

# BIZARRE FOSSIL INSECTS: WEB-SPINNING SAWFLIES OF THE GENUS *FERGANOLYDA* (VESPIDA, PAMPHILIOIDEA) FROM THE MIDDLE JURASSIC OF DAOHUGOU, INNER MONGOLIA, CHINA

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**Abstract:** Three new species, attributed to the extinct family Xyelydidae of the Pamphilioidea (Order Vespida = Hymenoptera), are described from the Middle Jurassic of Daohugou, Inner Mongolia, China: *Ferganolyda scylla* sp. nov., *F. charybdis* sp. nov. and *F. chungkuei* sp. nov. The new material demonstrates that the genus *Ferganolyda*, which was previously considered to be a morphologically ordinary group of web-spinning sawflies, is in fact a highly unusual

insect taxon. It is characterised, particularly in the male sex, by a huge head (about half as wide as the entire body length) and unusual modification of the antennae. Interpretation of the function of the unusual head and antennae is intriguing but unresolved.

**Key words:** Vespida, web-spinning sawflies, Middle Jurassic, Daohugou, China.

THE Xyelydidae is an extinct family and possibly the ancestor of the web-spinning sawflies (Superfamily Pamphilioidea) (Rasnitsyn 1968, 1980, 1983, 1988). This family is composed of six genera: *Ferganolyda* Rasnitsyn, 1983, *Sagulyda* Rasnitsyn, 1983, *Xyelyda* Rasnitsyn, 1968, *Prolyda* Rasnitsyn, 1968, *Strophandria* Rasnitsyn, 1968 and *Mesolyda* Rasnitsyn, 1963. The first two are from the Lower or Middle Jurassic Sogul Formation of Fergana, Kyrgyzstan and the remaining four from the Upper Jurassic Karabastau Formation of Karatau, southern Kazakhstan (except for *Mesolyda sibirica* Rasnitsyn, which is from the Upper Jurassic Uda Formation of Uda, Buryat Republic, Siberia; Rasnitsyn 1963, 1968, 1983) (Table 1). The genus *Ferganolyda*, established on the basis of three isolated forewings from the upper Lower or lower Middle Jurassic of Central Asia, was interpreted as a morphologically ordinary group of Xyelydidae (Rasnitsyn 1983). However, when complete fossils of this group were discovered in the Daohugou deposits of Inner Mongolia, China, it became apparent that *Ferganolyda* is a very unusual insect taxon.

## STRATIGRAPHICAL SETTING

The Daohugou deposits, consisting of grey tuff, tuffaceous siltstones and mudstones, yield insects, conchostracans,

plants, salamanders and pterosaurs (Wang 2000; Ji and Yuan 2002; Ren *et al.* 2002; Tan and Ren 2002; Wang *et al.* 2002; Zhang 2002; Gao and Shubin 2003; Shen *et al.* 2003; Rasnitsyn and Zhang 2004*b*). The age of the biota is Middle Jurassic to Early Cretaceous (Wang *et al.* 2000; Ji and Yuan 2002; Ren *et al.* 2002; Zhang 2002; Shen *et al.* 2003). Based on the composition of the hymenopteran fossil assemblage, which is clearly intermediate between latest Early Jurassic and early Late Jurassic assemblages, Rasnitsyn and Zhang (2004*b*) regarded the Daohugou assemblage as Middle Jurassic in age. This age assignment is supported by evidence from other biota, such as conchostracans (Shen *et al.* 2003), and from isotopic dating (Chen *et al.* 2004; Liu *et al.* 2004).

The Jurassic hymenopteran (Order Vespida = Hymenoptera) fauna had a comparatively low diversity during the Early Jurassic, but diversified in the Late Jurassic (Rasnitsyn 1980, 2002; Rasnitsyn *et al.* 2003). Until very recently, little was known about mid-Jurassic hymenopterans, and hence the exact timing and nature of the evolutionary radiation of the Vespida was unknown. Fortunately, the recently discovered Daohugou biota is beginning to fill this gap (Wang *et al.* 2000; Ji and Yuan 2002; Ren *et al.* 2002; Zhang 2002; Rasnitsyn and Zhang 2004*a, b*). Thus, the Daohugou insect biota, which contains abundant, diverse and well-preserved insects (including hymenopterans) (Rasnitsyn and Zhang 2004*b*), is highly

TABLE 1. Distribution of taxa of the family Xyelydidae.

