

RESEARCH ARTICLE

Two new genera of scorpionflies (Mecoptera: Panorpidae) from the Oriental Region, with descriptions of fourteen new species

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Abstract. *Panorpa* Linnaeus, 1758 is the largest genus in the scorpionfly family Panorpidae and is considered paraphyletic. According to recent phylogenetic studies, some closely related species are grouped into evolutionarily cohesive clusters, warranting recognition as separate genera. In order to take a further step towards natural, monophyletic taxa within the Panorpidae, several genera were erected from some species groups traditionally classified under *Panorpa*. In this paper, the *P. guttata* group with 39 species is raised as *Minorpa* gen. nov., and the *P. wormaldi* group with 19 species as *Wornorpa* gen. nov. Fourteen new species of *Minorpa* gen. nov. are described from Chinese provinces of Guizhou, Sichuan, and Yunnan: *M. abi* sp. nov., *M. azhu* sp. nov., *M. azi* sp. nov., *M. caojianensis* sp. nov., *M. duanzhengchun* sp. nov., *M. duanzhengming* sp. nov., *M. lijialingae* sp. nov., *M. liqushui* sp. nov., *M. muwanqing* sp. nov., *M. sujiei* sp. nov., *M. tangzenghuai* sp. nov., *M. wangyuyan* sp. nov., *M. xiaomizha* sp. nov., and *M. zhongling* sp. nov. Twenty-five species are transferred to *Minorpa* gen. nov. and 19 to *Wornorpa* gen. nov. from *Panorpa* resulting in the following new combinations: *Minorpa apscisacera* (Bicha & Suttiprapan, 2022) comb. nov., *M. caowei* (Wang, 2021) comb. nov., *M. dali* (Wang, 2021) comb. nov., *M. decolorata* (Chou & Wang, 1981) comb. nov., *M. duanyu* (Wang & Gong, 2021) comb. nov., *M. filina* (Chou & Wang, 1987) comb. nov., *M. filititilana* (Li & Hua, 2022) comb. nov., *M. furcata* (Zhou & Zhou, 2007) comb. nov., *M. guttata* (Navás, 1908) comb. nov., *M. hani* (Wang, 2021) comb. nov., *M. hirundo* (Wang, 2021) comb. nov., *M. huangguiqiangi* (Wang, 2021) comb. nov., *M. jiangrixini* (Wang, 2021) comb. nov., *M. jinfoshana* (Wang, 2021) comb. nov., *M. kunmingensis* (Fu & Hua, 2009) comb. nov., *M. latiloba* (Wang, 2021) comb. nov., *M. liaoi* (Zhou & Zhou, 2007) comb. nov., *M. nanzhao* (Wang, 2021) comb. nov., *M. parallela* (Wang & Hua, 2016) comb. nov., *M. qiana* (Zhou & Zhou, 2010) comb. nov., *M. reflexa* (Wang & Hua, 2016) comb. nov., *M. stella* (Wang, 2021) comb. nov., *M. substricta* (Wang, 2021) comb. nov., *M. xiaofeng* (Wang & Gong, 2021) comb. nov., *M. xuzhu* (Wang & Gong, 2021) comb. nov., *Wornorpa amamiensis* (Miyamoto & Makihara, 1984) comb. nov., *W. fengyanga* (Wang & Suzuki, 2022) comb. nov., *W. gressitti* (Byers, 1970) comb. nov., *W. hiurai* (Miyamoto, 1985) comb. nov., *W. implicata* (Cheng, 1957) comb. nov., *W. kiusiuensis* (Issiki, 1929) comb. nov., *W. longiramina* (Issiki & Cheng, 1947) comb. nov., *W. multifasciaria* (Miyaké, 1910) comb. nov., *W. nudiramus* (Byers, 2002) comb. nov., *W. obliqua* (Carpenter, 1945) comb. nov., *W. obliquifascia* (Chou & Wang, 1987) comb. nov., *W. ochraceocauda* (Issiki, 1927) comb. nov., *W. okinawaensis* (Nakamura, 2009) comb. nov., *W. peterseana* (Issiki, 1927) comb. nov., *W. striata* (Miyaké, 1908) comb. nov., *W. tokunoshimaensis* (Nakamura, 2009) comb. nov., *W. tsunekatanis* (Issiki, 1929) comb. nov., *W. wormaldi* (MacLachlan, 1875) comb. nov., and *W. zhuohengi* (Wang & Suzuki, 2022) comb. nov. A distributional map, keys to species, species lists, and discussions regarding the biological characteristics and diversity of the newly erected genera are also provided.

Key words. Mecoptera, Panorpidae, biodiversity, fauna, new combination, new species, scorpionflies, taxonomy, China

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Introduction

The Panorpidae are the most speciose family in the order Mecoptera, and are widely distributed throughout Eurasia and North America with approximately 570 species (BYERS & THORNHILL 1983, KALTENBACH 1978, PENNY & BYERS 1979, WANG 2024, WANG & ZHAO 2024, XIE & WANG 2025). They are commonly called scorpionflies due to the enlarged, recurved male genitalia, which resemble a scorpion's stinger (BYERS & THORNHILL 1983, WANG & HUA 2022). The members of Panorpidae are currently assigned to two subfamilies and 13 genera (BICHA 2015, WANG & HUA 2019, 2022, WILLMANN 2022, 2024). Adult scorpionflies are saprophagous, primarily feeding on dead arthropods and occasionally on other organic matter (BYERS 2009, PALMER 2010). They typically inhabit humid and densely vegetated areas, where they are often found on the upper surfaces of herb and shrub leaves (BICHA 2018; BYERS & THORNHILL 1983; WANG & HUA 2016, 2019, 2022). At rest, their wings are folded either in a V-shape or in a roof-like position (MA & HUA 2011, WANG & GONG 2021, WANG & HUA 2022). During mating, scorpionflies typically engage in nuptial feeding behavior (BYERS & THORNHILL 1983, ZHONG & HUA 2013, TONG & HUA 2019).

Panorpa Linnaeus, 1758 is the largest genus in the family, comprising over 280 species widely distributed across Europe, Asia, and North America (BICHA 2018; BICHA et al. 2022; LI & HUA 2022; PENNY & BYERS 1979; WANG & HUA 2017, 2021, 2022; WANG et al. 2019). These insects are primarily found in subtropical and temperate regions, with some species extending into tropical areas, such as northern Thailand (BICHA 2019, BICHA et al. 2022), South China (Hainan and Taiwan) (BYERS 2002, HUA & CHOU 1998), and Mexico (BICHA 2006; BYERS 2000, 2011). In this large, paraphyletic genus, some closely related species are grouped into evolutionarily cohesive clusters (species groups) that merit generic status, based on phylogenetic relationships inferred from both morphological and DNA sequence data (MIAO et al. 2019, WANG & HUA 2021). Several genera have been erected from the corresponding groups of *Panorpa*: *Cerapanorpa* Gao, Ma & Hua, 2016 (= the former *P. centralis* group) and *Dicerapanorpa* Zhong & Hua, 2013 (= the former *P. diceras* group). Recently, the *P. amurensis* and *P. japonica* groups were raised to generic status as *Mavropanorpa* Willmann, 2024, and the *P. nikkoensis* group as *Calliopanorpa* Willmann, 2024, respectively. Current treatment of *Panorpa*, however, is still largely based on artificial delimitations. Therefore, further splitting is required to finally resolve the paraphyly of *Panorpa*.

Generally, members of the *P. guttata* group can be recognized by relatively small body size, roof-like wing posture, unelongated male abdomen, and the female medigynium lacking a dorsal plate (WANG & GONG 2021, WANG & HUA 2022). Previously, the *P. guttata* group was known to include 25 species (24 endemic to China and one from Thailand) (BICHA et al. 2022, LI & HUA 2022, WANG & GONG 2021, WANG & HUA 2021). Based on morphological and DNA sequence data (MIAO et al. 2019, WANG & HUA 2021), members of this group form a

well-supported monophyletic clade that is closely related to the *P. wormaldi* group and genus *Furcatopanorpa* Ma & Hua, 2011. Members of the *P. wormaldi* group can be distinguished from those in the *P. guttata* group and *Furcatopanorpa* by greatly elongated lateral processes in the male aedeagus, and by the presence of a dorsal plate in the female medigynium (WANG & SUZUKI 2022). To take a further step towards natural, i.e., monophyletic taxa within the Panorpidae (WILLMANN 2024), the *P. guttata* and the *P. wormaldi* groups require elevation to generic rank (WANG & GONG 2021, WANG & SUZUKI 2022). Therefore, we erect two new genera, *Minorpa* gen. nov. and *Wornorpa* gen. nov., in the present study, with fourteen species described as new and 44 species transferred from *Panorpa* as new combinations. We also provide a distributional map, keys to species, species lists, and discussions regarding the biological characteristics and diversity of these two genera.

Materials and methods

All the materials examined in this study are deposited in the Biological Science Museum, Dali University (BMDU). Adult scorpionflies were caught with collecting nets or Malaise traps, preserved in 95% ethanol or pinned. The genitalia were dissected using forceps and dissecting needles under an Olympus SZX7 stereo microscope. After removing muscles and other soft tissues, the sclerotized parts were cleared in 10% sodium hydroxide solution at 60–80°C for 2–10 minutes, then rinsed with water and preserved in glycerin. Photographs of the insects were taken with a Nikon D850 digital camera in conjunction with a Nikkor AF-S Micro 105 mm f/2.8 lens (habitus), or a Canon R5 digital camera in conjunction with a Canon MP-E 65 mm f/2.8 1–5× macro lens (the other images). The female habitus in dorsal view were modified to omit the left antenna, wings, and legs. All pictures were adjusted and grouped with Adobe Photoshop CC.

Terminology follows WANG & GONG (2021), WANG & HUA (2021), and WANG & SUZUKI (2022). The following acronyms are applied in the main text:

A1	the first abdominal segment;
AbL	abdomen length;
AtL	antenna length;
BdL	body length;
FL	forewing length;
FW	forewing width;
HL	hindwing length;
HW	hindwing width;
ORs	origin of Rs;
T1	the first tergum (and so forth for other segments).

The male abdominal segments are indicated by Roman numerals. The following abbreviations and acronyms are applied in the figure annotations:

Ae	aedeagus;
Ap	apodeme of axis;
Ax	axis;
BL	basal lobe;
BP	basal plate;
Ce	cercus;
DBP	dorsal branch of paramere;
DPr	dorsal process;

DV	dorsal valve;
Ep	epandrium;
Gcx	gonocoxite;
Gs	gonostylus;
Hv	hypovalve;
MBP	median branch of paramere;
M-DBP	mid-dorsal branch of paramere;
MP	main plate of medigynium;
MPr	median process;
M-VBP	mid-ventral branch of paramere;
PA	posterior arm;
Pm	paramere;
SgP	subgenital plate;
StH	stalk of hypandrium;
StP	stalk of paramere;
VBP	ventral branch of paramere;
VV	ventral valve.

Results

Taxonomy

Order Mecoptera Packard, 1886

Suborder Pistillifera Willmann, 1987

Superfamily Panorpoidea Latreille, 1802

Family Panorpidae Latreille, 1802

Subfamily Panorpinae Latreille, 1802

Minorpa gen. nov.

(Figs 1–122)

Type species. *Panorpa guttata* Navás, 1908, here designated.

Diagnosis. Species in this genus are very similar to those in the genus *Wornorpa* gen. nov. from southern China and Japan in: i) small body sizes (with forewing length usually not exceeding 14.0 mm), ii) the wings held roof-like (Figs 1–3, 6, 9, 10, 103, 115) or horizontally (Figs 4, 5, 7, 8, 11, 96) over the abdomen when at rest; iii) the male abdomen shorter than wings (usually concealed under the wings); and iv) unelongated and cylindrical male A6–A8. However, they differ from the latter in the structure of the male and female genitalia: in males, i) ventral valves of aedeagus membranous (vs. greatly sclerotized); ii) lateral processes of aedeagus short and simple (vs. greatly elongated); in females, iii) medigynium lacking a dorsal plate (vs. with a greatly developed dorsal plate); and iv) medigynium with a pair of posterior arms usually shorter than greatly developed main plate (vs. posterior arms longer than poorly developed main plate).

They also resemble members of the Chinese genus *Furcatopanorpa* and the American *P. involuta* group in similar wing posture, but can be readily differentiated from *Furcatopanorpa* by smaller body size with forewing length usually not exceeding 14.0 mm (vs. forewings usually longer than 15.0 mm) and well-developed male notal and postnotal organs (vs. lacking); and from the *P. involuta* group by broader hypovalves (vs. usually slender and thread-like), and membranous and simple ventral valves of aedeagus (vs. sclerotized, projected ventrad and beak-like).

Etymology. The generic name is combined from ‘Mi’ (咪, a Chinese character commonly associated with things that are extraordinarily small in the Yunnan dialect) or

alternatively from the Latin word *minor* (= smaller) and ‘-norpa / -pa’, root suffix for *Panorpa*, referring to both the small body size and the relationship of its members to the genus *Panorpa*. The gender is feminine.

Distribution. Central and southwestern China; Northern Thailand (Fig. 122).

Species list of *Minorpa* gen. nov.

(39 species)

M. abi sp. nov.

China: Yunnan (Shilin: Laogui Mountain)

M. apscisacera (Bicha & Suttiapapan, 2022) **comb. nov.**

Thailand: Chiang Mai (Doi Pha Hom Pok) (BICHA et al. 2022)

M. azhu sp. nov.

China: Guizhou (Liupanshui: Meihua Mountain)

M. azi sp. nov.

China: Guizhou (Liupanshui: Meihua Mountain)

M. caojianensis sp. nov.

China: Yunnan (Yunlong)

M. caoweii (Wang, 2021) **comb. nov.**

China: Guangxi (Mount Mao'er) (WANG & GONG 2021)

M. dali (Wang, 2021) **comb. nov.**

China: Yunnan (Dali: Mount Cangshan) (WANG & GONG 2021)

M. duanzhengchun sp. nov.

China: Yunnan (Shilin: Laogui Mountain)

M. duanzhengming sp. nov.

China: Yunnan (Weixi)

M. decolorata (Chou & Wang, 1981) **comb. nov.**

China: Gansu, Hubei, and Shaanxi (WANG & GONG 2021)

M. duanyu (Wang & Gong, 2021) **comb. nov.**

China: Yunnan (Yunlong) (WANG & GONG 2021)

M. filina (Chou & Wang, 1987) **comb. nov.**

China: Hunan (Daoxian) (WANG & GONG 2021)

M. flititilana (Li & Hua, 2022) **comb. nov.**

China: Hunan (Mangshan Mountains) (LI & HUA 2022)

M. furcata (Zhou & Zhou, 2007) **comb. nov.**

China: Guizhou (Mounts Fanjing and Leigong) (WANG & GONG 2021)

M. guttata (Navás, 1908) **comb. nov.**

China: western Sichuan (WANG & GONG 2021)

M. hani (Wang, 2021) **comb. nov.**

China: Yunnan (Zhenyuan) (WANG & GONG 2021)

M. hirundo (Wang, 2021) **comb. nov.**

China: Sichuan (Mount Emei) (WANG & GONG 2021)

M. huangguiqiangi (Wang, 2021) **comb. nov.**

China: Guizhou (Liupanshui: Yushe) (WANG & GONG 2021)

M. jiangrixini (Wang, 2021) **comb. nov.**

China: Chongqing (Mount Jinfo) and Guizhou (Mount Fanjing) (WANG & GONG 2021)

M. jinfoshana (Wang, 2021) **comb. nov.**

China: Chongqing (Mount Jinfo) (WANG & GONG 2021)

M. kunmingensis (Fu & Hua, 2009) **comb. nov.**

China: Yunnan (Kunming and Anning) (WANG & GONG 2021)

M. latiloba (Wang, 2021) **comb. nov.**

China: Guizhou (Liupanshui: Yushe) (WANG & GONG 2021)

M. liaoi (Zhou & Zhou, 2007) **comb. nov.**

China: Guizhou (Mount Leigong) (WANG & GONG 2021)

Remarks. The illustrations of *M. liaoi* provided by WANG & HUA (2022) were based on a series of specimens collected from Mount Jinfo, Chongqing. After a careful re-examination and comparison with the original illustrations by ZHOU & ZHOU (2007), we consider that the specimens from Mount Jinfo are probably not true *M. liaoi*, as the apex of the middle branch of the male paramere is unevenly furcated (vs. evenly bifurcated and

Y-shaped). However, due to the lack of specimens from the type locality (Mount Leigong), we are not yet confident enough to treat the Mount Jinpo population as a distinct species. Therefore, only the type locality is listed here and indicated on the map (Fig. 122), and this issue will remain unresolved until additional material from Mount Leigong becomes available.

***M. lijialingae* sp. nov.**

China: Yunnan (Yunlong)

***M. liquishui* sp. nov.**

China: Yunnan (Yunlong)

***M. muwanqing* sp. nov.**

China: Yunnan (Gongshan)

***M. nanzhao* (Wang, 2021) comb. nov.**

China: Yunnan (Dali: Mount Cangshan) (WANG & GONG 2021)

***M. parallela* (Wang & Hua, 2016) comb. nov.**

China: Yunnan (Mounts Daxue and Tangli) (WANG & GONG 2021)

***M. qiana* (Zhou & Zhou, 2010) comb. nov.**

China: Guizhou (Mayanghe) (WANG & GONG 2021)

***M. reflexa* (Wang & Hua, 2016) comb. nov.**

China: Yunnan (Mounts Daxue and Tangli) (WANG & GONG 2021)

***M. stella* (Wang, 2021) comb. nov.**

China: Yunnan (Gaoligong Mountains, Mounts Daxue and Tangli) (WANG & GONG 2021)

***M. substricta* (Wang, 2021) comb. nov.**

China: Guizhou (Mount Leigong) (WANG & GONG 2021)

***M. sujiei* sp. nov.**

China: Sichuan (Puge)

***M. tangzenghuai* sp. nov.**

China: Sichuan (Dayi)

***M. wangyuyan* sp. nov.**

China: Yunnan (Dali: Mount Cangshan)



Figs 1–11. Members of *Minorpa* gen. nov. in the field. 1 – *Minorpa dali* (Wang, 2021) comb. nov., female. 2 – *M. decolorata* (Chou & Wang, 1981) comb. nov., male. 3 – *M. duanyu* (Wang & Gong, 2021) comb. nov., male. 4 – *M. guttata* (Navás, 1908) comb. nov., female. 5 – *M. huangguiqiangi* (Wang, 2021) comb. nov., male. 6 – *M. kunmingensis* (Fu & Hua, 2009) comb. nov., male. 7 – *M. latiloba* (Wang, 2021) comb. nov., male. 8 – *M. parallela* (Wang & Hua, 2016) comb. nov., male. 9 – *M. substricta* (Wang, 2021) comb. nov., male. 10 – *M. xuzhu* (Wang & Gong, 2021) comb. nov., female. 11 – *M. reflexa* (Wang & Hua, 2016) comb. nov., male.

