

# A review of *Trypoxylon* Latreille, 1796 (Hymenoptera, Crabronidae) of Southwest China with descriptions of two new species

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## Abstract

Two new species of the genus *Trypoxylon* (Hymenoptera: Crabronidae: Crabroninae: Trypoxylini) from Yunnan Province, China: *T. abelothoracicus* Fu & Li, **sp. nov.** and *T. ferrugineipes* Fu & Li, **sp. nov.** are described and illustrated. The female of *T. infoveatum* Li & Li, 2007 is described for the first time. In addition, ten species of *Trypoxylon* are newly recorded from China: *T. buddha* Cameron, 1889, *T. flavipes* Tsuneki, 1979, *T. fulvocollare* Cameron, 1904, *T. gampahae* Tsuneki, 1981, *T. imayoshii* Yasumatsu, 1938, *T. kandyianum* Tsuneki, 1979, *T. khasiae* Cameron, 1904, *T. nasale* Tsuneki, 1979, *T. pahangense* Tsuneki, 1979, and *T. pendleburyi* Tsuneki, 1979. An updated key to *Trypoxylon* of Southwest China is provided.

## Keywords

Crabronidae, Identification key, new records, taxonomy

## Introduction

Southwest China, belonging to the main bioregions of Southeast Asia (Indochina), is recognized as one of the world's 36 biodiversity hotspots and one of the regions with the richest and most threatened fauna worldwide. It's located at the intersection of the

Oriental and Palearctic regions, spanning subtropics and tropics and including plateau climate, tropical rainforest climate, and subtropical monsoon climate (CEPF 2020; Myers et al. 2000; Liu et al. 2022; Liu et al. 2023; Meng et al. 2023).

Southwest China, with an area of 2.5 million square kilometers, includes Yunnan Province, Guizhou Province, Sichuan Province, Chongqing Municipality, and Tibet Autonomous Region and is divided into three terrain units (Qinghai-Tibet Plateau, Yunnan-Guizhou Plateau, and Sichuan Basin), with the Hengduan Mountains, Yunnan-Guizhou Plateau, and Wushan Mountains regarded as the ‘Sky Islands of China’ and is a refuge for a wide range of flora and fauna, with an obvious vertical distribution of species (He and Jiang 2014; Yi et al. 2021; Wang et al. 2023). The species found in the southern and western regions have distinct Oriental characteristics, while those inhabiting the high mountain areas are related Palearctic species; hence, the insect fauna is diversified and abundant (Kryzhanovskiy 1956).

*Trypoxylon* Latreille, 1796, has the widest distribution and most species (633 species and 84 subspecies) among the seven genera of Trypoxylini (Hymenoptera: Crabronidae: Crabroninae) (Pulawski 2024). They usually build their nests in the wood or plant stalks and prey on spiders (Barth 1910; Kazenas 2001). Its members have a slender body 5.5–22.0 mm long; the inner eye orbits are notched; the antennal socket is far away from the frontoclypeal suture; the forewing has only one submarginal cell; and the petiole is long, stick-shaped, or flask-shaped (Bohart and Menke 1976).

Many authors studied the taxonomy of *Trypoxylon*. Richards (1934) revised the New World species, recognizing several species groups, and Tsuneki (1956a, b, 1972, 1973, 1974, 1976, 1977, 1978a, b, 1979a, b, c, 1980a, b, 1981a, b, c, d, e, f, 1986) studied the species of the Oriental and Australian Regions, including certain species of Northeast Asia and Europe. Bohart and Menke (1976) reviewed the genus on the worldwide basis, and Antropov (1984, 1985, 1986, 1987, 1988, 1989a, b, c, 2011, 2016) examined the species of the Palearctic and Oriental Regions. As of 2024, 633 species are known (Pulawski 2024).

In China, 55 species and nine subspecies of this genus are currently known, with 37 species and one subspecies found in southwest China (Strand 1922; Tsuneki 1966–1981; Wu and Zhou 1996; Li and Li 2007, 2010). Despite the extensive taxonomic studies conducted there over the past few decades, new species are continuously being discovered in various regions of Southwest China, especially in the tropical rainforests of Yunnan Province. In this study, two new species from Xishuangbanna, Yunnan, China, are described and illustrated; the female of *T. infoveatum* Li & Li, 2007 is described for the first time; ten species are recorded for the first time from China; and a key to the genus *Trypoxylon* of southwest China is provided.

## Material and methods

The specimens examined are deposited in the Insect Collection of Yunnan Agricultural University, Kunming, China (YNAU). The specimens were observed and illustrated using an Olympus stereomicroscope (SZ Series) with an ocular micrometer.

The photographs were taken with the VHX-5000 digital microscopic system and edited with Adobe Photoshop® 8.0. The descriptive terminology of morphological structures follows Bohart and Menke (1976) and Tsuneki (1979a). The abbreviations are as follows:

<b>AW</b>	apical width of the first flagellomere;
<b>BW</b>	basal width of the apical flagellomere in male;
<b>CV1, CV2</b>	abscissa I of cubital vein, abscissa II of cubital vein;
<b>F I, F II, F III, etc.</b>	the first, second and third flagellomere, etc.;
<b>GL/ W</b>	ratio of gastral petiole length to apical width (dorsal view);
<b>HL</b>	head length (frontal view);
<b>HW</b>	head width (frontal view);
<b>IOD</b>	interocular distance;
<b>IODc</b>	minimum IOD at base of clypeus (frontal view);
<b>IODv</b>	minimum IOD at vertex (dorsal view);
<b>IODs</b>	ratio of IODv to IODc;
<b>OOD</b>	ocellocular distance;
<b>Od</b>	posterior ocellus diameter;
<b>PD</b>	puncture diameter;
<b>PIS</b>	puncture interspace;
<b>POD</b>	postocellar distance;
<b>RI</b>	apical part of forewing vein RI beyond the meeting point with Rs;
<b>TCV</b>	transverse cubital vein.

The frontal shield in some species has lateral bifurcation directed towards the eye incision; the upper area of the frontal shield is the area from the top to the base of the lateral bifurcation, and the lower area is from the base of the lateral bifurcation to the junction of the lateral carina in the frontal end.

## Key to the species of *Trypoxylon* from Southwest China

### Females

- 1 Frons with shield-shaped enclosure; fore-wings with CV2 and TCV usually forming acute angle; dorsal and posterior area of propodeum with several conspicuous, transverse carinae ..... **2**
- Frons without shield-shaped enclosure; fore-wings with CV2 and TCV usually forming right or obtuse angle; dorsal and posterior area of propodeum without transverse carinae ..... **4**
- 2 Frontal shield discontinued, upper lateral carina broadly interrupted but dorsal carina clearly defined..... *Trypoxylon interruptum* Tsuneki, 1978
- Frontal shield complete, upper lateral carina and dorsal carina continued ..... **3**
- 3 Frontal shield with upper area subequal in length to lower area, at most 1.5 × as long as lower area, lateral carina of upper area curved; lateral surface of propo-

- deum coriaceous, conspicuously obliquely rugose .....  
 ..... *Trypoxylon schmiedeknechtii* Kohl, 1906
- Frontal shield with upper area more than  $1.5 \times$  as long as lower area, lateral carina of upper area almost parallel; lateral surface of propodeum smooth medially and posteriorly, with inconspicuous oblique rugae anteriorly .....  
 ..... *Trypoxylon thaianum* Tsunek, 1961
- 4 Gastral terga I–III with apical fovea; pronotal collar narrow, with median tubercle ..... 5
- Gastral terga I–III without apical fovea; pronotal collar broad, without median tubercle ..... 8
- 5 Frons and mesoscutum with large punctures,  $PIS \leq 0.5 \times PD$ , PIS shiny; lateral surface of propodeum dull, with conspicuous oblique rugae; free margin of clypeus markedly concave laterally, with short and wide protrusion medially .....  
 ..... *Trypoxylon buddha* Cameron, 1889
- Frons and mesoscutum with fine punctures,  $PIS \approx PD$ , PIS microscopically coriaceous; lateral surface of propodeum smooth, without rugae; free margin of clypeus straight or slightly convex laterally ..... 6
- 6 Gastral tergum I without apicomedian fovea; legs black, at most partly brown....  
 ..... *Trypoxylon bifoveatum* Tsuneki, 1979
- Gastral tergum I with apicomedian fovea; legs broadly yellow, only partly brown or black ..... 7
- 7 Supraantennal tubercle with transverse subquadrate edge anteriorly; R1 equal to TCV, not reaching wing apex; gaster wholly black .....  
 ..... *Trypoxylon maculipes* Tsuneki, 1979
- Supraantennal tubercle rounded, without anterior transverse edge; R1 longer than TCV, almost reaching wing apex; gastral terga II–IV, base of gastral sternum III, gastral sternum IV ferruginous ..... *Trypoxylon flavipes* Tsuneki, 1979
- 8 Gastral petiole clavate, gradually widening apically, as long as, or shorter than following two segments combined ..... 9
- Gastral petiole flask-shaped, apical swelling rather abrupt, with parallel-sided stalk, longer than following two segments combined ..... 22
- 9 Mandible thick, bidentate on inner margin near apex; head in frontal view quadrate, in dorsal view thick; median and lower frons roundly swollen .....  
 ..... *Trypoxylon gampahae* Tsuneki, 1981
- Mandible slender, without denticle on inner margin; head wider than long; median and lower frons not roundly swollen ..... 10
- 10 Frontal furrow deeply impressed; legs slender and long (hind tibia about  $1.25 \times$  as long as HW, midtarsomere I longer than half HW), hind coxa more than three  $\times$  apical width; propodeal dorsum long, more than  $3.5 \times$  as long as scutellum .....  
 ..... *Trypoxylon ferrugineipes* Fu & Li, sp. nov.
- Frontal furrow very fine, inconspicuously impressed; legs thick and short (hind tibia about  $0.93 \times$  as long as HW, midtarsomere I shorter than half HW), hind coxa as long as, or shorter than twice apical width; propodeal dorsum short, shorter than  $3.5 \times$  as long as scutellum ..... 11

- 11 Supraantennal tubercle with deep, longitudinal groove ..... 12  
 – Supraantennal tubercle without deep, longitudinal groove ..... 13
- 12 Sides of supraantennal tubercle with few rugae; gaster wholly black; IODs = 2:1  
 ..... *Trypoxylon koreanum* Tsuneki, 1956  
 – Sides of supraantennal tubercle without rugae; gastral sterna II–III ferruginous  
 brown, and apex of gastral petiole to sternum V yellow; IODs = 5:2 .....  
 ..... *Trypoxylon okinawanum* Tsuneki, 1966
- 13 Propodeal enclosure not delimited by boundary groove, densely covered with ir-  
 regular, reticulate carinae; pronotal collar with black posterior band ..... 14  
 – Propodeal enclosure delimited by more or less distinct U-shaped groove, surface  
 smooth or covered with several transverse carinae medially; pronotal collar with  
 light brown, translucent posterior band ..... 15
- 14 Supraantennal tubercle conspicuously nasiform, with thick, longitudinal carina;  
 clypeus with dense tiny punctures, free margin with small, rectangular protrusion  
 medially, protruding area shallowly incised mesally .....  
 ..... *Trypoxylon fronticorne obliquum* Tsuneki, 1981  
 – Supraantennal tubercle low, with thin, longitudinal carina; clypeus with sparse  
 large punctures, free margin with large, rectangular protrusion medially .....  
 ..... *Trypoxylon figulus* (Linnaeus, 1758)
- 15 Supraantennal tubercle low, medial longitudinal carina thin ..... 16  
 – Supraantennal tubercle highly nasiform, medial longitudinal carina thick ..... 20
- 16 Gaster black, most of gastral sterna brownish ..... 17  
 – Gaster more or less ferruginous ..... 18
- 17 Free margin of clypeus with nearly triangular protrusion, bidentate mesally; side of  
 propodeum with distinct lateral carina ..... *Trypoxylon shimoyamai* Tsuneki, 1958  
 – Free margin of clypeus with inverted trapezoid protrusion medially; side of propo-  
 deum without lateral carina ..... *Trypoxylon aphelothoracicus* Fu & Li, sp. nov.
- 18 Free margin of clypeus rounded, without protrusion medially; U-shaped bound-  
 ary groove on propodeal enclosure almost invisible and medial furrow shallow,  
 surface smooth and shiny, without punctures or rugae .....  
 ..... *Trypoxylon truncatum* Tsuneki, 1979  
 – Free margin of clypeus with distinct protrusion medially; U-shaped boundary  
 groove on propodeal enclosure and medial furrow clear and distinct, surface with  
 conspicuous and dense rugae ..... 19
- 19 Free margin of clypeus with distinct obtuse protrusion; supraclypeal area slightly nar-  
 row and long; gaster wholly ferruginous ..... *Trypoxylon pahangense* Tsuneki, 1979  
 – Free margin of clypeus medially with distinctly inverted trapezoidal protrusion;  
 supraclypeal area broad and short; gaster ferruginous from apex of petiole to api-  
 cal gastral segment ..... *Trypoxylon ferrugiabdominale* Li & Li, 2007
- 20 Free margin of clypeus conspicuously produced, with large semi-elliptic protru-  
 sion medially, as long as Od; gastral petiole and segments IV–VI black; legs whol-  
 ly black ..... *Trypoxylon clypeisinuatum* Li & Li, 2010  
 – Free margin of clypeus slightly produced medially, protrusion small, shorter than Od;  
 gastral terga IV–VI ferruginous or with black maculae; legs partly ferruginous ..... 21

- 21 Free margin of clypeus ferruginous, with semicircular protrusion, produced area shallowly incised mesally; gastral petiole broad and short,  $GL/W = 2.7-3.0$ ; gaster wholly ferruginous; all trochanters amber yellow.....  
..... *Trypoxylon nasale* Tsuneki, 1979
- Free margin of clypeus black, with two barely separated and round teeth medially; gastral petiole much slender,  $GL/W = 3.5-3.9$ ; gaster ferruginous from apex of petiole to apical segment; all trochanters black.....  
..... *Trypoxylon pendleburyi* Tsuneki, 1979
- 22 Gaster wholly or from apex of petiole to apical segment ferruginous..... 23
- Gaster black or middle part (from apex of petiole to segment III or IV or base of segments II–III) ferruginous ..... 25
- 23 Gaster wholly ferruginous, petiole with black macula; supraantennal furrow absent; supraantennal tubercle low, with anterior transverse carina connected to antennal socket rim..... *Trypoxylon kandyanum* Tsuneki, 1979
- Gaster from apex of petiole to apical segment ferruginous; supraantennal furrow well developed; supraantennal tubercle without anterior transverse carina..... 24
- 24 Supraantennal tubercle attenuate apically, apex of supraantennal tubercle obliquely inclined, forming smooth and shiny area with large median hollow; margin of clypeus sinuate; antenna and legs mostly ferruginous; body length 11.9–12.5 mm..... *Trypoxylon kbasiae* Cameron, 1904
- Supraantennal tubercle broaden apically, without anterior oblique flattened area; free margin of clypeus rounded; antenna and legs mostly black; body length 22.0 mm..... *Trypoxylon szechuen* Tsuneki, 1981
- 25 Mesoscutum microscopically coriaceous, with fine, dense punctures,  $PIS \leq PD$ .... 26
- Mesoscutum smooth and shiny, with fine, scattered punctures,  $PIS > PD$ ..... 28
- 26 Supraantennal tubercle without median carina, instead impressed line separated apex of supraantennal tubercle; pronotal collar thick.....  
..... *Trypoxylon bilobatum* Tsuneki, 1961
- Supraantennal tubercle with median carina; pronotal collar thin..... 27
- 27 Supraantennal tubercle low tuberiform; propodeal enclosure with clear U-shaped boundary groove and medial furrow; base of gastral segments II–IV and legs mostly ferruginous ..... *Trypoxylon imayoshii* Yasumatsu, 1938
- Supraantennal tubercle highly nasiform, with deep groove medially; propodeal enclosure with vague U-shaped boundary groove, without medial furrow; gaster wholly and legs black ..... *Trypoxylon infoveatum* Li & Li, 2007
- 28 Supraantennal furrow shallow; antennal socket rim anteriorly expanded into two separate cylinders; gaster wholly black..... *Trypoxylon takasago* Tsuneki, 1966
- Supraantennal furrow deep; antennal socket rim not expanded; gaster ferruginous medially ..... 29
- 29 Setae on head and thorax golden; pronotal collar posteriorly and base of gastral segments II–III ferruginous; body length 22.2 mm.....  
..... *Trypoxylon fulvocollare* Cameron, 1904
- Setae on head and thorax silvery; pronotal collar black posteriorly, gaster ferruginous from apex of petiole to segment III or IV; body length 18.0–20.0 mm.... 30