| Taxa   | Locality and horizon   |
|--|--|
| <i>Ferganolyda cubitalis</i> Rasnitsyn, 1983 | Sai-Sagul, Fergana, Kyrgyzstan; Lower or Middle Jurassic Sogul Formation       |
| <i>F. radialis</i> Rasnitsyn, 1983           |  |
| <i>F. sogdiana</i> Rasnitsyn, 1983           |  |
| <i>F. scylla</i> sp. nov.                    | Daohugou, Ningcheng, China; Middle Jurassic Daohugou deposits                  |
| <i>F. charybdis</i> sp. nov.                 |  |
| <i>F. chungkuei</i> sp. nov.                 |  |
| <i>Sagulyda arcuata</i> Rasnitsyn, 1983      | Sai-Sagul, Fergana, Kyrgyzstan; Lower or Middle Jurassic Sogul Formation       |
| <i>S. ferganica</i> Rasnitsyn, 1983          |  |
| <i>S. magna</i> Rasnitsyn, 1983              |  |
| <i>Xyelyda excellens</i> Rasnitsyn, 1968     | Mikhailovka, Karatau, southern Kazakhstan; Upper Jurassic Karabastau Formation |
| <i>Prolyda karatavica</i> Rasnitsyn, 1968    |  |
| <i>P. depressa</i> (Rasnitsyn, 1969)         |  |
| <i>P. xyelocera</i> Rasnitsyn, 1968          |  |
| <i>Strophandria grossa</i> Rasnitsyn, 1968   |  |
| <i>S. moderata</i> Rasnitsyn, 1983           |  |
| <i>Mesolyda jurassica</i> Rasnitsyn, 1963    |  |
| <i>M. sibirica</i> Rasnitsyn, 1983           | Uda, Buryat Republic, Siberia; Upper Jurassic Uda Formation                    |

significant and one of the most important of insect Lagerstätten.

## MATERIAL AND METHODS

The fossils (all described specimens) are preserved as impressions on the surface of grey tuffaceous siltstones from the Middle Jurassic Daohugou deposits (N41°18'37-6", E119°13'20-4") near Daohugou Village, Ningcheng, Neimonggol (Inner Mongolia), China. Conchostracans (*Euestheria*) are preserved on the same bedding plane. Specimens NND118/NIGP139303, NND119/NIGP139304 and NND301/NIGP139305 (consisting of part and counterpart) are male, while NND462/NIGP139306 (consisting of part and counterpart) is female. The specimens were examined using a NIKON SMZ1000 microscope at the State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing. The photographs were prepared using a NIKON D100 digital camera and the line drawings were prepared using CorelDRAW 9 software.

## SYSTEMATIC PALAEOLOGY

Class INSECTA Linné, 1758

Order VESPIDA Laicharting, 1781 (= Hymenoptera Linné, 1758)

Superfamily PAMPHILIOIDEA Cameron, 1890 (1834)

*Remarks.* Newman (1834) was the first to propose a family group name for the taxon currently known as the family Pamphiliidae,

viz. *Lydites* Newmen, 1834, based on the genus *Lyda* Fabricius, 1804, a junior synonym of *Pamphilius* Latreille, 1802. For cases of this type, ICZN (2000) indicates that the family name should be Pamphiliidae, but with the priority date inherited from Lydidae, and the form of indication utilized as above (Articles # 40.2, 40A).

### Family XYELYDIDAE Rasnitsyn, 1968

#### Genus FERGANOLYDA Rasnitsyn, 1983

*Type species.* *Ferganolyda cubitalis* Rasnitsyn, 1983, from the upper Lower or lower Middle Jurassic Sogul Formation of Fergana Valley, Kyrgyzstan.

*Other species.* *F. radialis*, *F. sogdiana* from the Sogul Formation of Fergana Valley, as above; *F. scylla* sp. nov., *F. charybdis* sp. nov., *F. chungkuei* sp. nov. from the Middle Jurassic of Daohugou, Inner Mongolia, China.

*Diagnosis.* (updated on the basis of the new material described herein). Sexual dimorphism high in body size (female smaller) and in morphology of head and antenna. Head grotesquely widened, being about half (in males) to one-third (in female) as wide as body is long, with mandible long, falcate, two-toothed as in Pamphiliidae. Clypeus short, very wide. Tentorium heavy, with anterior tentorial pits not very distant, unlike antennal foramina placed almost at extremities of head. Eyes comparatively small, at most half as wide as head long. Ocelli ordinary, forming close group. Antenna much longer than body in female and possibly in male, with fourth segment enlarged in addition to third, about as long as and only

somewhat narrower than third segment in female, much thinner but several times longer than that in male, with thin, long, multisegmented rest of flagellum present in female but apparently lost beyond fourth segment in male. Propleurae much enlarged, at least in male. Otherwise thorax not distinctive as preserved. Legs ordinary, sometimes rather long, with fore pair when preserved at most as long and wide as mid one. Forewing with SC having hind branch short, subvertical or weakly oblique, pterostigma variable (sclerotized on margins or entirely), first abscissa of RS short or missing, cells 1r and 1mcu comparatively short (1r shorter than 2rm, 1mcu less than twice as long as wide), cell 1mcu asymmetrical basally with fore margin straight, 1m-cu distinctly shorter than distally adjacent abscissa of Cu (sometimes half as long as that). Hindwing ordinary for family except that crossvein 2r-m is lost and the free base of Cu sometimes present. Male genitalia as preserved appear ordinary for this superfamily. Ovipositor insufficiently known.

