



## SEVEN NEW SPECIES OF *PHANOPERLA* BANKS FROM VIETNAM AND THAILAND (PLECOPTERA: PERLIDAE)

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### ABSTRACT

*Phanoperla hubleyi* sp. n. and *P. lobata* sp. n. are described from male specimens collected in Vietnam and *P. doisutep* sp. n., *P. huang* sp. n., *P. occipitalis* sp. n., *P. uchidai* sp. n. and *P. wieng* sp. n. from specimens collected in Thailand. The female and egg of *P. vietnamensis* Zwick and *P. lao* Stark are also described and additional records are given for *P. imitatrix* Zwick, *P. lisu* Stark and *P. malayana* Zwick. A provisional key is provided for *Phanoperla* males known for mainland Southeast Asia.

**Keywords:** *Phanoperla*, Plecoptera, Asia, New species

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### INTRODUCTION

The status and diversity of the Asian stonefly genus *Phanoperla* (Banks 1938) was clarified in a landmark study by Zwick (1982). Subsequently a few species have been added by Stark (1983), Zwick (1986), Zwick & Sivec (1985), Stark & Sivec (2007), Stark & Sheldon (2009) and Cao & Bae (2009), and the group now includes 39 species (DeWalt et al. 2009), distinguished primarily by variations in male genitalia and eggs. Only six of these species, *P. fuscipennis* (Navas), *P. imitatrix* Zwick, *P. malayana* Zwick, *P. simplex* Zwick, *P. vietnamensis* Zwick, and *P. namcattien*, a recently proposed species (Cao & Bae 2009), are currently recorded from Vietnam, and ten are known from all of mainland Southeast Asia.

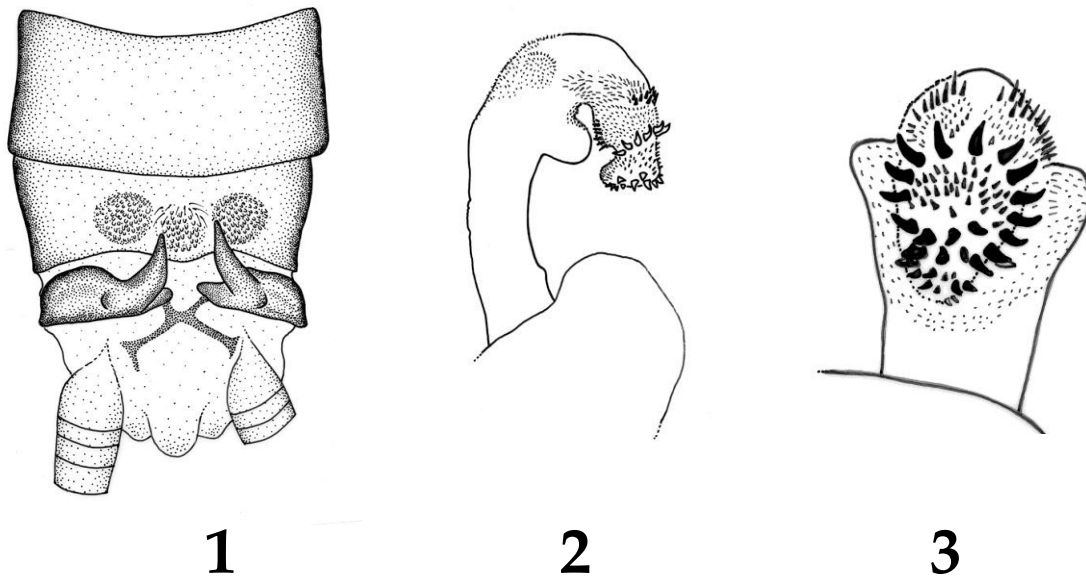
In this study we report the discovery from Thailand and Vietnam of seven previously undescribed *Phanoperla*, give additional records for previously recorded species and describe the female and egg for *P. vietnamensis* and *P. lao* Stark. We also provide a key for males of 14 *Phanoperla* species now

known from mainland Southeast Asia (*P. fuscipennis* and *P. namcattien*, not included). Material used in the study was provided by personnel of the Royal Ontario Museum, the Chiang Mai University Team and by H. Malicky. Specimens are deposited in the Royal Ontario Museum, Toronto, Canada (ROM), the Slovenian Museum of Natural History, Ljubljana, Slovenia (PMSL), the Institute of Ecology and Biological Resources, Hanoi, Vietnam (IEBR), and the Stark Collection, Clinton, Mississippi, U.S.A. (BPS).

### RESULTS AND DISCUSSION

*Phanoperla doisutep* sp. n.  
(Figs. 1-3)

**Material examined.** Holotype ♂ from Thailand, Chiang Mai Province, Doi Suthep-Pui National Park, Namtok Sai Yoi, 98° 55' N, 18° 48' E, 1000 m, 6-7 June 2002, Chiang Mai University Team (PMSL). Paratypes: Chiang Mai Province Doi Suthep-Pui



Figs. 1-3. *Phanoperla doisuthep*. 1. Male terminalia, dorsal. 2. Fully everted aedeagus, lateral. 3. Aedeagal sac apex.

National Park, Huai Kaew above Monthrarn, 98° 55' N, 18° 49' E, 800 m, 6-26 May 2002, Chiang Mai University Team 1♂ (PMSL). Phitsanulok Province, Phu Hin Rongkla National Park, Waterwheel Falls, 101° 00' N, 16° 59' E, 1280 m, 4-5 May 2003, I. Sivec (PMSL) 1♂.

**Adult habitus.** Biocellate. Ocelli large, close together and bordered by dark pigment on inner margins. Head yellow brown with slightly darker M-line and calluses; antennal bases yellow and flagellum brown. Pronotum pale with brown rugosities. Legs uniformly pale brown with small brown oval spot in upper third of tibiae; apical tarsal segment only slightly brownish. Cerci uniformly pale.

**Male.** Forewing length 10 mm. Tergum 8 with small mesal lobe. Tergum 9 with large lateral and median sensilla basiconica patches set on low mounds (Fig. 1). Hemitergal processes wide at base, tapered to an acute apex and curved slightly laterad. Aedeagal tube poorly sclerotized but with a pair of small ventrobasal knobs and a low dorsoapical membranous lobe (Fig. 2); aedeagal sac curved strongly ventrad and bearing a rounded membranous lobe near midlength; sac armature restricted to a dorsobasal patch of small to moderate

spines that extend onto lateral surface, and a more prominent subapical and apical patch which includes a prominent field of large cultriiform spines (Fig. 3).

