

Two new species and one newly recorded species in the genus *Neopanorpa* van der Weele (Mecoptera: Panorpidae) from southwestern China

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Abstract: The Oriental scorpionfly genus *Neopanorpa* van der Weele, 1909 has the highest diversity of species in southwestern China. Here, two species of *Neopanorpa* are described as new to science, *Neopanorpa leptorhapis* **sp. nov.** from Yunnan and *Neopanorpa lunulivalva* **sp. nov.** from Guangxi. *Neopanorpa lindsleyi* Bicha, 2015, originally described from Vietnam, is newly discovered from Guangxi, China.

Key words: *Neopanorpa*; new species; Oriental region; scorpionflies; taxonomy; Guangxi; Yunnan

中国西南地区新蝎蛉属两新种及一新记录种（长翅目：蝎蛉科）

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摘要：新蝎蛉属 *Neopanorpa* van der Weele, 1909是典型的东洋区昆虫类群，在中国西南地区有着最高的多样性。本文描述新蝎蛉属2新种：棒状新蝎蛉*Neopanorpa leptorhapis* **sp. nov.**采自云南，弯月新蝎蛉*Neopanorpa lunulivalva* **sp. nov.**采自广西。*Neopanorpa lindsleyi* Bicha, 2015原始记载于越南，本文首次报导于广西。

关键词：新蝎蛉属；新种；东洋区；蝎蛉；分类；广西；云南

Introduction

The scorpionfly genus *Neopanorpa* van der Weele, 1909 is distributed in the Oriental Region, ranging from India through southern China and the Indo-China Peninsula southward to Indonesia (Ma *et al.* 2011). It is the second largest genus of Panorpidae in Mecoptera, consisting of over 170 species, with approximately 60% of species recorded in China (Wang & Hua 2017, 2018, 2019; Wang 2021).

The adults of *Neopanorpa* are saprophagous, feeding on dead arthropods and soft worms, and are commonly found in moist, undisturbed herbs and shrubs. During mating, some species of *Neopanorpa* adopt a forced mating tactic with a well-developed notal organ to seize

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the wings of the female without nuptial feeding (Tong & Hua 2019). The saprophagous larvae inhabit the soil during most of their life time (Jiang *et al.* 2019). The distinct diagnoses of the larvae mainly lie in their head capsules with shallow furrows and their antennae, cephalic setae, and dorsal processes on the trunk being much shorter than in other genera (Jiang & Hua 2015). The full-grown larvae prepare a cell cavity in the soil for pupation. The exarate pupae basically take the form of the adults (Byers & Thornhill 1983).

The southwest of China includes Tibet, Yunnan, Sichuan, Guizhou, Chongqing and the northwest of Guangxi. This region is located in the subtropics with abundant annual precipitation and mountainous terrain. The topography is highly undulating, with a complex natural geographical environment. This geographical environment is not only conducive to the survival of *Neopanorpa*, but also generates the species diversity of this genus where Yunnan Province has the highest species richness of *Neopanorpa* in China (Wang & Hua 2018).

In this paper, we describe two new species of *Neopanorpa* from Yunnan and Guangxi, China. In addition, *Neopanorpa lindsleyi* Bicha, 2015, originally described from Vietnam, was recently discovered from Guangxi. The species numbers of *Neopanorpa* in Yunnan and Guangxi are thereby increased to 26 and six, respectively.

Material and methods

Specimens were collected with collecting nets and preserved in 75% ethanol at the Entomological Museum, Northwest A&F University, China (NWAUFU). Some type specimens are spread and pinned. The genitalia were dissected and observed under a Nikon SMZ 1500 Stereoscopic Zoom microscope. The measurements were made with a Vernier caliper. Wing length was measured from the base to the apex, and wing width from the ending of vein M_4 to the Costal margin. Male aedeagus and female medigynium were macerated in 5% NaOH for 5 min and then rinsed with tap water. Photographs were taken with a Nikon D200 digital camera for habitus, and with a scientific digital micrography system ZEISS SteREO Discovery V20 for micrographs. All pictures were adjusted and assembled with Adobe Photoshop CC 2018. The terminology follows Wang & Hua (2019) and Gao & Hua (2021).

