European Journal of Taxonomy 1115: 1–32
https://doi.org/10.5852/ejt.2026.1115.3349
europeanjournaloftaxonomy.eu
ISSN 2118-9773
2026 · Wang J.-S.
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Received: 22 January 2026 • *Accepted: 25 September 2026* • *Published: 4 November 2026*

Topic editor: Tony Robillard • *Section editor: Torbjørn Ekrem* • *Desk editor: Kristiaan Hoedemakers*

Research article

urn:lsid:zoobank.org:pub:1D08B571-92B0-4C97-986F-27AC9C41AE58

Systematic revision of the *Panorpa deceptor* group (Mecoptera: Panorpidae), with descriptions of seven new species from China

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Abstract. The scorpionfly genus *Panorpa* Linnaeus, 1758 is confirmed paraphyletic, with East Asia as a major center of diversity. The *Panorpa deceptor* group previously comprised 39 species distributed in China, Japan, and Thailand; however, many morphological characters traditionally used are non-diagnostic, and species diversity within the group has been underestimated. Here, I provide a checklist, key to species, and a distribution map for this group, and discuss its evolutionary and biogeographical implications. Seven species are described as new: *P. acharya* sp. nov., *P. dujingzhei* sp. nov., *P. huboliao* sp. nov., *P. lahu* sp. nov., *P. temperata* sp. nov., *P. yixini* sp. nov., and *P. zhengxinyiae* sp. nov. New material of *P. auripennis* Bicha, 2019 from China is also illustrated and discussed. This revision updates the species number for this group from 39 to 46, and provides a basis for future studies on the taxonomy and phylogeny of *Panorpa*.

Keywords. Scorpionflies, taxonomy, species diversity, morphology, identification key, East Asia.

Wang J.-S. 2026. Systematic revision of the *Panorpa deceptor* group (Mecoptera: Panorpidae), with descriptions of seven new species from China. *European Journal of Taxonomy* 1115: 1–32.
https://doi.org/10.5852/ejt.2026.1115.3349

Introduction

The scorpionfly genus *Panorpa* Linnaeus, 1758 is the most species-rich and taxonomically complex genus within the family Panorpidae Latreille, 1802 (Mecoptera Packard, 1886), comprising more than 250 described species worldwide (Wang & Hua 2022; Xie & Wang 2025a, 2025b; Gómez-Jácome & Contreras-Ramos 2026). Species of *Panorpa* are widely distributed across the Holarctic region, with East Asia recognized as one of the major centers of species diversity (Wang & Hua 2021, 2022). Based on morphological and molecular evidence (Miao *et al*. 2019; Wang & Hua 2021), *Panorpa* has been confirmed to be paraphyletic. An unofficial rank, the species group, is used to organize closely related species (Carpenter 1936, 1938; Cheng 1957a, 1957b; Wang & Hua 2021).

Since 2008, the generic framework of Panorpinae Latreille, 1802 has undergone substantial revision with the recognition of several new genera from previous species or groups under *Panorpa*. A series

of new genera were established in East and South Asia, including *Cerapanorpa* Gao, Ma & Hua, 2016 (= *P. centralis* group), *Dicerapanorpa* Zhong & Hua, 2013 (= *P. diceras* group), *Furcatopanorpa* Ma & Hua, 2011, *Megapanorpa* Wang & Hua, 2019, and *Sinopanorpa* Cai & Hua in Cai *et al*., 2008 from China, *Minorpa* Xie & Wang, 2025 (= *P. guttata* group) from China and Thailand, as well as *Calliopanorpa* Willmann, 2024 (= *P. nikkoensis* group) from Japan, and *Mavropanorpa* Willmann, 2024 (= *P. amurensis* group and *P. japonica* group) and *Wornorpa* Xie & Wang, 2025 (= *P. wormaldi* group) occurring in both China and Japan. Each of these taxonomic acts effectively redefined the boundaries of *Panorpa* by removing morphologically or evolutionarily distinct lineages. Despite these refinements, *Panorpa* remains poorly circumscribed with more than 18 groups left (Wang & Hua 2021), failing to reflect inferred phylogenetic relationships or consistent morphological affinities, and thus represents an artificial assemblage rather than a natural genus (Willmann 2024). Recent studies (Wang 2024; Wang & Zhao 2024) have provided preliminary reassessments of the remaining *Panorpa* groups, laying the groundwork for their future taxonomic treatment.

The *Panorpa deceptor* group was originally established by Issiki (1929a, 1929b) and summarized by Issiki (1933) and Issiki & Cheng (1947) to accommodate a set of morphologically similar species characterized by: (1) rostrum extremely long; (2) wing narrow with moderate macrotrichiation; (3) seventh and eighth male abdominal segments (A7 and A8) exceedingly elongated; (4) hypovalves flattened; gonostyli elongate, basal process reduced; and (5) dorsal valves of aedeagus (= dorsal titilator) rather broad. However, characters such as an extremely elongated rostrum, wing macrotrichiation, and flattened hypovalves are likely non-diagnostic, as they have evolved independently in distantly related lineages within the family (Wang & Hua 2021). Consequently, a redefinition and comprehensive systematic revision of the *P. deceptor* group are urgently required.

Thirty-nine known species of the *Panorpa deceptor* group are primarily distributed in East Asia, particularly in China (Issiki 1929a, 1929b; Issiki & Cheng 1947; Wang & Hua 2019, 2021, 2022), Japan (Ogai 2025), and Thailand (Bicha 2019; Bicha *et al*. 2022), where complex topography and diverse habitats have promoted species diversification. However, the taxonomy of the *Panorpa deceptor* group remains problematic. Several species were originally described based on limited material, often with brief descriptions and inadequate illustrations, making reliable identification difficult. Moreover, the discovery of abundant newly collected material from China in recent years has revealed previously unrecognized morphological variation, suggesting that species diversity within the group has been underestimated. As a result, the current classification of the *P. deceptor* group does not adequately reflect its true species diversity.

In the present study, I provide a systematic revision of the *Panorpa deceptor* group based on extensive material from China. Seven new species are described and illustrated in detail, updating the species number of this group from 39 to 46. A checklist, identification key, and distribution map are provided for the group, and its evolutionary and biogeographical implications are also discussed.

Material and methods

All specimens examined in this study are deposited in Anhui Normal University (AHNU) and the Biological Science Museum, Dali University (BMDU). Adult scorpionflies were collected using nets and preserved either in 95% ethanol or pinned. Genitalia were dissected under an Olympus SZX7 stereo microscope using forceps and dissecting needles. After removal of muscles and other soft tissues, sclerotized structures were cleared in 10% sodium hydroxide at 60–80°C for 2–10 min, rinsed with water, and preserved in glycerin.

Measurements and observation were made under a Keyence VHX-7000 digital microscope. Photographs were taken with a Nikon D850 digital camera with a Nikkor AF-S Micro 105 mm f/2.8 lens (habitus), or

a Canon R5 digital camera with a Canon MP-E 65 mm f/2.8 1–5× macro lens or a Mitutoyo 10× M Plan Apochromatic Objective (remaining images). Female habitus images in dorsal view were modified to omit the left antenna, wings, and legs. All images were adjusted and assembled using Adobe Photoshop CC.

Terminology follows Wang & Hua (2021), Wang (2024), and Wang & Zhao (2024).

The following acronyms and abbreviations are used in the main text:
A1 = first abdominal segment (and so forth for other segments)
AbL = abdomen length
AtL = antenna length
BdL = body length
FL = forewing length
FW = forewing width
HL = hindwing length
HW = hindwing width
ORs = origin of radial sector
S1 = first sternum (and so forth for other sternites)
T1 = first tergum (and so forth for other tergites)

The following abbreviations and acronyms are applied in the figure annotations:
Ae = aedeagus
Ap = apodeme
Ax = axis
BL = basal lobe
BP = basal plate
Ce = cercus
DBP = dorsal branch of paramere
DPr = dorsal process of aedeagus
DV = dorsal valve of aedeagus
Ep = epandrium
Gcx = gonocoxite
Gs = gonostylus
Hv = hypovalve
LPr = lateral process
Ltg = laterotergite
MP = main plate
MPr = median process
PA = posterior arm
Pm = paramere
SgP = subgenital plate
StH = stalk of hypandrium
StP = stalk of paramere
VBr = ventral bridge of paramere
VBP = ventral branch of paramere
VmP = ventromedial process
VPP = ventromedial posterior process
VV = ventral valve of aedeagus

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Mecoptera Packard, 1886
Infraorder Opisthogonopora Willmann, 1987
Superfamily Panorpoidea Latreille, 1802
Family Panorpidae Latreille, 1802
Subfamily Panorpinae Latreille, 1802
Genus *Panorpa* Linnaeus, 1758

***Panorpa deceptor* group** sensu Issiki (1929a)
Figs 1–10

Revised diagnosis

In Panorpinae, this group differs from *Calliopanorpa* by a less developed notal organ (vs greatly elongated and stick-like) in males; from *Cerapanorpa*, *Dicerapanorpa*, and *Megapanorpa* by the absence of anal horns (vs one or two) in males; from *Furcatopanorpa* by the presence of notal and postnotal organs and elongate abdominal segments A6–A8 (vs absence and unelongated) in males, and simple apex of axis in medigynium (vs bifurcated) in females; and from *Mavropanorpa*, *Minorpa*, and *Wornorpa* by the elongated, basally constricted A7 and A8 (vs unelongated or elongated, cylindrical), and the short and broad dorsal valves of the aedeagus (vs more or less elongated) in males.

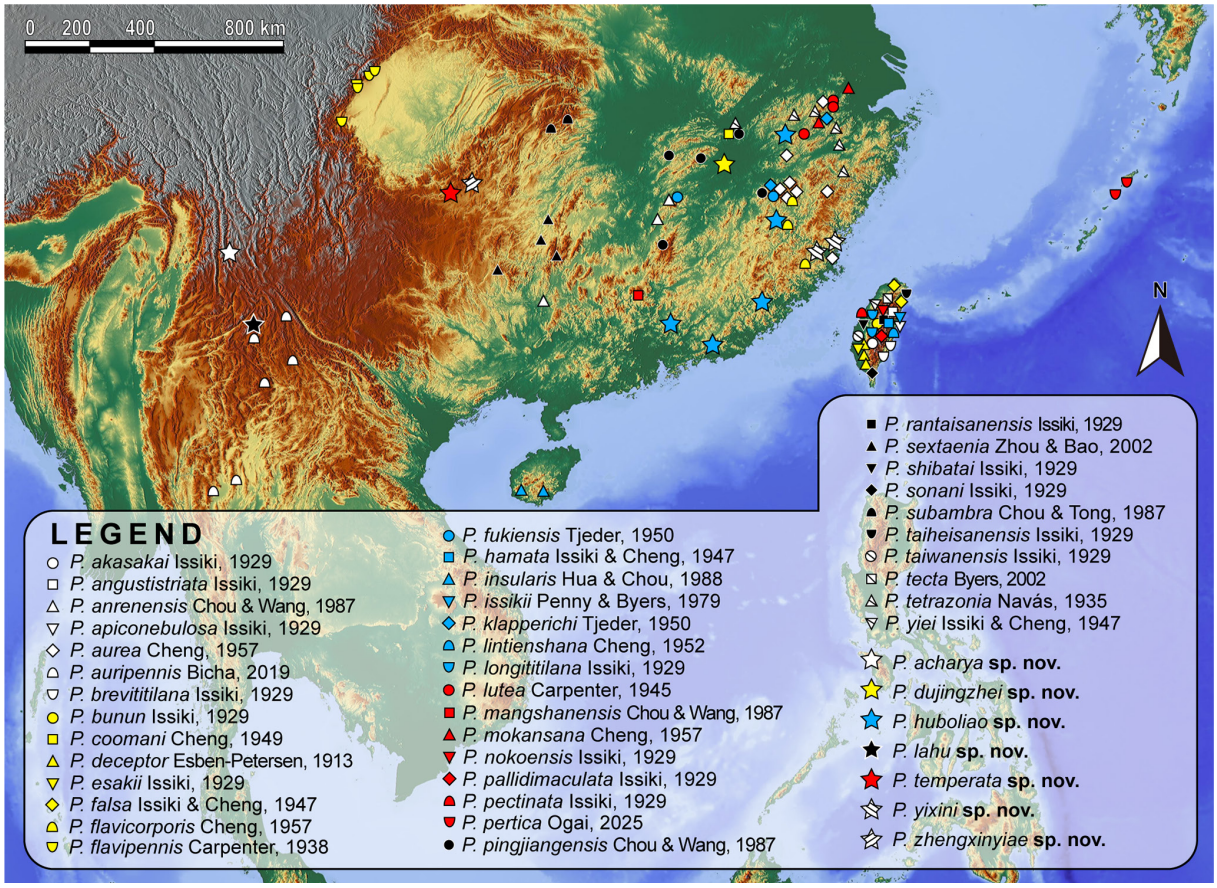


Fig. 1. Distribution of the *Panorpa deceptor* group.

It can be differentiated from the *P. communis* group (including the type species of the genus, *P. communis* Linnaeus, 1758) by the absence of a terminal plate on the gonocoxites (vs presence), parameres usually narrow (vs broad and plate-like), flat S10 (vs greatly protruding) in males, and a less enlarged decorated area of the axis in the medigynium (vs greatly enlarged) in females.