*Comparison.* Venational differences are keyed out by Rasnitsyn (1983). *Ferganolyda* differs significantly from all other hymenopterans, and possibly from all other insects, because of its exceptionally wide head (Diopsidae flies may be an exception, but unlike *Ferganolyda* the diopsidan head is wide because of the long stalked eyes) and much enlarged third and fourth antennal segments.

*Ferganolyda scylla* sp. nov.

Plate 1, figure 1; Text-figure 1

2004b *Ferganolyda* sp. Rasnitsyn and Zhang, p. 3, pl. 1, fig. 2, table 1.

*Derivation of name.* After the mythological monster of the Strait of Messina that devours sailors attempting to traverse the strait; noun in apposition.

*Holotype.* NND118/NIGP139303; male with antenna except third segment, mandibles, and apical 0.3 forewing lost and legs incomplete.

*Description.* Colour not reliably known because of absence of counterpart fossil; as preserved body pale with head and third antennal segment slightly darker and abdomen paler than thorax and legs; forewing somewhat infuscated subbasally, particularly so in costal area along veins. Prescutum in rear half, mesonotum except anterolaterally, and rear part of metanotum lateral of metascutellum roughly punctate. Third antennal segment thick, nearly straight. Head capsule tentatively interpreted owing to profound modification coupled with some post-mortem deformation: as preserved, more than twice as wide as long, widest behind midlength, with hind contour almost straight, eyes apparently occupying its posterolateral corners. Clypeus head

wide, very short, protruding laterally, slightly excised in central 0.25. Tentorium, if correctly interpreted, with fore arms lobate subbasally, and dorsal arms long, comparatively thick, and arching. Propleurae apparently wider than long, almost as wide as mesonotum. Mesonotum not distinctive. Mesopostnotum with round foramen centrally. Cenchi long, reaching beyond metanotum midlength. Metascutellum rounded triangular, comparatively small. Femora shorter than mesonotum width, with fore and mid ones narrow, and hind thick (less than three times as long as wide). Forewing with SC not reaching level of RS base, and its hind branch short, subvertical. Pterostigma weakly but rather uniformly sclerotized. First abscissa of RS distinct. 1mcu length full 1.5 times width, RS+M reaching midlength of its fore margin. M+Cu S-like bent. 1m-cu about 0.7 as long as distally adjacent abscissa of Cu. No supernumerary cu-a present. 2a almost three times as long as wide. Abdomen only slightly wider than mesonotum, terga with no laterotergite separation apparent on dorsal surface; tergum 1 distinctly split medially, tergum 2 apparently entire. Male genitalia with basal ring moderately narrow, angular anteromesally, deeply and narrowly excised posteromesally. Gonostyle quadrangular, somewhat longer than wide. Penial valve long, looking either subrectangular or almost diamond-shaped depending on position. Body length 19.5 mm, head width 9.5 mm, forewing (before pterostigma) length 8.0 mm, abdominal width 4.8 mm, genitalia length 2.3 mm.

*Comparison.* In Rasnitsyn's (1983) system this taxon keys out into *F. sogdiana* Rasnitsyn, but it differs in its uniformly sclerotized pterostigma and S-like bent M+Cu.

