

## STONEFLIES (Plecoptera) FROM TAIWAN IN THE BISHOP MUSEUM, HONOLULU

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*Abstract:* A new species, *Nemoura bispinosa* and some new plecopteran records are presented for Taiwan.

This article is based upon the stonefly collection accumulated by members of the Bishop Museum under the Scientific Cooperation Program of the United States and Japan<sup>2</sup>. It consists of 40 specimens, belonging to 9 species, of which one is new. They fall into 5 genera belonging to the families Nemouridae Leuctridae and Perlidae. For some, the specific identifications remain in question. The type specimen is in the Bishop Museum (BISHOP).

The stonefly fauna of Taiwan (Formosa) has already been reported by the following authors: Klapálek (1912, 1913, 1923), Okamoto (1912, 1922), Uéno (1928, 1929) and Banks (1937).

My grateful thanks are due to Prof. Dr Joachim Illies, of the Limnologische Flußstation des Max-Planck Instituts für Limnologie who kindly placed this material at my disposal. I am also indebted to Mr P. Zwick who gave me useful advice concerning the internal structure of the genus *Schistoperla*. It is a pleasure to thank Dr W. D. Williams for his kind help in reading and correcting this manuscript.

### NEMOURIDAE

***Amphinemura flavicollis*** Klapálek Fig. 1.

*Amphinemura flavicollis* Klapálek, 1912, Ent. Mitt. **1**: 347.- Okamoto, 1922, Bull. Agr. Exp. Sta. Chosen **1**: 27.- Illies, 1966, Tierreich **82**: 180.

SPECIMENS EXAMINED: 10 ♂♂, 6 ♀♀, Chiayi Hsien, 2400 m, a. s. l., Mt. Alishan, 12-16.VI. 1965, T. C. Maa & K. S. Lin

This species is known to occur only in Taiwan.

The wings of this species are subhyaline and have 4 smoked bands on the fore wing and many scattered smoked spots on the hind wing. The supra-anal process is large and covered with a chitinous membrane, the surface of which is rasp-like. A pair of oblong minute chitin plates occur near the tip.

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  2. Supported by the National Science Foundation (GF 151).