They can be further distinguished from other groups in *Panorpa* by the combination of the following characters: in males, (1) A6 elongated, gradually narrowing posteriorly, with its length less than twice as long as A5; (2) A7 and A8 strongly elongated, with bases markedly constricted; (3) parameres simple, unbranched or bifurcated, usually bearing microtrichia or long spines; (4) dorsal valves of the aedeagus usually short and broad; in females, (5) subgenital plate usually with conspicuous laterotergites; (6) main plate of the medigynium broad; axis extending beyond main plate or concealed; apodemes with basal apexes usually furcated.

Distribution (Fig. 1)

China (eastern, southern, and southwestern mainland, Hainan, and Taiwan), Japan (Amami Islands), and Thailand (Chiang Mai).

Checklist of the *Panorpa deceptor* group

(Distribution information summarized from Esben-Petersen 1913; Issiki 1929a, 1929b; 1933; Carpenter 1938, 1945; Issiki & Cheng 1947; Tjeder 1950; Cheng 1952, 1957a, 1957b; Penny & Byers 1979; Chou *et al*. 1987; Hua & Chou 1998; Zhou & Fan 1998; Hsu *et al*. 1999; Zhou 2001; Byers 2002; Zhou & Bao 2002; Zhou & Zhou 2014; Wang & Hua 2019, 2022; Wang *et al*. 2019; Bicha 2019; Bicha *et al.* 2022; Ogai 2025).

Panorpa acharya sp. nov.	CHINA: Yunnan (Yunlong)
Panorpa akasakai Issiki, 1929	CHINA: Taiwan (Alishan Range)
Panorpa angustistriata Issiki, 1929	CHINA: Taiwan (Hualien)
Panorpa anrenensis Chou & Wang in Chou *et al*., 1987	CHINA: Guangxi (Liuzhou), Hunan (Anren), Jiangxi (Mt Lu, Pingxiang)
Panorpa apiconebulosa Issiki, 1929	CHINA: Taiwan (Hualien)
Panorpa aurea Cheng, 1957	CHINA: Fujian (Chong'an, Fuzhou, Guangze, Shaowu, Wuyi Mountains), Jiangxi (Sanqing Mountain), Zhejiang (Fengyang Mountain, Longwang Mountain)
Panorpa auripennis Bicha, 2019	CHINA: Yunnan (Pu'er, Menghai, Shuangjiang, Zhenyuan); THAILAND: Chiang Mai, Doi Inthanon
Panorpa brevititilana Issiki, 1929	CHINA: Taiwan (Hualien, Taitung)
Panorpa bunun Issiki, 1929	CHINA: Taiwan (Nantou)
Panorpa coomani Cheng, 1957	CHINA: Jiangxi (Mount Lu)
Panorpa deceptor Esben-Petersen, 1913	CHINA: Taiwan (Chiayi, Kaohsiung, Tainan)
Panorpa dujingzhei sp. nov.	CHINA: Jiangxi (Nanchang: Meiling Mountain)
Panorpa esakii Issiki, 1929	CHINA: Taiwan (Alishan Range)
Panorpa falsa Issiki & Cheng, 1947	CHINA: Taiwan (Taipei, New Taipei, Yilan)
Panorpa flavicorporis Cheng, 1957	CHINA: Fujian (Dehua, Nanping, Wuyi Mountains)
Panorpa flavipennis Carpenter, 1938	CHINA: Sichuan: Chongzhou (Anzihe), Pengzhou (Bailuding), Jiguan Mountain, Jiufeng Mountain
Panorpa fukiensis Tjeder, 1950	CHINA: Fujian (Guangze), Jiangxi (Pingxiang)
Panorpa hamata Issiki & Cheng, 1947	CHINA: Taiwan (Hualien)
Panorpa huboliao sp. nov.	CHINA: Fujian (Nanjing, Nanping), Jiangxi (Wuyuan), Guangdong (Conghua, Huidong)
Panorpa insularis Hua & Chou, 1998	CHINA: Hainan (Diaoluo Mountain, Jianfeng Ridge)

Panorpa issikii Penny & Byers, 1979	CHINA: Taiwan (Hualien)
= *Panorpa acuta* Issiki & Cheng, 1947, preoccupied by *Panorpa acuta* Carpenter, 1931	
Panorpa klapperichi Tjeder, 1950	CHINA: Fujian (Guangze), Zhejiang (Qingliang Peak)
Panorpa lahu sp. nov.	CHINA: Yunnan (Lincang)
Panorpa lintienshana Cheng, 1952	CHINA: Taiwan (Hualien)
Panorpa longititilana Issiki, 1929	CHINA: Taiwan (Chiayi, Nantou)
Panorpa lutea Carpenter, 1945	CHINA: Anhui (Huangshan Mountain), Zhejiang (Mount Jinhua, Longwang Mountain, Tianmu Mountain)
Panorpa mangshanensis Chou & Wang in Chou *et al*., 1987	CHINA: Hunan (Mangshan Mountains)
Panorpa mokansana Cheng, 1957	CHINA: Zhejiang (Mount Mogan)
= *Panorpa wrightae* Cheng, 1957, synonymized by Wang *et al.* (2019)	
Panorpa nokoensis Issiki, 1929	CHINA: Taiwan (Nantou)
Panorpa pallidimaculata Issiki, 1929	CHINA: Taiwan (Nantou)
Panorpa pectinata Issiki, 1929	CHINA: Taiwan (Chiayi, Nantou)
Panorpa pertica Ogai, 2025	JAPAN: Amami Islands
Panorpa pertica okadai Ogai, 2025	JAPAN: Tokunoshima Island
Panorpa pertica pertica Ogai, 2025	JAPAN: Amami-Oshima Island
Panorpa pingjiangensis Chou & Wang in Chou *et al*., 1987	CHINA: Hunan (Pingjiang, Yanling), Jiangxi (Zixi, Mount Lu)
Panorpa rantaisanensis Issiki, 1929	CHINA: Taiwan (Nantou)
Panorpa sextaenia Zhou & Bao, 2002	CHINA: Guangxi (Longsheng), Guizhou (Liping, Maolan), Hunan (Huitong)
Panorpa shibatai Issiki, 1929	CHINA: Taiwan (Alishan Range)
Panorpa sonani Issiki, 1929	CHINA: Taiwan (Pingtung)
Panorpa subambra Chou & Tong in Chou *et al*., 1987	CHINA: Taiwan (Yilan)
Panorpa taiheisanensis Issiki, 1929	CHINA: Taiwan (Yilan)
Panorpa taiwanensis Issiki, 1929	CHINA: Taiwan (Chiayi, Nantou)
Panorpa tecta Byers, 2002	CHINA: Taiwan (Nantou)
Panorpa temperata sp. nov.	CHINA: Guizhou (Xishui)
Panorpa tetrazonia Navás, 1935	CHINA: Anhui (Huangshan, Taiping), Jiangxi (Mount Lu), Zhejiang (Jinhua, Lishui, Tonglu, Qingliang Ridge)
Panorpa yiei Issiki & Cheng, 1947	CHINA: Taiwan (Alishan Range)
Panorpa yixini sp. nov.	CHINA: Fujian (Fuzhou, Yongtai)
Panorpa zhengxinyiae sp. nov.	CHINA: Guizhou (Suiyang)

Key to species of the *Panorpa deceptor* group

(44 spp., *P. klapperichi* and *P. insularis* are not included due to males unknown)

1. Wing markings greatly reduced (water-stain-like), or absent 2
– Wing markings well developed 10

2. Hindwings broad, as wide as or wider than forewings 3
– Hindwings narrower than forewings 6

3. Male parameres unbranched, greatly elongated, exceeding basal lobe of gonostylus; female medigynium with posterior arms shorter than main plate 4
– Male parameres bifurcated, not exceeding basal lobe of gonostylus; female medigynium with posterior arms longer than main plate 5

4. Male basal lobe of gonostyli not split; parameres extending far beyond middle of gonostyli; female medigynium with apodemes of axis concealed in main plate ..... ***P. zhengxinyiae*** sp. nov.
– Male basal lobe of gonostyli bilobed; parameres not exceeding middle of gonostyli; female medigynium with apodemes of axis extending beyond main plate basally..... ***P. subambra*** Chou & Tong, 1987

5. Male parameres with ventral branch shorter than dorsal branch; female medigynium with basal plate nearly as long as main plate .....***P. acharya*** sp. nov.
– Male parameres with ventral branch much longer than dorsal branch; female medigynium with basal plate much shorter than main plate ..... ***P. lahu*** sp. nov.

6. Male gonostyli greatly elongated and longer than gonocoxites; parameres bifurcated 7
– Male gonostyli shorter than gonocoxites; parameres unbranched 8

7. Male parameres with dorsal branch enlarged apically, and ventral branch hook-like distally .....
..... ***P. longititilana*** Issiki, 1929
– Male parameres with dorsal branch slender apically, and ventral branch simple distally .....
..... ***P. nokoensis*** Issiki, 1929

8. Male parameres not extending beyond apex of gonocoxites ..... ***P. bunun*** Issiki, 1929
– Male parameres extending to basal lobe of gonostyli 9

9. Male parameres bearing short microtrichia; female medigynium with posterior arms .....
..... ***P. esakii*** Issiki, 1929
– Male parameres bearing long spines; female medigynium lacking posterior arms .....
..... ***P. apiconebulosa*** Issiki, 1929

10. Male A6 bearing a dorsally directed conical process at distal ⅓ .....***P. flavipennis*** Carpenter, 1938
– Male A6 lacking such process 11

11. Male parameres bifurcated basally 12
– Male parameres unbranched basally 21

12. Wing membrane tinged with dense yellow 13
– Wing membrane colorless or light brown 14

13. Male parameres exceeding apex of gonocoxites .....***P. aurea*** Cheng, 1957
– Male parameres not exceeding apex of gonocoxites .....***P. lutea*** Carpenter, 1945

14. Male gonocoxites with ventromedial process greatly enlarged, plate-like, and covering basal portion of parameres ventrally ..... ***P. pingjiangensis*** Chou & Wang, 1987
– Male gonocoxites with ventromedial process less developed 15

15. Male parameres with ventral branch at least ⅔ as long as dorsal branch or longer 16
– Male parameres with ventral branch shorter than ⅓ of dorsal branch 17

16. Male parameres with ventral branch approximately ⅔ as long as dorsal branch .....
..... ***P. coomani*** Cheng, 1957
– Male parameres with ventral branch much longer than dorsal branch ..... ***P. huboliao*** sp. nov.

17. Male parameres with ventral branch pointed apically 18
– Male parameres with ventral branch rounded apically 19

18. Male parameres with ventral branch directed caudad; dorsal branch bearing indistinct microtrichia ..... ***P. temperata*** sp. nov.
– Male parameres with ventral branch directed caudomedially; dorsal branch bearing numerous long spines 20

19. Male parameres with dorsal branch bifurcated subapically ..... ***P. pectinata*** Issiki, 1929
– Male parameres with dorsal branch simple subapically ..... ***P. pallidimaculata*** Issiki, 1929

20. Male parameres with dorsal branch nearly as wide as ventral branch; dorsal processes of aedeagus finger-like and nearly parallel ..... ***P. tetrazonia*** Navás, 1935
– Male parameres with dorsal branch much thinner than ventral branch; dorsal processes of aedeagus slender and greatly divergent apically ..... ***P. mokansana*** Cheng, 1957

21. Wing membrane tinged with dense yellow 22
– Wing membrane colorless or light brown 23

22. Forewings with basal spot elongated and stripe-like; apical and pterostigmal bands water-stain-like and indistinct; male parameres greatly enlarged basally and tapering towards subacute apex, covered with numerous microtrichia throughout ..... ***P. sextaenia*** Zhou & Bao, 2002
– Forewings with basal spot diminutive; pterostigmal band with basal branch and lacking apical branch; apical band distinct or indistinct; male parameres slender with numerous long setae on apical ⅔ ..... ***P. auripennis*** Bicha, 2019

23. Male parameres extending beyond basal lobe of gonostyli 24
– Male parameres not exceeding basal lobe of gonostyli 28

24. Male gonostyli with basal lobe bifurcated 25
– Male gonostyli with basal lobe simple 26

25. Male gonostyli with ventral branch of basal lobe thorn-like, longer than dorsal branch; female subgenital plate with rounded apex ..... ***P. dujingzhei*** sp. nov.
– Male gonostyli with ventral branch of basal lobe short and triangular, nearly as long as dorsal branch; female subgenital plate with emarginated apex ..... ***P. anrenensis*** Chou & Wang, 1987

26. Male gonostyli with basal lobe short, subtriangular and rounded; female medigynium with apodemes of axis nearly twice as long as main plate ..... ***P. deceptor*** Esben-Petersen, 1913
– Male gonostyli with basal lobe elongated and irregular apically; female medigynium with apodemes of axis shorter than main plate 27

27. Male gonostyli with basal lobe greatly curved cephalad apically, forming C-shape; female subgenital plate constricted at basal ⅖ ..... ***P. yixini*** sp. nov.
– Male gonostyli with basal lobe slightly curved caudad apically; female subgenital plate narrow at base and slightly broadening and then tapering towards apex ..... ***P. flavicorporis*** Cheng, 1957

28. Male parameres extending beyond apex of gonocoxites 29
– Male parameres concealed in aedeagal concavity or extending to apex of gonocoxites 34

29. Male gonocoxites with ventromedial process greatly developed, plate-like, and directed caudad ..... ***P. mangshanensis*** Chou & Wang, 1987
– Male gonocoxites with ventromedial process undeveloped 30

30. Male parameres bifurcated and wrench-shaped subapically; female subgenital plate with a deep U-shaped incision on each side at basal ¼ ..... ***P. sonani*** Issiki, 1929
– Male parameres and female subgenital plate simple 31