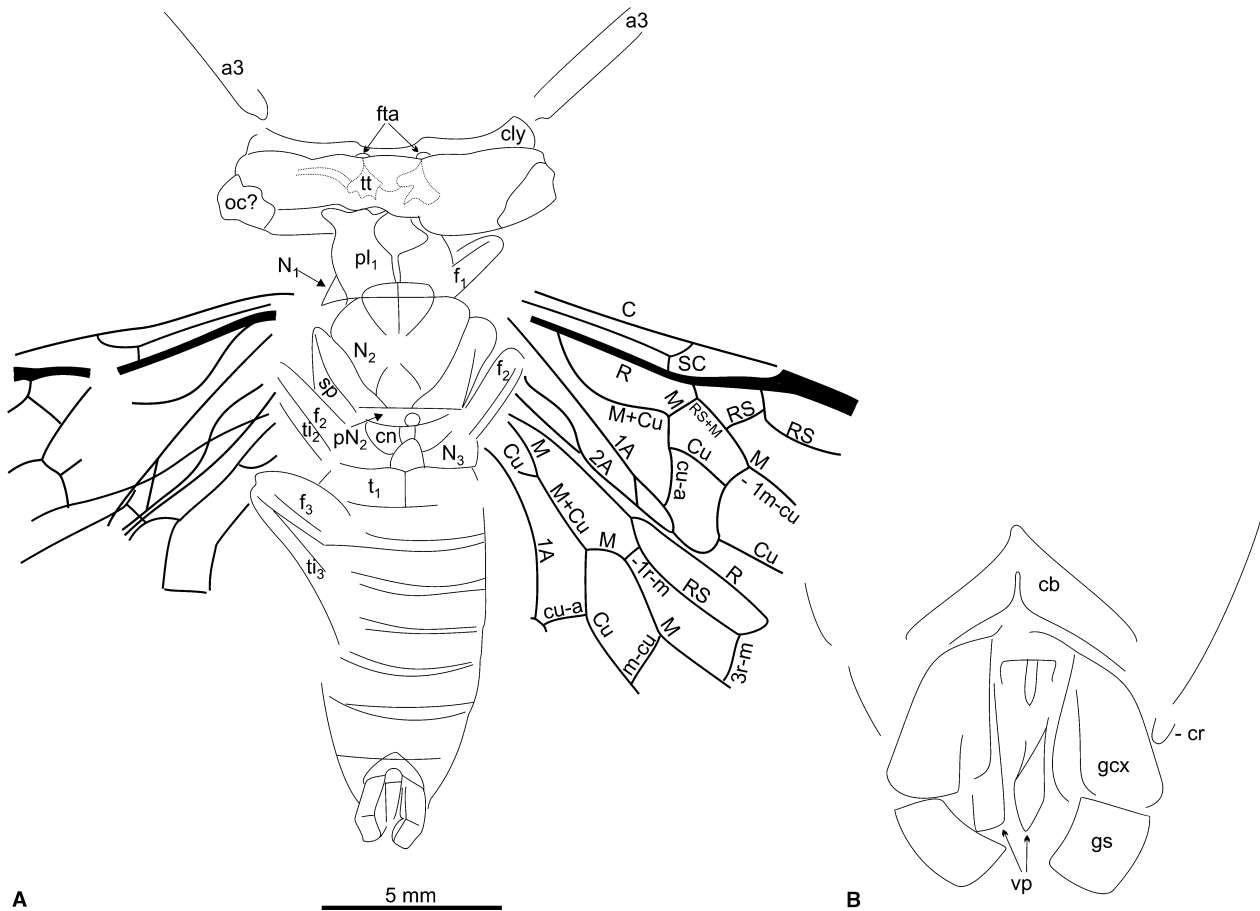
*Ferganolyda charybdis* sp. nov.

Plate 1, figure 2; Text-figure 2

*Derivation of name.* After the mythological monster, in the image of the whirlpool, of the Strait of Messina that devours entire ships; noun in apposition.

*Holotype.* NND119/NIGP139304; male with legs and abdomen not preserved (lost or pale and hence invisible), and with hindwings hardly seen through forewings.

*Description.* Colour not reliably known owing to absence of counterpart fossil; as preserved, body moderately pale including pterostigma, with antenna slightly darker and wing membrane somewhat infuscated in basal half, particularly along veins. Surface sculpture essentially as in *F. scylla*. Mandibles nearly symmetrical, distinctly arching in basal half, reaching base of contralateral mandible, with small inner tooth at about apical 0.35. Antenna with third segment thick, narrowed apically, about half as long as head is wide, much longer than mesonotum width; fourth segment (incompletely preserved) much thinner and longer than the third, slightly tapering apically. Head capsule widest before middle, with eye, if correctly interpreted, small, placed near mandibular base. Head with hind contour convex (concave in central 0.3), three small ocelli placed in close triangle, two bracket-like lines behind ocelli and three diverging lines near hind margin.



**TEXT-FIG. 1.** *Ferganolyda scylla* sp. nov., line drawing of holotype NIGP139303. A, body; B, male genitalia in detail. The vein nomenclature is standard. a3, third antennal (first flagellar) segment; cb, basal ring; cly, clypeus; cn, cenchrus; cr, cercus; f<sub>1</sub>, fore femur; f<sub>2</sub>, mid femur; f<sub>3</sub>, hind femur; fta, anterior tentorial foramen; gcs, gonocoxa; gs, gonostyle; N<sub>1</sub>, pronotum; N<sub>2</sub>, mesonotum; N<sub>3</sub>, metanotum; oc?, supposed eye; pl<sub>1</sub>, propleura; pN<sub>2</sub>, mesopostnotum; sp, pleural suture of mesopleuron; t<sub>1</sub>, first abdominal tergum; ti<sub>2</sub>, mid tibia; ti<sub>3</sub>, hind tibia; tt, supposed tentorium (all structures shown with the dotted line); vp, penial valve.

Pro- and mesothoracic structure poorly known, mesopostnotum with elongate central foramen. Metanotum with cenchri small and metascutellum comparatively wide. Legs not preserved. Forewing venation typical for genus except M reaching R rather than RS, pterostigma pale and apparently not at all incrassate. SC meeting R far basal of RS base, with hind branch short, vertical. 2r-m subvertical, distal of 2r-rs. M+Cu arching. 1m-cu cell almost twice as long as high, with RS+M nearly reaching midlength of its fore margin. 1m-cu nearly half as long as distally adjacent abscissa of Cu. No supernumerary cu-a crossvein present. 2a about three times as long as wide. Hind wing not distinctive as preserved.

Abdomen hardly discernible. Body length up to tips of folded forewings 27.5 mm, head width 11.0 mm, mandible length 9.0 mm, forewing length 18.0 mm.

