species, and *W. chikunii* (Oi, 1979). A new species from the Yunnan province of China was recently added by Yang, Zhu and Song (2006). More recently, Xu and Li (2007) have described another new species from China, *W. megacanthus* and have reported the occurrence of *W. chikunii* in the Chinese province of Sichuan. Hormiga and Tu (2008) transferred *megacanthus* to a new genus, *Putaoa*, which also includes a second Chinese species, *P. huaping* Hormiga and Tu, 2008 (the type species). On the other hand, *Weintrauboa chikunii* had been previously known to occur in Japan and the Sakhalin islands (Hormiga, 2003) and therefore the Chinese records reported by Xu and Li (2007) would represent a significant extension of the distribution range of this species (Sichuan is more than 3,000 km away from the type locality of *W. chikunii* in Japan; see map in Fig. 10). Examination of the Chinese specimens described by Xu and Li (2007) suggests that they are not conspecific with *W. chikunii* and that they belong to a new species. In this paper I describe this new species of *Weintrauboa* from China and, in light of newly studied specimens the Sakhalin islands, I clarify the status of the species of *Weintrauboa* in Japan and adjacent islands.

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Material and methods

Morphological methods are described in detail in Hormiga (2000, 2002). Taxonomic descriptions follow the format of Hormiga (1994a, 2002). Specimens were examined and illustrated using a Leica MZ16A and a Leica MZAPO stereoscopic microscope, with a camera lucida. Further details were studied using a Leica DMRM compound microscope with a drawing tube or an Olympus BX40 compound microscope. Digital images were taken with a Leica DFC 500 camera. The digital images depicting the habitus and genital morphology are a composite of multiple images taken at different focal lengths along the Z axis and assembled using the software package Leica Application Suite. Left structures (e.g., palps, legs, etc.) are depicted unless otherwise stated. Most hairs and macrosetae are usually not depicted in the final palp and epigynum drawings. All morphological measurements are in millimeters. Somatic morphology measurements were taken using a scale reticle in the dissecting microscope. The position of the metatarsal trichobothrium is expressed as in Denis (1949). Female genitalia were excised using surgical blades or sharpened needles. Epigyna and palps were transferred to methyl salicylate (Holm, 1979) for examination under the microscope, temporarily mounted as described in Grandjean (1949) and Coddington (1983).

Anatomical abbreviations used in the text and figures

Male Palp	
C	conductor
CP	cymbial process
E	embolus
PEP	pimoid embolic process
Epigynum	
CD	copulatory duct
FD	fertilization duct
S	spermatheca
Somatic morphology	
ALE	anterior lateral eye(s)
AME	anterior median eye(s)
PLE	posterior lateral eye(s)
PME	posterior median eye(s)

Cladistic analysis

Taxa. I have added the new species (*Weintrauboa yele*) to the character matrix of Hormiga and Tu (2008), which included three other *Weintrauboa* species, the two known species of the recently described genus *Putaoa*, four species of *Pimoa*, *Nanoa enana* Hormiga, Buckle and Scharff, 2005 and 21 linyphiid species. The species coded under *Weintrauboa chikunii* in the matrix of Hormiga and Tu (2008) is actually *W. insularis* (Saito, 1935) n. comb., as it is discussed in the taxonomic section of the present paper. Due to the lack of female specimens of this latter species many character were not coded in the previous matrix but are coded for *insularis* in the present one. I have also scored representatives of three other araneoid families (Tetragnathidae, Theridiosomatidae, and Theridiidae) to root the “linyphioids.” The Linyphiidae sample attempts to represent morphological diversity at the subfamilial level. The goal of this analysis is to study the placement of the new *Weintrauboa* species within Pimoidae. The matrix includes a total of 35 taxa (Appendix 2).

Characters. The characters used in the current analysis are those of Hormiga and Tu (2008) with one additional character (character 3, see Appendix 1). Six of the 83 characters in the matrix are parsimony uninformative but are kept because they may be useful with a different taxonomic sample.

Analyses. The character matrix was edited and managed using the program Mesquite version 2.0 (Maddison & Maddison 2007). The parsimony analyses were performed using the computer program TNT version 1.1 (Goloboff *et al*. 2007) using both equal weights and implied weights (Goloboff 1993). Mesquite version 2.0 and WinClada version 1.00.08 (Nixon 1999) were used to study character optimizations on the cladograms. Ambiguous character optimizations were resolved so as to favor reversal or secondary loss over convergence (Farris optimization or ACCTRAN). The 18 multistate characters in the matrix were treated as non-additive (unordered or Fitch minimum mutation model; Fitch 1971). Bremer support indices (Bremer 1988, 1994) were calculated in TNT using the macro "bremer.run." Parsimony jackknife indices (Farris *et al*. 1996) were also calculated in TNT using 10,000 replicates (traditional search with TBR), a 0.36 removal probability and collapsing groups with a frequency below 50% (both clade support indices are reported in Fig. 11).

Results

Heuristic searches in TNT under equal weights, collapsing branches if supported ambiguously ("Rule 1") and performing 1000 replicates of TBR resulted in four minimal length trees of 212 steps in all 1000 replicates (with ensemble consistency and retention indices of 0.50 and 0.75, respectively; the consistency index is 0.48 after exclusion of the six uninformative characters). Two nodes are collapsed in the strict consensus cladogram, both within Linyphiidae (Fig. 11). Implied weights analyses in TNT under $k = 1$ and 3 resulted in the same cladogram for the internal relationships of Pimoidae (that is, identical to that found under equal weights) with tree lengths under equal weights of 219 and 212 steps, respectively. Consequently k values higher than 3 converge on the same pimoid internal relationships (e.g., k values of 6, 12 and 50 result in optimal topologies that are 212 steps under equal weights). The genus *Weintrauboa* is monophyletic and sister to *Putaoa*. *Weintrauboa contortipes* (Karsch, 1881) is sister to a clade that includes the remaining species in the genus.

Discussion

Although the discovery of a new species of *Weintrauboa* in China, as well as the availability of new specimens of *W. insularis* n. comb., has improved our understanding of this interesting lineage of pimoids, the group remains poorly studied. Most species are known after only a few museum specimens (none seem to be available for study in the case of the Japanese species *W. chikunii*) and consequently the distribution ranges of the five described species (see map in Fig. 10) should be considered very preliminary. The limited species distribution data available suggest that additional species probably exist in China, given that there is a distributional gap more than 2,500 km. wide between the records of *W. yunnan* (in Yunnan, China) and the most western records of *W. contortipes* (in Honshu, Japan). We do not know much about their biology either, if anything.

The sheet web of *W. contortipes* is illustrated in Shinkai & Takano (1984: 27) and one would presume that the other species in the genus build sheet webs as well, as it is the case in *Pimoa* (Hormiga 1994a) and *Putaoa* (Hormiga & Tu 2008). In all *Weintrauboa* species described so far the adult males have modified metatarsi in the first pair of legs and the morphological details vary across species (and at least in *W. yele* within species; see Xu & Li 2007: 499), from a fairly subtle sinuous metatarsal base (in *W. yunnan*; see Yang *et al*. 2006: fig. 1b) to a conspicuously enlarged and twisted base with a depression bordered by modified setae (in *W. contortipes*; see Hormiga 2003: figs. 3 and 7). Since these modifications are exclusive of males they may play a role in courtship and/or mating. Sexually dimorphic modified legs are extremely rare in linyphioids. Only one other pimoid species has been reported to have something similar: the male metatarsus I of *Pimoa hespera* (Gertsch & Ivie, 1936) is sinuous and widest at the distal end of the proximal third (Hormiga 1994a: fig. 129).

Within Linyphiidae modified male metatarsi I, similar to those of *Pimoa hespera*, have been described in the Holarctic genus *Stemonyphantes* Menge, 1866 (van Helsdingen 1968) but are otherwise rare in the family.

The cladistic analysis presented here does not provide new data on the phylogenetic relationships among the pimoid genera and the only relevant comment to make is that after the addition of new species to the matrix the genus *Weintrauboa* remains monophyletic and sister to *Putaoa* (as suggested by the analysis of Hormiga & Tu 2008).

