



SYSTEMATIC NOTES ON *KIOTINA* KLAPÁLEK AND *HEMACRONEURIA* ENDERLEIN (PLECOPTERA: PERLIDAE), WITH DESCRIPTION OF FOUR NEW SPECIES

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ABSTRACT

Data supporting recognition of genus *Hemacroneuria* Enderlein are presented and *H. marginalis*, sp. n., and *H. malickyi* sp. n., from Vietnam are proposed. In addition, several poorly known *Kiotina* Klapálek species from China, Taiwan and Okinawa are redescribed (*K. collaris* (Banks), *K. quadrituberculata* Wu, *K. riukiuiensis* Ueno), the synonymy of *Schistoperla* Banks with *Kiotina* is supported, and two new Chinese species, *Kiotina bifurcata* sp. n. and *K. delicata* sp. n. are described.

Keywords: Plecoptera, *Hemacroneuria*, *Kiotina*, new species, Asia

INTRODUCTION

Uchida (1990), in his unpublished thesis on Japanese Perlidae, proposed a tribe within Acroneuriinae to include *Kiotina* Klapálek and several related genera. *Hemacroneuria* Enderlein was included as a "possible representative" although Zwick (1973b) had removed the lone species, *H. violacea* Enderlein, from *Kiotina* and placed it as a member of *Acroneuria* Pictet. Other Asian genera considered by Uchida (1990) as members of this group include *Caroperla* Kohno, *Flavoperla* Chu, *Gibosia* Okamoto and *Niponiella* Klapálek. Some of these are typified by an elongate adult head capsule, a distinct epiproct sclerite in males and by the presence of a pair of lateral spines or low knobs on male tergum 10; females have long subgenital plates and the known larvae lack distinctive color patterns (Kawai 1967, Uchida 1990, Stark & Sivec 2008).

The present study is based on a few specimens of *Kiotina* and *Hemacroneuria* from Vietnam, Okinawa, Taiwan, North Korea, South Korea, Japan and

mainland China. Much of the Vietnamese material was provided through the courtesy of B. Hubley of the Royal Ontario Museum, Toronto (ROM) or was borrowed from the Zoologisches Museum der Humboldt-Universität, Berlin (ZMH). Other specimens from Okinawa, China and South Korea were loaned by O.S. Flint of the United States National Museum of Natural History, Washington (USNM) or by B.C. Kondratieff of the Gillette Museum, Colorado State University, Fort Collins (CSU), and a small series from Taiwan was studied by the senior author on a visit to the Bernice P. Bishop Museum, Honolulu (BPBM). A few specimens provided by C.F. Lee, H. Malicky or S. Uchida are in the Slovenian Museum of Natural History, Ljubljana (PMSL) and others are on loan from the Hungarian Natural History Museum, Budapest (HNHM) or the Alexander Koenig Zoological Research Institute and the Zoological Museum, Bonn (ZFMK). Specimens are deposited in these various collections as indicated in the text.

RESULTS AND DISCUSSION

Kiotina Klapálek

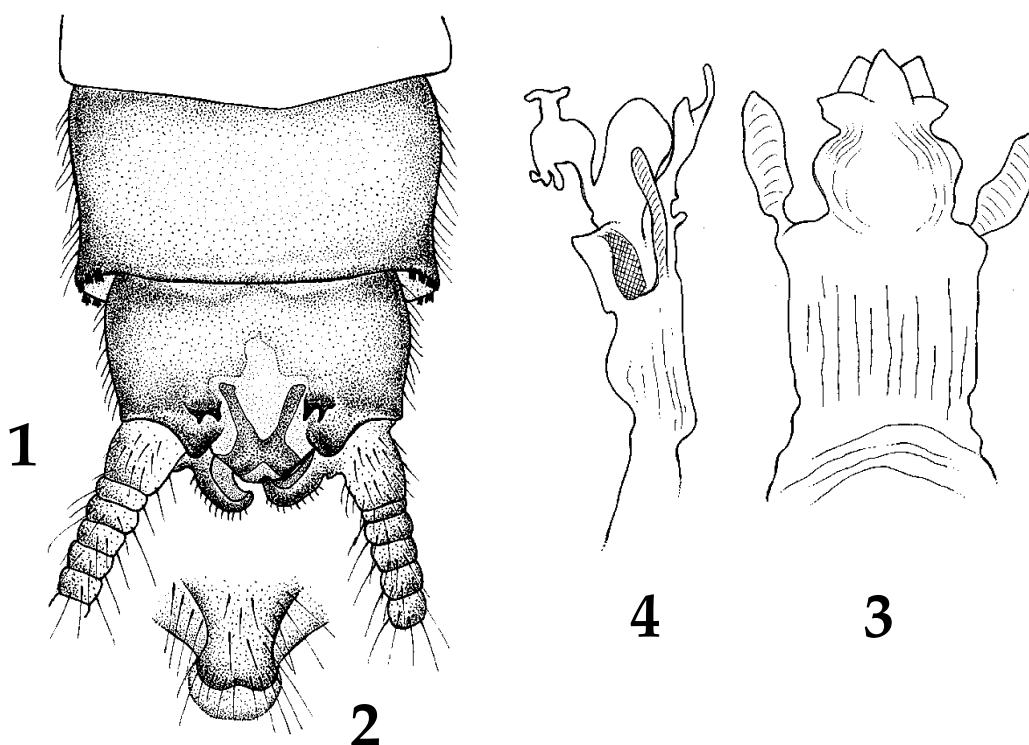
Acroneuria (*Kiotina*) Klapálek, 1907:8. Type species, *Acroneuria* (*Kiotina*) *pictetii* Klapálek

Schistoperla Banks, 1937:271. Type species, *Schistoperla collaris* Banks, Synonymy by Uchida (1990)

Kiotina remains a poorly known, seldom collected stonefly genus of the Orient and eastern Palearctic despite the efforts of Kawai (1967, 1968a, 1968b) and Kawai & Isobe (1979). The group was proposed by Klapálek (1907) as a subgenus of *Acroneuria*, but later (Klapálek 1913) it was treated as a valid genus and within three years (Klapálek 1916), four species were included. Illies (1966) and Zwick (1973a) list nine species in the genus but Zwick (1973b) removed *Hemacroneuria violacea*, where it had been placed by Klapálek (1916), to *Acroneuria*, and at least one other species, *K. kelloggi* Wu & Claassen, should be excluded based on the figures of the female subgenital plate (Wu & Claassen 1934). Wu (1938)

and Banks (1939) also described three species in genus *Atoperla* (now a synonym of *Perlinella*) which Du et al. (1999) include in *Kiotina*, and we add two previously undescribed species, *K. bifurcata* and *K. delicata* to the genus. Uchida (1990) considered *Schistoperla* as a junior synonym of *Kiotina*, and apparently Du et al. (1999) agreed in this placement with which we also concur, thus adding two species, *K. collaris* (Banks) and *K. decorata* (Zwick), to the genus. The recorded distribution of the genus after the synonymy of *Schistoperla* is recognized, and the records below are listed, includes Japan, Okinawa, Taiwan, South Korea, North Korea and mainland China. (Du et al. 1999; Kawai 1968a, 1968b; Uchida 1990; Zwick 1973c).

Species list: 1) *bifurcata* sp. n., 2) *chekiangensis* (Wu, 1938), 3) *chiangi* (Banks, 1939), 4) *collaris* (Banks, 1937), 5) *decorata* (Zwick, 1973c), 6) *delicata* sp. n., 7) *lugubris* (McLachlan, 1875), 8) *nigra* (Wu, 1938), 9) *pictetii* (Klapálek, 1907), 10) *quadrituberculata* Wu, 1948, 11) *resplendens* Banks, 1939, 12) *riukiensis* Ueno, 1938, 13) *spatulata* Wu, 1948, 14) *suzukii* Okamoto, 1912.



Figs. 1-4. *Kiotina bifurcata* structures. 1. Male terminalia, dorsal, 2. Male sternum 9, 3. Aedeagus, ventral, 4. Aedeagus, lateral.

Kiotina bifurcata sp. n.

(Figs. 1-4)

Material examined. Holotype ♂ (pinned, forewings missing) from China, Fujian Province, Kuatun, 2300 m, 27.4° N, 117.4° E, 1 April 1938, J. Klapperich (ZFMK).

Adult habitus. Apparently biocellate, anterior ocellus absent or obscure. Body color dark brown to black. Head and pronotum black. Ocelli widely spaced, nearer eyes than each other. Pronotum widest medially, bearing rugosities. Meso and meta nota dark, abdomen paler. Legs and antennae dark.