- 30 Free margin of clypeus transversely produced mesally, slightly incised; gaster ferruginous from apex of petiole to segment III, darkly marked dorsally and ventrally; legs black; IODs = 1:1..... *Trypoxylon orientale* Cameron, 1904
- Free margin of clypeus rounded mesally, not produced and incised; gaster ferruginous from apex of petiole to base of segment IV; legs black, with ferruginous spots; IODs varied ..... 31
- 31 Side of propodeum with distinct lateral carina; all trochanters amber yellow; IODs = 1.5:1 ..... *Trypoxylon errans* Saussure, 1867
- Side of propodeum without lateral carina; all trochanters amber black..... 32
- 32 Lateral tubercles of pronotum toothed; vertex conspicuously depressed; F I = 2.8–3.3 × AW; antenna mostly ferruginous beneath; body length 14.0–19.0 mm .....  
..... *Trypoxylon bicolor* Smith, 1856
- Lateral tubercles of pronotum triangular; vertex undepressed; F I = 2.0–2.5 × AW; antenna brown beneath; body length 10.0–19.0 mm .....  
..... *Trypoxylon petiolatum* Smith, 1858

## Males

- 1 Frons with shield-shaped enclosure; fore-wings with CV2 and TCV usually forming acute angle; dorsal and posterior area of propodeum with several conspicuous, transverse carinae ..... 2
- Frons without shield-shaped enclosure; fore-wings with CV2 and TCV usually forming right or obtuse angle; dorsal and posterior area of propodeum without transverse carinae ..... 4
- 2 Frontal shield discontinued, upper lateral carina broadly interrupted but dorsal carina clearly defined; flagellomere III beneath with linear tyloids, flagellomere IV excavate beneath at base (apical flagellomere longer than two but shorter than three preceding articles combined) .....  
..... *Trypoxylon interruptum* Tsuneki, 1978
- Frontal shield complete, upper lateral carina and dorsal carina continued; flagellomeres not modified ..... 3
- 3 Frontal shield with upper area as long as lower area, upper lateral carina curved; apical flagellomere longer than three but shorter than four preceding articles combined ..... *Trypoxylon schmiedeknechtii* Kohl, 1906
- Frontal shield with upper area longer than lower area; apical flagellomere as long as three preceding articles combined.....  
..... *Trypoxylon thaianum* Tsunek, 1961
- 4 Gastral terga I–III with apical fovea; pronotal collar narrow, with median tubercle ..... 5
- Gastral terga I–III without apical fovea; pronotal collar broad, without median tubercle ..... 8
- 5 Frons and mesoscutum with large punctures, PIS ≤ 0.5 × PD, PIS shiny; lateral surface of propodeum dull, with conspicuous oblique rugae; lateral margin of clypeus slightly concave, with short, wide protrusion medially (penis valve sub-

- apically with narrow, curved hook on each side).....
- ..... *Trypoxylon buddha* Cameron, 1889
- Frons and mesoscutum with fine punctures, PIS  $\approx$  PD, PIS microscopically coriaceous; lateral surface of propodeum smooth, without rugae; lateral margin of clypeus straight or slightly convex ..... 6
- 6 Gastral tergum I without fovea; flagellomeres II–VI beneath with tyloids, flagellomeres VII–VIII excavate at base ..... *Trypoxylon bifoveatum* Tsuneki, 1979
- Gastral tergum I with fovea; flagellomeres II–VI beneath without tyloids, flagellomeres V–VI excavate at base..... 7
- 7 Supraantennal tubercle subquadrate, surface nearly flat, including supraantennal furrow; R1 equal to TCV, not reaching wing apex; penis valve simple at apex ....
- ..... *Trypoxylon maculipes* Tsuneki, 1979
- Supraantennal tubercle low, broad, roundly tuberiform, apical edge curved, not including supraantennal furrow; R1 longer than TCV, almost reaching apex of wing; penis valve subapically with narrow, curved hook on each side .....
- ..... *Trypoxylon flavipes* Tsuneki, 1979
- 8 Gastral petiole clavate, as long as or shorter than segments II–III combined ..... 9
- Gastral petiole flask-shaped, longer than segments II–III combined..... 20
- 9 Supraantennal tubercle with deep longitudinal groove .....
- ..... *Trypoxylon koreanum* Tsuneki, 1956
- Supraantennal tubercle without deep longitudinal groove..... 10
- 10 Propodeal enclosure not delimited by boundary groove, densely covered with irregular, reticulate carinae; pronotal collar with black posterior band; penis valve with more or less pronounced preapical enlargement ..... 11
- Propodeal enclosure delimited by more or less distinct U-shaped groove, surface smooth or covered with several transverse carinae medially; pronotal collar with light brown, translucent posterior band; penis valve without preapical enlargement .... 12
- 11 Supraantennal tubercle highly nasiform, with thick mid-longitudinal carina; flagellomeres without tyloids ..... *Trypoxylon fronticorne obliquum* Tsuneki, 1981
- Supraantennal tubercle low, longitudinal carina thin; flagellomeres III–VIII beneath with tyloids ..... *Trypoxylon figulus* (Linnaeus, 1758)
- 12 Median and lower frons flat, without apical transverse carina and medial carina (flagellomeres I–XI beneath with tyloids, flagellomere IV excavate at base beneath) .....
- ..... *Trypoxylon planifrons* Tsuneki, 1977
- Median and lower frons raised, with apical transverse carina or medial carina. 13
- 13 Supraantennal tubercle highly nasiform, medial longitudinal carina thick..... 14
- Supraantennal tubercle low, medial longitudinal carina narrow..... 17
- 14 Antenna without tyloids..... 15
- Antenna with tyloids..... 16
- 15 Apical flagellomere as long as three preceding articles combined; gaster ferruginous, with vaguely outlined, black, regular-shaped band on gastral terga I–IV ....
- ..... *Trypoxylon fenchibuense* Tsuneki, 1967
- Apical flagellomere as long as four preceding articles combined; gaster brown to black .....
- ..... *Trypoxylon similichingi* Li & Li, 2010

- 16 Flagellomeres II–IV beneath with linear tyloids, apical flagellomere as long as, or shorter than five preceding articles combined.....  
 ..... *Trypoxylon chypeisinuatum* Li & Li, 2010
- Flagellomeres III–IV beneath with linear tyloids, apical flagellomere as long as four preceding articles combined..... *Trypoxylon pacificum* Gussakovskij, 1932
- 17 Apical flagellomere curved, conspicuously hollowed beneath (as long as three preceding articles combined); U-shaped boundary groove on propodeal enclosure almost invisible and medial furrow shallow, surface smooth and shiny, without punctures or rugae ..... *Trypoxylon truncatum* Tsuneki, 1979
- Apical flagellomere not curved; U-shaped boundary groove on propodeal enclosure and medial furrow clear, distinct, surface with conspicuous dense rugae ..18
- 18 Flagellomeres without tyloids and not excavate beneath (apical flagellomere as long as four preceding articles combined).....  
 ..... *Trypoxylon ferrugiabdominale* Li & Li, 2007
- Flagellomeres with tyloids ..... 19
- 19 Flagellomeres V–VI stoutly dentate beneath, apical flagellomere as long as two preceding articles combined ..... *Trypoxylon shimoyamai* Tsuneki, 1958
- Flagellomeres not dentate beneath, flagellomeres III–VIII beneath with linear tyloids, apical flagellomere as long as three preceding articles combined.....  
 ..... *Trypoxylon kansitakum* Tsuneki, 1971
- 20 Apical flagellomere as long as or longer than four preceding articles combined21
- Apical flagellomere shorter than four preceding articles combined .....23
- 21 Flagellomere VIII excavate beneath at base, distinctly incrassate toward apex; supraantennal tubercle highly nasiform, with deep longitudinal groove at base.....  
 ..... *Trypoxylon infoveatum* Li & Li, 2007
- Flagellomeres unmodified; supraantennal tubercle tuberiform, without groove...  
 ..... 22
- 22 Apical flagellomere longer than five preceding articles combined; setae on head and thorax silvery; gastral segments II–III ferruginous .....  
 ..... *Trypoxylon errans* Saussure, 1867
- Apical flagellomere as long as four preceding articles combined; setae on head and thorax golden; apex of gastral segments II–III ferruginous .....  
 ..... *Trypoxylon fulvocollare* Cameron, 1904
- 23 Mesoscutum distinctly microscopically coriaceous, superimposed with punctures, PIS  $\approx$  PD, PIS coarse (apical flagellomere longer than two preceding articles combined; base of gastral segments II–IV ferruginous).....  
 ..... *Trypoxylon imayoshii* Yasumatsu, 1938
- Mesoscutum without microsculpture, simply punctated, PIS > PD, PIS smooth and shiny ..... 24
- 24 Supraantennal furrow shallow, antennal socket rim anteriorly expanded (supraantennal tubercle round, without transverse carina or band-like expansion at anterior margin; apical flagellomere longer than three preceding articles combined)..  
 ..... *Trypoxylon takasago* Tsuneki, 1966
- Supraantennal furrow deep, antennal socket rim not expanded.....25

- 25 Supraantennal tubercle attenuate apically, apex of supraantennal tubercle obliquely inclined, forming smooth and shiny area with large hollow mesally (apical flagellomere longer than two preceding articles combined and shorter than three preceding articles combined)..... *Trypoxylon khasiae* Cameron, 1904  
 – Supraantennal tubercle broaden apically, without anterior oblique flattened area ..... 26
- 26 Side of propodeum with distinct lateral carina; clypeus conspicuously protruded medioapically; gaster from apex of petiole to segment III ferruginous laterodorsally, dark dorsally and ventrally ..... *Trypoxylon orientale* Cameron, 1904  
 – Side of propodeum without lateral carina; clypeus round medioapically; gaster ferruginous from apex of petiole to base of gastral segment IV ..... 27
- 27 Lateral tubercles of pronotum dentate; vertex conspicuously depressed; apical flagellomere in lateral view distinctly tapering..... *Trypoxylon bicolor* Smith, 1856  
 – Lateral tubercles of pronotum triangular; vertex undepressed; apical flagellomere in lateral view not tapering, slightly curved medially .....  
 ..... *Trypoxylon petiolatum* Smith, 1858

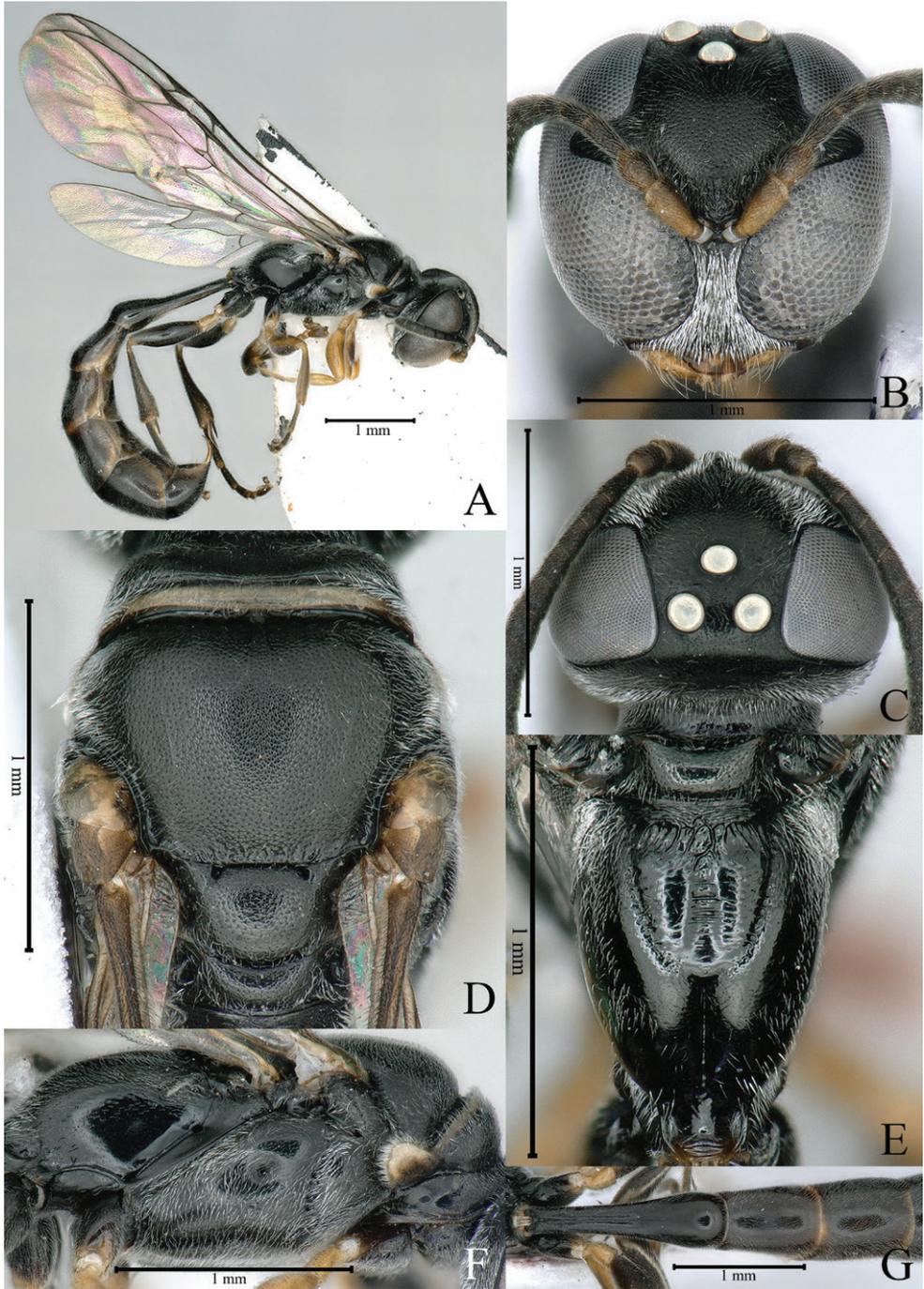
***Trypoxylon aphelothoracicus* Fu & Li, sp. nov.**

<https://zoobank.org/23AF9F03-3F22-419E-832F-E62658160F28>

Fig. 1

**Type material.** *Holotype*: ♀: CHINA, Yunnan Province, Jinghong City, Menghai County, Bulang Mountain, 21°37'35"N, 100°24'23"E, 1438 m., 20.VI–20.VII.2018, Li Ma project team (YNAU). *Paratypes*: 29♀♀: same locality as for holotype except: 20.VI–20.VII.2018 (10♀♀), 20.VII–15.VIII.2018 (3♀♀), 17.V–21.VI.2018 (2♀♀), 25.IV–17.V.2018 (3♀♀), 28.V–28.VI.2019 (10♀♀), 15.IV–27.V.2021 (1♀); 1♀, CHINA, Yunnan, Jinghong City, Menghai County, Guanggang Village, Ancient tea forest, 21°49'15"N, 100°29'44"E, 1526 m, 20.VIII–16.IX.2018, coll. Li Ma project team (YNAU).