31. Male genital bulb long ellipsoidal; parameres bearing a tuft of long microtrichia on outer side of middle portion ..... ***P. akasakai*** Issiki, 1929
– Male genital bulb broadly oval; parameres bearing microtrichia or spines along inner margin 32

32. Male parameres bearing numerous long spines along inner margin ..... ***P. tecta*** Byers, 2002
– Male parameres bearing short microtrichia along inner margin 33

33. Male hypovalves short, not exceeding middle of gonocoxites; parameres broad basally and tapering towards apex ..... ***P. issikii*** Penny & Byers, 1979
– Male hypovalves long, extending to distal ⅔ of gonocoxites; parameres relatively slender .....
..... ***P. taiheisanensis*** Issiki, 1929

34. Male parameres with apex extending dorsal to ventral valves of aedeagus and hardly visible ventrally ..... ***P. pertica*** Ogai, 2025
– Male parameres clearly visible ventrally 35

35. Male gonostyli as long as or slightly longer than gonocoxites 36
– Male gonostyli much shorter than gonocoxites 37

36. Male parameres acute apically and bearing a few long spines terminally .....
..... ***P. brevititilana*** Issiki, 1929
– Male parameres rounded apically and bearing numerous long spines along inner margin ..... ***P. rantaisanensis*** Issiki, 1929

37. Male parameres bifurcated subapically 38
– Male parameres unbranched subapically 40

38. Male parameres with ventral branch longer than dorsal branch; dorsal valves of aedeagus slightly curved outward at apex ..... ***P. angustistriata*** Issiki, 1929
– Male parameres with ventral branch shorter than dorsal branch; dorsal valves of aedeagus not curved outward 39

39. Male parameres enlarged apically; dorsal branch rounded ..... ***P. shibatai*** Issiki, 1929
– Male parameres slender apically; dorsal branch acute ..... ***P. taiwanensis*** Issiki, 1929

40. Male parameres with apical portion greatly bending inward ..... ***P. hamata*** Issiki & Cheng, 1947
– Male parameres with apical portion relatively straight 41

41. Male parameres greatly enlarged subapically and pointed terminally .. ***P. lintienshana*** Cheng, 1952
– Male parameres not enlarged subapically and evenly tapering towards apex 42

42. Male hypovalves nearly as long as basal stalk of hypandrium; parameres broad, foliate basally and evenly tapering towards apex ..... ***P. fukiensis*** Tjeder, 1950
– Male hypovalves much longer than basal stalk of hypandrium; parameres slender 43

43. Male parameres straight; dorsal processes of aedeagus subacute apically.....
..... ***P. falsa*** Issiki & Cheng, 1947
– Male parameres slightly curved inward at apex; dorsal processes of aedeagus broad with shallow emargination apically ..... ***P. yiei*** Issiki & Cheng, 1947

Description of species

Panorpa acharya sp. nov.
urn:lsid:zoobank.org:act:A287EE79-51B1-4043-9ED4-D83270FBE39B
Figs 1–2, 10A

Diagnosis

This species superficially resembles *Panorpa subambra* Chou & Tong in Chou *et al*., 1987 in the yellow wing membrane, the reduced, water-stain-like markings, and the exceptionally broad hindwings (Fig. 2A–B), which are generally as wide as or slightly narrower than the forewings in the genus *Panorpa*. However, it can be readily separated from the latter by the short and bifurcated male parameres (vs unbranched, thin and greatly elongated). It is also very similar to *P. esakii* Issiki, 1929, *P. longititilana* Issiki, 1929, and *P. nokoensis* Issiki, 1929 in general appearance, especially the yellowish-brown head with the transverse black band across the ocellar triangle and the yellow wing membrane, but can be differentiated from the latter by the cylindrical and simple male A6 (vs bearing rounded protuberance dorsally in *P. longititilana* and *P. nokoensis*), much shorter parameres (vs greatly elongated and exceeding middle of gonostyli), and greatly elongated posterior arms in female medigynium (vs greatly reduced).

Etymology

The species is named using the Sanskrit 'Acharya' (a teacher or religious instructor), a key figure in Azhaliism, a Vajrayana Buddhist religion practiced by the Bai people of Yunnan, China. Noun in apposition.

Type material

Holotype

CHINA – **Yunnan Province** • ♂; Dali Bai Autonomous Prefecture, Yunlong County; 25°51′51.91″ N, 99°18′47.79″ E; 2200 m a.s.l.; 12 Sep. 2023; J.-L. Li and J.-S. Wang leg.; BMDU, CNYNYL23Paach001.

Paratypes

CHINA – **Yunnan Province** • 4 ♂♂, 8 ♀♀; same data as for holotype; BMDU, CNYNYL23Paach002–CNYNYL23Paach013.

Description

Measurements (mm). Male (holotype and paratypes, n = 5). AtL 10.8–11.0, AbL 11.5–12.0, BdL 14.8–15.5, FL 12.8–13.3, FW 3.2–3.3, HL 11.5–12.0, HW 3.2–3.3. Female (paratypes, n = 8). AtL 12.0–12.5, AbL 6.2–6.5, BdL 10.5–10.8, FL 14.2–14.8, FW 3.5–3.7, HL 12.8–13.0, HW 3.5–3.7.

Males

Head (Fig. 2A). Vertex and occiput yellowish-brown. Broad black stripe passing through ocellar triangle and extending laterally to compound eyes. Dark markings passing longitudinally across occiput. Rostrum yellow with darkened palps. Antennae with scape and pedicel dark brown, and 39–41 black flagellomeres.

Thorax (Fig. 2A). Pronotum mostly dark brown, with yellowish-brown spots at posterolateral corners; 3–4 stout setae along each side of anterior margin. Meso- and metanotum dark brown medially, lateral portions yellowish-brown, forming distinct longitudinal median stripe. Pleura light yellowish-brown. Legs yellowish-brown with darkened terminal tarsomeres.

Wings (Fig. 2A). Forewing membrane subhyaline and strongly tinged with golden yellow. Markings water-stain-like with hardly observable basal and pterostigmal bands. Pterostigma reddish brown. R2 bifurcated. 1A ending far beyond level of ORs. Hindwings similar, broad along M1–CuP.

Abdomen (Fig. 2A, C). T2–T3 dark brown, laterally yellowish-brown, T3 with semicircular notal organ on hind border. T4–T5 yellowish-brown. S2–S5 light brown. T6 subcylindrical, yellowish-brown, slightly tapering apically. A2–A8 with black longitudinal markings on tergites, pleura, and sternites. A7 constricted and curved basally, distal portion abruptly enlarged (approximately two times as wide as basal width). A8 less constricted, evenly enlarged apically.

Genitalia (Fig. 2D–H). Genital bulb suboval, yellowish-brown, with base narrowed and apex enlarged. Epandrium deeply emarginated in broad U-shape, with pair of stout lateral processes. Hypandrium with narrow basal stalk. Hypovalves stripe-like, slightly longer than basal stalk, strongly divergent in distal

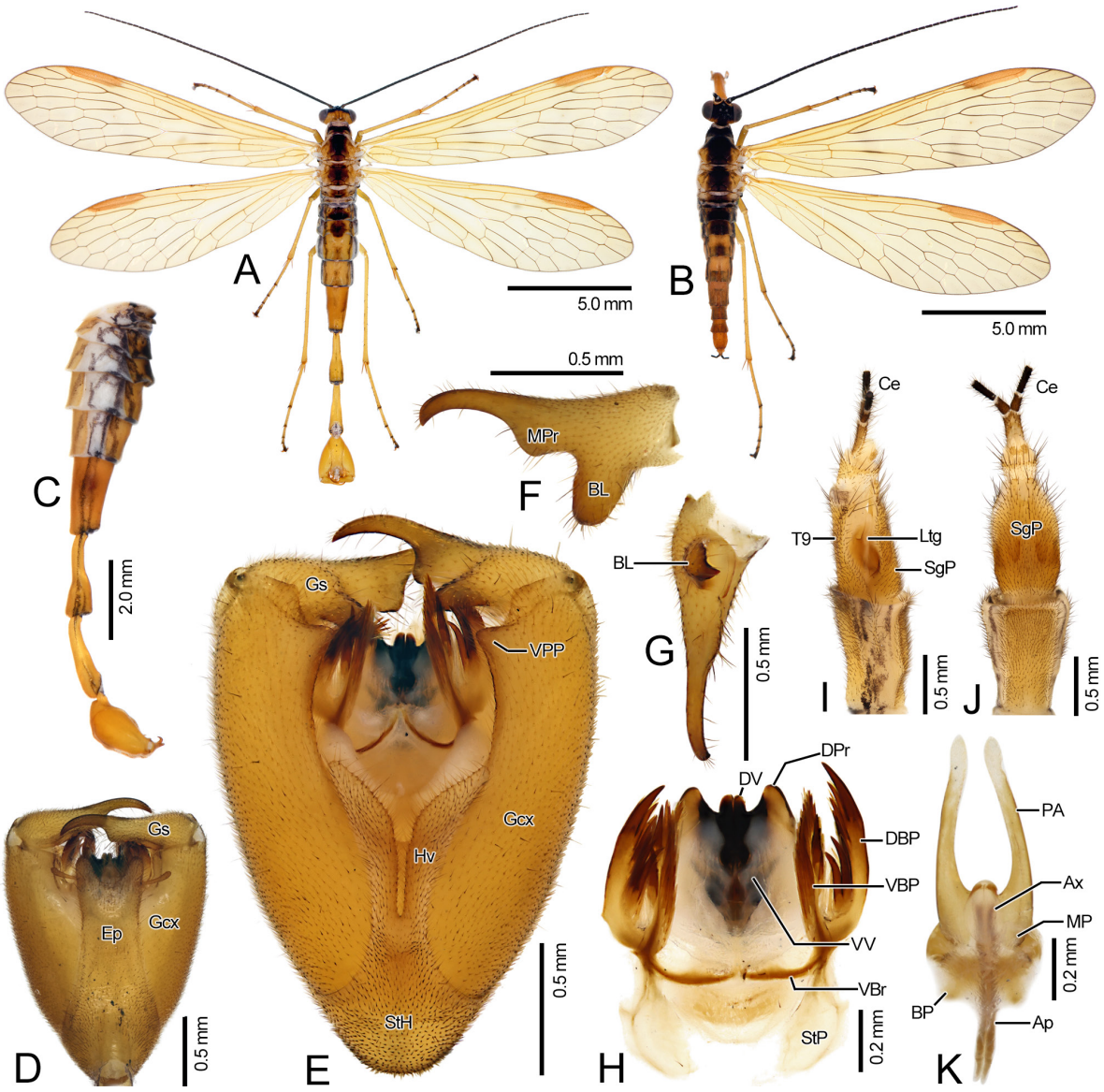


Fig. 2. *Panorpa acharya* sp. nov. **A, C–H**. Holotype, ♂ (BMDU, CNYNYL23Paach001). **B, I–K**. Paratype, ♀ (BMDU, CNYNYL23Paach002). **A–B**. Habitus, dorsal views. **C**. Abdomen, left-lateral view. **D–E**. Genital bulb, dorsal and ventral views, respectively. **F–G**. Right gonostylus, dorsal and left-lateral views, respectively. **H**. Aedeagal complex, ventral view. **I–J**. Terminal abdomen, left-lateral and ventral views, respectively. **K**. Medigynium, ventral view. Abbreviations: see Material and methods.

half, extending nearly to middle of gonocoxites. Gonocoxites with aedeagal concavity oval, lacking ventromedial processes, with subtriangular ventromedial posterior processes. Gonostyli approximately half as long as gonocoxites, with rounded median process and greatly elongated, stout, finger-like basal lobe; apex of basal lobe acute and greatly bending dorsad. Parameres with broad basal stalk and ventrally connected to base of ventral aedeagal valves through greatly sclerotized ventral bridges; bifurcated with dorsal branch slightly longer than ventral branch; both branches bearing long and stout spines. Aedeagus short and broad. Ventral valves membranous; dorsal valves M-shaped; dorsal processes slightly elevated and subtriangular with rounded apex, and slightly exceeding dorsal valves apically; lateral processes indistinct.

Females

Habitus (Fig. 2B). Similar to males, with darker body coloration and denser wing markings.

Genitalia (Fig. 2I–K). Subgenital plate oval, with shallow terminal emargination. Laterotergites broad at base, tapering to finger-like distal ends. Medigynium with broad basal plate covering basal half of main plate; posterior arms greatly elongated, over twice as long as main plate, with slightly convergent apices; axis with parallel, slender apodemes approximately three times as long as main plate.

Distribution

China: Yunnan (Yunlong).

Panorpa dujingzhei sp. nov.
urn:lsid:zoobank.org:act:742950CF-80E6-44BD-8168-45DBBEFCA2D4
Figs 1, 3

Diagnosis

This species is superficially similar to *Panorpa anrenensis* Chou & Wang in Chou *et al*., 1987 by the greatly elongated male parameres and the short, divergent apodemes in the female medigynium (Fig. 3). However, it can be differentiated from the latter by the following characters: in males, (1) gonostyli with ventral branch of basal lobe thorn-like, longer than dorsal branch (vs shorter); (2) epandrium with terminal emargination shallow (vs relatively deep); in females, (3) subgenital plate with rounded apex (vs emarginated); and (4) medigynium with base of posterior arms approximately as wide as decorated region of axis (vs wider).

Etymology

This species is named in honor of its collector, Jing-Zhe Du. Noun in the genitive case.

Type material

Holotype

CHINA – **Jiangxi Province** • ♂; Nanchang City, Meiling Mountain; 28°44′49.74″ N, 115°40′23.61″ E; 757 m a.s.l.; 18 Oct. 2024; J.-Z. Du leg.; BMDU, CNJXML24Padjz001.

