



## A SYNOPSIS OF STYLOPERLIDAE (INSECTA, PLECOPTERA) WITH DESCRIPTION OF *CERCONYCHIA SAPA*, A NEW STONEFLY FROM VIETNAM

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### ABSTRACT

*Cerconychia sapa*, spec. nov. is described from adult specimens collected in Vietnam. The species is compared to others in the genus and provisional keys to male *Cerconychia* Klapálek and *Styloperla* Wu are provided.

**Keywords:** Plecoptera, Styloperlidae, *Cerconychia*, new species

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### INTRODUCTION

Styloperlidae, originally proposed as a subfamily of Peltoperlidae (Illies 1966), but later given family status (Uchida & Isobe 1989), currently includes three *Cerconychia* Klapálek species and six *Styloperla* Wu species known from Taiwan, Hainan or mainland China (Uchida & Isobe 1989; Yang & Yang 1990; Yang & Yang 1995). Several species are poorly known, descriptions are generally based on relatively few specimens and several types of Chinese species are lost. A general revision of the family is needed but specimens from the type localities of some Wu (1935; 1962; 1973) species are needed to help resolve questions about their status.

### METHODS AND MATERIALS

The present study is based primarily on a sample of *Cerconychia* specimens collected in Vietnam by personnel of the Royal Ontario Museum, Toronto (ROM) and the Museum für Naturkunde, Berlin (MNB). Comparative specimens of *Styloperla* were also examined from material collected in China by the junior author and placed in the Slovenian Museum of Natural History, Ljubljana (PMSL), or from specimens made available by the United States National Museum, Washington (USNM). Specimens

are deposited in these museums, in the Stark Collection, Clinton (BPS), or in the Institute of Ecology and Biological Resources, Hanoi (IEBR) as indicated in the text.

Specimens were examined using a Wild M5A stereo microscope equipped with drawing tube. Specimens examined with scanning electron microscopy were dehydrated in ethanol to 100%, placed in hexamethyldisilazane for 1 hour, attached to SEM stubs, coated with gold-palladium and examined with an AMRAY 1800D scanning electron microscope.

### RESULTS AND DISCUSSION

#### *Cerconychia* Klapálek, 1913

*Cerconychia* was proposed by Klapálek (1913) for *C. brunnea* and *C. livida*, a closely related pair of Taiwanese species. These remained poorly known until Uchida & Isobe (1989) designated male lectotypes and provided comprehensive redescriptions for both species. Included in the Uchida & Isobe (1989) study was the first nymphal description for a species placed in the Styloperlidae. The genus, as currently defined, is distinguished

from *Styloperla* on the basis of a transversely oriented hair brush on male sternum 9, the absence of vaginal sclerites, and a parabolic, lightly sclerotized projection on the apex of male tergum 10. The latter structure is considered a rudimentary epiproct and is flanked basally by a pair of rudimentary hemiterga (Uchida & Isobe 1989). In addition to the Taiwanese species, Yang & Yang (1995) described *C. sinensis* from a small sample collected at Jianfengling on Hainan Island

***Cerconychia sapa*, sp.n. (Figs. 1-9)**

**Material examined.** Holotype ♂ and 15 ♂, 28 ♀ paratypes from Vietnam, Loa Cai, Sapa, large waterfall on road from Sapa to Lai Chau, UV light, 8 May 1995, D. Currie, B. Hubley, J. Swann (Royal Ontario Museum 956022), Holotype (ROM), paratypes (BPS, IEBR, PMSL, USNM). Additional paratypes: Vietnam, Loa Cai, ca. 12 km along road from Sapa to Lai Chau, 1950 m, 22° 20' 58.3" N, 103° 46' 15.7" E, Malaise trap, B. Hubley, 1 ♂ (ROM 992002), (ROM). Vietnam, Cao Bang, Ba Be National Park, jct. road to Ba Be, 19 May 1995, D. Currie, K. Ciruna, J. Whiting, 2 ♂, 2 ♀ (ROM 956101), (ROM). Vietnam, Sapa, Fan Si Pang Mt., 1600 m, 22-29 April 1995, light trap, 2 ♂, 3 ♀ (MNB).