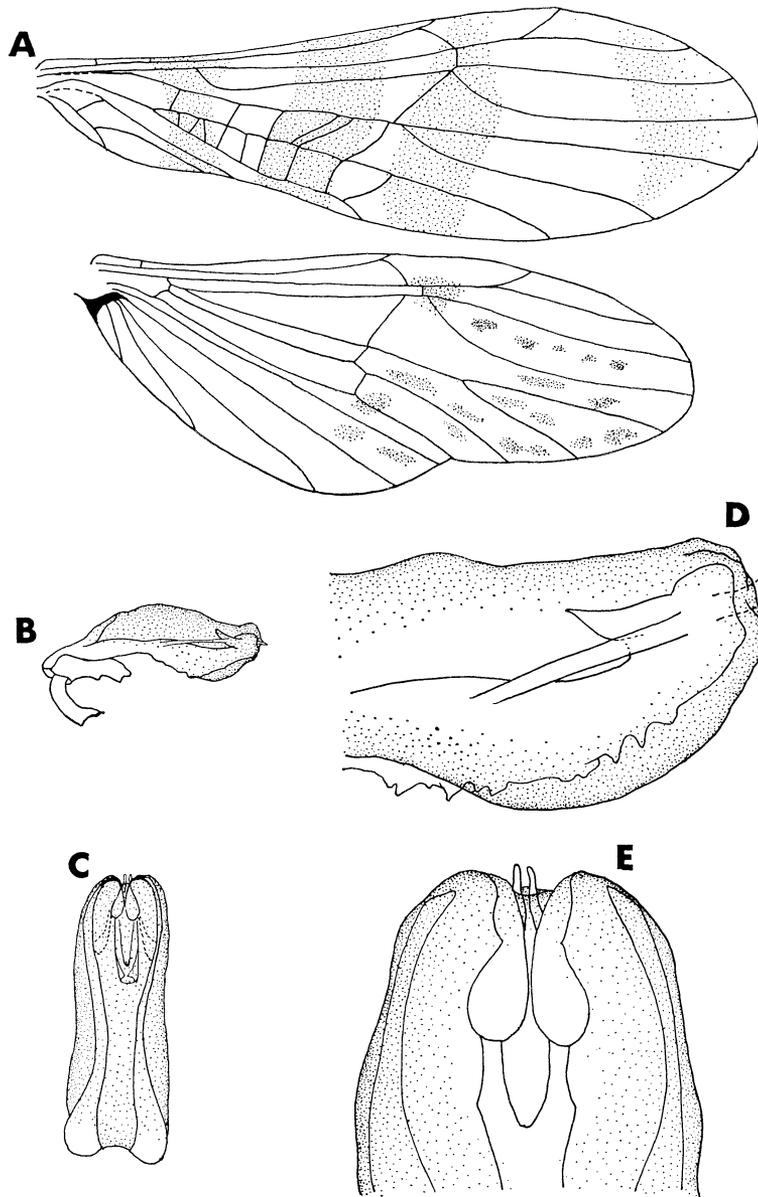


Fig. 1. *Amphinemura flavicollis* Klapálek: A, wings; B, supra-anal process, lateral; C, the same, dorsal; D, tip of the supra-anal process, lateral; E, the same, dorsal view.

**Amphinemura** sp.

SPECIMEN EXAMINED: 1 ♂, collected by sweeping, Taipei Hsien, Chaochi nr Yilan to Pingulin, 15-16.IV.1965, Yoshimoto.

Identification to species was not possible because much of the genital organs were missing.

**Amphinemura** sp.

SPECIMENS EXAMINED: 6 ♀♀, Chiayi Hsien, 2400 m, a. s. l., Mt. Alishan, 12-16.VI.1965, Maa & Lin.

**Protonemura** sp.

SPECIMENS EXAMINED: 2 ♀♀, Chiayi Hsien, 2400 m, a. s. l., Mt. Alishan, 12-16.VI.1965, Maa & Lin.

**Nemoura bispinosa** Kawai, new species      Fig. 2.

♂. Very small stonefly. General color brown without markings and spots on head and prothorax. Head wider than prothorax, antenna long and slender, brown; with 3 minute ocelli;