Male. Forewings missing, hind wing length 12 mm. Tergum 10 armed with a pair of forked, lateral spines and a subterminal pair of dark projections. Epiproct

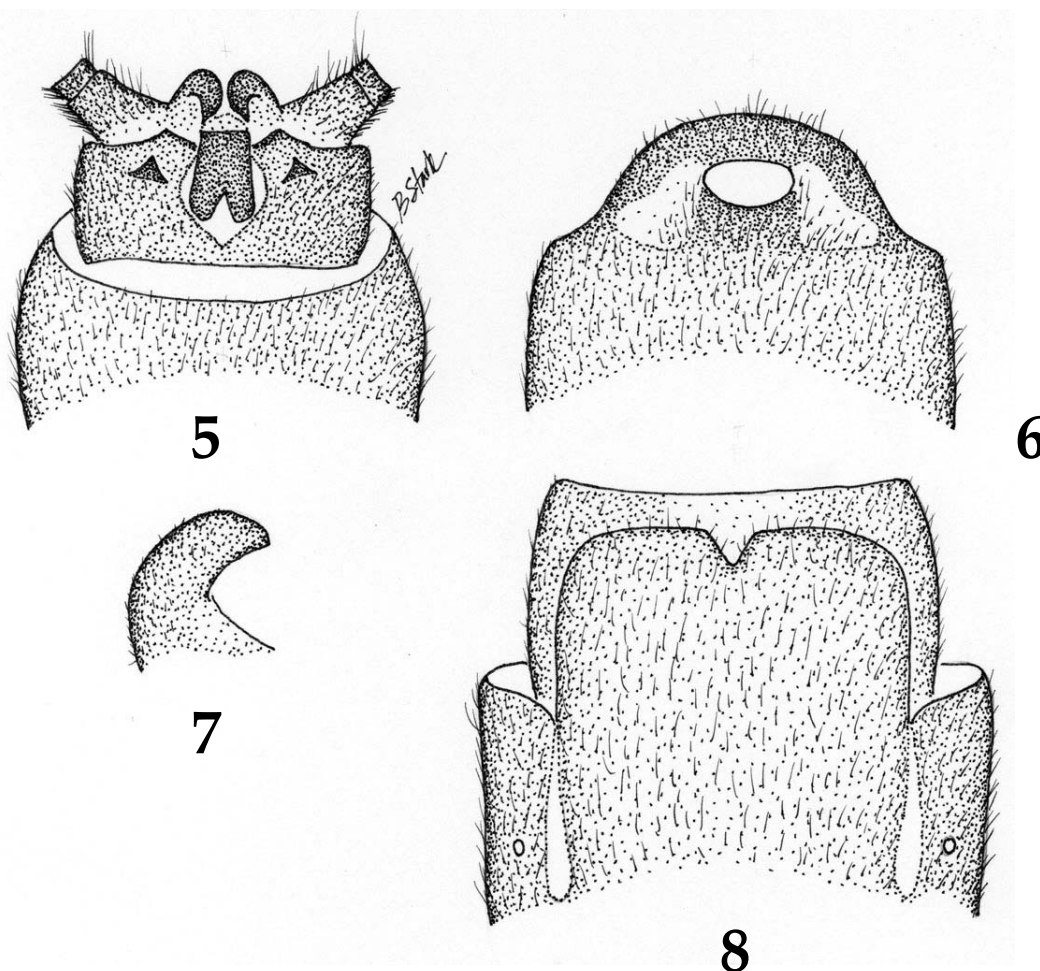
sclerite with well developed long, slender arms arising from a short base (Fig. 1). Paraprocts curved forward over tip of abdomen. Aedeagus incompletely everted but membranous and bearing a pair of lateral arm-like lobes (Figs. 3-4); apical area of aedeagus complexly lobed. Hammer oval and set near posterior margin of sternum 9 (Fig. 2).

Female. Unknown.

Larva. Unknown.

Etymology. The species name is based on the distinctive, forked lateral spines on tergum 10.

Diagnosis. This species is distinguished from known *Kiotina* by the bifurcate tergal spines and by the long, slender epiproct sclerite Y-arms. We have seen a similar specimen from Guangxi Province, China, but do not have sufficient data to determine its status.



Figs. 5-8. *Kiotina collaris* structures. 5. Male terminalia, dorsal, 6. Male sternum 9, 7. Male paraproct, lateral. 8, Female abdominal sternite 8-9.

***Kiotina collaris* (Banks)**
(Figs. 5–16)

Schistoperla collaris Banks, 1937:271. Taiheizan, Taiwan (Museum of Comparative Zoology, Harvard)

Schistoperla collaris: Kawai, 1968b:245.

Kiotina collaris: Uchida, 1990:135.

Kiotina collaris: Du et al., 1999:63.

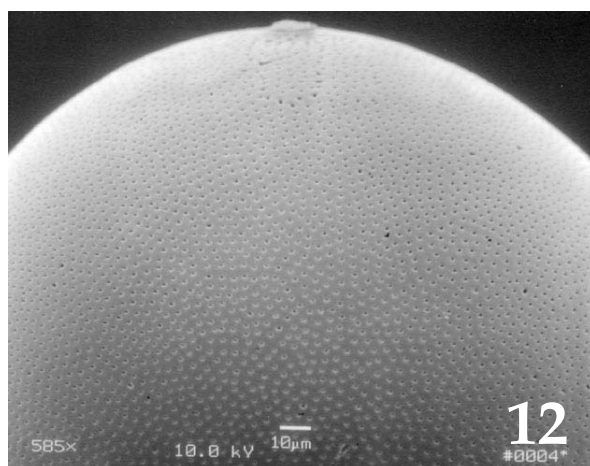
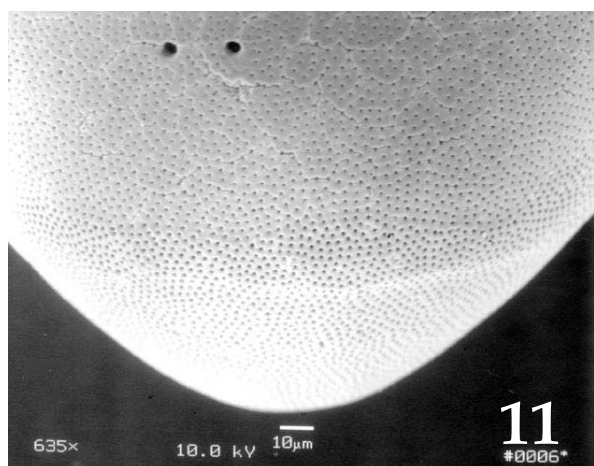
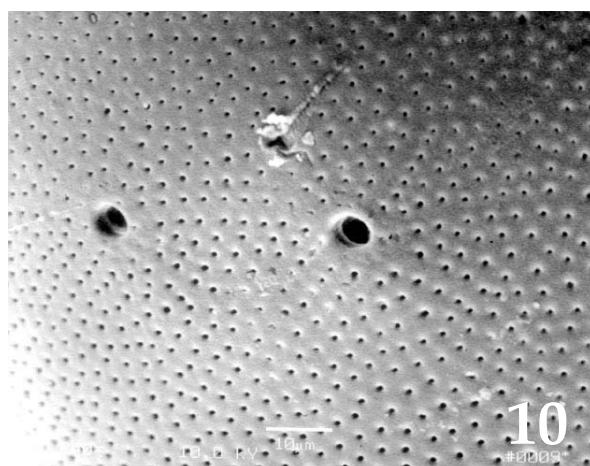
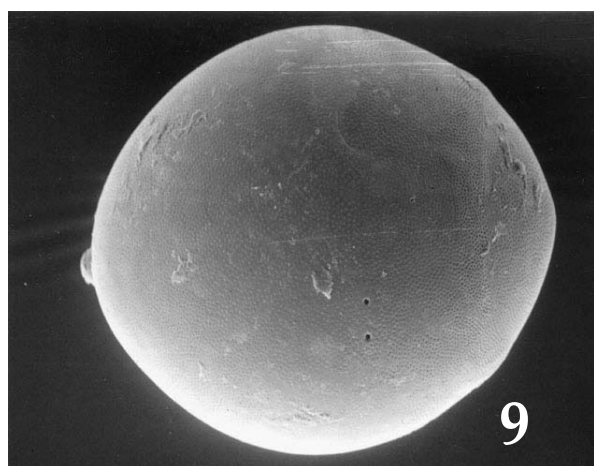
Material examined. Taiwan: Taipei Co., Wulai Shiao, 350 m, 8 April 1996, I. Sivec, B. Horvat, 2 ♂, 1 ♀ (PMSL). Taipei Co., Shihpai, 450 m, 7 April 1996, I. Sivec, B. Horvat, 1 larva (PMSL). Wulai, near Taipei, 300-500 m, 12 April 1960, T.C. Maa, 2 ♂, 1 ♀ (BPBM). Ilan, Chihtuan, 18 April 1990, C.C. Chiang, 1 ♂ (ZFMK). Urai, 28 March 1932, M. Chugo, 2 ♂ (ZFMK). Urai, 3 April 1938, J. Sonan, 2 ♂ (ZFMK).

Adult habitus. Triocellate or some apparently

biocellate; ocelli small and widely spaced. General body color dark brown to black. Head almost entirely black, pronotum black except pale band along lateral margins. Legs dark brown. Wings black except for pale costal band.

Male. Forewing length 15 mm. Abdominal tergum 10 with a pair of sharp pointed posterolateral spines on either side of median epiproct sclerite; epiproct sclerite Y-shaped with short wide stem and short arms; terga 9-10 without patches of sensilla basiconica (Fig. 5). Paraprocts slender and strongly curved forward (Figs. 5, 7). Oval hammer present on abdominal sternum 9 (Fig. 6).

