



NEW VIETNAMESE SPECIES OF GENUS *ACRONEURIA* (PLECOPTERA: PERLIDAE)

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ABSTRACT

Two new species of *Acroneuria* Pictet are recognized from Vietnam and additional records are presented for *A. bachma* Cao & Bae and *A. magnifica* Cao & Bae. The new species, *A. apicalis* sp. n., and *A. azunensis* sp. n., are compared with related congeners, and an unassociated female is described under informal designation.

Keywords: Plecoptera, Perlidae, Vietnam, new species, *Acroneuria*

INTRODUCTION

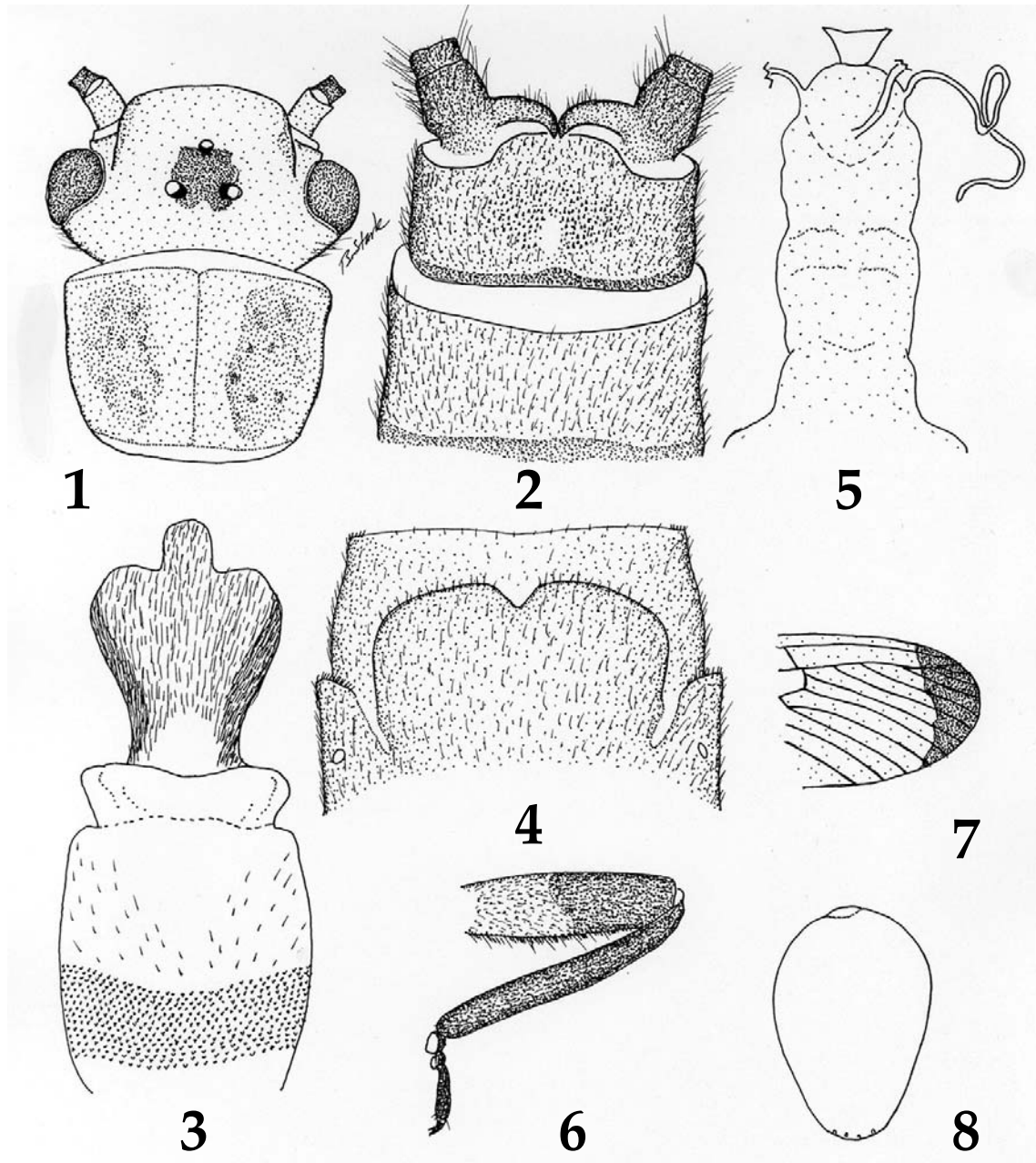
Acroneuria was proposed as a subgenus of *Perla* by Pictet (1841) based on *Perla arenosa* Pictet, a species widely distributed in eastern North America. In the most recent treatment of Nearctic *Acroneuria*, Stark (2004) recognized 17 North American species. In addition to Nearctic representatives, various authors have placed many large eastern Palearctic and Oriental Acroneuriini in the genus (e.g. Kawai 1967; Wu 1938), but some of these species have more recently been placed in *Calineuria* Ricker (Uchida 1983) or *Sinacroneuria* Yang & Yang (Du et al. 1999; Yang & Yang 1995). Uchida (1990) proposed additional genera to accommodate Japanese perlids but, unfortunately, these were never published and most of the large, regional Acroneuriini species remain in *Acroneuria*. We are following this practice for the present time, at least until more information is available for *Brahmana* Klapálek and other poorly known genera.

