

A key to all species of *Fagineura* Vikberg & Zinovjev (Hymenoptera, Tenthredinidae) worldwide with the descriptions of two new Chinese species

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Abstract

Fagineura was established by Vikberg & Zinovjev in Shinohara et al. (2000). In this paper, two new species of *Fagineura* are described and illustrated, *F. brevicornis* **sp. nov.** collected in Hubei Province and *F. longitangia* **sp. nov.** collected in Hunan Province from China. A key to all species of *Fagineura* worldwide is provided, now including six species.

Keywords

China, key, Nematinae, sawfly, taxonomy, Tenthredinoidea

Introduction

Fagineura Vikberg & Zinovjev, 2000 (Shinohara et al. 2000) is a small genus of the subfamily Nematinae (Tenthredinidae). Until now, only four species have been known worldwide (Taeger et al. 2010; Liu et al. 2019), namely *F. crenativora* Vikberg & Zinovjev, 2000 and *F. quercivora* Togashi, 2006, distributed in Japan; and *F. flactoserula* Liu, Li & Wei, 2019 and *F. xanthosoma* Liu, Li & Wei, 2019, distributed in China. In the course of studying Nematinae from China, two specimens of *Fagineura*

were found that are different from the four known species, and they are described here as new species. The two species are described and illustrated, and a key to the known species of *Fagineura* worldwide is provided.

Materials and methods

Imaging, terminology, deposition of material

The specimens were examined with a Motic-SMZ-171 stereomicroscope. Images of the imagines were taken with a Nikon D700 digital camera and a Leica Z16APO separately. The genitalia were examined with a Motic BA410E microscope, and images of the genitalia were taken with Motic Moticam Pro 285A. The series of images produced were focus-stacked using Helicon Focus (HeliconSoft, Kharkiv, Ukraine) and further processed with Adobe Photoshop CS 11.0.

The terminology of genitalia follows Ross (1945) and that of general morphology follows Viitasaari (2002). For a few terms, including middle fovea, lateral fovea, and lateral walls, we follow Takeuchi (1952).

Specimens examined in this study are deposited in the Asian Sawfly Museum, Nanchang, China (ASMN), including holotypes of the two new species, 2 specimens of *F. flaccoserrula* Liu, Li & Wei, 2019 and 16 specimens of *F. xanthosoma* Liu, Li & Wei, 2019.

Abbreviations used in the text and illustrations are as follows:

- OCL** The distance between a lateral ocellus and the occipital carina, or the hind margin of the head where this carina would be if it were developed (Benson 1954);
OOL The distance between an eye and a lateral ocellus;
POL The distance between the mesal margins of the 2 lateral ocelli.

Results

Taxonomy

Fagineura Vikberg & Zinovjev, 2000

Figures 1, 2

Type species. *Fagineura crenativora* Vikberg & Zinovjev, 2000.

Diagnosis. Compared with the diagnosis of Liu et al. (2019), we present the following changes: Medium-sized; clypeus and labrum yellowish white to yellow; clypeus with broad and moderately deep (0.3–0.5) emargination apically; mandibles symmetrical; malar space shorter than diameter of median ocellus, and in most species not exceeding $0.5 \times$ of diameter of median ocellus; postocellar area more than $2.0 \times$ as wide as long;