Female. Forewing length 17 mm. Subgenital plate with relatively parallel lateral margins for much of length, posterior margin with small median notch; plate extends over most of sternum 9 (Fig. 8).

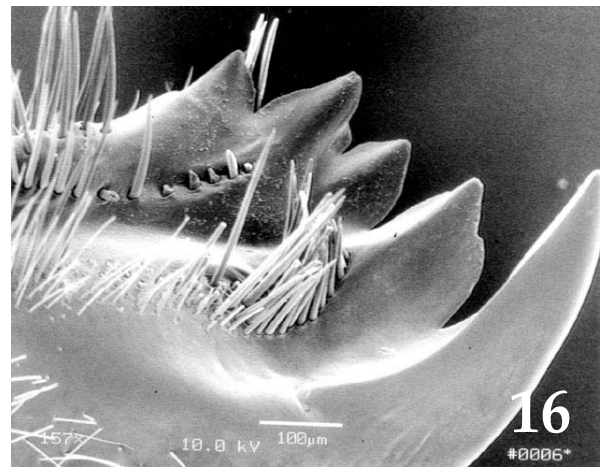
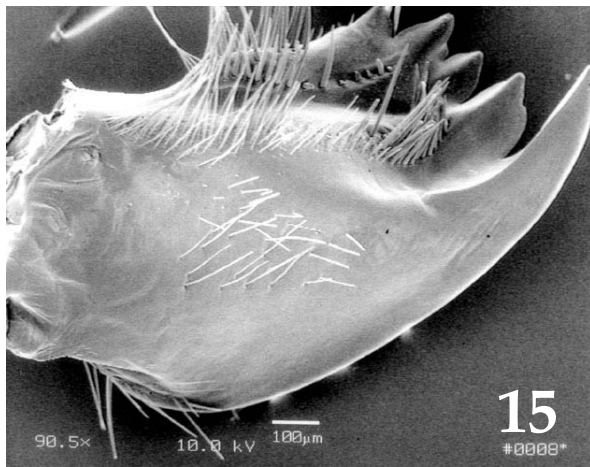
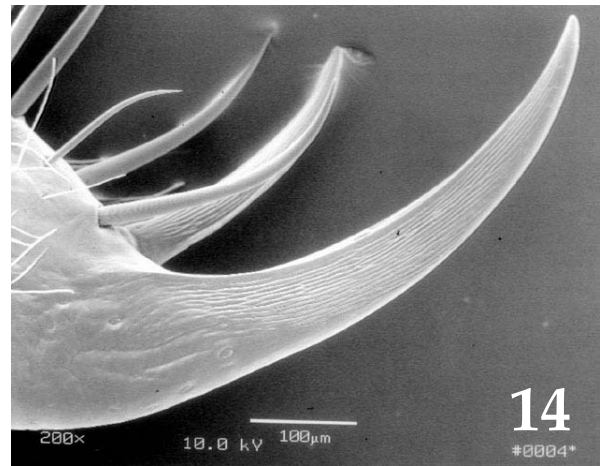
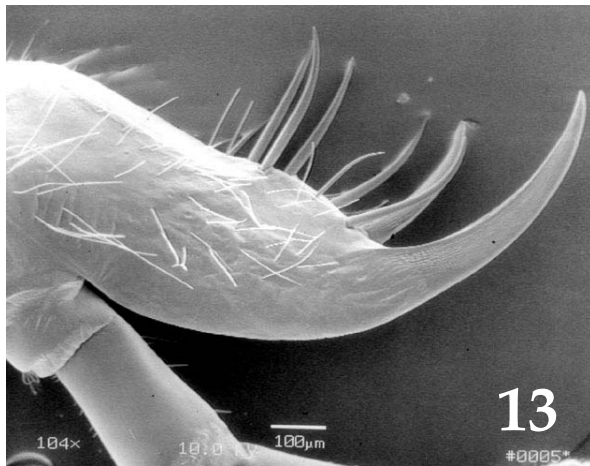


Figs. 9-12. *Kiotina collaris* eggs. 9. Entire egg, lateral aspect, 10. Chorionic detail with micropyles, 11. Anterior pole with opercular line, 12. Collar.

Egg. Length ca. 0.35 mm, width ca. 0.28 mm. Outline a plump oval shape with indistinct opercular line (Figs. 9, 11). Collar small, button-like (Fig. 12). Chorionic surface covered with small punctations throughout, follicle cell impressions obscure. Opercular line a circumlinear raised ridge ca. 4-5 punctations in width. Micropylar orifices sessile, much larger than punctations, and set on subequatorial line (Fig. 10).

Larva. Triocellate, anterior ocellus minute. Body length ca. 18.5 mm. General color yellow-brown without distinctive pattern. Pronotal fringe interrupted along most of lateral margin. Gill filaments long and slender, projecting beyond thoracic notae; anal gills present. Dorsal abdominal intercalary setae on terga 7-10 generally less than 10 per segment, but more numerous laterally. Abdominal terga slightly darker along posterior

margins. Cercomeres with strong setal whorls. Femora armed with strong bristles; tibiae and femora with sparse swimming fringe. Lacinia bidentate, inner tooth reaching beyond mid length of primary tooth; both teeth bearing irregular striae (Figs. 13-14); inner margin of lacinia with ca. 5-6 thick primary bristles and several finer secondary bristles scattered to near base. Venter of lacinia bearing scattered fine bristles over much of surface. Mandible with five teeth (Figs. 15-16). Inner margin with a cluster of thick bristles near mid length and a small tuft of ca. 4 fine fringe hairs at base of cluster; basal third of inner margin bare. 2nd and 4th teeth with bristle rows terminating at their bases, and additional fine setae located mesally on ventral surface and a few long bristles located basally on outer margin; part of a dorsal row of bristles can also be seen projecting between the 4th and 5th teeth in figure 16.



Figs. 13-16. *Kiotina collaris* larval mouthparts. 13. Lacinia, 14. Lacinial apex, 15. Mandible, 16. Mandibular apex.

Remarks. Known only from Taiwan.

Kiotina decorata (Zwick)

Schistoperla decorata Zwick, 1973c:166. Holotype ♂, Kengi Province, Bagyon Mountains, Kaesong, Korea
Kiotina decorata Uchida, 1990:135.

Material examined. North Korea: North Pyongan Province, Myohyang-san, Isonnam Valley, 23 May 1991, L. Ronkay, A. Vojnits, 1 ♂ (HNHM). North Pyongan Province, Myohyang-san, Hyangsan Valley, 28 May 1991, L. Ronkay, A. Vojnits, 1 ♀ (HNHM). North Pyongan Province, Myohyang-san, Hotel Myohyang, 28 May 1991, L. Ronkay, A. Vojnits, 2 ♂ (HNHM). Province Kangwon, Kungang-san, Manmulsang Rocks, 750 m, 11 June 1991, L. Ronkay, A. Vojnits, 3 ♂ (HNHM). South Korea: Onyang/Asan City, Chungnam, 16 May 1996, P. McLellan, 2 ♀ (CSU). National Forest, 10 May 1954, Krauel, 1 ♀ (USNM).

Remarks. Zwick (1973c) provides an excellent, well illustrated description of the adults of this species. Eggs and larvae were unavailable for the original description and no larvae were available to us, however, Yoon & Sung (1985) provide a brief description of the larva and figures of the head and pronotum for this species known only from the Korean Peninsula. Although no eggs suitable for good quality scanning electron microscopy study

were available, a few with soft chorions were examined and these were punctate over the entire surface and the collar was a small nipple-like structure generally similar to the eggs of *K. collaris*.

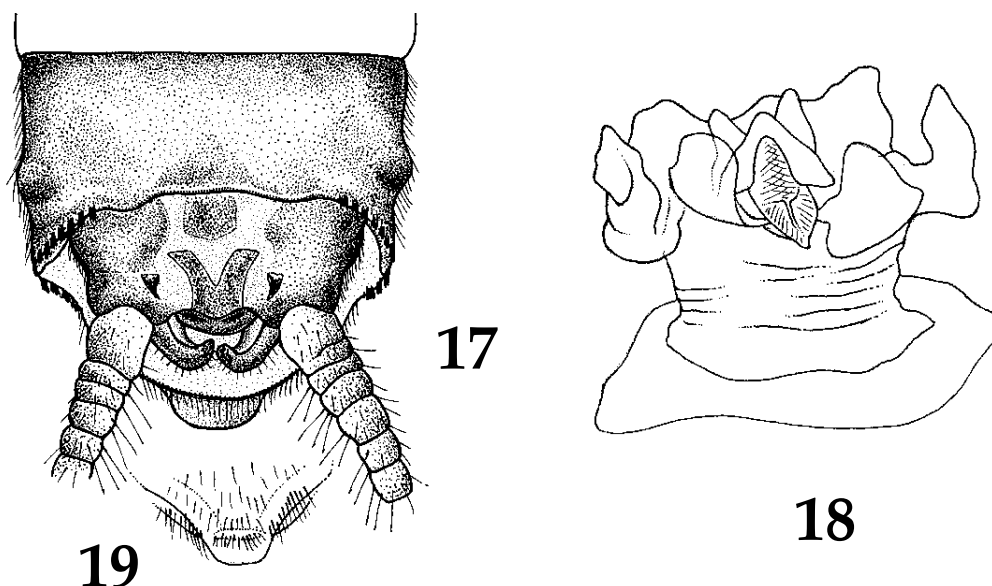
Kiotina delicata sp. n.