- M. xiaofeng* (Wang & Gong, 2021) **comb. nov.**
China: Yunnan (Yunlong) (WANG & GONG 2021)
- M. xiaomizha* sp. nov.
China: Yunnan (Yulong)
- M. xuzhu* (Wang & Gong, 2021) **comb. nov.**
China: Yunnan (Yunlong) (WANG & GONG 2021)
- M. zhongling* sp. nov.
China: Yunnan (Binchuan: Mount Jizu)

Key to males of *Minorpa* gen. nov.
(39 species)

- 1 Wings with well-developed apical, pterostigmal, basal bands, and marginal and basal spots. 2
- Wings with more or less reduced markings. 4
- 2 Pterostigmal band with detached distal branch; parameres wave-shaped in middle portion.
..... *M. tangzenghuai* sp. nov.
- Pterostigmal band with connected distal and basal branches; parameres relatively straight. 3
- 3 Parameres with small inner projection subapically.
..... *M. qiana* (Zhou & Zhou, 2010) **comb. nov.**
- Parameres simple.
..... *M. furcata* (Zhou & Zhou, 2007) **comb. nov.**
- 4 A6 and A7 cylindrical apically. 5
- A6 emarginated on dorsal apex; A7 greatly humped on dorsal apex. 21
- 5 A7–A8 yellowish brown. 6
- A7–A8 black or dark brown. 11
- 6 T1–T5 yellow or yellowish brown. 7
- T1–T5 dark brown. 8
- 7 Wings slightly tinged with yellow; parameres unfurcated. *M. parallela* (Wang & Hua, 2016) **comb. nov.**
- Wings slightly tinged with grayish brown; parameres bifurcated.
..... *M. xuzhu* (Wang & Gong, 2021) **comb. nov.**
- 8 Head with black pattern enclosing ocellar triangle, another black pattern on occiput.
..... *M. reflexa* (Wang & Hua, 2016) **comb. nov.**
- Head with only ocellar triangle black. 9
- 9 Parameres bifurcated.
..... *M. caowei* (Wang, 2021) **comb. nov.**
- Parameres unfurcated. 10
- 10 Parameres stout and finger-like.
..... *M. decolorata* (Chou & Wang, 1981) **comb. nov.**
- Parameres slender and needle-like.
..... *M. filititilana* (Li & Hua, 2022) **comb. nov.**
- 11 Parameres unfurcated at base. 12
- Parameres furcated at base. 18
- 12 Parameres shortly bifurcated apically.
..... *M. muwanqing* sp. nov.
- Parameres unfurcated apically. 13
- 13 Parameres crossed. 14
- Parameres uncrossed. 15
- 14 Hypandrium with basal stalk approximately 3/4 as long as hypovalves; parameres crossed subapically.
..... *M. caojianensis* sp. nov.
- Basal stalk approximately half as long as hypovalves; parameres crossed in middle portion.
..... *M. duanyu* (Wang & Gong, 2021) **comb. nov.**
- 15 Hypandrium approximately 2/3 as long as gonocoxites. 16
- Hypandrium much longer than 2/3 of gonocoxites.
..... 17
- 16 Parameres elongated, but not reaching apex of gonostyli; basal lobe of gonostyli covered with numerous microtrichia. *M. zhongling* sp. nov.
- Parameres distinctly longer, reaching nearly apex of gonostyli; basal lobe of gonostyli covered with long and stout bristles. *M. wangyuyan* sp. nov.
- 17 Hypovalves of hypandrium with subbasal projection on inner margin; parameres lacking spine.
..... *M. duanzhengming* sp. nov.
- Hypovalves of hypandrium lacking projection on inner margin; parameres bearing inner spine on subbasal portion. *M. liqiushui* sp. nov.
- 18 Parameres trifurcated or quadrifurcated. 19
- Parameres bifurcated. 20
- 19 Hypovalves of hypandrium with projection on inner margin; parameres quadrifurcated.
..... *M. azhu* sp. nov.
- Hypovalves of hypandrium lacking projection on inner margin; parameres trifurcated.
..... *M. liaoi* (Zhou & Zhou, 2007) **comb. nov.**
- 20 Hypandrium with basal stalk approximately as long as hypovalves; parameres with dorsal branch crossed.
..... *M. azi* sp. nov.
- Basal stalk shorter than hypovalves; parameres uncrossed. *M. nanzhao* (Wang, 2021) **comb. nov.**
- 21 A6 with shallow emargination on dorsal apex and forming a pair of inconspicuous lobes. 22
- A6 with deep emargination on dorsal apex and forming a pair of conspicuous lobes. 24
- 22 Head with vertex shining black; parameres trifurcated.
..... *M. jiangrixini* (Wang, 2021) **comb. nov.**
- Head with vertex yellowish brown; parameres bifurcated. 23
- 23 Hypandrium with long basal stalk and splitting of hypovalves in distal 2/5.
..... *M. dali* (Wang, 2021) **comb. nov.**
- Hypandrium with greatly shortened basal stalk and a pair of long hypovalves.
..... *M. apscisacera* (Bicha & Suttiaprapan, 2022) **comb. nov.**
- 24 A6 with one or a few small and acute teeth on each lateral side below dorsal; gonostylus covered with dozens of long setae on basal half of ventral surface.
..... 25
- A6 simple on lateral sides; gonostylus lacking such setae. 27
- 25 A6 with truncated lobes on dorsal apex, and only one acute tooth on each lateral side below dorsal lobes.
..... *M. guttata* (Navás, 1908) **comb. nov.**
- A6 with subtriangular lobes on dorsal apex, and five teeth on each lateral side. 26
- 26 A6 with dorsal lobes not exceeding middle of A7, and one large tooth and four smaller teeth on each lateral side. *M. jinfoshana* (Wang, 2021) **comb. nov.**
- A6 with dorsal lobes exceeding middle of A7, and five same-sized teeth on each lateral side.

- *M. latiloba* (Wang, 2021) **comb. nov.**
- 27 Head with black pattern enclosing ocellar triangle, and another black pattern on occiput. 28
- Head with only ocellar triangle black. 29
- 28 Wings with broad apical band, reduced pterostigma and basal bands; parameres bifurcated.
- *M. stella* (Wang, 2021) **comb. nov.**
- Wings with only reduced pterostigma and basal band; parameres unfurcated. *M. duanzhengchun* **sp. nov.**
- 29 A6 with pair of very small dorsal lobes; each lobe narrower than half width of A6 at base.
- *M. substricta* (Wang, 2021) **comb. nov.**
- A6 with pair of broad dorsal lobes; each lobe approximately half width of A6 at base. 30
- 30 Parameres with ventral branch greatly enlarged subapically and pointed apex.
- *M. hirundo* (Wang, 2021) **comb. nov.**
- Parameres with ventral branch simple. 31
- 31 Parameres with dorsal branch greatly curved outward at subbasal portion and bearing two acute teeth apically. *M. filina* (Chou & Wang, 1987) **comb. nov.**
- Parameres with dorsal branch relatively straight. .. 32
- 32 Hypandrium with basal stalk shorter than hypovalves. 33
- Hypandrium with basal stalk as long as or longer than hypovalves. 36
- 33 Hypandrium approximately 3/4 as long as gonocoxites; parameres with dorsal branch lobate. 34
- Hypandrium approximately 2/3 as long as gonocoxites; parameres with dorsal branch long needle-like. 35
- 34 A6 with pair of triangular lobes; parameres with ventral branch very short and unfurcated.
- *M. hani* (Wang, 2021) **comb. nov.**
- A6 with pair of trapezoid-shaped lobes; parameres with ventral branch greatly elongated and further bifurcated. *M. lijialingae* **sp. nov.**
- 35 Parameres with ventral branch curved, and dorsal branch crossed subapically.
- *M. huangguiqiangi* (Wang, 2021) **comb. nov.**
- Parameres with ventral branch straight, and dorsal branch uncrossed. *M. abi* **sp. nov.**
- 36 Wings devoid of markings; body pale yellowish.
- *M. xiaomizha* **sp. nov.**
- Wings with scattered markings; body mostly yellowish brown. 37
- 37 Parameres with dorsal branch greatly elongated and extending beyond middle portion of gonostyli.
- *M. sujiei* **sp. nov.**
- Parameres with much shorter dorsal branch. 38
- 38 Apical and pterostigmal bands scattered into several spots; hypovalves slightly divergent terminally.
- *M. xiaofeng* (Wang & Gong, 2021) **comb. nov.**
- Apical and pterostigmal bands reduced into large spot clusters; hypovalves convergent terminally.
- *M. kunmingensis* (Fu & Hua, 2009) **comb. nov.**

Key to females of *Minorpa* gen. nov.

(35 species; females of *M. apscisacera*, *M. filina*, *M. liaoi* and *M. qiana* unknown)

- 1 Wings with well-developed markings, apical, pterostigmal and basal bands. 2
- Wings with more or less reduced markings. 3
- 2 Pterostigmal band with detached distal branch; subgenital plate subtrapezoidal with truncated apex.
- *M. tangzenghuai* **sp. nov.**
- Pterostigmal band with connected distal and basal branches; subgenital plate oblong with rounded apex.
- *M. furcata* (Zhou & Zhou, 2007) **comb. nov.**
- 3 A9 greatly elongated and approximately twice as long as A8; medigynium with a pair of anterior arms.
- *M. reflexa* (Wang & Hua, 2016) **comb. nov.**
- A9 simple; medigynium lacking anterior arms. 4
- 4 Vertex shining black; medigynium with axis entirely concealed in main plate. 5
- Vertex yellowish brown; medigynium with axis longer than main plate. 8
- 5 Subgenital plate with rounded apex. 6
- Subgenital plate with truncated apex. 7
- 6 Medigynium with posterior arms thin and approximately 1/4 as long as main plate.
- *M. jiangrixini* (Wang, 2021) **comb. nov.**
- Medigynium with posterior arms stout and approximately 1/8 as long as main plate.
- *M. duanzhengming* **sp. nov.**
- 7 Medigynium with main plate broadly subtriangular; posterior arms approximately 1/5 as long as main plate. ...
- *M. liquishui* **sp. nov.**
- Medigynium with main plate narrowly subtriangular; posterior arms approximately 1/4 as long as main plate.
- *M. wangyuyan* **sp. nov.**
- 8 Medigynium with posterior arms longer than main plate. 9
- Medigynium with posterior arms shorter than main plate. 12
- 9 Wings devoid of markings; T1–T5 pale yellowish.
- *M. xiaomizha* **sp. nov.**
- Wings with reduced markings; T1–T5 dark brown.
- 10
- 10 Medigynium with extremely long posterior arms approximately twice as long as main plate.
- *M. sujiei* **sp. nov.**
- Medigynium with posterior arms slightly longer than main plate. 11
- 11 Medigynium with axis approximately three times as long as main plate.
- *M. kunmingensis* (Fu & Hua, 2009) **comb. nov.**
- Medigynium with axis approximately twice as long as main plate.
- *M. xiaofeng* (Wang & Gong, 2021) **comb. nov.**
- 12 Subgenital plate greatly emarginated terminally. 13
- Subgenital plate rounded, truncated or slightly emarginated terminally. 14
- 13 Medigynium with main plate hourglass-shaped, and lateral margins incurvated. *M. azhu* **sp. nov.**
- Medigynium with main plate diamond-shaped, and lat-

- eral margins convex. *M. azi* sp. nov.
- 14 Medigynium with axis very stout, approximately half as wide as main plate. *M. duanzhengchun* sp. nov.
- Medigynium with axis relatively slender. 15
- 15 Subgenital plate truncated terminally; medigynium with greatly curled lateral margins. 16
- Subgenital plate rounded, slightly truncated or emarginated terminally; medigynium with simple lateral margins. 17
- 16 Head with black star-shaped pattern enclosing ocellar triangle, and another black pattern on occiput; medigynium with posterior arms slender.
- *M. stella* (Wang, 2021) **comb. nov.**
- Head most yellow with only ocellar triangle black; medigynium with posterior arms short triangular.
- *M. huangguiqiangi* (Wang, 2021) **comb. nov.**
- 17 Medigynium with subtriangular main plate. 18
- Medigynium with main plate oval or oblong. 20
- 18 Medigynium with basal plate oblong at base.
- *M. guttata* (Navás, 1908) **comb. nov.**
- Medigynium with basal plate constricted at base. 19
- 19 Medigynium with posterior arms almost parallel.
- *M. jinfoshana* (Wang, 2021) **comb. nov.**
- Medigynium with posterior arms greatly incurvated.
- *M. latiloba* (Wang, 2021) **comb. nov.**
- 20 Medigynium with posterior arms very short and subtriangular. 21
- Medigynium with posterior arms very slender. 23
- 21 Medigynium with axis posteriorly concealed within main plate. *M. hani* (Wang, 2021) **comb. nov.**
- Medigynium with axis posteriorly beyond main plate ..
- 22
- 22 Medigynium with main plate approximately 4/5 as long as axis. *M. abi* sp. nov.
- Medigynium with main plate approximately half as long as axis. *M. muwanqing* sp. nov.
- 23 Medigynium with axis at least twice as long as main plate. 24
- Medigynium with axis shorter than twice length of main plate. 31
- 24 Medigynium with main plate oval or suboval in shape. 25
- Medigynium with main plate oblong in shape. 29
- 25 Medigynium with main plate smoothly convex on lateral margins.
- *M. decolorata* (Chou & Wang, 1981) **comb. nov.**
- Medigynium with main plate greatly convex on lateral margins. 26
- 26 T1–T5 shining black. *M. zhongling* sp. nov.
- T1–T5 dark brown. 27
- 27 Medigynium with main plate broadest near middle.
- *M. hirundo* (Wang, 2021) **comb. nov.**
- Medigynium with main plate broadest at subbasal portion. 28
- 28 Forewing with reduced basal band; subgenital plate rounded apically. *M. dali* (Wang, 2021) **comb. nov.**
- Forewing lacking basal band; subgenital plate slightly emarginated apically.
- *M. xuzhu* (Wang & Gong, 2021) **comb. nov.**

- 29 Medigynium slender, approximately five times as long as wide. 30
- Medigynium shorter, at most four times as long as wide. *M. nanzhao* (Wang, 2021) **comb. nov.**
- 30 Subgenital plate rounded apically.
- *M. caowei* (Wang, 2021) **comb. nov.**
- Subgenital plate slightly truncated apically.
- *M. flititilana* (Li & Hua, 2022) **comb. nov.**
- 31 Medigynium with triangular projection at apex of main plate between posterior arms.
- *M. parallela* (Wang & Hua, 2016) **comb. nov.**
- Medigynium lacking such projection. 32
- 32 Subgenital plate with slightly truncated apex; medigynium with posterior arms approximately half as long as main plate.
- *M. substricta* (Wang, 2021) **comb. nov.**
- Subgenital plate rounded apically; medigynium with posterior arms approximately 1/3 as long as main plate. 33
- 33 T1–T5 black; medigynium with main plate approximately 3/5 as long as axis.
- *M. duanyu* (Wang & Gong, 2021) **comb. nov.**
- T1–T5 yellowish brown; medigynium with main plate approximately 2/3 as long as axis. 34
- 34 Forewing with reduced apical, pterostigmal and basal bands; medigynium with slightly curled lateral margins. *M. lijialingae* sp. nov.
- Forewing with only reduced pterostigmal band; medigynium with relatively straight lateral margins.
- *M. caojianensis* sp. nov.

Descriptions of new species

Minorpa abi sp. nov.

(Figs 12–21)

Type material. HOLOTYPE: ♂ (CN23Mabi001), CHINA: YUNNAN: Kunming Prefecture, Shilin Yi Autonomous County, Laogui Mountain, 24°38'01"N, 103°34'59"E, 2560 m, 17.ix.2023, leg. Jiao Xie, Liang-Jie Jia, Jia-Ling Li & Ji-Shen Wang (BMDU). PARATYPES: 4 ♂♂ 26 ♀♀ (CN23Mabi002–031), same data as holotype (BMDU).

Diagnosis. The new species closely resembles *M. huangguiqiangi* (Wang, 2021) in general appearance, especially the scattered wing markings, but can be differentiated from the latter by the following characters: in males, i) parameres bifurcated with ventral branch straight and dorsal branch uncrossed (*vs.* ventral branch curved and dorsal branch crossed subapically); and in females, ii) medigynium with simple lateral margin (*vs.* greatly curled on lateral margin); and iii) posterior arms greatly reduced (*vs.* posterior arms well-developed).

Description. Male. Head (Fig. 12). Vertex, occiput and rostrum yellowish brown, ocellar triangle black. Antennae with scape yellowish brown, pedicel dark brown, flagellum black.

Thorax (Fig. 12). Pronotum yellow with anterior and posterior margins blackish, and with five or six stout setae along each side of anterior margin. Meso- and metanotum yellow in middle and brown laterally. Legs light yellowish brown with distal tarsomeres dark brown.

Wings (Fig. 12). Membrane hyaline, tinged with grayish brown, markings brown. Veins dark brown except for pale apical cross-veins. Pterostigma yellow and conspicuous. Forewing markings greatly reduced; apical band split into two parts; pterostigmal band forming four spots; other markings absent. Sc extending slightly beyond middle of wing but not reaching pterostigma; 1A ending slightly beyond level of ORs; and two cross-veins between 1A and 2A. Hindwings similar to forewings with more reduced markings.

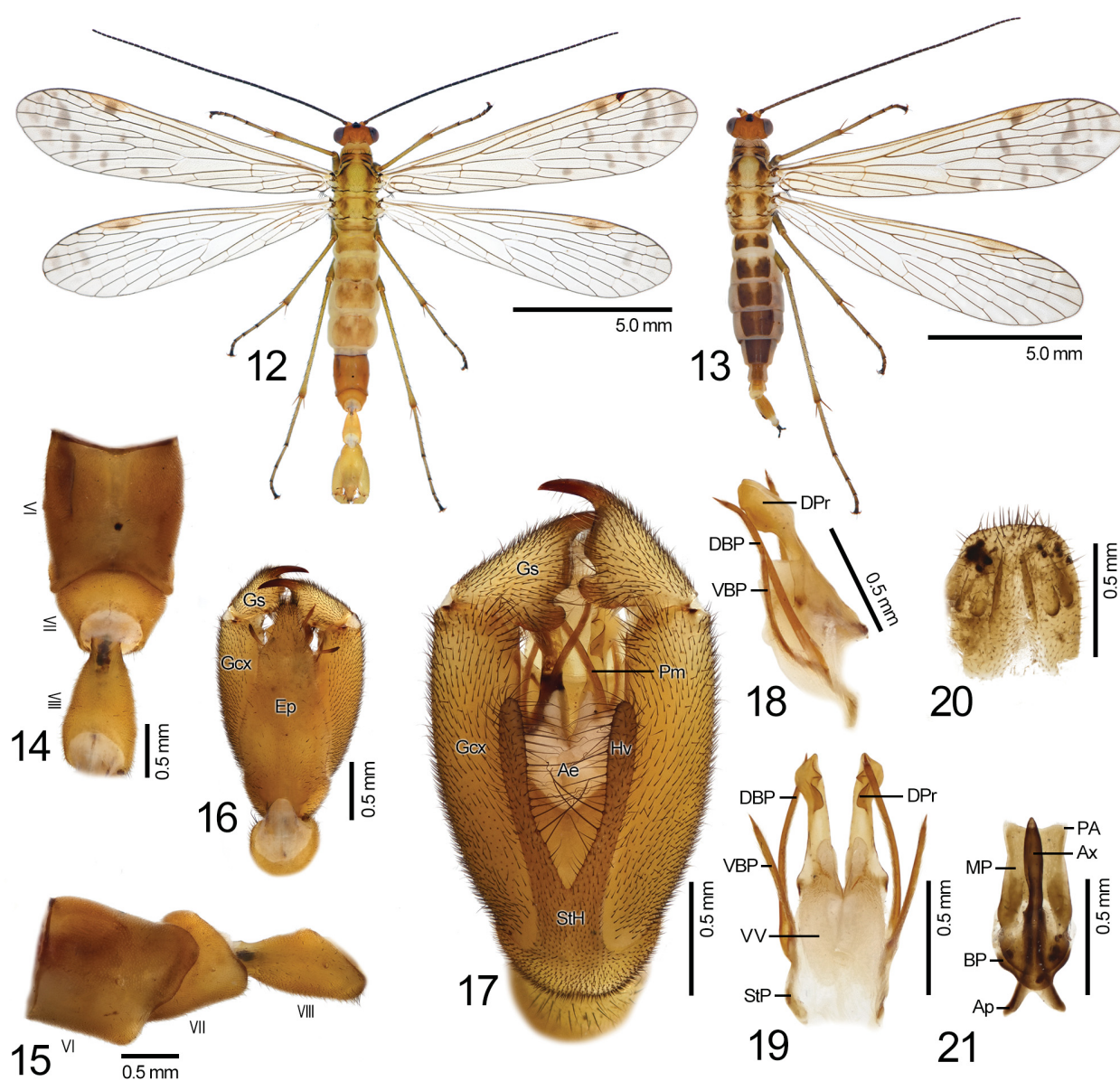
Abdomen (Figs 12, 14–15). T1–T5 unevenly yellowish brown. A6 yellowish brown, cylindrical, with moderately deep arcuate emargination on dorsal apex, and forming pair of broad triangular lobes laterally. A7 and A8 yellow, A7 nearly cylindrical and greatly humped on dorsal apex, A8 constricted basally and beveled apically.