The following abbreviations are applied in the main text: A1 — the first abdominal segment (and so forth for other abdominal segments); FL — length of forewing; FW — width of forewing; HL — length of hindwing; HW: width of hindwing; S1 — the first sternum (and so forth for other sterna); T1 — the first tergum (and so forth for other terga).

The following abbreviations are applied in the figure notes: ae — aedeagus; ap — apodeme; ax — axis; bp — basal process; ce — cercus; dbr — dorsal bridge; dp — dorsal process; dv — dorsal valve; ep — epandrium; epl — epandrial lobe; gcx — gonocoxite; gs — gonostylus; hpp — hypandrial process; hv — hypovalve; lpr — lateral process; mdg — medigynium; mdt — median tooth; ms — mesonotum; mt — metanotum; no — notal organ; pa — posterior arm; pm — paramere; pno — postnotal organ; pr — pronotum; sgp — subgenital plate; sth — stalk of hypandrium; stp — stalk of paramere; vv — ventral valve.

Taxonomy

1. *Neopanorpa leptorhapis* Li & Hua sp. nov. (Figs 1, 2)

Description. Holotype. FL 12.1 mm, FW 2.9 mm, HL 11.0 mm, HW 2.8 mm. Paratypes. FL 11.1–12.1 mm, FW 2.5–2.9 mm, HL 10.1–11.1 mm, HW 2.5–2.8 mm.

Male. Head (Fig. 1C). Frons, vertex and occiput black. Ocelli amber. Rostrum yellowish brown, with two pale brown longitudinal stripes along clypeus. Labrum dark brown. Maxillary and labial palps yellowish brown, but apex dark brown. Scape sordid pale, pedicel brownish-black; 42–43 flagellomeres, brownish-black.

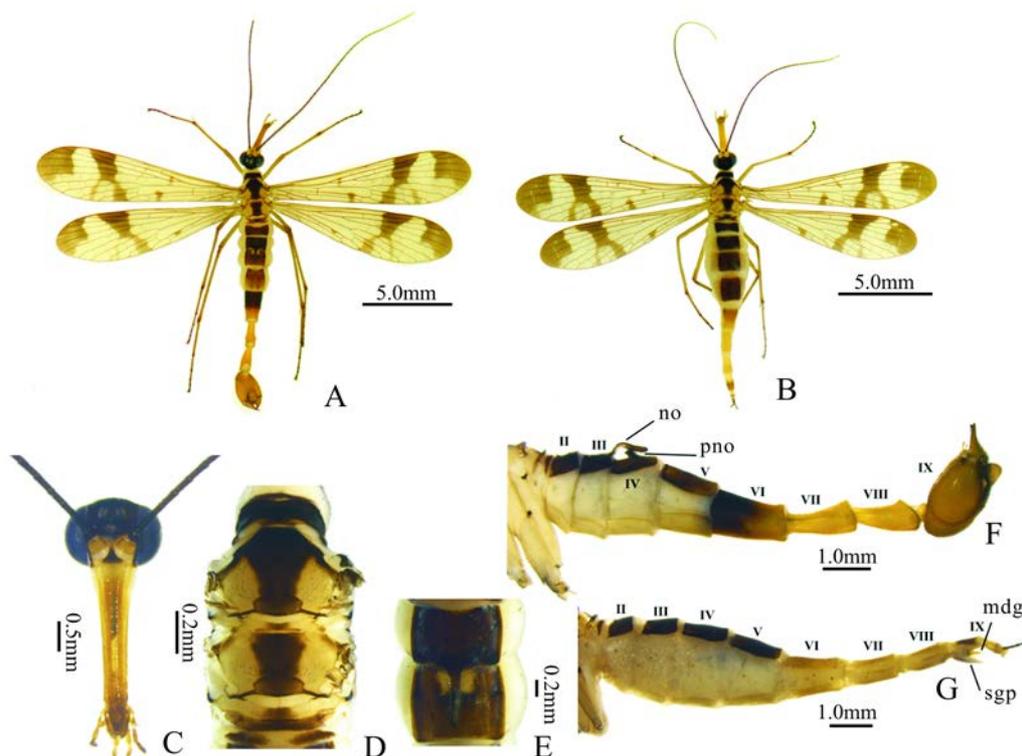


Figure 1. *Neopanorpa leptorhapis* sp. nov., ♂ (A, C, D, E, F), ♀ (B, G). A, B. Habitus, dorsal views; C. Head, frontal view; D. Thorax, dorsal view; E. Terga 3 and 4, dorsal view; F, G. Abdomen, lateral views.