**Adult habitus.** Biocellate. General color pale yellow brown. Head pale over much of occiput but dusky brown behind eyes and along stem of epicranial suture in fully pigmented individuals; stem and Y-arms of suture dark brown, frons mostly dark brown (Fig. 1). Pronotum dark brown on anterior and posterior margins of disc; disc pale except for dark rugosities which form an irregular mid lateral band (Fig. 1). Legs brown, without banding. Wings transparent, veins brown.

**Male.** Forewing length 12-17 mm. Basal cercal segment swollen in dorsal aspect, terminating in a long, curved, acute process which projects along inner cercal margin (Figs. 2, 6, 7); basal segment and process armed asymmetrically along length with numerous (ca. 15 or more) small spines or enlarged sensilla (Figs. 6-7); second and sometimes third segment armed with an enlarged dorsal spine (Figs. 6-9). Ninth sternum bearing a thick, wide setal brush near anterior margin (Figs. 3-4).

**Female.** Forewing length 20-22 mm. Subgenital plate very slightly produced into a short tab with mesal emargination (Fig. 5). Sternum 9 sparsely setose over

central area but with a patch of coarse short setae associated with basomesal fold posterior to gonopore. Intersegmental membrane between sternum 9 and 10 with microtrichia. Vagina a membranous sac, wide at base, narrowly rounded at tip, and lightly coated with pale brown spinulae in the wrinkled chamber. Spermatheca long, slender and bearing several slender accessory glands.

**Egg.** Typical of genus. Ovoid with collar absent and chorion smooth.

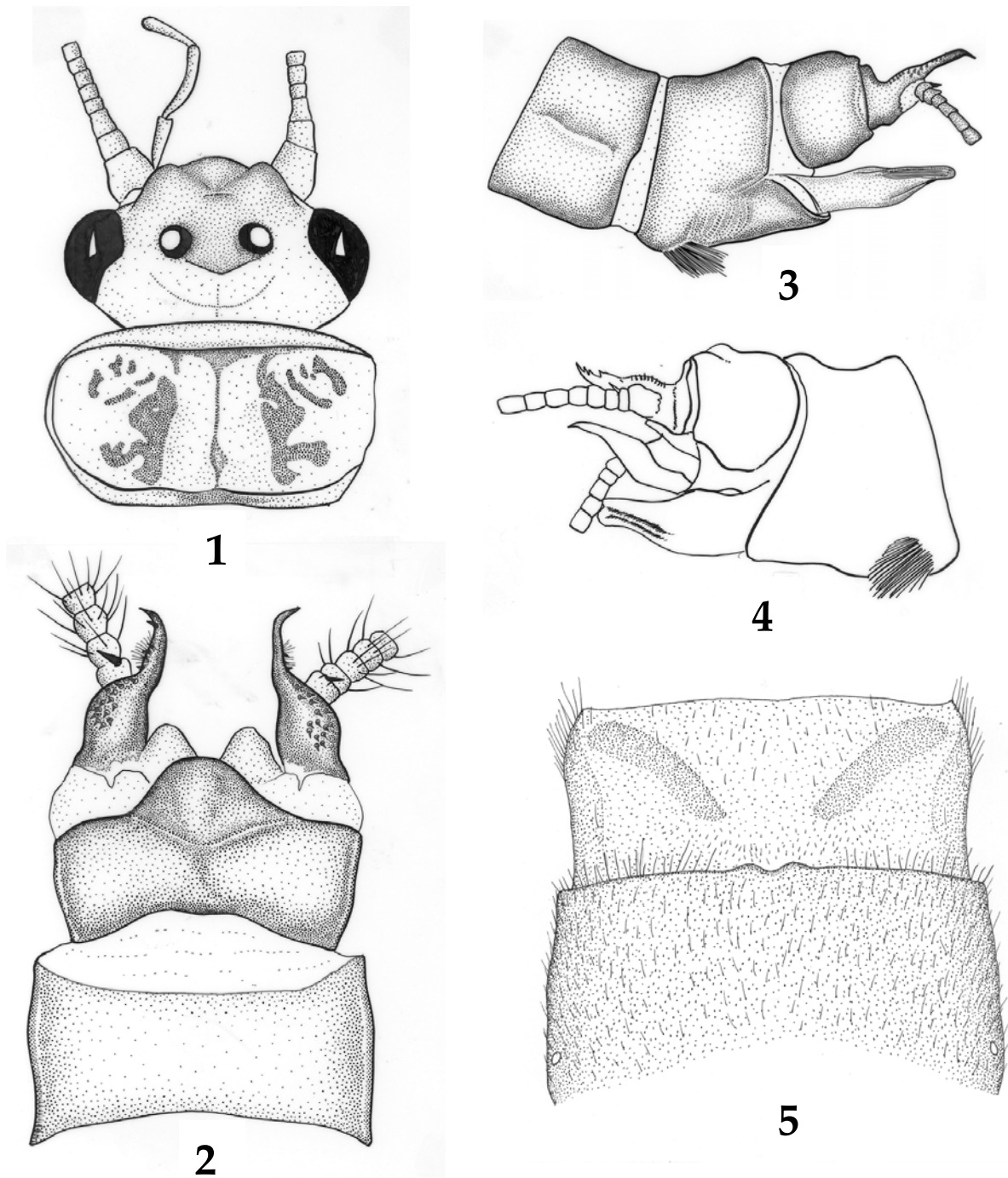
**Nymph.** Unknown.