**Diagnosis.** The species resembles *T. minutum* Tsuneki, 1979 and *T. undatum* Tsuneki, 1979 in lacking the lateral carina on the propodeum. It differs from both by the supraantennal tubercle with small U-shaped carina, transverse carina on both sides of apex, and with short, longitudinal carina mesally (in *T. minutum* the supraantennal tubercle is triangular, without transverse carina anteriorly and without middle carina; in *T. undatum* the supraantennal tubercle is low, with conspicuous, transverse carina anteriorly and thick, longitudinal carina mesally), free margin of clypeus with an inverted trapezoid projection (in *T. minutum* the free margin of clypeus is triangularly produced; in *T. undatum* the clypeal margin is wavy, without projection), gastral sterna II–IV black, gastral terga II–IV brown to black (in *T. minutum* gastral sterna II–IV are dark red, gastral terga II–IV are ferruginous; in *T. undatum* gastral sterna and terga II–IV are ferruginous, gastral terga II–III each with broad brown mark).



**Figure 1.** *Trypoxylon aphelothoracicus* sp. nov. holotype ♀ **A** habitus (lateral view) **B** head (frontal view) **C** head (dorsal view) **D** thorax (dorsal view) **E** propodeum (dorsal view) **F** thorax (lateral view) **G** gastral segments I–III (dorsal view).

**Description. Female:** Body length, 6.9–7.2 mm (Fig. 1A). Body black; labial palpi, maxillary palpi and pronotal lobe apically ivory; yellowish brown are: most of mandible, clypeal apex, scape beneath, foretrochanter, forefemur except with brown stripe on inner surface, foretibia, apex of midcoxa, mid- and hindtrochanters; brown are: mandible apically, pedicel beneath, tegula, midfemur except yellow stripe on outer surface, midtibia and fore- and midtarsi; wings hyaline, veins and pterostigma brown. The following body parts covered with short, dense, silvery pubescence (length of setae less than Od): most of clypeus, supraclypeal area, lower inner orbit, gena, pronotum, metapleuron, side of propodeal dorsum and posterior part of propodeum.

**Head:** Head quadrate in frontal view (Fig. 1B), HW: HL = 10: 10, thick in dorsal view (Fig. 1C). Mandible simple, without denticle on inner margin. Clypeus nearly flat, with fine, dense punctures; lateral margin of clypeus more concave; free margin of clypeus with inverted trapezoid protrusion that is slightly concave in middle (Fig. 1B). Supraclypeal area narrow, long, length greater than its maximum apical width. Supraantennal tubercle low, its anterior margin with small U-shaped carina, with anterior transverse carina connected to antennal socket rim, and short longitudinal carina mesally (Fig. 1B). Supraantennal furrow lacking. F I = 2.0 × AW, F I: F II: F III = 7: 5: 4. Frons slightly convex medially, microscopically coriaceous, with fine, dense punctures (PIS ≈ PD) and hardly visible medial furrow. Inner eye orbits convergent below, broadly, shallowly notched (IODs = 10:4.5). Vertex slightly convex, ocellar triangle flattened (OOD: Od: POD = 2: 9: 5) (Fig. 1C). Gena narrow, evenly convex.

**Thorax:** Pronotum with deep, transverse furrow anteriorly, convex laterally, flattened anteriorly, pronotal collar narrow medially, enlarged towards side, without median tubercle, with distinct, translucent, posterior border; pronotal lobes rounded. Mesoscutum (Fig. 1D) microscopically coriaceous, with fine, dense punctures (PIS ≈ PD); admedial line inconspicuously impressed, only extended to 1/4 of scutum length; prescutal sutures absent; parapsidal line distinct. Scutellum and metanotum microscopically coriaceous, with fine and dense punctures (PIS ≈ PD). Metapleuron impunctate (Fig. 1F). Propodeal enclosure with deep U-shaped groove (Fig. 1E), basally with short oblique rugae, with narrow, deep mid furrow and short transverse rugae within furrow, side of groove smooth, impunctate. Posterior part of propodeum with deep mid groove, except apically. Side of propodeum without lateral carina; lateral surface shiny, impunctate (Fig. 1F). In forewing, R1 equal to TCV, CV1 = CV2 × 2.8, TCV < CV2. Hind coxa without small tubercle ventrally.

**Gaster:** Gastral petiole (Fig. 1G) clavate, about 3.40 × as long as apical width in dorsal view, shorter than segments II–III combined.

**Male.** Unknown.

**Distribution.** China (Yunnan).

**Etymology.** The specific name is derived from two Greek words: *apheles* - (=smooth) and *-thoracicus* (= Latinized form of thorax), referring to the mesopleuron, metapleuron, and propodeal lateral surface smooth, and the side of propodeum without lateral carina in the female.

***Trypoxylon ferrugineipes* Fu & Li, sp. nov.**

<https://zoobank.org/9AE3DBB3-47D1-4DE6-A468-EE7F9EAE5DB9>

Fig. 2

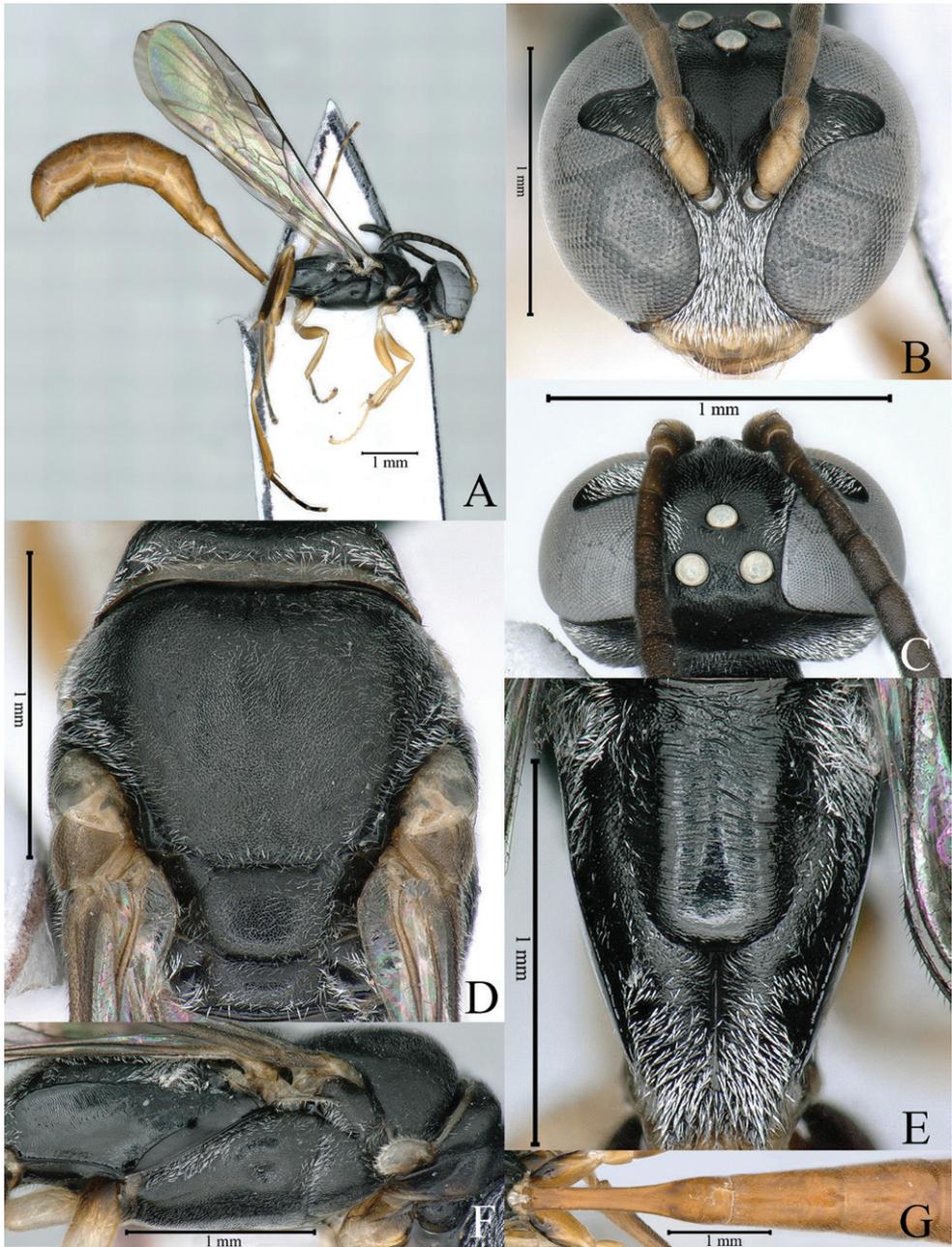
**Type material.** *Holotype*: ♀: CHINA, Yunnan Province, Jinghong City, Menghai County, Bulang Mountain, 21°37'35"N, 100°24'23"E, ca 1438 m, 21.VI–20.VII.2018, Li Ma project team (YNAU). *Paratype*: 3♀♀: same date as holotype except: 28.V–28.VI.2019 (2♀♀), 13.VIII–15.IX.2020 (1♀).

**Diagnosis.** The species resembles *T. longipes* Tsuneki, 1979 in having the legs markedly slender and elongate (hind tibia about 1.25 × as long as HW, midtarsomere I longer than half HW), free margin of clypeus wavy, supraantennal tubercle low and supraantennal furrow shallow. It differs by the IODs = 10:7 (in *T. longipes* the IODs = 10:4), gastral petiole slightly flask-shaped, GL/ W = 4.1 (in *T. longipes* gastral petiole distinctly flask-shaped, GL/ W = 5.6), gaster wholly ferruginous (in *T. longipes* gastral tergum V blackish). The species also resembles *T. ambiguum* Tsuneki, 1956 in the shape of the clypeal free margin and pronotal collar, but has a shallow supraantennal furrow (in *T. ambiguum* the supraantennal furrow is absent), IODs = 10:7 (in *T. ambiguum* IODs = 10:9), gastral petiole slightly clavate (in *T. ambiguum* gastral petiole flask-shaped), GL/ W = 4.1 (in *T. ambiguum* GL/ W = 5.0).

**Description. Female:** Body length, 7.7–8.0 mm (Fig. 2A). Body black; labial palpi, maxillary palpi and most of pronotal lobe ivory; yellow are: most of mandible, clypeal apex, scape and pedicel beneath, foreleg except base of forecoxa, midleg from apex of midcoxa to midtarsomere I; yellowish brown are: mandible apically, midtarsomere II–IV, hindcoxa on inner surface, hindtrochanter and inner surface of hindfemur; gaster wholly ferruginous; wings hyaline, veins and pterostigma brown. The following body parts covered with short, dense, silvery pubescence (length of setae less than Od): most of clypeus, supraclypeal area, lower inner orbit, gena, pronotum, side of propodeal dorsum and posterior part of propodeum.

**Head:** Head rounded in frontal view (Fig. 2B), HW: HL = 10: 9, thin in dorsal view (Fig. 2C). Mandible simple, without denticle on inner margin. Clypeus nearly flat, with fine, dense punctures; lateral margin of clypeus slightly concave; margin of clypeus sinuate, slightly concave medially (Fig. 2B). Supraclypeal area narrow and long, length greater than its maximum apical width. Supraantennal tubercle low, without anterior transverse carina, with short longitudinal carina mesally (Fig. 2B); supraantennal furrow shallow in dorsal view. F I = 3.0 × AW, F I: F II: F III = 3: 2: 2. Frons microscopically coriaceous, with fine, dense punctures (PIS ≈ PD), frontal furrow deeply impressed. Inner eye orbits convergent below, with broad, shallow notch (IODs = 10:7). Vertex slightly convex, ocellar triangle flattened (OOD: Od: POD = 1: 7: 5) (Fig. 2C). Gena narrow, evenly convex.

**Thorax:** Pronotum with deep transverse furrow anteriorly, convex laterally, flattened anteriorly, pronotal collar narrow medially and enlarged towards side, with minute median tubercle, with distinct, translucent, posterior border; pronotal lobe round-



**Figure 2.** *Trypoxylon ferrugineipes* sp. nov. holotype ♀ **A** habitus (lateral view) **B** head (frontal view) **C** head (dorsal view) **D** thorax (dorsal view) **E** propodeum (dorsal view) **F** thorax (lateral view) **G** gastral segments I–III (dorsal view).

ed. Mesoscutum (Fig. 2D) microscopically coriaceous, with fine, dense punctures (PIS  $\approx$  PD); admedial line inconspicuously impressed, only extending to 1/5 of scutum; prescutal suture absent; parapsidal line distinct. Scutellum and metanotum microscop-

ically coriaceous, with fine, dense punctures (PIS  $\approx$  PD). Metapleuron microscopically coriaceous, impunctate (Fig. 2F). Propodeal enclosure with deep U-shaped groove (Fig. 2E), with few, short and oblique rugae basomedially, with broad, deep mid furrow, long and transverse rugae within furrow, sides of furrow smooth, scattered with fine punctures. Posterior part of propodeum with deep medial groove, except for apical portion. Propodeal lateral carina well-developed (Fig. 2F); propodeal lateral surface dull, microscopically coriaceous, with inconspicuous rugae anteriorly. In fore wing, R1 longer than TCV, almost reaching wing apex, CV1 = CV2  $\times$  3.1, TCV = CV2. Legs very slender, elongate, hindtibia about 1.25  $\times$  as long as HW, midtarsomere I longer than half HW and hindcoxa longer than three  $\times$  apical width; hindcoxa without small ventral tubercle.

**Gaster:** Gastral petiole (Fig. 2G) slightly clavate, about 4.10  $\times$  as long as apical width in dorsal view, shorter than segments II–III combined.

**Male.** Unknown.

**Distribution.** China (Yunnan).

**Etymology.** The specific name is derived from two Latin words: *ferrugineus* - (= ferruginous) + *-pes* (= leg), referring to the legs partly ferrugineous in female.

### *Trypoxylon infoveatum* Li & Li, 2007

Fig. 3

*Trypoxylon infoveatum* Li & Li, 2007: 6.

**Material examined.** 6♀♀: CHINA, Yunnan Province, Jinghong City, Menghai County, Bulang Mountain, 21°37'35"N, 100°24'23"E, ca 1438 m, 21.VI–20.VII.2018 (1♀), 25.IV–17.V.2018 (1♀), 19.IV–28.V.2019 (2♀♀), 28.V–28.VI.2019 (2♀♀), Li Ma project team (YNAU); 15♂♂: same data as for preceding: 25.IV–17.V.2018 (1♂), 17.V–21.VI.2018 (1♂), 21.VI–20.VII.2018 (1♂), 20.VII–15.VIII.2018 (1♂), 15.IX–16.X.2018 (2♂♂), 16.X–17.XI.2018 (2♂♂), 26.II–22.III.2019 (1♂), 22.III–19.IV.2019 (1♂), 28.VI–19.VII.2019 (3♂♂), 13.VIII–15.IX.2020 (1♂), 27.V–15.VI.2021 (1♂).

**Diagnosis.** The species resembles *T. koreanum* Tsuneki, 1956 and *T. koikense* Tsuneki, 1956 in having the supraantennal tubercle highly nasiform, with deep groove medially. It differs from both by gastral petiole flask-shaped, longer than following two segments combined, GL/ W = 5.25 (in *T. koreanum* and *T. koikense* the gastral petiole is clavate, shorter than following two segments combined, GL/ W = 2.0–2.7), propodeal dorsum without mid furrow, obliquely carinae (in *T. koreanum* and *T. koikense* the propodeal dorsum with mid furrow, without oblique carinae), flagellomere VIII excavate beneath at base and distinctly incrassate toward apex in male (in *T. koreanum* flagellomeres unmodified in male; in *T. koikense* flagellomere VIII unmodified but flagellomere IV excavate beneath at base in male).