Thorax (Figs 1A, 1D). Pronotum brownish-black, without setae along anterior margin. Anterior edge of mesonotum brownish-black, medial band brownish-black, narrow backwards, remaining part sordid pale. Metanotum with brownish-black medial band, lateral portion sordid pale. Scutella brownish-black. Pleura sordid pale, legs sordid pale.

Wing (Fig. 1A). Wing membrane hyaline, slightly tinged with brown, bearing brown markings; R_2 two-branched in forewing; pterostigma inconspicuous; apical band broad, reaching over R_5 , and unconnected to pterostigmal band on costal margin; pterostigmal band complete, with basal branch approximately twice as wide as apical branch; marginal spot present as oblique thin band extending from R_1 to middle nygma; basal band split into two irregular spots; basal spot absent, inconspicuous. Hindwing similar to forewing in shape and venation, but lacking marginal spot.

Abdomen (Figs 1A, 1E, 1F). T1–T5 brownish-black, corresponding sterna light yellowish. Pleura pale. Notal organ on posterior margin of T3 slender, rod-like, not reaching posterior margin of T4. Postnotal organ in the middle of T4 with keen-edged apex, slightly curved forward. T4 with square membranous region in front of postnotal organ. A6 cylindrical, slightly tapering toward apex, with anterior part brownish-black and caudal part yellowish-brown. A7 as long as A8, slightly shorter than A6, yellowish-brown, subconical, gradually enlarged in diameter backwards. A8 with beveled apex.

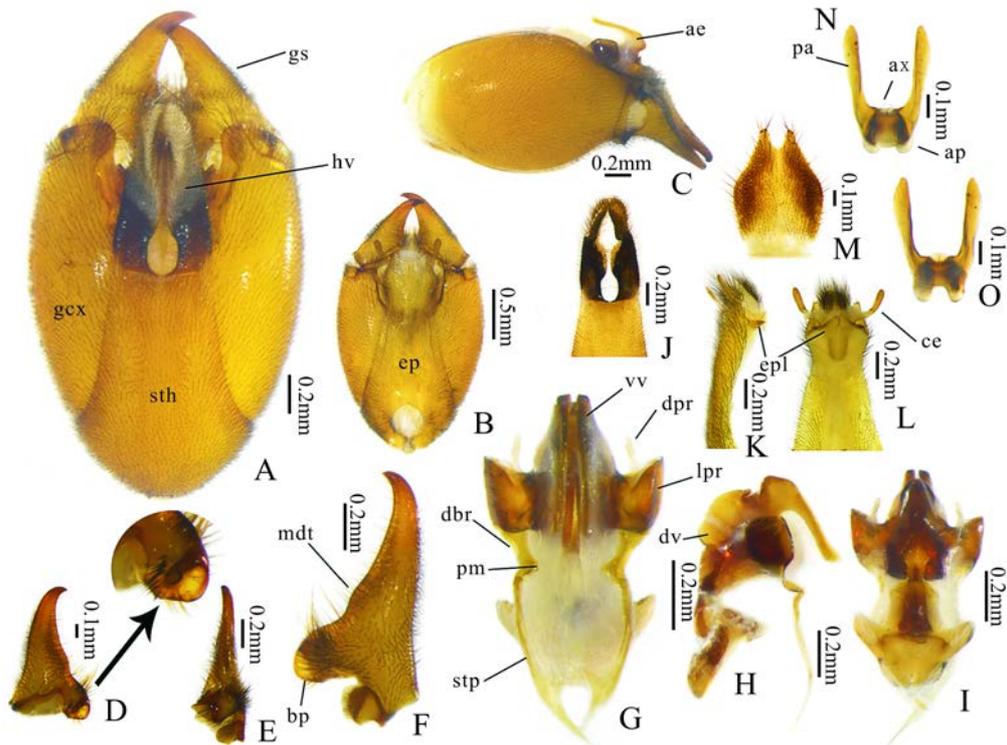


Figure 2. *Neopanorpa leptorhapis* sp. nov., ♂ (A–L), ♀ (M–O). A–C. Genital bulb, ventral, dorsal and lateral views; D–F. Gonostylus, dorsal, lateral and ventral views; G–I. Aedeagal complex, ventral, lateral and dorsal views; J. Hypandrium, dorsal view; K, L. Epandrium, lateral and ventral views; M. Subgenital plate, ventral view; N, O. Medigynium, ventral and dorsal views.