The first Vietnamese *Acroneuria* species were proposed independently by Enderlein (1909) and Klapálek (1909). Type material of the Enderlein species (*A. nobilitata*) was studied by Zwick (1973) and Klapálek's species (*A. ampla*) was placed as a synonym of *A. nobilitata* by Zwick (1973). Enderlein's

other Vietnamese acroneuriine species from this study was originally proposed as *Hemacroneuria violacea*; this genus is now considered distinct from *Acroneuria* and more closely related to *Kiotina* Klapálek (Uchida 1990; Stark & Sivec 2008). More recently, Cao & Bae (2007) proposed two additional *Acroneuria* species from Vietnam, and included larval descriptions for both forms. Our study is based primarily on light trap samples of acroneuriine adults and kick samples of a few larvae made in Vietnam by personnel of the Royal Ontario Museum, Toronto (ROM), and by A.V. Gorohov. Included in the samples are specimens of both species described by Cao & Bae (2007) and two previously undescribed species are also recognized. Specimens are deposited in the Royal Ontario Museum, Toronto (ROM), the Institute of Ecology and Biological Resources, Hanoi (IEBR), the Stark collection, Clinton (BPS), and the Slovenian Museum of Natural History, Ljubljana (PMSL) as indicated in the text.

RESULTS AND DISCUSSION

Acroneuria apicalis sp.n.
(Figs. 1-8)



Figs. 1-8. *Acroneuria apicalis*. 1. Head and pronotum, 2. Male terminalia, dorsal, 3. Aedeagus, ventral, 4. Female terminalia, ventral, 5. Vagina, dorsal, 6. Foreleg, 7. Wing tip, 8. Egg, lateral aspect.

Material studied. Holotype ♂ from Vietnam, Vinh Phu Province, Tam Dao Hill Station, forest edge near town, 5-31 May 1996, B. Hubley, ROM 961006 (ROM). Paratypes: Vietnam: Vinh Phu Province, Tam Dao Hill Station, lower waterfall of stream flowing through town, 11 May 1996, B. Hubley, D.C. Darling, ROM 961030, 1 ♀ (ROM). Vinh Phu Province, Tam

Dao Hill Station, 3-31 May 1996, B. Hubley, D.C. Darling, M. Hanson, 1 ♂ (pinned, IEBR). Vinh Phu Province, Tam Dao Hill Station, 930 m, 15 May 1996, B. Hubley, D.C. Darling, M. Hanson, 1 ♂ (pinned, ROM). Vinh Phu Province, Tam Dao Hill Station, 2 km along forest trail at west end of town, 4-31 May 1996, B. Hubley, 1 ♀ (pinned, ROM). Vinh Phu

Province, Tam Dao, 600-900 m, 17-31 May 1995, A.V. Gorohov, 1 ♂, 2 ♀ (PMSL). Vinh Phu Province, Tam Dao, 7 April 1994, S. Nirasawa, 1 ♀ (PMSL). Same location, 2 May 1994, S. Nirasawa, 2 ♀ (PMSL). Same location, 29 April-3 May 1989, Z. Hubonov, 3 ♀ (PMSL).