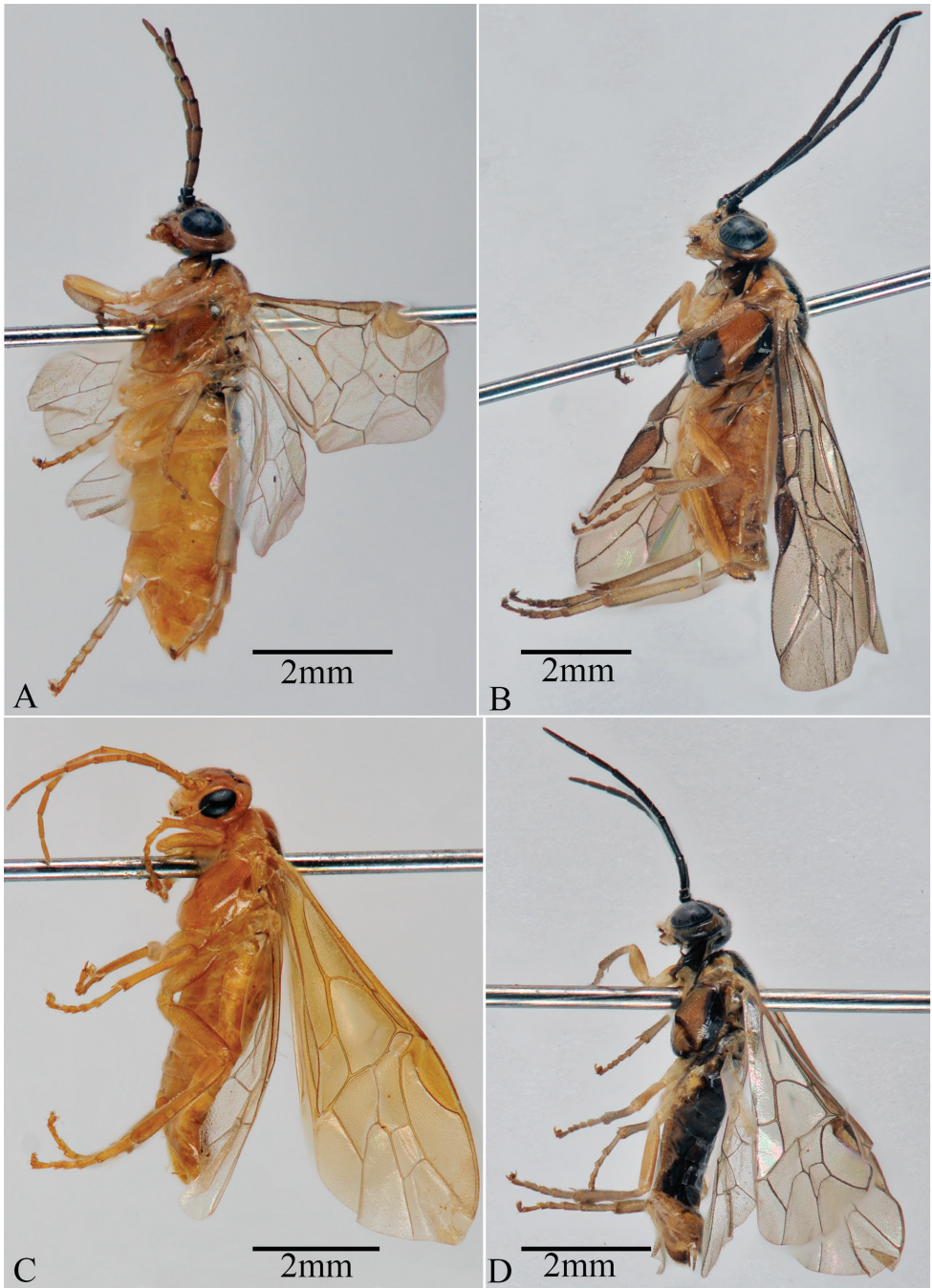


Figure 1. Whole body in lateral view of *Fagineura* species, female **A, B, D** holotype **C** paratype **A** *F. brevicornis* sp. nov. **B** *F. longitangia* sp. nov. **C** *F. xanthosoma* Liu, Li & Wei, 2019 **D** *F. flactoserrula* Liu, Li & Wei, 2019.