Male genitalia (Figs 16–19). Genital bulb yellow, oval. Epandrium (T9) extending beyond middle of gonostyli,

tapering towards apex, with U-shaped terminal emargination and forming two short processes. Hypandrium Y-shaped and approximately 2/3 as long as gonocoxites, with basal stalk approximately 1/4 as long as hypovalves. Hypovalves narrow, divergent basally, with sparse long bristles along inner margin. Gonostyli shorter than half length of gonocoxites, with broad earlobe-shaped basal lobe and rounded median tooth. Parameres bifurcated and covered with numerous microtrichia on inner margin of each branch; ventral branch slender, with pointed apex, approximately 2/3 as long as dorsal branch; dorsal branch extending to apex of dorsal processes of aedeagus. Ventral aedeagal valves membranous, covered with numerous microtrichia; dorsal processes stout, greatly elongated, slightly divergent apically, and beveled apically.

Female. Similar to males in general appearance (Fig. 13) except for denser wing markings and dark brown terga.

Female genitalia (Figs 20–21). Subgenital plate oblong



Figs 12–21. *Minorpa abi* sp. nov. 12, 14–19 – male. 13, 20–21 – female. 12–13 – habitus, dorsal view. 14 – A6–A8, dorsal view; 15 – A6–A8, left-lateral view. 16 – genital bulb, dorsal view. 17 – genital bulb, ventral view. 18 – aedeagal complex, right-lateral view. 19 – aedeagal complex, ventral view. 20 – subgenital plate, ventral view. 21 – medigynium, ventral view.

with subtruncated apex and sparse long setae on distal margin. Medigynium with main plate approximately 4/5 as long as axis, broad, nearly rectangular; posterior arms greatly reduced, very short and stout; apodemes divergent basally.

Measurements (mm). *Male* (holotype and paratypes, $n = 5$): AtL 8.4–8.9, AbL 8.1–8.7, BdL 11.1–11.9, FL 9.3–10.2, FW 2.3–2.5, HL 8.7–9.6, HW 2.3–2.4. *Female* (paratypes, $n = 26$): AtL 8.4–9.1, AbL 6.9–8.3, BdL 9.7–12.5, FL 9.6–11.4, FW 2.4–2.7, HL 8.6–10.6, HW 2.3–2.5.

Etymology. The new species is named after Abi, a female character in the renowned Chinese novel *Demi-Gods and Semi-Devils*. Noun in apposition.

Distribution. China: Yunnan: Shilin (Fig. 122).

***Minorpa azhu* sp. nov.**

(Figs 22–30)

Type material. HOLOTYPE: ♂ (CN22Mazhu001), CHINA: GUIZHOU: Liupanshui, Meihua (Plum Blossom) Mountain, 26°38'11"N, 104°43'51"E, 2400 m, 12.vii–28.viii.2022, leg. Gui-Qiang Huang by

Malaise trap (BMDU). PARATYPES: 23 ♂♂ 53 ♀♀ (CN22Mazhu002–077), same data as holotype (BMDU).

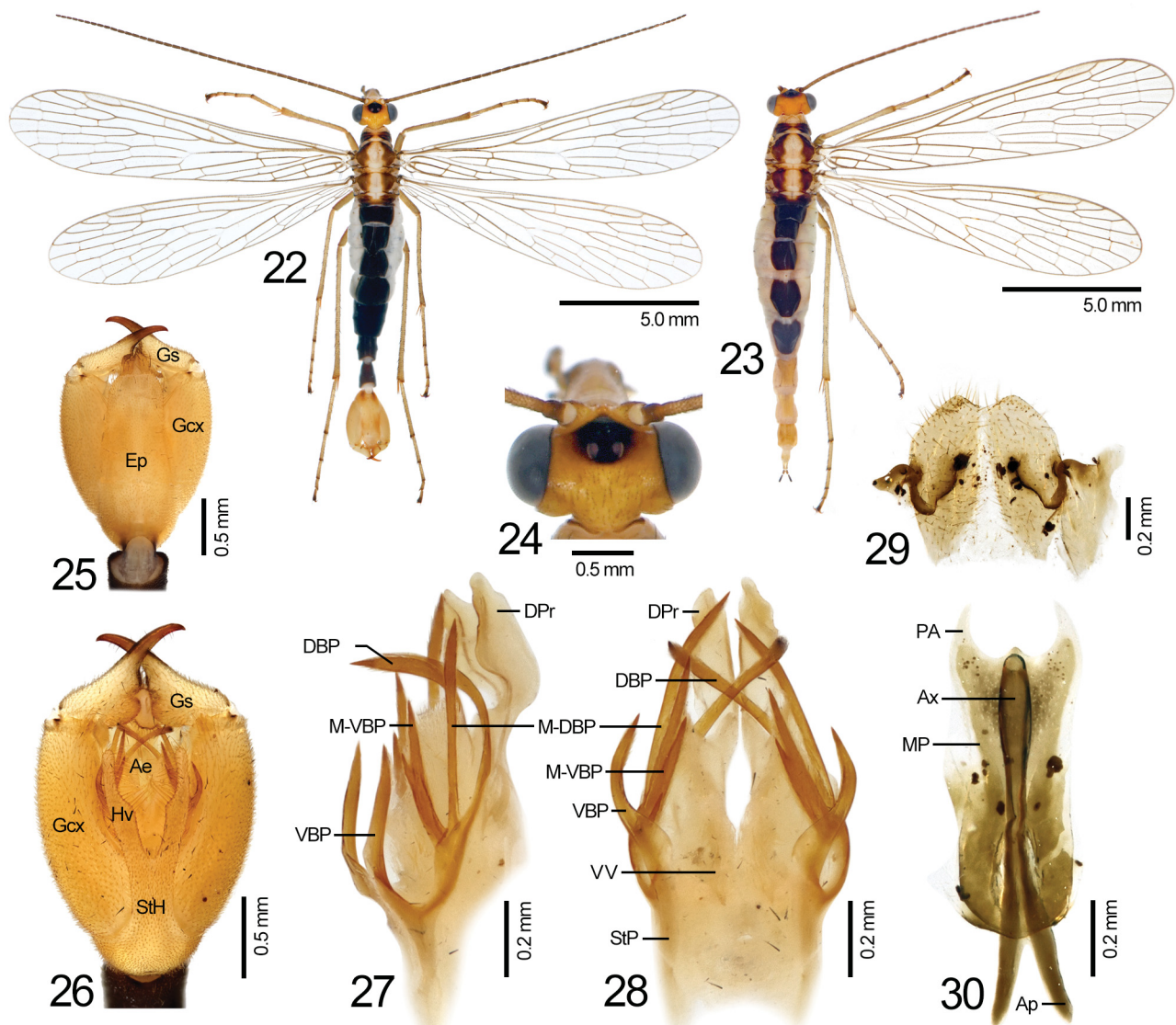
Diagnosis. The new species is similar to *M. liaoi* (Zhou & Zhou, 2007) in general appearance, but can be differentiated from the latter by the following characters: in males, i) hypovalves with projection on inner margin (vs. lacking) and ii) parameres quadrifurcated (vs. trifurcated). The four-branched male parameres are unique in this genus.

Description. Male. *Head* (Figs 22, 24). Vertex, rostrum and occiput yellowish brown; large black spot enclosing ocellar triangle and wider than half of vertex.

Wings (Fig. 22). Membrane hyaline and devoid of markings. Forewing 1A almost ending at same level of ORs. Hindwings similar.

Abdomen (Fig. 22). T1–T5 black. A6–A8 black, cylindrical; A8 constricted basally and beveled apically.

Male genitalia (Figs 25–28). Genital bulb yellow, oval. Epandrium not extending beyond middle of gonostyli, with U-shaped terminal emargination and forming two finger-like processes. Hypandrium Y-shaped and approximately



Figs 22–30. *Minorpa azhu* sp. nov. 22, 24–28 – male. 23, 29–30 – female. 22–23 – habitus, dorsal view. 24 – head, dorsal view. 25 – genital bulb, dorsal view. 26 – genital bulb, ventral view. 27 – aedeagal complex, right-lateral view. 28 – aedeagal complex, ventral view. 29 – subgenital plate, ventral view. 30 – medigynium, ventral view.

3/4 as long as gonocoxites, with basal stalk as long as hypovalves. Hypovalves divergent, with projection on inner margin. Gonostyli approximately half as long as gonocoxites, with earlobe-shaped basal lobe and subtriangular median tooth. Parameres quadrifurcated, covered with numerous microtrichia on inner margin of each branch; dorsal branches crossed in middle portion; mid-dorsal branch nearly straight; mid-ventral branch bifurcated in middle into long dorsal subbranch and much shorter ventral subbranch; and ventral branch curved inward in distal portion. Dorsal processes elongated and slightly convergent, deeply concave in basal-ventral portion.

Female. Similar to males in general appearance (Fig. 23).

Female genitalia (Figs 29–30). Subgenital plate oblong with emarginated apex, and sparse long setae on distal margin. Main plate of medigynium hourglass-shaped and approximately 4/5 as long as axis; posterior arms very short and approximately 1/5 as long as main plate; apodemes of axis greatly divergent.

Measurements (mm). *Male* (holotype and paratypes,

$n = 24$): AtL 10.6–11.5, AbL 7.5–9.1, BdL 11.1–12.6, FL 11.0–12.1, FW 2.5–2.7, HL 9.8–11.1, HW 2.4–2.6. *Female* (paratypes, $n = 53$): AtL 9.3–10.9, AbL 8.7–9.9, BdL 11.3–13.8, FL 11.6–12.5, FW 2.6–2.9, HL 11.0–11.8, HW 2.6–2.7.

Etymology. The new species is named after Azhu, one of the main female characters in the novel *Demi-Gods and Semi-Devils*. Noun in apposition.

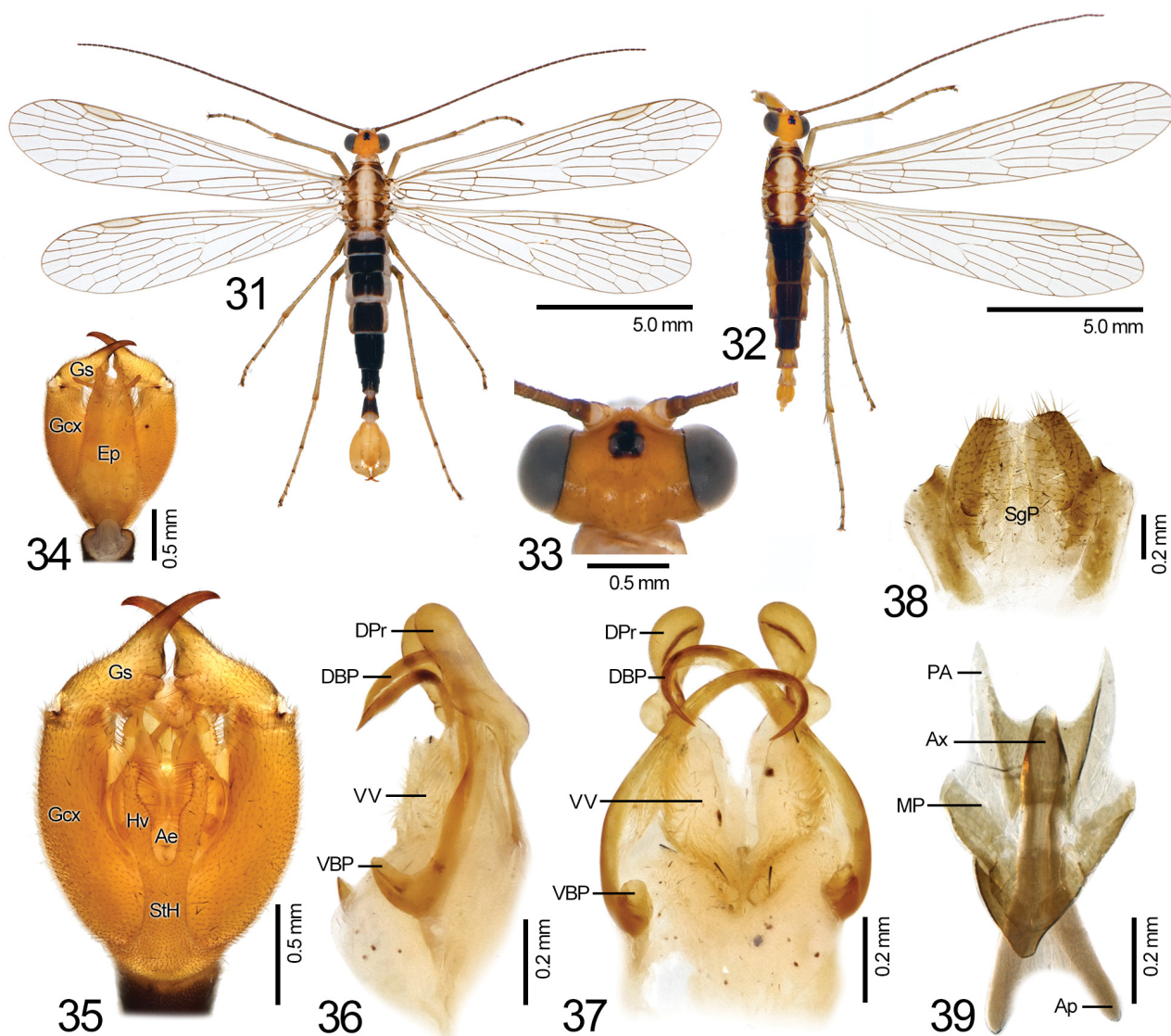
Distribution. China: Guizhou: Liupanshui (Fig. 122).

***Minorpa azi* sp. nov.**

(Figs 31–39)

Type material. HOLOTYPE: ♂ (CN22Mazi001), CHINA: GUIZHOU: Liupanshui, Meihua (Plum Blossom) Mountain, 26°38'11"N, 104°43'51"E, 2400 m, 12.vii–28.viii.2022, leg. Gui-Qiang Huang by Malaise trap (BMDU). PARATYPES: 11 ♂♂ 24 ♀♀ (CN22Mazi002–036), same data as holotype (BMDU).

Diagnosis. The new species is mostly similar to *M. liaoi* (Zhou & Zhou, 2007) and *M. azhu* sp. nov. in general appearance. However, it can be readily differentiated from *M. liaoi* by the following characters: in males, i) hypovalves



Figs 31–39. *Minorpa azi* sp. nov. 31, 33–37 – male. 32, 38–39 – female. 31–32 – habitus, dorsal view. 33 – head, dorsal view. 34 – genital bulb, dorsal view. 35 – genital bulb, ventral view. 36 – aedeagal complex, right-lateral view. 37 – aedeagal complex, ventral view. 38 – subgenital plate, ventral view. 39 – medigynium, ventral view.

with projection on inner margin (vs. lacking); ii) parameres bifurcated (vs. trifurcated); from *M. azhu* sp. nov. by the following characters: i) head with small black spot enclosing ocellar triangle, approximately 1/3 as wide as vertex (vs. large black spot enclosing ocellar triangle and wider than half of vertex); in males, ii) parameres bifurcated and dorsal processes enlarged distally (vs. quadrifurcated and dorsal processes tapering distally); iii) hypandrium approximately 2/3 as long as gonocoxites (vs. approximately 3/4 as long as gonocoxites); and in females, iv) medigynium with main plate diamond-shaped and approximately 2/3 as long as axis (hourglass-shaped and approximately 4/5 as long as axis).

Description. Male. Head (Figs 31–33). Vertex, rostrum and occiput yellowish brown; small black spot enclosing ocellar triangle, approximately 1/3 as wide as vertex.

Wings (Fig. 31). Membrane hyaline, slightly tinged with yellowish brown, and devoid of markings.

Abdomen (Fig. 31). T1–T5 black. A6–A8 black, cylindrical; A8 constricted basally and beveled apically.

Male genitalia (Figs 34–37). Hypandrium Y-shaped and approximately 2/3 as long as gonocoxites, with basal stalk slightly shorter than hypovalves. Hypovalves divergent, with projection on inner margin, and distal half approximately half as wide as basal half. Gonostyli approximately half as long as gonocoxites, with broad finger-shaped basal lobe and subtriangular median tooth. Parameres bifurcated and covered with numerous microtrichia on inner margin of each branch; ventral branch very short and stout; dorsal branches slender, hook-like, and crossed in distal 1/4. Dorsal processes elongated, nearly parallel, and enlarged distally.

Female. Similar to males in general appearance (Fig. 32).

Female genitalia (Figs 38–39). Subgenital plate oblong with shallow emargination terminally and sparse long setae on distal margin. Medigynium with main plate broad, diamond-shaped and approximately 2/3 as long as axis; posterior arms with pointed apices, approximately 1/4 as long as main plate; apodemes of axis greatly divergent.

Measurements (mm). *Male* (holotype and paratypes, $n = 12$): AtL 8.3–9.1, AbL 7.6–8.9, BdL 10.0–11.5, FL 10.1–10.8, FW 2.2–2.4, HL 9.1–9.8, HW 2.1–2.3. *Female* (paratypes, $n = 24$): AtL 8.9–10.2, AbL 6.3–8.8, BdL 9.1–12.1, FL 10.7–11.3, FW 2.2–2.5, HL 9.6–10.3, HW 2.1–2.4.

Etymology. The new species is named after Azi, one of the main female characters in the novel *Demi-Gods and Semi-Devils*. Noun in apposition.

Distribution. China: Guizhou: Liupanshui (Fig. 122).

Minorpa caojianensis sp. nov.

(Figs 40–45)

Type material. HOLOTYPE: ♂ (CN21Mcj001), CHINA: YUNNAN: Dali Bai Autonomous Prefecture, Yunlong County, Caojian Forest Farm, 25°45'51.18"N, 99°6'5.45"E, 2450 m, 22.vii.2021, leg. Ben-Yong Mao, Miao Li, Yao Deng, Meng-Qi Wang (BMDU). PARATYPES: 2 ♂♂ 8 ♀♀ (CNS21Mcj002–011), same data as holotype (BMDU).

Diagnosis. The new species is mostly similar to *M. duanyu*

(Wang & Gong, 2021) in general appearance, but can be differentiated from the latter by the following characters: in males, i) hypandrium with basal stalk approximately 2/3 as long as hypovalves (vs. approximately half as long as hypovalves); ii) parameres crossed subapically (vs. crossed at middle portion); iii) dorsal processes slender, greatly elongated, slightly convergent in basal half and nearly parallel in distal half (vs. stout and nearly parallel, neck-like in basal half and subacute in distal half); and in females iv) medigynium with main plate approximately 2/3 as long as axis (vs. approximately 3/5 as long as axis).

Description. Male. Head (Fig. 40). Vertex and occiput yellowish brown; ocellar triangle enclosed by black spot.

Wings (Fig. 40). Membrane hyaline, slightly tinged with yellowish brown, with greatly reduced pterostigmal bands.