Adult habitus. Triocellate. General color yellow patterned with dark brown to black pigment. Head yellow with dark ocellar patch (Fig. 1). Pronotum yellow with mesal area of pale brown; meso and metathorax each with lateral dark spot; mesonotum dark brown between wing bases. Femora banded, pale basally and dark brown to black in apical half (Fig. 6); tibiae and tarsi dark. Wings pale yellow brown except for dark brown tips (Fig. 7). Antennal bases pale but flagellum dark brown; cerci entirely dark brown to black.

Male. Forewing length 27 mm. Paraprocts heavily sclerotized, slender, dark and hooked at the tips (Fig. 2). Tergum 10 with large mesal sensilla basiconica patch, tergum 9 without sensilla basiconica. Aedeagus membranous, but armed with variably sized setal spines; apical section bearing ventrolateral bands of thin, brown setal spines in two dense patches (Fig. 3); ventral surface of apical section rather uniformly covered with thin brown setal spines. Basal half of aedeagus bearing a basal, complete band of pale, triangular scale-like spines; mesal area with scattered slender setal spines and microtrichia; apex of mesal area bare.

Female. Forewing length 30 mm. Subgenital plate broadly produced over half of sternum 9, hind margin emarginate or weakly notched (Fig. 4); subgenital plate covered with fine, upright bristles. Vagina membranous, more or less cylindrical, without obvious internal armature, and bearing a pair of slender, elongate accessory glands on anterior angles (Fig. 5); spermatheca lost during dissection.

Egg. Outline pear shaped. Collar button-like (Fig. 8). Chorion smooth, micropyles located near anterior pole.

Larva. Unknown.

Etymology. The species name refers to the darkened wing tips of this species.

Diagnosis. This species is closely related to *A. azunensis* (described below) and *A. bachma* (Cao & Bae 2007); males of both new species are identified as *A. bachma* in the key presented by Cao & Bae (2007). The three species share a similar color pattern

including a pale yellow to pale brown general habitus, dark brown to black quadrangular ocellar spot, dorsomesal dark area on mesonotum between wing bases, lateral dark spots on meso and metathorax, and banded femora. In addition, these species are very similar in the shape of male paraprocts, pattern of sensilla basiconica on male tergum 10, female subgenital plate structure and egg shape. This species is distinguished from these similar species on the basis of dark wing tips, dark cerci, and differences in aedeagal armature (Figs. 3, 7).