Paratypes

CHINA – **Jiangxi Province** • 6 ♂♂, 3 ♀♀; same data as for holotype; BMDU, CNJXML24Padjz002–CNJXML24Padjz010.

Description

Measurements (mm). Male (holotype and paratypes, n = 7). AtL 9.2–10.0, AbL 11.0–11.6, BdL 14.0–15.0, FL 11.1–11.2, FW 2.9–3.0, HL 9.6–10.0, HW 2.8–2.9. Female (paratypes, n = 3). AtL 10.0–11.0, AbL 6.4–6.6, BdL 10.4–11.0, FL 11.5–12.2, FW 3.0–3.1, HL 10.2–11.0, HW 2.9–3.0.

Males

Head (Fig. 3A). Vertex and occiput unevenly yellowish-brown. Black spot enclosing ocellar triangle. Dark markings on lateral sides of vertex. Rostrum yellowish-brown with darkened palps. Antennae with scape and pedicel dark brown, and 40–41 black flagellomeres.

Thorax (Fig. 3A). Pronotum dark brown, with 3–4 stout setae along each side of anterior margin. Meso- and metanotum dark brown laterally, with distinct, yellowish-brown, longitudinal median stripe. Pleura light yellowish-brown. Legs yellowish-brown with darkened terminal tarsomeres.

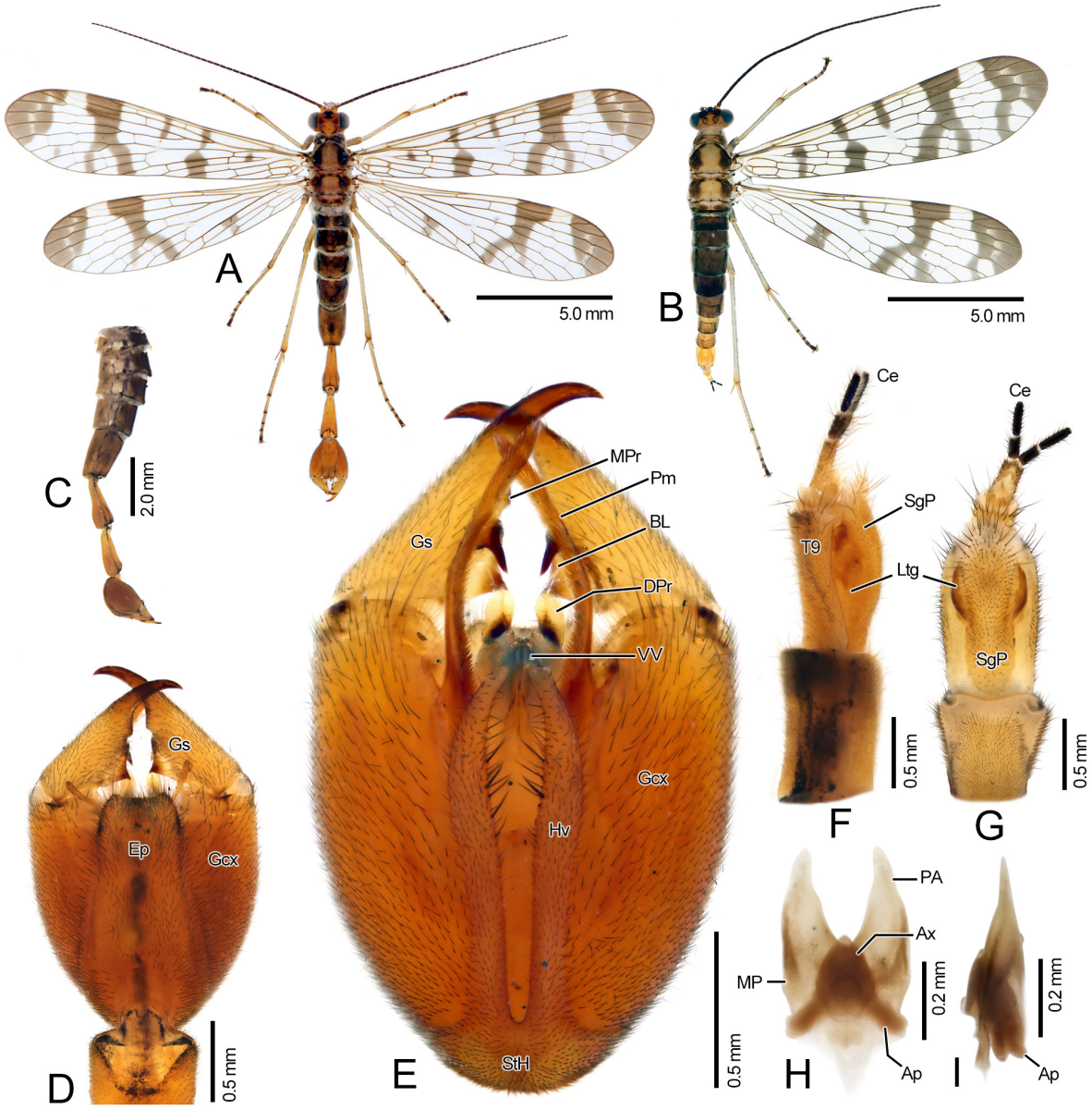


Fig. 3. *Panorpa dujingzhei* sp. nov. **A, C–E**. Holotype, ♂ (BMDU, CNJXML24Padjz001). **B, F–I**. Paratype, ♀ (BMDU, CNJXML24Padjz002). **A–B**. Habitus, dorsal view. **C**. Abdomen, left-lateral view. **D–E**. Genital bulb, dorsal and ventral views, respectively. **F–G**. Terminal abdomen, left-lateral and ventral views, respectively. **H–I**. Medigynium, ventral and right-lateral views, respectively. Abbreviations: see Material and methods.

Wings (Fig. 3A). Forewing membrane subhyaline and tinged with light brown, markings dark brown. Pterostigma brown. R2 bifurcated. 1A ending far beyond level of ORs. Hindwings similar.

Abdomen (Fig. 3A, C). T2–T5 dark brown, unevenly mixed with yellowish-brown, T3 with semicircular notal organ on hind border. T6 subcylindrical, yellowish-brown, slightly tapering towards apex. A2–A8 with black longitudinal markings on tergites, pleura, and sternites. A7 basally constricted, enlarged towards apex. A8 less constricted.

Genitalia (Fig. 3D–E). Genital bulb oval, yellowish-brown. Epandrium shallowly emarginated terminally. Hypandrium with extremely short basal stalk. Hypovalves stripe-like, approximately ⅘ as long as gonocoxites, slightly tapering towards subacute apex, and bearing stout setae along distal half of inner margin. Gonostyli approximately ⅔ as long as gonocoxites, with subacute median process and bifurcated basal lobe; ventral branch of basal lobe darkened, greatly elongated, thorn-like, and slightly longer than triangular dorsal branch. Parameres ventrally connected to base of ventral aedeagal valves through slightly sclerotized ventral bridges; extending beyond median process of gonostyli, and bearing numerous microtrichia along inner side. Ventral valves of aedeagus membranous; dorsal processes greatly sclerotized and widely separated; lateral processes indistinct.

Females

Habitus (Fig. 3B). Similar to males.

Genitalia (Fig. 3F–I). Subgenital plate long tongue-shaped, rounded terminally without emargination. Laterotergites broad, greatly sclerotized, approximately ⅓ as long as subgenital plate. Medigynium with well-developed main plate, its base triangular and greatly protruded; posterior arms slightly shorter than main plate, their base approximately as wide as decorated region in axis; apodemes of axis widely divergent, with apex bifurcated.

Distribution

China: Jiangxi (Meiling Mountain).

Panorpa huboliao sp. nov.

urn:lsid:zoobank.org:act:9B93B819-EBEA-490C-B7A1-76B752864CB7

Figs 1, 4, 10C

Diagnosis

This species resembles *P. coomani* Cheng, 1957 by the bifurcated male parameres and the greatly elongated dorsal processes of the aedeagus. However, it can be readily differentiated from the latter by the following characters: (1) in fore- and hindwings, apical band encloses two rows of apical crossveins, each corresponding to a row of semitransparent spots (vs one row); (2) in forewings, pterostigmal band with an apical incision between R_3 and R_4 (vs without); (3) apical branch of pterostigmal band detached or nearly detached (vs broad and complete); in males, (4) inner margin of hypovalves angularly produced at middle (vs not produced); and (5) ventral branch of parameres much longer than dorsal branch (vs shorter). The female of *P. coomani* is unknown.

It is also similar to the female-only-known species *P. insularis* Hua & Chou, 1998 in possessing black spots on the vertex and occiput arranged in a V-shape, as well as two rows of semitransparent spots in the apical band of both the fore- and hindwings. It can be distinguished from the latter by the absence of a basal plate in the medigynium (vs present), and by the main plate being broadest at the middle (vs slightly narrowed near the middle). In a manner similar to *P. insularis*, the light yellow pterostigmata are prominent in living individuals (Fig. 10C) but barely visible in alcohol-preserved specimens (Fig. 4A–B).

Etymology

This species is named after its type locality, Huboliao National Nature Reserve.

Type material

Holotype

CHINA – **Fujian Province** • ♂; Zhangzhou City, Nanjing County, Huboliao National Nature Reserve; 24°31′2.88″ N, 117°14′53.47″ E; 290 m a.s.l.; 9 Nov. 2023; Y.-B. Yao, J.-X. Gong, R. Zhao and M.-X. Wu leg.; BMDU, CNFJNJ23Pahbl001.

Paratypes

CHINA – **Fujian Province** • 1 ♂, 1 ♀; same data as for holotype; BMDU, CNFJNJ23Pahbl002, CNFJNJ23Pahbl003 • 2 ♀♀; Nanping City, Yanping District, Mangdang Mountain; 26°38′48.80″ N, 118°5′26.27″ E; 900 m a.s.l.; 19 Oct. 2021; D.-C. Zhu leg.; BMDU, CNFJNP21Pahbl001, CNFJNP21Pahbl002. – **Guangdong Province** • 2 ♂♂, 1 ♀; Guangzhou City, Conghua District, Liuxihe National Forest Park; 18 Oct. 2020; D. Yang and H. Dong leg.; BMDU, CNGDLXH20Pahbl001–CNGDLXH20Pahbl003 • 2 ♀♀; Huizhou City, Huidong County; 23°3′59.37″ N, 115°12′23.40″ E; 400 m a.s.l.; 21 Jan. 2026; Y.-J. Lin leg.; AHNU, CNGDHD26Pahbl001, CNGDHD26Pahbl002. – **Jiangxi Province** • 1 ♂; Shangrao City, Wuyuan County, Wengong Mountain; 29°10′37.26″ N, 117°46′33.94″ E; 145 m a.s.l.; 15 Dec. 2021; Z.-H. Shen, C.-L. Li and Y.-Y. Xu leg.; BMDU, CNJXSR21Pahbl001.

Description

Measurements (mm). Male (holotype and paratypes, n = 5). AtL 10.0–11.4, AbL 8.6–9.0, BdL 12.0–13.5, FL 12.0–12.4, FW 2.6–2.7, HL 11.0–11.1, HW 2.5–2.6. Female (paratypes, n = 6). AtL 11.0–11.8, AbL 6.0–6.9, BdL 9.6–10.0, FL 12.5–13.0, FW 3.0–3.1, HL 11.2–12.0, HW 2.9–3.0.

Males

Head (Fig. 4A). Vertex and occiput mostly yellowish-brown, with two rows of black spots arranged in V-shape. Ocellar triangle black. Rostrum pale brown medially and dark brown laterally. Antennae with scape yellow, pedicel dark brown, and 42–44 black flagellomeres.

Thorax (Fig. 4A). Pronotum pale yellowish-brown medially and dark brown laterally, bearing 4–5 stout setae along each side of anterior border. Meso- and metanotum pale yellowish-brown medially, forming distinct mesal stripe and dark brown laterally. Pleura and legs dark greyish brown with darkened terminal tarsomeres.

Abdomen (Fig. 4A, C). T2–T5 dark brown, T3 with semicircular notal organ on hind border. T6 subcylindrical, unevenly dark yellowish-brown, tapering towards apex. A2–A8 with black longitudinal markings on tergites, pleura, and sternites. A7 basally constricted and curved, enlarged towards apex. A8 less constricted basally.

Genitalia (Fig. 4D–E). Genital bulb oval, yellowish-brown. Epandrium greatly emarginated terminally in U-shape and forming pair of finger-like processes laterally. Hypandrium with extremely short basal stalk. Hypovalves stripe-like, half as long as gonocoxites, with rounded apex and bearing stout setae along distal half of inner margin, its inner margin angularly produced at middle. Gonocoxites with ventromedial processes flat and indistinct. Gonostyli with basal lobe subtriangular and deeply darkened along margin, median process short subtriangular. Parameres bifurcate: ventral branch slender, strongly curved at base and slightly crossed subapically, slightly expanded distally and abruptly pointed at apex, bearing microtrichia but glabrous on distal ⅓; dorsal branch approximately ⅔ as long as ventral branch, bearing long spines along inner margin, distally foliate with abruptly pointed apex. Ventral valves of aedeagus membranous; dorsal processes greatly elongated and extending slightly beyond apex of gonocoxites; lateral processes distinct, directed laterad.

Females

Habitus (Fig. 4B). Similar to males except darker body color.

Genitalia (Fig. 4G–I). Subgenital plate rectangular in basal ⅔ and subtriangular in distal ⅓, without terminal emargination. Medigynium with main plate broad, laterally expanded at mid-length, approximately ⅔ as long as axis. Posterior arms slender, slightly shorter than main plate. Axis with apodemes mostly parallel, but strongly divergent at base.