(Figs. 17–19)

Material examined. Holotype ♂ (pinned), from China, Fujian Province, Kuatun, 2300 m, 27.4° N, 117.4° E, 12 April 1938, J. Klapperich (ZFMK). Paratypes, same site as holotype, 28-29 April 1938, J. Klapperich, 2 ♂ (pinned, ZFMK).

Adult habitus. Apparently biocellate, anterior ocellus, if present obscured by specimen condition. General color brownish. Head dark but with pale transverse band forward of ocelli. Palpi and antennae dark brown. Pronotum uniformly dark brown with prominent rugosities; pronotum widest medially. Wings dark brown with pale costal field. Abdomen brown but paler than pronotum.

Male. Forewing length 14-15 mm. Lateral spines of tergum 10 slender, acute and curved gently inwards. Epiproct sclerite deeply notched, Y-arms slightly longer than base (Fig. 17). Posterior margin of tergum 10 with a pair of projecting points. Aedeagus incompletely everted but membranous with a pair of lateral arms (Fig. 18); armature consists of minute triangular spines and microtrichia. Hammer oval, located near apex of sternum 9 (Fig. 19).



Figs. 17-19. *Kiotina delicata* structures. 17. Male terminalia, dorsal, 18. Aedeagus, ventral, 19. Male sternum 9.

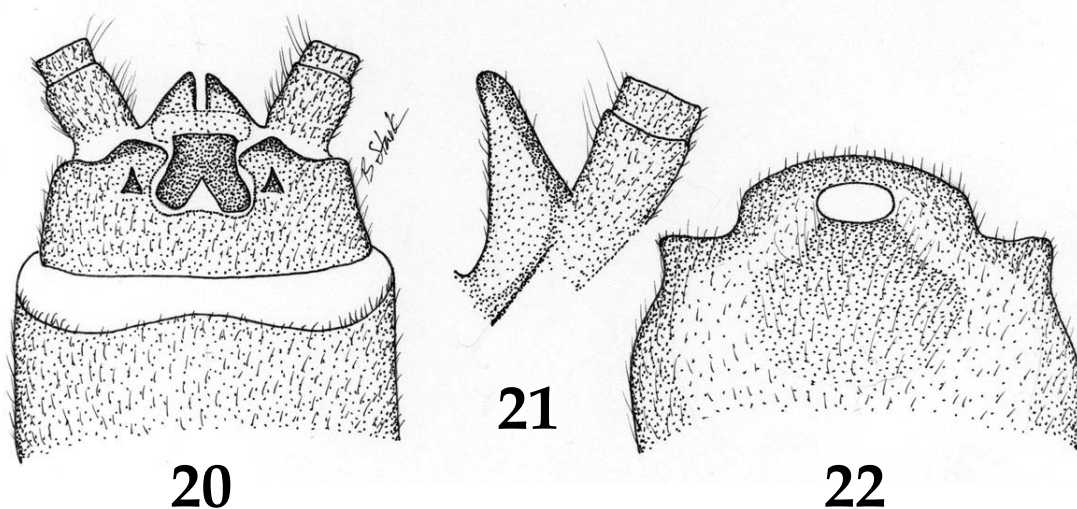
Female. Unknown.

Larva. Unknown.

Etymology. The species name refers to the delicately

curved lateral processes of tergum 10.

Diagnosis. This species is distinguished from known *Kiotina* by the delicately curved tergal spines.



Figs. 20-22. *Kiotina quadrituberculata* structures. 20. Male terminalia, dorsal, 21. Male paraproct, caudoventral aspect, 22. Male sternum 9.

***Kiotina quadrituberculata* Wu**
(Figs. 20–22)

Kiotina quadrituberculata Wu, 1948:148. Holotype ♂, presumed lost (Yenching University Collection). Ta-chu-luan, Shao-wu, Fukien (Fujian), China

Material examined. China: Fukien (Fujian) Province, Ta-chu-laun, foot of Kuantun Mountain, 4500 feet, 1-5 May 1948, J. Fu, 2 ♂ (USNM).

Adult habitus. Obscured by specimen condition but general color dark brown to black. Head black, pronotum black with pale lateral margins. Costal area of wings pale, contrasting with dark brown on rest of wing membrane. Antennae and legs dark brown to black.

Male. Forewing length 15-16 mm. Tergum 10 bearing a pair of short, triangular spines positioned on either side of epiproct sclerite, and a pair of darkened, blunt projections on posterior margin above cercal bases (Fig. 20). Epiproct sclerite Y-shaped with short stem and truncate posterior margin. Paraprocts narrowly triangular with outer margins sclerotized and inner margins pale (Figs. 21); suture along base of paraprocts dark. Hammer transversely oval (Fig. 22). Aedeagus not everted, but apparently a

membranous, multilobed, wide sac armed with microtrichia.

Female. Unknown.

Larva. Unknown.

Remarks. The type material for this species is presumed lost or destroyed, and to our knowledge, no neotype has been proposed. Although these two males are in poor condition, they are apparently from a site very near the type locality and were taken in the same time frame as the holotype. Consequently, we regard these specimens as topotype representatives for this species known only from Fujian Province, China. Fresh material, including gravid females from the type locality would be highly desirable. In the absence of fresh material from the type locality, one of these specimens would be a suitable neotype.

***Kiotina riukiensis* Ueno**
(Figs. 23–33)

Kiotina riukiensis Ueno, 1938:94. Holotype ♀. Bennoki, Okinawa

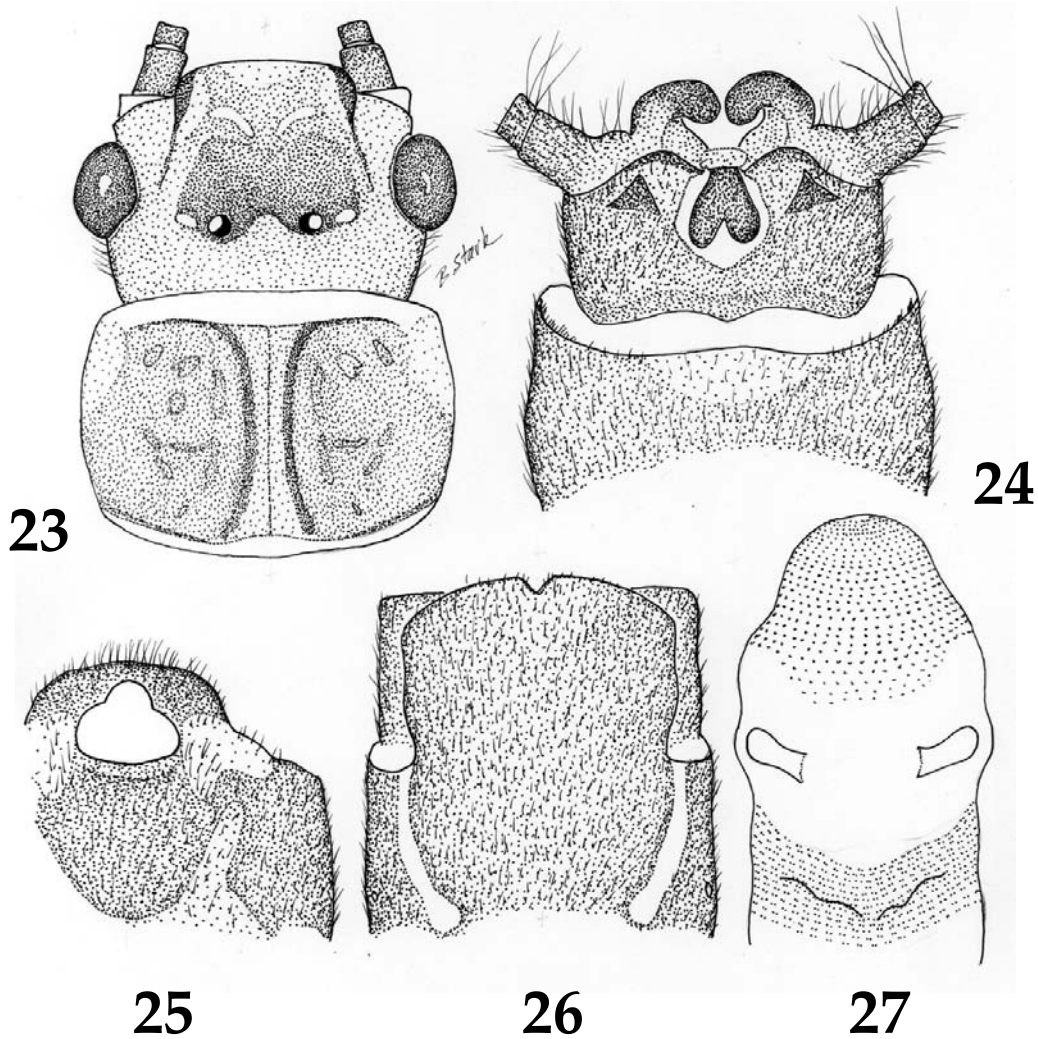
Kiotina riukiensis: Kawai, 1968a:236. Male description

Material examined. Okinawa: Kunigami-gun, upper

Genka-gawa, Genka, 26° 35.9' N, 128° 05.0' E, 25-28 March 1997, O.S. Flint, Jr. 2 ♂ (USNM). Kunigami-gun, falls Okuma-gawa, 280 m, 26° 43.8' N, 128° 12.7' E, 26 March 1997, O.S. Flint, Jr. 1 ♀ (USNM). Kunigami-gun, Hiji Falls, Hiji-otaki, 26° 43.1' N, 128°

10.7' E, 26-28 March 1997, O.S. Flint, Jr. 1 ♀ (USNM).