Genitalia (Figs 2A–L). Genital bulb yellowish-brown; long ellipsoidal, nearly twice as long as wide. Epandrium narrowing toward apex, slightly dilated near apex; apex with shallow U-shaped emargination; epandrial lobes triangular. Hypandrium narrowing toward apex, separated near middle into pairs of hypovalves; hypovalves not overlapping, with basal part dark brown and remainder greyish brown; inner margin of apical part twisted out about 90°; hypandrial process absent. Gonostylus yellowish-brown, shorter than half of gonocoxite, median tooth slightly raised; basal processes conspicuous, curved dorsad, with long setae on middle of ventral surface, divided into two flaps at apex, dorsal surface of basal processes bearing one row of black setae. Paramere extremely vestigial, only basal stalk left. Dorsal bridge curved in lateral view. Stalk of paramere elongate, connected near middle. Ventral valves of aedeagus sclerotized only on outer margin, bluntly raised near apex. Outer margin of

dorsal valves arched; slightly lower than ventral valves, especially narrow near apex. Lateral processes thick, apex approximately right-angled in lateral view. Ventral valves and lateral processes protruded in genital bulb in lateral view. Dorsal processes elongated, arc-shaped at apex, slightly exceeding dorsal valves in lateral view, but not exceeding ventral valves.

Female (Figs 1B, 1G). Head and thorax similar to male in appearance, but wing with denser markings. T1–T5 brownish-black, S1–S5 light yellow, A6–A8 yellowish-brown, A9–A11 brownish-black. Cerci black.

Genitalia (Figs 2M–O). Subgenital plate widest near middle, with deep V-shaped emargination at apex; apex and lateral edges bearing long setae, unevenly yellowish brown, both sides darker. Posterior arms of medigynium narrow, bladed-shaped, twisted near base, about two-thirds as long as medigynium; axis slightly extending out of the main plate with two rounded apodemes.

Holotype. ♂, **China**, Yunnan, Yongde County, Mt. Tangli, 1750 m, 99°14'36"E, 24°02'24"N, 15-VI-2021, leg. Lele HE. **Paratypes.** 4♂15♀, **China**, Yunnan, Yongde County, Mt. Tangli, 1600–1900 m, 99°14'36"E, 24°02'24"N, 11–15-VI-2021, leg. Lu LIU. 1♂1♀, **China**, Yunnan, Yongde County, Mt. Daxue, 1180–1600 m, 99°42'47"E, 24°02'15"N, 16-VI-2021, leg. Lele HE.

Etymology. The specific epithet is derived from the Greek, '*leptos*' (slender) and '*rhapido*' (a rod), referring to the slender rod-like notal organ.

Diagnosis. This new species can be distinguished from its congeners through the following characters: 1) notal organ rod-like, base raised slightly, not extending to the apex of T4; 2) gonostylus shorter than half of gonocoxite; 3) hypovalves curved dorsad apically; 4) paramere greatly reduced, dorsal processes elongated dorsad; 5) subgenital plate of female with deep V-shaped emargination at apex; and 6) axis of medigynium slightly beyond main plate, with short apodeme.

Remarks. This new species bears rod-like notal organ, T4 with square membranous region, much similar to *Neopantorpa pielina* Navás, 1936, but differs from the latter in genitalia: male paramere greatly reduced (vs. developed, flush with lateral processes); dorsal processes elongate, slightly beyond dorsal valves (vs. small); and axis of female medigynium short, slightly beyond main plate (vs. longer than posterior arms). Due to these special characteristics, it is difficult to assign *Neopantorpa leptorhapis* sp. nov. into any species group.

2. *Neopantorpa lunulivalva* Li & Hua sp. nov. (Figs 3, 4)

Description. Holotype. FL 14.6 mm, FW 3.4 mm, HL 13.2 mm, HW 3.3 mm. Paratypes. FL 14.6–14.9 mm, FW 3.4–3.5 mm, HL 13.1–13.3 mm, HW 3.3–3.4 mm.