**Etymology.** The species name, used as a noun in apposition, is based on the type locality near Sapa.

**Diagnosis.** Males of this species are distinct from all known Styloperlidae by virtue of the numerous small spines scattered over the dorsum and margin of the basal cercal segment and process. Females have a slightly produced, emarginate subgenital plate similar to that of other *Cerconychia* (Uchida & Isobe 1989), but the forewing length is greater than the 9-16 mm composite range given for the Taiwanese species. *Cerconychia brunnea* Klapálek and *C. livida* Klapálek are known from Taiwan (Uchida & Isobe 1989) and *C. sinensis* Yang & Yang is known from Hainan (Yang & Yang 1995), thus *C. sapa* is the first mainland *Cerconychia* species. The following provisional key, modified from Uchida & Isobe (1989), is offered as an aid for identification of *Cerconychia* males.

**Provisional key to *Cerconychia* males**

1. Dorsum of basal cercal segment bearing a patch of at least 10 short thick spines which continue along outer margin of process to apex; known from Vietnam (Fig. 2) ..... *C. sapa*  
Dorsum and margin of basal cercal segment and process without clusters of short thick spines..... 2
2. Process of basal cercal segment rounded apically and bearing a cluster of terminal spines; known from Hainan ..... *C. sinensis*  
Process of basal cercal segment acute apically and lacking terminal spine cluster; known from Taiwan ..... 3
3. Dorsum of basal cercal segment swollen near base of process and with a small constriction at process base ..... *C. brunnea*  
Dorsum of basal cercal segment and process without swelling or constriction ..... *C. livida*



Figs. 1-6. *Cerconychia sapa* structures. 1. Head and pronotum, 2. Male terminalia dorsal, 3. Male terminalia, lateral, 4. Male terminalia, oblique lateral. 5. Female terminalia, ventral.