In a recent study, published after the completion of the descriptive work presented in this paper, Li & Wunderlich (2008) have erected a new araneoid family ("Sinopimoidae"), based on a single species collected from the canopy of tropical forests in Southern China. According to these authors "Sinopimoidae" is closely related to linyphiids and pimoids based on the presence of cheliceral stridulatory striae and patella-tibia autospasy (mistakenly referred as "autotomy"). Furthermore, based on the shape of the paracymbium, which they describe in *Sinopimoa* as "simple, pointed, only fairly bent, and fused to the cymbium," Li & Wunderlich (2008:2) argue that Pimoidae and "Sinopimoidae" probably are sister taxa, although this conjecture is not based on explicit cladistic reasoning or on a character matrix based analysis. Fused ("integral") paracymbia are symplesiomorphic within Araneoidea (e.g., see Griswold et al. 1998) and as such cannot provide evidence for the monophyly of Pimoidae and "Sinopimoidae." The details of the paracymbium morphology of *Sinopimoa* are not clear, but simple and pointed paracymbia are found across several araneoid lineages and it is possible that this is also a shared primitive trait. Although a detailed study of the phylogenetic affinities of *Sinopimoa bicolor* Li & Wunderlich, 2008 is beyond the scope of this study, given the alleged phylogenetic position of *Sinopimoa*, it seems appropriate to provide here some comments about what the morphology of this minute species, as described in Li & Wunderlich (2008), implies about what its close relatives may be. The cheliceral striae and the patella-tibia autospasy indeed suggest that *Sinopimoa* is a "linyphioid" but the interpretation of its palpal morphology as described and illustrated in the aforementioned paper is far from straightforward. For example, the embolus is not identified as such in any of the illustrations (and the sperm duct is not depicted in the drawings) nor the details of how the embolus connects to the rest of the palp are provided (e.g., is the embolus connected by means of a membrane? Where does it attach? Is there a radix?). How the so-called "bulbus" (their figures 10 and 13) connects to the tegulum is also unclear in the published illustrations (it is not described in the text either). The authors restrict any attempts to homologize palpal sclerites to the trivial correspondences (tegulum, paracymbium, etc.). For example, would the so-called "Tegular Apophysis", a rather large structure that reaches the base of the pedipalpal tibia, be a homolog of the araneoid conductor or the median apophysis (both present in many pimoids)? No pimoid has ever been described with either a median apophysis or a conductor of such dimensions or morphology, and linyphiids lack both sclerites. Is there any other tegular structure that could be homologized with either sclerite? (None is mentioned as such in the description) How and where does the "Tegular Apophysis" connect to the tegulum? Is there a suprategulum? The answers to these and other critical questions are not provided in the mentioned paper. Once it is hypothesized that this species is a "linyphioid", the apparent absence of conductor and median apophysis suggests that *Sinopimoa bicolor* is a member of Linyphiidae. Furthermore, *Sinopimoa* shares two of the synapomorphies of the linyphiid subfamily Erigoninae (or of some erigonine clades; see Hormiga 1994b, 2000; Miller & Hormiga 2004): absence of cheliceral pedipalpal claw in the females and presence of a retrolateral tibial apophysis (in Miller & Hormiga's analysis the latter is suggested to have evolved multiple times within Erigoninae). Coincidentally, like many erigonines, *Sinopimoa bicolor* is of very small size (unlike pimoids, which are of median to large size), and has only one dorsal tibial spine in legs III and IV. Integral paracymbia (or even absence of paracymbia) have been described in several erigonines (e.g., Miller & Hormiga 2004), as well as in other linyphiids. Unlike erigonines, *Sinopimoa* has a prolateral femoral macroseta. Although neither the tracheal anatomy (which is desmitracheate in most erigonines) nor the male epiandrous fusules (which are absent in erigonines) are described in Li & Wunderlich's paper, the most parsimonious interpretation of the available evidence suggests that *Sinopimoa bicolor* is a linyphiid and possibly an erigonine.

Systematics

Family Pimoidae Wunderlich, 1986

Weintrauboa Hormiga, 2003

Type species: *Linyphia contortipes* Karsch, 1881

Weintrauboa yele new species

(Figs. 1–5)

W. chikunii Xu & Li 2007: 496, figs. 62–74. Misidentification.

Types. Male holotype (IZCAS – Ar 10983), one male (IZCAS – Ar 10984) and two female paratypes (IZCAS – Ar 10985 - 10986) (GH0745). P. R. China, Sichuan Prov., Yele Nature Reserve, Mianning Co., 28.9° N: 102.2° E; 22.x.2005, X. Xu, X. Zhang & L. Tu (all deposited at Institute of Zoology, Chinese Academy of Sciences, Beijing).

Etymology. The species epithet is a noun in apposition taken from the type locality.

Diagnosis. Males of *W. yele* new species are most easily distinguished from other *Weintrauboa* species by the shape of the ectal cymbial process (Figs. 3A, C) and the form of the pimoid embolic process (Fig. 2A, 2B, 3A). Females of *yele* are diagnosed by the presence of a small knob-like posterior projection of the epigynal septum which is extended beyond the posterior margin of the epigynal plate (Figs. 1C, 1D, 4A–B). In *W. insularis* this projection is also knob like but in ventral view it does not reach the posterior margin of the epigynal plate (Figs. 8A). *W. chikunii* has a similar epigynum, but in ventral view the shape of the posterior margin is different (Oi 1979: fig. 12). In *W. yunnan* the posterior projection is not knob shaped (Yang *et al*. 2006: fig. 2) and in *W. contortipes* the epigynum is very different and lacks scape like projections (Hormiga 2003: figs. 2E, 3A–C).

Weintrauboa yele has been recently misidentified in the literature with *W. chikunii* (Xu & Li 2007); the latter is a species that has been reported from Japan (Honshu).

Males of *W. yele* new species can be most easily distinguished from those of *W. chikunii* by the shape of the ectal cymbial process because the apophyses are more pointed in the former species (Figs. 3A, C).

Additional morphological data. *Weintrauboa yele* new species has been recently described and illustrated in detail by Xu & Li (2007) as *W. chikunii* (see Diagnosis). The description and illustrations presented here complement their description and are provided to help distinguishing *W. yele* new species from other species in the genus.

Male (holotype, Yele Nature Reserve). Total length 4.31. Cephalothorax 2.25 long, 1.75 wide, 1.4 high. Abdomen 2.25 long, 1.78 wide. Femur I 2.5 long. Cheliceral stridulatory striae absent. Palp illustrated in Figs. 2 and 3. Modified setae at the base of the cymbium are present but fewer and smaller in size compared to other species in the genus (e.g., see Hormiga 2003: fig. 5E for *W. contortipes*).

Female (paratype, same locality as male). Total length 4.66. Cephalothorax 2.1 long, 1.56 wide, 1.15 high. Abdomen 3.1 long, 2.17 wide. Femur I 2.25 long. Cheliceral stridulatory striae absent. Epigynum illustrated in Figs. 1C–D, 4 and 5.

Variation. Xu & Li (2007: 499) examined 20 males and reported variation in the metatarsus morphology, ranging from having a conspicuously modified basal process to a slightly modified process.

Distribution. Reported form the Sichuan province of China (see map in Fig. 10).

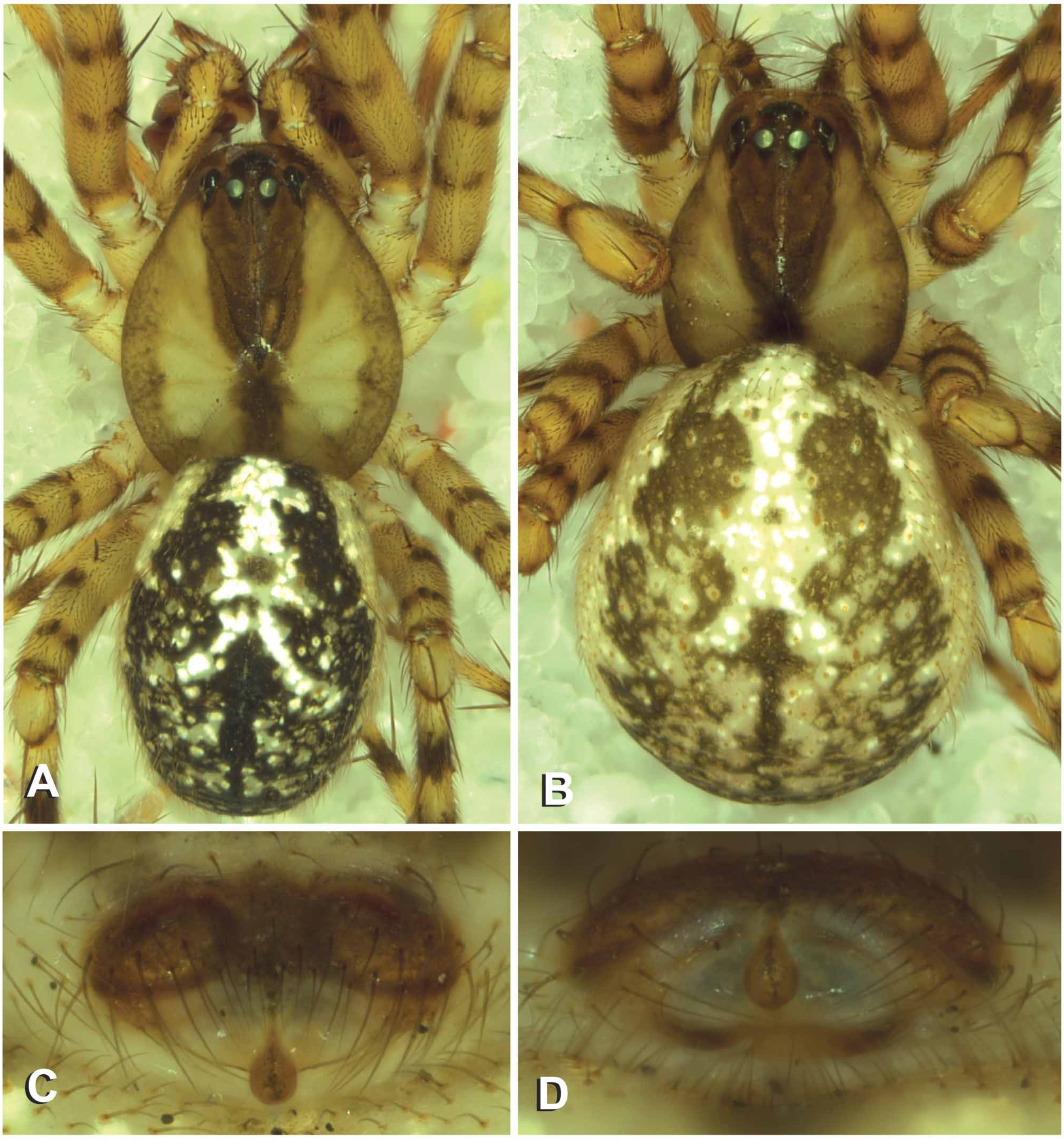

FIGURE 1. *Weintrauboa yele* **new species.** Male and female from Yele Nature Reserve (Sichuan Province, China). A, male, dorsal; B, female, dorsal; C, epigynum, ventral; D, epigynum, caudal.