Male. Head (Fig. 3C). Frons brownish-black. Vertex and occiput black, ocelli amber. Rostrum yellowish-brown with two brown longitudinal stripes along clypeus; labrum yellowish-brown. Maxillary and labial palps yellowish-brown, but apical segment dark brown. Antennae with 45 flagellomeres, scape brown, pedicel and flagellum black.

Thorax (Fig. 3D). Pronotum black, bearing six thick black setae on anterior margin. Mesonotum black on anterior and middle part, arrow-shaped; pale postero-laterally. Metanotum similar to mesonotum, but with larger sordid pale part. Scutella black. Pleura and legs sordid pale.

Wing (Fig. 3A). Wing membrane hyaline; wing markings dark brown; veins brown, except apical crossveins transparent; pterostigma indistinct; R_2 two-branched in forewing; apical band connected to pterostigmal band on costal margin, only anterior part left, extending to R_5 ; pterostigmal band with broad basal branch, but apical branch absent or reduced to a little spot; marginal spot reduced as a small spot in the middle nygma; basal band reduced as little spot extending from inner margin to CuA; basal spot absent. Hindwing similar to forewing in shape and venation, but pterostigmal band lacking apical branch and apical band greatly reduced.

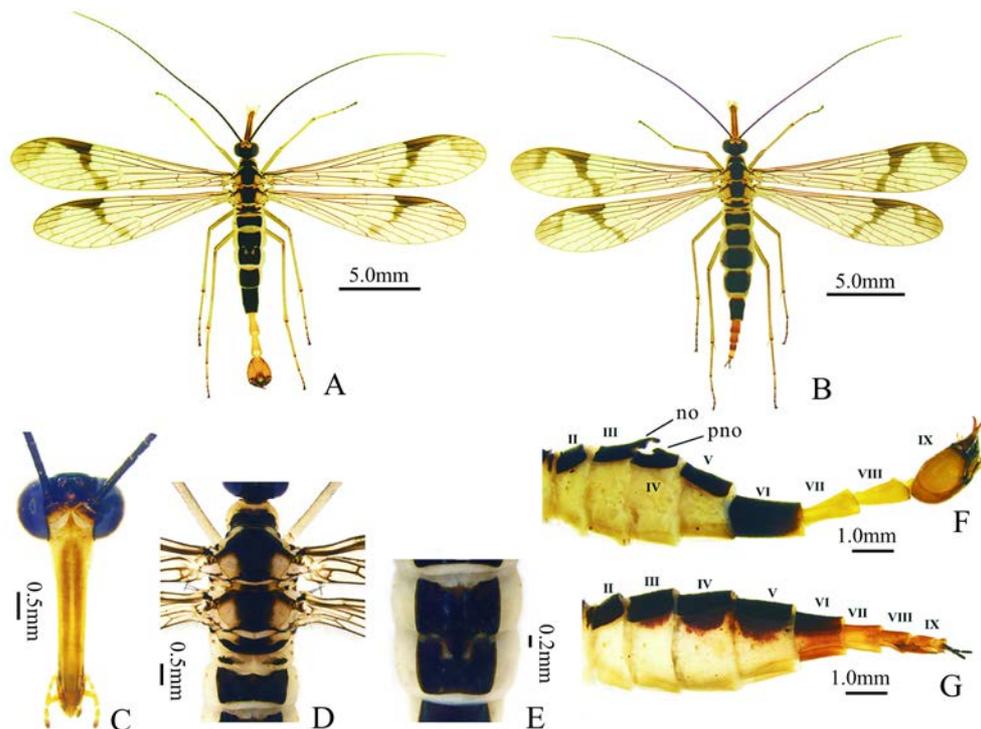


Figure 3. *Neopanorpa lunulivalva* sp. nov., ♂ (A, C, D, E, F), ♀ (B, G). A, B. Habitus, dorsal views; C. Head, frontal view; D. Thorax, dorsal view; E. Terga 3 and 4, dorsal view; F, G. Abdomen, lateral views.

Abdomen (Figs 3E, 3F). T2–T5 black; corresponding sterna light yellowish. Pleural areas sordid pale. Notal organ of T3 triangular, extending to half of T4. T4 with square membranous area in front of postnotal organ. Postnotal organ near middle of T4, blunt and slightly tilted forward. A6 black, caudal margin yellowish-brown, approximately cylindrical. A7 shorter than A6, yellowish-brown, subconical. A8 shorter than A7, beveled at end.