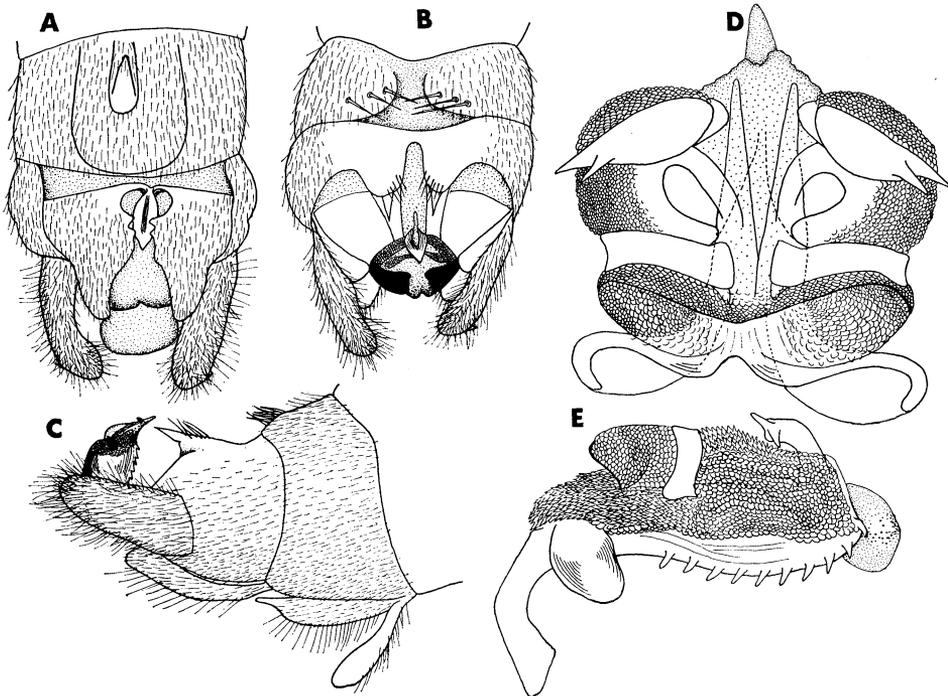


Fig. 2. *Nemoura bispinosa* n. sp.: A, ♂ terminal segments of abdomen, ventral; B, the same, dorsal; C, the same, lateral view; D, surpa-anal process, dorsal; E, the same, lateral view.

distance between posterior 2 nearly  $2\times$  as far as between posterior one and inner margin of compound eye. Compound eye large and black, projecting laterally. Dorsal callosities indistinct.

Pronotum brown, nearly as wide as long, all angles not rounded, both lateral margins straight, dorsal side somewhat arched. Legs rather long and slender, brown; each tibial and tarsal segment a little dark. Wings subhyaline, veins brown; venation not different from that of genus.

Abdomen cylindrical, pale brown, membranous except last 2 chitinized segments. Eighth tergite broadly cleft at hind margin, both sides of cleft with 3 bristles, the area between them being semi-chitinous. Hind margin of 9th tergite broadly cleft, the area between also membranous; both lateral sides with a sharp pointed spine directed backwards with a few bristles. Subanal lobe wide and rapidly narrowed and distal part a little recurved upwards with a blunt tip. Cerci not so modified, directed backwards, making a chitinous lobe with a very small claw near tip and covered with soft fine hairs. Supra-anal process very small, dorsal side covered with rasp-like chitinous membrane, and ventral side heavily chitinized with 2 rows of a few minute teeth on surface; with a pair of 2 very minute sharp pointed spines at dorsal side near tip. Subgenital plate quadrate, longer than wide, with rounded hind margin; ventral lobe nearly  $1/2$  as long as subgenital plate.

Body length 4 mm; length of fore wing 5.5 mm and of hind wing 4 mm.

♀. Unknown.

Holotype ♂ (BISHOP 7518), Taipei Hsien, Wulai, 17.IV.1965, Yoshimoto.

Paratopotype: ♂, same data as holotype.

Remarks: This new species agrees well with the Chinese species, *Nemoura spinosa* Wu, but can be easily separated from the latter by the size of the species, relative length of the spine on the hind margin of the 9th tergite and the shape of the subgenital plate.

#### **Nemoura** sp.

SPECIMENS EXAMINED: 4 ♀♀, Chiayi Hsien, 2400 m, a. s. l., Mt Alishan, 12-16.VI.1965, Maa & Lin; 3 ♀♀, Taipei Hsien, Yehlio beach, 29. III. 1965, Yoshimoto; 1 ♀, by malaise trap, Taipei Hsien, Wulai, 17.IV.1965, Yoshimoto.

### LEUCTRIDAE

#### **Rhopalopsole subnigra** Okamoto

*Rhopalopsole subnigra* Okamoto, 1922, Bull. Agr. Exp. Sta. Chosen **1**:42. - Uéno, 1938, Kontyû **12**: 172 (nymph). - Illies, 1966, Tierreich **82**: 119. - Kawai, 1967, Plecoptera, Fauna Japon.: 45.

SPECIMENS EXAMINED: 1 ♂, by sweeping collection, Taipei Hsien, Chaochi nr. Yilan to Pinglin, 15-16.IV.1965, Yoshimoto; 1 ♂, Taipei Hsien, Wulai, 17.IV.1965, Yoshimoto.