**Description. Female** (first description of female): Body length, 7.5 mm (Fig. 3A). Black; yellowish brown are: labial and maxillary palpi, most of mandible, tegula, apex of foretibia, foretarsus and midtarsomere I; brown are: wings hyaline, veins and pter-

ostigma. The following body parts covered with long, dense, silvery pubescence (length of setae greater than Od): most of clypeus, supraclypeal area, lower inner orbit, gena, pronotum, metapleuron, side of propodeal dorsum and posterior part of propodeum.

**Head:** Head rounded in frontal view (Fig. 3D), HW: HL = 10: 8.8, thin in dorsal view. Mandible simple, without denticle on inner margin. Clypeus nearly flat, with fine, dense punctures; lateral margin of clypeus slightly concave; free margin of clypeus with short rectangular protrusion, protrusion shallowly incised mesally (Fig. 3D). Supraclypeal area broad, short, shorter than its maximum apical width. Supraantennal tubercle highly nasiform, with deep longitudinal groove at base (Fig. 3D). F I = 2.5 × AW, F I: F II: F III = 1: 1: 1. Frons slightly (mainly mesally) convex, microscopically coriaceous, with fine, dense punctures, and hardly visible medial furrow. Inner eye orbits convergent below, broadly and shallowly notched (IODs = 10:10). Vertex slightly convex, ocellar triangle flattened (OOD: Od: POD = 2: 6: 5). Gena narrow, evenly convex.

**Thorax:** Pronotum with deep transverse furrow anteriorly, convex laterally, flattened anteriorly, pronotal collar narrow medially, enlarged towards side, with minute median tubercle, with distinct black posterior border; pronotal lobe rounded. Mesoscutum microscopically coriaceous (Fig. 3G), with fine, dense punctures (PIS ≈ PD); admedial line inconspicuously impressed, only extended to 1/4 of scutum; prescutal suture absent; parapsidal line distinct. Scutellum and metanotum microscopically coriaceous, with fine, dense punctures (PIS ≈ PD). Metapleuron microscopically coriaceous, dull. Propodeal enclosure with shallow U-shaped groove, without mid furrow, oblique striation covering almost entire propodeal enclosure surface (Fig. 3F). Posterior part of propodeum with deep medial groove, except for apical portion. Lateral carina of propodeum well-developed (Fig. 3J), propodeal lateral surface dull, with inconspicuous rugae anteriorly. In fore wing, R1 equal to TCV, CV1 = CV2 × 2.5, TCV = CV2.

**Gaster:** Gastral petiole (Fig. 3L) flask-shaped, about 5.25 × as long as apical width in dorsal view, longer than segments II–III combined.

**Male:** Sculpture, setae, and body coloration (Fig. 3E, H, I, K, M) as in female except as follows: body length 7.3 mm (Fig. 3B); clypeal free margin not obviously produced (Fig. 3E); IODs = 10:8; OOD: Od: POD = 3.5: 2.5: 2.5; F I: F II: F III = 9: 3: 5; flagellomere VIII excavate beneath at base and distinctly incrassate toward apex (Fig. 3C); F XI = 3.5 × BW, flagellomere XI as long as four preceding articles combined; male sternum VIII (Fig. 3N); and male genitalia (Fig. 3O, P).

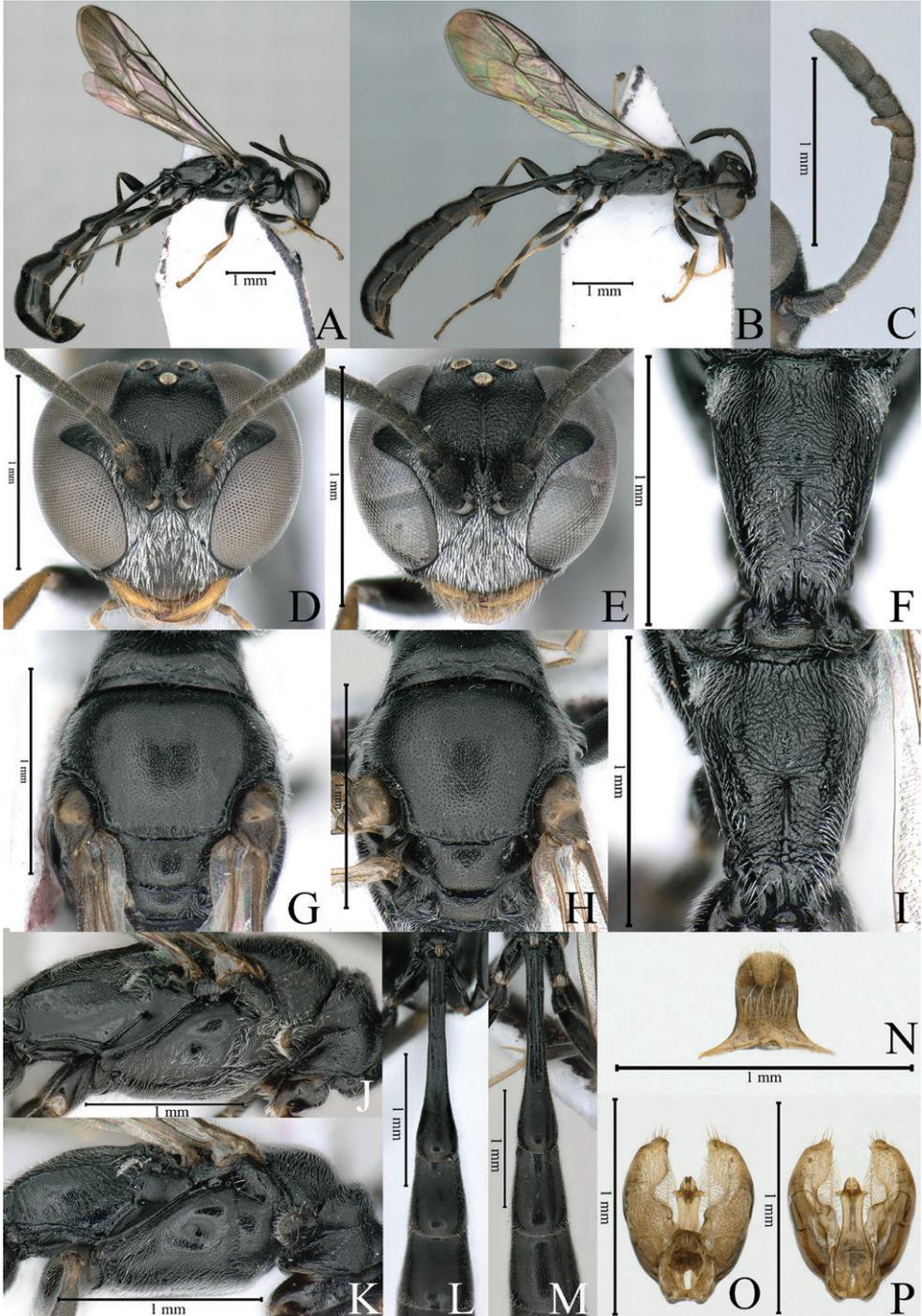
**Distribution.** China (Yunnan).

### *Trypoxylon buddha* Cameron, 1889

Fig. 4

*Trypoxylon buddha* Cameron, 1889: 118, 119; Bingham 1897: 225; Richards 1934: 338; R. Bohart and Menke 1976: 345; Tsuneki 1978b: 33, 76, 1979a: 3, 19, 1979b: 3, 8, 1980b: 4, 16, 21, 1981d: 18, 22, 1981f: 41.

*Trypoxylon monstruosum* Tsuneki, 1974: 633, synonymized with *Trypoxylon buddha* by Tsuneki 1978b: 36; R. Bohart and Menke 1976: 630.



**Figure 3.** *Trypoxylon infoveatum* Li & Li, 2007. ♀ (A, D, F, G, J, L); ♂ (B, C, E, H, I, K, M, N, O, P) A, B habitus (lateral view) C male antenna (lateral view) D, E head (frontal view) G, H thorax (dorsal view) F, I propodeum (dorsal view) J, K thorax (lateral view) L, M gastral segments I–III (dorsal view) N male sternum VIII O, P genitalia.

*Trypoxylon buddhae tarawakanum* Tsuneki, 1976: 92, synonymized with *Trypoxylon buddha* by Tsuneki 1978b: 36.

**Material examined.** 1♀: CHINA, Yunnan Province, Jinghong City, Mengla County, Longmen Village, 21°16'46"N, 101°32'19"E, ca 923 m, 10.IV.2010, Rui Zhang (YNAU).

**Diagnosis.** *T. buddha* resembles *T. brevipenne* de Saussure, 1867 in having large punctures on the frons and mesoscutum, metapleural keel conspicuously curved and hind coxae with tubercle in female. It differs by the apex of gastral terga I–III each with apicomedian fovea (in *T. brevipenne* the gastral terga I–III without fovea), free margin of clypeus with short, wide protrusion medially (in *T. brevipenne* free margin of clypeus with semicircular protrusion medially). The species also resembles *T. maculipes* Tsuneki, 1979 in sharing the apex of gastral terga I–III each with apicomedian fovea and in body colour, but the punctures on frons and mesoscutum are large (in *T. maculipes* punctures on the frons and mesoscutum are small), supraantennal tubercle with middle carina and anterior transverse carina (in *T. maculipes* supraantennal tubercle without middle carina and anterior transverse carina inconspicuous), free margin of clypeus with short, wide protrusion medially (in *T. maculipes* free margin of clypeus with bidentate protrusion medially).

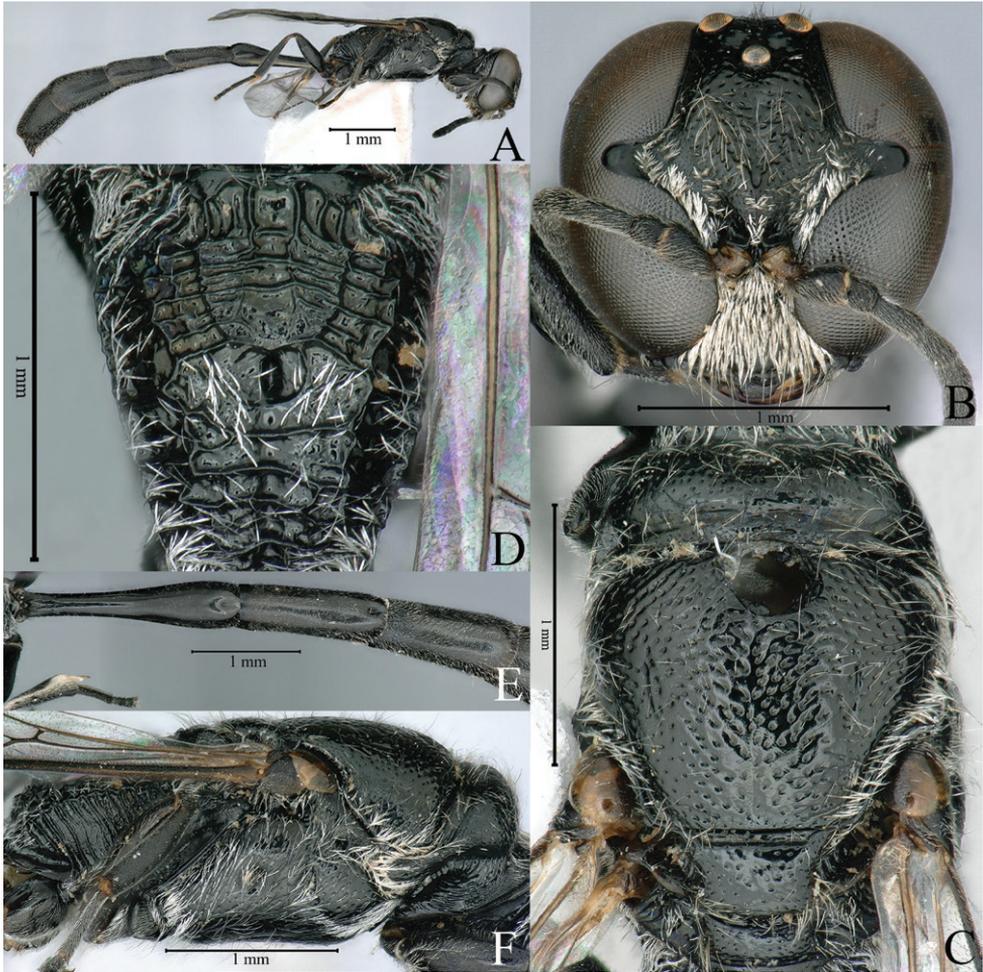
**Description. Female** (first record from China): Body length 9.5 mm (Fig. 4A). Body black; head and thorax with dense, short silvery setae (length of setae less than Od). Head sub-quadrangle in frontal view (Fig. 4B), almost equal in width and height; lateral margin of clypeus markedly concave, with short, wide protrusion medially; supraclypeal area broad, short; supraantennal tubercle highly nasiform, with conspicuous middle carina, and anterior transverse carina connected to antennal socket rim; frons with large, irregular punctures (PIS < PD), PIS smooth, shiny, frontal furrow deeply impressed. Pronotal collar flat, without median tubercle; mesoscutum, scutellum and metanotum with large, scattered punctures (PIS < PD), PIS smooth, shiny (Fig. 4C); propodeal enclosure with distinct U-shaped groove (Fig. 4D), with wide mid furrow and transverse wrinkles in furrow; gastral petiole slightly flask-shaped (Fig. 4E), shorter than following two segments combined, apex of gastral terga I–III each with apicomedian fovea. Side of propodeum with distinct lateral carina (Fig. 4F), propodeal lateral surface dull, with conspicuous oblique rugae. HW: HL = 10: 10. IODs = 10:6. OOD: Od: POD = 2: 7: 8; F I = 3.2 × AW, F I: F II: F III = 7: 8: 6. R1 longer than TCV, almost reaching wing apex, CV1 = CV2 × 2, CV2 = 1/2 TCV. GL/ W = 4.2.

**Distribution.** China (Yunnan); India; Philippines; Sri Lanka.

### *Trypoxylon flavipes* Tsuneki, 1979

Fig. 5

*Trypoxylon flavipes* Tsuneki, 1979a: 3, 24, 1979b: 3, 8, 1980a: 4, 17, 1981a: 4, 13, 1981b: 100, 103, 1981d: 18, 1981f: 43.



**Figure 4.** *Trypoxylon buddha* Cameron, 1889 ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

**Material examined.** 2♀♀: CHINA, Yunnan Province, Jinghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Rainforest, 21°91'37"N, 101°27'07"E, ca 606 m, 24.IV–31.V.2019, Yongsheng Pu (YNAU).

**Diagnosis.** *T. flavipes* resembles *T. buddha* Cameron, 1889 and *T. maculipes* Tsuneki, 1979 in having the apex of gastral terga I–III each with apicomedian fovea and head sub-quadrated in frontal view. It differs from both by the anterior edge of supraantennal tubercle rounded (in *T. buddha* supraantennal tubercle with conspicuous transverse carina anteriorly; in *T. maculipes* the anterior edge of supraantennal tubercle transverse), the gaster and legs more or less ferruginous (in *T. buddha* and *T. maculipes* the gaster and legs wholly black), punctures on the frons and mesoscutum are small (in *T. buddha* punctures on the frons and mesoscutum are large), free margin of clypeus with bidentate protrusion medially (in *T. buddha* free margin of clypeus with short,

wide protrusion medially), the penis valve subapically with narrow, curved hook on each side (in *T. maculipes* the penis valve is simple at apex).