Abdomen (Fig. 40). T1–T5 yellowish brown A6 blackish brown, cylindrical. A7 and A8 dark brown, A7 nearly cylindrical, A8 constricted basally and beveled apically.

Male genitalia (Figs 42–43). Epandrium with U-shaped terminal emargination and forming two slightly divergent finger-like processes. Hypandrium Y-shaped and approximately 2/3 as long as gonocoxites, with basal stalk approximately 3/4 as long as hypovalves. Hypovalves divergent and narrow, with slightly enlarged apex. Gonostyli approximately half as long as gonocoxites, with short finger-shaped basal lobe and subtriangular median tooth. Parameres slender and crossed subapically. Dorsal processes greatly elongated, slightly convergent in basal half and nearly parallel in distal half.

Female. Similar to males in general appearance (Fig. 41).

Female genitalia (Figs 44–45). Subgenital plate oblong with rounded apex and sparse long setae on distal margin. Medigynium slender, with broad main plate, approximately 2/3 as long as axis; posterior arms slender and 1/3 as long as main plate; apodemes of axis greatly divergent basally.

Measurements (mm). *Male* (holotype and paratypes, $n = 3$): AtL 8.2–8.7, AbL 7.3–8.1, BdL 9.5–11.2, FL 9.3–9.9, FW 2.1–2.4, HL 8.9–9.1, HW 2.0–2.2. *Female* (paratypes, $n = 8$): AtL 9.3–9.7, AbL 5.4–8.5, BdL 8.1–10.6, FL 10.8–11.1, FW 2.2–2.5, HL 10.1–10.2, HW 2.1–2.3.

Etymology. The new species is named after the type locality, Caojian Forest Farm. Adjective.

Distribution. China: Yunnan: Yunlong (Fig. 122).

Minorpa duanzhengchun sp. nov.

(Figs 46–53)

Type material. HOLOTYPE: ♂ (CN23Mdzc001), CHINA: YUNNAN: Kunming Prefecture, Shilin Yi Autonomous County, Laogui Mountain, 24°38'01"N, 103°34'59"E, 2560 m, 17.ix.2023, leg. Jiao Xie, Liang-Jie Jia, Jia-Ling Li & Ji-Shen Wang (BMDU). PARATYPES: 3 ♂♂ 5 ♀♀ (CN23Mdzc002–009), same data as holotype (BMDU).

Diagnosis. The new species is peculiar in the genus by the combination of the following characters: i) head with black spot enclosing ocellar triangle and two small black patterns on occiput laterally; in males, ii) parameres slender and extending beyond basal lobes of gonostyli; and in females, iii) subgenital plate truncated terminally; and iv) medigynium with axis stout, approximately half as wide as main plate.

Description. Male. Head (Fig. 46). Vertex yellowish orange, black spot enclosing ocellar triangle. Occiput yellowish orange with small black patterns laterally.

Wings (Fig. 46). Membrane hyaline and tinged with grayish brown, markings blackish brown. Pterostigma reddish brown and conspicuous. Forewings devoid of markings except for reduced pterostigmal band. Hindwings similar to forewings.

Abdomen (Figs 46, 48–49). T1–T5 dark brown, with yellow, discontinuous median stripe extending from T1 to T4. A6 black in basal half and gradually yellowing towards apex, with deep U-shaped emargination and forming pair of long triangular lobes laterally at dorsal apex; A7 greatly humped on dorsal apex, A8 longer than A7, constricted basally and beveled apically.

Male genitalia (Figs 50–51). Genital bulb long oval. Epandrium extending beyond middle of gonostyli, broadened in basal half and tapering in distal half, with deep V-shaped terminal emargination and forming two finger-like processes. Hypandrium Y-shaped and approximately 3/4 as long as gonocoxites, with broad basal stalk slightly shorter than

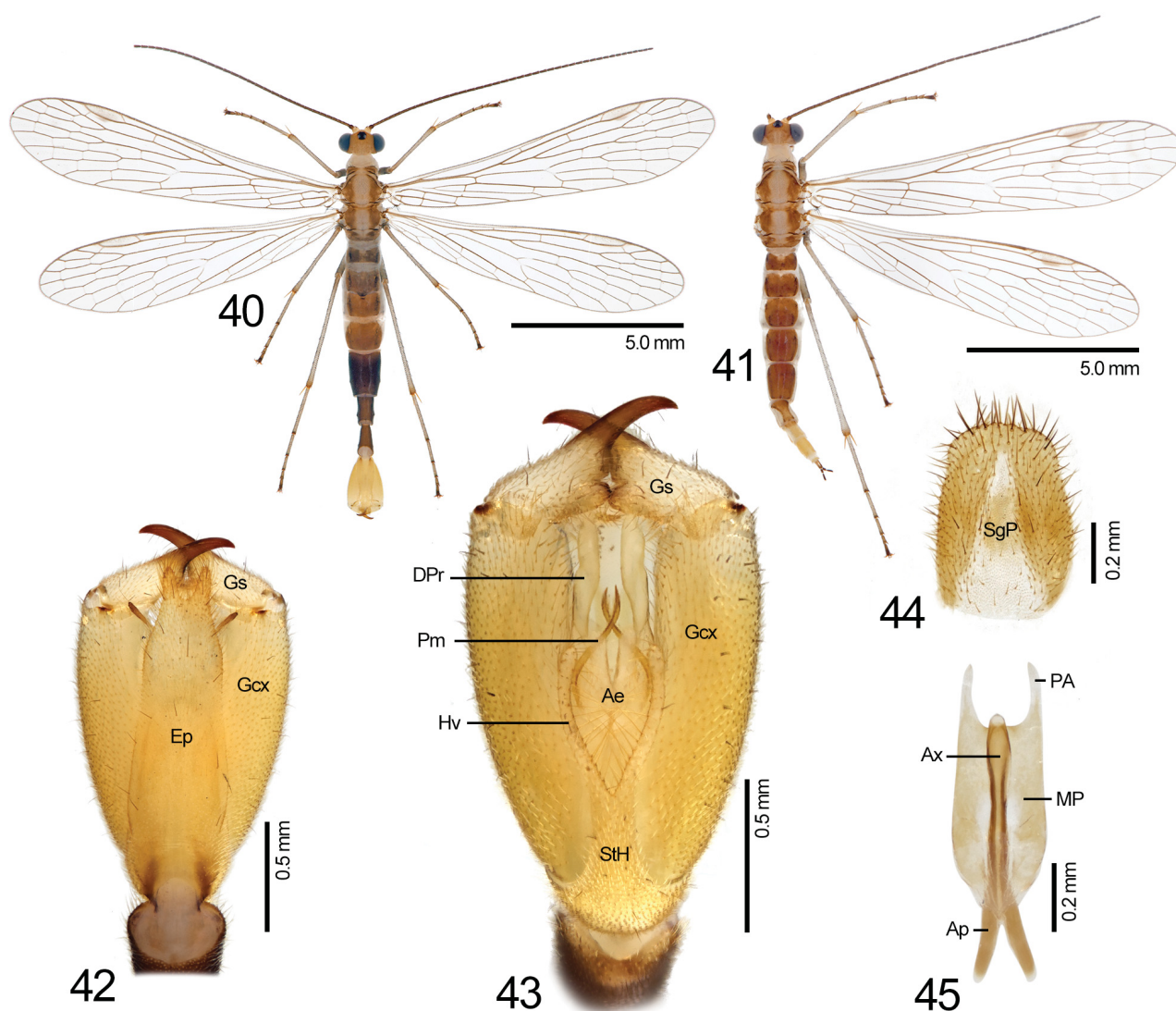
hypoalves. Hypoalves with sparse long and stout bristles along inner margin. Gonostyli approximately 2/3 as long as gonocoxites. Parameres slender with pointed apex, and gradually bending inwards in distal portion. Dorsal processes stout, short, nearly parallel, and slightly tapering toward apex.

Female. Similar to males in general appearance (Fig. 47) except for more developed wing spots, including scattered pterostigmal band and spot-like basal band.

Female genitalia (Figs 52–53). Subgenital plate oblong with truncated apex and sparse long setae marginally. Medigynium short, with main plate nearly trapezoidal, approximately twice as long as posterior arms; axis very stout, approximately half as wide as main plate; apodemes greatly divergent and slightly pointed at base.

Measurements (mm). *Male* (holotype and paratypes, $n = 4$): AtL 7.9–9.5, AbL 7.1–7.9, BdL 9.9–11.3, FL 9.8–10.8, FW 2.4–2.6, HL 9.0–9.7, HW 2.3–2.5. *Female* (paratypes, $n = 5$): AtL 8.5–9.7, AbL 6.0–7.9, BdL 8.7–11.1, FL 11.2–11.5, FW 2.4–2.7, HL 10.1–10.6, HW 2.3–2.5.

Etymology. The new species is named after Zheng-Chun



Figs 40–45. *Minorpa caojianensis* sp. nov. 40, 42–43 – male. 41, 44–45 – female. 40–41 – habitus, dorsal view. 42 – genital bulb, dorsal view. 43 – genital bulb, ventral view. 44 – subgenital plate, ventral view. 45 – medigynium, ventral view.

Duan, a male character in the novel *Demi-Gods and Semi-Devils*. Noun in apposition.

Distribution. China: Yunnan: Shilin (Fig. 122).

***Minorpa duanzhengming* sp. nov.**

(Figs 54–59)

Type material. HOLOTYPE: ♂ (CN23Mdzm001), CHINA: YUNNAN: Diqing Tibetan Autonomous Prefecture, Weixi Lisu Autonomous County, Alpine Forest near Luoma Village, 27°56'08"N, 98°57'55"E, 2940 m, 13.viii.2023, leg. Ji-Shen Wang & Chun-Mei Liao (BMDU). PARATYPE: 1 ♀ (CN23Mdzm002), same data as holotype (BMDU).

Diagnosis. The new species can be recognized by the following characters: in males, i) stoutly spherical shape of genital bulb; ii) hypovalves with projection on inner margin subbasally; iii) parameres greatly elongated and stout, extending beyond median tooth of gonostyli; and in females, iv) medigynium with main plate triangular, and axis entirely concealed in main plate.

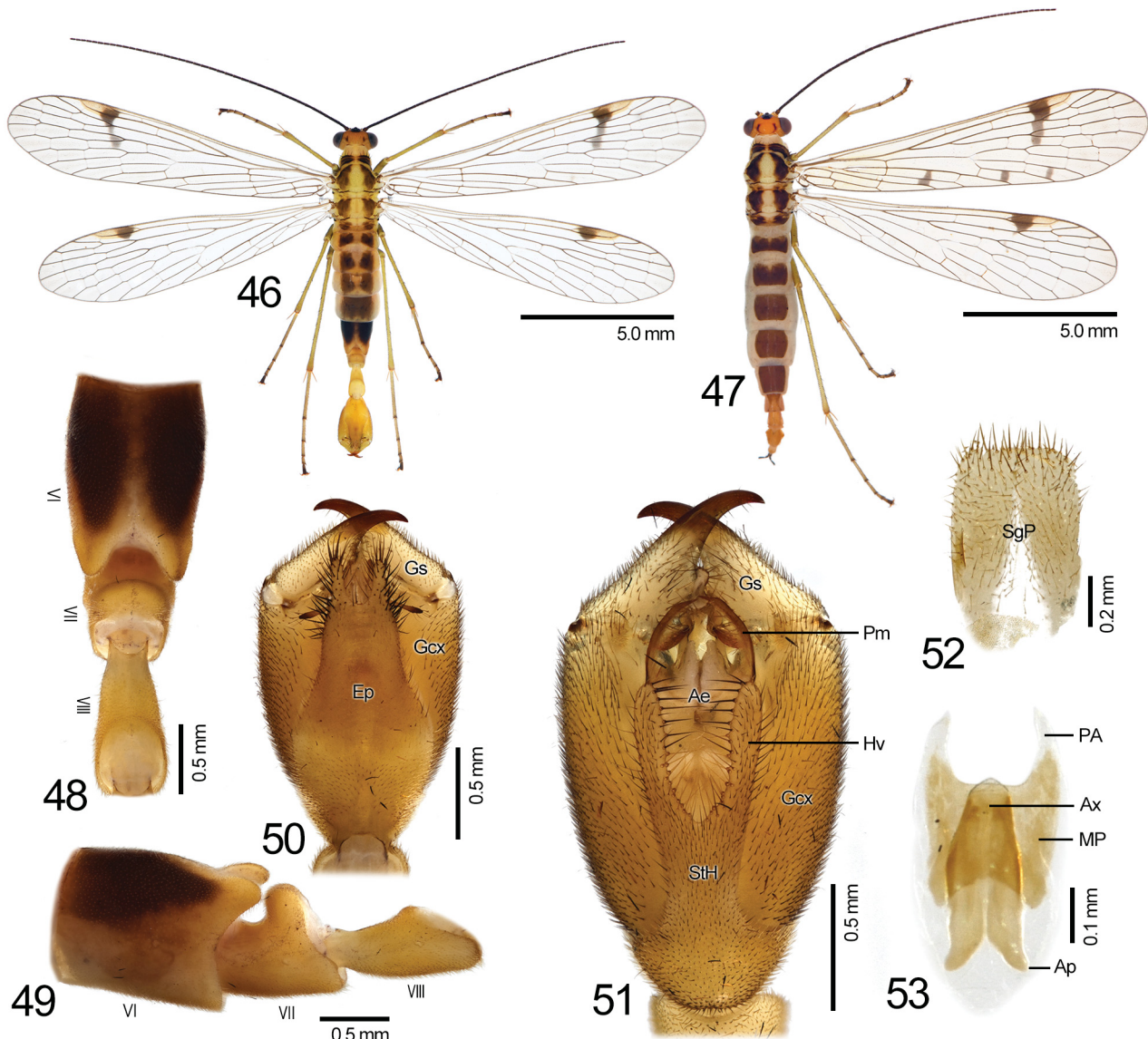
Description. *Male.* *Head* (Fig. 54). Vertex black; occiput yellowish brown; rostrum yellowish pale; and ocellar triangle black.

Thorax (Fig. 54). Meso- and metanotum black laterally with discontinuous pale median stripe forming two vase-shaped patterns. Pleura and legs brown with distal tarsomeres dark brown.

Wings (Fig. 54). Membrane hyaline, slightly tinged with grayish brown and devoid of markings.

Abdomen (Fig. 54). T1–T5 shining black. A6 shining black, cylindrical, nearly truncated apically and lacking lateral lobes. A7 and A8 shining black, A7 nearly cylindrical and slightly beveled at dorsal apex, A8 constricted basally and greatly beveled apically.

Male genitalia (Figs 56–57). Genital bulb stoutly spherical. Epandrium broad, slightly tapering towards apex, with deep U-shaped terminal emargination and forming two parallel finger-like processes. Hypandrium Y-shaped and approximately 9/10 as long as gonocoxites, with narrow basal stalk approximately 2/3 as long as hypovalves. Hypovalves narrow, with projection on inner margin subbasally, and bearing sparse long bristles along inner margin. Gonocoxites with greatly wide aedeagal concavity. Gonostyli longer than half length of gonocoxites, slightly incurvated



Figs 46–53. *Minorpa duanzhengming* sp. nov. 46, 48–51 – male. 47, 52–53 – female. 46–47 – habitus, dorsal view. 48 – A6–A8, dorsal view. 49 – A6–A8, left-lateral view. 50 – genital bulb, dorsal view. 51 – genital bulb, ventral view. 52 – subgenital plate, ventral view. 53 – medigynium, ventral view.

on outer margin, with earlobe-shaped basal lobe and subtriangular median tooth, bearing dozens of long bristles. Parameres greatly elongated, extending beyond median tooth of gonostyli. Ventral aedeagal valves membranous, rounded, and covered with numerous microtrichia; dorsal processes stout, slightly elongated.

Female. Similar to males in general appearance (Fig. 55), but with greatly reduced pterostigmal bands in wings.

Female genitalia (Figs 58–59). Subgenital plate oval with rounded apex, and sparse long setae on distal margin. Medigynium with main plate subtriangular; axis entirely concealed in main plate; posterior arms very short and stout, and approximately 1/8 as long as main plate; apodemes slightly divergent basally.

Measurements (mm). *Male* (holotype, $n = 1$): AtL 11.2, AbL 9.6, BdL 13.3, FL 13.2, FW 3.1, HL 12.1, HW 2.9; *Female* (paratype, $n = 1$): AtL 10.0, AbL 7.0, BdL 10.9, FL 12.1, FW 3.0, HL 11.1, HW 2.7.

Etymology. The new species is named after Zheng-Ming Duan, a male character in the novel *Demi-Gods and Semi-Devils*. Noun in apposition.

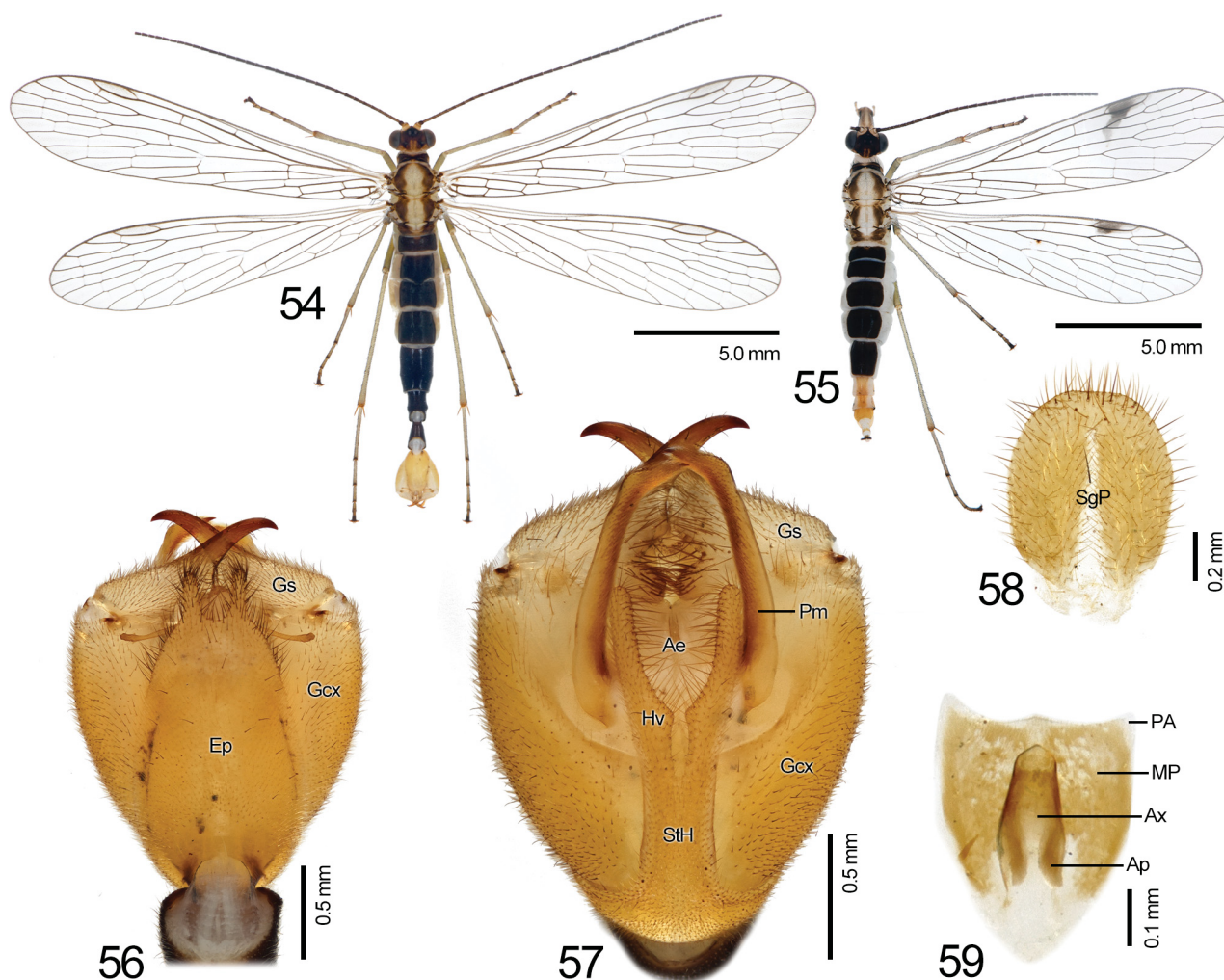
Distribution. China: Yunnan: Weixi (Fig. 122).