The original description of the species was based on 3 ♂♂ and 1 ♀ from Minomo, of Osaka, Japan and the species was thought to be distributed in Honshu, Japan only. I, however, have examined for the first time 2 ♂♂ from Taiwan.

#### **Rhopalopsole** sp.

SPECIMEN EXAMINED: ♀, by sweeping collection, Taipei Hsien, Chaochi nr. Yilan to Pinglin, 15-16.IV.1965, Yoshimoto.

The subgenital plate of this species differs from those of known species. It is probably a new form.

## PERLIDAE

*Schistoperla collaris* Banks Fig. 3-5.

*Schistoperla collaris* Banks, 1937, Phil. J. Sci., **62**: 271.- Illies, 1966, Tierreich **82**: 428.

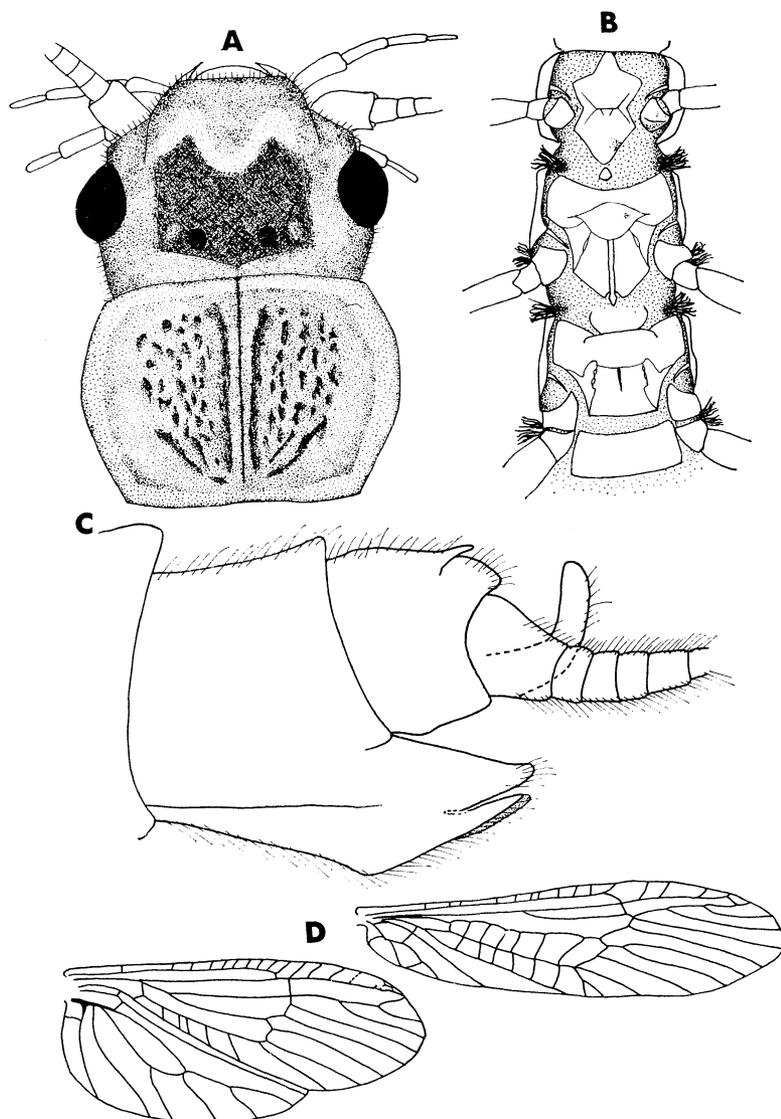


Fig. 3. *Schistoperla collaris* Banks: A, head and prothorax, dorsal; B, thoracic segments, ventral; C, ♂ terminal segments of abdomen, lateral view; D, wings.