**Description. Female** (first record from China): Body length 7.7–7.8 mm (Fig. 5A). Body black; yellow are: mandible basally, scape and pedicel beneath, pronotal lobe, tegula, fore legs, midleg except midtarsomere II–V, hindtrochanter and apex of hindtibia; ferruginous are: apex of mandible, clypeus, base of gastral terga II–IV, base of gastral sternum III, gastral sternum IV. Head and thorax with dense, short silvery setae (length of setae less than Od). Head sub-quadrate in frontal view (Fig. 5B), almost equal in width and height; clypeus with bidentate protrusion; supraclypeal area narrow and long; supraantennal tubercle low, with conspicuous middle carina, anterior carina rounded; frons microscopically coriaceous, with fine, dense punctures (PIS  $\approx$  PD), frontal furrow deeply impressed. Pronotal collar with median tubercle; mesoscutum, scutellum and metanotum with fine, dense punctures (PIS  $\approx$  PD), PIS microscopically coriaceous (Fig. 5C); propodeal enclosure with distinct U-shaped groove (Fig. 5D), with wide mid furrow, and transverse wrinkles in furrow; gastral petiole slightly flask-shaped (Fig. 5E), shorter than following two segments combined, apex of gastral terga I–III each with fovea medially. Side of propodeum with distinct lateral carina (Fig. 5F), propodeal lateral surface shiny. HW: HL = 10: 10. IODs = 10:4. OOD: Od: POD = 1: 3: 4. F I = 3.0  $\times$  AW, F I: F II: F III = 10: 9: 8. R1 longer than TCV, almost reaching wing apex, CV1 = CV2  $\times$  4, CV2 = TCV. GL/ W = 5.8.

**Distribution.** Australia; Borneo; China (Yunnan); India; Laos; Moluccas; New Guinea; Pacific Islands; Philippines; Sri Lanka; Sulawesi.

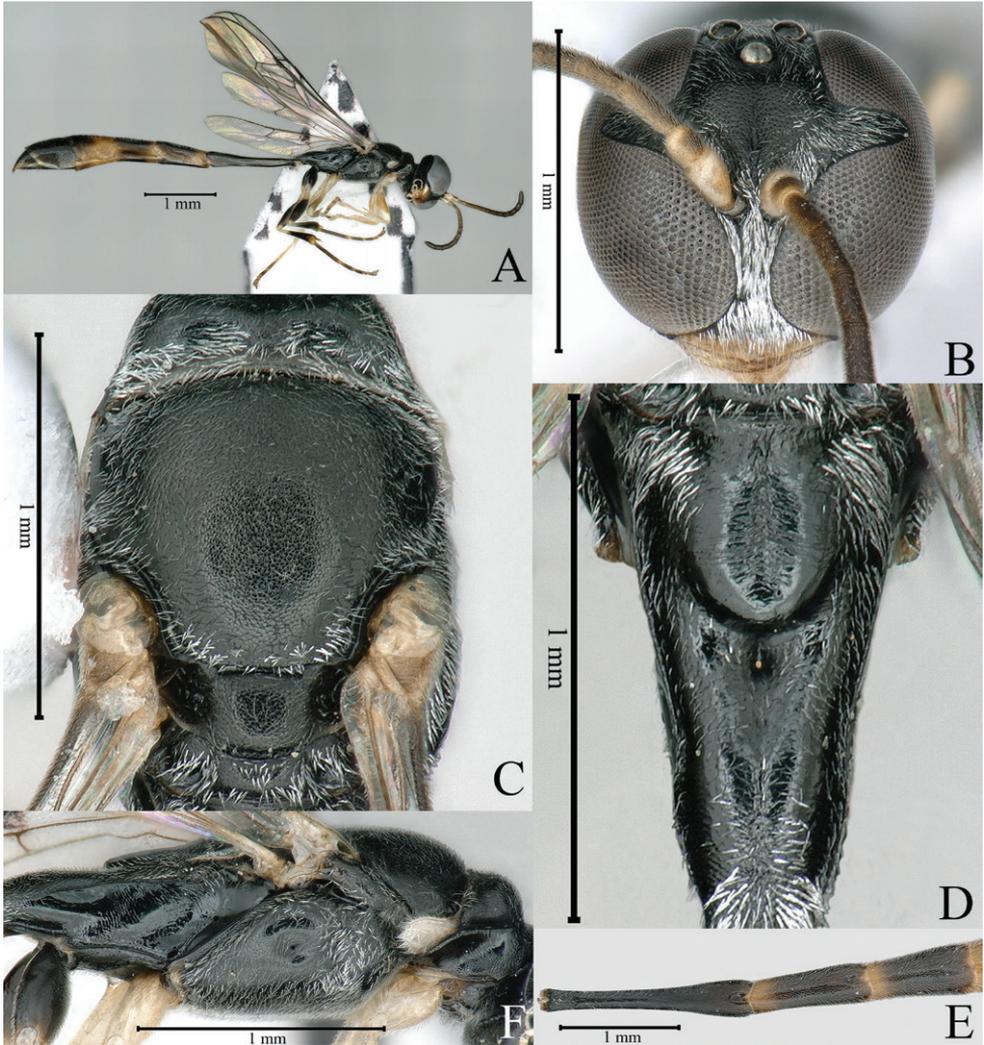
### *Trypoxylon fulvocollare* Cameron, 1904

Fig. 6

*Trypoxylon fulvocollare* Cameron, 1904: 217; Tsuneki 1978b: 52, 78, 1979a: 12, 101, 1979c: 8, 1980a: 7, 55, 1980b: 8, 70, 1981f: 70.

**Material examined.** 1♀: CHINA, Yunnan Province, Jinghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Rainforest, 21°91'37"N, 101°27'07"E, ca 606 m, 19.VI–13.VII.2021, Yongsheng Pu (YNAU).

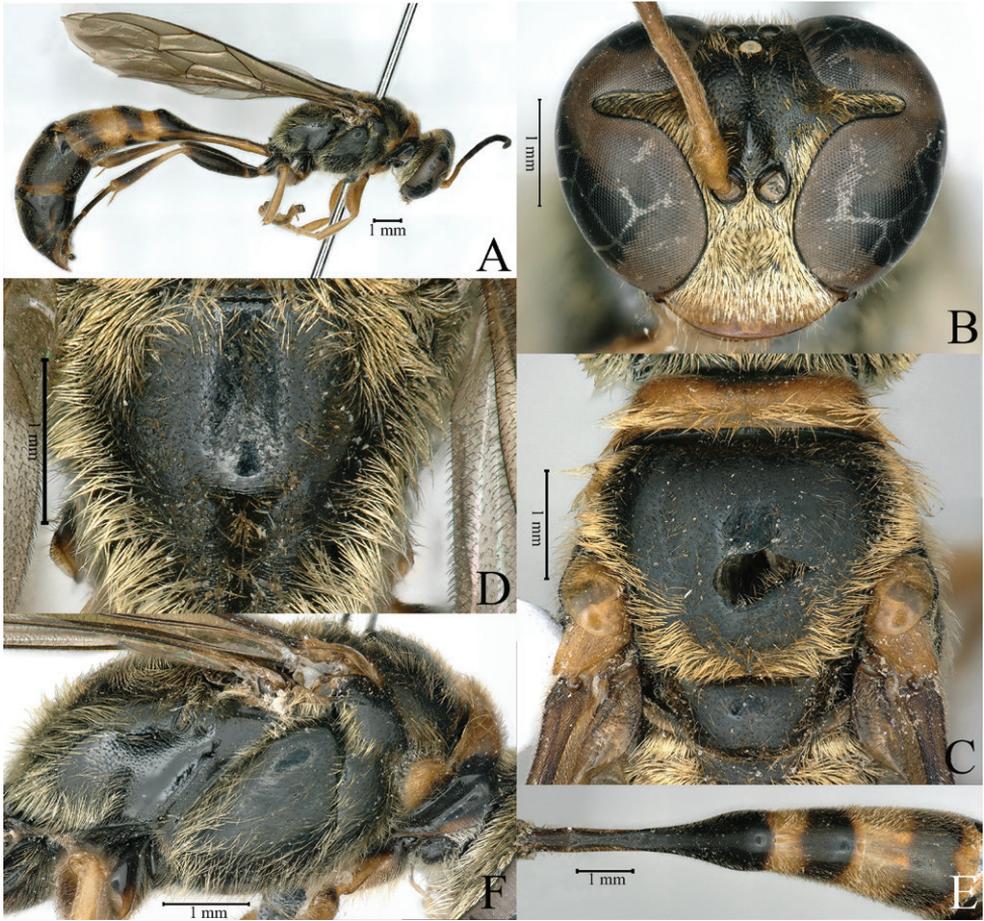
**Diagnosis.** *T. fulvocollare* resembles *T. taiwanum* Tsuneki, 1967 and *T. atricorne* Tsuneki, 1979 in having the supraantennal tubercle low, with thin mid-longitudinal carina, without anterior carina, the antennal socket rim tricarinate, the shape of pronotal collar and punctures on the frons and mesoscutum fine and sparse. It differs from both by the body covered with golden setae (in *T. taiwanum* and *T. atricorne* the setae are silvery), the flagellomeres I–II beneath and pronotal collar posteriorly yellow (in *T. taiwanum* the pronotal collar posteriorly black to light brown; in *T. atricorne* the flagellomeres I–II black and pronotal collar posteriorly are black to light brown), the base of gastral segments II–III are ferruginous (in *T. taiwanum* and *T. atricorne* the



**Figure 5.** *Trypoxylon flavipes* Tsuneki, 1979. ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

gaster is ferruginous from apex of petiole to segment III or IV), OOD: POD = 2: 3 (in *T. taiwanum* OOD: POD = 1: 3 and in *T. atricorne* OOD: POD = 1: 2), free margin of clypeus rounded (in *T. taiwanum* free margin of clypeus is conspicuously rounded; in *T. atricorne* free margin of clypeus is rounded and shallowly incised mesally).

**Description. Female** (first record from China): Body length 21.2 mm (Fig. 6A). Body black; yellow are: mandible, clypeal apex, scape, pedicel, flagellomeres I–II beneath, pronotal collar posteriorly, pronotal lobe, tegula, fore- and midlegs except base of coxa, apex of hindtibia; base of gastral segments II–III ferruginous. Head and thorax with dense, long golden setae (length of setae greater than Od). Head rounded in fron-



**Figure 6.** *Trypoxylon fulvocollare* Cameron, 1904. ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

tal view (Fig. 6B); free margin of clypeus rounded, without protrusion; supraclypeal area broad and short; supraantennal tubercle low, with thin mid-longitudinal carina, without anterior transverse carina; frons microscopically coriaceous, with midsize to large and dense punctures ( $PIS \approx PD$ ), frontal furrow deeply impressed. Pronotal collar flat, without tubercle mesally; mesoscutum, scutellum and metanotum with fine, scattered punctures ( $PIS > PD$ ), PIS smooth, shiny (Fig. 6C); propodeal enclosure with inconspicuous U-shaped groove (Fig. 6D), with wide mid furrow, without transverse carinae; gastral petiole flask-shaped (Fig. 6E), longer than following two segments combined. Side of propodeum with distinct lateral carina (Fig. 6F), propodeal lateral surface shiny. HW: HL = 10: 8.2. IODs = 10:10. OOD: Od: POD = 2: 3: 3. F I = 5.7 × AW, F I: F II: F III = 10: 7: 7. R1 short, R1 = 1/2 TCV, CV1 = CV2 × 7, CV2 = 1/2 TCV. GL/ W = 4.5.

**Distribution.** Borneo; China (Yunnan); Indonesia; Java; Lesser Sunda Islands; Malaysia; Moluccas; Philippines; Sulawesi; Sumatra.

***Trypoxylon gampahae* Tsuneki, 1981**

Fig. 7

*Trypoxylon gampahae* Tsuneki, 1981d: 5, 19.

**Material examined.** 1♀: CHINA, Yunnan Province, Jinghong City, Menghai County, Bulang Mountain, 21°37'35"N, 100°24'23"E, ca 1438 m, 27.V–15.VI.2021, Yongsheng Pu (YNAU).

**Diagnosis.** *T. gampahae* resembles *T. mandibulatum* Richards, 1933 and *T. pygmaeum* Cameron, 1900 in having the mandible bidentate on inner margin near apex, median and lower frons roundly swollen and head sub-quadrangle in frontal view. It differs from both by punctures on the frons and mesoscutum are fine and sparse (in *T. mandibulatum* punctures on the frons and mesoscutum somewhat are large and conspicuous), the frons in lateral view is highly raised and inclined to antennal socket rim anteriorly (in *T. pygmaeum* the frons in lateral view is inconspicuously raised and almost flat anteriorly), the free margin of clypeus is conspicuously produced and with bidentate protrusion medially (in *T. mandibulatum* the clypeal free margin is inconspicuously produced and with truncate protrusion medially; in *T. pygmaeum* the free margin of clypeus is inconspicuously produced and slightly wavyed).

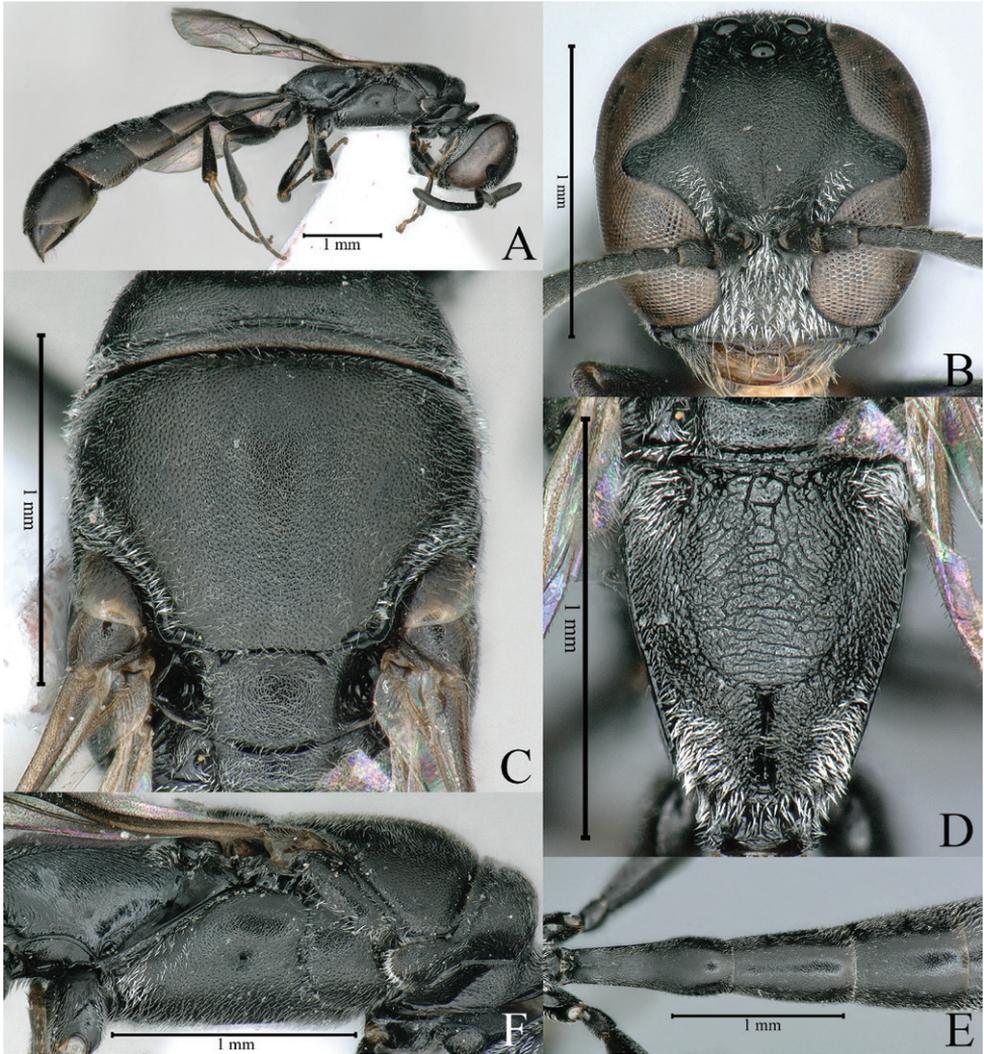
**Description. Female** (first record from China): Body length 7.5 mm (Fig. 7A). Body black; head and thorax with dense, short silvery setae (length of setae less than Od). Head sub-quadrangle in frontal view (Fig. 7B); mandible thick, bidentate on inner margin near apex; free margin of clypeus gently raised, inconspicuously incised medially; supraclypeal area broad, short; median and lower frons roundly swollen, without anterior transverse carina; frons microscopically coriaceous, with fine, dense punctures (PIS ≈ PD), frontal furrow shallow. Pronotal collar flat, without median tubercle; mesoscutum, scutellum and metanotum with fine, dense punctures (PIS ≈ PD), PIS microscopically coriaceous (Fig. 7C); propodeal enclosure with shallow but distinct U-shaped groove (Fig. 7D), without mid furrow, oblique striation covering almost entire propodeal enclosure surface; gastral petiole clavate (Fig. 7E), shorter than following two segments combined. Side of propodeum with distinct lateral carina (Fig. 7F), propodeal lateral surface dull, with inconspicuous rugae anteriorly. HW: HL = 10: 10. IODs = 10:7. OOD: Od: POD = 2: 5: 8. F I = 2.0 × AW, F I: F II: F III = 10: 7: 7. R1 equal to TCV, CV1 = CV2 × 2.3, CV2 = TCV. GL/ W = 3.3.