Minorpa lijialingae sp. nov.

(Figs 60–69)

Type material. HOLOTYPE: ♂ (CN23Mjl001), CHINA: YUNNAN: Yunnan: Dali Bai Autonomous Prefecture, Yunlong County, 25°51'51.91"N, 99°18'47.79"E, 2200 m, 12.ix.2023, leg. Liang-Jie Jia, Jiao Xie & Jia-Ling Li (BMDU). PARATYPES: 1 ♂ 4 ♀♀ (CN23Mjl002–006), same data as holotype (BMDU).

Diagnosis. The new species resembles *M. hani* (Wang, 2021) and *M. stella* (Wang, 2021) in the structure of male A6 and bifurcated parameres. However, it can be readily differentiated from *M. hani* by short-trapezoidal shape of the lateral lobes at dorsal apex of male A6 (vs. long triangular); greatly elongated and basally curved inner subbranch of ventral branch of parameres (vs. much shorter and curved inward); rounded apex of the female subgenital plate (vs. truncated); and slender posterior arms of medigynium (vs. stout). In addition, it can further be differentiated from *M. stella* by scattered apical band in wings (vs. complete); greatly shortened basal stalk of the male hypandrium (vs. long); greatly elongated and basally curved inner subbranch of ventral branch of parameres (vs. unelongated and straight); and rounded apex of the female subgenital plate (vs. truncated).



Figs 54–59. *Minorpa duanzhengming* sp. nov. 54, 56–57 – male. 55, 58–59 – female. 54–55 – habitus, dorsal view. 56 – genital bulb, dorsal view. 57 – genital bulb, ventral view. 58 – subgenital plate, ventral view. 59 – medigynium, ventral view.

Description. Male. Head (Fig. 60). Vertex and occiput yellowish orange, ocellar triangle enclosed by black spot.

Thorax (Fig. 60). Meso- and metanotum yellow medially and grayish brown laterally.

Wings (Fig. 60). Membrane hyaline and tinged with light yellowish brown, markings brown. Pterostigma orange and conspicuous. Forewing with apical and pterostigmal bands greatly reduced into several small spots; basal band reduced to small spot above CuP; marginal and basal spots absent. Hindwings similar to forewings but with more reduced markings.

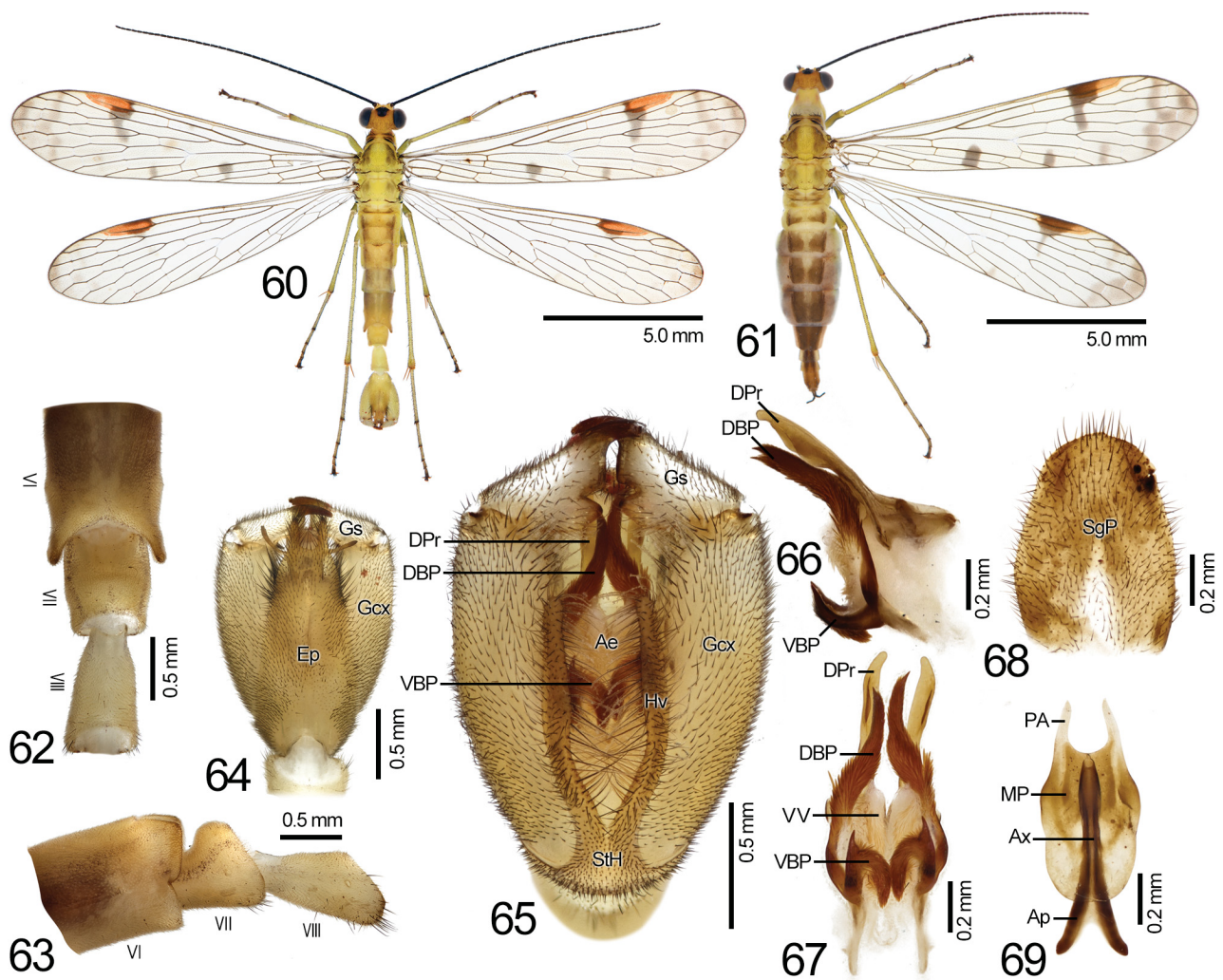
Abdomen (Figs 60, 62–63). T1–T5 yellowish brown. A6 brown, cylindrical, with deeply arcuate emargination and forming pair of broad trapezoid-shaped lobes laterally at dorsal apex. A7 and A8 pale brown, cylindrical, A7 greatly humped on dorsal apex; A8 slightly longer than A7, constricted basally and beveled apically.

Male genitalia (Figs 64–67). Epandrium with deep U-shaped terminal emargination, forming two parallel finger-like processes, and covered with long stout setae on outer margin of distal 1/3. Hypandrium Y-shaped and approximately 3/4 as long as gonocoxites, with greatly reduced basal stalk and approximately 1/5 as long as

hypoalves. Hypoalves narrow, divergent in base half and nearly parallel in distal half, with sparse long bristles along inner margin. Gonostyli shorter than half length of gonocoxites, with triangular basal lobe and subtriangular median tooth. Parameres bifurcated, both branches covered with numerous spines; ventral branch further bifurcated near middle, with outer subbranch short and thorn-like, and inner subbranch greatly elongated and curved towards aedeagal base; dorsal branch lobate, twisted, with subapical notch on inner side, and bending outwards apically. Ventral aedeagal valves membranous, rounded, and covered with numerous microtrichia; dorsal processes slender, greatly elongated, and slightly convergent.

Female. Similar to males in general appearance (Fig. 61), but with denser markings and darker terga.

Female genitalia (Figs 68–69). Subgenital plate oval with rounded apex, and sparse long setae on distal margin. Medigynium with nearly ellipsoidal main plate approximately 2/3 as long as axis, slightly curled marginally; posterior arms slender, approximately 1/3 as long as main plate; apodemes greatly divergent basally. Subgenital plate oval with rounded apex, and sparse long setae on distal margin. Medigynium with main plate half as long as



Figs 60–69. *Minorpa lijialingae* sp. nov. 60, 62–67 – male. 61, 68–69 – female. 60–61 – habitus, dorsal view. 62 – A6–A8, dorsal view. 63 – A6–A8, left-lateral view. 64 – genital bulb, dorsal view. 65 – genital bulb, ventral view. 66 – aedeagal complex, right-lateral view. 67 – aedeagal complex, ventral view. 68 – subgenital plate, ventral view. 69 – medigynium, ventral view.

axis, and slightly curled marginally; posterior arms short and thin, approximately 1/3 as long as main plate; main plate approximately 2/3 as long as axis. Apodemes of axis slightly divergent basally.

Measurements (mm). *Male* (holotype and paratype, $n = 2$): AtL 8.3–9.0, AbL 6.7–7.4, BdL 9.9–10.8, FL 10.0–10.9, FW 2.3–2.6, HL 9.0–9.9, HW 2.2–2.5. *Female* (paratypes, $n = 4$): AtL 8.8–9.2, AbL 6.5–7.3, BdL 10.2–11.5, FL 11.1–11.5, FW 2.5–2.7, HL 10.1–10.6, HW 2.3–2.6.

Etymology. Named after its discoverer and collector, Jia-Ling Li. Feminine noun in the genitive case.

Distribution. China: Yunnan: Yunlong (Fig. 122).

***Minorpa liqiushui* sp. nov.**

(Figs 70–75)

Type material. HOLOTYPE: ♂ (CN22Mlqs001), CHINA: YUNNAN: Dali Bai Autonomous Prefecture, Yunlong County, southern slope of the Wubao Mountain, 25°51'08"N, 99°15'09"E, 2560 m, 3.vi.2022, leg. Liang-Jie Jia, Jia-Ling Li, Jiao Xie, Chun-Mei Liao & Ji-Shen Wang (BMDU). PARATYPES: 7 ♂♂ 17 ♀♀ (CN22Mlqs002–025), same data as holotype (BMDU).

Diagnosis. The new species is most similar to *M. duan-zhengming* sp. nov. in general appearance, but can be differentiated from the latter by the following characters: i)

head with vertex, occiput, and ocellar triangle shining black (vs. mostly black with yellowish occiput); ii) meso- and metanotum with pale median stripe narrow (vs. broad); in males, iii) stalk of hypandrium half as long as hypovalves (vs. 2/3 as long as hypovalves); iv) hypovalves lacking projection on inner margin (vs. with subbasal projection on inner margin); v) parameres bearing inner spine on subbasal portion (vs. lacking); and in females, vi) medigynium with posterior arms slender (vs. short and stout).

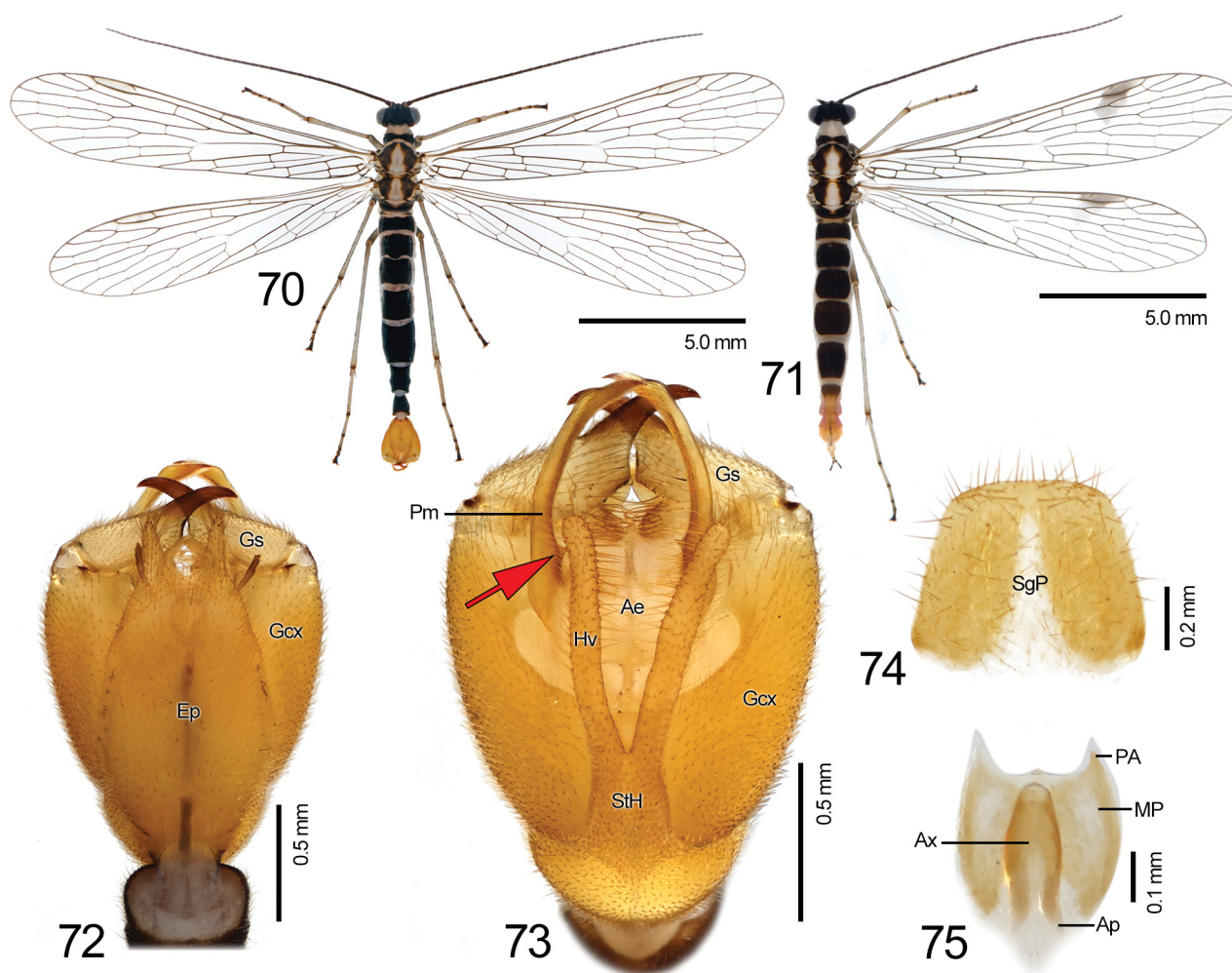
Description. *Male.* **Head** (Fig. 70). Vertex, occiput, and ocellar triangle shining black; rostrum yellowish pale.

Thorax (Fig. 70). Meso- and metanotum black laterally with discontinuous pale median stripe forming two vase-shaped patterns.

Wings (Fig. 70). Membrane hyaline, slightly tinged with grayish brown and devoid of markings.

Abdomen. T1–T5 shining black. A6 shining black, cylindrical, nearly truncated apically and lacking lobes. A7 and A8 shining black, nearly cylindrical, A8 constricted basally and slightly beveled at dorsal apex.

Male genitalia (Figs 72–73). Epandrium broad, slightly tapering towards apex, with deep U-shaped terminal emargination, and forming two slightly divergent finger-like processes. Hypandrium Y-shaped and approximately 9/10



Figs 70–75. *Minorpa liqiushui* sp. nov. 70, 72–73 – male. 71, 74–75 – female. 70–71 – habitus, dorsal view. 72 – genital bulb, dorsal view. 73 – genital bulb, ventral view. 74 – subgenital plate, ventral view. 75 – medigynium, ventral view. Red arrow indicates inner spine of paramere.

as long as gonocoxites, with basal stalk approximately 2/5 as long as hypovalves. Hypovalves divergent in base, with sparse long bristles along inner margin. Gonostyli approximately 2/3 as long as gonocoxites, slightly incurved on outer margin, with earlobe-shaped basal lobe and subtriangular median tooth. Parameres greatly elongated, stout, bearing numerous microtrichia along inner margin and inner spine on subbasal portion, with their terminal portions shortly contacted.

Female. Similar to males in general appearance (Fig. 71), but with greatly reduced pterostigmal bands in wings.

Female genitalia (Figs 74–75). Subgenital plate oval with nearly truncated apex, and sparse long setae on distal margin. Medigynium with main plate broadly subtriangular, broadest in middle; axis entirely concealed in main plate; posterior arms very short, triangular, and approximately 1/5 as long as main plate; apodemes slightly divergent basally.

Measurements (mm). *Male* (holotype and paratypes, $n = 8$): AtL 8.7–9.3, AbL 6.9–8.1, BdL 9.1–11.9, FL 10.5–11.0, FW 2.3–2.6, HL 9.7–10.1, HW 2.1–2.4. *Female* (paratypes, $n = 17$): AtL 9.1–10.6, AbL 5.2–7.5, BdL 8.9–11.1, FL 11.1–12.8, FW 2.5–2.8, HL 10.2–11.8, HW 2.4–2.6.

Etymology. This new species is named after Qiu-Shui Li, a female character in the novel *Demi-Gods and Semi-Devils*.

Noun in apposition.

Distribution. China: Yunnan: Yunlong (Fig. 122).

***Minorpa muwanqing* sp. nov.**

(Figs 76–81)

Type material. HOLOTYPE: ♂ (CN23Mmwq001), CHINA: YUNNAN: Gongshan, Nujiang Lisu Autonomous Prefecture, Gongshan Derung and Nu Autonomous County, 28°03'28"N, 98°43'56"E, 15.viii.2023, leg. Chun-Mei Liao & Ji-Shen Wang (BMDU). PARATYPES: 1 ♂ 3 ♀♀ (CN23Mmwq002–005), same date (BMDU). PARATYPES: 6 ♂♂ 22 ♀♀ (CN21Mmwq001–028), same locality except 13.vii.2021, leg. Guo-Cong Huang, Lu Qiu, Ji-Shen Wang & Hao Xu (BMDU).