**Female.** Unknown.

**Larva.** Unknown.

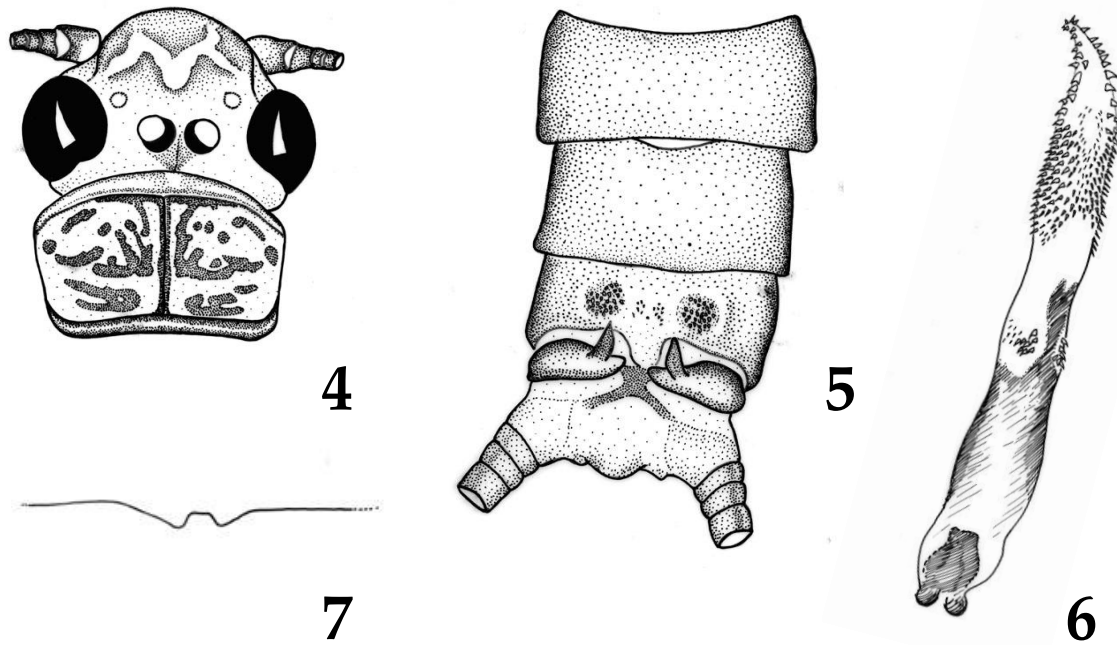
**Etymology.** The species name, used as a noun in apposition, is based on the type locality.

**Diagnosis.** The aedeagus and male terminalia of *P. doisuthep* are similar to those of *P. himalayana* Zwick, a species known from Bhutan, India and Nepal (Zwick 1982). It differs in having a poorly developed ventral sclerite and in lacking the ventroapical lobes on the aedeagal tube which occur distal to the sclerite in *P. himalayana*. In addition, *P. doisuthep* has a prominent ventral lobe on the sac that is absent in *P. himalayana* and the distribution of large apical spines on the sac also differ.

#### *Phanoperla huang* sp. n.

(Figs. 4-10)

**Material examined.** Holotype ♂ and 1♀ paratype from Thailand, Loei Province, Na Heaw National Park, Namtok Tat Huang, 100° 59' N, 17° 33' E, 500 m, 22 October 2002, I. Sivec (PMSL). Additional



Figs. 4-7. *Phanoperla huang*. 4. Head and pronotum. 5. Male terminalia, dorsal. 6. Aedeagus, oblique ventrolateral. 7. Female terminalia.

paratypes: Thailand: Boripat Waterfall, 100° 09' N, 06° 59' E, 1200 m, 27-28 April 1993, H. Malicky, 1♂ (PMSL). Mae Hong Son Province, Namtok Mae Surin National Park, Mae Nam Pai, 97° 59' N, 19° 221' E, 310 m, 19 March 2002, I. Sivec, 1♂ (PMSL).

**Adult habitus.** Biocellate, ocelli large and very close together. Head yellow brown with darker markings behind ocelli and on both sides of pale M-line (Fig. 4); antennal scape bicolored, base yellow; antennal flagellum brown. Pronotum pale with darker rugosities. Femora pale, tibiae dark along outer margin; apical tarsal segment dark brown. Basal cercal segment pale, rest of cerci brown.

**Male.** Forewing length 9 mm. Tergum 8 with small mesal lobe; posterior margin darkened and slightly emarginate. Tergum 9 with lateral sensilla basiconica patches well developed, mesal patch reduced to a few sensilla (Fig. 5). Processes of hemitergal lobes short, wide to midlength and curved laterad. Aedeagal tube more sclerotized in apical half and armed near tube apex on either side of sclerite with a small patch of variably sized spines (Fig. 6); aedeagal

sac tubular, without lobes; armature developed into a complete wide band of variably sized spines near midlength of sac and continuing beyond band with irregular row of slightly larger spines along both margins.

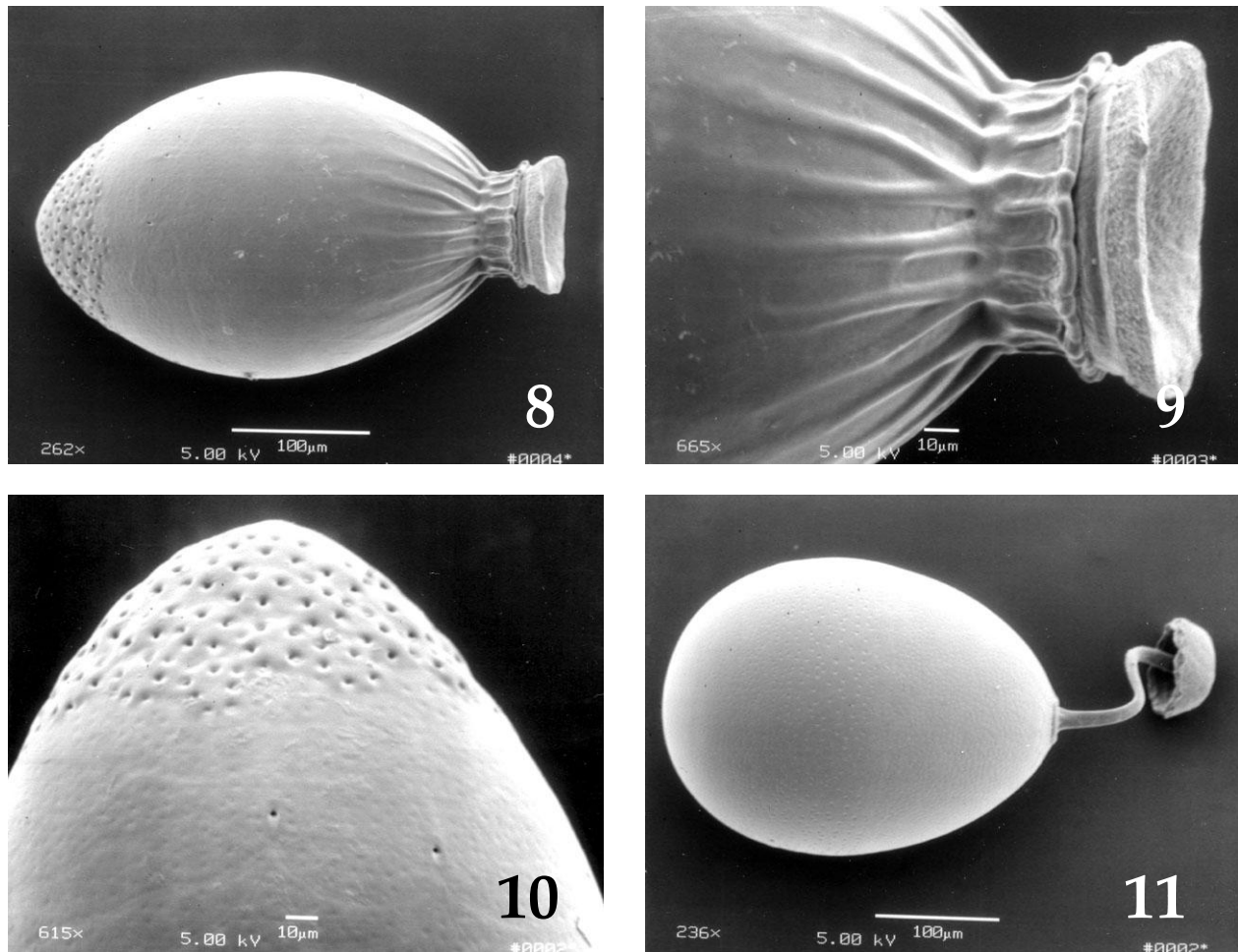
**Female.** Forewing length 11 mm. Subgenital plate slightly produced as a small triangle with wide notch (Fig. 7).

**Egg.** Oval with short, wide collar (Fig. 8); egg length ca. 344 µm, width ca. 218 µm, collar length ca. 25 µm, collar width ca. 89 µm. Sides of collar and upper egg body with a series of narrow ridges (Fig. 9); lid below micropylar line covered with small pores (Fig. 10). Micropyles simple.