Weintrauboa insularis (Saito, 1935) **new combination**

Lepthyphantes insularis Saito 1935: 58, figs. 1a, b.
Lepthyphantes insularis Saito 1959: 79, figs. 81a–c.
Labulla insularis Marusik et al. 1993a: 75 (synonymy with *Labulla chikunii* Oi, 1979 rejected by Hormiga 2003: 276).
W. chikunii Hormiga 2003: 276, figs. 2A–D, 3I, J, 6A–D. Misidentification

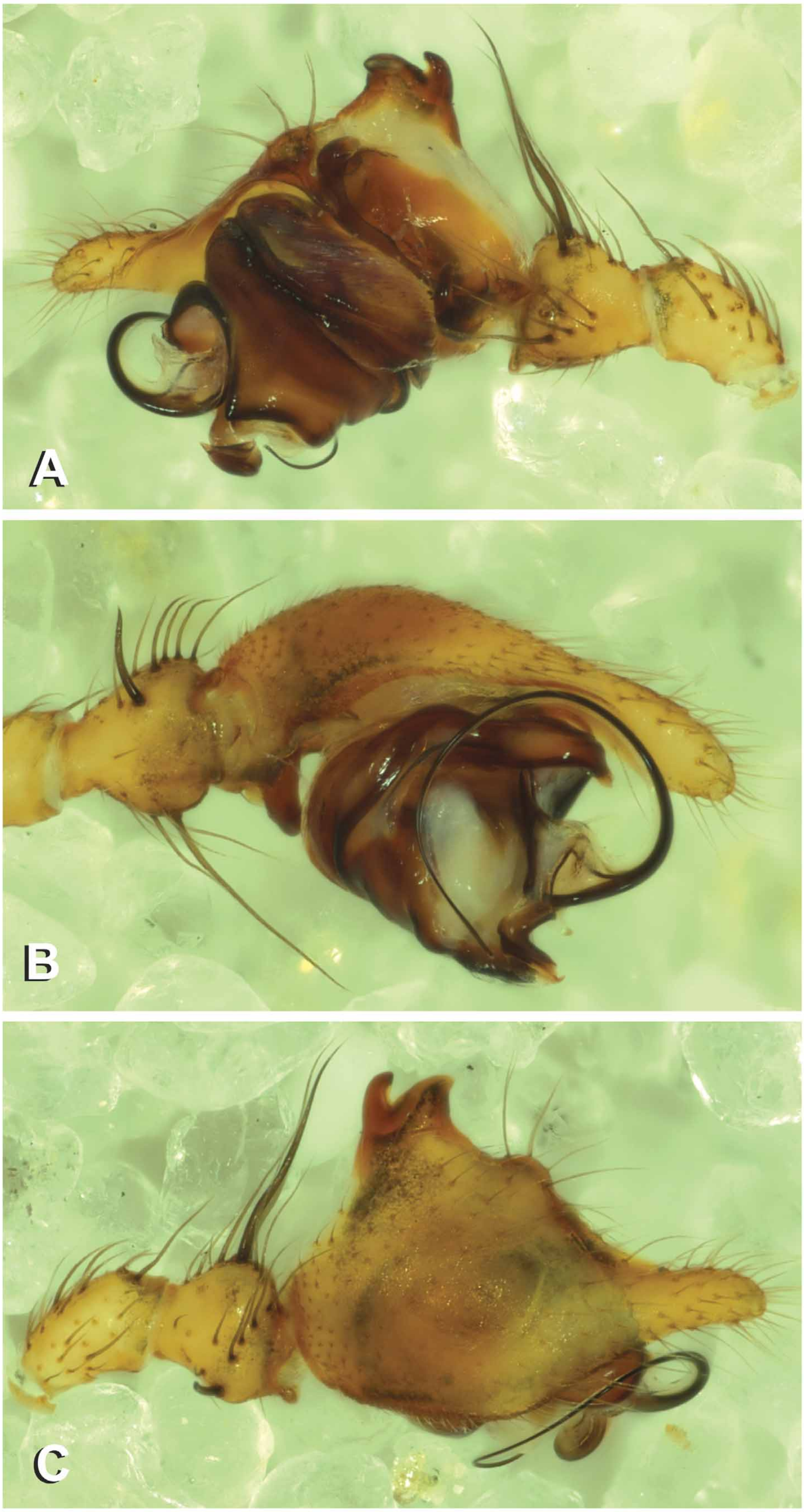

FIGURE 2. *Weintrauboa yele* **new species.** Male from Yele Nature Reserve (Sichuan Province, China), palp. A, ectal; B, mesal; C, dorsal.

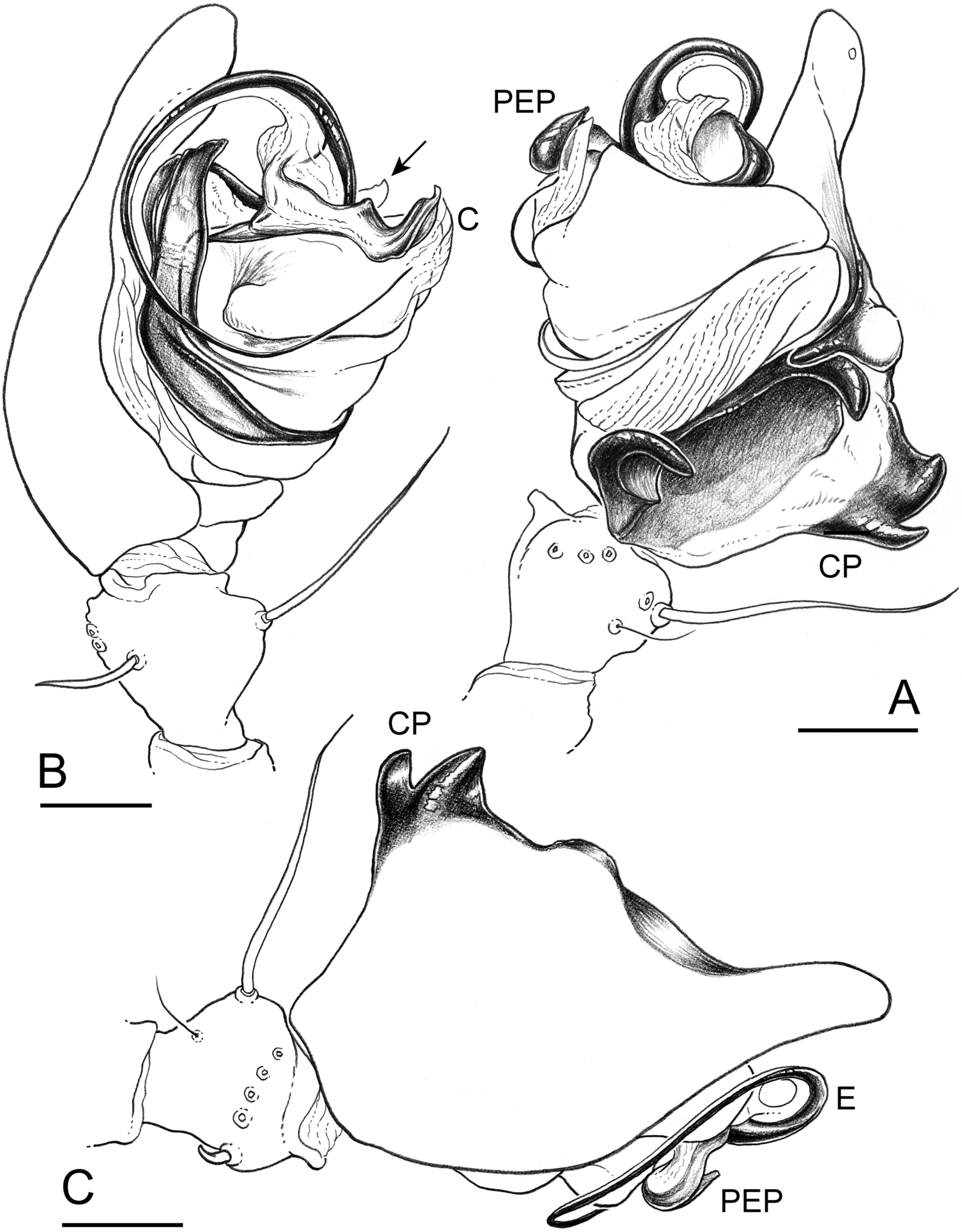

FIGURE 3. *Weintrauboa yele* **new species.** Male from Yele Nature Reserve (Sichuan Province, China), palp. A, ectal; B, mesal; C, dorsal. Scale bar, 0.2 mm.