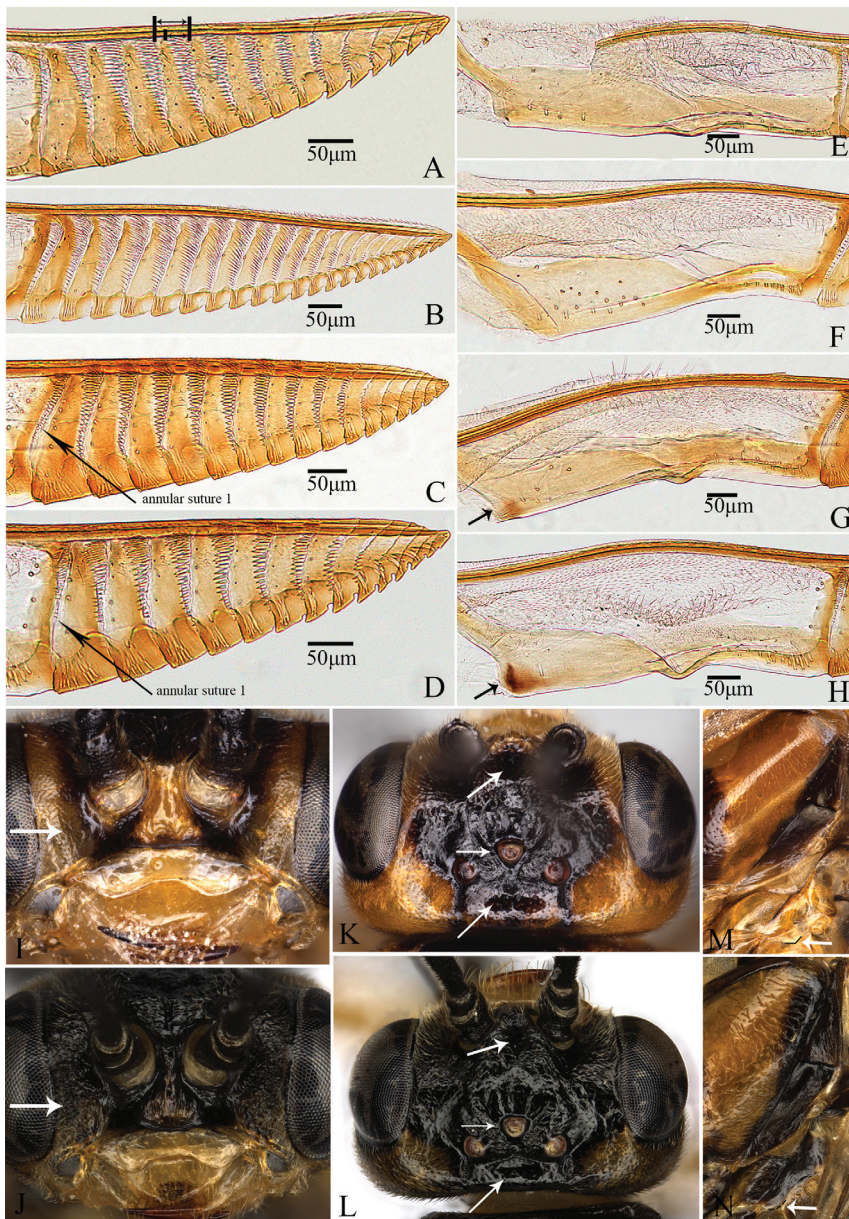


Figure 2. Characters used to identify *Fagineura* species **A** *F. brevicornis*, lamnium (the short double arrow denotes the longest setae band, the long double arrow denotes the length of the annulus) **B** *F. xanthosoma*, lamnium **C** *F. longitangia*, lamnium **D** *F. flactoserrula*, lamnium **E** *F. brevicornis*, tangium **F** *F. xanthosoma*, tangium **G** *F. longitangia*, tangium (arrow denotes the posterior corner not swollen) **H** *F. flactoserrula*, tangium (arrow denotes the posterior corner swollen) **I** *F. longitangia* (arrow denotes inner orbit of head) **J** *F. flactoserrula* (arrow denotes inner orbit of head) **K** *F. longitangia* (arrows from top to bottom denote middle fovea, circumocellar furrow and postocellar area) **L** *F. flactoserrula* (arrow denotes inner orbit of head) **M** *F. longitangia* (arrows from top to bottom denote middle fovea, circumocellar furrow and postocellar area) **N** *F. flactoserrula* (arrow denotes posterodorsal corner of metepimeron).

antenna usually shorter than thorax and abdomen together; posterior part of mesopleural katepimeron covered with hairs; distance between cenchri as long as or shorter than breadth of a cenchrus; forewing without radial cross-vein; the costa of forewing less dilated than in *Pristiphora*; petiole of anal cell of hindwing of *F. quercivora* Togashi, 2006 short than cu-a, and the other 5 species longer than cu-a; claws bifid, inner tooth large; sawsheath short; annular suture 1 with setae band; the longest setae bands of lancet is at least $0.5 \times$ length of annulus; cypsella of basal serrulae absent, apically short and with emargination; tangium of lancet with campaniform sensilla in most species; except for *F. quercivora* Togashi, 2006 we unknown, the radix of *F. xanthosoma* Liu, Li & Wei, 2019 shorter than lamnium, and the other 4 species longer than or as long as lamnium.

Remarks. Shinohara et al. (2000) provided the differences between *Fagineura* and *Nematus*, but based on all species of *Fagineura*, it differs from *Nematus* in annular suture 1 of lancet with setae band; less derived shape of the mandibles; malar space narrower than the diameter of the median ocellus; katepimeron of the mesopleuron with hairs; having campaniform sensilla on the tangium except for *F. flactoserrula* only one or none; the apically emarginate sawsheath except for *F. xanthosoma*.

Key to all species of *Fagineura* worldwide

- 1 Mesepisternum, all coxae and ovipositor sheath black; inner tooth of tarsal claw longer than outer tooth. Japan (Honshu)....***F. quercivora* Togashi, 2006**
- Mesepisternum mostly or entirely yellow or yellowish brown (Fig. 1A–D); all coxae yellowish white or yellow, or only basal margin black; ovipositor sheath yellow or yellowish brown, or apical margin of valvula 3 black; inner tooth of tarsal claw shorter than outer tooth.....**2**
- 2 Frontal area mostly yellow or yellowish brown; mesonotum mostly yellowish brown; wing veins mostly pale yellow**3**
- Frontal area entirely black; mesonotum mostly black; wing veins mostly black-brown.....**4**
- 3 Area surrounding anterior tentorial pit and subantennal groove black; malar space $0.4 \times$ as long as diameter of median ocellus; middle fovea sub-circular (Fig. 3B, C); sheath $2.3 \times$ as long as metatarsomere 1, valvula 3 almost as long as valvifer 2 (Fig. 3G); lancet with 15 serrulae, sutures 1–12 with setae bands, longest setae band about $0.7 \times$ length of annulus (Fig. 2A); cypsellae of serrulae 1–7 absent, tangium with 4 campaniform sensilla, radix $1.1 \times$ as long as lamnium (Figs 2E, 3H–J). China (Hubei)***F. brevicornis* sp. nov.**
- Area surrounding anterior tentorial pit and subantennal groove yellow; malar space $0.8 \times$ as long as diameter of median ocellus; middle fovea long, groove-like; sheath $1.8 \times$ as long as metatarsomere 1, valvula 3 $1.3 \times$ as long as valvifer 2; lancet with 21 serrulae, sutures 1–13 with setae bands, longest setae band about $0.9 \times$ length of annulus (Fig. 2B); cypsellae of serrulae 1–2 nearly absent, tangium with more than 10 campaniform sensilla (Fig. 2F), radix $0.6 \times$ as long as lamnium. China (Hubei, Hunan) ***F. xanthosoma* Liu, Li & Wei, 2019**