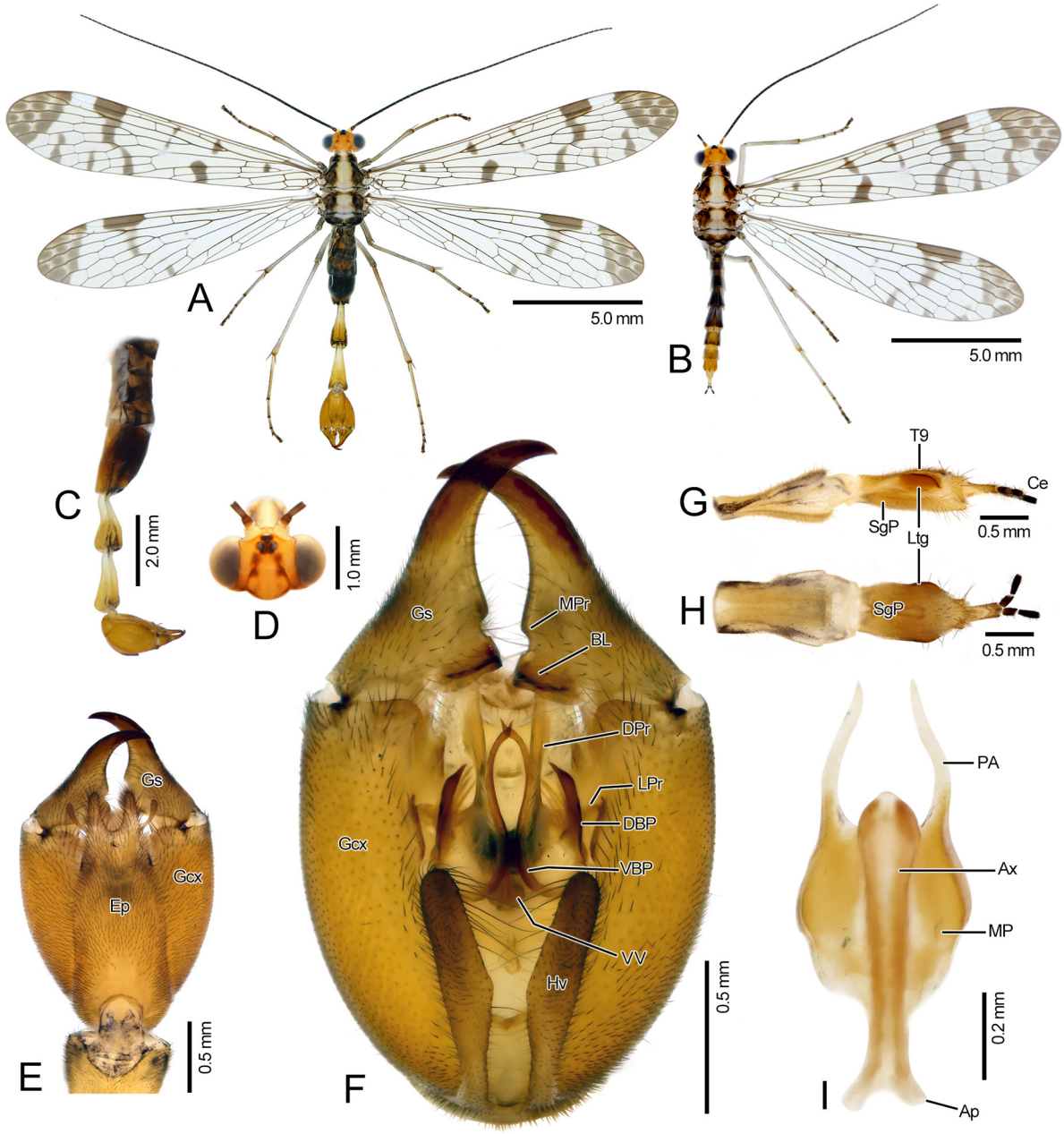


Fig. 4. *Panorpa huboliao* sp. nov. **A, C, E–F**. Holotype, ♂ (BMDU, CNFJNJ23Pahbl001). **B, G–I**. Paratype, ♀ (CNFJNJ23Pahbl002). **D**. Paratype, ♀ (BMDU, CNFJNP21Pahbl001). **A–B**. Habitus, dorsal view. **C**. Abdomen, left-lateral view. **D**. Head, dorsofrontal view. **E–F**. Genital bulb, dorsal and ventral views, respectively. **G–H**. Terminal abdomen, left-lateral and ventral views, respectively. **I**. Medigynium, ventral view. Abbreviations: see Material and methods.

Distribution

China: Fujian (Nanjing, Nanping), Guangdong (Conghua, Huidong), and Jiangxi (Wuyuan).

Panorpa lahu sp. nov.
urn:lsid:zoobank.org:act:F7145B82-FB6B-4C83-94AC-274C1EEC5951
Figs 1, 5

Diagnosis

This species superficially resembles *P. acharya* sp. nov. and *P. subambra* by the yellow wing membrane, the reduced, water-stain-like markings, the exceptionally broad hindwings, and the general morphology of male and female genitalia. However, it can be differentiated from *P. acharya* by the following characters: (1) occiput black (vs yellowish-brown); in males, (2) ventromedial posterior process inconspicuous (vs conspicuous and subtriangular); (3) parameres with ventral branch much longer than dorsal branch (vs shorter); (4) ventral bridge of parameres weakly sclerotized (vs strongly sclerotized); and in females, (5) medigynium with basal plate much shorter than main plate (vs nearly as long as main plate). It can be readily distinguished from *P. subambra* by the short and stout male parameres (vs slender).

Etymology

The specific epithet is derived from one of the ethnic groups inhabiting the vicinity of the type locality, the Lahu people.

Type material

Holotype

CHINA – **Yunnan Province** • ♂; Lincang City, Linxiang District, Boshang Town; 23°40′46.42″ N, 100°1′20.25″ E; 2180 m a.s.l.; 17 Oct. 2025; Q. Tang, J. Xie and J.-S. Wang leg.; BMDU, CNYNLC25Palah001.

Paratypes

CHINA – **Yunnan Province** • 6 ♀♀; same data as for holotype; BMDU, CNYNLC25Palah002–CNYNLC25Palah007.

Description

Measurements (mm). Male (holotype, n = 1). AtL 10.9, AbL 10.6, BdL 14.0, FL 12.1, FW 3.2, HL 10.9, HW 3.2. Female (paratypes, n = 6). AtL 11.0–11.5, AbL 8.0–8.9, BdL 11.0–13.0, FL 13.5–14.0, FW 3.3–3.4, HL 12.5–13.0, HW 3.3–3.5.

Males

Head (Fig. 5A). Vertex and occiput black. Rostrum yellow with darkened palps. Antennae with scape and pedicel dark brown, and 40–41 black flagellomeres.

Thorax (Fig. 5A). Pronotum black, with 4 stout setae along each side of anterior margin. Meso- and metanotum dark brown medially, lateral portions yellowish-brown near wing bases. Pleura yellowish-brown. Legs yellowish-brown with darkened terminal tarsomeres.

Wings (Fig. 5A). Forewing membrane subhyaline and strongly tinged with golden yellow. Markings water-stain-like, with hardly observable basal and pterostigmal bands. Pterostigma reddish brown. R2 bifurcated. 1A ending far beyond level of ORs. Hindwings similar, broad along M1–CuP.

Abdomen (Fig. 5A, C). T2–T3 black, T3 with semicircular notal organ on hind border. T4–T5 unevenly yellowish-brown. S2–S5 light brown. T6 subcylindrical, yellowish-brown, slightly tapering towards

apex. A2–A8 with black longitudinal markings on tergites, pleura, and sternites. A7 greatly constricted and curved basally, distal portion abruptly enlarged (approximately two times as wide as basal width). A8 less constricted, evenly enlarged apically.

Genitalia (Fig. 5D–E). Genital bulb suboval, yellowish-brown, with base narrowed and apex enlarged. Epandrium deeply emarginated in broad U-shape, with pair of stout lateral processes. Hypandrium with short and narrow basal stalk, extending nearly to basal ⅖ of gonocoxites. Hypovalves stripe-like, slightly longer than basal stalk, strongly divergent in distal half. Gonocoxites with aedeagal concavity U-shaped, lacking ventromedial processes, without ventromedial posterior processes. Gonostyli approximately half

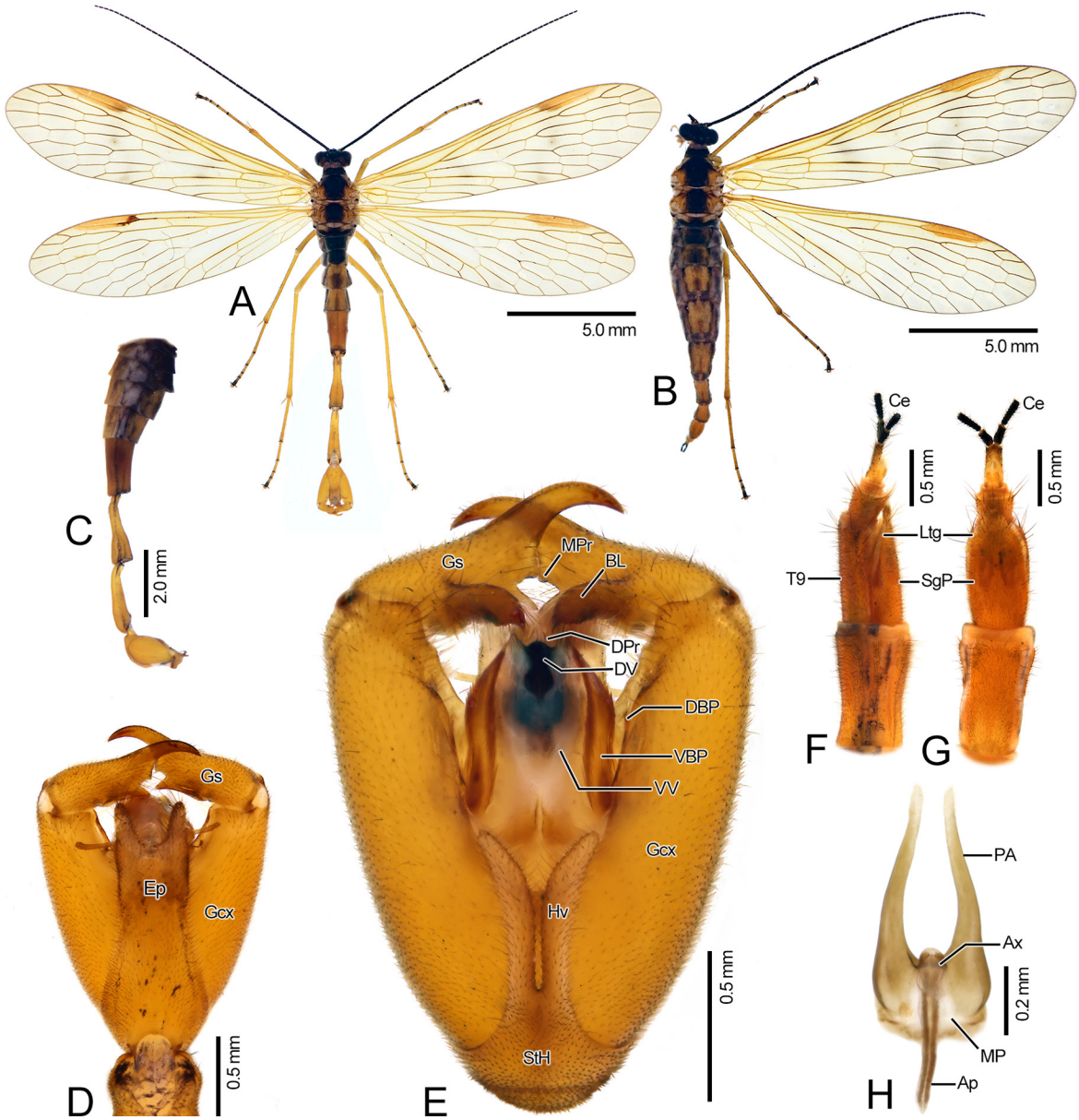


Fig. 5. *Panorpa lahu* sp. nov. **A, C–E**. Holotype, ♂ (BMDU, CNYNLC25Palah001). **B, F–H**. Paratype, ♀ (CNYNLC25Palah002). **A–B**. Habitus, dorsal view. **C**. Abdomen, left-lateral view. **D–E**. Genital bulb, dorsal and ventral views, respectively. **F–G**. Terminal abdomen, left-lateral and ventral views, respectively. **H**. Medigynium, ventral view. Abbreviations: see Material and methods.

as long as gonocoxites, with subtriangular median process and greatly elongated, stout, finger-like basal lobe; apex of basal lobe acute and greatly bending dorsad. Parameres ventrally connected to base of ventral aedeagal valves through weakly sclerotized ventral bridges; bifurcated with ventral branch twice as long as dorsal branch; both branches bearing long and stout spines. Aedeagus elongated, columnar. Ventral valves membranous; dorsal valves short; dorsal processes slightly elevated and subtriangular with acute apex; lateral processes indistinct.

Females

Habitus (Fig. 5B). Similar to males, with darker body coloration and denser wing markings.

Genitalia (Fig. 5F–H). Subgenital plate elongate-oval, terminal emargination indistinct. Laterotergites broad basally, distally finger-like. Medigynium with basal plate narrow, covering basal margin of main plate; posterior arms greatly elongated, more than twice as long as main plate, apices slightly convergent; axis with apodemes slender, parallel, approximately twice as long as main plate.