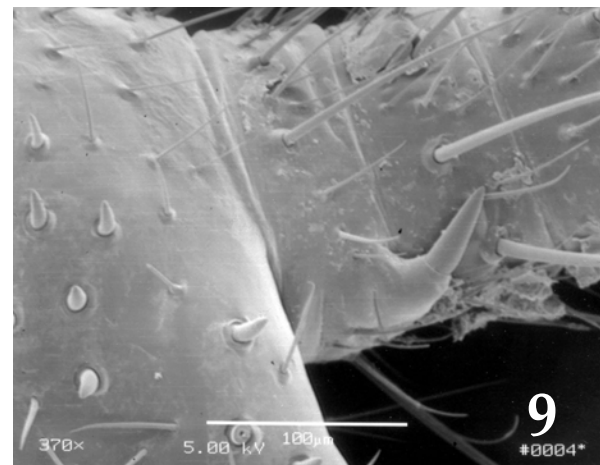
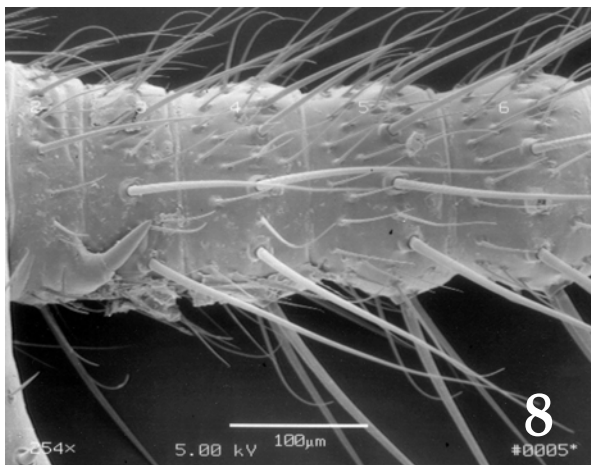
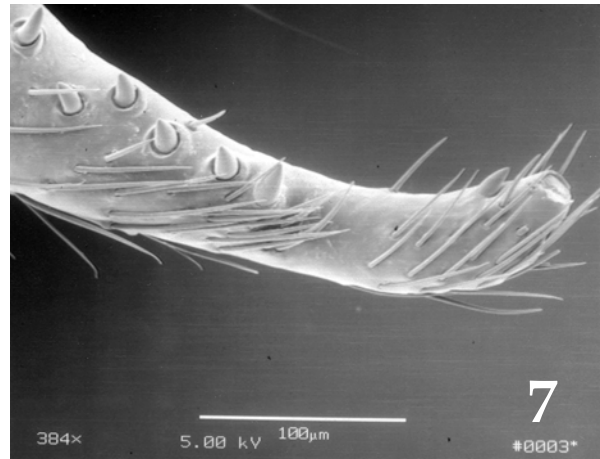
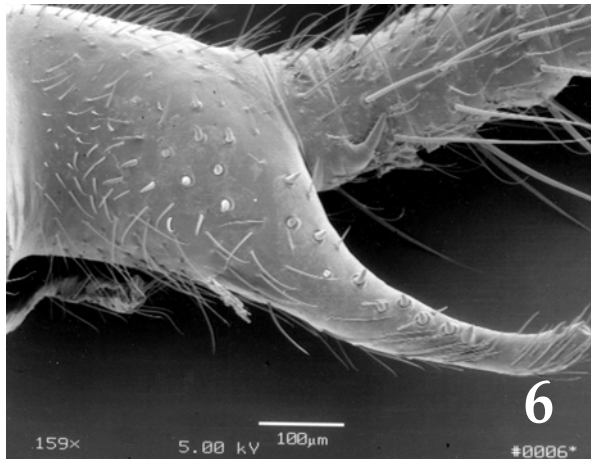
***Styloperla* Wu, 1935**

Wu (1935) proposed *Styloperla* for *S. spinicercia* but the holotype is missing (Uchida & Isobe 1989) and

paratype specimens retained in China were also apparently destroyed, consequently this species is known from the figures and descriptions provided by Wu (1935, 1938). Chao (1947) added *S. inae* and *S.*

*wui* from Fujian Province and these were redescribed by Uchida & Isobe (1989). These authors also transferred two species, *Cerconychia flectospina* (Wu 1962) and *Nogiperla obtusispina* (Wu 1973) to the genus. Subsequently, Yang & Yang (1990) described

*S. jiangxiensis*. Males of the genus are distinguished from those of *Cerconychia* by a longitudinally oriented hair brush on sternum 9 and females by the presence of vaginal sclerites.



Figs. 6-9. *Cerconychia sapa* SEM photomicrographs. 6. Male right cercus, dorsobasal aspect, 7. Apex of male cercal process, dorsal (tip broken), 8. Male cercal segments 2-6, dorsal, 9. Male cercal segments 2-3, dorsal.

***Styloperla jiangxiensis* Yang & Yang (Figs. 10-13)**

*Styloperla jiangxiensis* Yang & Yang, 1990. Acta Agriculturae Universitatis Jiangxiensis 2:45-46.

**Material examined.** China: Zhejiang, Long Wang Shan, 560 m, 30° 28' N, 119° 22' E, 3 June 1999, I. Sivec, 4 ♂, 3 ♀ (PMSL). Zhejiang, Long Wang Shan, 600 m, 30° 28' N, 119° 22' E, 3 June 1999, I. Sivec, 2 ♂, 1 ♀, 2 exuviae (PMSL). Zhejiang, Long Wang Shan,