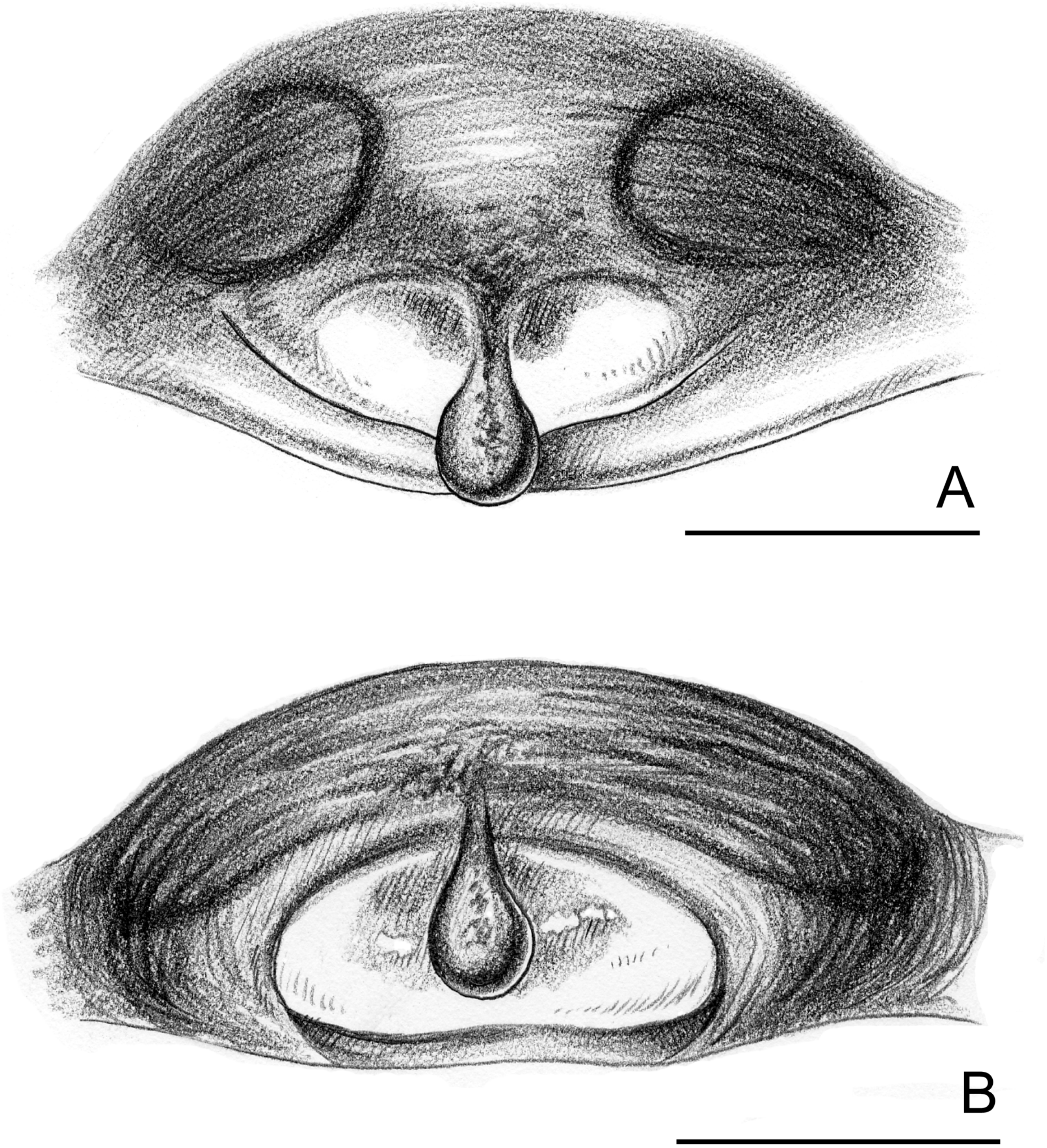

FIGURE 4. *Weintrauboa yele* **new species.** Female from Yele Nature Reserve (Sichuan Province, China), epigynum. A, ventral; B, caudal. Scale bar, 0.2 mm.

Types. Presumed to be lost (see comments below).

N. B. *Lepthyphantes insularis* Saito was synonymized with *Labulla chikunii* Oi, 1979 by Marusik *et al.* (1993:75), but this synonymy was rejected by Hormiga (2003). In this section I shall rephrase and revise my earlier argument based on the study of new specimens from Sakhalin Island. Tanasevitch & Eskov (1987:194) had argued that *Lepthyphantes insularis* Saito, described after a single female specimen from the Sakhalin, did not belong in the genus *Lepthyphantes*, based on Saito's (1935, fig. 1b) epigynum illustration. However Tanasevitch & Eskov did not provide any new illustrations or redescription of *insularis*, nor did they examine

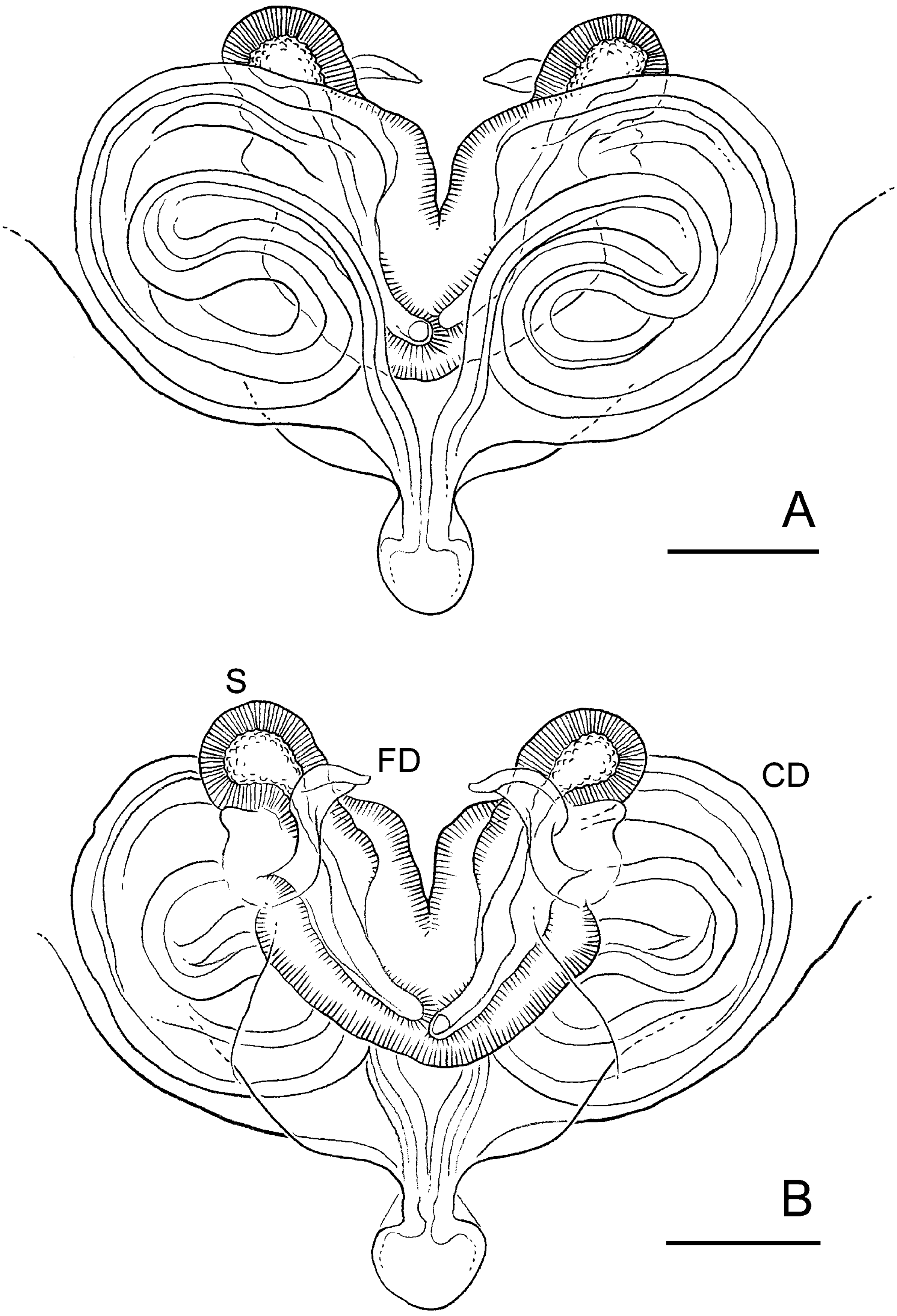

FIGURE 5. *Weintrauboa yele* **new species.** Female from Yele Nature Reserve (Sichuan Province, China), cleared epigynum. A, ventral; B, dorsal. Scale bar, 0.2 mm.