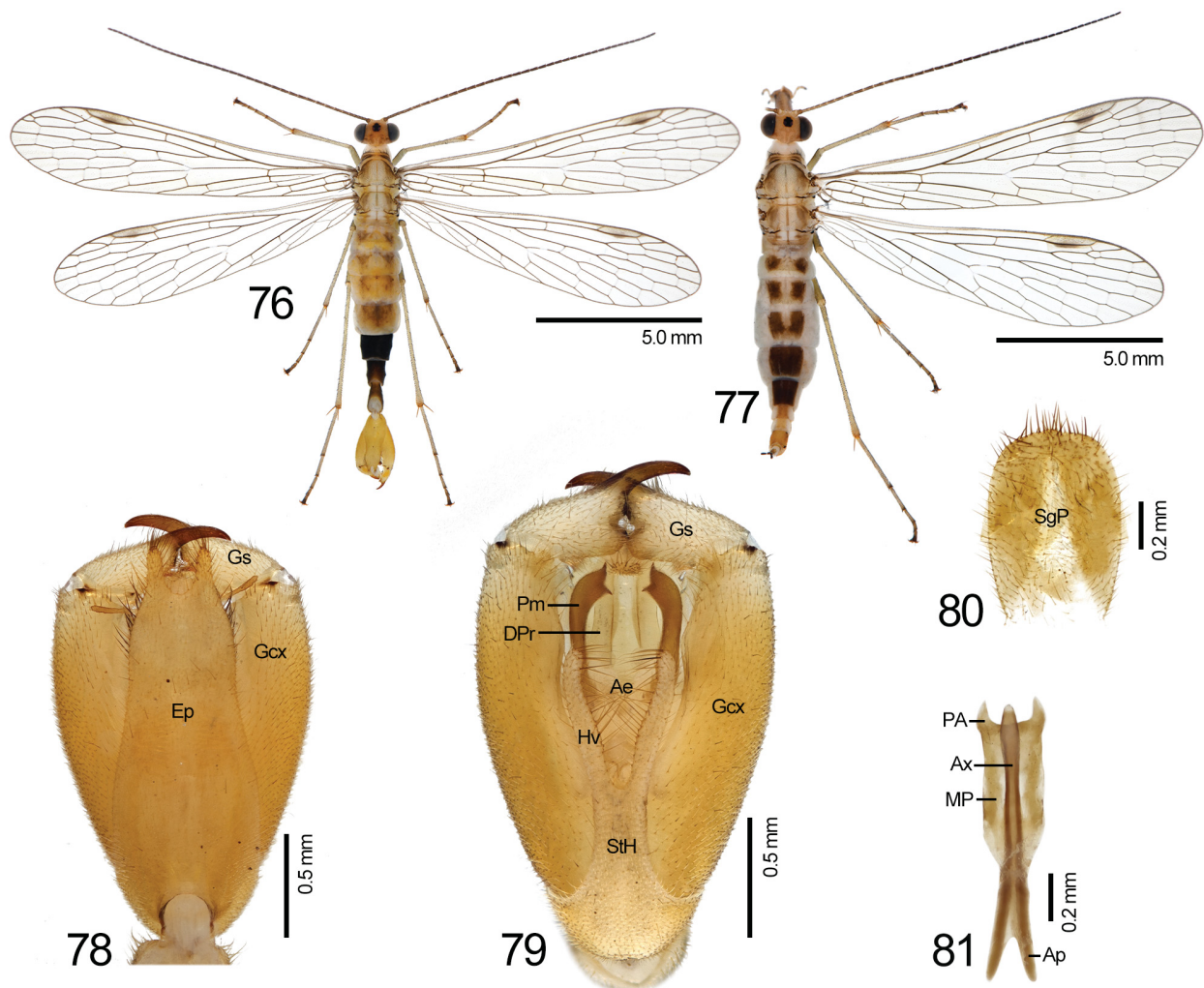
Diagnosis. The new species is peculiar in the genus for the male parameres unbranched at base, but shortly bifurcated apically; and for greatly elongated female medigynium which bears extremely shortened posterior arms.

Description. Male. *Head* (Fig. 76). Vertex, occiput and rostrum yellowish orange, ocellar triangle black.

Thorax (Fig. 76). Meso- and metanotum pale yellowish brown in middle and darkened laterally.

Wings (Fig. 76). Membrane hyaline, tinged with yellowish brown and devoid of markings. Pterostigma brown and conspicuous.

Abdomen (Fig. 76). T1–T5 unevenly yellow, tinged with brown. A6 black, cylindrical, with shallow arcuate



Figs 76–81. *Minorpa muwanqing* sp. nov. 76, 78–79 – male. 77, 80–81 – female. 76–77 – habitus, dorsal view. 78 – genital bulb, dorsal view. 79 – genital bulb, ventral view. 80 – subgenital plate, ventral view. 81 – medigynium, ventral view.

emargination on dorsal apex. A7 and A8 black, A7 nearly cylindrical and slightly beveled at dorsal apex, A8 constricted basally and greatly beveled apically.

Male genitalia (Figs 78–79). Genital bulb yellow, long oval. Hypandrium Y-shaped and approximately 2/3 as long as gonocoxites, with basal stalk approximately 2/3 as long as hypovalves. Hypovalves narrow, divergent basally, with sparse long bristles along inner margin. Gonostyli half as long as gonocoxites, with earlobe-shaped basal lobe and rounded median tooth. Parameres unbranched at base, greatly enlarged and bent inward near apex, and shortly bifurcated apically; dorsal processes stout, greatly elongated and nearly parallel.

Female. Similar to males in general appearance (Fig. 77) except for darker T2–T4.

Female genitalia (Figs 80–81). Subgenital plate oblong with rounded apex and sparse long setae on distal margin. Medigynium greatly elongated with subrectangular main plate half as long as axis; posterior arms short, approximately 1/6 as long as main plate; axis with its posterior portion extending beyond main plate; apodemes divergent basally.

Measurements (mm). *Male* (holotype and paratypes, $n = 8$): AtL 8.1–9.6, AbL 6.1–8.9, BdL 9.4–12.1, FL 10.0–10.9, FW 2.3–2.5, HL 9.1–9.9, HW 2.2–2.4. *Female* (paratypes, $n = 25$): AtL 9.2–10.7, AbL 5.3–6.4, BdL 9.1–10.7, FL 11.1–11.9, FW 2.8–2.9, HL 10.1–10.8, HW 2.7–2.8.

Etymology. This new species is named after Wan-Qing Mu, a female character in the novel *Demi-Gods and Semi-Devils*. Noun in apposition.

Distribution. China: Yunnan: Gongshan (Fig. 122).

Minorpa sujiei sp. nov.

(Figs 82–89)

Type material. HOLOTYPE: ♂ (CN23Msuj001), CHINA: SICHUAN: Liangshan Yi Autonomous Prefecture, Puge County, eastern slope of Mount Luoji, 27°34'46.93"N, 102°26'18.36"E, 1958 m, 12.ix.2023, leg. Jie Su & Yi-Fan Liu (BMDU). PARATYPES: 1 ♂ 1 ♀ (CN23Msuj002–003), same data as holotype (BMDU).

Diagnosis. The new species closely resembles *M. kunmingensis* (Fu & Hua, 2009) in general appearance, especially the wing markings and genital bulb appearance, but differs from the latter in the following features: in males, i) gonostyli with broad ear-shaped basal lobe (vs. large disc-like basal lobe); ii) hypandrium with basal stalk as long as hypovalves (vs. basal stalk longer than hypovalves); iii) parameres with dorsal branch greatly elongated and extending beyond middle of gonostyli (vs. much shorter); in females, iv) posterior arms of medigynium approximately twice as long as main plate (vs. as long as or slightly longer than main plate); v) main plate approximately 3/4 as long as axis (vs. 1/3 as long as axis); and vi) widely divergent apodemes of axis (vs. slightly divergent).

Description. Male. Head (Fig. 82). Vertex, occiput and rostrum yellowish brown, ocellar triangle enclosed by dark spot.

Thorax (Fig. 82). Meso- and metanotum black laterally with pale median stripe.

Wings (Fig. 82). Membrane hyaline and tinged with

grayish brown, markings grayish brown. In forewings, apical band broad and dense, with a few hyaline spots, pterostigmal band with detached apical and basal branch, reduced to small spots along hind margin; basal band reduced to small spots; marginal spots absent. Hindwings similar to forewings with more reduced markings.

Abdomen (Figs 82, 84–85). T1–T5 dark brown, with yellowish brown, continuous median stripe. A6–A8 yellowish orange, A6 with deep arcuate emargination and forming pair of broad triangular lobes laterally at dorsal apex; A7 greatly humped on dorsal apex, A8 approximately as long as A7, and beveled apically.

Male genitalia (Figs 86–87). Hypandrium Y-shaped and approximately 5/6 as long as gonocoxites, with basal stalk approximately as long as hypovalves. Hypovalves narrow, divergent in basal half and gradually drawing together in distal half, with sparse long bristles along inner margin. Gonostyli approximately 4/5 as long as gonocoxites, with broad ear-shaped basal lobe and subtriangular median tooth. Parameres bifurcated, with dorsal branch greatly elongated, spear-like, and extending beyond middle of gonostyli. Dorsal processes stout, short, nearly parallel, and with shallow emargination on apex.

Female. Similar to males in general appearance (Fig. 83).

Female genitalia (Figs 88–89). Subgenital plate oblong with slightly emarginated apex and sparse long setae on distal margin. Medigynium with slender and extremely long posterior arms, approximately twice as long as main plate; main plate approximately 3/4 as long as axis; axis enlarged, with apodemes greatly divergent basally.

Measurements (mm). *Male* (holotype and paratype, $n = 2$): AtL 8.3–10.2, AbL 8.9–10.3, BdL 13.1–14.0, FL 10.4–11.9, FW 2.6–2.8, HL 8.8–10.7, HW 2.6–2.7. *Female* (paratype, $n = 1$): AtL 11.2, AbL 9.9, BdL 13.9, FL 13.4, FW 3.2, HL 12.2, HW 2.9.

Etymology. The new species is named after Jie Su, collector of the type specimens. Masculine noun in the genitive case.

Distribution. China: Sichuan: Puge (Fig. 122).

Minorpa tangzenghuae sp. nov.

(Figs 90–95)

Type material. HOLOTYPE: ♂ (CN21Mtzh001), CHINA: SICHUAN: Chengdu City, Dayi County, Qingxia Town, 30°38'16.62"N, 103°31'24.84"E, 594 m, 17.x.2021, leg. Tian-Long He (BMDU). PARATYPE: ♀ (CN21Mtzh002), same data as holotype (BMDU).

Diagnosis. The new species is superficially similar to *M. furcata* (Zhou & Zhou, 2007) in the wing markings and flat genital bulb, but differs from the latter in the following features: i) in forewings, pterostigmal band with detached apical branches, basal bands reduced to speckles (vs. pterostigmal band with complete apical branches, basal band broad, complete); ii) male parameres slender, wave-shaped in middle portion (vs. straight); iii) posterior arms of female medigynium short and triangular (vs. nearly absent).

Description. Male. Head (Fig. 90). Vertex, occiput and rostrum dark brown, ocellar triangle enclosed by diamond-shaped dark spot.

Thorax (Fig. 90). Meso- and metanotum mostly dark

brown with discontinuous yellowish orange interlaced. Legs pale brown with distal tarsomeres dark brown.

Wings (Fig. 90). Membrane hyaline and tinged with grayish brown, markings dark brown. In forewings, apical band broad with several hyaline spots along apical cross-veins, pterostigmal band with detached apical branches, basal bands reduced to speckles; with marginal and basal spots. Hindwings similar to forewings with more reduced markings.

Abdomen (Fig. 90). T1–T6 black. A7 yellowish brown, cylindrical; A8 constricted basally and beveled apically.

Male genitalia (Figs 91–93). Genital bulb dark brown, flat and long oval. Hypandrium Y-shaped, approximately 3/4 as long as gonocoxites, with basal stalk and pair of rod-like hypovalves, basal stalk approximately 3/5 as long as hypovalves. Gonostyli shorter than half length of gonocoxites, with triangular basal lobe and subtriangular median tooth. Parameres slender and covered with numerous microtrichia on inner margin, wave-shaped in middle,

and straight from middle to apex. Ventral aedeagal valves membranous; dorsal processes tapering towards apex.

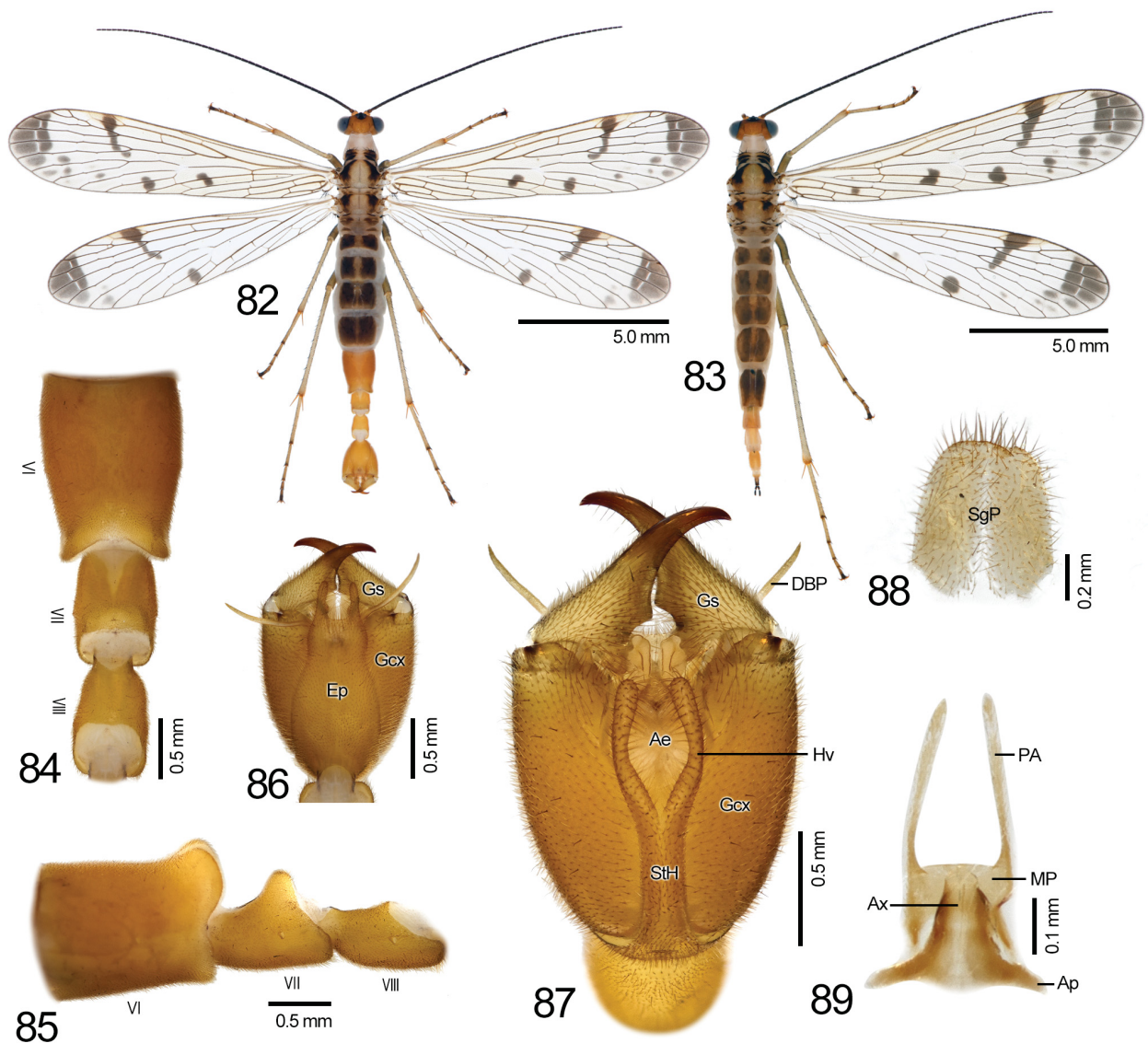
Female. Similar to males in general appearance.

Female genitalia (Figs 94–95). Subgenital plate greatly elongated, subtrapezoidal with truncated apex and narrow base, and sparse long setae on distal margin. Medigynium with very long and stout axis approximately 1/3 as wide as main plate; main plate approximately 2/5 as long as axis; posterior arms very short, triangular and 1/6 as long as main plate; apodemes of axis enlarged and slightly divergent at base.

Measurements (mm). *Male* (holotype, n = 1): AtL 9.2, AbL 7.9, BdL 11.4, FL 12.1, FW 2.9, HL 10.8, HW 2.8. *Female* (paratype, n = 1): AtL 9.8, AbL 9.1, BdL 12.3, FL 13.2, FW 3.1, HL 12.8, HW 3.0.

Etymology. The new species is dedicated to Mrs. Zeng-Hua Tang, the mother of the collector. Feminine noun in the genitive case.

Distribution. China: Sichuan: Dayi (Fig. 122).



Figs 82–89. *Minorpa sujiei* sp. nov. 82, 84–87 – male. 83, 88–89 – female. 82–83 – habitus, dorsal view. 84 – A6–A8, dorsal view. 85 – A6–A8, left-lateral view. 86 – genital bulb, dorsal view. 87 – genital bulb, ventral view. 88 – subgenital plate, ventral view. 89 – medigynium, ventral view.

***Minorpa wangyuyan* sp. nov.**

(Figs 96–102)

Type material. HOLOTYPE: ♂ (CN21Mwyy001), CHINA: YUNNAN: Dali Bai Autonomous Prefecture, Dali City, northern slope of the Mount Cangshan, Huadianba (flower-meadowland), 25°52'47"N, 100°00'53"E, 2930 m, 2.vi.2021, leg. Ji-Shen Wang (BMDU). PARATYPES: 3♀♀ (CN-21Mwyy002–004), same data as holotype (BMDU).

Diagnosis. The new species resembles *M. duanzhengming* sp. nov., *M. liqiushui* sp. nov. and *M. parallela* (Wang & Hua, 2016) in greatly elongated male parameres. However, it can be readily differentiated from *M. duanzhengming* sp. nov. by elongated oval shape of genital bulb (vs. stoutly oval); from *M. liqiushui* sp. nov. by shorter hypandrium slightly extending beyond middle of gonocoxites (vs. much longer and extending to apex of gonocoxites) and projection on inner margin of hypovalves (vs. lacking); and from *M. parallela* by concealed axis of female medigynium (vs. exposed).

Description. Male. Head (Fig. 97). Vertex yellowish; occiput black brown; rostrum black brown laterally with pale median stripe; and ocellar triangle enclosed by dark spot.

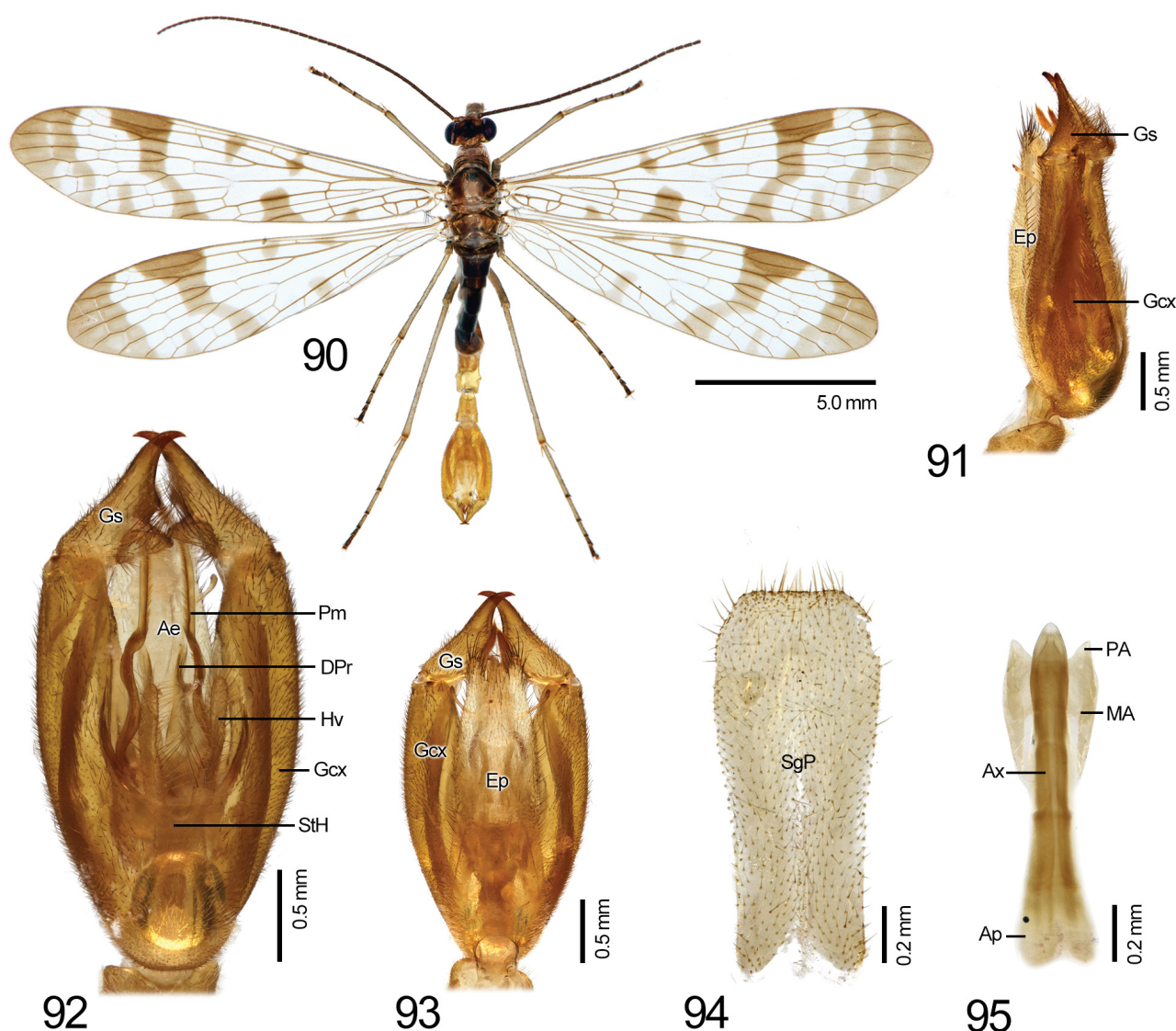
Thorax (Fig. 97). Pronotum black, with four to five

stout setae along each side of anterior margin. Meso- and metanotum mostly dark brown with discontinuous pale median stripe forming two vase-shaped patterns.