- 4 Mesopleuron entirely pale yellowish brown; ovipositor sheath short, $1.6 \times$ as long as metatarsomere 1, with shallow emargination apically; annular suture 1 of lancet straight, and with 3 marginal sensilla below. Japan (Hokkaido, Honshu, Kyushu, Shikoku) *F. crenativora* Vikberg & Zinovjev, 2000
- Mesopleuron with distinct black spots; ovipositor sheath relatively long, 1.9 or $2.0 \times$ as long as metatarsomere 1, tapering toward apex; annular suture 1 of lancet oblique to the apex of lancet, and with 7 or 9 marginal sensilla below..... 5
- 5 Supraclypeal area and inner orbit black, and with wrinkles (Fig. 2J); metapleuron and abdominal terga mostly black; posterodorsal corner of metepimeron rounded (Fig. 2N); middle fovea long and groove-like; circumocellar furrow indistinct; postocellar area $3.0 \times$ as wide as long (Fig. 2L); lancet with 14 serrulae, each middle serrula with 10–13 distal teeth; annular suture 1 slightly curved, sutures 1–10 with setae bands, longest setae band about $0.7 \times$ length of annulus; cypsella of serrulae 1–4 absent (Fig. 2D); tangium with 1 campaniform sensillum, and basoventral corner swollen (Fig. 2H). China (Hubei)..... *F. flactoserrula* Liu, Li & Wei, 2019
- Most of supraclypeal area, inner orbit, metapleuron, most of abdominal terga yellowish brown (Fig. 4C, E); posterodorsal corner of metepimeron squared (Fig. 2M); middle fovea sub-circular; circumocellar furrow distinct; postocellar area $2.5 \times$ as wide as long (Fig. 2K); lancet with 16 serrulae, each middle serrula with 13–16 distal teeth; annular suture 1 distinctly curved, sutures 1–11 with setae bands, longest setae band about $0.6 \times$ length of annulus; cypsella 1–9 absent (Fig. 2C); tangium with 6 campaniform sensilla, and basoventral corner not swollen (Figs 2G, 4H, I). China (Hunan)..... *F. longitangia* sp. nov.

***Fagineura brevicornis* Liu, Li & Wei, sp. nov.**

<http://zoobank.org/6543B58F-779E-48AA-A4B8-FD290B16CA8D>

Figure 3

Material examined. *Holotype*, female, CHINA: Hubei Province, Yichang City, Shengnongjia Mountain, Guitouwan, $31^{\circ}28.44'N$, $110^{\circ}08.87'E$, 2150 m, 19 May 2012, leg. Ze-Jian Li, ASMN.

Diagnosis. *F. brevicornis* is most similar to *F. xanthosoma* in having both the mesepisternum, head and wing veins mainly yellow or yellow-brown; ovipositor sheath entirely yellow or yellowish brown; but *F. brevicornis* can be differentiated from the latter by the black subantennal groove and area surrounding anterior tentorial pit (in *F. xanthosoma* these are yellow); malar space $0.4 \times$ as long as diameter of median ocellus; middle fovea sub-circular (Fig. 3B, C); sheath $2.3 \times$ as long as metatarsomere 1, valvula 3 almost as long as valvifer 2 (Fig. 3G); lancet with 15 serrulae, sutures 1–12 with setae bands, longest setae band about $0.7 \times$ length of annulus (Fig. 2A); cypsellae of serrulae 1–7 absent, tangium with 4 campaniform sensilla, radix $1.1 \times$ as long as lamnium (Figs 2E, 3H–J).