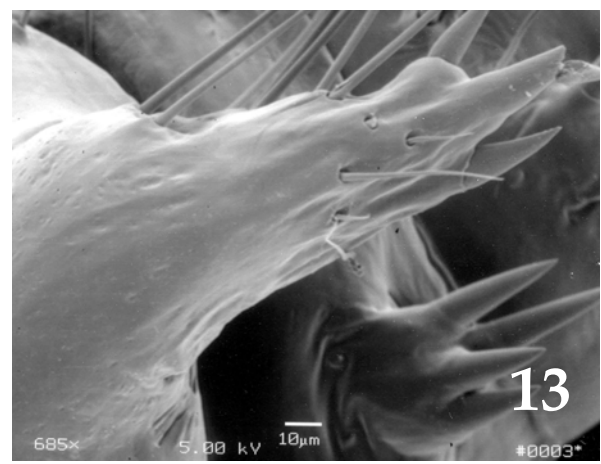
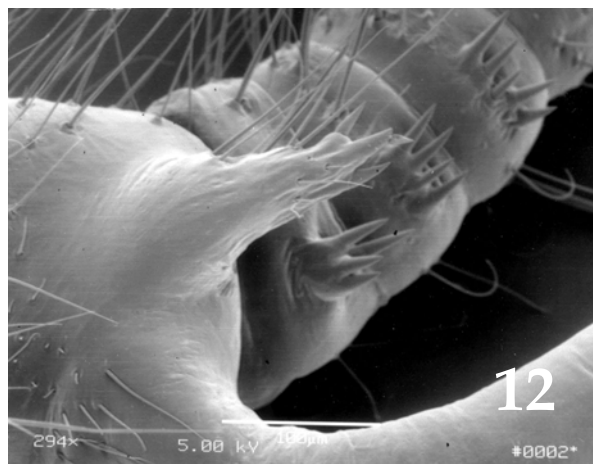
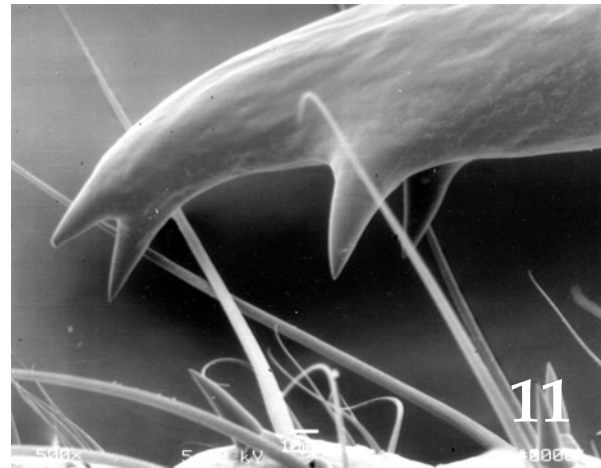
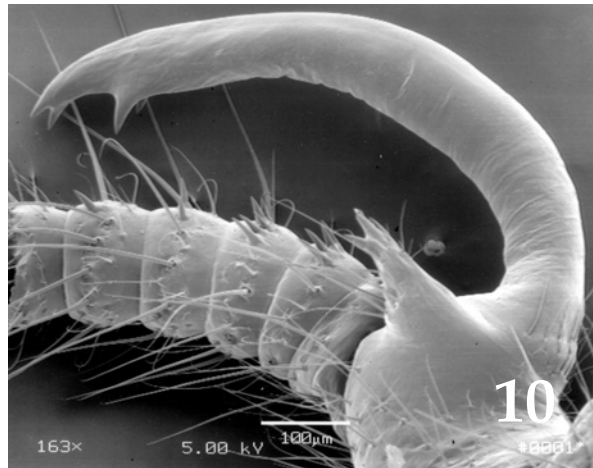
700-1000 m, 30° 28' N, 119° 22' E, 4 June 1999, I. Sivec, 3 ♂, 1 ♀ (PMSL).

**Adult habitus.** Biocellate. General color pale yellow brown. Head pale over much of occiput but stem of epicranial suture dark brown and areas adjacent dusky brown. Dark brown ocellar patch extends to narrow pale M-line and forward of M-line to anterior margins of frons. Pronotum completely margined with an impressed narrow black line and shadowed with dusky brown external to line; median pronotal

band brown, disk with irregular brown midlateral band and paler rugosities in the anterolateral and posterolateral quadrants. Legs and antennae dark brown. Wings transparent, veins brown.