Wings (Fig. 97). Membrane hyaline, slightly tinged with grayish brown and devoid of markings.

Abdomen (Fig. 97). T1–T5 dark brown to black. A6–A8 black, cylindrical; A8 constricted basally and beveled apically.

Male genitalia (Figs 99–100). Genital bulb yellow, long oval. Epandrium tapering towards apex, with U-shaped terminal emargination and forming two finger-like processes. Hypandrium Y-shaped and approximately 2/3 as long as gonocoxites, with basal stalk approximately 2/3 as long as hypovalves. Hypovalves with projection on inner margin subbasally, and its distal half approximately half as wide as basal half. Gonostyli longer than half length of gonocoxites, with broad rounded basal lobe covered with long and stout bristles, and subtriangular median tooth. Parameres greatly stout and long, extending nearly to apex of gonostyli, slightly curved inwards in distal portion, and tapering towards pointed apices. Dorsal processes stout, elongated, and projected laterally.



Figs 90–95. *Minorpa tangzenghuai* sp. nov. 90, 91–93. male. 94–95 – female. 90 – habitus, dorsal view. 91 – genital bulb, left-lateral view. 92 – genital bulb, ventral view. 93 – genital bulb, dorsal view. 94 – subgenital plate, ventral view. 95 – medigynium, ventral view.



Fig. 96. Living male of *Minorpa wangyuyan* sp. nov.

Female. Similar to males in general appearance (Fig. 98) except for forewing with greatly reduced, triangular pterostigmal band.

Female genitalia (Figs 101–102). Subgenital plate oval with slightly truncated apex, and sparse long setae on distal margin. Medigynium with main plate narrowly subtriangular, approximately as long as axis; posterior arms

triangular, and approximately 1/4 as long as main plate; apodemes of axis slightly divergent basally.

Measurements (mm). *Male* (holotype, $n = 1$): AtL 9.4, AbL 7.1, BdL 10.4, FL 10.9, FW 2.7, HL 9.9, HW 2.5. *Female* (paratypes, $n = 3$): AtL 10.4–10.9, AbL 5.8–8.1, BdL 9.1–12.1, FL 11.0–12.5, FW 2.6–2.8, HL 10.4–11.6, HW 2.5–2.7.

Etymology. The new species is named after Yu-Yan Wang, one of the main female characters in the novel *Demi-Gods and Semi-Devils*. Noun in apposition.

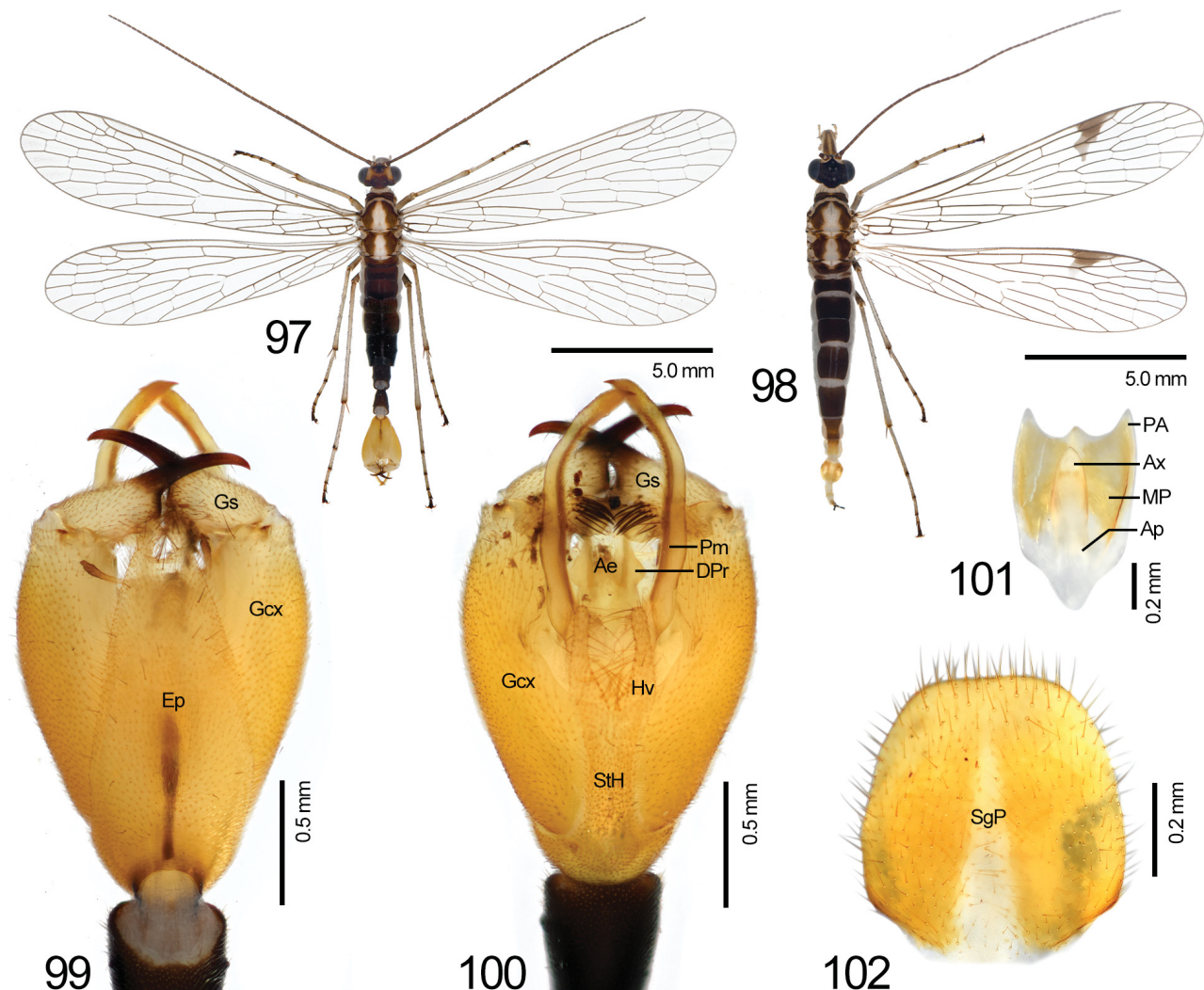
Distribution. China: Yunnan: Dali (Fig. 122).

***Minorpa xiaomizha* sp. nov.**

(Figs 103–114)

Type material. HOLOTYPE: ♂ (CN23Mxmz001), CHINA: YUNNAN: Lijiang Prefecture, Yulong Naxi Autonomous County, Forest near Bangbangchong, 26°40'40.98"N, 99°55'0.66"E, 2760 m, 08.viii.2023, leg. Ji-Shen Wang & Chun-Mei Liao (BMDU). PARATYPES: 3 ♂♂ 3 ♀♀ (CN23Mxmz002–007), same data as holotype (BMDU). PARATYPES: 2 ♂♂ 5 ♀♀ (CN23Mxmz008–014), Forest near Fuguo Temple, southern slope of the Yulong Snow Mountain, 26°56'48.88"N, 100°11'19.33"E, 2960 m, 09.viii.2023, leg. Ji-Shen Wang & Chun-Mei Liao (BMDU).

Diagnosis. The new species closely resembles *M. dali*



Figs 97–102. *Minorpa wangyuyan* sp. nov. 97, 99–100 – male. 98, 101–102 – female. 97–98 – habitus, dorsal view. 99 – genital bulb, dorsal view. 100 – genital bulb, ventral view. 101 – medigynium, ventral view. 102 – subgenital plate, ventral view.



Fig. 103. Living female of *Minorpa xiaomizha* sp. nov.

(Wang, 2021) in the morphology of the male genital bulb, especially narrow hypoalves and disc-shaped basal lobe of gonostyli. However, it can be readily differentiated from the latter by the following characters: i) pale yellowish body color (vs. yellowish brown); ii) wings devoid of markings (vs. apical, pterostigmal and

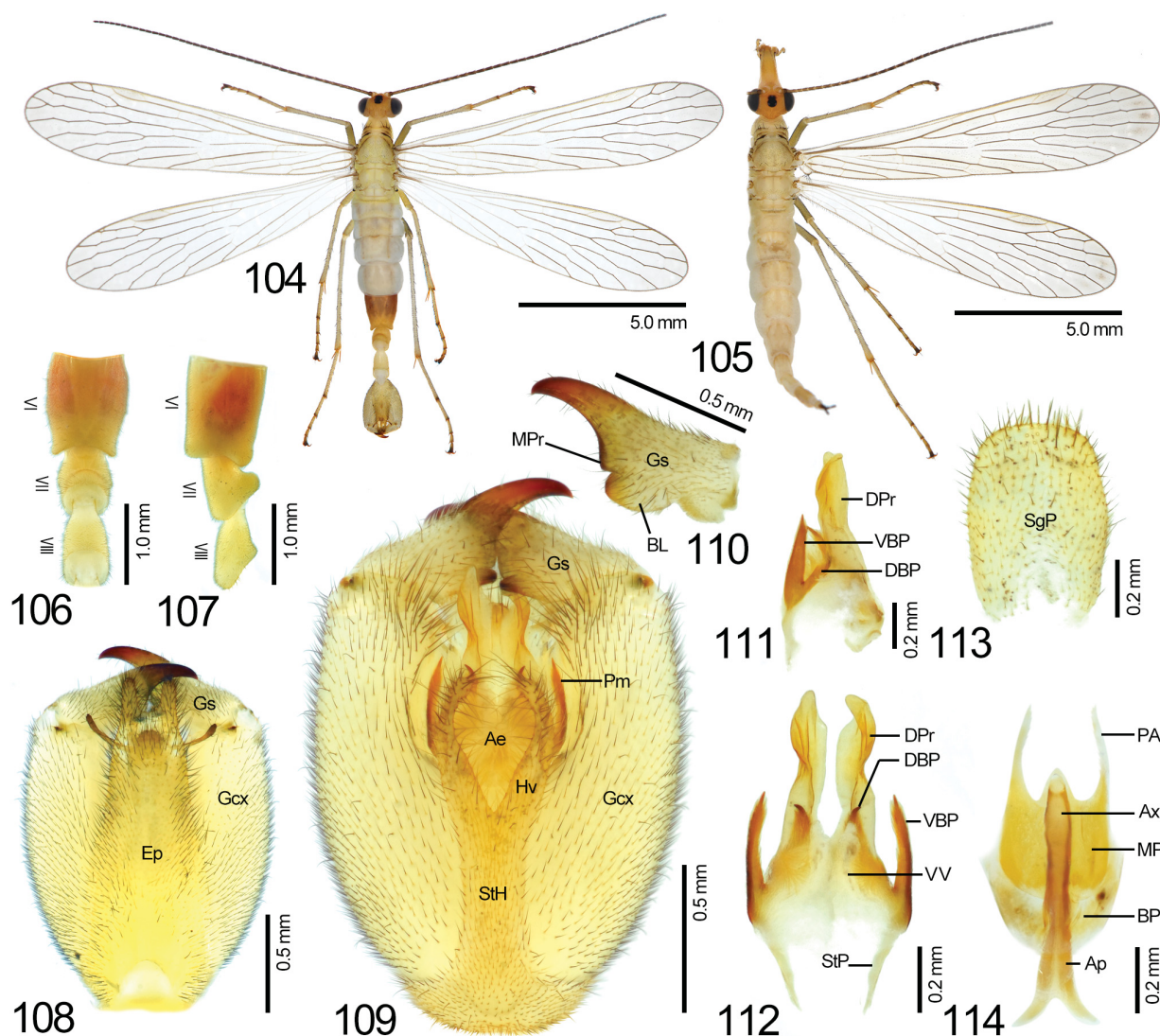
basal band scattered into several small spots); in males, iii) A7 greatly humped on dorsal apex (vs. hump lacking); iv) parameres with dorsal branch slender, arcuate, and bearing numerous microtrichia (vs. lobate and bearing a row of long stout spine); and in females, v) medigynium with posterior arms approximately as long as main plate (vs. shorter).

Description. Male. Head (Fig. 104). Vertex, occiput and rostrum yellowish brown, ocellar triangle black. Antennae scape yellowish brown, pedicel dark brown, flagellum dark brown.

Thorax (Fig. 104). Pronotum yellow with anterior and posterior margins blackish, and with four or five stout setae along each side of anterior margin. Meso- and metanotum yellow or rarely brown laterally. Legs light yellowish brown with distal tarsomeres dark brown.

Wings (Fig. 104). Membrane hyaline, slightly tinged with grayish brown and devoid of markings.

Abdomen (Figs 104, 106–107). T1–T5 pale yellowish brown. A6 yellowish brown, cylindrical, with arcuate emargination on dorsal apex, and forming pair of subtriangular



Figs 104–114. *Minorpa xiaomizha* sp. nov. 104, 106–112 – male. 105, 113–114 – female. 104–105 – habitus, dorsal view. 106 – A6–A8, dorsal view. 107 – A6–A8, left-lateral view. 108 – genital bulb, dorsal view. 109 – genital bulb, ventral view. 110 – right gonostylus, ventral view. 111 – aedeagal complex, right-lateral view. 112 – aedeagal complex, ventral view. 113 – subgenital plate, ventral view. 114 – medigynium, ventral view.

lobes laterally. A7 and A8 yellow, A7 greatly humped on dorsal apex, A8 slightly longer than A7, constricted basally and beveled apically.

Male genitalia (Figs 108–112). Hypandrium Y-shaped and approximately $3/4$ as long as gonocoxites, with long basal stalk and split into pair of hypovalves in distal half. Hypovalves narrow, divergent and tapering towards apex, and approximately $3/4$ as long as basal stalk. Gonostyli shorter than half length of gonocoxites, with disc-shaped basal lobe and subtriangular median tooth. Parameres bifurcated, with dorsal branch arcuate and covered with numerous microtrichia; ventral branch slightly curved inward and tapering towards apex. Dorsal processes stout, greatly elongated, nearly parallel but slightly convergent apically, with longitudinal groove, and curled marginally.

Female. Similar to males in general appearance (Fig. 105) except for light yellowish T6–T8.

Female genitalia (Figs 113–114). Subgenital plate oval with rounded apex and sparse long setae on distal margin. Medigynium with developed and subtriangular basal plate; main plate nearly quadrate, approximately $1/2$ as long as axis; posterior arms slender, slightly longer than main plate; apodemes greatly divergent at base.

Measurements (mm). *Male* (holotype and paratypes, $n = 4$): AtL 7.0–9.0, AbL 4.9–7.1, BdL 7.8–10.2, FL 8.9–10.1, FW 2.2–2.4, HL 8.0–9.1, HW 2.1–2.2. *Female* (paratypes, $n = 8$): AtL 8.8–9.1, AbL 5.9–8.1, BdL 8.2–11.0, FL 10.5–11.0, FW 2.1–2.3, HL 9.5–10.0, HW 2.0–2.2.

Etymology. This species is named using the Yunnan dialect word ‘xiaomizha’, which means something very small and adorable, in reference to its diminutive body size and attractive coloration. Treated as a noun in apposition.

Distribution. China: Yunnan: Yunlong (Fig. 122).

Minorpa zhongling sp. nov.

(Figs 115–121)

Type material. HOLOTYPE: ♂ (CN23Mzh1001), CHINA: YUNNAN: Dali Bai Autonomous Prefecture, Binchuan County, Mount Jizu, 25°58'15.16"N, 100°21'44.06"E, 2930 m, 27.vi.2023, leg. Ji-Shen Wang (BMDU). PARATYPES: 22 ♂♂ 3 ♀♀, (CN23Mzh1002–026), same data as holotype (BMDU).

Diagnosis. The new species is superficially similar to *M. liqushui* sp. nov. in elongated male parameres, but can be easily distinguished from the latter by the following characters: i) head mostly yellowish orange with only ocellar triangle black (vs. all shining black); in males, ii) hypovalves of hypandrium with subbasal projection on inner margin (vs. projection lacking); iii) parameres lacking spine (vs. bearing inner spine on subbasal portion); and in females, iv) medigynium with axis very long, approximately twice as long as main plate (vs. short, approximately as long as main plate).

It also resembles *M. duanzhengming* sp. nov. and *M. wangyuyan* sp. nov. in greatly elongated male parameres and the inner projection on hypovalves. It can be differentiated from *M. duanzhengming* sp. nov. by the following characters: in males, i) hypandrium approximately $2/3$ as long as gonocoxites (vs. $9/10$); ii) gonostyli with disc-shaped basal lobe (vs. earlobe-shaped basal lobe); and in



Fig. 115. Living male of *Minorpa zhongling* sp. nov.

females, iii) medigynium with posterior arms short and thin, approximately $1/3$ as long as main plate (vs. very short and stout, and approximately $1/8$ as long as main plate); iv) axis very long, about twice the length of main plate, and exposed in female medigynium (vs. axis short, approximately half as long as main plate, and entirely concealed in female medigynium).

From *M. wangyuyan* sp. nov. it differs in the following characters: in males, i) parameres elongated, not reaching apex of gonostyli (vs. markedly longer, extending nearly to apex of gonostyli); and in females, ii) subgenital plate oval with rounded apex (vs. with slightly truncated apex); iii) medigynium with main plate half as long as axis (vs. approximately as long as axis).

Description. Male. Head (Fig. 116). Vertex and occiput yellowish orange, ocellar triangle black.

Thorax. Pronotum black with inner margins yellowish and with five or six stout setae along each side of anterior margin. Meso- and metanotum black laterally with discontinuous pale yellowish median stripe. Pleura and legs brown with distal tarsomeres dark brown.

Wings (Fig. 116). Membrane hyaline, slightly tinged with grayish brown and devoid of markings. Pterostigma pale brown.

Abdomen (Fig. 116). T1–T5 shining black. A6 shining black, cylindrical. A7 blackish brown, nearly cylindrical, A8 blackish brown with yellow apex, constricted basally and slightly beveled at dorsal apex.

Male genitalia (Figs 118–119). Epandrium with deep U-shaped terminal emargination, forming two long finger-like processes. Hypandrium Y-shaped and approximately $2/3$ as long as gonocoxites, with slender basal stalk approximately $4/5$ as long as hypovalves. Hypovalves divergent in basal half and nearly parallel in apical half, bearing long bristles along inner margin, and with rounded projection on inner margin. Gonostyli approximately $3/5$ as long as gonocoxites, with disc-shaped basal lobe and subtriangular median tooth. Parameres elongated, covered with numerous microtrichia on each branch, and greatly curved inward in distal half. Dorsal processes stout, elongated, and nearly parallel.

Female. Similar to males in general appearance (Fig. 117), but with speckled apical band in fore- and hindwings.