**Larva.** Unknown.

**Etymology.** The species name, used as a noun in apposition, is based on the stream name of the type locality in Na Heaw National Park.

**Diagnosis.** This species is a member of the *P. pallipennis* (Banks) species group as defined by Zwick (1982) and is most similar in aedeagal structure to *P. malayana* Zwick. In that species the largest aedeagal



Figs. 8-11. *Phanoperla* eggs. *P. huang* (8-10), *P. lao* (11). 8. Entire egg, lateral. 9. Detail of collar and anchor. 10. Detail of lid. 11. Entire egg, lateral.

sac spines form a discrete, fairly regular subapical ring of a few spines whereas in *P. huang*, the largest spines are much smaller than these and are arranged in two linear clusters along the ventrolateral margins extending from the broad band of small spines at midlength of the sac to the apex. The egg is very similar to that of *P. uchidai* described below.

***Phanoperla hubleyi* sp. n.**  
(Figs. 12-13)

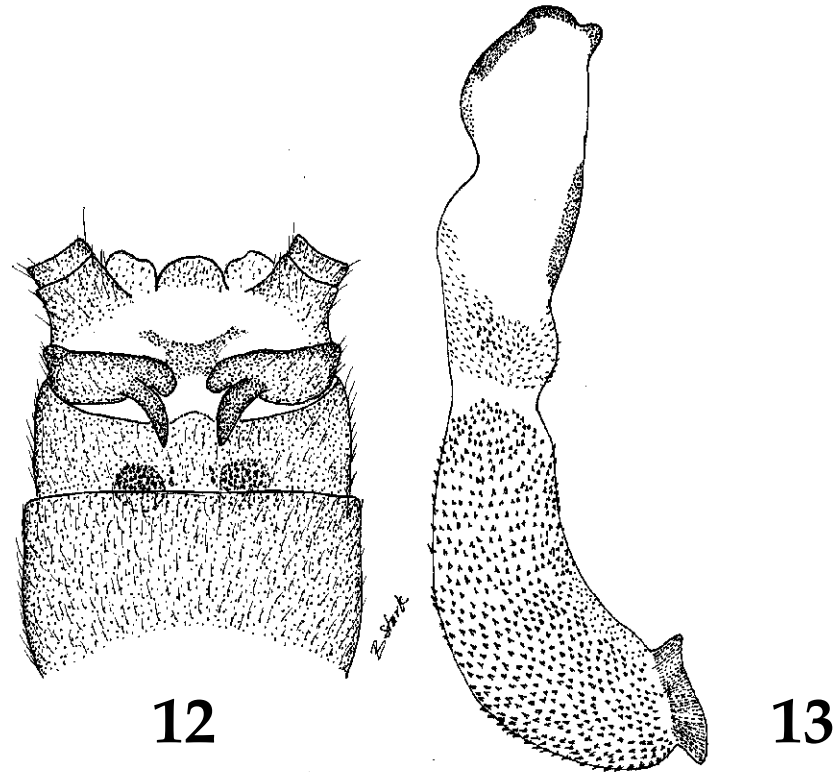
**Material examined.** Holotype ♂ from Dong Nai, Vietnam, Cat Tien National Park, stream N Park Headquarters, 23 August 1998, B. Hubley, D. Currie,

ROM 982006 (ROM). Paratype: Vietnam, Nam Cat Tien, 200 m 17-25 June 1995, H. Malicky, 1♂ (PMSL).

**Adult habitus.** Biocellate. General body color in alcohol pale without dark markings on head. Pronotum pale with obscure darker rugosities on disk; anterior and posterior margins and median suture dark brown, lateral margins pale. Wings pale, veins pale brown; Rs with two branches. Legs pale brown.

**Male.** Forewing length 7.5 mm. Tergum 8 without mesal lobe. Tergum 9 with lateral sensilla basiconica patches set on low humps, median patch reduced to a few stray sensilla. Processes of hemitergal lobes curved distinctly laterad (Fig. 12). Mesal clusters of





Figs. 12-13. *Phanoperla hubleyi*. 12. Male terminalia, dorsal. 13. Fully everted aedeagus, lateral.

long setae present on sternum 7, poorly developed on sternum 6 and absent on sternum 8. Aedeagal tube and sac without lateral lobes; dorsal sclerite about half tube length, wide and truncate apically; sac as long as tube and armed almost to tip with a dense patch of moderate size spines; sac apex armed with finer and denser spination; apex of tube with a broad complete ring of fine spines (Fig. 13).

**Female.** Unknown.

**Larva.** Unknown.

**Etymology.** The patronym honors B. Hubley, collector of the holotype and other significant material used in this study.

**Diagnosis.** The aedeagus of this species is generally similar to that of the Ceylonese species, *P. wedda* Zwick, although the sac is not as inflated. In addition, *P. wedda* differs in having a mesal cluster of long setae on sternum 8, a well developed mesal sensilla patch on tergum 9, and a slender dorsal aedeagal sclerite.

#### *Phanoperla imitatrix* Zwick

*Phanoperla imitatrix* Zwick, 1986:154. Holotype ♂ (B.P. Bishop Museum). Fyan, Vietnam

**Material examined.** Vietnam: Gia Lai, An Khe Dist., Tram Lap, Azun River, 3 km NE forestry building, 21 June 1996, D. Currie, J. Swann, ROM 961076, 2♂ (ROM). Gia Lai, An Khe Dist., Tram Lap, Azun River, NE Tram Lap, 20 June 1996, B. Hubley, D. Currie, ROM 961073, 1♂ (IEBR).

**Remarks.** Previous records are from the type locality and from the Ban Me Thuot area of Dac Lac Province south of the newly reported sites in Gia Lai Province.

#### *Phanoperla lao* Stark

(Figs. 11, 14-15)

*Phanoperla lao* Stark, 1983:99. Holotype ♂ (National Reference Collection, Thailand). Chiang Mai, Mon Ung Kate, Thailand

**Material examined.** Thailand: Chiang Mai Province, Doi Inthanon National Park, Huai Sai Lueng, 98° 27' N, 18° 31' E, 1060 m, 7-8 May 2002, Chiang Mai University Team, 1♂, 1♀ (PMSL).

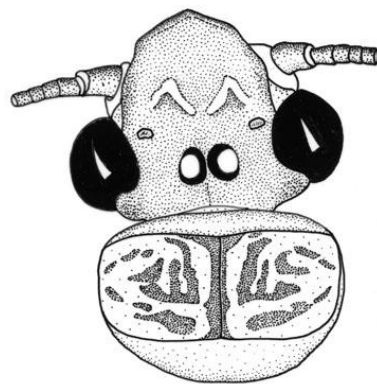
This species was previously known from the type series of 10 male specimens collected in Chiang Mai Province. The female is associated for the first time.

**Female.** Biocellate. Forewing length 11 mm. Head rather uniformly brown except for pale M-line. Pronotum with dark median band and scattered dark

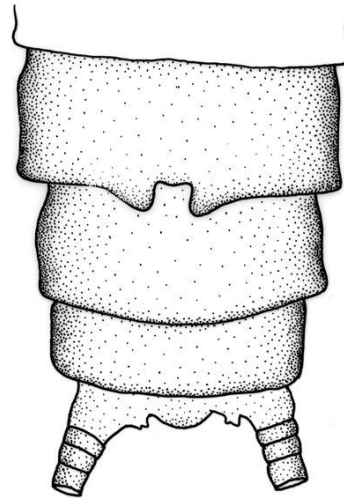
rugosities on disk (Fig. 14). Subgenital plate slightly produced and deeply divided by a quadrate notch into two small lobes (Fig. 15).