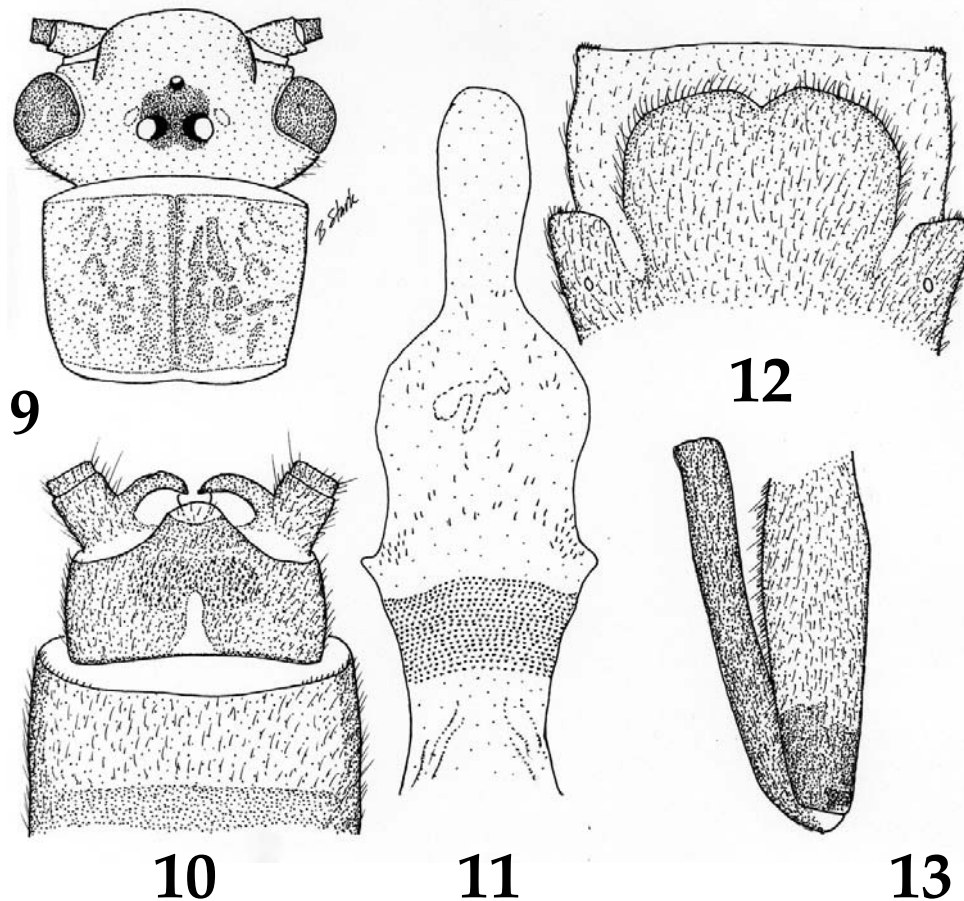
Acroneuria azunensis sp. n.

(Figs. 9-15)

Material examined. Holotype ♂, 7 ♂, 6 ♀ paratypes from Vietnam, Gia Lai Province, An Khe District, Tram Lap, Azun River, 2 km northwest on trail from forestry building, 17 June 1996, D. Currie, J. Swann, ROM 961056 (ROM). Additional Paratypes: Vietnam: Same site as holotype, 23 June 1996, D. Currie, J. Swann, ROM 961084, 1 ♂, 2 ♀ (IEBR). Same data but 3 km northeast of forestry building, 21 June 1996, D. Currie, J. Swann, ROM 961076, 1 ♂, 1 ♀ (BPS). Same data but 1 km southwest on trail from forestry building, 18 June 1996, B. Hubley, ROM 961057, 2 ♂ (ROM). Gia Lai Province, An Khe District, Dacklest River, 5.2 km northeast Tram Lap on forest road, 15 June 1996, D. Currie, J. Swann, ROM 961047, 3 ♂ (ROM). Gia Lai Province, Buon Li Mountains, Kon Cha Range, 1000-1200 m, 14-20 April 1995, A. Gorohov, 1 ♂, 1 ♀ (PMSL). Same location, May 1995, A. Gorohov, 1 ♂, 1 ♀ (PMSL).

Adult habitus. Triocellate. General color yellow patterned with dark brown. Head yellow with dark ocellar patch (Fig. 9). Pronotum pale brown with scattered brown rugosities; meso and metathorax each with lateral dark spot; mesonotum dark brown between wing bases. Femora banded, pale on proximal 2/3, dark apically (Fig. 13); fore tibiae mostly brown, mid and hind tibiae brown along dorsal margin but paler ventrally. Wings pale yellow brown. Antennal segments 2-26 brown, but pale beyond; cerci pale.

Male. Forewing length 21-22 mm. Paraprocts triangular, heavily sclerotized in apical half but with circular membranous area near base (Fig. 10).



Figs. 9-13. *Acroneuria azunensis*. 9. Head and pronotum, 10. Male terminalia, dorsal, 11. Aedeagus, ventral, 12. Female terminalia, ventral, 13. Foreleg.