Female genitalia (Figs 120–121). Subgenital plate oval with rounded apex, and sparse long setae on distal margin. Medigynium with main plate half as long as axis, and slightly curled marginally; posterior arms short and thin, approximately 1/3 as long as main plate; axis very long, broadest in distal 1/3. Apodemes slightly divergent basally.

Measurements (mm). *Male* (holotype and paratypes, $n = 23$): AtL 10.5–10.9, AbL 6.5–7.1, BdL 10.1–10.8, FL 10.9–12.3, FW 2.8–2.9, HL 10.0–11.4, HW 2.6–2.8. *Female* (paratypes, $n = 3$): AtL 9.8–10.3, AbL 5.8–6.5, BdL 8.9–9.6, FL 11.3–12.4, FW 2.7–2.9, HL 10.3–11.2, HW 2.5–2.7.

Etymology. The new species is named after Ling Zhong, a female character in the novel *Demi-Gods and Semi-Devils*. Noun in apposition.

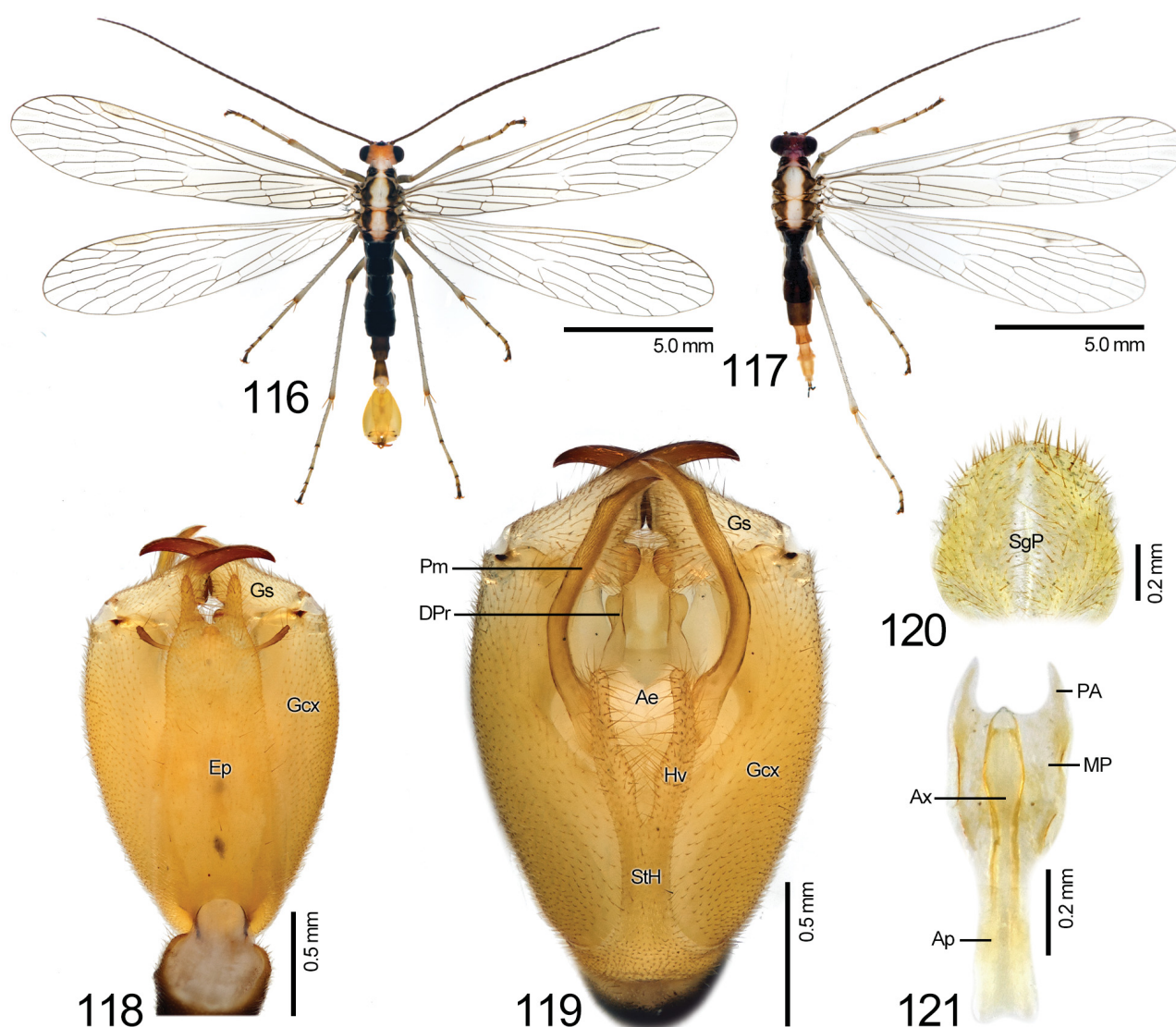
Distribution. China: Yunnan: Binchuan (Fig. 122).

Wornorpa gen. nov.

(Fig. 123)

Type species. *Panorpa wormaldi* MacLachlan, 1875, here designated.

Diagnosis. Members of this genus are similar to those of *Minorpa* gen. nov., *Furcatopanorpa*, and the *Panorpa involuta* group in roof-like wing posture. They can be differentiated from *Minorpa* gen. nov. by the structure of the male and female genitalia (see WANG & SUZUKI 2022: figs 1–5): in males, i) hypandrium usually U-shaped with broad hypovalves (vs. usually Y-shaped with slender hypovalves); ii) ventral valves of aedeagus greatly sclerotized (vs. membranous); iii) lateral processes of aedeagus greatly elongated (vs. short and simple); in females, iv) medigynium with greatly developed dorsal plate (vs. lacking dorsal plate); and v) medigynium with a pair of posterior arms longer than poorly developed main plate (vs. posterior arms usually shorter than greatly developed main plate).



Figs 116–121. *Minorpa zhongling* sp. nov. 116, 118–119 – male. 117, 120–121 – female. 116–117 – habitus, dorsal view. 118 – genital bulb, dorsal view. 119 – genital bulb, ventral view. 120 – subgenital plate, ventral view. 121 – medigynium, ventral view.

They can be differentiated from *Furcatopanorpa* by the following characters: i) smaller body size with forewings usually shorter than 14.0 mm (vs. forewings usually longer than 15.0 mm); ii) male notal and postnotal organs present (vs. absent); iii) female medigynium with posterior apex of axis short and simple (vs. greatly elongated and bifurcated); and from the *P. involuta* group by broader hypoalves (vs. usually slender and thread-like), and aedeagus with simple ventral valves (vs. greatly elongated and beak-like).

Etymology. The generic name is combined from ‘wor-’ (the prefix of the specific name of the type species, *P. wormaldi*) and ‘-norpa’ (root suffix for *Panorpa*). Feminine.

Distribution. China and Japan (WANG & SUZUKI 2022).

Remarks. The members of this new genus were recently reviewed and well-illustrated as the *P. wormaldi* group by WANG & SUZUKI (2022). Therefore, we do not provide detailed morphological illustrations, descriptions, key to species, and distributional map for them.

Species list of *Wornorpa* gen. nov.

(19 species)

W. amamiensis (Miyamoto & Makihara, 1984) **comb. nov.**

Japan: Kagoshima (Amami) (WANG & SUZUKI 2022)

W. fengyang (Wang & Suzuki, 2022) **comb. nov.**

China, Zhejiang (Mount Fengyang) (WANG & SUZUKI 2022)

W. gressitti (Byers, 1970) **comb. nov.**

China: Guangdong (Conghua, Shaoguan, and Shixing) (WANG & SUZUKI 2022)

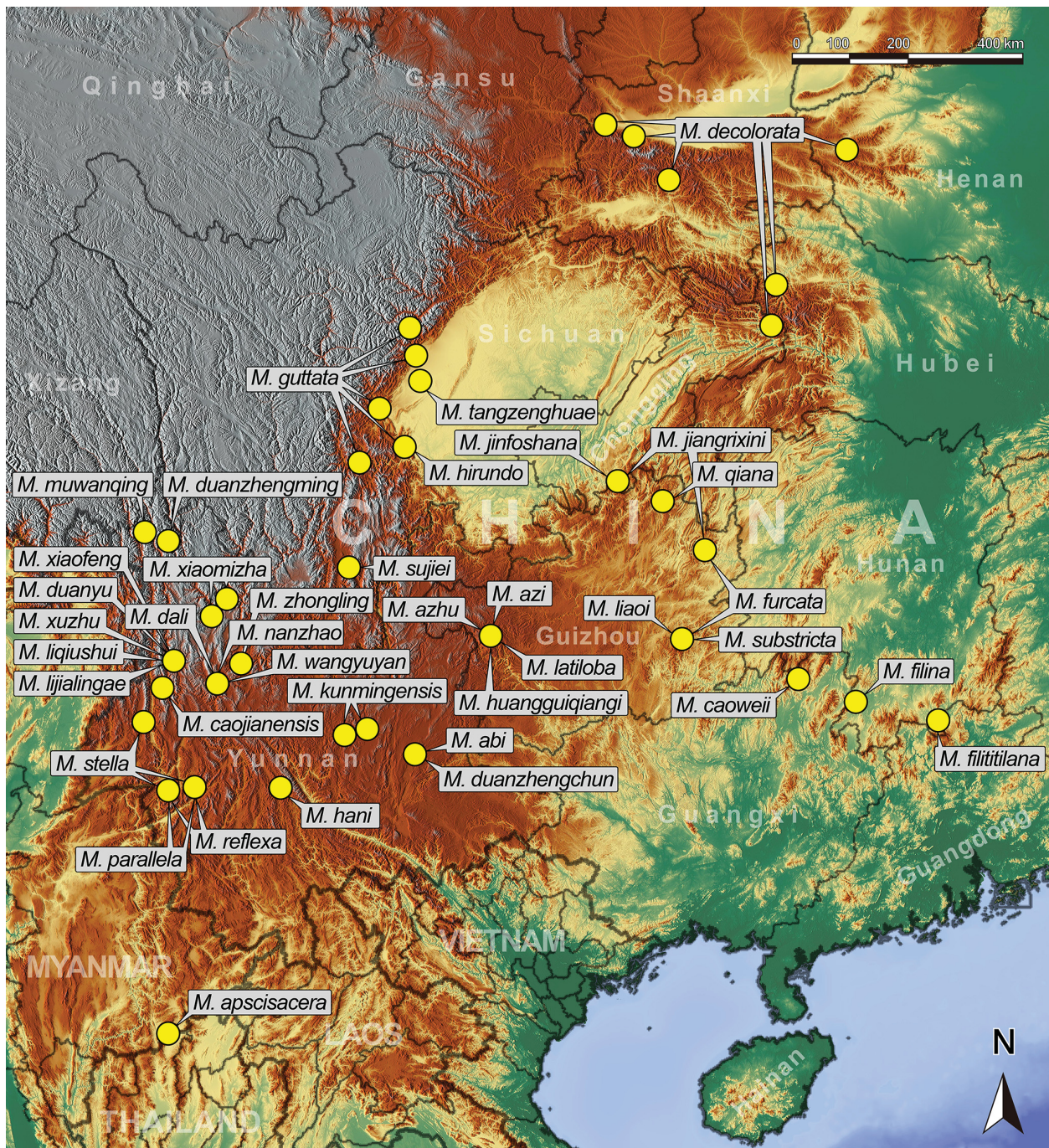


Fig. 122. Distribution of 39 species of *Minorpa* gen. nov., updated from WANG & GONG (2021). Yellow dots indicate locations of each species.

- W. hiurai* (Miyamoto, 1985) **comb. nov.**
Japan: Honshu (Shiga) (WANG & SUZUKI 2022)
- W. implicata* (Cheng, 1957) **comb. nov.**
China: Fujian (Shaowu) and Jiangxi (Zixi) (WANG & SUZUKI 2022)
- W. kiusiuensis* (Issiki, 1929) **comb. nov.**
China: Japan: Kyushu (Fukuoka, Kagoshima, Kumamoto, Oita, Saga) (WANG & SUZUKI 2022)
- W. longiramina* (Issiki & Cheng, 1947) **comb. nov.**
China: Taiwan (Chiayi, Nantou, and Taitung) (WANG & SUZUKI 2022)
- W. multifasciaria* (Miyaké, 1910) **comb. nov.**
Japan: Honshu (Gifu, Hiroshima, Hyōgo, Nagano, and Toyama) (WANG & SUZUKI 2022)
- W. nudiramus* (Byers, 2002) **comb. nov.**
China: Taiwan (Hualien and Nantou) (WANG & SUZUKI 2022)
- W. obliqua* (Carpenter, 1945) **comb. nov.**
China: Jiangxi (Xunwu) (WANG & SUZUKI 2022)
- W. obliquifascia* (Chou & Wang, 1987) **comb. nov.**
China: Guangdong (Nanling Mountains) and Hunan (Mangshan Mountains) (WANG & SUZUKI 2022)
- W. ochraceocauda* (Issiki, 1927) **comb. nov.**
China: Taiwan (Nantou) (WANG & SUZUKI 2022)
- W. okinawaensis* (Nakamura, 2009) **comb. nov.**
Japan: Okinawa (Okinawa-jima) (WANG & SUZUKI 2022)
- W. peterseana* (Issiki, 1927) **comb. nov.** Chi-
na: Taiwan (Chiayi, Nantou, and Pingtung) (WANG & SUZUKI 2022)
- W. striata* (Miyaké, 1908) **comb. nov.**
Japan: Shikoku (Ehime and Tokushima) (WANG & SUZUKI 2022)
- W. tokunoshimaensis* (Nakamura, 2009) **comb. nov.**
Japan: Ryukyu Islands (Tokuno-shima) (WANG & SUZUKI 2022)
- W. tsunekatanis* (Issiki, 1929) **comb. nov.**
China: Japan: Honshu (Aichi, Ishikawa, Nagano, Niigata, Shinano, Toyama, and Yamanashi) (WANG & SUZUKI 2022)
- W. wormaldi* (MacLachlan, 1875) **comb. nov.**
Japan: Honshu (Kanagawa, Nagano, Nara, Tokyo, and Yamanashi) (WANG & SUZUKI 2022)
- W. zhuohengi* (Wang & Suzuki, 2022) **comb. nov.**
China: Guangdong (Fengkai) (WANG & SUZUKI 2022)

Discussion

Scorpionflies of the family Panorpidae are generally adapted to mesic and cool-climate (SU et al. 2023). In order to avoid the summer heat, they developed two strategies: either live in high-altitude mountainous regions or emerge as adults in early spring or autumn in lower mountains and plains (WANG & HUA 2022). Correspondingly, members of the genus *Minorpa* gen. nov. exhibit two categories of climate preference. Some species (e.g., *M. guttata*, *M. dali*, *M. xiaofeng*, and *M. xuzhu*) prefer high-altitude, mountainous regions with cool summer temperatures (usually above 1000 m, with *M. hirundo* the highest, inhabiting the top of Mount Emei at approximately 3000 m). Some others (e.g., *M. tangzenghuai* sp. nov.), however, emerge as adults in autumn and are still active in lower plains and mountains around an elevation of 600 m. According to our limited knowledge, all the members of *Wornorpa* gen. nov. emerge as adults only in spring and early summer, and perish before the end of August (WANG & SUZUKI 2022).

Members of *Minorpa* gen. nov. often inhabit dense and low (20–60 cm) herbaceous vegetation (WANG & GONG 2021), preferring to move among deeply shaded twigs and leaves, and are usually most abundant in deeply shaded ravi-



Fig. 123. Living male of *Wornorpa gressitti* (Byers, 1970).

nes. Their flight ability is relatively reduced, resulting in weak migratory capacity (WANG & GONG 2021). The mountainous regions of southwestern China (hereafter referred to as MSC), also known as the Hengduan Mountains and adjacent areas, feature complex topographical conditions and are recognized as biodiversity hotspots (HE & JIANG 2014). In the MSC, the diverse habitats created by the complex terrain support the exceptionally high biodiversity and endemism of *Minorpa* gen. nov. For instance, at Mount Cangshan (Yunnan), there are three species: *M. dali*, *M. nanzhao*, and *M. wangyuyan* sp. nov.; at Meihua Mountain (Guizhou), *M. azhu* sp. nov. and *M. azi* sp. nov. coexist; and at Wubao Mountain (Yunnan), several sympatric species can be found, including *M. xiaofeng*, *M. xuzhu*, *M. duanyu*, *M. lijialingae* sp. nov., and *M. liqiushui* sp. nov., etc.

In addition, the wings of *Minorpa* gen. nov. and *Wornorpa* gen. nov. are usually held roof-like (Figs 1–3, 6, 9, 10, 103, 115) or horizontally (Figs 4, 5, 7, 8, 11, 96) over the abdomen when at rest, unlike most scorpionflies that usually rest on leaf surfaces with a V-shaped wing posture (WANG & HUA 2022). This posture is similar to that of the monotypic genus *Furcatopanorpa*, which is peculiar in the family due to the lack of notal and postnotal organ in male abdomen (MA & HUA 2011, ZHONG et al. 2015). In the Panorpidae, the roof-like or horizontal postures of wings are likely independently evolved in several distantly related groups, e.g., the *Neopanorpa denticulata* group (*Neopanorpa*inae) from India, the *Panorpa cornigera* group from northeastern Asia (WANG & HUA 2021), the *P. involuta* and the *P. lugubris* groups from North America (BICHA 2006), and some species in the genus *Dicerapanorpa* (WANG 2022). These adaptations might give these insects some advantages when they move across the dense vegetation. It is also worth mentioning that some species of *Wornorpa* gen. nov., such as *W. peterseana* from Taiwan (China), tend to stay on tree-canopy blossoms and require a net with an extension handle to capture them (BICHA et al. 2020).

The males of the genus *Minorpa* gen. nov. can be divided into two major categories based on two distinct features: i) the dorsal apex of A6 is significantly concave in middle and forming a pair of morphologically diverse projections laterally. For example, in *M. guttata*, A6 bears a deep median emargination on the dorsal apex, forming a pair of truncated lobes laterally; in *M. huangguiqiangi* and *M.*

abi sp. nov., A6 bears a shallow arcuate emargination on the dorsal apex, and forms a pair of broad triangular lobes laterally. These variations can be observed in 19 species; ii) A6 is simple and cylindrical in the remaining 20 species. The specialized structures on the dorsal apex of A6 are speculated to be related to the non-genital contact between males and females during copulation. For instance, in the mating behavior of *M. kunmingensis*, these structures are used to clasp the female's terminal abdomen (WANG & HUA 2022). Further observations of the mating behavior within the genus *Minorpa* gen. nov. are necessary to confirm the functional spectrum of these specialized structures.

According to recent phylogenetic analyses based on morphological data (WANG & HUA 2021), the representative species of *Minorpa* gen. nov. and *Wornorpa* gen. nov. form two monophyletic clades that are sister to each other. The monophyly of the representatives of the *Panorpa guttata* group has also been supported by morphological data combining mitochondrial and nuclear DNA sequences (HU et al. 2015, MIAO et al. 2019). However, the molecular data are still lacking for the *P. wormaldi* group, which was recently reviewed and characterized by a series of synapomorphies (WANG & SUZUKI 2022). Additionally, A7 and A8 of these two genera are not elongated and constricted basally as in most members of the Panorpinae (for example, the type species of the genus *Panorpa*, *P. communis* Linnaeus, 1758). Similarly, the monotypic genus *Furcatopanorpa* shows cylindrical and unelongated male A7 and A8 (MA & HUA 2011). By contrast, the two recently erected genera, *Calliopanorpa* and *Mavropanorpa*, exhibit cylindrical but variously elongated male A7 and A8 (WILLMANN 2024). Therefore, the establishment of the two new genera is a further step in resolving the paraphyly of the genus *Panorpa*.

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