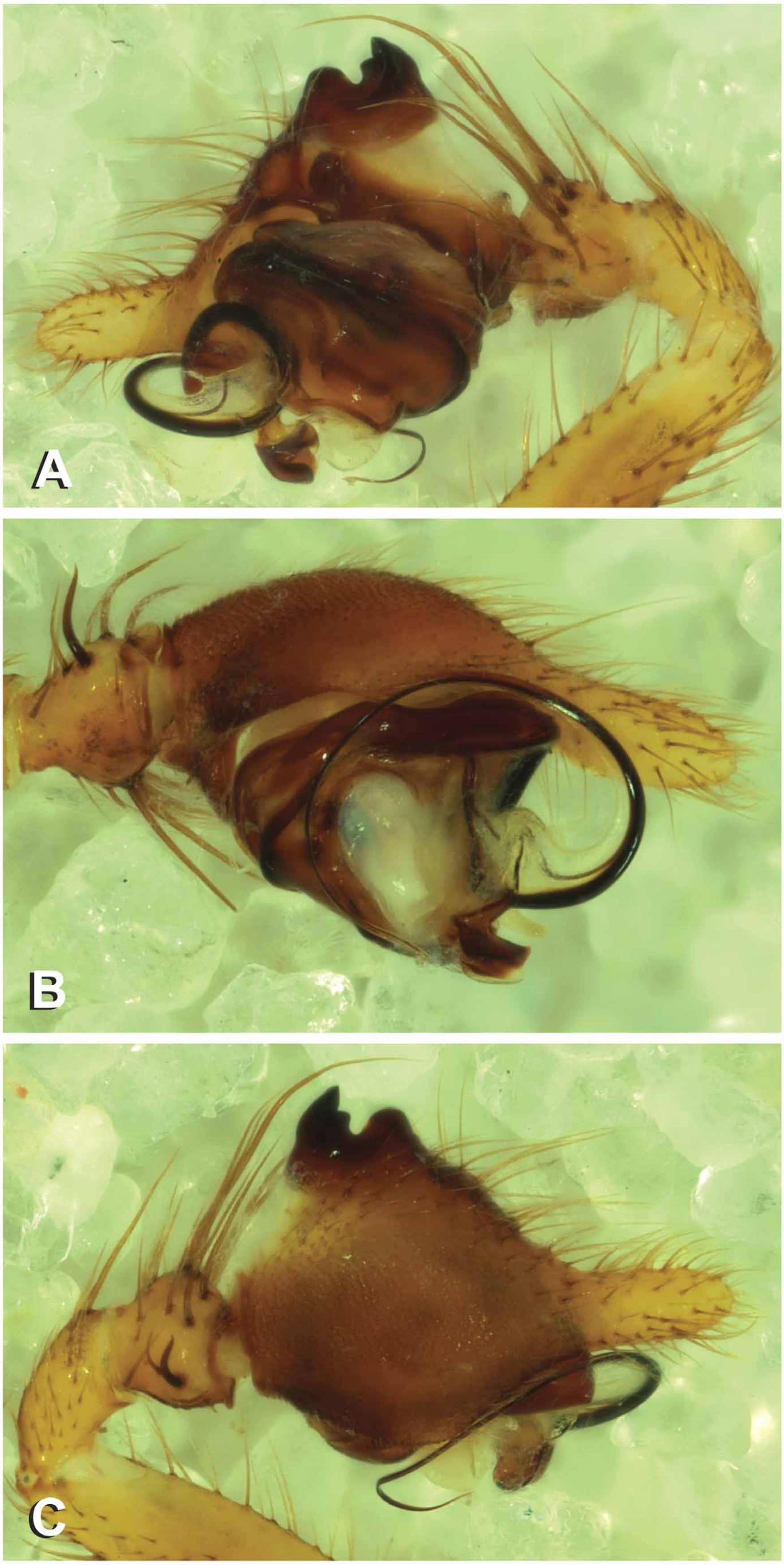

FIGURE 6. *Weintrauboa insularis* (Saito, 1935) **new combination.** Male from Sakhalin Island, palp. A, ectal; B, mesal; C, dorsal.

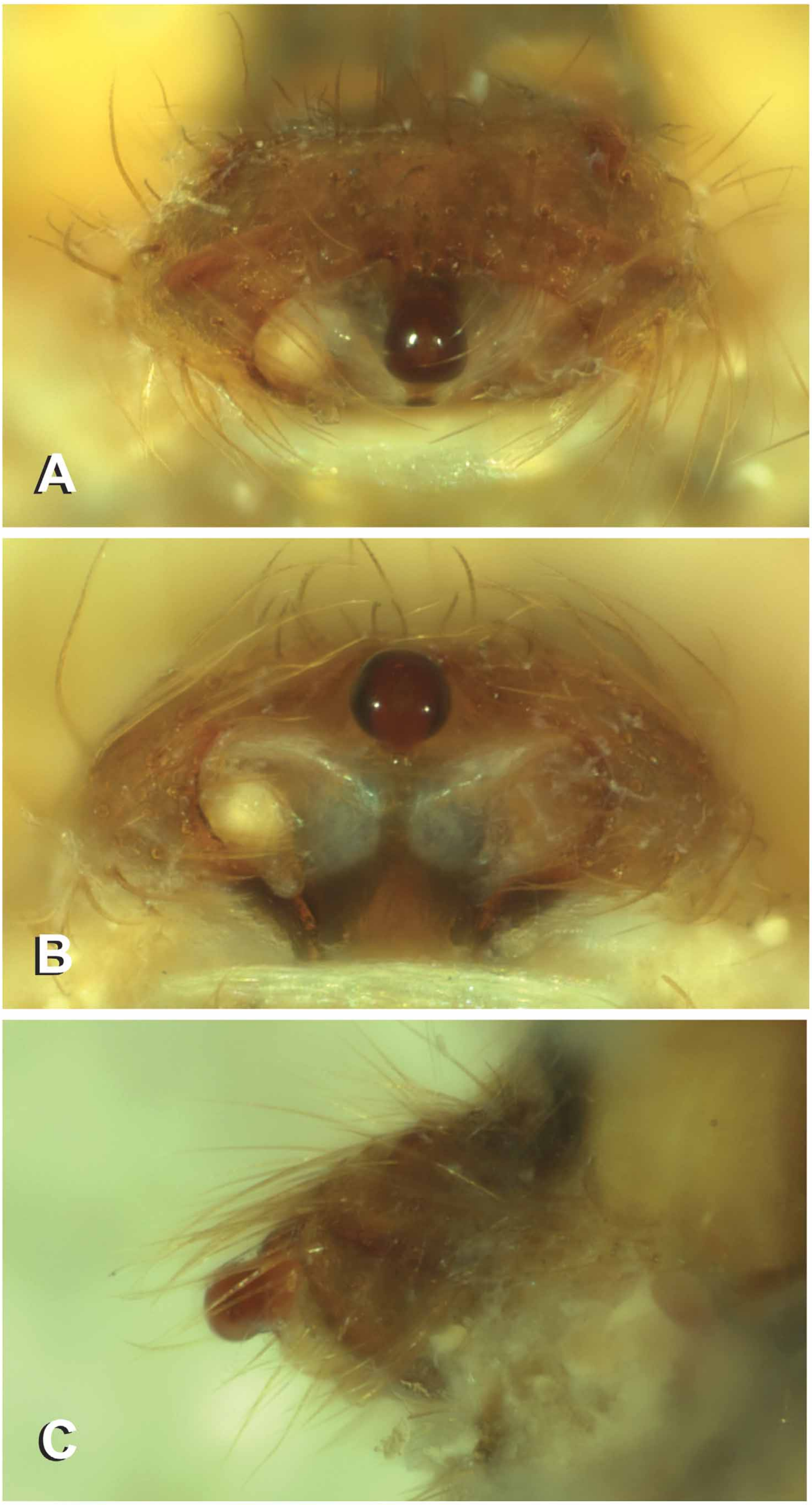

FIGURE 7. *Weintrauboa insularis* (Saito, 1935) **new combination.** Female from Sakhalin Island, epigynum. A, ventral; B, caudal; C, lateral.