Distribution

China: Yunnan (Lincang).

Panorpa temperata sp. nov.
urn:lsid:zoobank.org:act:4D0E0225-C68F-45C1-AAB7-3359458C34AE
Figs 1, 6

Diagnosis

This species resembles *P. tetrazonia* Navás, 1935 and *P. mokansana* Cheng, 1957 by the greatly developed wing markings, which comprise a broad apical band, a posteriorly branched pterostigmal band, an elongated marginal spot, a broad basal band, and a distinct basal spot (Fig. 6A–B). It can be readily differentiated from the latter two by the following characters: in males, (1) ventral branch of parameres pointed (vs rounded); (2) dorsal branch of parameres relatively straight and bearing microtrichia along inner margin (vs curved and bearing numerous long spines); and in females, (3) axis of medigynium with apodemes concealed in main plate (vs extending beyond main plate).

Etymology

The specific epithet from the Latin ‘temperāta’ (‘mild’ or ‘moderate’) refers to the mild climate in spring, when the specimens were collected. Adjective.

Type material

Holotype

CHINA – **Guizhou Province** • ♂; Zunyi City, Xishui County, near Zhongshan Village; 28°12′34.84″ N, 106°15′26.24″ E; 900 m a.s.l.; 15 Apr. 2022; D.-C. Zhu leg.; BMDU, CNGZXS22Patem001.

Paratypes

CHINA – **Guizhou Province** • 1 ♂, 4 ♀♀; same data as for holotype; BMDU, CNGZXS22Patem002–CNGZXS22Patem006.

Description

Measurements (mm). Male (holotype and paratype, n = 2). AtL 9.7–9.8, AbL 9.8–10.0, BdL 13.5–13.8, FL 10.8–10.9, FW 2.8–2.9, HL 10.0–10.2, HW 2.7–2.8. Female (paratypes, n = 4). AtL 10.6–10.8, AbL 9.2–9.5, BdL 14.2–14.5, FL 12.5–12.9, FW 3.0–3.4, HL 11.0–11.6, HW 2.9–3.2.

Males

Head (Fig. 6A). Vertex and occiput yellowish-brown; large subrectangular pattern enclosing ocellar triangle, not reaching compound eyes laterally. Rostrum yellowish-brown, palps darkened. Antennae: scape yellowish-brown, pedicel and first flagellomeres dark reddish brown, remaining flagellomeres black; 39–41 flagellomeres.

Thorax (Fig. 6A). Pronotum unevenly dark yellowish-brown, bearing 5 stout setae along each side of anterior border. Meso- and metanotum light yellowish-brown mesally and dark yellowish-brown laterally, forming distinct mesal stripe. Pleura and legs yellowish-brown with darkened terminal tarsomeres.

Abdomen (Fig. 6A, C). T2 dark yellowish-brown, T3 dark brown in basal half and yellowish-brown in distal half with semicircular notal organ on hind border. T4 and T5 yellowish-brown. S2–S5 greyish brown. T6 subcylindrical, yellowish-brown, slightly tapering towards apex. A2–A8 with black longitudinal

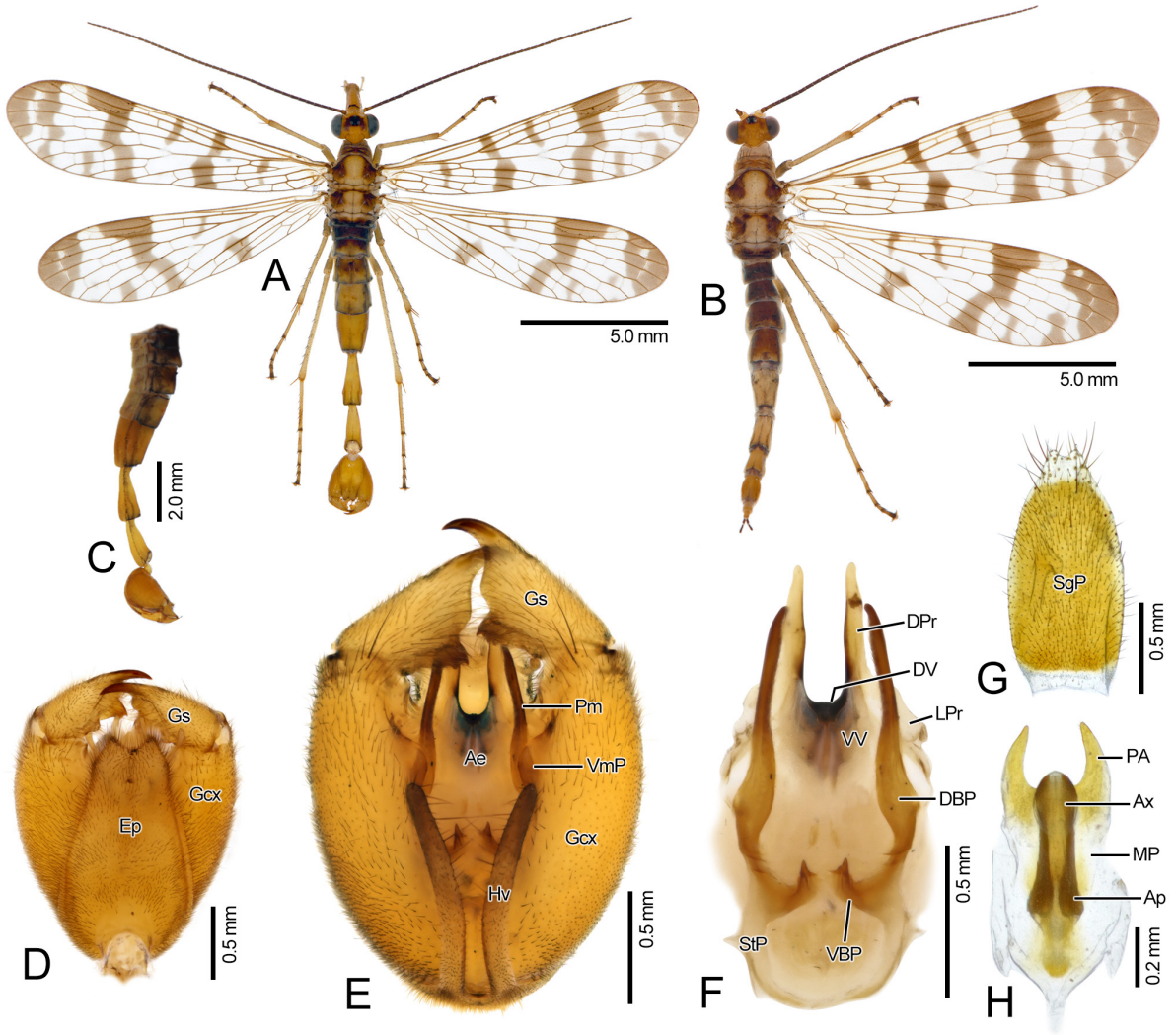


Fig. 6. *Panorpa temperata* sp. nov. **A, C–F**. Holotype, ♂ (BMDU, CNGZXS22Patem001). **B, G–H**. Paratype, ♀ (BMDU, CNGZXS22Patem003). **A–B**. Habitus, dorsal view. **C**. Abdomen, left-lateral view. **D–E**. Genital bulb, dorsal and ventral views, respectively. **F**. Aedeagal complex, ventral view. **G**. Subgenital plate, ventral view. **H**. Medigynium, ventral view. Abbreviations: see Material and methods.

markings on tergites, pleura, and sternites. A7 greatly constricted basally, distal portion abruptly enlarged (approximately two times as wide as basal width). A8 less constricted, evenly enlarged apically.

Genitalia (Fig. 6D–E). Genital bulb broadly oval. Epandrium with wide V-shaped terminal emargination. Hypandrium with extremely short basal stalk. Hypovalves narrow, stripe-like, extending nearly to ⅗ of gonocoxites, bearing long, stout setae on distal half of inner margin. Gonocoxites with distinct, ear-like ventromedial processes. Gonostyli greatly broadened in basal ¾, slender and sickle-like in distal ¼, with rounded median process and subtriangular basal lobe. Parameres bifurcated basally: ventral branch extremely short, apex acute, directed caudad; dorsal branch long, neck-like basally, foliate subbasally, slender distally, bearing microtrichia along inner margin, apex slightly surpassing apex of gonocoxites. Ventral bridge weakly sclerotized, indistinct. Aedeagus with membranous ventral valves; dorsal valves short, black; dorsal processes greatly elongated, extending beyond parameres; lateral processes short.

Females

Habitus (Fig. 6B). Similar to males except darker body color and denser markings.

Genitalia (Fig. 6G–H). Subgenital plate long-oval, with distinct terminal emargination. Medigynium with main plate largely membranous, its basal portion elegantly extended basad. Posterior arms short and slightly convergent. Axis approximately ⅗ as long as main plate, with apodemes markedly enlarged at base.

Distribution

China: Guizhou (Xishui).

Panorpa yixini sp. nov.
urn:lsid:zoobank.org:act:16E3111A-5E4F-4351-973B-8FB2F8FE7DAC
Figs 1, 7

Diagnosis

This new species superficially resembles *Panorpa flavicorporis* Cheng, 1957 by the wing markings and the general morphology of the genitalia. It can be differentiated from the latter by the following characters: in males, (1) gonostyli with basal lobe greatly curved cephalad apically, forming a C-shape (vs shorter and stout); in females, (2) subgenital plate constricted at basal ⅖ (vs near middle); (3) medigynium with apodemes of axis widely divergent (vs slightly divergent); and (4) posterior arms extremely narrow and acute in distal portion (vs broad and subtriangular).

It also resembles the female-only-known species *P. klapperichi* Tjeder, 1950 by the wing markings, the enlarged T9, and the narrow subgenital plate. It can be readily differentiated from the latter by: (1) forewings with basal spot minute (vs enlarged); (2) subgenital plate constricted near basal ⅖ (vs near middle); (3) subgenital plate nearly rounded apically (vs emarginated); (4) medigynium with main plate broad, length approximately equal to width (vs narrow basally, length longer than width); and (5) apodemes of axis greatly enlarged and directed dorsad (vs less enlarged and directed basodorsad).

Etymology

This species is named in honor of Mr Jia-Xin Li, the first discoverer, using his naturalist name, Yixin (literally ‘one-heart’ in Chinese).

Type material

Holotype

CHINA – **Fujian Province** • ♂; Fuzhou City, Yongtai County, Xiandong; 25°48′47.38″ N, 118°58′39.51″ E; 600 m a.s.l.; 24 Oct. 2023; J.-X. Li leg.; BMDU, CNFJYT23Payxn001.

Paratypes

CHINA – **Fujian Province** • 2 ♀♀; same data as for holotype; BMDU, CNFJYT23Payxn002, CNFJYT23Payxn003 • 2 ♀♀; Fuzhou City, Jin'an District, Shoushan Town, Tianshizhilei; 26°17′18.38″ N, 119°19′9.66″ E; 390 m a.s.l.; 10 Dec. 2023; Z.-H. Qi leg.; BMDU, CNFJFZ23Payxn001, CNFJFZ23Payxn002 • 1 ♂, 1 ♀; Fuzhou City, Yongtai County, Geling Town, Yangxi Village, Tianmen Mountain; 25°49′5.34″ N, 119°00′40.79″ E; 480 m a.s.l.; 4 Nov. 2023; Y.-B. Yao, M.-X. Wu and Y.-C. Jin leg.; BMDU, CNFJYT23Payxn004, CNFJYT23Payxn005 • 2 ♀♀; Fuzhou City, Jin'an District, Shoushan Town, Jiufeng Village; 26°15′27.12″ N, 119°17′13.6″ E; 450 m a.s.l.; 1 Jan. 2024; Y. Zheng and Z.-X. Li leg.; BMDU, CNFJFZ24Payxn001, CNFJFZ24Payxn002.