Kawai (1967, 1968a) provides the most recent figures and descriptions for adults of this species. We are able to add a few details based on the recently collected material listed above.

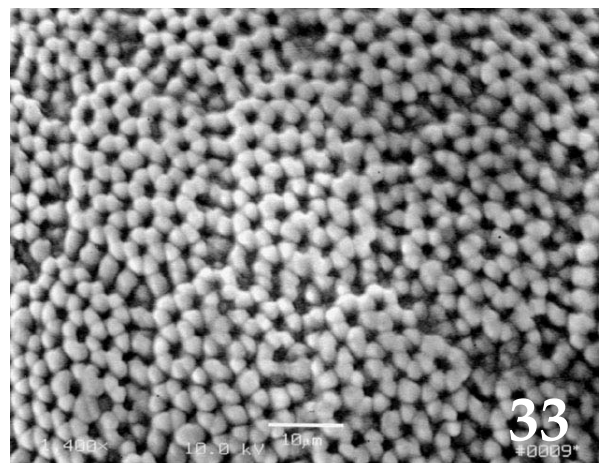
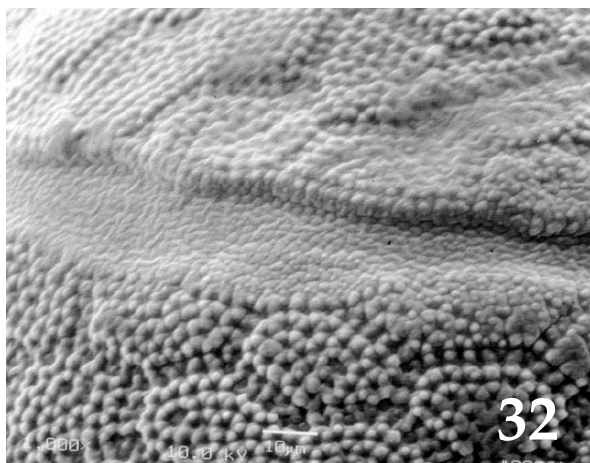
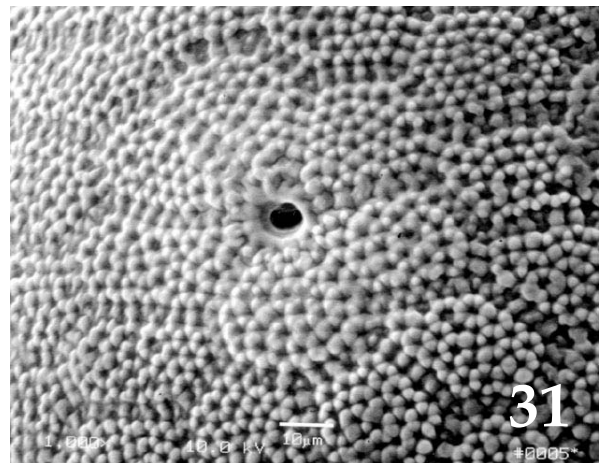
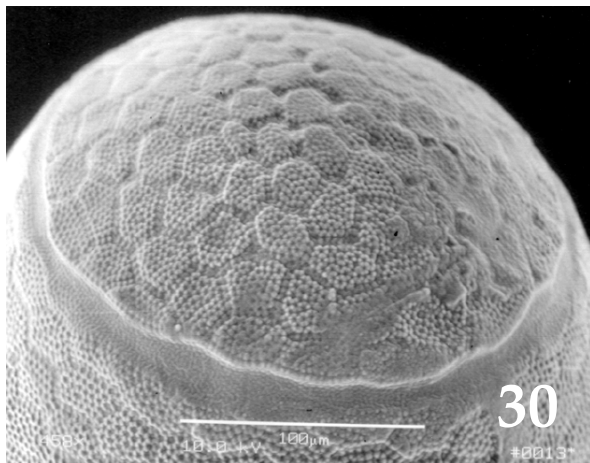
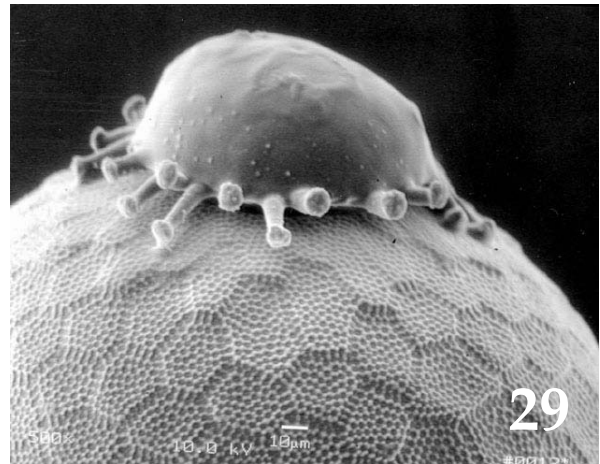
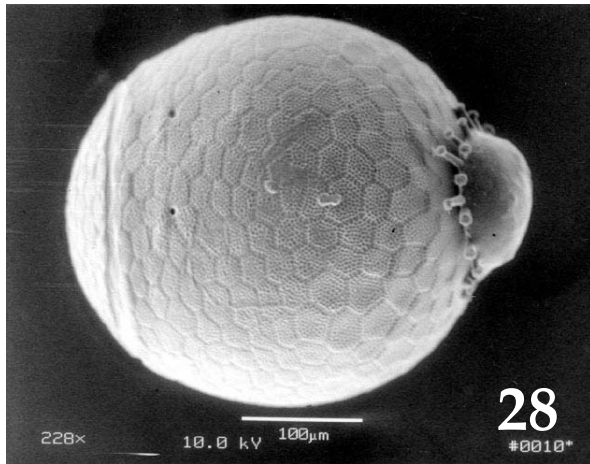


Figs. 23-27. *Kiotina riukiensis* structures. 23. Head and pronotum, 24. Male terminalia, dorsal, 25. Male sternum 9, 26. Female terminalia, ventral, 27. Incompletely everted aedeagus, ventral aspect.

Adult habitus. General color dark brown to black. Head dark with obscure pale M-line and large oval callosities located laterad to ocelli (Fig. 23); occiput and area laterad of lappets pale brown; antennae brown, palpi pale brown. Pronotum brown with pale anterolateral angles and pale brown median band. Wings and legs dark brown; wings without pale

costal area.

Male. Forewing length 15.5 mm. Tergum 10 bearing a pair of prominent darkened, triangular spines positioned on either side of epiproct sclerite and a pair of blunt, darkened projections on posterior margin of segment lateral to epiproct sclerite (Fig. 24). Epiproct sclerite Y-shaped with short,



Figs. 28-33. *Kiotina riukiensis* eggs. 28. Entire egg, 29. Collar end with anchor, 30. Anterior pole with opercular line, 31. Chorionic detail with micropyle, 32. Opercular line detail, 33. Follicle cell impression detail.

truncate stem. Paraprocts slender, curved processes with darkened tips. Sternum 9 with a bell shaped hammer located slightly anterior to posterior margin; apex of hammer free and projecting over base of apical shelf of sternum (Fig. 25). Aedeagus not fully everted but consisting of a wide, membranous sac, covered ventrally in apical third with dense patch of brown, scale-like armature and in basal half with a sparse patch of microtrichia; area between apical and basal patches bare (Fig. 27).

Female. Forewing length 17 mm. Subgenital plate projecting over sternum 9 (Fig. 26). Lateral margins of plate parallel, apical margin rounded and notched on midline.

Egg. Length ca. 0.37 mm, width ca. 0.34 mm. Outline oval to sub-spherical, anchor medusoid with basal, tentacle-like projections (Figs. 28-29); collar button-like. Chorionic surface covered throughout with shallow, hexagonal follicle cell impressions containing numerous fine tubercles arranged in clusters of 5-7 surrounding a median space (Figs. 28, 33). Opercular line a well defined, circumferential depression near anterior pole; floor of depression granular, width ca. 0.01-0.02mm (Figs. 30, 32).

Micropylar orifices sessile, micropyles located ca. medially between opercular line and equator (Figs. 28, 31).