Genitalia (Figs 4A–I). Genital bulb long oval. Epandrium narrowing toward apex, with triangular epandrial lobes. Cerci yellowish-brown. Hypandrium split into pairs of hypovalves at three-fifths; base of hypovalves dark brown, remainder greyish, greyish portion twisted out, curved inward near apex; hypandrial processes black, spinous, slightly curved backward. Gonocoxite yellowish-brown, dark brown apically. Gonostylus shorter than gonocoxite, dark brown, slightly curved dorsad; median tooth slightly raised, obtuse triangular; basal processes

conspicuous, apex concave, divided into two flaps: ventral flap auriform, anterior part with numerous black long stout setae; dorsal flap extending forward beyond ventral flap, dorsal surface bearing one row of black stout setae. Paramere elongate, slightly beyond lateral process, acinaciform, apex pointed. Dorsal bridge straight, connected to base of lateral processes. Lateral processes broad and blunt. Ventral valves of aedeagus crescent-shaped in lateral view, anterior part hook-shaped curved ventrad. Dorsal valves developed, blunt and near ventral valves narrow. Dorsal processes small and sharp.

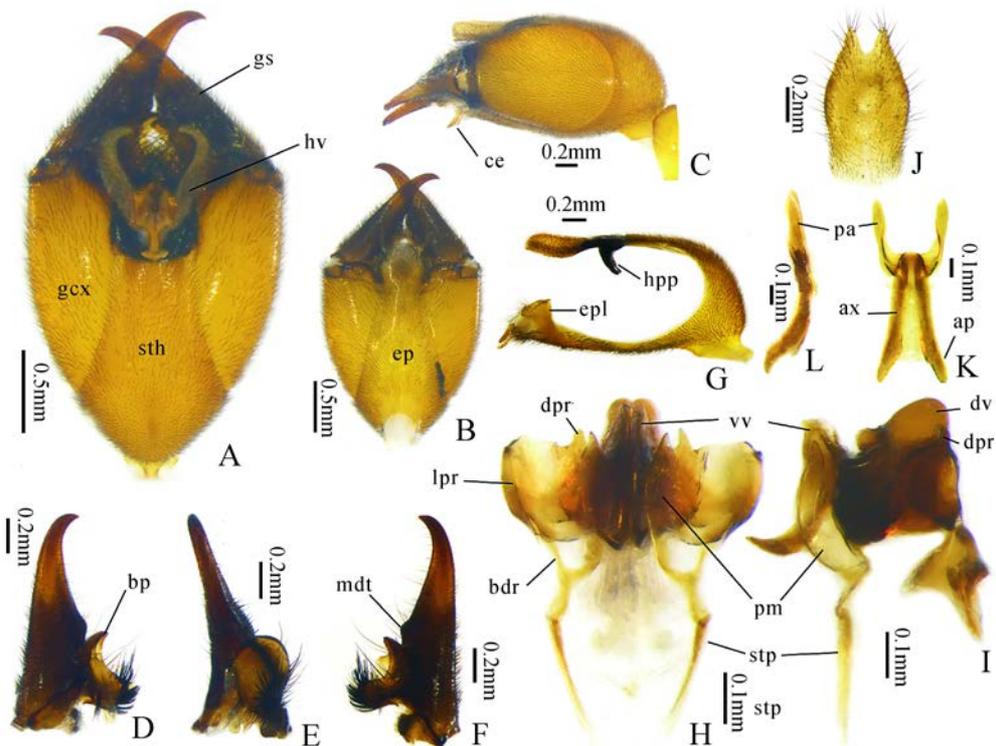


Figure 4. *Neopanorpa lunulivalva* sp. nov., ♂ (A–I), ♀ (J–L). A–C. Genital bulb, ventral, dorsal and lateral views; D–F. Gonostylus, dorsal, lateral and ventral views; G. Epandrium and hypandrium, lateral view; H, I. Aedeagal complex, ventral and lateral view; J. Subgenital plate, ventral view; K, L. Medigynium, ventral and lateral views.

Female (Figs 3B, 3G). Similar to male in head, thorax and wing. T2–T6 black, S2–S5 yellowish, T7–T10 yellowish-brown, S6–S10 yellowish-brown. Cerci black.