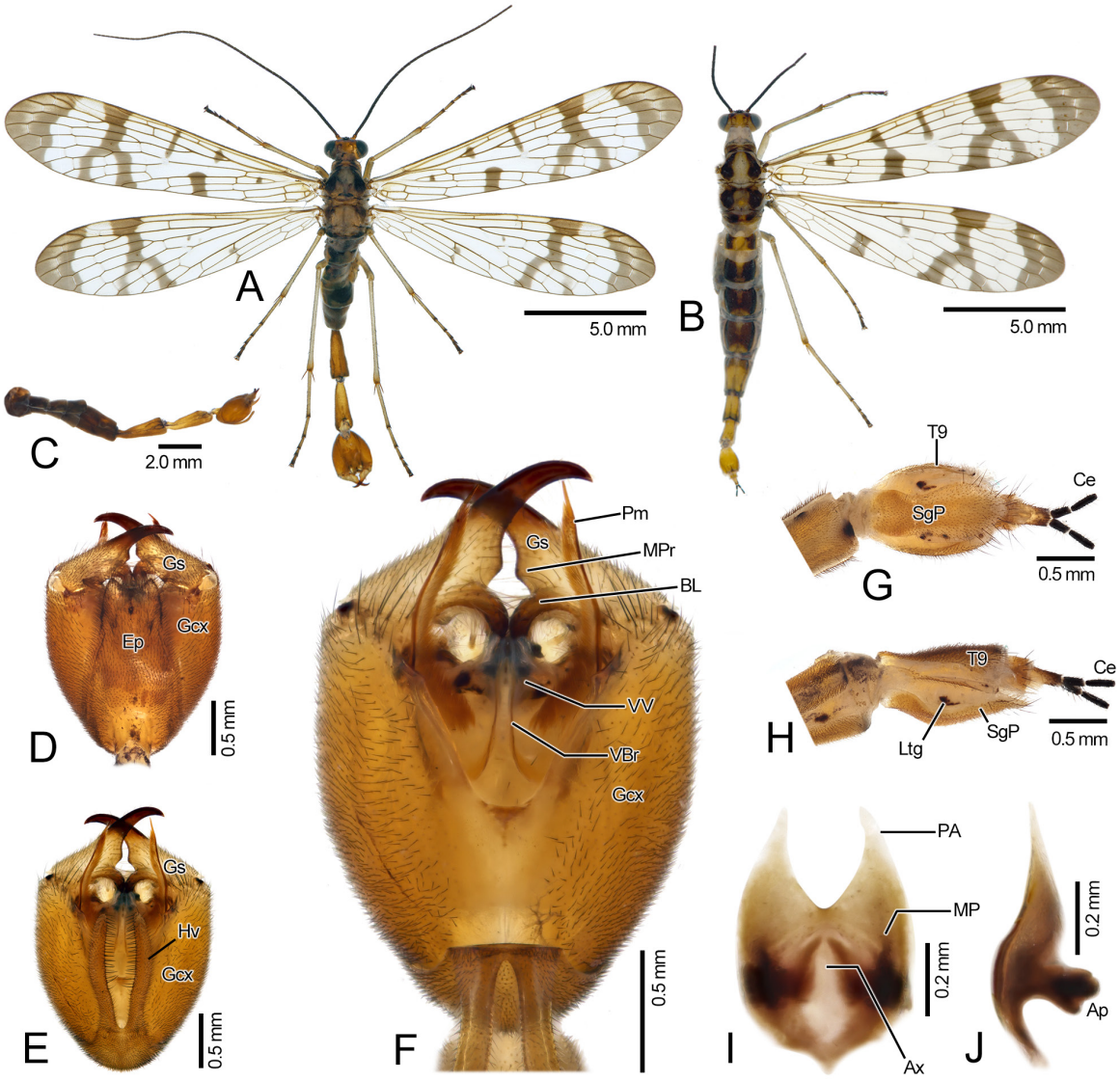


Fig. 7. *Panorpa yixini* sp. nov. **A, C–F**. Holotype, ♂ (BMDU, CNFJYT23Payxn001). **B, G–J**. Paratype, ♀ (BMDU, CNFJYT23Payxn002). **A–B**. Habitus, dorsal view. **C**. Abdomen, left-lateral view. **D–E**. Genital bulb, dorsal and ventral views, respectively. **F**. Genital bulb with hypovalves folded back, ventral view. **G–H**. Terminal abdomen, ventral and left-lateral views, respectively. **I–J**. Medigynium, ventral and right-lateral views, respectively. Abbreviations: see Material and methods.

Description

Measurements (mm). Male (holotype and paratype, n = 2). AtL 13.5–14.0, AbL 11.0–11.5, BdL 14.5–15.2, FL 13.4–13.5, FW 3.4–3.5, HL 12.0–12.1, HW 3.2–3.3. Female (paratypes, n = 4; three individuals damaged). AtL 12.0–13.0, AbL 11.0–12.0, BdL 15.0–16.0, FL 14.0–14.2, FW 3.4–3.5, HL 13.0–13.1, HW 3.2–3.4.

Males

Head (Fig. 7A). Vertex and occiput yellowish-brown with black, ellipsoidal pattern on each side of occiput. Black pattern transversally enclosing ocellar triangle and extending to compound eyes laterally. Rostrum yellowish-brown with darkened palps. Antennae with scape and pedicel dark yellowish-brown, and 38–40 black flagellomeres.

Thorax (Fig. 7A). Pronotum unevenly dark yellowish-brown, bearing 5 stout setae along each side of anterior border. Meso- and metanotum light yellowish-brown mesally and dark yellowish-brown laterally, forming distinct mesal stripe. Pleura and legs yellowish-brown with darkened terminal tarsomeres.

Abdomen (Fig. 7A, C). T2–T5 dark yellowish-brown, with semicircular notal organ on hind border of T3. S2–S5 dark greyish brown. T6 subcylindrical, yellowish-brown, slightly tapering towards apex. A2–A8 with black longitudinal markings on tergites, pleura, and sternites. A7 greatly constricted basally, distal portion abruptly enlarged (approximately two times as wide as basal width). A8 less constricted, evenly enlarged apically.

Genitalia (Fig. 7D–F). Genital bulb broadly oval. Epandrium widely emarginated in V-shape and forming two subtriangular lateral processes. Hypandrium with short basal stalk. Hypovalves stripe-like, bearing comb-like setae along distal ⅗ of inner margin, extending to approximately ⅘ of gonocoxites. Gonostyli with subtriangular median process, basal lobe greatly curved in C-shape. Parameres connected to membranous ventral valves of aedeagus through sclerotized ventral bridges, bearing numerous microtrichia along inner margin, extending slightly beyond middle portion of gonostyli. Ventral and dorsal valves short and cone-shaped.

Females

Habitus (Fig. 7B). Similar to males except darker body color and denser wing markings.

Genitalia (Fig. 7G–J). Subgenital plate narrow, constricted near basal ⅖ and nearly rounded apically without emargination, enclosed by greatly expanded T9. Medigynium with main plate broad and slightly pointed at base. Posterior arms slightly shorter than main plate with acute apices. Axis with apodemes greatly trilobulated basally, and directed dorsad.

Distribution

China: Fujian (Fuzhou, Yongtai).

Panorpa zhengxinyiae sp. nov.

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Figs 1, 8

Diagnosis

This new species is superficially similar to *Panorpa subambra* by the exceptionally broad hindwings, and the general morphology of the genitalia. It can be differentiated from the latter by the following characters: in males, (1) hypandrium short, extending nearly to middle of gonocoxites (vs long, extending

nearly to apex of gonocoxites); (2) basal lobe of gonostyli single-lobed (vs bilobed); (3) parameres extremely long, extending nearly to apex of gonostyli (vs shorter, not exceeding basal lobe of gonostyli); in females, (4) main plate approximately twice as long as wide (vs shorter); and (5) apodemes of axis of medigynium concealed in main plate (vs extending beyond main plate basally).

Etymology

This species is named in honor of Dr Xin-Yi Zheng, the collector of the type specimens.

Type material

Holotype

CHINA – **Guizhou Province** • ♂; Zunyi City, Suiyang County, Kuankuoshui National Nature Reserve; approximately 28°14′6.75″ N, 107°10′52.00″ E; 1400 m a.s.l.; 23 Aug. 2020; X.-Y. Zheng leg.; BMDU, CNGZKKS20Pazxy001.

Paratype

CHINA – **Guizhou Province** • 1 ♀; same data as for holotype; BMDU, CNGZKKS20Pazxy002.

Description

Measurements (mm). Male (holotype, n =1). AtL 11.0, AbL 11.3, BdL 14.5, FL 13.2, FW 3.2, HL 11.8, HW 3.7. Female (paratype, n = 1). AtL 11.6, AbL 7.2, BdL 11.3, FL 13.5, FW 3.4, HL 12.1, HW 3.7.

Male

Head (Fig. 8A). Vertex dark yellowish-brown with broad black pattern enclosing ocellar triangle. Occiput light yellowish-brown. Rostrum yellowish-brown with darkened palps. Antennae with scape light yellowish-brown, pedicel brown, 40 flagellomeres dark brown.

Thorax (Fig. 8A). Pronotum dark yellowish-brown with six stout setae on each side of anterior border. Meso- and metanotum dark yellowish-brown without mesal stripe. Pleura and legs light yellowish-brown with darkened terminal tarsomeres.

Abdomen (Fig. 8A, C). T2–T5 brown with dark borders. Notal organ on hind border of T3 semicircular. S2–S5 light greyish brown. A6 cylindrical basally and tapering towards apex in distal portion. A7 greatly constricted basally, distal portion enlarged. A8 less constricted, evenly enlarged apically, distinctly shorter than A7.

Genitalia (Fig. 8D–E). Genital bulb long oval. Epandrium deeply emarginated in U-shape and forming pair of finger-like lateral processes. Hypandrium Y-shaped with short and narrow basal stalk. Hypovalves narrow, extending nearly to middle of gonocoxites, widely divergent. Gonocoxites with prominent ventromedial processes. Gonostyli with short median process, basal lobe large, greatly folded with small outer prominence and large inner prominence. Parameres greatly elongated, thread-like, extending nearly to distal portion of gonostyli, and bearing microtrichia along inner margin. Ventral valves slightly sclerotized; dorsal valves greatly melanized; dorsal processes widely separated in deep U-shape and convergent apically.

Female

Habitus (Fig. 8B). Similar to males except denser wing markings.

Genitalia (Fig. 8F–H). Subgenital plate long subtriangular without terminal emargination. Medigynium with main plate twice as long as wide and greatly constricted near middle, with basal half distinctly wider

than distal half; posterior arms slender, basally divergent and distally convergent, approximately half as long as main plate. Axis completely concealed in main plate with parallel apodemes.

Distribution

China: Guizhou (Suiyang).

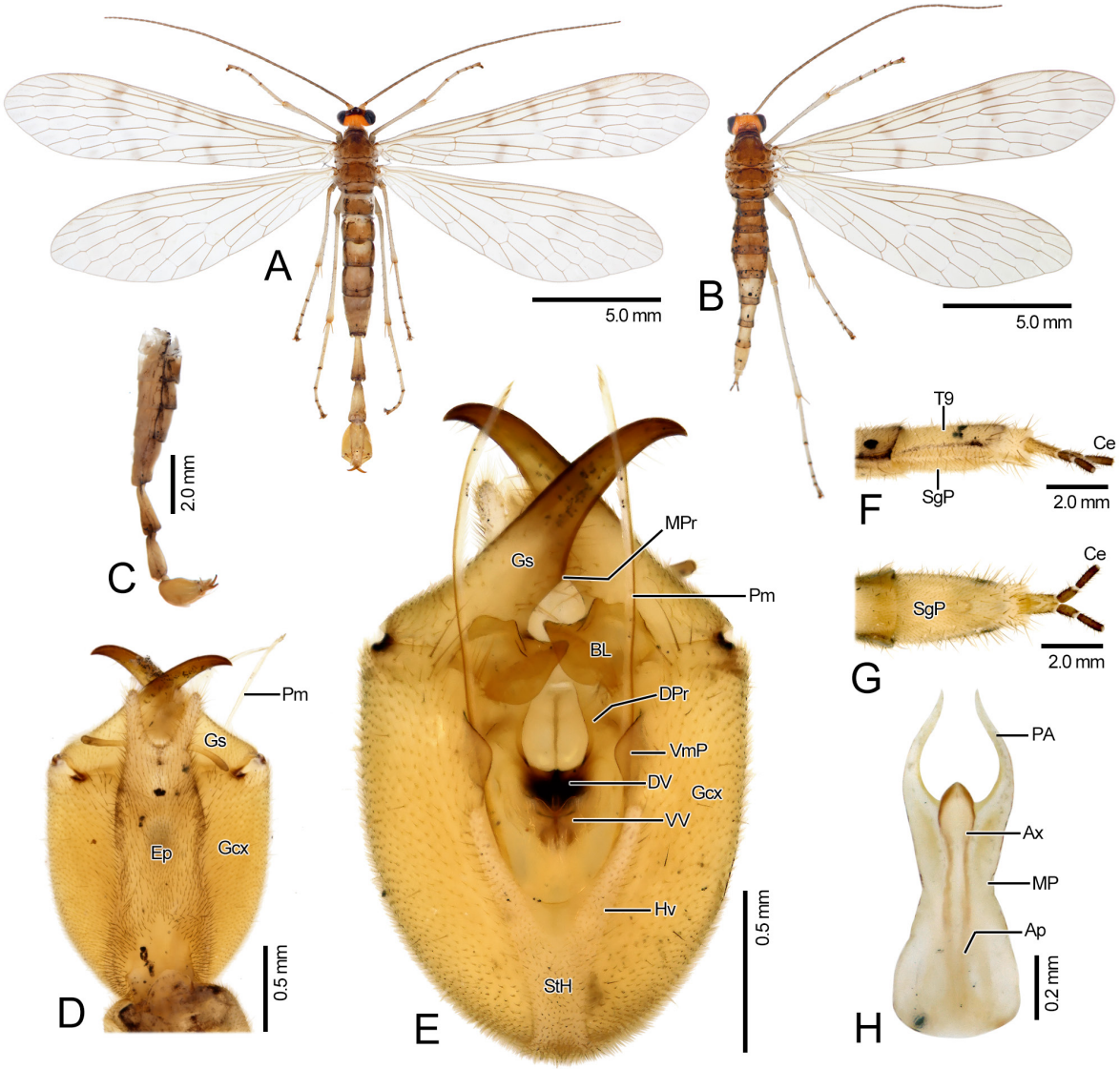


Fig. 8. *Panorpa zhengxinyiae* sp. nov. **A, C–E**. Holotype, ♂ (BMDU, CNGZKKS20Pazxy001). **B, F–H**. Paratype, ♀ (BMDU, CNGZKKS20Pazxy002). **A–B**. Habitus, dorsal view. **C**. Abdomen, left-lateral view. **D–E**. Genital bulb, dorsal and ventral views, respectively. **F–G**. Terminal abdomen, left-lateral and ventral views, respectively. **H**. Medigynium, ventral view. Abbreviations: see Material and methods.