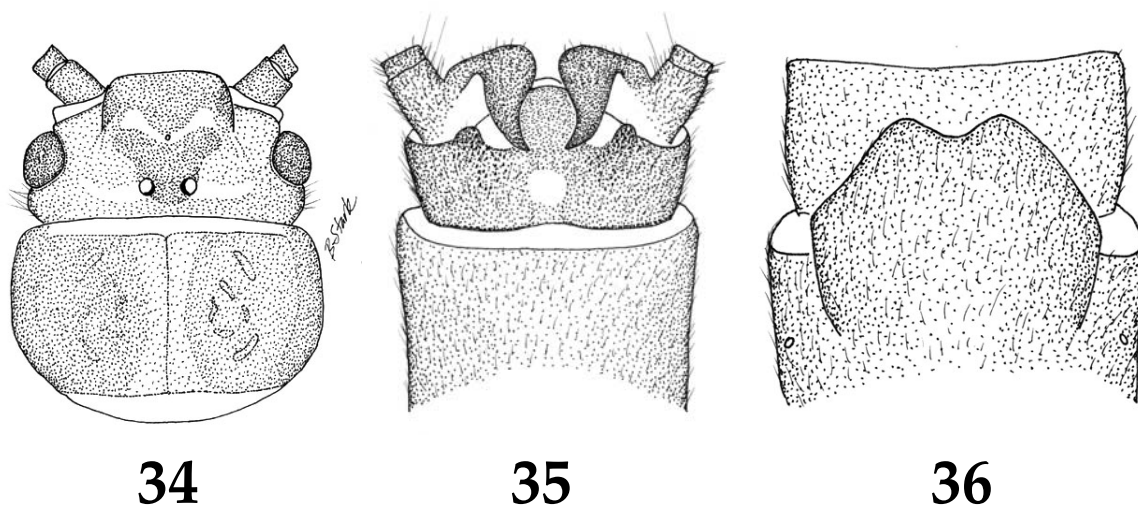
Remarks. Known from Okinawa.

Hemacroneuria Enderlein

Hemacroneuria Enderlein, 1909:395. Type species, *Hemacroneuria violacea* Enderlein, 1909, gen. propr.

This genus was placed in the synonymy of *Kiotina* by Klapálek (1916) and it remained there until Zwick (1973b) placed it as a synonym of *Acroneuria*. Uchida (1990) considered it a valid genus and possible member of the proposed tribe, but in the absence of publication of this opinion the genus has remained in the synonymy of *Acroneuria*. The genus is presently known from Vietnam. *Hemacroneuria* males are distinguished from *Kiotina*, *Flavoperla* and *Gibosia* by the presence of low knobs instead of triangular spines on tergum 10, and by the absence of a distinct epiproct sclerite on tergum 10.

Species list: 1) *malickyi* sp. n., 2) *marginalis* sp. n., 3) *violacea* Enderlein, 1909.



Figs. 34-36. *Hemacroneuria malickyi* structures. 34. Head and pronotum, 35. Male terminalia, dorsal, 36. Female terminalia, ventral.

Hemacroneuria malickyi sp. n. (Figs. 34-40)

Material examined. Holotype ♂ and 2 ♂ and 2 ♀ paratypes from Vietnam, Vinh Phu Province, Tam

Dao, 800-1000 m, 21° 28' N, 105° 38' E, 19 May-13 June 1995, H. Malicky (PMSL). Additional paratype: Vietnam: Vinh Phu Province, Tam Dao, 29 May 1995, C.F. Lee, 1 ♀ (PMSL).

Adult habitus. Triocellate, but anterior ocellus

minute. General color dark brown. Head brown but M-line pale; intercellular area darker (Fig. 34). Pronotum brown but median area and some scattered rugosities paler. Wings brown, costal field pale brown. Legs, cerci and antennae brown.

Male. Forewing length 20 mm. Tergum 10 with posterolateral tubercles covered with short, peg-like setae; median field sclerotized between tubercles but a small membranous oval area located near anterior margin (Fig. 35). Paraprocts broadly triangular but sharply pointed and incurved at tips. Aedeagus not fully everted, but membranous and covered with fine spines and microtrichia.

Female. Forewing length 25 mm. Subgenital plate projecting over all or most of sternum 9; posterior margin notched (Fig. 36). Vagina membranous, slender without armature, similar to *H. marginalis*.

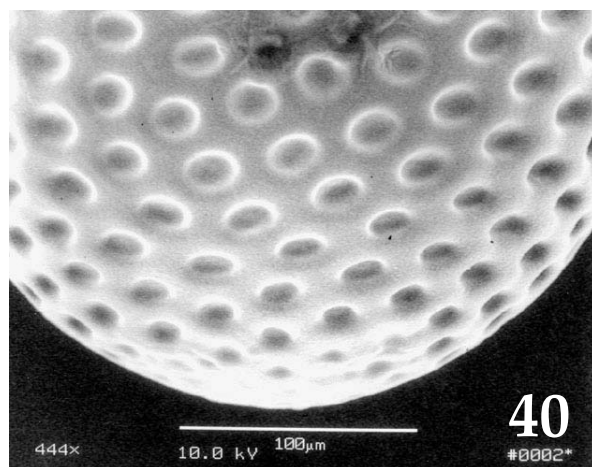
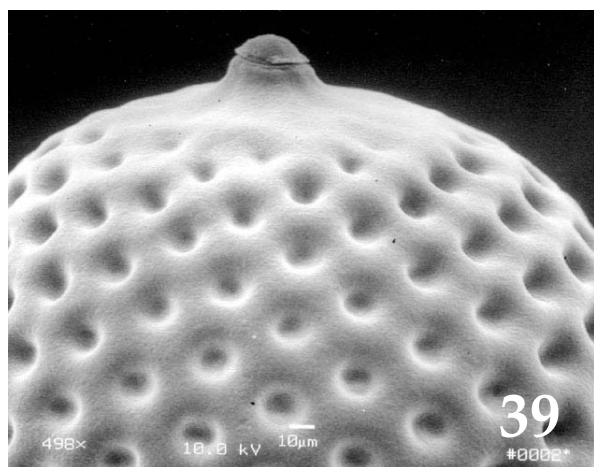
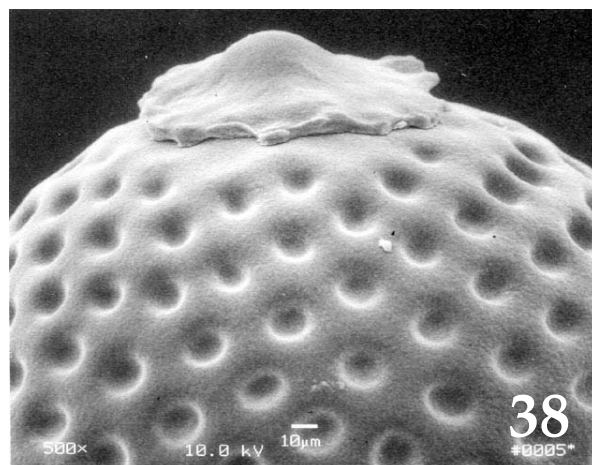
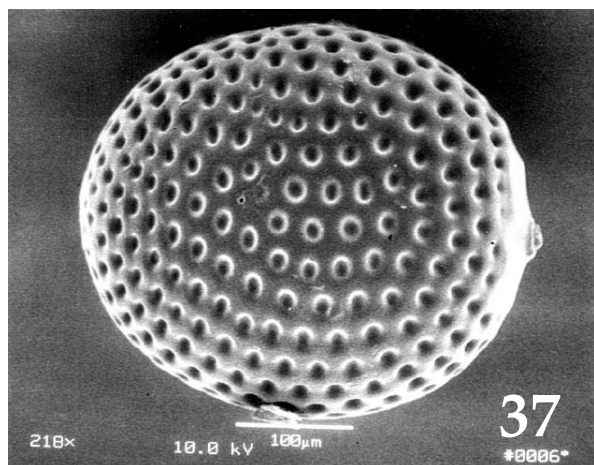
Egg. Length ca. 0.40 mm, width ca. 0.34 mm. Outline

oval to sub-spherical, collar a small, slightly projecting button (Figs. 37, 39). Chorion coarsely punctate throughout (Figs. 37-40); micropyles sessile, set on ridges surrounding chorionic punctations (Fig. 37).

Larva. Unknown.

Etymology. The patronym honors H. Malicky, collector of the holotype and numerous other interesting specimens from this region.

Diagnosis. This species can be distinguished from *H. marginalis* (described below) on the basis of pronotal color pattern and by details of male tergum 10. In *H. marginalis* a membranous band divides tergum 10 along its entire length, whereas in *H. malickyi* the posterior area of tergum 10 is sclerotized. It can also be distinguished from *H. violacea* on the basis of the peg-like setae found on male tergum 10; these structures are absent in *H. violacea*.



Figs. 37-40. *Hemacroneuria malickyi* eggs. 37. Entire egg, lateral, 38. Anchor, 39. Collar, 40. Anterior pole.