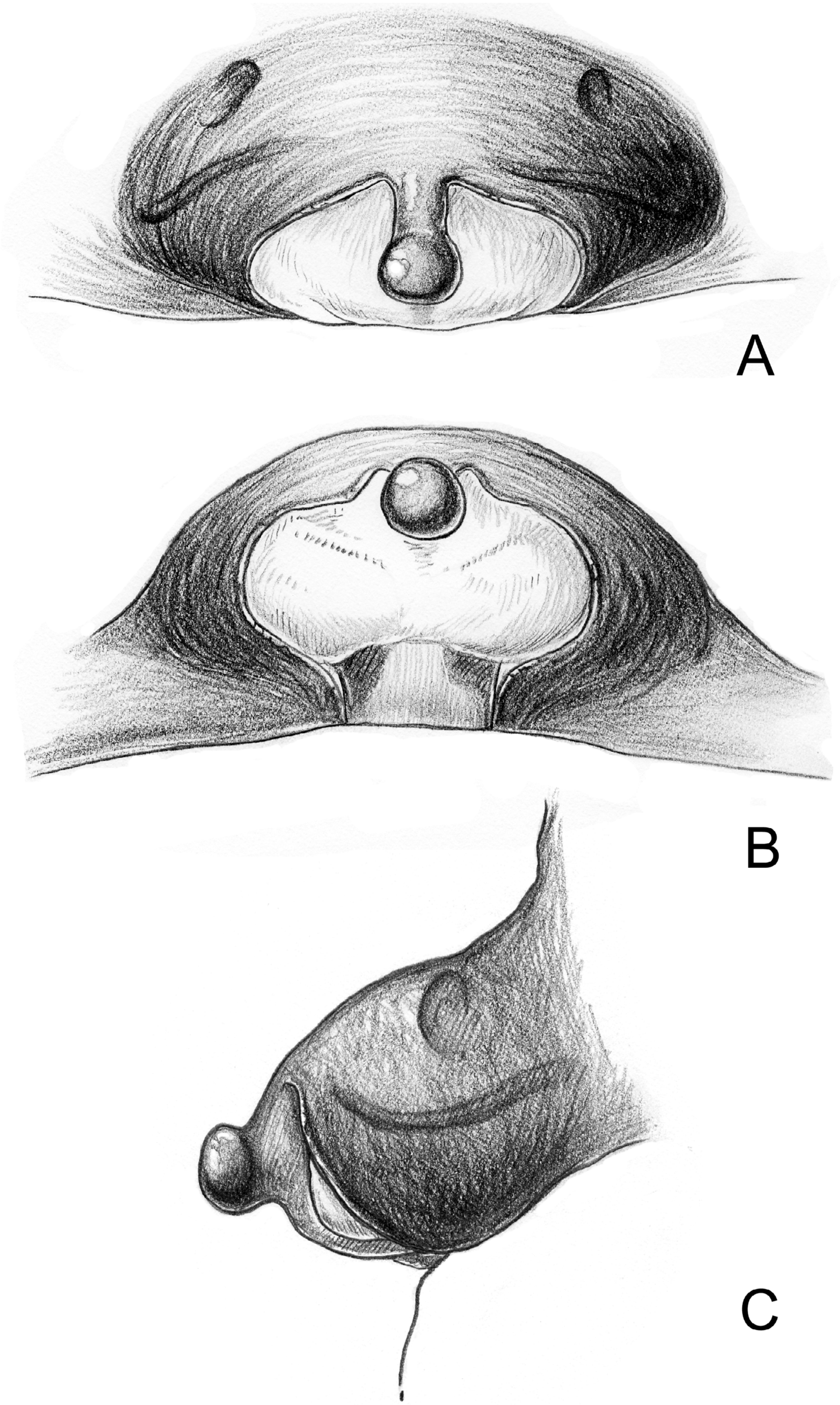

FIGURE 8. *Weintrauboa insularis* (Saito, 1935) **new combination.** Female from Sakhalin Island, epigynum. A, ventral; B, caudal; C, lateral.

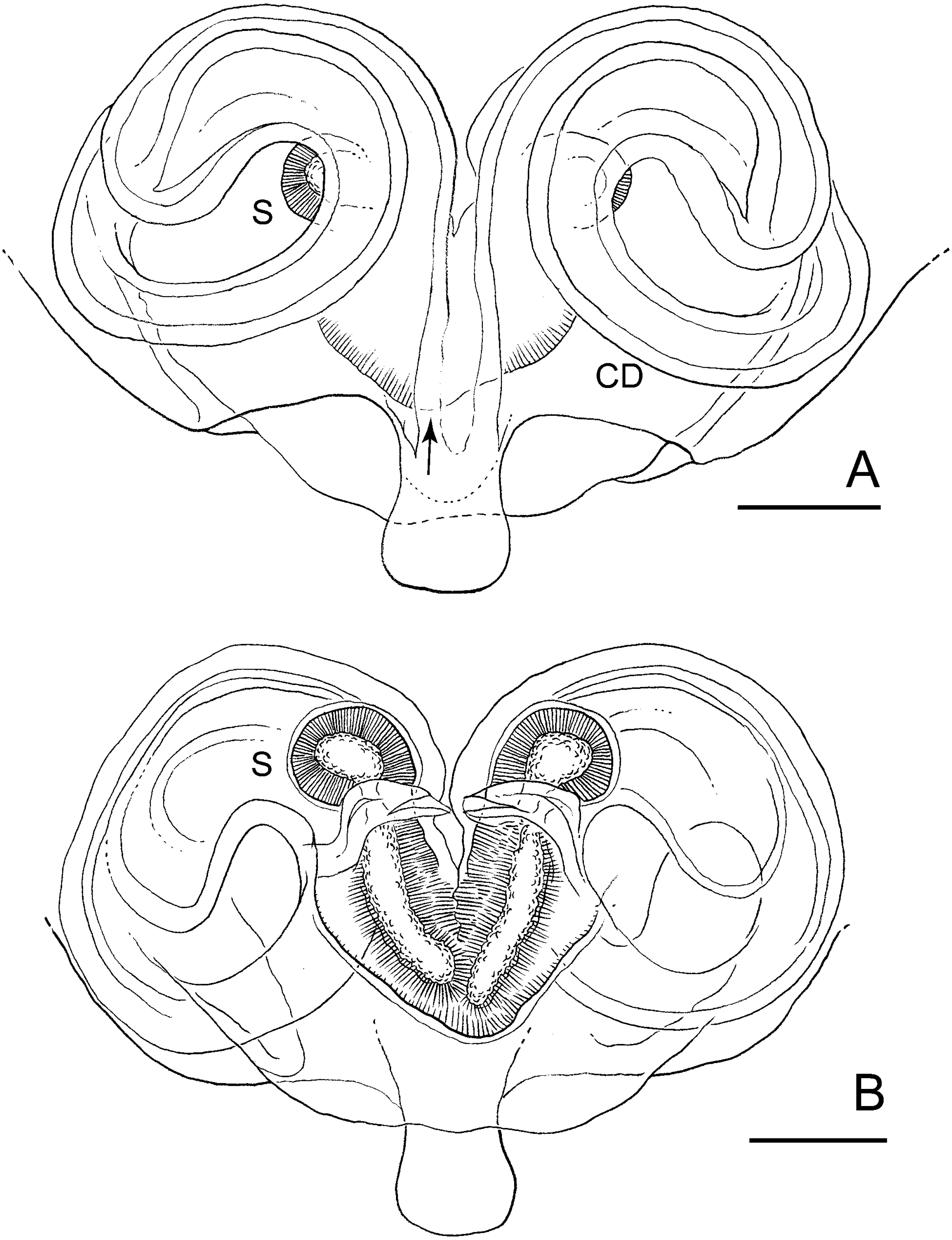

FIGURE 9. *Weintrauboa insularis* (Saito, 1935) **new combination.** Female from Sakhalin Island, cleared epigynum. A, ventral; B, dorsal. Scale bar, 0.1 mm.

the type or any other specimens. Tanasevitch & Eskov (1987) suggested that *Lepthyphantes insularis* should be transferred to the genus *Labulla* Simon, 1884, and that it could be a junior synonym of the type species, *Labulla thoracica* (Wider, 1834), although they did not formalize any transfer or new synonymy. Unfortunately Saito's type material, formerly at the University of Hokkaido, is presumably lost (H. Ono, in litt.). Oi (1979) described and illustrated both sexes of *Labulla contortipes chikunii*. The type locality of this latter subspecies is in Horigane, in Japan's Nagano Prefecture (about 1,100 km away from the southern tip of Sakhalin Island). Eskov (1992: 53) elevated *chikunii* from subspecies of *L. contortipes* to a species rank (*Labulla chikunii*), although no justification for the change was published. I have not been able to study any specimens of *chikunii*, but Oi's (1979) illustration of the *chikunii* epigynum, as well as Chikuni's (1989, fig. 12) excellent color photographs, show substantial differences with Saito's (1935) epigynum illustration of *insularis*.