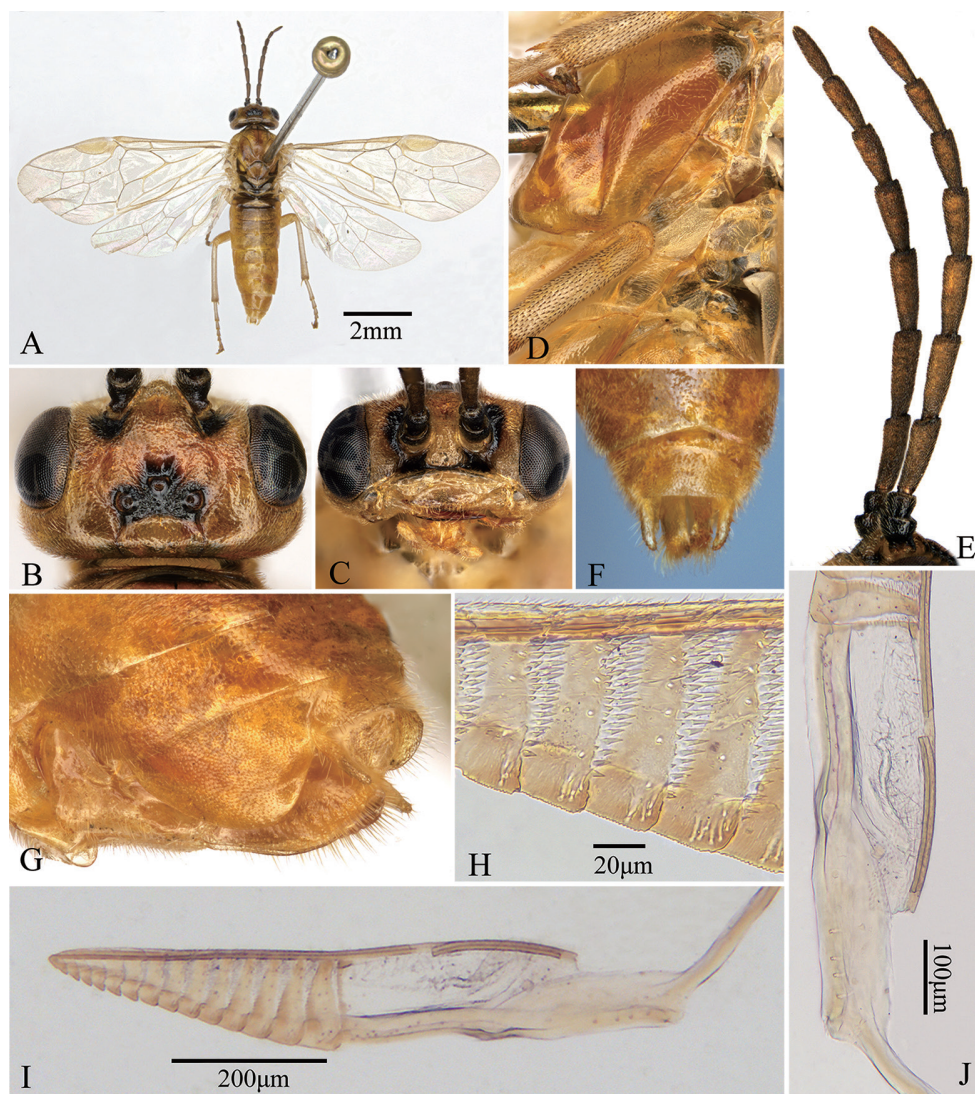


Figure 3. *Fagineura brevicornis* sp. nov., female, holotype **A** dorsal view **B** head, dorsal view **C** head, anterior view **D** mesopleuron and metapleuron **E** antenna, lateral view **F** ovipositor sheath, dorsal view **G** ovipositor sheath, lateral view **H** middle serrulae **I** lancet **J** tangium.

Description. Holotype, female. Body length approximately 7.0 mm (Fig. 3A).

Color. Body yellowish brown. Areas surrounding ocelli, antennal sockets, subantennal groove, anterior tentorial pit, scape and pedicel of antenna, triangular spot on the upper side of mesepisternum, anterior edge on the upper side of median mesoscutal lobe, spot of median metascutellum, tergum 1 except triangular spot, anterior edge of tergum 2 black; cenchrus yellowish white. Wings hyaline, without smoky macula, stigma and most parts of veins pale yellow.

Head. Base of labrum elevated, apex rounded; base of clypeus strongly elevated, anterior margin of clypeus arcuate and incised to $0.5 \times$ length of clypeus, lateral corners slightly rounded; labrum and clypeus shiny, basally without punctures or microsculpture, apically with sparse and small punctures, without microsculpture. Malar space $0.4 \times$ as long as diameter of median ocellus. Inner margins of eyes slightly convergent downward in frontal view, distance between eyes $2.0 \times$ as long as height of eyes (Fig. 3C). In dorsal view, inner margins of eyes subparallel; middle fovea sub-circular, slightly deep, with a longitudinal groove at bottom. Frontal area elevated, slightly shiny, punctures small and somewhat sparse, with weak microsculpture; anterior wall slightly elevated, notched medially, lateral walls low and blunt, lateral furrows of frontal area slightly narrow and shallow. The top surface of ocelli higher than the top surface of eye clearly in lateral view; interocellar furrow broad and shallow, postocellar furrow somewhat narrow and shallow; circumocellar furrow indistinct; POL : OOL : OCL = $0.9 : 1.0 : 0.8$ (Fig. 3B). Vertex and postocellar area shiny, punctures faint and very sparse, without microsculpture; postocellar area slightly convex, middle furrow of postocellar area faint, approx. $2.2 \times$ as wide as long, lateral postocellar furrows narrow and slightly deep, divergent backward clearly (Fig. 3B). Antenna filamentous, shorter than thorax and abdomen together, antennomeres 3–8 slightly compressed; antennomere 2 $1.2 \times$ as wide as long, relative length of antennomere 3 : antennomere 4 : antennomere 5 = $1.0 : 1.1 : 1.0$ (Fig. 3E).