**Distribution.** China (Yunnan); Sri Lanka.

***Trypoxylon imayoshii* Yasumatsu, 1938**

Fig. 8

*Trypoxylon imayoshii* Yasumatsu, 1938: 451, 453; Tsuneki 1956a: 120, 122, 1956b: 4, 8, 19, 1972: 8, 1973: 32, 36, 1981e: 6, 1981f: 36; Antropov 1988: 87; 416; Terayama and Nambu 2009: 7, 26; Jeong and J.-K. Kim 2020: 246, 248.



**Figure 7.** *Trypoxylon gampahae* Tsuneki, 1981 ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

**Material examined.** 1♀1♂: CHINA, Guizhou Province, Zunyi City, Leigong Mountain, 27°52'06"N, 106°56'53"E, 1184 m, 19.VII.2019 (1♀), 15.VII.2019 (1♂), Yan Zhang (YNAU). 2♀♀3♂♂: CHINA, Guizhou Province, Zunyi City, Dabanshui Forest Park, 27°42'18"N, 106°51'15"E, ca 1001 m, 10. VII. 2011, Feng Dongdong (YNAU).

**Diagnosis.** *T. imayoshii* resembles *T. ambiguum* Tsuneki, 1956 in having a similar shape of the supraantennal tubercle, the pronotal collar and gastral petiole, punctures on the frons and mesoscutum are fine and sparse. It differs by the free margin of clypeus is conspicuously produced and with slightly bidentate protrusion medially (in *T. ambiguum* the margin of clypeus is inconspicuously produced and slightly waved), the frontal furrow is conspicuously impressed, the surface gently inclined towards middle

(in *T. ambiguum* the frontal furrow is inconspicuous, only conspicuous before anterior ocellus), the flagellomere XI longer than two preceding articles combined in male (in *T. ambiguum* the flagellomere XI shorter than two preceding articles), the apex of sternum VIII rounded in male (in *T. ambiguum* the apex of sternum VIII incised mesally in male). The species also resembles *T. infoveatum* Li & Li, 2007 in having the shape of pronotal collar and gastral petiole, punctures on the frons and mesoscutum are fine and sparse, but the supraantennal tubercle is low (in *T. infoveatum* the supraantennal tubercle is highly nasiform), the gaster is more or less ferruginous (in *T. infoveatum* the gaster is wholly black), the flagellomeres are unmodified in male (in *T. infoveatum* the flagellomere VIII excavate beneath at base and markedly incrassate toward apex).

**Description. Female** (first record from China): Body length 8.0–9.7 mm (Fig. 8A). Body black; yellowish brown are: mandible, clypeal apex, pronotal lobe, tegula, foreleg except base of forecoxa, midleg except midtarsomere II–IV, apex of hindcoxa, hindtrochanter and base of hindtibia; base of gastral segments II–IV ferruginous. Head and thorax with dense, long silvery setae (length of setae greater than Od). Head rounded in frontal view (Fig. 8D); free margin of clypeus with reversed trapezoidal protrusion, produced area shallowly incised mesally; supraclypeal area broad and short; supraantennal tubercle low, without anterior transverse carina; frons microscopically coriaceous, with fine, dense punctures, frontal furrow shallow. Pronotal collar trituberculate, with median tubercle; mesoscutum, scutellum and metanotum with fine, dense punctures, PIS microscopically coriaceous (Fig. 8G); propodeal enclosure with distinct U-shaped groove (Fig. 8F), with wide mid furrow, and transverse rugae in furrow; gastral petiole flask-shaped (Fig. 8L), longer than following two segments combined. Side of propodeum with distinct lateral carina (Fig. 8J), propodeal lateral surface shiny. HW: HL = 10: 8.2. IODs = 10:9. OOD: Od: POD = 1: 5: 3. F I = 3.6 × AW, F I: F II: F III = 12: 9: 9. R1 equal to TCV, CV1 = CV2 × 2.9, CV2 = TCV. GL/ W = 4.9.

**Male.** Body length 7.0–9.6 mm (Fig. 8B). Sculpture, setae, and coloration (gaster sometimes wholly brown) (Fig. 8E, H, I, K, M) as in female except as follows: clypeal free margin roundly produced (Fig. 8E); IODs = 10:8. OOD: Od: POD = 3: 4: 3; F I: F II: F III = 9: 8: 8; F XI = 2.4 × BW, flagellomere XI longer than two preceding articles combined, but shorter than three preceding articles combined (Fig. 8C). Male sternum VIII (Fig. 8N). Male genitalia (Fig. 8O, P).

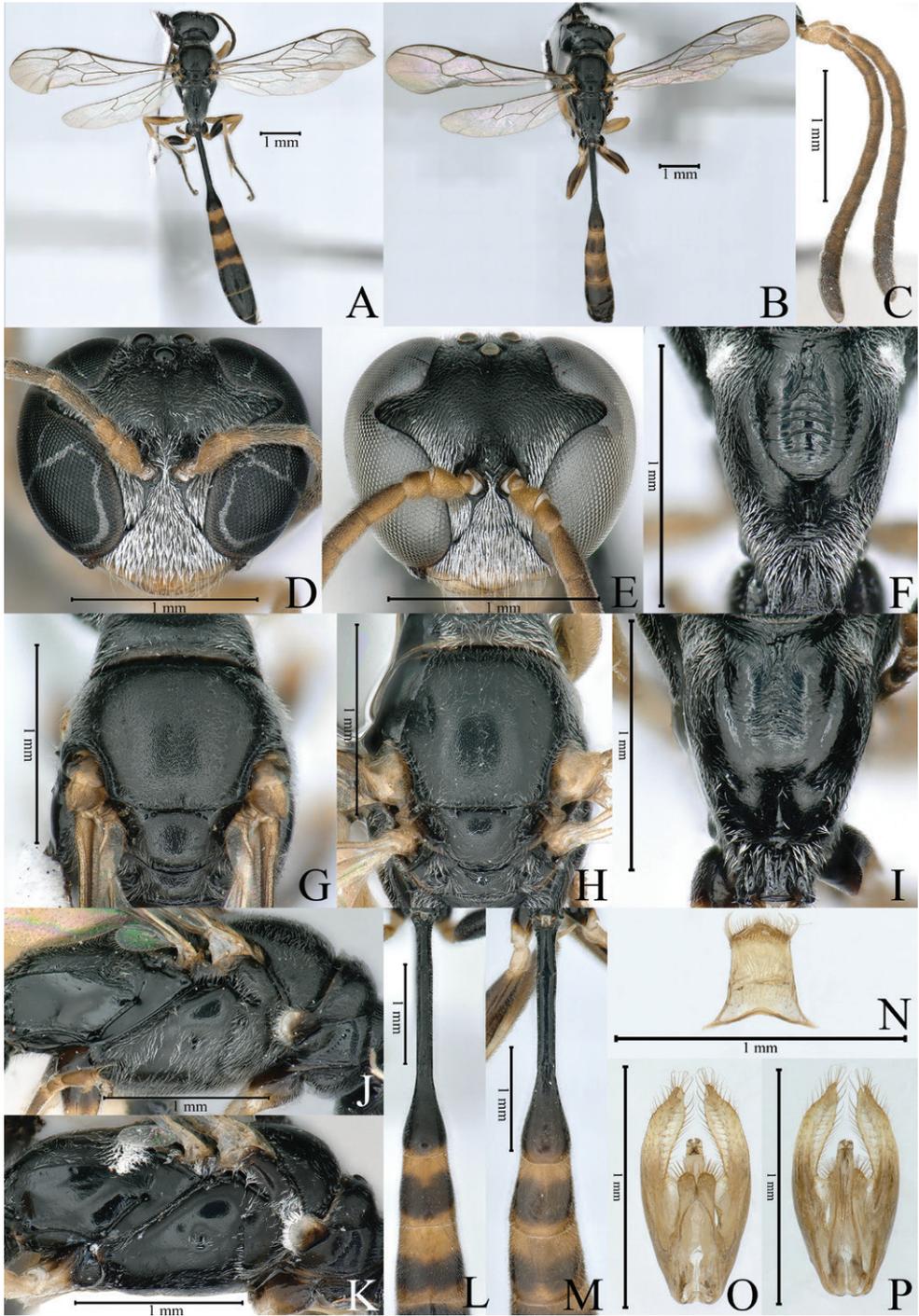
**Distribution.** China (Fujian, Guangdong, Guangxi, Shandong, Yunnan, Zhejiang); Japan; Korea; Russia.

### *Trypoxylon kandyianum* Tsuneki, 1979

Fig. 9

*Trypoxylon kandyianum* Tsuneki, 1979b: 4, 17, 1981d: 19.

**Material examined.** 1♀: CHINA, Yunnan Province, Jinghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Rainforest, 21°91'37"N, 101°27'07"E, ca 606 m, 24.IV–31.V.2019, Yongsheng Pu (YNAU); 1♀: CHINA, Yunnan Province, Jin-



**Figure 8.** *Trypoxylon imayoshii* Yasumatsu, 1938. ♀ (A, D, F, G, J, L); ♂ (B, C, E, H, I, K, M, N, O, P) A, B habitus (lateral view) C male antenna (lateral view) D, E head (frontal view) G, H thorax (dorsal view) F, I propodeum (dorsal view) J, K thorax (lateral view) L, M gastral segments I–III (dorsal view) N male sternum VIII O, P genitalia.

ghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Sandalwood and pomelo mixed forest, 27°90'04"N, 106°27'21"E, ca 508 m, 25.IX–25.X.2019, Yongsheng Pu (YNAU).

**Diagnosis.** The species resembles *T. formosicola* Strand, 1922 in having the supraantennal tubercle is low, but differs by rounded free margin of clypeus (in *T. formosicola* free margin of clypeus have short, wide protrusion), the scape and pedicel beneath and gaster are wholly ferruginous (in *T. formosicola* the scape and pedicel beneath and gaster are wholly black). The species also resembles *T. gracilescens* F. Smith, 1860 in having the free margin of clypeus rounded. It differs by the supraantennal furrow is absent (in *T. gracilescens* the supraantennal furrow is deep), the side of the propodeum have conspicuous lateral carina (in *T. gracilescens* the lateral carina is inconspicuous, almost lacking), the supraantennal tubercle is low, with anterior transverse carina connected to antennal socket rim (in *T. gracilescens* the medio-apical area of supraantennal tubercle is obliquely flattened into smooth, shiny and round area, not connected to the antennal socket rim).

**Description. Female** (first record from China): Body length 11.9–12.5 mm (Fig. 9A). Body black; yellow are: mandible, clypeal apex, scape and pedicel beneath and flagellomere I, pronotal lobe, tegula, fore- and midlegs except coxa and trochanter, hindtibia and hindtarsus; gaster ferruginous from apex of petiole to apical gastral segment. Head and thorax with dense, long silvery setae (length of setae greater than Od). Head rounded in frontal view (Fig. 9B); free margin of clypeus rounded, without protrusion; supraclypeal area broad and short; supraantennal tubercle low, with anterior transverse carina connected to antennal socket rim; frons microscopically coriaceous, with medium-large, dense punctures (PIS = PD), frontal furrow deeply impressed. Pronotal collar flat, without median tubercle; mesoscutum, scutellum and metanotum with fine, scattered punctures (PIS > PD), PIS smooth and shiny (Fig. 9C); propodeal enclosure with inconspicuous U-shaped groove (Fig. 9D), mid furrow shallow, transversely rugose; gastral petiole flask-shaped (Fig. 9E), longer than following two segments combined. Side of propodeum with distinct lateral carina (Fig. 9F), propodeal lateral surface shiny. HW: HL = 10: 8. IODs = 11:9. OOD: Od: POD = 1: 3: 2. F I = 4.0 × AW, F I: F II: F III = 10: 7: 6. R1 equal to TCV, CV1 = CV2 × 7, CV2 = 1/2 TCV. GL/ W = 5.1.

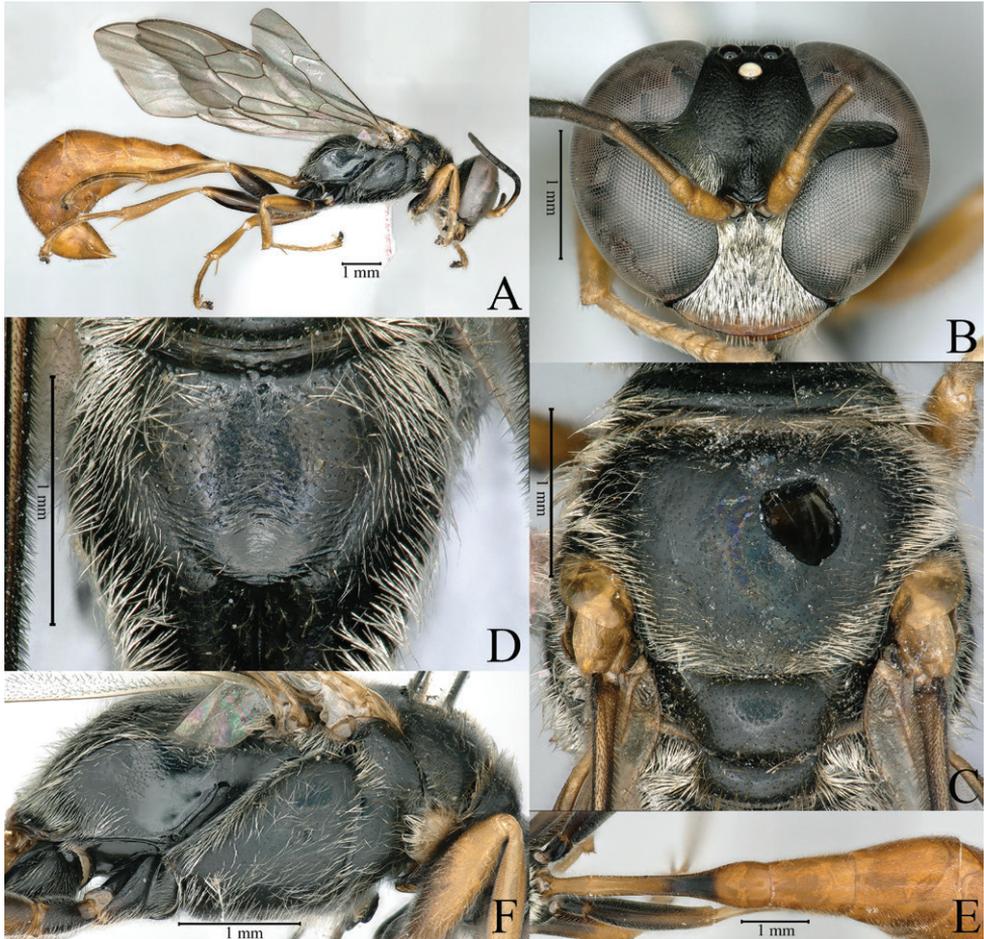
**Distribution.** China (Yunnan); Sri Lanka.