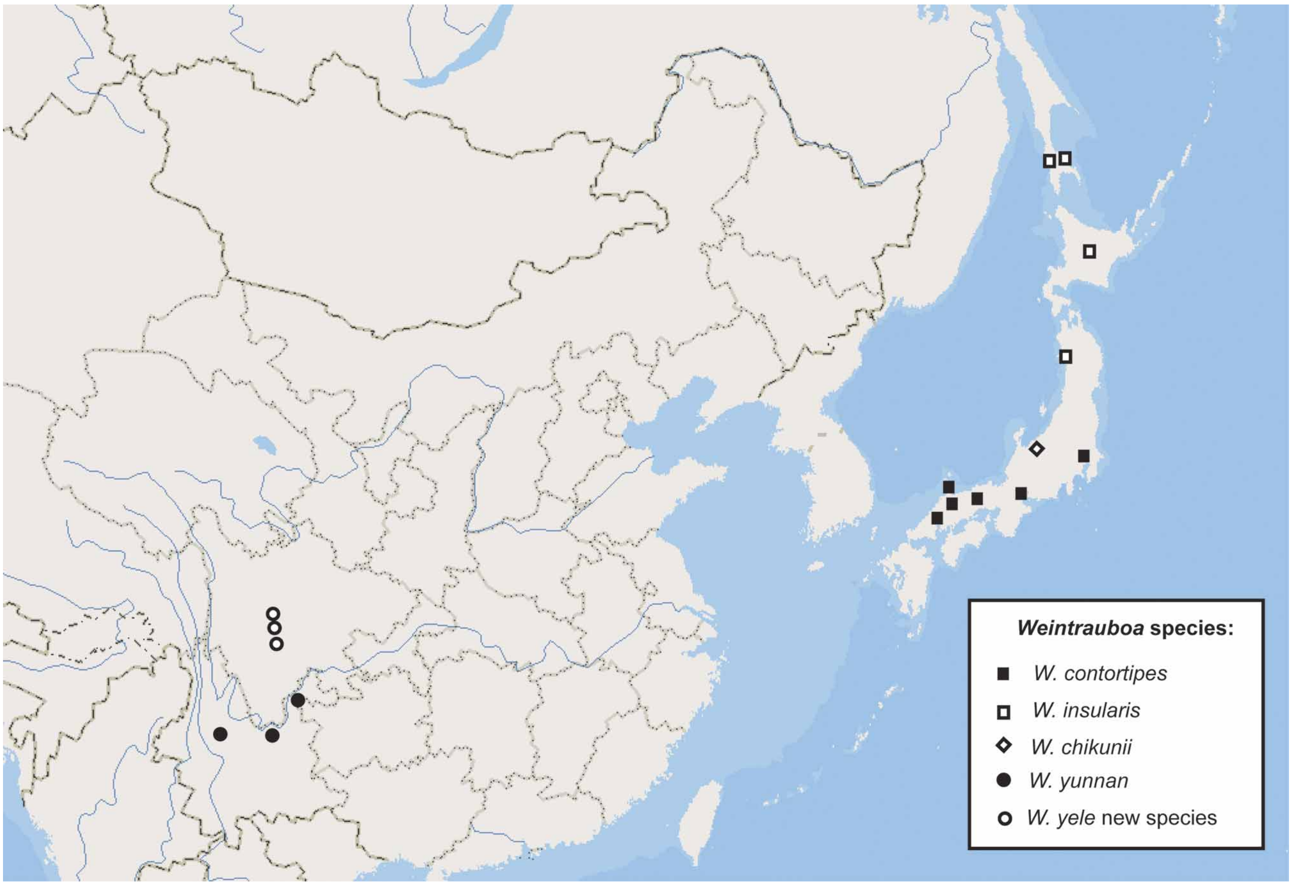

FIGURE 10. Distribution of *Weintrauboa* species based on examined specimens and records from the literature (see text for details).

Since Marusik *et al.* (1993) did not base their synonymy of *Labulla chikunii* with *Lepthyphantes insularis* on examination of types, and the descriptions of these two species are quite different, on the basis of the available evidence Hormiga (2003) argued that it seemed unjustified to synonymize *Labulla contortipes chikunii* with *Lepthyphantes insularis*. In *Lepthyphantes insularis* the ventral scape is very short and wide, and the posterior edges of the ventral epigynal wall curve posteriorly. The comparable structure in *chikunii* is much longer and thinner and the posterior edges of the ventral epigynal wall curve first anteriorly before descending towards the epigastric furrow. The recent availability of female specimens of the Sakhalin species of *Weintrauboa* has further clarified the status of *insularis*, as the species from the type locality of *chikunii* (in Nagano Prefecture) and the species in Sakhalin are different. The latter one corresponds to Saito's *insularis*, and therefore becomes *Weintrauboa insularis* (Saito) new combination. Dr. H. Ono (National Science Museum, Tokyo) has shared male and female illustrations (rendered by Mrs. Matsuda) of specimens collected in Hokkaido that can be identified as belonging to *W. insularis*. The male specimens identified and illustrated in Hormiga (2003) as *W. chikunii* were collected in Sakhalin and belong to *W. insularis*.

Diagnosis. Males of *W. insularis* can be distinguished from other *Weintrauboa* species by the shape of the ectal cymbial process (Fig. 6) combined with sinuous apophysis of the first metatarsus which is less pronounced than in *W. contortipes* but more than in *W. chikunii* and *W. yunnan* (Hormiga 2003: figs. 3I and 3J, labeled as "*W. chikunii*"). The shape of the epigynal scape, with its rounded apical end (Figs. 7 and 8), is diagnostic for the species.

Additional morphological data. Male: See Hormiga (2003: 276) under "*W. chikunii*."

Female (from Sakhalin, Krilyon Peninsula, Ulyanovka river valley). Total length 5.56. Cephalothorax 2.62 long, 2.01 wide, 1.66 high. Abdomen 2.77 long, 1.55 wide. Femur I 2.84 long. Cheliceral stridulatory striae absent. Epigynum illustrated in Figs. 7–9.

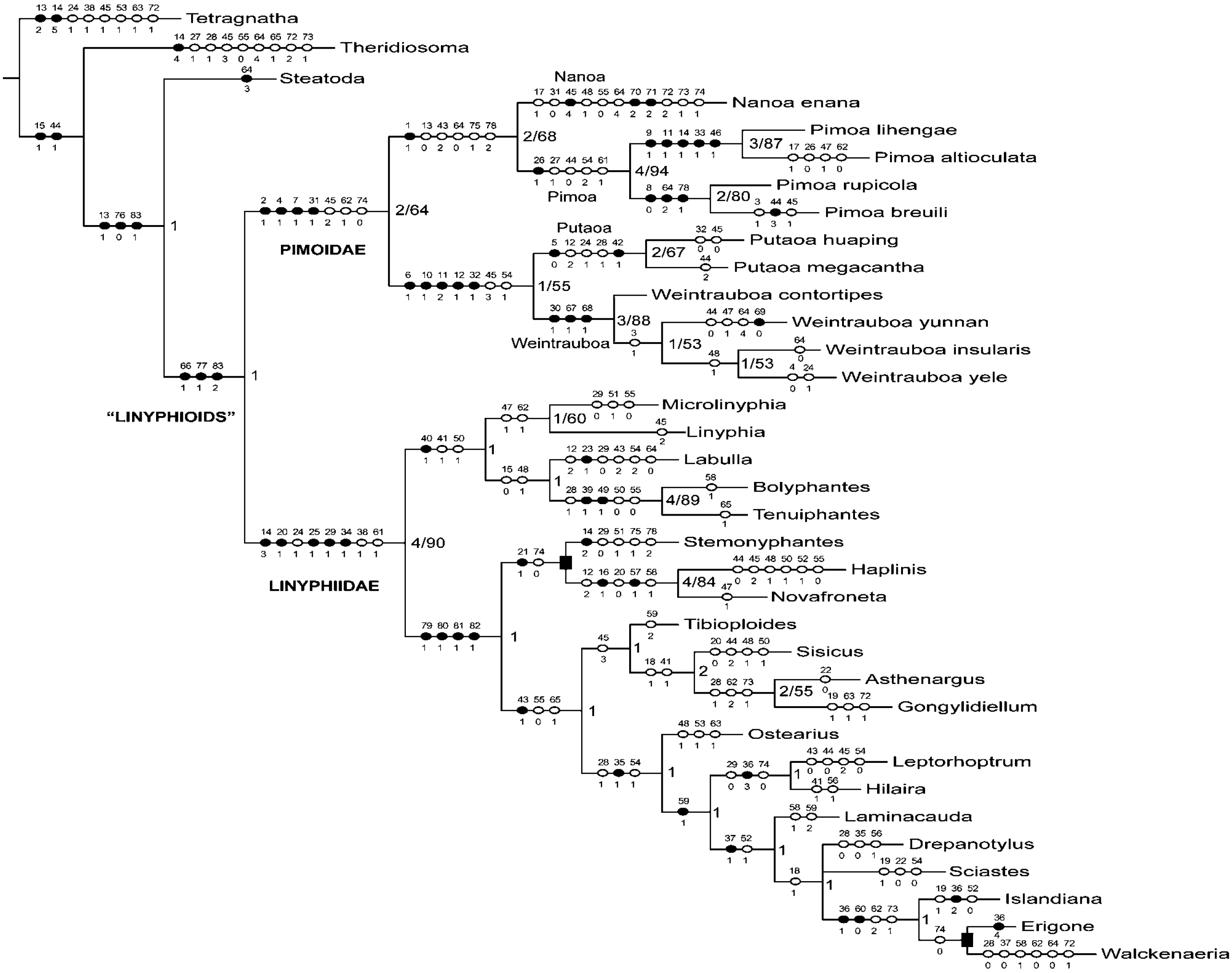

FIGURE 11. One of the four minimal length trees of 212 steps that result from the parsimony analysis of the data matrix presented in Appendix 1 (CI = 0.50, RI = 0.75). Exclusion of the six parsimony uninformative characters decreases the tree length to 203 steps and the ensemble consistency index to .48 Ambiguous character changes are resolved under "Farris optimization." Closed circles represent non-homoplasious character changes. The two nodes that collapse in the strict consensus cladogram of the four most parsimonious trees are marked with a closed rectangle. Numbers at nodes indicate Bremer support / parsimony jackknife frequency (only those above 50% are reported). The basal trichotomy has been resolved according to the araneoid topology presented in Griswold *et al.* (1998); see text for additional details of the cladistic analysis.

Specimens examined: RUSSIA, Sakhalin Island, Aniva Dist., Krilyon Peninsula, Ulyanovka river valley, 1–5.xi.1989. A.M. Basarukin, 2 males, 1 female (specimens poorly preserved, partially covered with fungal hypha; deposited at California Academy of Sciences). Sakhalin Island, Juzhno-Sakhalinsk, Tourist valley, 18.x.1985, A.M. Basarukin, 2 males (handwritten label in Russian; K. Eskov Personal Collection). JAPAN, Northern Honshu, Akia-Shi, Mt. Taiheizan, 800 m., Akito Fukushima, 1 female (deposited at California Academy of Sciences).

Weintrauboa chikunii (Oi, 1979)

Labulla contortipes chikunii Oi, 1979: 330, fig. 9–12.
Labulla contortipes chikunii Chikuni 1989b: 48, fig. 12.
Labula chikunii Eskov 1992a: 53 (elevated from subspecies of *L. contortipes*).
Labulla insularis Marusik *et al*. 1993a: 75 (synonymy rejected by Hormiga 2003: 276).