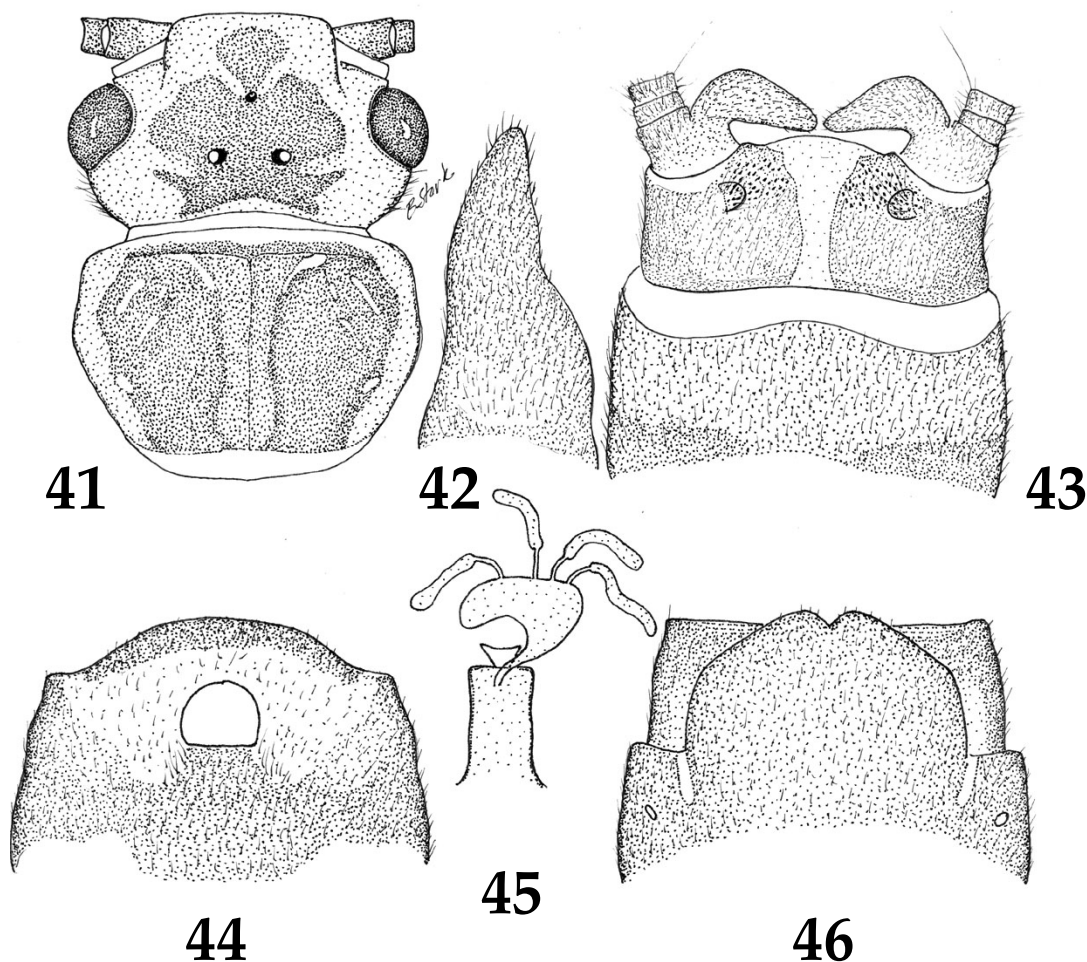
Hemacroneuria marginalis sp. n.
(Figs. 41–50)

Material examined. Holotype ♂ from Vietnam, Lao Cai Province, Sapa, large waterfall on road from Sapa to Lai Chau, 8 May 1995, D. Currie, B. Hubley, J. Swann, ROM 956022 (ROM). Paratypes: Vietnam: Lao Cai Province, Sapa, small stream crossing road from Quy Ho to Ta Grang Phinh, 9 May 1995, D. Currie, B. Hubley, J. Swann, ROM 956023, 1 ♀ (pinned, ROM). Lao Cai Province, ca. 12 km on road from Sapa to Lai Chau, 1950 m, 28 April–12 May 1999, 22° 20' 58.3" N, 103° 46' 15.7" E, B. Hubley, ROM 992001, 1 ♂ (pinned, aberrant paraprocts, ROM). Same site, 1–12 May 1999, B. Hubley, ROM 992011, 1 larva (ROM). Lao Cai Province, Sapa, Fan

Si Pang Mountain, 1600 m, 22–29 April 1995, LF, 1 ♂ (ZMH).

Adult habitus. Triocellate, ocelli small and anterior ocellus minute. General color dark brown to black patterned with pale yellow. Central occiput and frons dark brown from ocelli to M-line; forward of M-line a dark tongue shaped median patch extends to clypeus (Fig. 41). Pronotum dark brown on disk but slightly paler along median suture and pale along lateral margins. Legs dark brown, wing membrane dark brown except costal area pale from base to cord.

Male. Forewing length 18 mm. Paraprocts thick, triangular in outline and densely hairy on posterior surface (Fig. 42). Tergum 10 with a pair of low lateral knobs and conspicuous sensilla basiconica patch



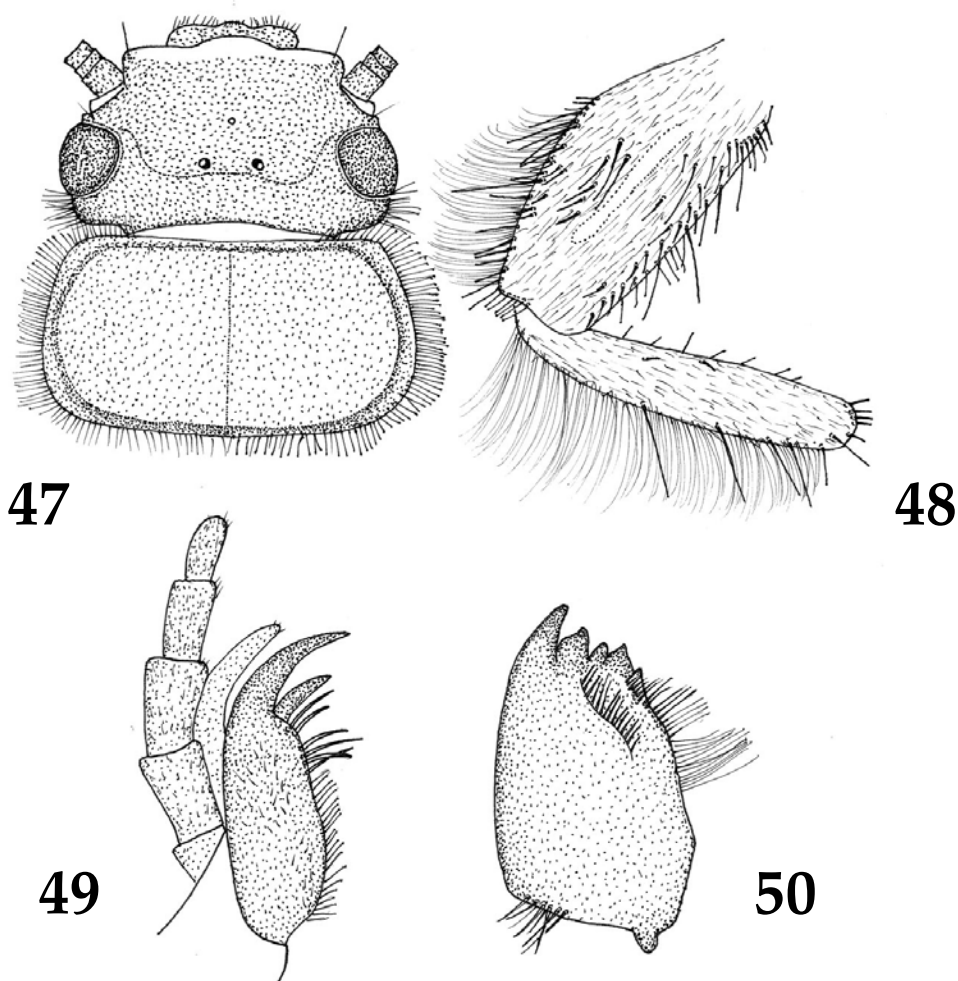
Figs. 41–46. *Hemacroneuria marginalis* structures. 41. Head and pronotum, 42. Male paraproct, caudal aspect, 43. Male terminalia, dorsal, 44. Male sternum 9, 45. Vagina, dorsal aspect, 46. Female terminalia, ventral.

divided by membranous band (Fig. 43). Hammer wide along anterior margin and narrowed posteriorly giving a more or less rounded triangular shape (Fig. 44). Aedeagus not completely everted, but surface armed with apical patch of very fine setal spines giving a brown cast to structure; median and basal areas armed with microtrichia.

Female. Forewing length 17 mm. Subgenital plate lateral margins subparallel to about midlength but angled posteriorly in distal half (Fig. 46). Posterior margin with shallow median notch. Vagina very slender, completely membranous and without obvious armature; spermatheca an inflated bag attached to dorsal vaginal surface by a narrow stalk and bearing several accessory glands (Fig. 45).