*Comparison.* Differs from all congeners in M reaching R and accordingly RS+M starting from R, and also in pale, thin pterostigma. Differs from *F. scylla* in occipital contour of head convex, third antennal segment more conical, SC particularly short, with hind branch very short and vertical, and in M+Cu gently curved.

#### EXPLANATION OF PLATE 1

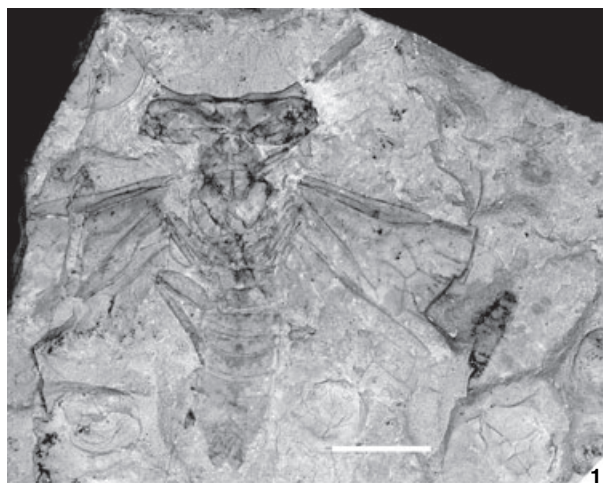
Fig. 1. *Ferganolyda scylla* sp. nov., NIGP139303, holotype, male, dorsal view.

Fig. 2. *Ferganolyda charybdis* sp. nov., NIGP139304, holotype, male, dorsal view.

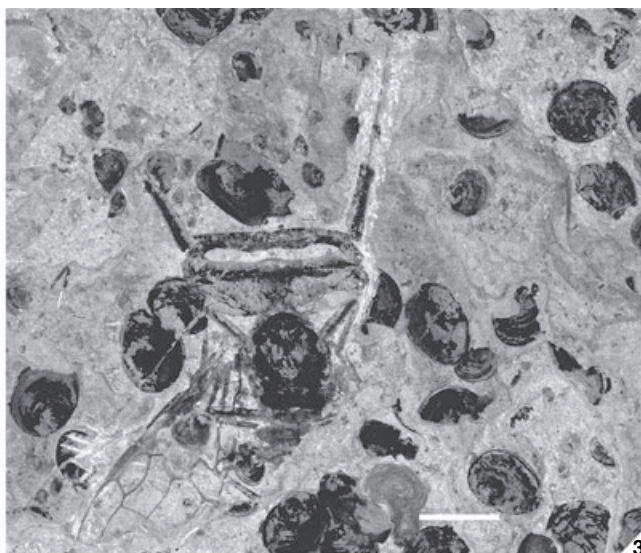
Figs 3–4. *Ferganolyda chungkuei* sp. nov., NIGP139305, holotype, male, dorsal view. 3, part. 4, counterpart.

Figs 5–6. *Ferganolyda ?chungkuei* sp. nov., NIGP139306, non-type female, dorsal view. 5, part. 6, counterpart.

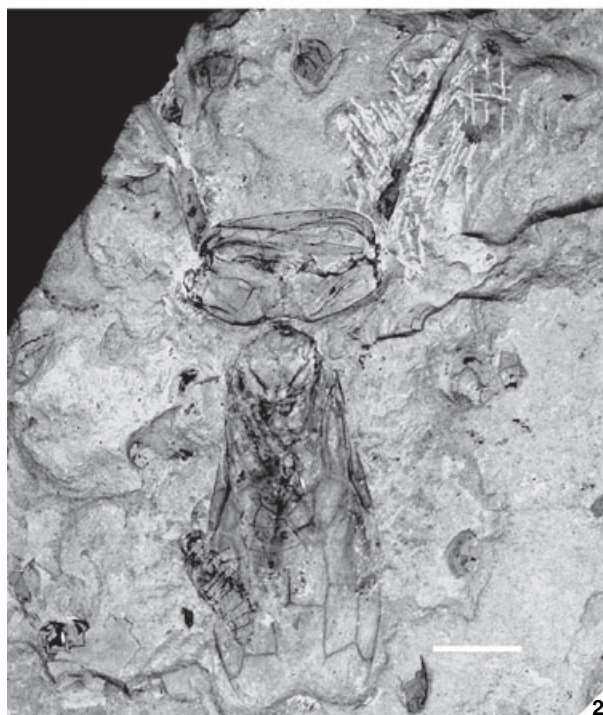
Scale bars represent 5 mm.