**Egg.** Tear drop-shaped, length ca. 318 µm, equatorial width ca. 238 µm. Collar sessile but anchor petiolate, ca. 120 µm long (Fig. 11). Chorionic surface finely pitted throughout.

**Remarks.** The egg, female and aedeagus of this species place it close to *P. himalayana* Zwick in the *P. maindroni* (Navas) species group as defined by Zwick (1982).



14



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Figs. 14-15. *Phanoperla lao*. 14. Head and pronotum. 15. Female terminalia.

### *Phanoperla lisu* Stark

*Phanoperla lisu* Stark, 1983:100. Holotype ♂ (National Reference Collection, Thailand). Chiang Mai, Ban Yang, Thailand

**Material examined.** Thailand: Chiang Mai Province, Doi Suthep-Pui National Park, Namtok Sai Yoi, 98°55' N, 18° 48' E, 1000 m, 7 May 2002, 1♂ (PMSL).

**Remarks.** This species was previously known from the holotype (Stark 1983); Uchida & Yamasaki (1989) reported a second specimen from Thung Saleng Luang, Thailand but that is based on a closely related species, *P. uchidai* which we describe below.

### *Phanoperla lobata* sp. n.

(Figs. 16-18)

**Material examined.** Holotype ♂ and 4♂ paratypes from Dong Nai, Vietnam, Cat Tien National Park, stream N of Park Headquarters, 120 m, 23 August 1998, B. Hubley, D. Currie, ROM 982006 (holotype ROM, paratypes ROM, IEBR). Additional paratypes: Vietnam: Dong Nai, Cat Tien National Park, stream N of Park Headquarters, 120 m, 22 August 1998, B. Hubley, D. Currie, ROM 982002, 2♂ (BPS). Dong Nai, Cat Tien National Park, gazebo near Park Headquarters, Dong Nai River, 31 May 1999, D. Currie, D.C. Darling, B. Hubley, ROM 993045, 1♂

(ROM). Nam Cat Tien, 200 m, 17-25 June 1995, H. Malicky, 1♂ (PMSL).

**Adult habitus.** Biocellate. General body color in alcohol pale without dark markings on head. Pronotum pale with obscure, slightly darker rugosities; entire pronotal margins dark brown. Wings membranous, veins pale brown; Rs with two branches. Legs pale brown.

**Male.** Forewing 7.0-7.5 mm. Tergum 8 with a wide, slightly produced median lobe. Tergum 9 with median and two lateral sensilla basiconica patches set on low humps. Process of hemitergal lobes curved slightly laterad, wide basally and tapered to tip (Fig. 16). Mesal clusters of long setae present on abdominal sterna 5-7. Aedeagal tube and sac without lateral lobes; dorsal sclerite rhomboid-shaped and almost as long as tube; sac short, plump, curved ventrad and armed laterally with prominent transverse double rows of lateral spines; spine rows incomplete on dorsal (Fig. 18) and ventral (Fig. 17) margins; larger more basally located row in lateral aspect consists of 6-8 large black cultriiform spines;

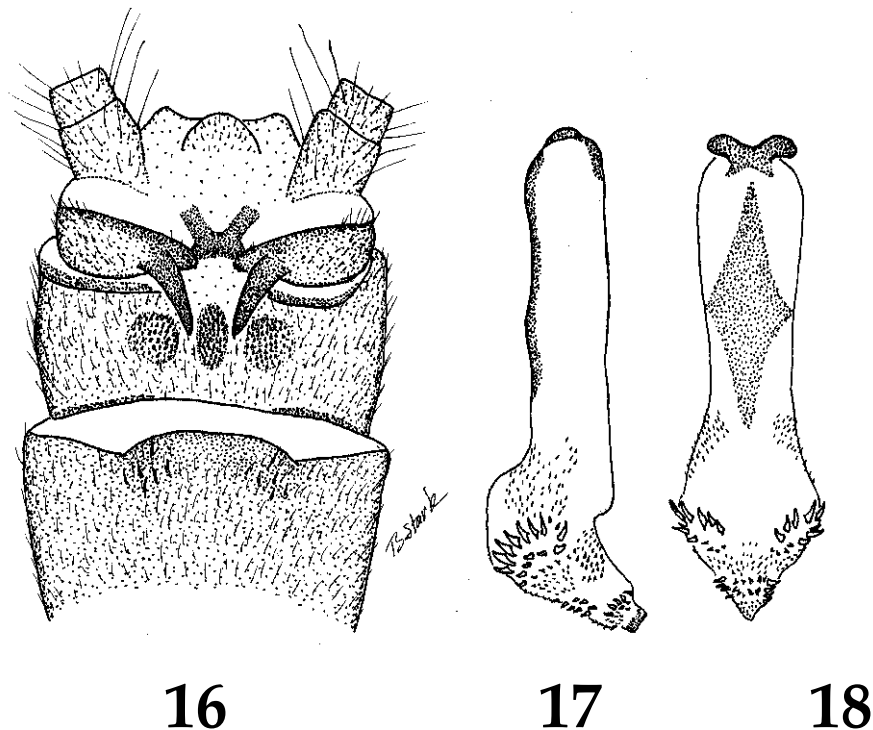
smaller more apically located row in lateral aspect consists of ca. 6 smaller, black cultriiform spines; additional clusters of smaller spines occur on each side of large spine rows, and another cluster of relatively large spines occurs near apex (Figs. 17-18).

**Female.** Unknown.

**Larva.** Unknown.

**Etymology.** The species name refers to the presence of a small lobe on the male 9<sup>th</sup> tergum.

**Diagnosis.** The absence of lateral lobes and the aedeagal armature detail of this species are similar to those features in *P. incompleta* Zwick, but that species has many more spines in the double rows and the spines are more similar in size. In addition, *P. incompleta* has no lobe on tergum 8 (Zwick 1986). The aedeagus is also similar to that of *P. namcattien*, a new species proposed by Cao & Bae (2009) from Nam Cat Tien, but that species is shown to have longer, more slender spines with a more extensive subapical grouping and it apparently also lacks a lobe on tergum 8. Specimens of *P. namcattien* were unavailable to us.



Figs. 16-18. *Phanoperla lobata*. 16. Male terminalia, dorsal. 17. Fully everted aedeagus, lateral. 18. Fully everted aedeagus, dorsal.