**Male.** Forewing length 12.5-14 mm. Basal cercal segment swollen and armed near the apical margin with a prominent multispined spur (Figs. 12-13) and a long curved process along the inner cercal margin

(Fig. 10); process terminating with a pair of small spines and a pair of ventral, subapical spines (Fig. 11). Cercal segments 2-4 bear small clusters of mid-dorsal spines and long setae (Fig. 12). Aedeagus tongue shaped with a pair of dorsal sclerites bearing irregular striae; venter primarily membranous but with a slender pair of sclerotized bars which connect to the dorsal sclerites and extend from near



Figs. 10-13. *Styloperla jiangxiensis* SEM photomicrographs. 10. Male right cercus, dorsobasal aspect, 11. Apex of male cercal process, dorsal, 12. Male cercal spur and segments 2-4, 13. Male cercal spur and spine of segment 2.

midlength to the apex. Apex partially sclerotized and split; each apical flap armed with several rows of minute spines; apex somewhat foot shaped in lateral aspect.

**Female.** Forewing length 16.5-18 mm. Subgenital plate slightly produced into a small mesal tab; vaginal sclerites conspicuous through wall of

sternum 8. Sternum 9 bearing weakly sclerotized lateral bars and a membranous mesal area armed with short setae; intersegmental membrane of sterna 9-10 bearing a patch of microtrichia.

**Egg.** Typical of genus. Ovoid with collar absent and chorion smooth.

**Remarks.** Yang & Yang (1990) described this species

from a single male taken at Jing Gang Shan in Jiangxi near the border with Zhejiang Province. Although the basal cercal spur is shown as somewhat longer in the figure prepared by Yang & Yang (1990) than for our specimens, we are tentatively placing these specimens as *S. jiangxiensis* on the basis of a similar color pattern, similarly armed apex of the cercal process, similarly shaped aedeagus, and proximity of collection localities. Unfortunately, without access to the holotype we are unable to confirm this placement.

The collection made at 600 m on Long Wang Shan includes two exuviae which are similar in size, coloration and body form to the *Cerconychia livida* nymphs described by Uchida & Isobe (1989). However these exuviae have bidentate, carnivorous type laciniae, paraglossae larger than glossae, a much reduced, chloroperlid-like, apical maxillary palpal segment, and spurs rather than trifurcate setae on the tibial apex. The mandibles have four major teeth, a distinct mola, and a ventral row of peg bristles originating near the base of the second tooth and extending almost to the inner margin of the mandible. The mixture of chloroperlid-styloperlid features suggests caution should be used in associating these exuviae with the adult *Styloperla* specimens collected with them.

### *Styloperla wui* Chao

*Styloperla wui* Chao, 1947. Biological Bulletin of Fukien Christian University 5:93-96.

*Styloperla wui*: Uchida & Isobe, 1989

**Material examined.** China: Fujian Province, Ta Chu Lan, 4500 feet, base of Kuantun Mountain, 16-20 June 1948, J. Fu, 1 ♂, 1 ♀ (USNM). Zhejiang Province, Gutien Shan, 400 m, 26° 21' 05" N, 119° 26' 12" E, 7 June 1999, 5 ♂ (PMSL).

**Remarks.** The male of this species was redescribed by Uchida & Isobe (1989) from a pair of specimens collected at Kuantun in Fujian Province. Their description is in agreement with the topotype male in the USNM and with the series of males from Zhejiang Province.

### Provisional key to *Styloperla* males

1. Process of basal cercal segment a low rounded knob on inner margin ..... *S. obtusispina*

- Inner process of basal cercal segment a long, acute spine ..... 2
2. Process of basal cercal segment without secondary spines; basal cercal segment without laterally directed spur; known from Hainan .... *S. flectospina*
- Process of basal cercal segment with one or more secondary spines; basal cercal segment with a laterally directed spur; known from mainland China ..... 3
3. Apex of cercal process terminating in a pair of small spines giving forked appearance ..... 4
- Apex of cercal process terminating in a single spine ..... 5
4. Ventrolateral aspect of cercal process with a secondary pair of subapical spines... *S. jiangxiensis*
- Ventrolateral aspect of cercal process with a single secondary spine near midlength ..... *S. inae*
5. Lateral spur of basal cercal segment with two or more teeth ..... *S. wui*
- Lateral spur of basal cercal segment a simple, single spine ..... *S. spinicercia*

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