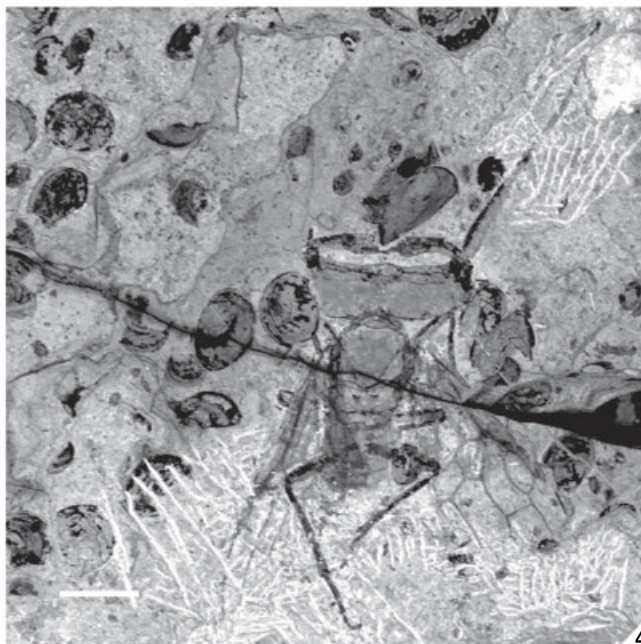
1



3



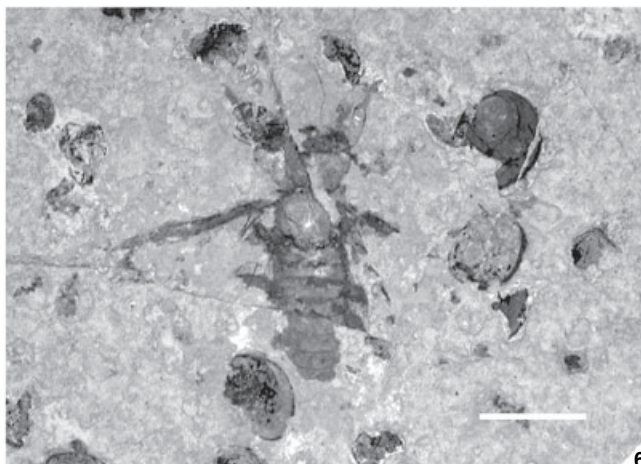
2



4



5



6



**TEXT-FIG. 2.** *Ferganolyda charybdis* sp. nov., line drawing of holotype NIGP139304. A, body; B, wing venation combined from right and left wings. md, mandible; na, notaulus; ocl, ocelli; scl3, metascutellum; 1a, first interanal cell; 2a, second interanal cell; 1cua, first cubitoanal cell; 2cua, second cubitoanal cell; 1mCu, first mediocubital cell; 2mCu, second mediocubital cell; 1r, first interradiial cell; 2r, second interradiial cell; 3r, third interradiial cell; 2rm, second radiomedial cell; 3rm, third radiomedial cell; otherwise as in Text-figure 2.

*Remarks.* The holotype is identified as male because it is similar to the undoubtedly male holotype of *F. scylla* in the head capsule, which is comparatively short and the second flagellomere, which is thin and very long. In contrast, the only known female of *Ferganolyda* (see below) has a longer head capsule (with mandibles closed, 0.7 times as long as wide, as opposed to half as long as wide in *F. charibdis*), and a comparatively short and thick second flagellomere (about as long as, and about 0.7 times as thick as, the first flagellomere, as opposed to *F. charib-*

*dis*, whose second flagellomere, even if distinctly incomplete, is much longer and several times thinner than the first flagellomere).

*Ferganolyda chungkuei* sp. nov.  
Plate 1, figures 3–6; Text-figures 3–4

*Derivation of name.* Chung K'uei is the legendary queller of demons in a Chinese legend; noun in apposition.

*Holotype*. NND301/NIGP139305; male with antennae, legs, hindwing and abdomen incompletely preserved.

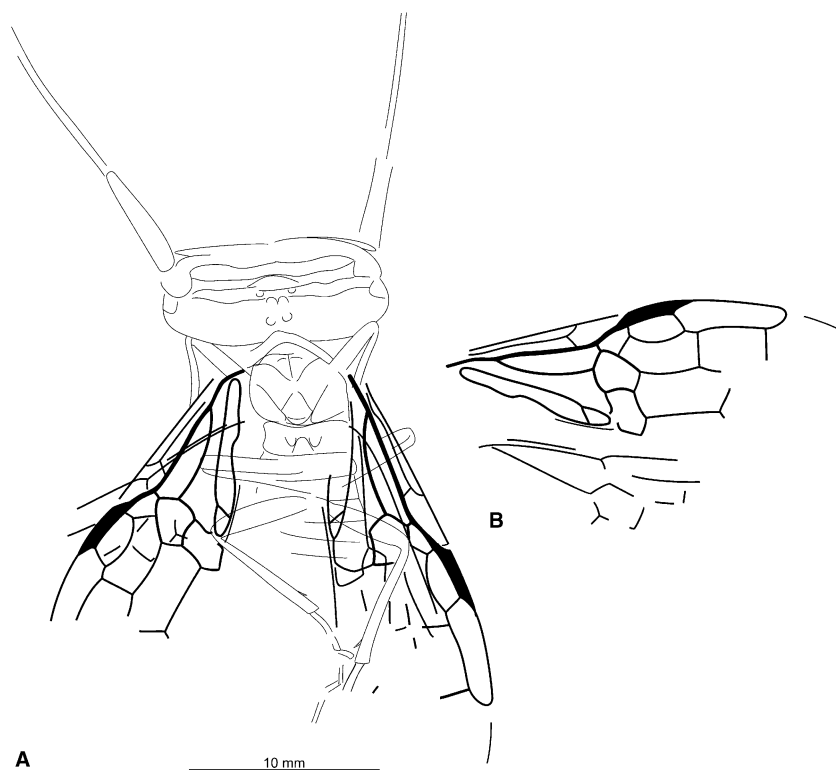
*Other material*. NND462/NIGP139306; female with wings, legs and abdomen incompletely preserved, questionably attributed to this species.