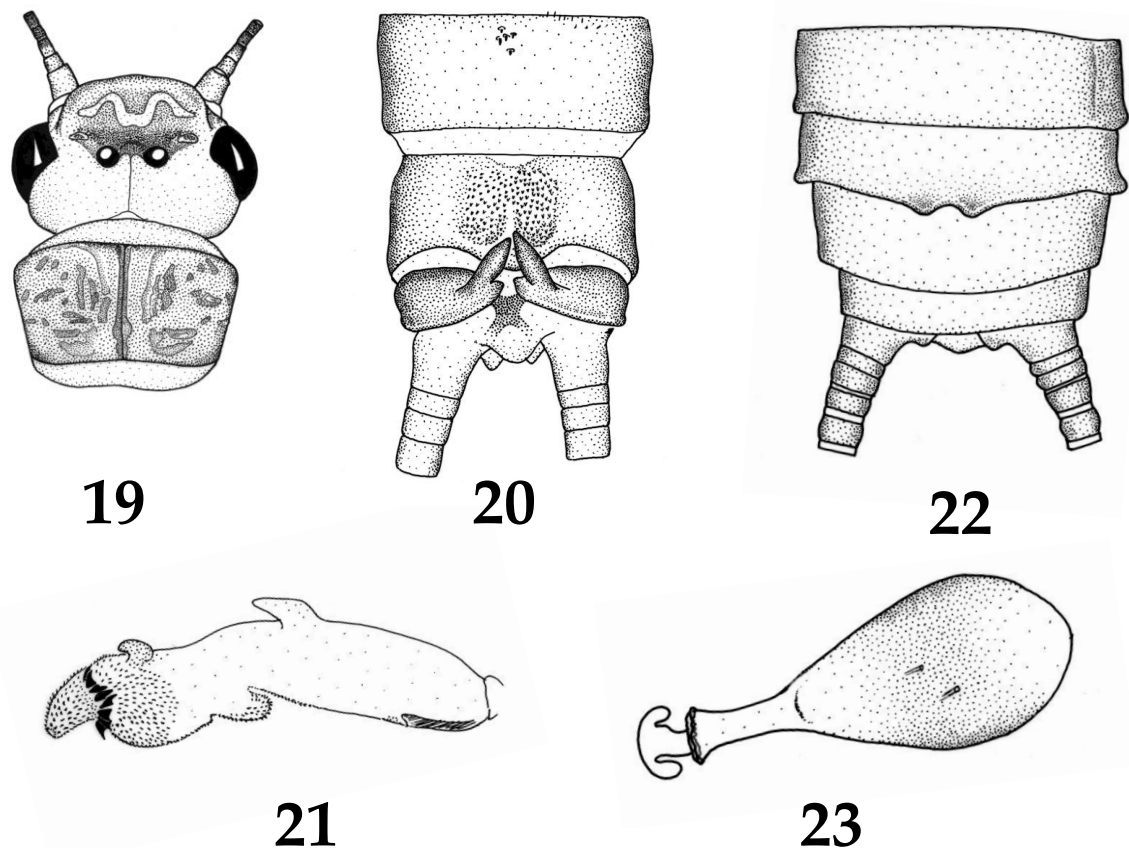
***Phanoperla malayana* Zwick**

*Phanoperla malayana* Zwick, 1982:104. Holotype ♂ (Field Museum of Natural History). Krachong Forest near Trang, Thailand

**Material examined.** Thailand: Ton Nga Chang, 100 m, 24 April 1993, H. Malicky, 1♂, 1♀ (PMSL). Chiang Mai Province, Chiang Dao, 98° 55' N, 19° 21' E, 25 April-2 July 2003, numerous male and female

specimens. Chiang Mai Province, Doi Inthanon National Park, Haui Mae Pan Noi, 750 m, 3-4 April 2003, I. Sivec, 1♂ (PMSL). Songkhla-Satun Province, Ton Nga Chang Waterfall, 100° 14' N, 6° 57' E, 24 April 1993, H. Malicky, 1♂, 2♀ (PMSL). Tham Than Lod National Park, 500 m, 99° 20' N, 14° 46' E, 5 April 1989, H. Malicky & Wan Lee Lang, 3♂, 2♀ (PMSL).

**Remarks.** This species was previously reported from Malaysia and from two sites in Thailand by Zwick (1982).



Figs. 19-23. *Phanoperla occipitalis*. 19. Head and pronotum. 20. Male terminalia, dorsal. 21. Aedeagus, lateral. 22. Female terminalia. 23. Egg.

***Phanoperla occipitalis* sp. n.**  
(Figs. 19-23)

**Material examined.** Holotype ♂ and 2♂ paratypes from Thailand, Chiang Mai Province, Doi Suthep-Pui National Park, Namtok Monthatarn, 98° 55' N, 18°

49' E, 700 m, 5-6 May 2002, Blacklight trap, Chiang Mai University Team (PMSL). Additional paratypes: Thailand: type locality, 27 May-6 June 2002, Malaise trap, Chiang Mai University Team, 1♀ (PMSL). Chiang Mai Province, Doi Inthanon National Park, 98° 27' N, 18° 31' E, 1060 m, Huai Sai Lueng, 7-8 May



2002, Blacklight trap, Chiang Mai University Team, 1♀ (PMSL). Chiang Mai Province, Doi Inthanon National Park, Nam Mae Klang at Ban Sop Aep, 98° 36' N, 18° 31' E, 630 m, 7-8 June 2002, I. Sivec, 1♂(PMSL). Doi Suthep- Pui National Park, Huai Kaew above Monthratarn, 800 m, 6-26 May 2002, I. Sivec, 1♂ (PMSL). Khampaeng Phet Province, Khlong Lan National Park, namtok Khlong Lan, 99° 16' N, 16° 07' E, 310 m, 21 February 2002, 1♀, Chiang Mai University Team (PMSL). Same location, 7-8 March 2002, 6♂, 7♀, Chiang Mai University Team (PMSL). Same location, 19-20 June 2002, 3♂, 2♀, Chiang Mai University Team (PMSL). Same location, 21-22 August 2002, 1♂, Chiang Mai University Team (PMSL). Same location, 19-20 October 2002, 1♂, 1♀, Chiang Mai University Team (PMSL).

**Adult habitus.** Biocellate with ocelli separated by at least one ocellar diameter. Occiput yellow, contrasting with dark frons; M-line pale, epicranial suture dark (Fig. 19). Pronotum brown with pale rugosities.

**Male.** Forewing length 11 mm. Tergum 8 without mesal lobe. Tergum 9 with large mesal patch of sensilla basiconica almost divided by thin bare area devoid of structures; hind margin of tergum 9 produced as a small mesal lobe (Fig. 20). Processes of hemitergal lobes short and wide but acute at apex. Aedeagal tube with slender ventral sclerite and ventroapical membranous lobe; aedeagal sac bearing a dorsobasal and a smaller, distal ventral lobe; both lobes covered at least partially by small spines (Fig. 21); apex and subapex of sac armed with a continuous broad band of spines; largest spines form an almost complete, close-set, subapical ring.

**Female.** Forewing length 12 mm. Subgenital plate wide, slightly produced over anterior margin of sternum 9 and shallowly notched (Fig. 22).

**Egg.** Outline tear drop-shaped, with long slender collar, flanged rim and short, petiolate anchor (Fig. 23).

**Larva.** Unknown.

**Etymology.** The species name refers to the distinctively pale occiput of this species.

**Diagnosis.** This relatively large species is similar to *P. sertispina* Jewett in external male genitalic and aedeagal characters. It differs in having the sensilla patch of tergum 9 united on the anterior margin and in having the ventral and dorsal lobes of the aedeagal

sac covered with spines. In *P. sertispina* no dorsobasal lobe is shown by Zwick (1982) and the midventral sac lobe is membranous and lacks spines. The eggs of the two species also differ, with *P. occipitalis* eggs lacking markedly raised “meshes” on the collar.

### *Phanoperla simplex* Zwick

*Phanoperla simplex* Zwick, 1982:114. Holotype ♂ (British Museum of Natural History). Kuala Lumpur, Malaysia

*Phanoperla simplex*: Zwick & Sivec, 1985:124. In part

**Material examined.** Thailand: Chiang Mai Province, Chiang Dao National Park, Namtok Srisungwan, 98° 57' N, 19° 37' E, 600 m, 26 May 2002, Chiang Mai University Team, 1♀ (PMSL). Chiang Mai Province, Chiang Dao, 18 May 1983, 1♂ (PMSL). Khampaeng Phet Province, Khlong Lan National Park, Namtok Klong Lan, 99° 16' N, 16° 07' E, 310 m, 19-20 October 2002, I. Sivec, 1♀ (PMSL). Mae Hong Son Province, Namtok Mae Surin National Park, Mae Nam Pai, 97° 59' N, 19° 21' E, 310 m, 15 October 2002, I. Sivec, 1♀ (PMSL). Same site, 19 March 2002, 1♂, 1♀ (PMSL).