Tergum 10 with large mesal sensilla basiconica patch continuous across center of segment (Fig. 10); tergum 9 without sensilla basiconica patch. Aedeagus a relatively cylindrical membranous bag with slender apex, armed with patches of variably sized, small to minute spines (Fig. 11); basal section completely ringed by broad band of densely packed, small, triangular scale setae; mid section armed with scattered fine setal spines; tip not completely everted, but apparently sparsely armed with microtrichia. Dorsal aspect with an uneverted gonopore lobe near midlength.

Female. Forewing length 26-27 mm. Subgenital plate broadly produced over 2/3 of sternum 9, hind margin emarginate or weakly notched (Fig. 12); plate surface covered with scattered, upright, prominent bristles. Vagina slender, more or less cylindrical, with robust

spermatheca about 2/3 vaginal length; apex of spermatheca hooked ventrad and bearing elongate accessory glands.

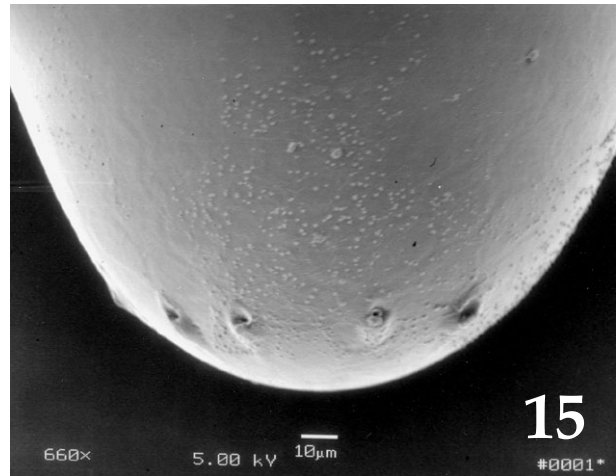
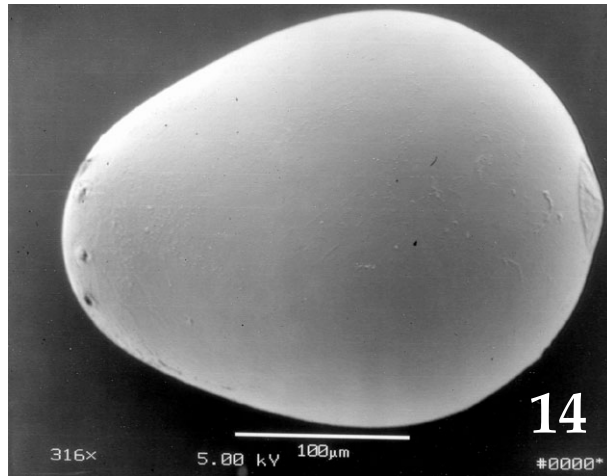
Egg. Length ca. 0.32 mm, diameter ca. 0.24 mm. Outline pear shaped, collar button-like. Chorion smooth or with very faint follicle cell impressions (Figs. 14-15). Micropyles located near anterior pole.

Larva. Unknown.

Etymology. The species name is based on the Azun River where most of the type series was collected.

Diagnosis. Although *A. azunensis* is similar to both *A. apicalis* and *A. bachma* in general color pattern, the uniformly yellow wing membrane and longitudinally bicolored mid and hind tibiae are distinctive. The species is more similar to *A. apicalis* but differs from that species in lacking dark wing tips and black cerci and in the absence of dense patches of setal spines on

the apical aedeagal section (Fig. 11).



Figs. 14-15. *Acroneuria azunensis* egg micrographs. 14. Entire egg, lateral, 15. Enlargement of anterior pole with micropyles located near apex.