### *Trypoxylon khasiae* Cameron, 1904

Fig. 10

*Trypoxylon khasiae* Cameron, 1904d: 218; Tsuneki 1978b: 54, 80, 1979a: 11, 12, 84, nec 1979c: 7, 8, 9, 36 (= *Trypoxylon varipilosum*), 1981f: 58.

**Material examined.** 3♀♀: CHINA, Yunnan Province, Honghe Prefecture, Hekou County, Nanxi Town, 22°37'32"N, 103°56'53"E, ca 121 m, 6.VIII.2016 (2♀♀), 28.X.2016 (1♀), Hesheng Wang (YNAU); 3♀♀: CHINA, Yunnan Province, Jin-



**Figure 9.** *Trypoxylon kandyianum* Tsuneki, 1979 ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

ghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Rubber forest, 21°92'26"N, 101°26'50"E, ca 543 m, 20.VIII–18.IX.2018, Li Ma project team (YNAU); 1♀: CHINA, Yunnan Province, Jinghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Rainforest, 21°91'37"N, 101°27'07"E, ca 606 m, 20.VIII–18.IX.2018, Li Ma project team (YNAU); 1♀: CHINA, Yunnan Province, Jinghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Sandalwood and pomelo mixed forest, 27°90'04"N, 106°27'21"E, ca 508 m, 26.VIII–26.IX.2019, Li Ma project team (YNAU).

**Diagnosis.** *T. khasiae* resembles *T. varipilosum* Cameron, 1901 and *T. hyperorientale* Strand, 1922 in having the medio-apical area of supraantennal tubercle obliquely flattened into smooth, shiny and round area, the shape of pronotal collar, and a smooth mesoscutum. It differs from both by the body with silvery setae (in *T. varipilosum* the setae brassy), oblique area of supraantennal tubercle carrying fovea on it (in *T. var-*

*ipilosum* oblique area is flat), IODs = 10:5.6 (in *T. varipilosum* IODs = 10:9.0), the free margin of clypeus is rounded out, with two notches medially (in *T. hyperorientale* the margin of clypeus is rounded, slightly incised mesally), flagellomeres beneath and gaster from apex of petiole to apical gastral segment are ferruginous (in *T. hyperorientale* the flagellomeres and gaster are wholly black).

**Description. Female** (first record from China): Body length 11.9–12.5 mm (Fig. 10A). Body black; yellow are: mandible, clypeal apex, scape and pedicel beneath and all flagellomeres beneath, pronotal lobe, tegula, fore- and midfemora and all tibiae and tarsi; gaster ferruginous from apex of petiole to apical gastral segment. Head and thorax with dense and long silvery setae (length of setae greater than Od). Head rounded in frontal view (Fig. 10B); free margin of clypeus rounded out, with two notches medially; supraclypeal area broad, short; supraantennal tubercle nasiform, without anterior transverse carina, medio-apical area of supraantennal tubercle obliquely flattened into smooth, shiny, round area, with distinct fovea on it; frons with deep medial groove, punctures fine (PIS = PD). Pronotal collar flat, without median tubercle; mesoscutum, scutellum and metanotum with fine, scattered punctures (PIS > PD), PIS smooth and shiny (Fig. 10C); propodeal enclosure with inconspicuous U-shaped groove (Fig. 10D), with wide, transversely rugose middle furrow; gastral petiole flask-shaped (Fig. 10E), longer than following two segments combined. Side of propodeum with distinct lateral carina (Fig. 10F), propodeal lateral surface shiny. HW: HL = 10:8.5. IODs = 10:5.6. OOD: Od: POD = 2: 7: 4. F I = 4.0 × AW, F I: F II: F III = 27: 18: 16. R1 equal to TCV, CV1 = CV2 × 4.1, CV2 = 1/2 TCV. GL/ W = 4.7.

**Distribution.** China (Yunnan); India; Indonesia; Laos; Thailand.

### *Trypoxylon nasale* Tsuneki, 1979

Fig. 11

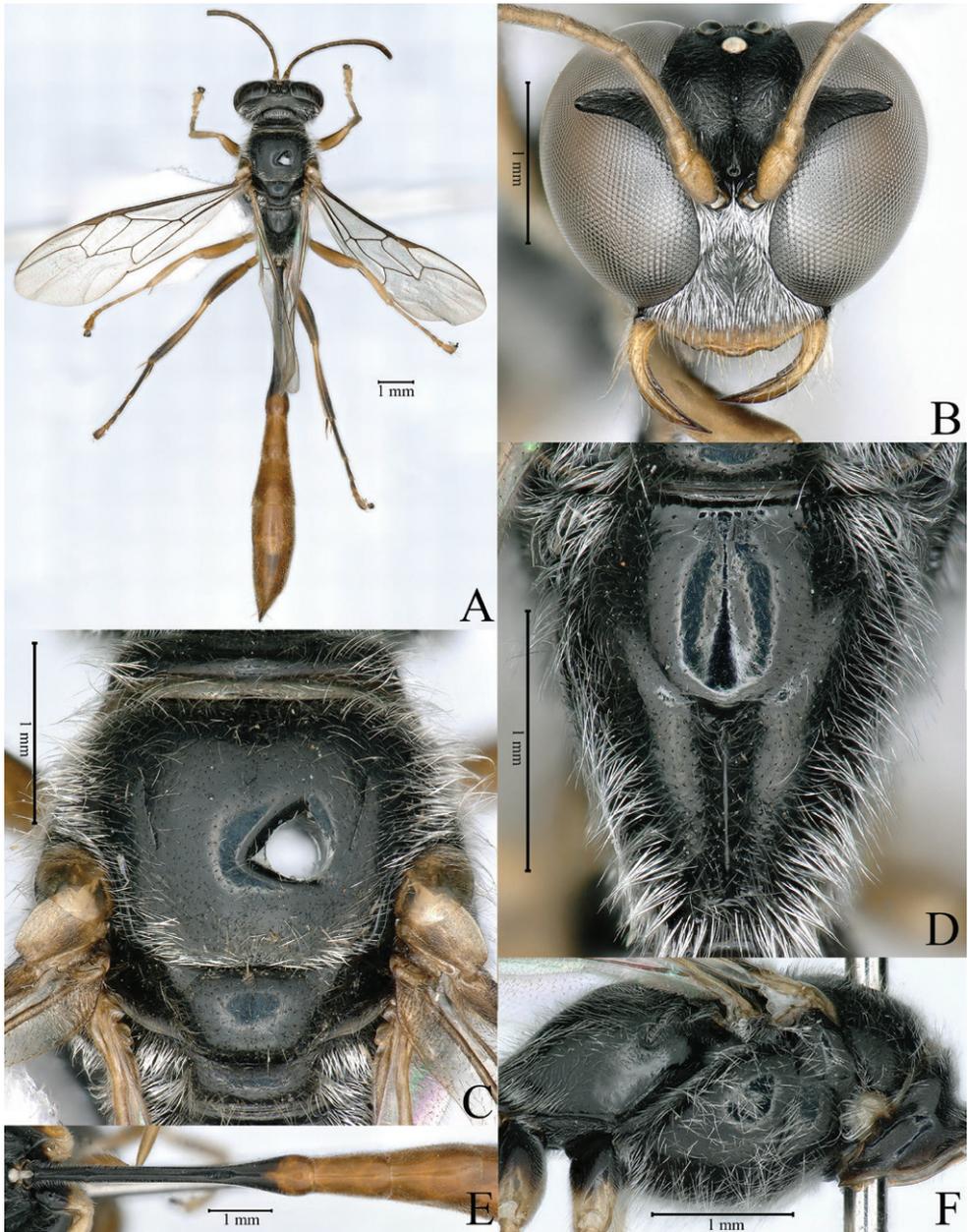
*Trypoxylon nasutum* Tsuneki, 1979a: 5, 37.

*Trypoxylon nasale* Tsuneki, 1980a: 2. Substitute name for *Trypoxylon nasutum* Tsuneki, 1979.

*Trypoxylon minahime* Tsuneki, 1992: 54. Unnecessary substitute name for *Trypoxylon nasutum* Tsuneki, 1979.

**Material examined.** 3♀♀: CHINA, Yunnan Province, Jinghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Rainforest, 21°91'37"N, 101°27'07"E, ca 606 m, 24.IV–31.V.2019, Yongsheng Pu (YNAU); 3♀♀: CHINA, Yunnan Province, Jinghong City, Mengla County, Xishuangbanna Tropical Botanical Garden, Rubber forest, 21°92'26"N, 101°26'50"E, ca 543 m, 15.V–18.VI.2018, Lin Zhao (YNAU).

**Diagnosis.** *T. nasale* resembles *T. sauteri* Tsuneki, 1981 and *T. clypeisinuatum* T. Li and Q. Li, 2010 in having the supraantennal tubercle is high nasiform, with anterior transverse carina connected to antennal socket rim. It differs from both by IODs = 10:8 (in *T. sauteri* IODs = 10:3.4), the fore- and midlegs except base of coxa and gaster



**Figure 10.** *Trypoxylon khasiae* Cameron, 1904 ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

are ferruginous (in *T. sauteri* the gastral segment I, V and VI are black; in *T. clypeisinuatum* the legs are wholly black, the gastral segment I, V and VI are black), free margin of clypeus have semicircular protrusion, the protrusion is shallowly incised mesally (in *T. sauteri* the margin of clypeus is slightly semicircularly produced; in *T. clypeisinuatum* the margin of clypeus is conspicuously semicircularly produced).

**Description. Female** (first record from China): Body length 8.7–9.2 mm (Fig. 11A). Body black; ferruginous are: mandible basally, clypeal apex, scape and pedicel beneath and flagellomere I, pronotal lobe, tegula, fore- and midlegs except base of coxa, apex of hindcoxa, hindtrochanter, apex of hindtibia, hindtarsus and gaster. Head and thorax with dense, short silvery setae (length of setae less than Od). Head rounded in frontal view (Fig. 11B); free margin of clypeus with semicircular protrusion, produced area shallowly incised mesally; supraclypeal area broad and short; supraantennal tubercle high nasiform, with anterior transverse carina connected to antennal socket rim; frons microscopically coriaceous, with fine, dense punctures (PIS  $\approx$  PD), frontal furrow shallow. Pronotal collar flat, without median tubercle; mesoscutum, scutellum and metanotum with fine, dense punctures (PIS  $\approx$  PD), PIS microscopically coriaceous (Fig. 11C); propodeal enclosure with distinct U-shaped groove (Fig. 11D), with wide, transversely rugose middle furrow; gastral petiole clavate (Fig. 11E), shorter than following two segments combined. Side of propodeum with distinct lateral carina (Fig. 11F), propodeal lateral surface shiny. HW: HL = 10: 9. IODs = 10:8. OOD: Od: POD = 2: 9: 6. F I =  $3.7 \times$  AW, F I: F II: F III = 10: 7: 6. R1 equal to TCV, CV1 = CV2  $\times$  2.8, CV2 = TCV. GL/ W = 2.7–3.0.

**Distribution.** China (Yunnan); Malaysia.

### *Trypoxylon pahangense* Tsuneki, 1979

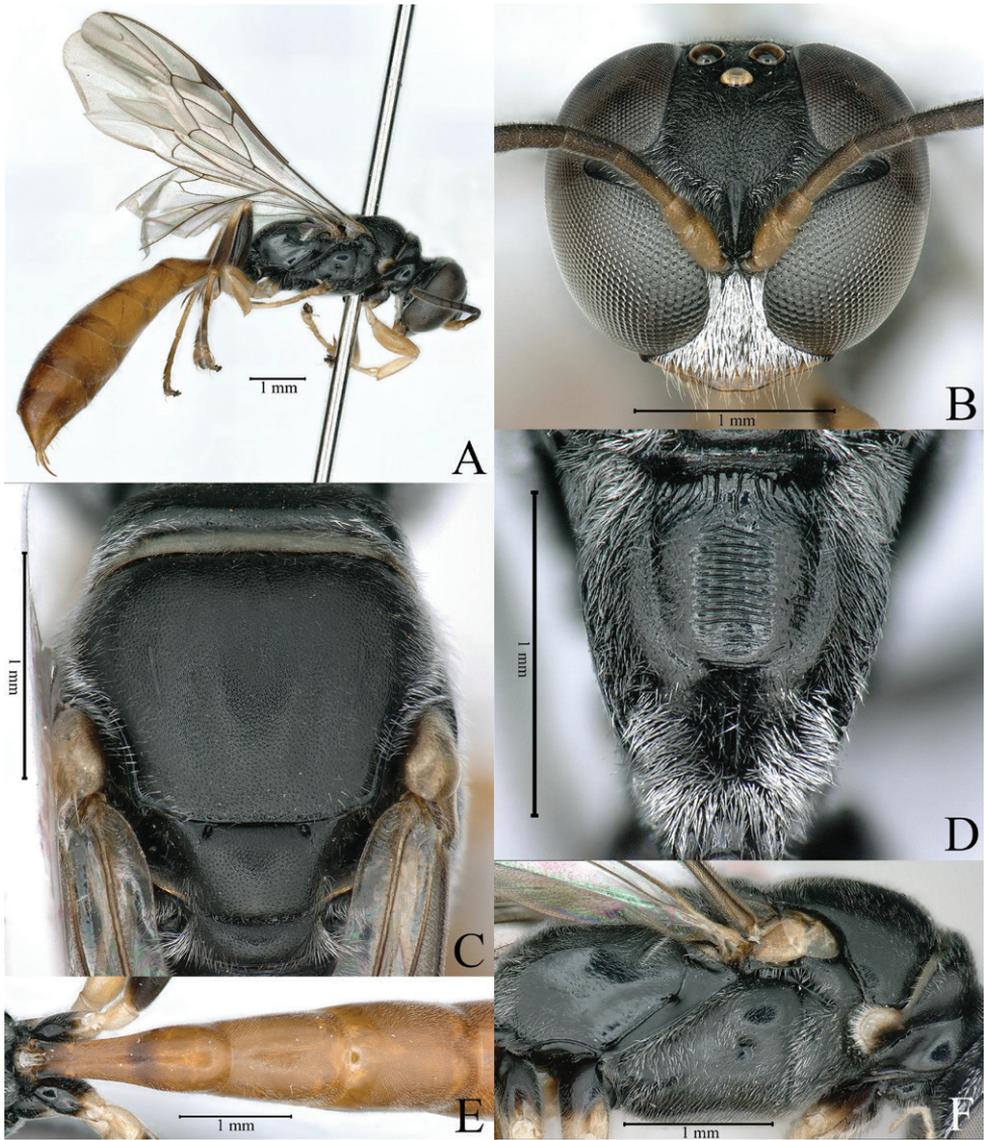
Fig. 12

*Trypoxylon pahangense* Tsuneki, 1979a: 6, 51, 1981d: 26, 38.