Thorax. Mesonotum slightly shiny, with fine and somewhat dense punctures, without microsculpture; median mesoscutal groove shallow and thin; mesoscutellum shiny, with faint and sparse punctures, without microsculpture, and flat, without middle ridge, about $0.8 \times$ as long as wide; mesoscutellar appendage shiny, with small and sparse punctures, microsculpture indistinct, about $0.3 \times$ length of scutellum, middle ridge very low and blunt. Distance between cenchri as long as breadth of a cenchrus. Mesepisternum shiny, without microsculpture, with fine setigerous punctures; anepimeron of mesepimeron shiny, with few punctures and microsculpture; katepimeron smooth and shiny, posterior part with distinct microsculpture and covered with setae, punctures indistinct; metapleuron shiny and smooth, punctures and microsculpture indistinct (Fig. 3D). Vein Sc almost interstitial with origin of vein M from R, and vein M shorter than vein R+M; forewings with cross-vein cu-a joining cell 1M at basal 0.6 , cell 2Rs $1.5 \times$ as long as wide, petiole of anal cell of hindwing $1.7 \times$ as long as cu-a.

Abdomen. All abdominal terga slightly shiny, with small and very sparse setigerous punctures, microsculpture fine and dense. Ovipositor sheath slightly shiny, punctures on valvula 3 fine and sparse, microsculpture indistinct; sheath $2.3 \times$ as long as metatarsomere 1 and $1.4 \times$ as long as front tibia, valvula 3 almost as long as valvifer 2; in lateral view, sheath tapering toward apex (Fig. 3G); in dorsal view, apex of cercus hardly protruding beyond valvula 3, angle between most lateral setae of valvula 3 about 40° . Lancet with 15 serrulae (Fig. 3I); each middle serrula with 14–16 distal teeth (Fig. 3H); annular suture 1 approximately straight, sutures 1–12 with setae bands, longest setae band about $0.7 \times$ length of annulus; cypsellae of serrulae 1–7, 14–15 absent, cypsellae of serrulae 8–13 short; tangium slender and $5.5 \times$ as long as annulus 1, with 4 campaniform sensilla (Fig. 3J), radix $1.1 \times$ as long as lamnium.

Legs. Protarsomere 1 shorter than combined length of tarsomeres 2–4; inner apical spur of hind tibia $0.4 \times$ as long as metatarsomere 1, metatarsomere 1 $0.6 \times$ as long as combined length of metatarsomeres 2–5; tarsal claw with inner tooth long, $0.8 \times$ as long as outer tooth.

Male. Unknown.

Distribution. China (Hubei).

Remarks. The new species can be easily distinguished from the other *Fagineura* species in body color and antenna (antennomeres 3–8 slightly compressed and looks more stubby than other *Fagineura* species).

Etymology. The specific name “*brevicornis*” is refers to the short antenna.

***Fagineura longitangia* Liu, Li & Wei, sp. nov.**

<http://zoobank.org/606EF4B7-2DC2-4A55-BFB2-DB9B05720128>

Figure 4

Material examined. *Holotype*, female, CHINA: Hunan Province, Yizhang County, Mang Mountain, Datangkeng, $24^{\circ}59.02'N$, $112^{\circ}48.14'E$, 1090 m, 11 April 2007, leg. Mei-Cai Wei, ASMN.

Diagnosis. *F. longitangia* is most similar to *F. flactoserrula* in having both the frontal area entirely black; mesonotum mostly black; wing veins mostly black-brown; margin of valvula 3 black; but *F. longitangia* can be differentiated from the latter by most of supraclypeal area, inner orbit, metapleuron, most of abdominal terga yellowish brown (Fig. 4C, E); posterodorsal corner of metepimeron squared (Fig. 2M); middle fovea sub-circular; circumocellar furrow distinct; postocellar area $2.5 \times$ as wide as long (Fig. 2K); lancet with 16 serrulae, each middle serrula with 13–16 distal teeth; annular suture 1 distinctly curved, sutures 1–11 with setae bands, longest setae band about $0.6 \times$ length of annulus; cypsella 1–9 absent (Fig. 2C); tangium with 6 campaniform sensilla, and basoventral corner not swollen (Figs 2G, 4H–I).