Acroneuria bachma Cao & Bae
(Fig. 16)

Acroneuria bachma Cao & Bae, 2007:193. Holotype ♂ (Seoul Women's University Aquatic Insect Collection), Bach Ma National Park, Thua Thien-Hue Province, Vietnam

Material examined. Vietnam: Thua Thien-Hue Province, Bach Ma National Park, near junction Rhododendron and Five Lakes trails, 16° 11' 10" N, 107° 50' 55" E, 1200 m, 16 June 2000, B. Hubley, D.C.Darling, ROM 2000531, 1 ♂ (pinned, ROM). Thua Thien-Hue Province, Bach Ma National Park, campsite trail, edge of small stream, 1200 m, 16° 11' 36" N, 107° 51' 15" E, 2 June 2000, B. Hubley, ROM 2000502, 2 ♀ (pinned, ROM). Thua Thien-Hue Province, Bach Ma National Park, 100 m along road past Five Lakes Trail, 1200 m, 16° 11' 37" N, 107° 51' 19" E, 9 May 2000, B. Hubley, ROM 2000518, 1 ♀ (pinned, IEBR). Same site, 11 May 2001, D. Currie, B. Hubley, ROM 2001522, 1 ♀ (pinned, ROM). Same site, 15 June 2000, ROM 2000527, 2 larvae (ROM).

Remarks. This series of specimens are in close agreement in most respects with the description of Cao & Bae (2007). They are, however, slightly darker with a general brownish body and wing coloration. In addition, the aedeagal shape and armature pattern

in the original description appear to be based on an incompletely everted specimen. We offer the following modification based on cleared and everted specimens.

Aedeagus a long, slender, membranous bag, narrowed in apical half and slightly forked at the tip; apical section armed with midventral pair of long slender patches of dark red-brown setal spines (Fig. 16); mesoventral section armed with scattered fine setal spines; basal section armed with a continuous ring of microtrichia.

Cao & Bae (2007) based their larval association on co-occurrence of adult and larval specimens at Bach Ma National Park and the absence of "...other acroneuriids...found in the park area...". We can confirm their association on the basis of dissection and eversion of the aedeagus from a pharate specimen.

Acroneuria magnifica Cao & Bae
(Fig. 17)

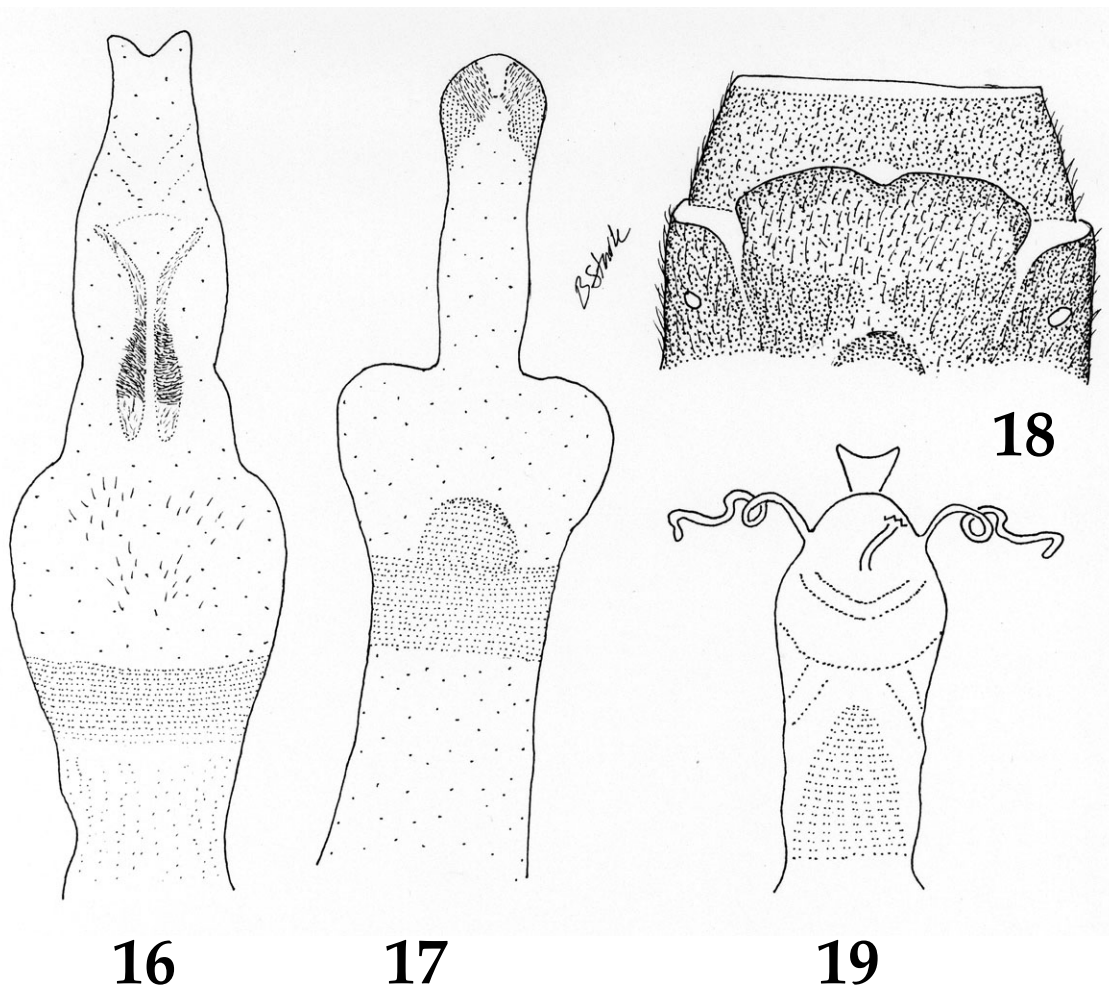
Acroneuria magnifica Cao & Bae, 2007:197. Holotype ♂ (Seoul Women's University Aquatic Insect Collection), Thac Bac, Sa Pa, Lao Cai Province, Vietnam