**Material examined.** 1♀: CHINA, Yunnan, Jinghong City, Menghai County, Guanggang Village, Ancient tea forest, 21°49'15"N, 100°29'44"E, ca 1526 m, 20.VIII–16.IX.2018, coll. Li Ma project team (YNAU); 1♀: CHINA, Yunnan Province, Jinghong City, Menghai County, Bulang Mountain, 21°37'35"N, 100°24'23"E, ca 1438 m, 17.V–20.VI.2018, Li Ma project team (YNAU); 13♀♀: same data as for preceding: 20.VI–20.VII.2018 (2♀♀), 20.VII–16.VIII.2018 (3♀♀), 16.VIII–14.IX.2018 (3♀♀), 28.V–28.VI.2019 (1♀), 28.VI–19.VII.2019 (1♀), 19.VII–21.VIII.2019 (1♀), 21.VIII–20.IX.2019 (1♀), 10.VII–13.VIII.2020 (1♀).

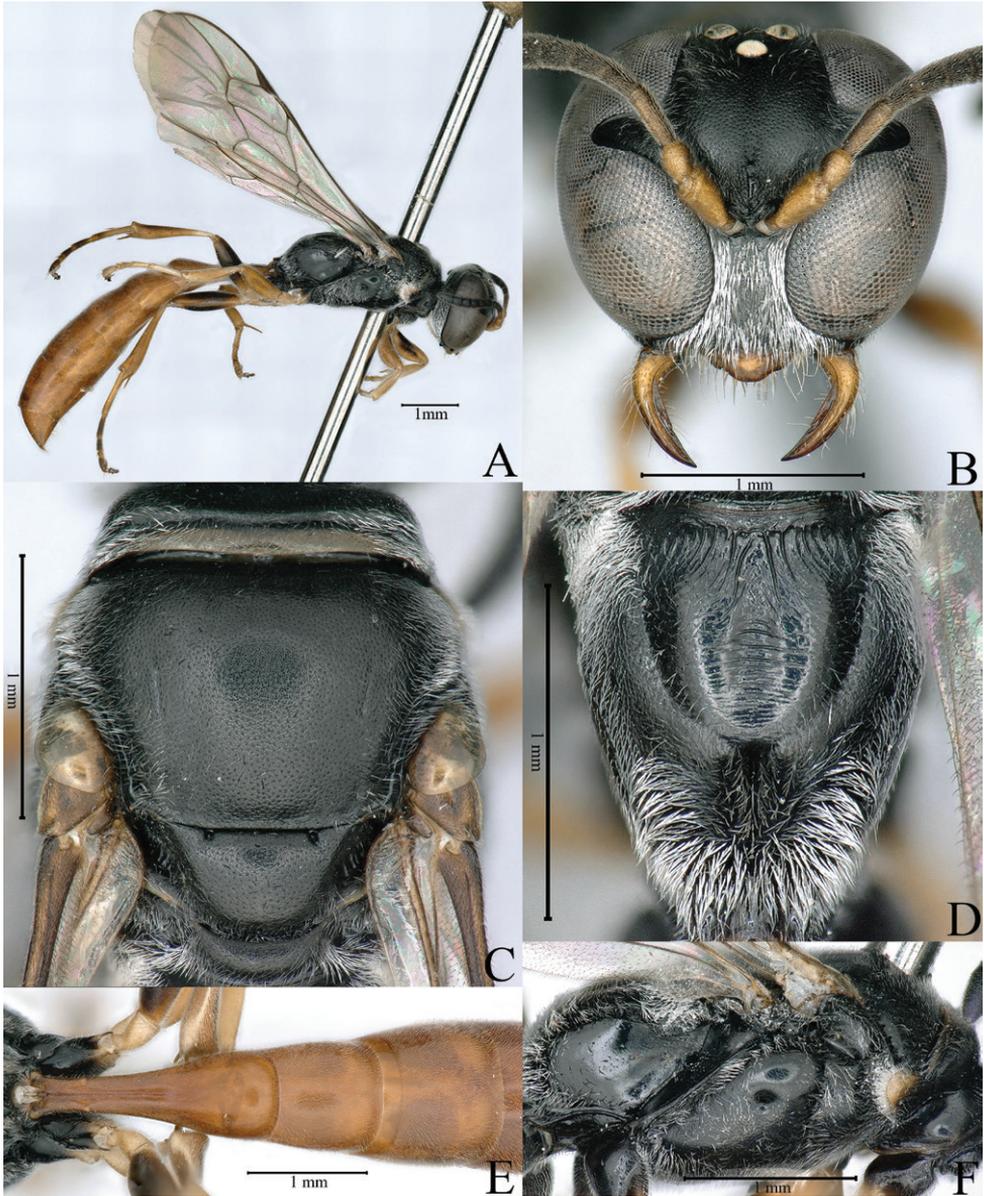
**Diagnosis.** *T. pahangense* resembles *T. truncatum* Tsuneki, 1979 and *T. brunneimaculatum* T. Li and Q. Li, 2007 in having the supraantennal tubercle is low, with anterior transverse carina connected to antennal socket rim. It differs from both by the free margin of clypeus have conspicuously obtuse-shaped protrusion (in *T. truncatum* the margin of clypeus is rounded, without projection; in *T. brunneimaculatum* the clypeal free margin is slightly semicircularly produced), the gaster is wholly ferruginous (in *T. truncatum* the gastral petiole is black; in *T. brunneimaculatum* the gastral segment I, V and VI are black).

**Description. Female** (first record from China): Body length 7.7–10.1 mm (Fig. 12A). Body black; yellow are: mandible, clypeal apex, pronotal lobe, tegula, fore- and midlegs except base of coxa, apex of hindcoxa, hindtrochanter, hindtibia and hind-



**Figure 11.** *Trypoxylon nasale* Tsuneki, 1979 ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

tarsomere I; gaster ferruginous. Head and thorax with dense and short silvery setae (length of setae less than  $Od$ ). Head rounded (Fig. 12B); free margin of clypeus with distinctly obtuse-shaped protrusion; supraclypeal area broad, short; supraantennal tubercle low, with anterior transverse carina; frons microscopically coriaceous, with fine, dense punctures ( $PIS \approx PD$ ), frontal furrow shallow. Pronotal collar flat, without median tubercle; mesoscutum, scutellum and metanotum with fine, dense punctures ( $PIS \approx PD$ ),  $PIS$  microscopically coriaceous (Fig. 12C); propodeal enclosure with distinct U-shaped groove (Fig. 12D), with wide, transversely rugose middle furrow; gastral petiole



**Figure 12.** *Trypoxylon pahangense* Tsuneki, 1979 ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

clavate (Fig. 12E), shorter than following two segments combined. Side of propodeum with distinct lateral carina (Fig. 12F), propodeal lateral surface shiny. HW: HL = 10: 9. IODs = 10:5. OOD: Od: POD = 1: 3: 2. F I = 3.5 × AW, F I: F II: F III = 10: 6: 6. R1 equal to TCV, CV1 = CV2 × 3.2, CV2 = TCV. GL/ W = 2.7–3.0.

**Distribution.** China (Yunnan); Malaysia.

***Trypoxylon pendleburyi* Tsuneki, 1979**

Fig. 13

*Trypoxylon pendleburyi* Tsuneki, 1979a: 5, 36.

**Material examined.** 1♀, CHINA, Yunnan, Jinghong City, Menghai County, Guanggang Village, farmland, 21°49'50"N, 100°28'20"E, ca 1229 m, 16.IX–19.X.2018, coll. Li Ma project team (YNAU); 9♀♀: same data as for preceding: 28.V–28.VI.2019 (1♀), 20.VII–23.VIII.2019 (2♀♀), 23.X–24.XI.2019 (2♀♀), 13.I–15.II.2021 (4♀♀).

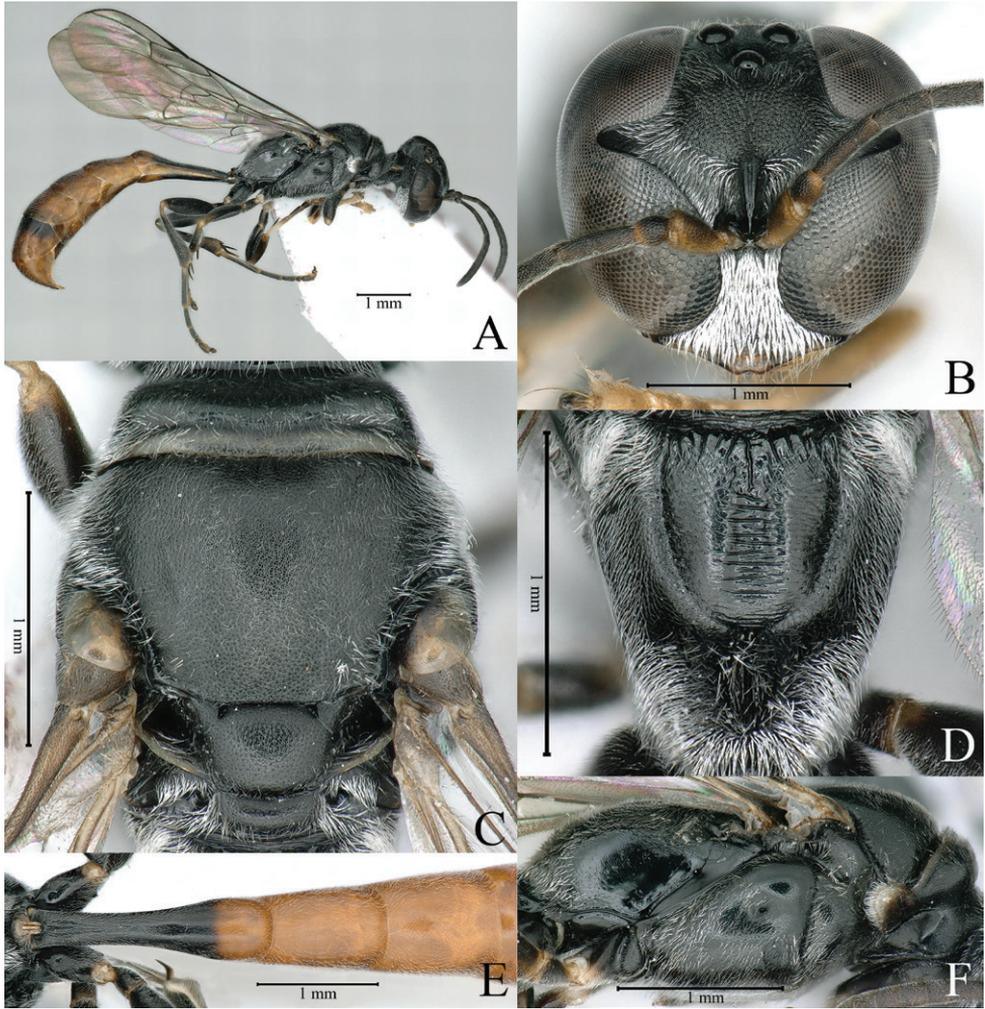
**Diagnosis.** *T. pendleburyi* resembles *T. nasale* Tsuneki, 1979 and *T. clypeisinuatum* T. Li and Q. Li, 2010 in having the supraantennal tubercle is highly nasiform, with anterior transverse carina connected to antennal socket rim. It differs from both by free margin of clypeus have two barely separated and round teeth medially (in *T. nasale* the margin of clypeus have semicircular protrusion, the protrusion is shallowly incised mesally; in *T. clypeisinuatum* the margin of clypeus is conspicuously produced and with semicircular protrusion), the all trochanter are black, the gaster from apex of petiole to end is ferruginous (in *T. nasale* the all trochanter and gaster are wholly ferruginous; in *T. clypeisinuatum* the gastral segment I, V and VI are black), the gastral petiole is much slender (in *T. nasale* the gastral petiole is broad and short).

**Description. Female** (first record from China): Body length 7.5–9.2 mm (Fig. 13A). Body black; yellow are: base of mandible, clypeus, pronotal lobe, tegula, foretibia and foretarsus, base of midtibia, midtarsomere I and base of hindtibia; gaster ferruginous from apex of petiole to segment VI, sometimes gastral segment V with black mark. Head and thorax with dense and short silvery setae (length of setae less than Od). Head rounded in frontal view (Fig. 13B); free margin of clypeus with two barely separated and round teeth medially; supraclypeal area broad, short; supraantennal tubercle high nasiform, with anterior transverse carina connected to antennal socket rim; frons microscopically coriaceous, with fine, dense punctures (PIS ≈ PD), frontal furrow shallow. Pronotal collar flat, without median tubercle; mesoscutum, scutellum and metanotum with fine, dense punctures (PIS ≈ PD), PIS microscopically coriaceous (Fig. 13C); propodeal enclosure with distinct U-shaped groove (Fig. 13D), with wide mid furrow, and transverse rugae in furrow; gastral petiole clavate (Fig. 13E), shorter than following two segments combined. Side of propodeum with distinct lateral carina (Fig. 13F), propodeal lateral surface shiny. HW: HL = 10: 8.4. IODs = 10:5. OOD: Od: POD = 2: 5: 6. F I = 3.5 × AW, F I: F II: F III = 10: 7: 6. R1 equal to TCV, CV1 = CV2 × 2.7, CV2 = TCV. GL/ W = 3.5–3.9.

**Distribution.** Australia; Borneo; China (Yunnan); India; Laos; Moluccas; New Guinea; Pacific Islands; Sri Lanka; Sulawesi.

**Discussion**

Species from southwest China are found in both the Oriental and Palearctic regions, highlighting the richness and uniqueness of the region's biodiversity and reflecting the complexity and diversity of the region's natural environment. This study lays the foun-



**Figure 13.** *Trypoxylon pendleburyi* Tsuneki, 1979 ♀ **A** habitus (lateral view) **B** head (frontal view) **C** thorax (dorsal view) **D** propodeum (dorsal view) **E** gastral segments I–III (dorsal view) **F** thorax (lateral view).

dation for further research on the relationship between climate change, environmental heterogeneity, and the diversity of sphecid wasps in southwest China.

Southeast Asia has the greatest diversity of the genus *Trypoxylon*, with Indonesia and Malaysia harboring the highest species diversity (Pulawski 2024). The research and supplementation of *Trypoxylon* species in Southeast Asia have mainly benefited from the contributions of Tsuneki (1956–1986). The ecological diversity of Southeast Asia is remarkable, encompassing tropical rainforests, monsoon forests, mountain forests, swamps, and other ecosystems (Sodhi et al. 2004; Buerki et al. 2014; Jiang et al. 2017; Tan et al. 2020; Meng et al. 2023). Southwest China, covering an area of 2.5 million square kilometers, features complex landforms and diverse climate types. Serving as a main ecological environment in Southeast Asia, it hosts a large number of plant and

animal species along with various ecosystem types (Zhang et al. 2014; Cao et al. 2011; Zhang et al. 2011). This region offers not only different ecological environments and habitat options but also abundant food resources, which may be the main reason why the genus *Trypoxylon* is concentrated in southwest China.

The endemic and newly recorded species of China are mainly distributed in southern China, which is part of the Indochina bioregions. The discovery of new species and the revision of existing ones in this region will provide new insights into the biodiversity and biogeographic distribution of Indochina. Additionally, it will provide a basis for further research on the origin, diffusion paths, and historical evolution processes of biological species across various bioregions.

Prospect. On the basis of morphological classification studies and the analysis of insect gene sequences by molecular biology methods, insect species can be identified and classified more accurately, thereby solving the problem of some species being very similar in morphology and difficult to distinguish (Liu et al. 2021). It is also possible to jointly construct phylogenetic trees of insects to reveal their relationships and evolutionary history (Ilyasov et al. 2018). Furthermore, combining geographical and ecological environment analysis can help us explore the patterns and mechanisms of biological evolution, as well as the causes and processes of biodiversity formation in the region.

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