Larva. Triocellate. Body length about 17 mm. General color pale yellow-brown without obvious

pattern. Post occipital fringe includes several long bristles (Fig. 47). Pronotum completely fringed with bristles along lateral margins. Legs with sparse dorsal fringes on femora and tibiae but rather heavily armed with stout setae (Fig. 48). Lacinia bidentate with inner tooth about 2/3 length of outer tooth; inner margins completely lined with primary and secondary setae and ventral surface with a sparse median patch of fine setae (Fig. 49). Mandible with five teeth and bearing a submarginal row of short, thick setae and a marginal row of thick bristles followed by a more basal tuft of fine setae; basoventral area of mandible bearing a cluster of thick bristles near outer margin (Fig. 50). Well developed anal gills present; additional gills include SC₁ (double), AT₂, SC₂ (double), AT₃, SC₃ (double), PT₃.



Figs. 47-50. *Hemacroneuria marginalis* nymphal structures. 47. Head and pronotum, 48. Foreleg, 49. Maxilla, 50. Mandible.

Etymology. The species name refers to the pale marginal bands along the lateral margins of the adult pronotum.

Diagnosis. This species is distinguished from *H. violacea* on the basis of the extensive pale areas on the head and laterally on the pronotum. In addition, tergum 10 of this species bears a conspicuous patch of sensilla basiconica which are absent in *H. violacea*, and the paraprocts are longer, narrower and more apically blunt than in that species. The hammer of this species is also slightly larger than in *H. violacea*.

***Hemacroneuria violacea* Enderlein**
(Figs. 51–53)

Hemacroneuria violacea Enderlein, 1909:395. Lectotype ♂ (Polish Academy of Sciences, Warsaw). Manson-Gebirge, Tonkin (Vietnam)

Kiotina violacea: Klapálek, 1916:60.

Acroneuria violacea: Zwick, 1973b:491.

Material examined. Vietnam: Lao Cai Province, ca. 5

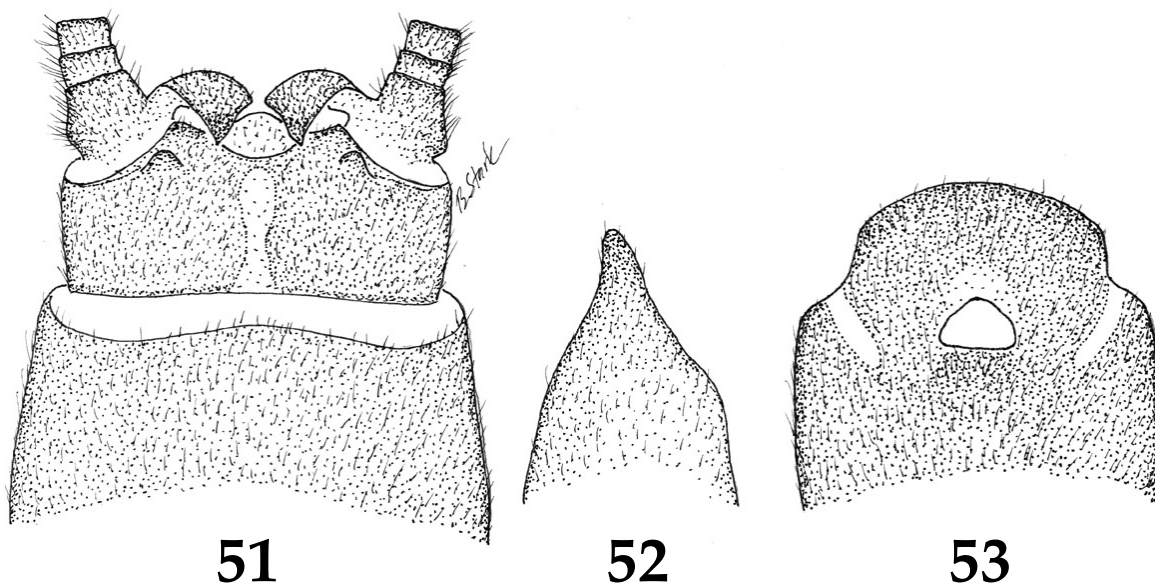
km southeast Sapa village, 1500 m, 26 May-3 June 1999, A. Lathrop, ROM 992022, 1 ♂ (pinned, ROM).

Adult habitus. Triocellate, anterior ocellus minute. General color black, head and pronotum essentially entirely dark. Legs, tarsi and antennae black; wings dark except costal area pale to cord.

Male. Forewing length 17-20 mm. Tergum 10 bearing a pair of low posterolateral knobs and tergum almost divided by hairless, poorly sclerotized median band (Fig. 51); tergum 10 without sensilla basiconica but numerous short setae occur in field between knobs. Paraprocts triangular, curved forward over abdominal apex and tips darkened and pointed apically (Fig. 52); paraproct length slightly greater than width. Hammer small with anterior edge wider than posterior edge appearing somewhat triangular (Fig. 53). Aedeagus damaged but much of surface covered with variably shaped microtrichia ranging from triangular scales to minute pegs or linear ridges.

Female. Zwick (1973b) shows the subgenital plate as reaching beyond the tip of sternum 9.

Larva. Unknown.



Figs. 51-53. *Hemacroneuria violacea* structures. 51. Male terminalia, dorsal, 52. Male paraproct, caudal aspect, 53. Male sternum 9.

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REFERENCES

- Banks, N. 1937. Neuropteroid insects from Formosa. *Philippine Journal of Science*, 62:255-291.
- Banks, N. 1939. New genera and species of neuropteroid insects. *Bulletin of the Museum of Comparative Zoology*, 85:439-504.
- Du, Y., I. Sivec & J. He. 1999. A checklist of the Chinese species of the family Perlidae (Plecoptera: Perlodea). *Acta Entomologica Slovenica*, 7:59-67.
- Enderlein, G. 1909. Klassifikation der Plecopteren sowie Diagnosen neuer Gattungen und Arten. *Zoologischer Anzeiger*, 34:385-419.
- Illies, J. 1966. Katalog der rezenten Plecoptera. Das Tierreich 82. Walter de Gruyter, Berlin. XXX + 632 pp.
- Kawai, T. 1967. Plecoptera (Insecta). *Fauna Japonica*. Biogeographical Society of Japan, Tokyo. 211 pp.
- Kawai, T. 1968a. Stoneflies (Plecoptera) from the Ryukyu Islands in the Bishop Museum, Honolulu. *Pacific Insects*, 10:231-239.
- Kawai, T. 1968b. Stoneflies (Plecoptera) from Taiwan in the Bishop Museum, Honolulu. *Pacific Insects*, 10:241-248.
- Kawai, T. & Y. Isobe. 1979. Some taxonomic relationships of the genera *Schistoperla* Banks and *Kiotina* Klapálek. *Gewässer und Abwässer*, 64:74-76.
- Klapálek, F. 1907. Japonské druhy podčeledi Perlinae. *Rozpravy České Akademie*, 16³¹:1-28.
- Klapálek, F. 1913. Plecoptera II. Pp. 112-127. *In*. H. Sauter's *Formosa-Ausbeute*. *Supplementa Entomologica*, 2.
- Klapálek, F. 1916. Subfamilia Acroneuriinae Klp. *Časopis České Společnosti Entomologické*, 13:45-84.
- McLachlan, R. 1875. Perlidae. Pp. 171-173. *In*. A sketch of our present knowledge of the neuropterous fauna of Japan. *Transactions of the Entomological Society of London*, 1875.
- Okamoto, H. 1912. Erster Beitrag zur Kenntnis der japanischen Plecopteren. *Transactions of the Sapporo Natural History Society*, 4:105-170.
- Stark, B.P. & I. Sivec. 2008. New Vietnamese species of the genus *Flavoperla* Chu (Plecoptera: Perlidae). *Illiesia*, 4:59-65.
- Uchida, S. 1990. A revision of the Japanese Perlidae (Insecta: Plecoptera), with special reference to their phylogeny. Unpublished PhD thesis, Tokyo Metropolitan University. 228 pp.
- Ueno, M. 1938. Stoneflies and mayflies collected in Okinawa, Ryukyu Islands. *Transactions of the Biogeographical Society of Japan*, 3:92-99.
- Wu, C.F. 1938. *Plecoptera Sinensium*, A monograph of the stoneflies of China (Order Plecoptera). Peiping, China, 225 pp.
- Wu, C.F. 1948. Fifth supplement to the stoneflies of China (Order Plecoptera). *Peking Natural History Bulletin*, 17:145-151.
- Wu, C.F. & P.W. Claassen. 1934. New species of Chinese stoneflies. *Bulletin of the Peking Society of Natural History*, 9:111-129.
- Yoon, I.B. & J.A. Sung. 1985. A taxonomic study on the stonefly (Plecoptera) nymphs of Korea (I). Suborder Holognatha and Systellognatha. *Entomological Research Bulletin*, 11:111-139.
- Zwick, P. 1973a. Insecta: Plecoptera. Phylogenetisches system und Katalog. *Das Tierreich* 94. Walter de Gruyter, Berlin. XXXII + 465 pp.
- Zwick, P. 1973b. Die Plecopteren-Arten Enderleins (Insecta): Revision der Typen. *Annales Zoologici*, 30:471-507.
- Zwick, P. 1973c. Plecoptera from Korea. *Annales Historico-Naturales Musei Nationalis Hungarici*, 65:157-169.

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