**SPECIMENS EXAMINED:** 2 ♂♂, sweeping collection, Taipei Hsien, Chaochi nr. Yilan to Pinglin, 15-16.IV.1965, Yoshimoto.

This peculiar species was originally described from Taiheizan, Taiwan by Banks (1937), but his description and figure are very obscure. The range of its distribution seems to be restricted to Taiwan only.

♂. Comparatively large-sized stonefly. General color black with blackish-brown markings on head and prothorax. Head black with a large blackish-brown marking which contains ocelli as shown in Fig. 3, and M-line reddish brown. Antenna black. Prothorax with a narrow blackish-brown median longitudinal stripe, both sides of stripe black with a narrow blackish-brown marking and many irregular blackish-brown markings; pronotal margins yellow. Meso- and metanotum black. Legs black but each tarsal segment of each leg a little paler. Abdomen and cerci uniformly black.

Head not rounded, nearly quadrate, longer than wide, nearly as wide as prothorax; with 2 large ocelli, distance between them nearly as far as between one and inner margin of compound eye, and situated on a line with posterior margin of compound eyes. Compound eyes not large and situated on middle of lateral side of head. Dorsal callosities oblong, blackish brown, situated on outer lateral side of each ocellus. Basal arm of epicranial suture distinct, very short, lateral arm long, turned forwards at situation of dorsal callosities and parallel to each other but distal end almost invisible. Antenna long and slender, a little longer than body, 20 mm, composed of 50 segments.

Pronotum quadrate, much wider than long, anterior corner rounded and posterior corner not rounded; dorsum somewhat rugose. *Six pairs of vestiges of gill filaments present on ventral side of thoracic segments*; 1 pair on each intersegmental membrane between pro- and mesosternum and meso- and metasternum; 2 pairs on each coxa of mid and hind leg. Legs long and slender; claw of each leg very strong, with 3 brown setae on proximal part. Wings brown, veins dark brown, except yellowish Sc and costal cross-veins in both wings. (The venation of this species is very closely related to those of *Gibosia* and *Kiotina* which are widely distributed in eastern Palearctic and Oriental regions). Eight or 10 costal cross-veins before end of cord and 3 or 4

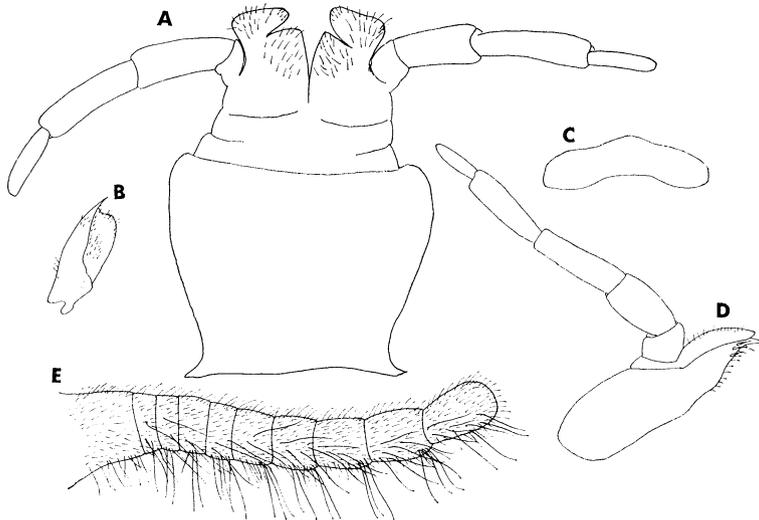


Fig. 4. *Schistoperla collaris* Banks: A, labium; B, mandible; C, labrum; D, maxilla; E, cercus, dorsal view.

beyond Sc in both wings. Rs of both wings 3-branched; median cross-vein 7 in fore wing and no cross veins in hind wing; intercubital cross-veins 7 in fore wing and 5 in hind wing; anal field of hind wing very large, 2A of hind wing with 2 branches and a little bent towards 3A and connected to 3A by a cross-vein.