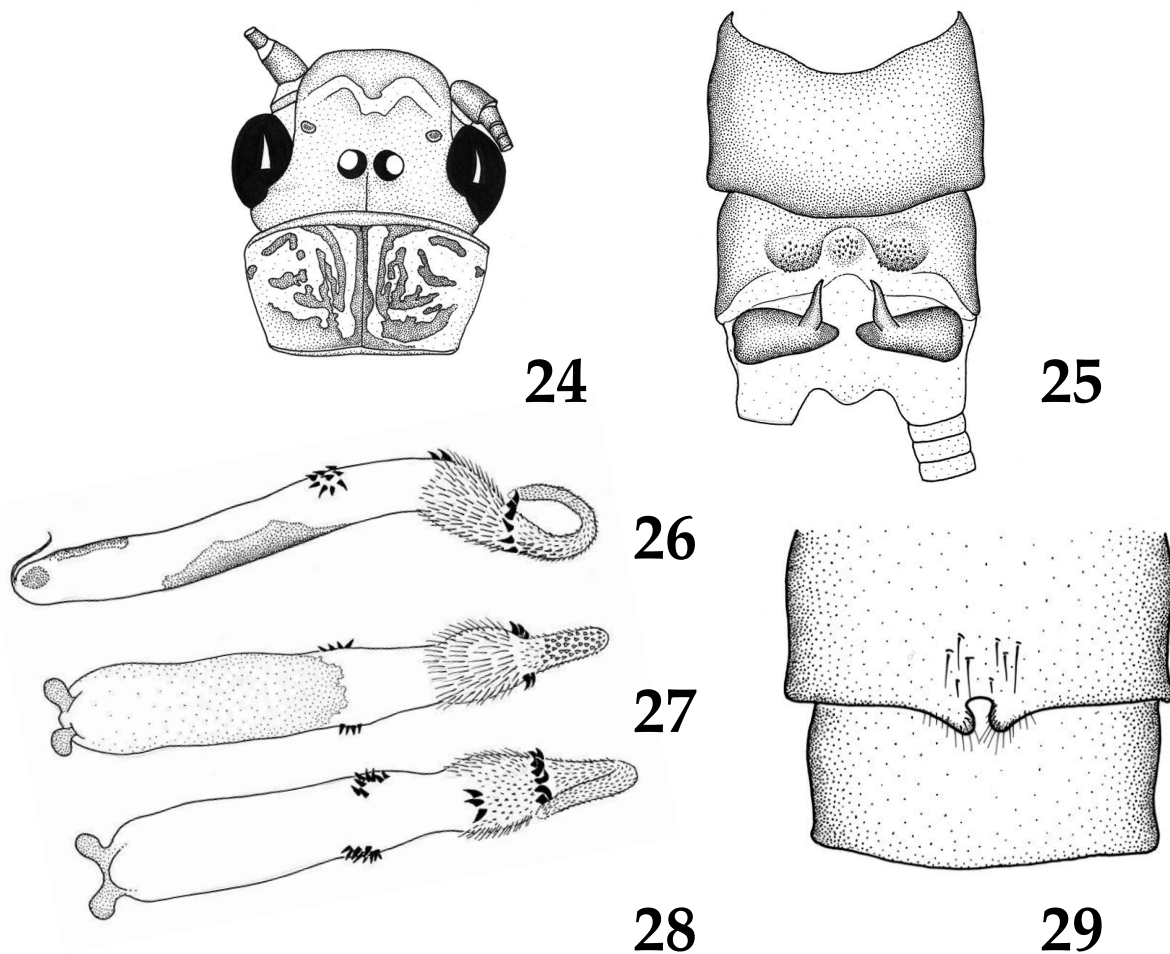
**Remarks.** Zwick (1982) reported this species from several Malaysian and Thai sites and additional localities were given in Zwick & Sivec (1985). The latter study includes specimens from Sumatra which have egg collars markedly different from mainland specimens. In our experience this much variation in such a structure suggests more than one species is involved. In our opinion various populations of *P. simplex* should be carefully re-examined when material becomes available.

### *Phanoperla uchidai* sp. n.

(Figs. 24-32)

*Phanoperla lisu*: Uchida & Yamasaki, 1989:141. Not Stark, 1983

**Material examined.** Holotype ♂ and 59♂, 46♀ paratypes from Thailand, Kao Soi Dao National Park, 102° 10' N, 13° 06' E, 400 m, 22-23 April 1996, H. Malicky, P. Chantaramongkol (PMSL). Additional paratypes: Thailand: Chiang Mai Province, Chiang Dao, River King, 4 April 1993, I. Sivec, Horvat, 1♂, 1♀ (PMSL). Chiang Mai Province, Doi Inthanon National Park, Bang Khun Klang, 98° 32' N, 18° 32' E,



Figs. 24-29. *Phanoperla uchidai*. 24. Head and pronotum. 25. Male terminalia, dorsal. 26. Aedeagus, lateral. 27. Aedeagus, dorsal. 28. Aedeagus, ventral. 29. Female terminalia.

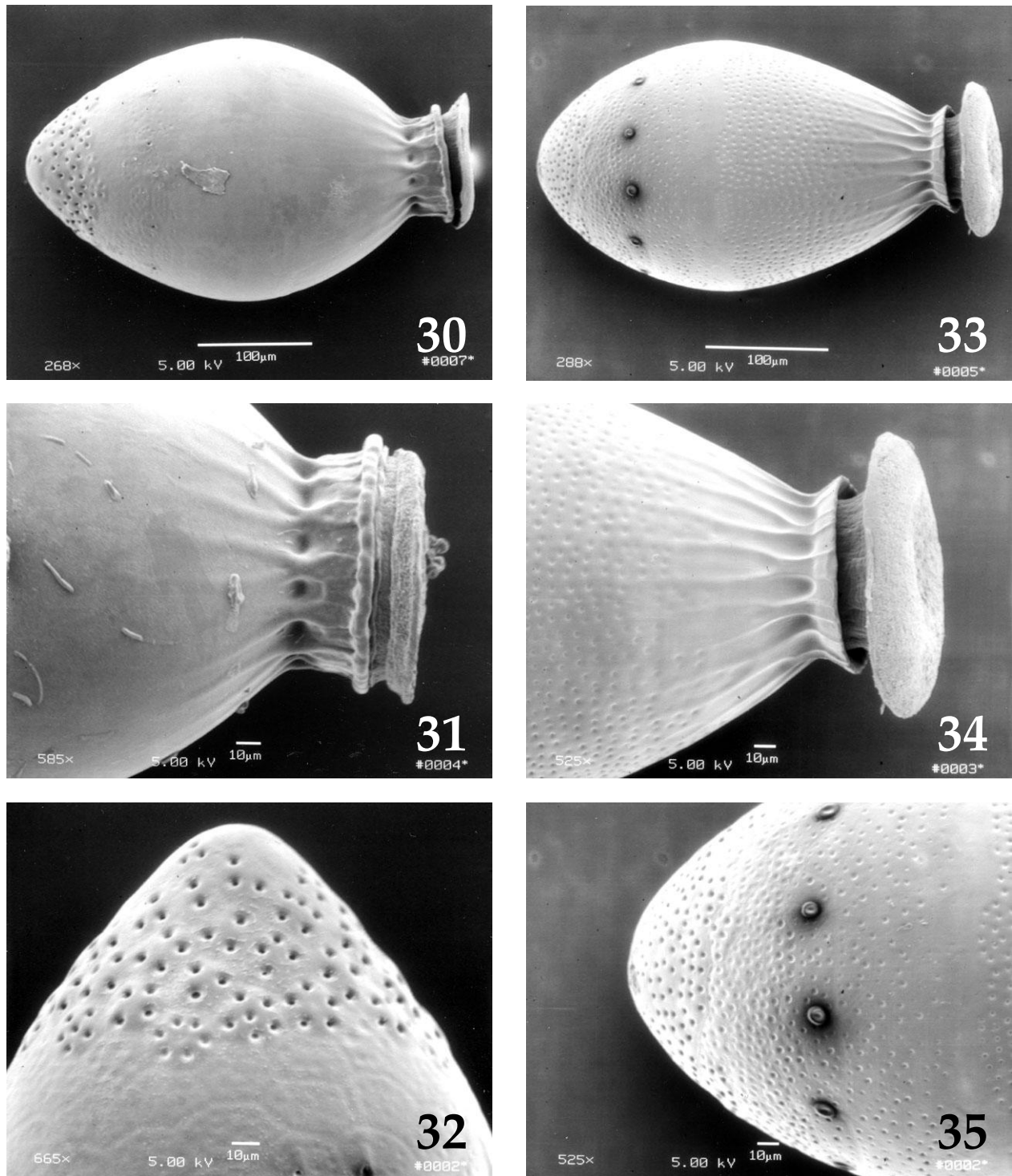
1200 m, 10-17 July 1989, H. Malicky, P. Chantaramongkol 1♀ (PMSL). Same location, 17-26 July 1989, H. Malicky, P. Chantaramongkol, 1♀ (PMSL). Lamphun Province, Mae Ping National Park, Huai Mae Hat, 98° 52' N, 17° 40' E, 660 m, 5-10 September 1991, H. Malicky, 5♂, 3♀ (PMSL).