Description. Holotype, female. Body length approximately 7.5 mm (Fig. 4A).

Color. Body yellowish brown. Area surrounding subantennal groove and anterior tentorial pit, antenna, most of frontal aspect of head, anterior margin of pronotum, mesonotum except triangular spot of median mesoscutal lobe, metanotum, ventral third and posterior margin of mesepisternum, most of mesepimeron, median spot and lateral margin of tergum 1, margin of valvula 3 black; cenchrus yellowish white. Wings hyaline, without smoky macula, stigma and veins black brown.

Head. Base of labrum elevated weakly, apex rounded; base of clypeus elevated, anterior margin of clypeus and incised to $0.3 \times$ length of clypeus, lateral corners rounded; labrum smooth and shiny, without punctures and microsculpture, clypeus smooth and shiny, with few fine punctures, without microsculpture. Malar space $0.3 \times$ as long as diameter of median ocellus. Inner margins of eyes convergent downward in frontal view, distance between eyes $1.6 \times$ as long as height of eye (Fig. 4C). In dorsal view, inner margins of eyes subparallel; middle fovea sub-circular, deep, with a longitudinal

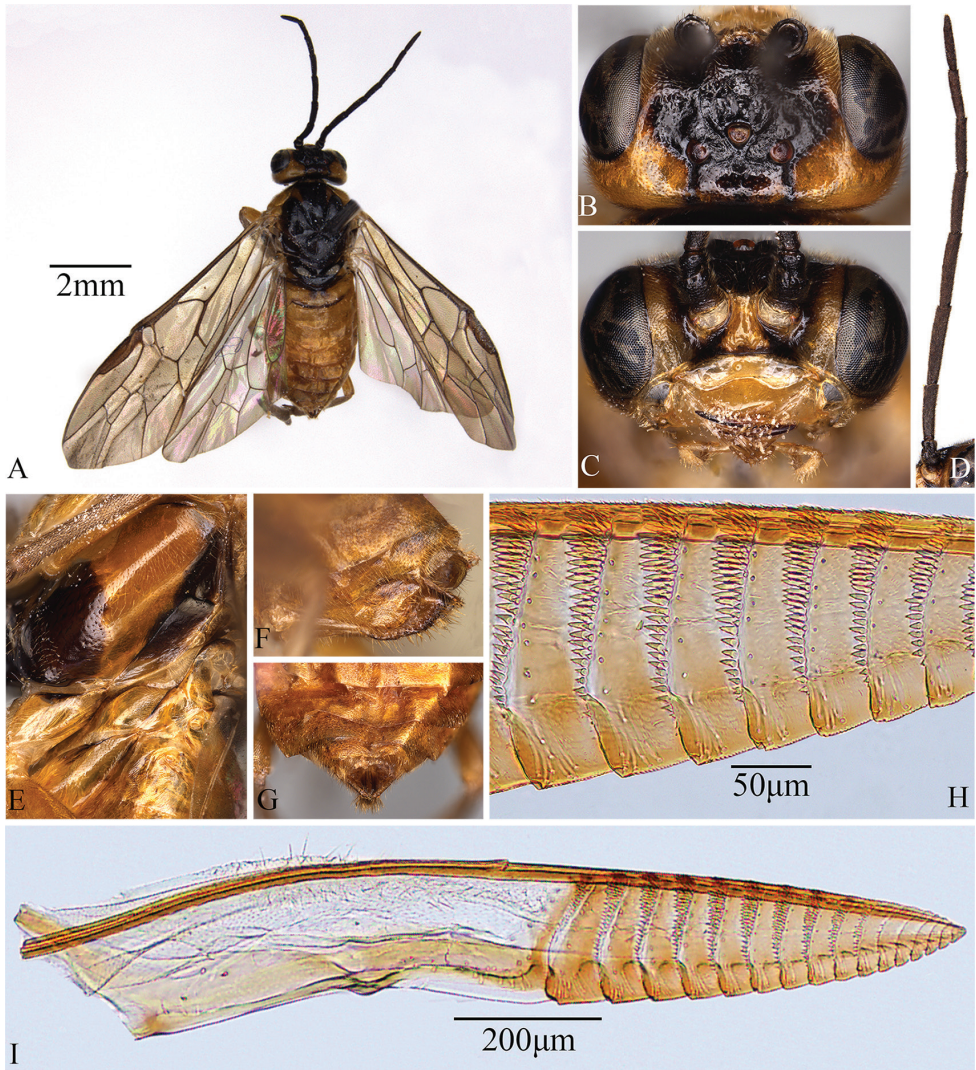


Figure 4. *Fagineura longitangia* sp. nov., female, paratype **A** dorsal view **B** head, dorsal view **C** head, anterior view **D** antenna, lateral view **E** mesopleuron and metapleuron **F** ovipositor sheath, lateral view **G** ovipositor sheath, dorsal view **H** middle serrulae **I** lancet.