Mouth parts not different from those of Perlidae as shown in Fig. 4. Labrum quadrangular, hairy, a little forwards at middle. Maxilla not so reduced, galea a little shorter than lacinia which is sharply pointed at tip; maxillary palpus very long and slender, 5-segmented, about 5× as long as galea, ratio of 5 segments from base to tip, 1 : 2 : 2 : 3 : 1.5. Mandible small and weak. Labium reduced, submentum very large; glossa very small and paraglossa somewhat swollen; labial palpus long and slender, 3-segmented, ratio of segments from base to tip, 1 : 1.5 : 1.

Abdomen cylindrical, without peculiar structure on dorsal side. Tenth tergite broadly cleft with a small black Y-shaped chitin plate; both inner corner of cleft with a very small chitin process which is directed backwards; a pair of genital hooks hairy, black and directed backwards and upwards with a blunt tip. These hooks seem to be developed apparently from the 10th tergite. Subgenital plate very large, and strongly produced backwards and turned upwards over 10th sternite, with rounded hind margin which has a rounded hammer at middle. Cerci very short, 3 mm, composed of 10 segments, covered with fine brown hairs; inner side of each segment with stout brown hairs.

Body length 18 mm; length of fore wing 19 mm and of hind wing 16 mm.

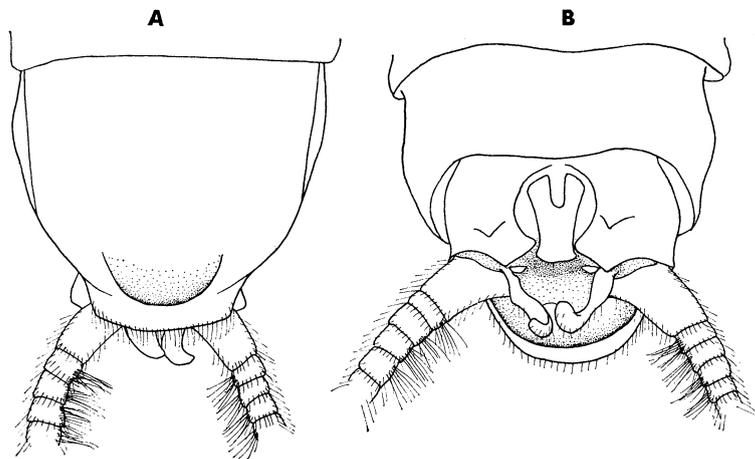


Fig. 5. *Schistoperla collaris* Banks: A, ♂ terminal segments of abdomen, ventral; B, the same, dorsal view.

The genus *Schistoperla* is placed by Illies (1966) under the subfamily Paraperlinae of the family Chloroperlidae. The external morphological characters of the genus *Schistoperla* resemble more closely, however, those of the family Perlidae, especially the genera *Gibosia* and *Kiotina*. The resemblances existing between *Schistoperla* and the genera *Gibosia* and *Kiotina* are the wing venation, the thoracic gills and the genital parts of the male. But *Schistoperla* is distinguishable from the latter two genera by the form of its head and prothorax, the localisation of the compound eyes, coloration and the stout brown hairs on the inner side of each cercal segment. The venational character of the genus *Schistoperla* does not fit in that of the Chloroperlidae. And also, according to Zwick's observa-

tions, the internal structures of Paraperlinae, especially the arrangement of the abdominal ganglia and the inner genital organs, do not resemble those of the Perlidae; on the other hand, the resemblances with Chloroperlidae are in archaic features only. Those structures stated above are those of Perlidae but are all archaic too and cannot prove that *Schistoperla* belongs to Perlidae. As the ventral nerve cord (which has 6 ganglia only in Perlidae but 7 in Chloroperlinae and Paraperlinae) could not be studied, the genus *Schistoperla* cannot be placed with certainty now. It seems to be desirable to place the genus *Schistoperla* in a family other than the family Chloroperlidae.

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