*Description*. Male (Pl. 1, figs 3–4; Text-fig. 3). Head partly, third antennal segment, mandibles, thorax and legs entirely or predominantly dark; pterostigma and, to a lesser extent, wing membrane in basal half, particularly in costal space and along veins, infuscate; otherwise colour pale. Head posteriorly and laterally punctate; other surface sculpture essentially as in *F. scylla*. Mandibles longer than in *F. charybdis*, almost straight except basally, with inner tooth not apparent (possibly because mandibles are preserved in tight position). Third antennal segment tapering apically, comparatively narrow; fourth segment long and thin, less distinctly tapering than in *F. charybdis*. Head capsule with occipital margin straight except laterally, widest near midlength, eyes approaching mandibular base, clypeus ribbon-like throughout with medial convexity. Anterior tentorial pits not distant, ocelli in close group. Pronotum short, more arching than normal in Pamphilioidea. Mesonotum and metanotum ordinary, cenchri and metascutellum comparatively narrow. Femora and tibiae comparatively long and narrow, of similar size for all three pairs (less certain for tibiae), hind tibia with one preapical spur preserved, hind tarsus shorter than tibia, with tarsomere length ratio about 29 : 9 : 8 : 5 : 9 (two apical tarsomeres are somewhat deformed). Forewing with pterostigma sclerotized. SC not reaching RS base, with hind branch suboblique and comparat-

ively long (not to the extent characteristic of *Xyelyda*). First abscissa of RS distinct. RS+M reaching about 0.4 fore margin of 1m-cu cell. 2r-m subvertical, distal of 2r-rs. M+Cu gently arching. 1m-cu only slightly longer than wide. 1m-cu about 0.7 times as long as distally adjacent abscissa of Cu. No supernumerary cu-a crossvein present. 2a about twice as long as wide. Hind wing with no free base of Cu preserved, otherwise similar to that in *F. scylla* as preserved. Abdomen poorly preserved. Body length about 22–25 mm; head width 12.0 mm, length without mandibles 3.8 mm; third antennal segment length 6.0 mm, fourth segment as preserved 9.0 mm; forewing length up to end of 3r cell 18.5 mm; hind tibia length 7.0 mm.

Female (tentatively identified) (Pl. 1, figs 5–6; Text-fig. 4). Colour pattern uniformly moderately pale. Surface sculpture as in male. Mandibles much shorter than head is wide (no further details preserved). Antenna distinctly longer than body, with both third and fourth segments disproportionately long and wide. Third segment more than half as long as head is wide, slightly wider at midlength than at both ends. Fourth segment about as long as but distinctly narrower than third, tapering basally, mounted with flagellum of at least 19 segments, all elongate and mainly of subequal length, except for five or six apical flagellomeres gradually shortening apically. Flagellum tapering apically, with basal segments about half as wide as fourth antennal segment, with six basal flagellomeres combined as long as fourth antennal segment. Head capsule narrower but much longer than in male (about 0.4 times as wide as the whole body is long, about 0.3 times as long as thorax and abdomen combined), transversely oval, with eyes at midlength of its sides, subequal to or larger than in male. Thorax insufficiently preserved. Legs

**TEXT-FIG. 3.** *Ferganolyda chungkuei* sp. nov., line drawing of holotype NIGP139305. A, body; B, wing venation combined from right and left wings.



much stouter than in male, particularly hind femur. Wings poorly known; as preserved, fore wing similar to that in male. Abdomen and ovipositor poorly preserved, not distinctive as preserved. Body length 12.0 mm; third antennal segment length 2.8 mm, fourth segment 2.8 mm, flagellum 8.2 mm; head width 4.7 mm, length with mandibles closed 3.3 mm (without mandibles possibly 2.8 mm); forewing length up to end of cell 3r 9.0 mm.

*Comparison.* Differs from all congeners in having shorter RS+M and cells 1mcu and 2a, from *F. scylla* and *F. charybdis* also in the longer hind branch of SC (unknown in all species from Sagul).

*Remarks.* The holotype is identified as male because it is similar to the undoubtedly male holotype of *F. scylla* in the head capsule, which is comparatively short, and the second flagellomere, which is thin and very long. In contrast, the only known female of *Ferganolyda*, the non-type specimen of *F. chungkuei*, has a longer head capsule (with mandibles closed, 0.7 times as long as wide, as opposed to half as long as wide in the holotype), and a comparatively short, thick second flagellomere (about as long as, and about 0.7 times as thick as, the first flagellomere, as opposed to the holotype, whose second flagellomere, even if distinctly incomplete, is much longer and several times thinner than the first flagellomere). The non-type specimen is identified as female based on its ovipositor, which is unmistakable even if poorly preserved.