groove at bottom. Frontal area hardly elevated, weakly shiny, with some hair warts and wrinkles, punctures small and sparse; anterior wall elevated and curved, notched medially, lateral walls slightly low and blunt, lateral furrows of frontal area broad and shallow. The top surface of ocelli higher than the top surface of eye in lateral view; interocellar furrow broad and deep, postocellar furrow slightly narrow and shallow; circumocellar furrow distinct; POL : OOL : OCL = 1.0 : 1.0 : 0.7 (Fig. 4B). Vertex and postocellar area smooth and shiny, punctures faint and sparse, without microsculpture; postocellar area convex, middle furrow of postocellar area narrow and shallow,

2.5 × as wide as long, lateral postocellar furrows broad and shallow, subparallel backward (Fig. 4B). Antenna filiform, slightly shorter than thorax and abdomen together, relative length of antennomere 3 : antennomere 4 : antennomere 5 = 1.0 : 1.4 : 1.2 (Fig. 4D).

Thorax. Mesonotum shiny, with minute and slightly sparse punctures, microsculpture indistinct; median mesoscutal groove very shallow and narrow; mesoscutellum and mesoscutellar appendage shiny, with minute and slightly dense punctures, microsculpture indistinct, mesoscutellum 0.7 × as long as wide; mesoscutellar appendage approximately 0.3 × as long as scutellum, middle ridge low and blunt. Distance between cenchri 0.9 × as long as breadth of cenchrus. Mesepisternum smooth and shiny, setigerous punctures fine and very sparse, without microsculpture; mesepimeron smooth and shiny, with some microsculpture on margins, punctures indistinct, posterior part of katepimeron covered with setae; metapleuron shiny and smooth, posterior of metepisternum with some setigerous punctures, without microsculpture (Fig. 4E). Vein Sc little basad of origin of vein M from R, vein M slightly shorter than vein R+M; forewings with cross-vein cu-a joining cell 1M at basal 0.5, cell 2Rs 1.5 × as long as wide, petiole of anal cell of hindwing 1.4 × as long as cu-a.

Abdomen. All abdominal terga slightly shiny, with weak and sparse setigerous punctures, microsculpture fine and dense. Ovipositor sheath shiny, punctures on valvula 3 small and very sparse, microsculpture indistinct; ovipositor sheath 1.9 × as long as metatarsomere 1 and 1.2 × as long as front tibia, valvula 3 1.2 × as long as valvifer 2; in lateral view, sheath tapering toward apex (Fig. 4F); in dorsal view, apex of cercus slightly protruding beyond valvula 3, angle between most lateral setae of valvula 3 about 70° (Fig. 4G). Lancet with 16 serrulae (Fig. 4I); each middle serrula always with 13–16 distal teeth (Fig. 4H); annular suture 1 oblique and curved, sutures 1–11 with setae bands, longest setae band approx. 0.6 × length of annulus; cypsellae 1–9 absent; tangium 4.1 × as long as annulus 1, with 6 campaniform sensilla, radix approximately as long as lamnium (Fig. 4I).

Legs. Protarsomere 1 approximately as long as combined length of tarsomeres 2–4; inner apical spur of hind tibia 0.5 × as long as metatarsomere 1, hind tibia 1.3 × as long as hind tarsus, metatarsomere 1 0.7 × as long as combined length of metatarsomeres 2–5; tarsal claw with inner tooth 0.7 × as long as outer tooth.

Male. Unknown.

Distribution. China (Hunan).

Remarks. The new species is very similar to *F. flactoserrula* Liu, Li & Wei, 2019, having similar body color, clypeus, antenna and so on, but *F. longitangia* can be distinguished from the latter using the above diagnosis and key to species. While we recognize that some of these differences are quite small, we found the characters of *F. flactoserrula* described Liu et al. (2019) to be relatively steady across the two specimens we examined. Furthermore, we argue that the holotype of *F. longitangia* differs in too many respects for these differences to be attributable to intraspecific variability of *F. flactoserrula*, and that it therefore represents a distinct species.

Etymology. The specific name “*longitangia*” refers to the long tangium of the lancet.

Discussion

In this paper, two new species of *Fagineura* are described and illustrated. The morphological characters of the two new species conform to the generic characters of *Fagineura* proposed by Shinohara et al. (2000), Prous et al. (2014) and Liu et al. (2019), such as: malar space shorter than diameter of median ocellus, and in most species not exceeding $0.5 \times$ of diameter of median ocellus; postocellar area short, more than $2.0 \times$ as wide as long; posterior part of mesopleural katepimeron covered with hairs; annular suture 1 with setae band; tangium of lancet with campaniform sensilla; and others. Also the two new species can be distinguished easily from the four known species using the key to all species of *Fagineura* worldwide above. Only one specimen of the new species and we think they can be distinguished from the known species by morphological characters, there is no sequence data in this paper.

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