**Adult habitus.** Biocellate, ocelli large and nearly touching. Occiput dusky behind ocelli and median suture line dark; frons dusky without distinct dark pattern; M-line pale (Fig. 24). Pronotum pale with darker rugosities.

**Male.** Forewing length 8-8.5 mm. Tergum 8 with low, broad, mesal lobe. Tergum 9 with lateral patches of sensilla basiconica set on low mounds and small

median patch set in depression between lateral patches (Fig. 25). Hemitergal processes short, acute and curved slightly inward at tips. Sclerite of aedeagal tube broadly covering dorsal surface from midlength to near apex, and extending around dorsolateral margins; aedeagal sac with lateral patches of spines near base and a large apical patch which begins near midlength (Figs. 26-28); apex long and tapered, largest spines form a partial ring near mid point of patch.

**Female.** Forewing length 9-9.5 mm. Subgenital plate slightly produced and deeply notched, dividing plate into a pair of small lobes (Fig. 29). Lobes of plate bear several long thin setae and a few thick setae occur anterior to notch.



Figs. 30-35. *Phanoperla* eggs. *P. uchidai* (30-32), *P. vietnamensis* (33-35). 30. Entire egg, lateral. 31. Detail of collar and anchor. 32. Detail of lid. 33. Entire egg, lateral. 34. Detail of collar and anchor. 35. Detail of lid.



**Egg.** Oval, with short, wide collar, distinctly constricted at base; egg length ca. 363  $\mu\text{m}$ , width ca. 221  $\mu\text{m}$ , collar length ca. 29  $\mu\text{m}$ , collar width ca. 106  $\mu\text{m}$  (Fig. 30). Sides of collar with several vertical ridges which extend onto egg body (Fig. 31). Lid covered completely with fine punctations below micropylar line (Fig. 32). Micropyles with slightly raised rim along lower surface.

**Larva.** Unknown.

**Etymology.** The patronym honors our friend and colleague, S. Uchida for his important contributions in the study of Asian Plecoptera.

**Diagnosis.** The aedeagus of this species is similar to that of *P. lisu* Stark but in that species the largest sac armature consists of lateral rows of spines which become less prominent apically.

*Phanoperla vietnamensis* Zwick  
(Figs. 33-36)

*Phanoperla vietnamensis* Zwick, 1986:151. Holotype ♂ (B.P. Bishop Museum). Kim Lien, Vietnam

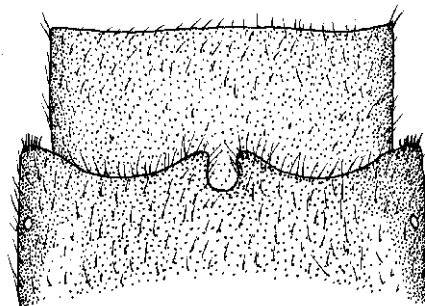
**Material examined.** Vietnam: Dac Lac, Yok Don National Park, Park Headquarters, ca. 2 km SE Ban Don, 31 May 1997, D.C. Darling, D. Currie, A. Guidotti, ROM 974019, 2♂, 5♀ (ROM). Dong Nai, Cat Tien National Park, nr. Park Headquarters, 22 August 1998, B. Hubley, D. Currie, ROM 982002, 2♂, 1♀ (ROM, IEBR). Same site, 23 August 1998, B. Hubley, D. Currie, ROM 982006, 4♂ (ROM, BPS). Gia Lai, An Khe Dist., Tram Lap, Azun River, 21 June 1996, D. Currie, J. Swann, ROM 961076, 1♂ (ROM). Same site, 23 June 1996, D. Currie, J. Swann, ROM 961084, 1♂ (ROM). Same site, 17 June 1996, D. Currie, J. Swann, ROM 961056, 2♂ (IEBR). Nam Cat Tien, 200 m, 17-25 June 1995, H. Malicky, 1♂ (PMSL). Nghe An, W Con Cuong, Khe Moi Forestry Camp, 25-26 October 1994, D. Currie, ROM 946111, 1♂ (ROM).

**Remarks.** The new records are from sites in the central and southern regions of Vietnam, generally north of the Lam Dong site where a paratype was collected (Zwick 1986). The females are associated on the basis of occurrence together with males of *P. vietnamensis* at two sites and on the basis of slightly larger size for this species than for others found at Cat Tien National Park.

**Female.** Forewing length 10-11 mm. Body pale,

without distinctive dark pigment except on margins and median suture of pronotum. Subgenital plate lobes directed inward and apically narrowed; notch U-shaped (Fig. 36). Plate generally similar to that of *P. maindroni* (Navas) and *Phanoperla* sp. D (Zwick 1982) but the notch appears to be somewhat narrower and more rounded anteriorly than for either of these species.

**Egg.** Length ca. 435  $\mu\text{m}$ , equatorial width ca. 205  $\mu\text{m}$ . Collar short and ca. 84  $\mu\text{m}$  wide at rim; basal constriction ca. 74  $\mu\text{m}$  wide diameter (Fig. 33). Chorion punctate over most of surface but smooth in a narrow equatorial ring (Fig. 35); chorionic pits absent in zone along ribs extending from collar (Fig. 34); pits deeper and more distinct on lid (Fig. 35). Micropyles appearing evenly spaced in specimens examined; orifices surrounded by smooth circular rims. The egg of *P. vietnamensis* is similar to that of *P. wedda* (Zwick 1982) but varies in lacking pits along the chorionic ribs associated with the collar.



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Fig. 36. *Phanoperla vietnamensis* female subgenital plate and sternum 9.

*Phanoperla wieng* sp. n.  
(Figs. 37-41)

**Material examined.** Holotype ♂ from Thailand, Phrae Province, Wieng Ko Sai National Park, Namtok Maekueng, Tier 1, 99° 35' N, 17° 58' E, 350 m, 25-26 October 2002, Chiang Mai University Team (PMSL).

**Adult habitus.** Biocellate with ocelli nearly touching. Occiput and most of frons pale but median suture dark and area around M-line dusky; lappets brown



(Fig. 37). Palpi and antennae brown. Legs pale brown, dorsum of tibiae and tarsi darker. Wings brown with darker venation.