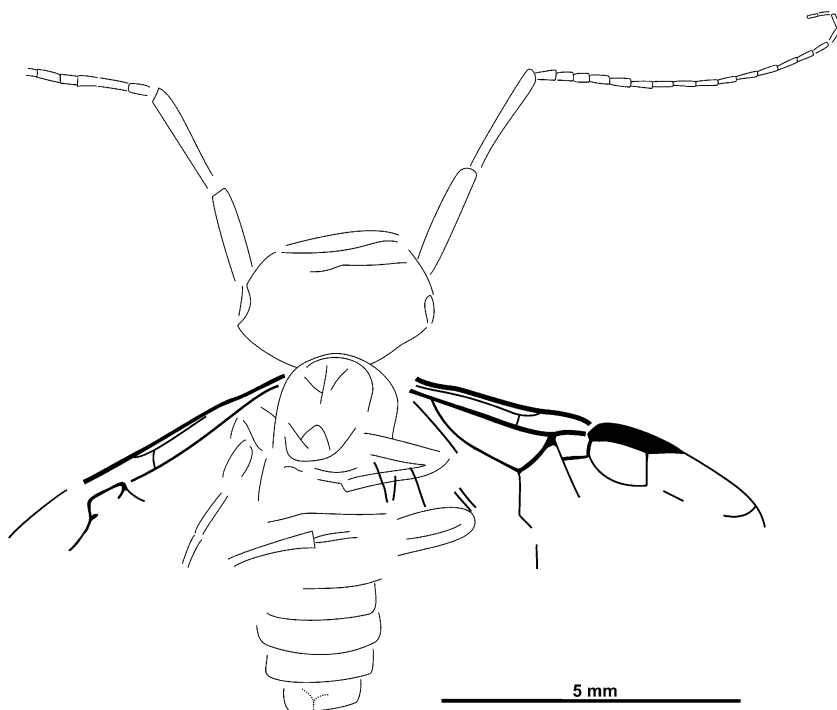
The female specimen is questionably attributed to the present species, in spite of its small size, based on its

similarity to the holotype (in its moderately short SC with a moderately long hind branch, its short RS+M, and in the combination of first abscissa of RS present, pterostigma sclerotized, and M+Cu gently arched). More certain sex association looks premature given the incomplete preservation of the female fossil and the high levels of sexual dimorphism.

Both the part and the counterpart must be present in order to interpret correctly the colour pattern, as is evident from study of the holotype. The counterpart (Pl. 1, fig. 4) shows that the fossil is generally pale, with legs and third antennal segment partially dark, while the part (Pl. 1, fig. 3) shows the dark thorax and, partially, head, third antennal segment and legs. Dark patches on the third antennal segment and legs supplement those on the counterpart and indicate that these parts were originally dark.

## DISCUSSION

The genus *Ferganolyda* is one of the most unusual insect groups known, because the male has an enormous head (about half the volume of its body in size) and antennal flagella modified into long, entire, thin, springy threads. To our knowledge, a broadly similar antennal structure is found only in males of the equally bizarre dipteran family Deuterophlebiidae, and these probably use their antennae to control and secure their patrolling flight over the surface of torrential stream water, when they are expecting the emergence of females (Courtney 1990; pers. obs. by



**TEXT-FIG. 4.** *Ferganolyda ?chungkuei* sp. nov., line drawing of non-type female NIGP139306.

APR in 1985 on *Deuterophlebia sajanica* Jedlicka and Halgos, 1981 in the Ulya River Basin near the Okhotsk Sea). A similar habit is unlikely among the web-spinning sawflies because: (1) sawfly behaviour is rarely, if at all, connected to the surface of open water; (2) a patrolling flight in close proximity to the water surface needs highly specialized wing apparatuses, which are present in the Deuterophlebiidae, but are apparently absent from the present fossils; (3) such a large and heavy head makes patrolling flight (and even ordinary flight) impossible. The head size of *Ferganolyda* males is intriguing and raises further controversies. Extant pamphilioids have long and powerful mandibles (similar to those in the fossils) but only use them as weapons for defence. However, *Ferganolyda* males appear to have exaggerated mandibles, but these seem to have insufficient support, so their functional morphology is problematic. The hymenopteran head gains its support from propleurae, which do correspond to the head size in *Ferganolyda* males (Pl. 1, fig. 1; Text-fig. 1). This construction, in turn, gains its support from the fore leg pair, whose size is unexpectedly ordinary in *Ferganolyda* males (Pl. 1, figs 1, 3–4; Text-figs 1, 3). For time being we have to leave the puzzle unresolved and can only hope that future finds will shed light on the functional morphology and ecology of these strange insects.

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