Genitalia (Figs 4J–L). Subgenital plate widest near middle, then narrowing backward, apex with deep V-shaped emargination. Medigynium with obvious apodemes; axis developed, narrowing toward apex, anterior part curved dorsad; posterior arms approximately two-fifths the length of medigynium, blade-like, twisted near base.

Holotype. ♂, **China**, Guangxi, Tianlin County, Cenwanglaoshan National Nature Reserve, 1490 m, 106°21'05"E, 24°26'40"N, 22-VI-2022, leg. Yalong LI. **Paratypes.** 1♂6♀, same data as the holotype. 7♀, **China**, Guangxi, Tianlin County, Cenwanglaoshan National Nature Reserve, Laoshan Forest Farm, 1330 m, 106°23'20"E, 24°23'44"N, 24-VI-2021, leg. Lele HE.

Etymology. The specific epithet is derived from the Latin, ‘*lunula*’ (crescent-shaped) and ‘*valva*’ (a valve), referring to the crescent-shaped ventral valve of aedeagus.

Diagnosis. This new species closely resembles *Neopanorpa leigongshana* Zhou & Zhou, 2007 from Guizhou in wing markings and genitalia, but can be distinguished from the latter by the following characters: 1) hypovalves two-fifths the length of hypandrium, black basally, with black spinous hypandrial processes; 2) basal processes auriform, concave on inner side, and bearing numerous black, long, stout setae on anterior portion of ventral surface; 3) aedeagus with ventral valves curved apically, hook-shaped ventrad, and dorsal valves bulged; and 4) genital plate of female with developed axis and apodeme, axis approximately 1.5 times the length of posterior arm.

Remarks. This new species belongs to the *N. pielina* group. It is also similar to *N. tienpingshana* Chou & Wang, 1988 and *N. chaosiuhfui* Wang & Hua, 2017, but differs from the latter two species by the following characters: male with crescent-shaped ventral valves of aedeagus and black spinous hypandrial processes; female with well-developed axis of medigynium.

***Neopanorpa lindsleyi* Bicha, 2015** (Figs 5, 6), new record to China

Neopanorpa lindsleyi Bicha, 2015: 439, type locality: Vinh Phuc, Vietnam.

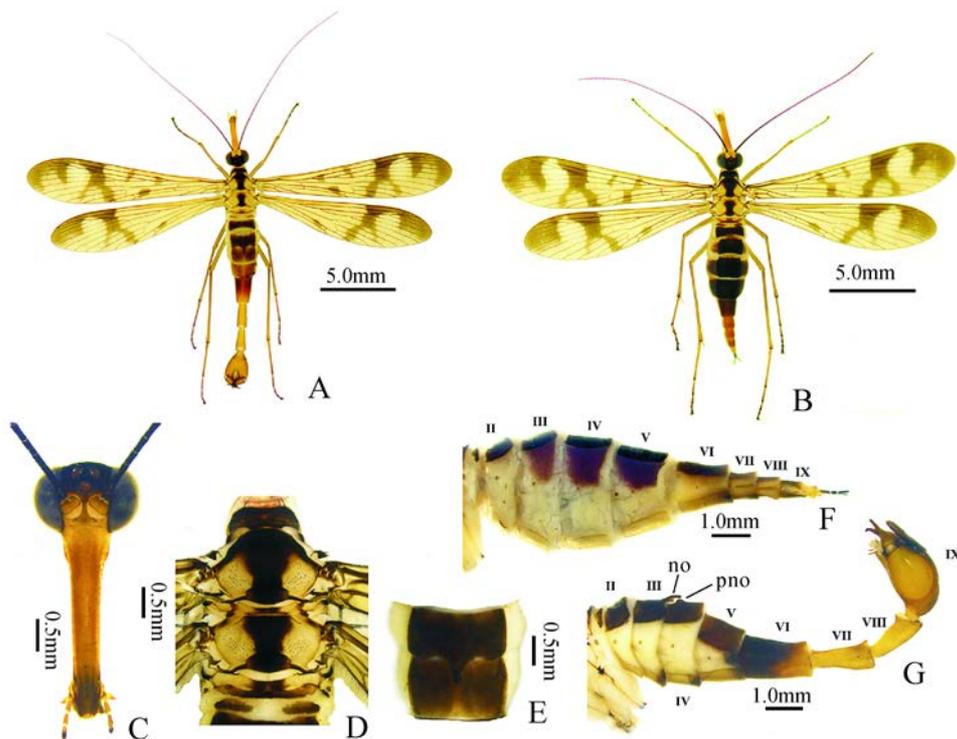


Figure 5. *Neopanorpa lindsleyi* Bicha, 2015, ♂ (A, C, D, E, G), ♀ (B, F). A, B. Habitus, dorsal views; C. Head, frontal view; D. Thorax, dorsal view; E. Terga 3 and 4, dorsal view; F, G. Abdomen, lateral view.