**Male.** Forewing length 10 mm. Tergum 8 without median lobe. Tergum 9 with lateral sensilla basiconica patches set on low mounds, median patch absent. Hemitergal processes short, wide at base and tapered to apex (Fig. 38). Aedeagal tube sclerite slender and narrowed apically; tube sprinkled with small spines over the apical region (Fig. 41); sac rather densely armed over most of surface; largest spines form a subapical double ring and an

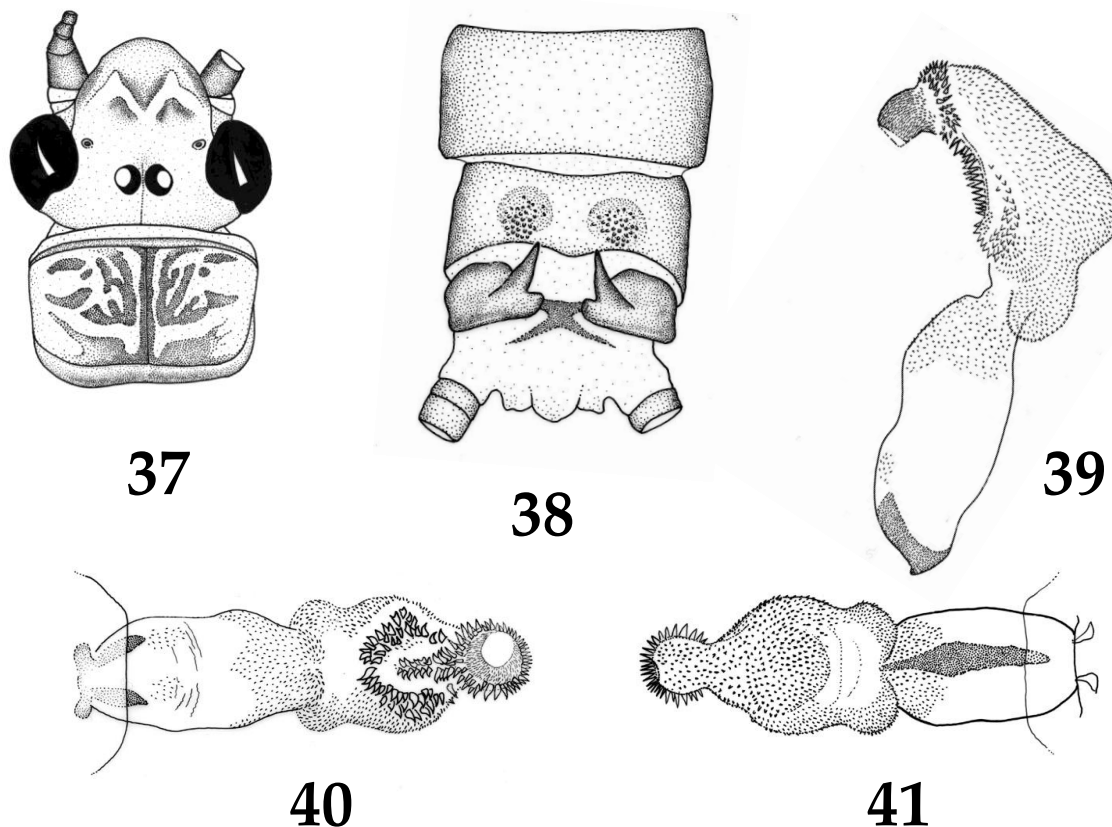
additional mesal circle, partially divided by a double row of spines (Figs. 39-41).

**Female.** Unknown.

**Larva.** Unknown.

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

**Diagnosis.** The male genitalia and aedeagus of this species is similar to those of *P. vietnamensis* Zwick. The new species differs in lacking the two small rows of sensilla which form the mesal patch on tergum 9 in *P. vietnamensis*, and in having a complete double row of large cultriform spines encircling the aedeagal sac.



Figs. 37-41. *Phanoperla wieng*. 37. Head and pronotum. 38. Male terminalia, dorsal. 39. Aedeagus, lateral. 40. Aedeagus, ventral. 41. Aedeagus, dorsal.

**Provisional Key for Mainland Southeast Asian  
*Phanoperla* Males**

[*P. fuscipennis* (Navas) and *P. namcattien* Cao & Bae not included]

- 1 Tergum 8 with a small median lobe (Fig. 15) ..... 2
- 1' Tergum 8 unmodified (Fig. 1) ..... 6
- 2 Aedeagal sac tubular, gradually tapered; basolateral area of sac with a pair of spiny patches (Figs. 6, 26) ..... 3

- |     |  |                     |
|-----|--|---------------------|
| 2'  | Aedeagal sac with additional lobes; basolateral area of sac without spiny patches (Figs. 2, 17) .....  | 5                   |
| 3   | Largest spines on aedeagal sac form a transverse subapical row (Fig. 26) .....   | <i>uchidai</i>      |
| 3'  | Largest spines on aedeagal sac form irregular longitudinal rows (Fig. 6) .....   | 4                   |
| 4   | Largest spines on aedeagal sac located nearer base of sac; spines become smaller nearer apex .....   | <i>lisu</i>         |
| 4'  | Largest spines clustered near tip of aedeagal sac (Fig. 6) .....   | <i>huang</i>        |
| 5   | Largest aedeagal spines form transverse row more or less in center of apical spine patch (Fig. 2) .....  | <i>doisuthep</i>    |
| 5'  | Largest aedeagal spines form transverse row at basal margin of apical spine patch (Fig. 17) .....  | <i>lobata</i>       |
| 6   | Aedeagal armature entirely of small to moderate size spines .....  | 7                   |
| 6'  | Aedeagal armature includes large black cultriform spines .....   | 10                  |
| 7   | Everted aedeagal sac with one or more membranous lobes .....   | 8                   |
| 7'  | Everted aedeagal sac tubular, without extra lobes .....  | 9                   |
| 8   | Mesal area of tergum 9 with two small irregular rows of sensilla between lateral patches; mesal section of aedeagal sac with a single finger-like lobe .....   | <i>lao</i>          |
| 8'  | Mesal area of tergum 9 without median sensilla between lateral patches; mesal section of aedeagal sac with a pair of finger-like lobes .....   | <i>imitatrix</i>    |
| 9   | Major aedeagal armature on everted sac restricted to patch covering less than half sac length; basal half of sac constricted between sac apex and tube .....   | <i>simplex</i>      |
| 9'  | Major aedeagal armature on everted sac covers almost entire sac length (Fig. 13); base of sac constricted but sac gradually widens from base to subapical area .....   | <i>hubleyi</i>      |
| 10  | Subapical area of everted aedeagal sac bearing a complete single or double ring of large, black, cultriform spines (Figs. 21,39); tergum 9 with two large patches of sensilla, or a single fused median patch (Fig. 20) .....                | 11                  |
| 10' | Subapical area of everted aedeagal sac bearing an incomplete ring of large, black, cultriform spines; tergum 9 with median sensilla between lateral patches .....  | 13                  |
| 11  | Almost entire lateral surface of aedeagal sac and apex of tube covered with a continuous spine patch (Fig. 39); largest aedeagal spines form a complete subapical double ring; sensilla patches of tergum 9 widely separated (Fig. 38) ..... | <i>wieng</i>        |
| 11' | About half of aedeagal sac surface covered with continuous spine patch (Fig. 19); largest aedeagal spines form a subapical single ring; sensilla patches of tergum 9 narrowly separated or united at base (Fig. 20) .....                    | 12                  |
| 12  | Sensilla patches of tergum 9 completely divided; membranous lobe of aedeagal sac not covered with spines .....   | <i>sertispina</i>   |
| 12' | Sensilla patches of tergum 9 united basally (Fig. 20); membranous lobes of aedeagal sac covered with spines (Fig. 21) .....  | <i>occipitalis</i>  |
| 13  | Everted aedeagal sac tubular, without membranous lobes; tergum 9 with a single median sensilla patch .....   | <i>malayana</i>     |
| 13' | Everted aedeagal sac bulbous and bearing a small finger-like membranous lobe; tergum 9 with median sensilla grouped in two irregular rows .....  | <i>vietnamensis</i> |

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