Material examined. 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, 3 ♂, 2 ♀ (ROM). Lao Cai Province, ca. 12 km along road from Sapa to Lai Chau, 22° 21' N, 103° 46' E, 1950 m, 1-12 May 1999, B. Hubley, ROM 992013, 1 ♂ (IEBR). Same site, 1-12 May 1999, B. Hubley, ROM 992011, 1 ♂, 1 larva (ROM). Same site, 29 April-12 May 1999, B. Hubley, ROM 992004, 4 ♂, 1 ♀ (pinned,

ROM). Same site, 30 April-12 May 1999, B. Hubley, 1 ♂ (ROM).

Remarks. This series of specimens is in close agreement with the descriptions from Cao & Bae (2007). We provide Fig. 17 which shows the aedeagus in ventral aspect.



Figs. 16-19. *Acroneuria* structures. 16. *A. bachma* aedeagus, ventral, 17. *A. magnifica* aedeagus, ventral, 18. *A. VN-A* female terminalia, ventral, 19. *A. VN-A* vagina, dorsal.

Acroneuria VN-A
(Figs. 18-19)

Material examined. Vietnam: Lao Cai Province, ca. 12 km along road from Sapa to Lai Chau, 1950 m, 22° 20' 58.3" N, 103° 46' 15.7" E, 29 April-12 May 1999, MV light, B. Hubley, ROM 992004, 1 ♀ (pinned, ROM).

Adult habitus. Triocellate. General color black with

iridescent sheen. Head and pronotum shiny black. Fore and mid femora black, hind femora banded with dark pigment basally and distally and yellow band on median third; tibiae and tarsi black. Wings, cerci and antennae black.

Female. Forewing length 28 mm. Subgenital plate projects over basal third of sternum 9 (Fig. 18); posterior margin of plate emarginate and darkly pigmented along edge and at base. Vagina a slender

membranous bag lined along dorsum with fine triangular spines near apex (Fig. 19); slender vaginal accessory glands present at anterior angles.

Egg. None could be extracted prior to clearing with KOH. The shape and collar appears similar to the eggs of other Vietnamese species.

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