Specimens examined. 29♀34♂, **China**, Guangxi, Youjiang County, Dawangling Nature Reserve, 700 m, 106°24'19"E, 23°44'02"N, 14-VI-2022; leg. Lele HE & Yalong LI. 35♀22♂,

China, Guangxi, Tianlin County, Cenwanglaoshan National Nature Reserve, 1490 m, 106°21'05"E, 24°26'40"N, 22-VI-2022, leg. Yalong LI & Lele HE.

Remarks. *Neopanorpa lindsleyi* Bicha, 2015 was originally described from Vinh Phuc Province, Vietnam. The specimens collected from Guangxi, China closely match the descriptions of the holotype, hence were identified as *N. lindsleyi*. This species is similar to *N. cavaleriei* Navás, 1908, but can be distinguished from the latter by the body yellowish brown, rostrum without brown stripe, and mesal stripe narrower.

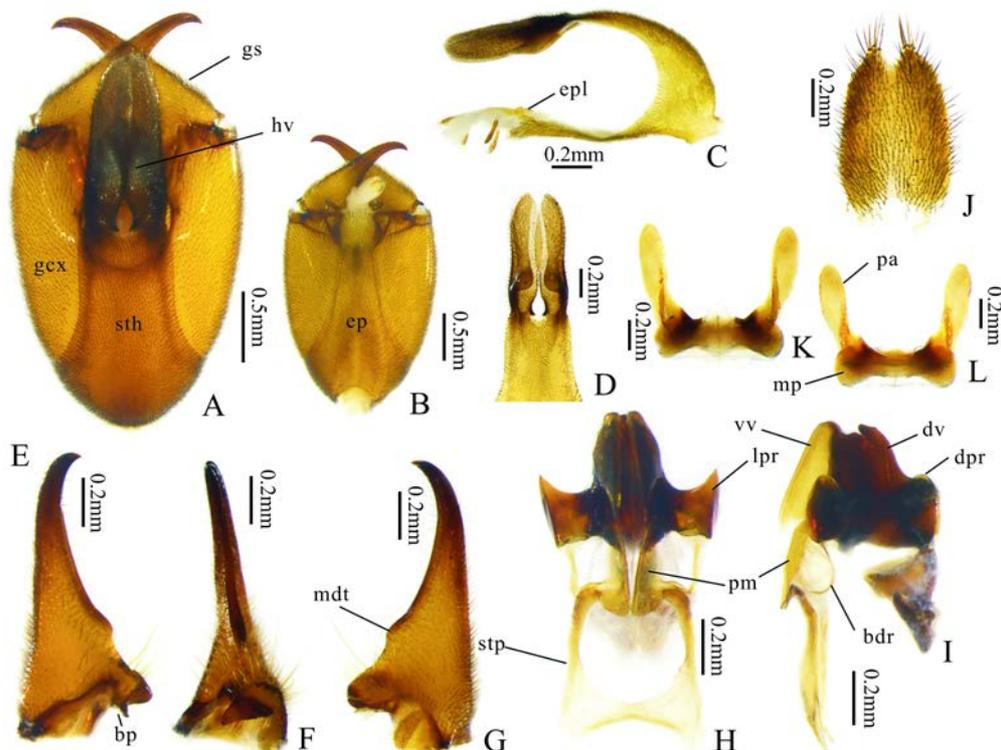


Figure 6. *Neopanorpa lindsleyi* Bicha, 2015, ♂ (A–I), ♀ (J–L). A, B. Genital bulb, ventral and dorsal views; C. Epandrium and hypandrium, lateral view; D. Hypandrium, dorsal view; E–G. Gonostylus, dorsal, lateral and ventral views; H, I. Aedeagal complex, ventral and lateral views; J. Subgenital plate, ventral view; K, L. Medigynium, ventral and dorsal views.

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