Types. Oi's types are apparently lost (H. Ono, in litt.)(male holotype and one female and one male paratype, collected in Japan, Horigane, Nagano Pref., 1.ix.1970, Y. Chikuni). I am not aware of the existence of any museum specimens of this species. The diagnosis provided here is based on the original species description and on Chikuni's (1989) photographs.

Diagnosis: Males of *W. chikunii* can be distinguished from other *Weintrauboa* species by the shape of the ectal cymbial process (Oi 1979: fig. 11) combined with very subtly sinuous apophysis of the first metatarsus (Oi 1979: fig. 11; Chikuni 1989: fig. 12) which is more pronounced in *W. contortipes* (Hormiga 2003: fig. 3), *W. yele* (Xu & Li 2007: Figs. 69 and 70, labeled as "*W. chikunii*") and *W. insularis* (Hormiga 2003: fig. 3, , labeled as "*W. chikunii*") but less pronounced in *W. yunnan* (Yang *et al*. 2006: fig. 1B). The epigynal morphology is diagnostic for the species, with its chordiform shape and median septum (Oi 1979: fig. 12; Chikuni 1989: fig. 12). Note that Chikuni's (1989) photographs clearly show a much more subtle apophysis in the male metatarsus I, compared to the homologous apophysis in *W. contortipes* and *W. insularis*.

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Appendix 1

The characters used in this study are those used in the matrix of Hormiga and Tu (2008) and are discussed in detail in that publications as well as in Hormiga (1994a, b, 2000), Miller and Hormiga (2004) and Hormiga *et al*. (2005). A new character (character 3) has been added to the matrix of Hormiga and Tu (2008). The entries of *Weintrauboa insularis* n. comb. are those of *W. chikunii* in the matrix of Hormiga and Tu (2008), due to the revised taxonomic status of these two species, with the difference that now I have been able to complete coding the female characters of *W. insularis*. Only new characters, recoded characters or modifications from previous state delimitations are discussed here (and those are marked with an asterisk in front of the character number). An example of a taxon exhibiting the new or edited described character states with reference to an illustration is given after the description. All multistate characters were treated as non-additive.

1. Alveolar sclerite: (0) absent; (1) present.
2. Ectal region of cymbium: (0) smooth (no process); (1) with ectal cymbial process.
*3. Ectal cymbial process, as seen in dorsal view: (0) single (*Weintrauboa contortipes*, Hormiga 2003: fig. 1E); (1) divided (*Weintrauboa yele* n. sp., Fig. 3C).
4. Cymbial macrosetae: (0) all about the same size; (1) at least some modified (distinctively larger, bigger socket/base; Fig. 8A).
5. Larger cymbial macrosetae length: (0) long (many times its diameter); (1) short, cuspule type.
6. Larger cymbial macrosetae location: (0) on cymbial process itself; (1) on dorsal surface of cymbium, not on process.
7. Pimoid cymbial sclerite (PCS): (0) absent; (1) present.
8. PCS: (0) with membranous flap; (1) without membranous flap.
9. PCS: (0) attached/fused to paracymbium; (1) separate from paracymbium.
10. End of PCS: (0) scoop or concave; (1) "solid".
11. PCS-cymbium connection: (0) sclerotized and rigid; (1) membranous; (2) of intermediate degree of sclerotization.
12. Distal end of cymbium: (0) rounded; (1) elongated; (2) conical.
13. Paracymbium attachment: (0) integral; (1) intersegmental; (2) articulated.
14. Paracymbium morphology: (0) linguiform; (1) triangular; (2) *Stemonyphantes* type; (3) U or J shaped; (4) hook; (5) straight and narrow.
15. Paracymbium apophyses: (0) present; (1) absent.
16. Mynoglenine tegular apophyses: (0) absent; (1) present.
17. Tegular suture: (0) conspicuous; (1) subtle or absent.
18. Protegulum: (0) absent; (1) present.
19. Protegular papillae: (0) absent; (1) present.
20. Suprategulum: (0) absent; (1) present.
21. Suprategulum: (0) continuous with tegulum; (1) articulated.
22. Suprategular distal apophysis: (0) absent; (1) present.
23. Suprategular marginal apophysis: (0) absent; (1) present.
24. Median apophysis: (0) present; (1) absent.
25. Conductor: (0) present; (1) absent.
26. Conductor papillae: (0) absent; (1) present.
27. Conductor base: (0) narrowly connected to tegulum, tongue-like; (1) broadly connected to tegulum.
28. Embolus length: (0) long; (1) short.
29. Embolic membrane: (0) absent; (1) present.
30. Embolic flap: (0) absent; (1) present.
31. Pimoid embolic process (PEP): (0) absent; (1) present.
32. Pimoid embolic process (PEP): (0) elongated; (1) compact.
33. Shape of elongated PEP: (0) bifurcated; (1) simple (one branch).
34. Radix: (0) absent; (1) present.
35. Radical tail piece: (0) absent; (1) present.
36. Radical tail piece morphology: (0) straight; (1) spiraled; (2) curved ectally; (3) curved mesally; (4) anteriorly directed.

37. Anterior radical process: (0) absent; (1) present.
38. Column: (0) absent; (1) present.
39. Fickert's gland: (0) absent; (1) present.
40. Terminal apophysis: (0) absent; (1) present.
41. Lamella characteristica: (0) absent; (1) present.
42. Male pedipalpal tibia macrosetae size: (0) ca. as the rest of pedipalp setae; (1) very thick, clearly larger in diameter and/or length.
43. Male pedipalpal tibial apophysis: (0) absent; (1) retrolateral; (2) dorsal.
44. Prolateral trichobothria in male pedipalpal tibia: (0) 2; (1) 1; (2) 0; (3) 3.
45. Retrolateral trichobothria in male pedipalpal tibia: (0) 2; (1) 4; (2) 3; (3) 1; (4) 0.
46. Epigynum protrusion: (0) protruding less than its width; (1) protruding more than its width.
*47. Dorsal plate scape: (0) absent; (1) present. We have coded *Weintrauboa insularis* n. comb. as lacking a dorsal plate scape, having a ventral plate scape instead (rather than a dorsal one; Figs. 8 and 9), similar to that of *W. yele* n. sp. *Pimoa altioculata* has been coded as having a dorsal plate scape (Hormiga 1994a: figs. 313, 329).
*48. Ventral plate scape: (0) absent; (1) present. See comments above.
*49. Ventral plate scape: (0) straight; (1) sigmoid. When present, the ventral plate scape of pimoids is straight (e.g., *Weintrauboa insularis* n. comb., Fig. 8).
50. Atrium: (0) absent; (1) present.
51. Copulatory duct: (0) separate from fertilization duct; (1) spirals fertilization duct.
52. Copulatory duct encapsulation: (0) absent; (1) present.
53. Spermathecae: (0) 2; (1) 4.
54. Fertilization duct orientation: (0) posterior; (1) mesal; (2) anterior.
55. Thoracic furrow: (0) nearly smooth, often recognizable only from pigment, not invagination; (1) thoracic furrow a distinct invagination.
56. Male post-PME lobe: (0) absent; (1) present
57. Subocular clypeal sulci: (0) absent; (1) present
58. Male cephalothoracic cuticular pores: (0) absent; (1) present
59. Tracheal system: (0) haplotracheate; (1) desmitracheate; (2) intermediate
60. Taenidia in tracheoles: (0) absent; (1) present.
61. Male chelicerae: (0) smooth; (1) stridulatory striae.
62. Cheliceral stridulatory striae: (0) ridged; (1) scaly; (2) imbricated.
63. Dorsal spur on male chelicerae: (0) absent; (1) present.
64. Retrolateral teeth female chelicera: (0) 3; (1) 4 or more; (2) 2; (3) 0; (4) 1.
65. Female pedipalpal tarsus: (0) with claw; (1) without claw.
66. Patella-tibia leg autospasy: (0) absent; (1) present.
67. Male Metatarsus I: (0) straight; (1) sinuous.
68. Male Metatarsus I proximal base: (0) diameter ca. as in Mt II; (1) diameter larger than Mt II.
69. Male Metatarsus I proximal apophysis: (0) subtly sinuous; (1) very sinuous.
70. Dorsal spines tibia I: (0) 2 or more; (1) 1; (2) 0.
71. Dorsal spines tibia II: (0) 2 or more; (1) 1; (2) 0.
72. Dorsal spines tibia III: (0) 2 or more; (1) 1; (2) 0.
73. Dorsal spines tibia IV: (0) 2 or more; (1) 1; (2) 0.
74. Trichobothrium metatarsus IV: (0) present; (1) absent.
75. Aciniform spigots in female PMS: (0) 1 or more; (1) absent.
76. PMS minor ampullate nubbins: (0) absent; (1) 1.
77. PLS mesal CY base: (0) same size as other CY; (1) enlarged.
78. Aciniform spigots in female PLS: (0) 2 or more; (1) 1; (2) absent.
79. PLS aggregate in male: (0) absent; (1) present.
80. PLS flagelliform in male: (0) absent; (1) present.
81. Male position during construction of sperm web: (0) above sperm web; (1) below sperm web.
82. Male position during ejaculation: (0) above sperm web; (1) below sperm web.
83. Web architecture: (0) orb; (1) tangle; (2) sheet.