Panorpa auripennis Bicha, 2019
Figs 9, 10B

Material examined

CHINA – **Yunnan Province** • 5 ♂♂, 3 ♀♀; Pu'er City, Zhenyuan County, forest edge near Zhalong; 24°02′42.27″ N, 101°08′36.57″ E; 1622 m a.s.l.; 4 Oct. 2023; C.-M. Liao and J.-S. Wang leg.; BMDU, CNYNZY23Paaur001–CNYNZY23Paaur008 • 2 ♂♂, 1 ♀; same data as for preceding; 7 Oct. 2025; BMDU, CNYNZY25Paaur001–CNYNZY25Paaur003 • 1 ♀; Lincang City, Shuangjiang County, Mengmeng Town; 23°30′50.0″ N, 99°54′53.9″ E; 1505 m a.s.l.; 17 Oct. 2025; Q. Tang, J. Xie and J.-S. Wang leg.; BMDU, CNYNSJ25Paaur001.

Remarks

Since its original discovery in Chiang Mai, *P. auripennis* is the sole species recorded from Thailand exhibiting golden-yellow to yellowish-orange wings (Bicha 2019; Bicha *et al*. 2022). An additional record from Doi Inthanon (https://www.inaturalist.org/observations/189324506) also clearly refers to this species.

Wang & Hua (2022) first reported its occurrence in Pu'er and Menghai, Yunnan Province, China. The newly examined material extends the known distributional range northward to Shuangjiang and Zhenyuan in Yunnan Province, southwestern China. Notably, the Chinese population exhibits marked morphological variation compared with the Thai population, particularly in wing markings (Figs 9A–B, 10B). In the Chinese specimens, the apical band of both fore- and hindwings is small but distinct, extending from R_2 to nearly R_5, or beyond R_5 in some individuals, whereas it is greatly reduced or entirely absent in Thai specimens; conversely, the minute basal spot is smaller in the Chinese populations but larger in the Thai populations (Bicha 2019; Bicha *et al.* 2022). The genitalia (Fig. 9D–K), however, show no differences of sufficient magnitude to justify species delimitation. Therefore, these populations are herein considered conspecific, with the observed morphological variation attributable to geographic variation across the species' broad distributional range.

When compared with its congeners from Yunnan and Indochina, *P. auripennis* appears to be an isolated species with no obvious closely related species currently recognized (Bicha 2019). The only other species of *Panorpa* known from Thailand, *Panorpa apscisacera* Bicha & Suttiprapan in Bicha *et al*., 2022, has recently been transferred to the genus *Minorpa*. When the comparative scope is broadened, another morphologically enigmatic species, *Panorpa sextaenia* Zhou & Bao, 2002, from Guangxi, Guizhou, and Hunan (China), exhibits similar 'golden' wings. This pattern may suggest the existence of as-yet-undiscovered intermediate species occurring in the geographic gap between these two taxa, awaiting future discovery.

Discussion

Although its placement within Panorpinae is clear, the precise systematic position of the *Panorpa deceptor* group within the subfamily remains unresolved. Based on morphological similarities, members of this group appear to be closely related to the *P. stigmalis* group (sensu Wang & Hua 2021) and to *Sinopanorpa*, sharing a posteriorly tapering or beveled apex of male abdominal segment VI (A6). The recently reviewed *P. issikiana* group (sensu Wang & Zhao 2024) also exhibits this character. However, recent molecular phylogenetic analyses based on combined nuclear and mitochondrial gene fragments (Hu *et al*. 2015; Miao *et al*. 2019) did not include any representatives of the *P. deceptor* group. Considering the broad geographical distribution and pronounced morphological heterogeneity of the *P. deceptor* group, species currently assigned to *Sinopanorpa* and the *P. stigmalis* group may represent specialized sublineages within this group. A comparable pattern is observed in another sublineage

comprising *P. acharya* sp. nov., *P. lahu* sp. nov., *P. subambra*, and *P. zhengxinyiae* sp. nov., which can be grouped by their exceptionally broad hindwings (Figs 2A, 5A, 8A). In contrast to most other lineages of Panorpidae, in which the hindwings are generally as wide as or narrower than the forewings, this condition represents a clear morphological specialization and may constitute a synapomorphy.

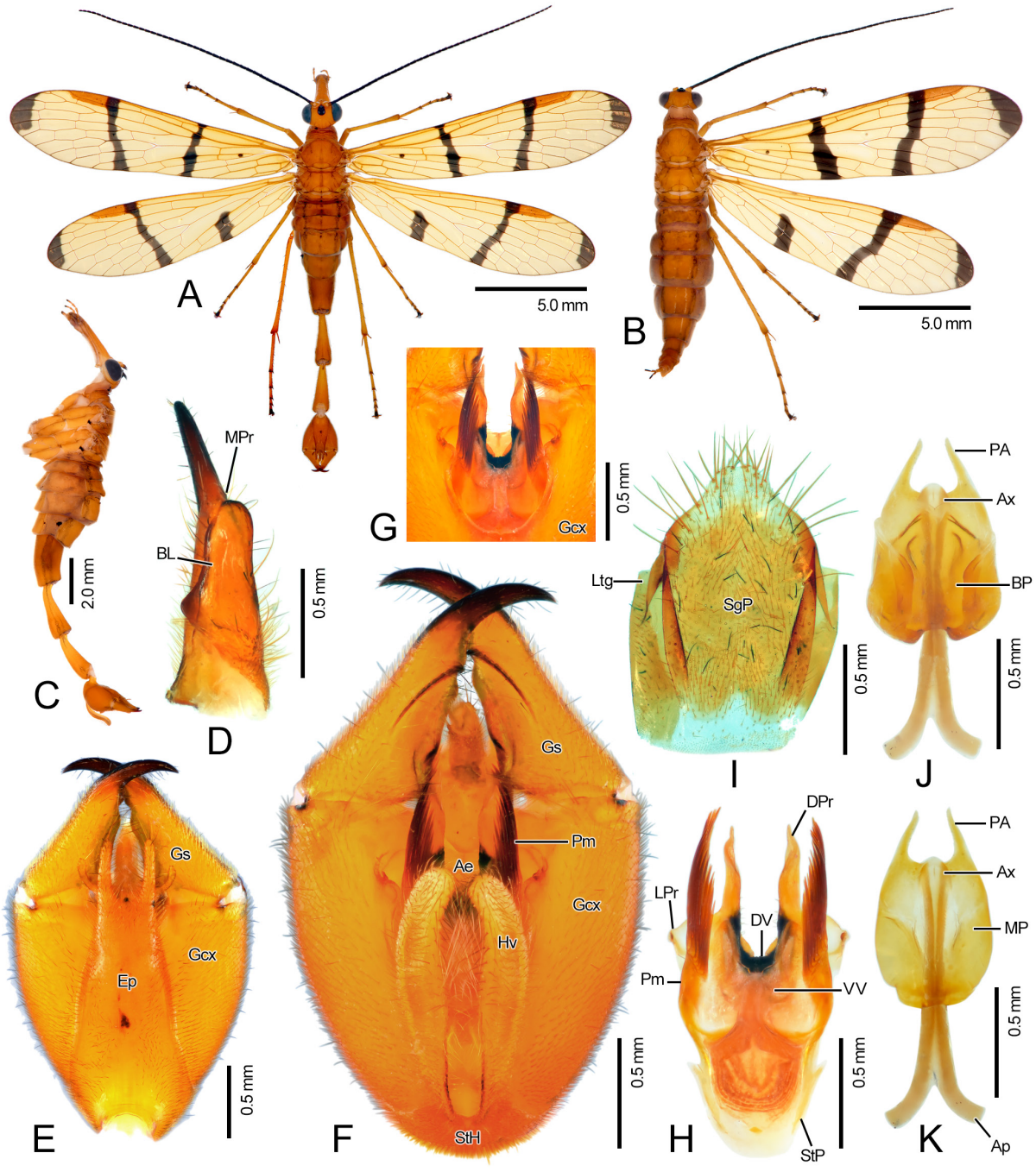


Fig. 9. *Panorpa auripennis* Bicha, 2019. **A, C–H**. ♂ (CNYNZY23Paaur001). **B, I–K**. ♀ (BMDU, CNYNZY23Paaur006). **A–B**. Habitus, dorsal view. **C**. Habitus, left-lateral view. **D**. Right gonostyli, left-lateral view. **E–F**. Genital bulb, dorsal and ventral views, respectively. **G–H**. Aedeagal complex, ventral view. **I**. Subgenital plate, ventral view. **J**. Medigynium, ventral view. **K**. Medigynium with basal plate removed, ventral view. Abbreviations: see Material and methods.

Panorpa concolor Esben-Petersen, 1915, is likely a member of this group. Issiki's (1927) description was based on a misidentified male with a single anal horn, later described as *P. horiensis* Issiki, 1929. Based on immaculate yellow wings, *P. concolor* closely resembles *P. longititilana* and *P. nokoensis*, and may be conspecific or closely related; however, key characters, including genitalia, remain unknown, precluding definitive assignment. *Panorpa horiensis* is also likely related to the *P. deceptor* group by the genital similarities. Previously assigned to the *P. cornigera* group due to a single anal horn on male T6 (Issiki & Cheng 1947), this character is now recognized as homoplastic, occurring in multiple distantly related Panorpinae lineages, including *Cerapanorpa*, *Megapanorpa*, *P. banksiana* group, *P. confusa* group, *P.*



Fig. 10. *Panorpa deceptor* group, living individuals. **A**. *P. acharya* sp. nov., ♀. **B**. *P. auripennis* Bicha, 2019, ♂. **C**. *P. huboliao* sp. nov., ♀. **D**. *P. lutea* Carpenter, 1945, ♂. **E**. *P. pingjiangensis* Chou & Wang, 1987, ♂. **F**. *P. tetrazonia* Navás, 1935, ♂. Copyright: C: ©Xin Xie; others: ©Ji-Shen Wang.

cornigera group, *P. debilis* group, *P. galerita* group, *P. kiautai* Zhou & Wu, 1993, and *P. horiensis*. Another Chinese species, *P. guidongensis* Chou & Li in Chou *et al*., 1987 resembles members in this group superficially, but lacks a median process in male gonostyli, has a columnar aedeagus and strongly reduced female medigynium apodemes, excluding it from the group.

Two subgroups within the *P. deceptor* group are distinguished by female medigynium morphology. The first, represented by *P. deceptor* (28 spp.), possesses prominent posterior arms, whereas the second, represented by *P. taiwanensis* (18 spp.), shows extremely reduced or absent posterior arms. Reduction of posterior arms is likely not a synapomorphy, as similar conditions occur in some North American species (e.g., *P. bicolumnaris* Gómez-Jácome & Contreras-Ramos, 2026, *P. rufa* Gray, 1832, *P. nuptialis* Gerstaecker, 1863, and *P. opposita* Gómez-Jácome & Contreras-Ramos, 2026). Posterior arms function in coupling with male lateral processes of the aedeagus (Tong & Hua 2019), suggesting a role in copulation; alternative mechanisms in species lacking these arms remain unknown.

Adult scorpionflies generally avoid summer heat, occurring either at higher elevations or emerging during cooler seasons such as spring or autumn. Autumn, and occasionally winter, emergence is common in the *P. deceptor* group. For example, *P. sextaenia*, *P. pingjiangensis* (Fig. 10E), and *P. tetrazonia* (Fig. 10F) typically emerge in late August and die by early December, whereas *P. huboliao* sp. nov. and *P. insularis* can persist until January. Correspondingly, species in this group show two altitudinal preferences: high-mountain (>2000 m; e.g., *P. acharya* sp. nov., *P. lahu* sp. nov.) and lowland/mid-mountain (<800 m; e.g., *P. tetrazonia*). A few species, such as *P. temperata* sp. nov., emerge in spring, possibly reflecting a bivoltine life cycle, although evidence is currently insufficient.

Taiwan, located off the southeastern coast of mainland China, harbors the highest diversity of the *P. deceptor* group, with 21 species recorded, compared to a single species on the Amami Islands, one on Hainan Island, and approximately twelve in adjacent continental provinces of China. Taiwan's steep elevation gradients and peaks exceeding 3900 m generate diverse microclimates and habitats, from lowland tropical forests to alpine tundra, facilitating species coexistence and specialization. In contrast, Hainan's lower topographic diversity limits species richness. Taiwan also served as a Pleistocene glacial refuge, retaining species from northern and southern regions (Siame *et al*. 2007); some ancestral taxa of this group likely dispersed via land bridges from southeastern China to Taiwan and onward to the Amami Islands.

Funding

This research was financially supported by the Starting Foundation for the High-level Talents, Dali University (grant number KY2096124040), and the Project of the Cangshan Forest Ecosystem Observation and Research Station of Yunnan Province, Yunnan Provincial Department of Science and Technology (grant number 202305AM070003).

Data availability

All data supporting the conclusions of this study are presented in the article.

Acknowledgments

I would like to express my sincere thanks to Hui Dong, Jing-Zhe Du, Jia-Xian Gong, Yan-Cai Jin, Jia-Ling Li, Jia-Xin Li, Xuan-Kun Li, Zi-Xuan Li, Chun-Mei Liao, Ye-Jie Lin, Zhi-Hao Qi, Qing Tang, Ming-Xuan Wu, Jiao Xie, Yan-Bin Yao, Ding Yang, Rui Zhao, Yi Zheng, Yu-Chen Zheng, Xin-Yi Zheng, Dan-Chen Zhu for collecting and donating the precious specimens, and Wesley Bicha for his valuable insights into the species identification. I am especially grateful to Xin Xie for granting permission to use his photograph. The author also thanks the anonymous reviewers for their insightful comments on the manuscript.

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