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## Some *Neoperla* from Taiwan (Plecoptera: Perlidae)

With 51 text figures

### Introduction

The present paper tries to provide a sound basis for the study of *Neoperla* from Taiwan (Formosa) by redescribing previously named (but generally insufficiently described) Taiwanese species from types. Some additional material was also examined and one new species is named, but we do not attempt to present a comprehensive treatment of the Taiwanese species now. The discrepancy in the number of known males and females of the *N. clymene*-group suggests that a lot of work remains to be done. Types of *N. formosana* OKAMOTO not available to us have recently been examined by UCHIDA (1987). All other types have been examined by one or both of us. Note that *N. hatekayamae* OKAMOTO allegedly named from Taiwan (ILLIES, 1966) was in fact described from Echigo, Japan and does not occur in Taiwan. Nor does *N. luteola* (BURMEISTER), which NAVÁS (1930) reported, based on misidentified specimens; see *N. formosana*. Our present findings have been compared to ample recent information on Oriental *Neoperla* (mainly SIVEC 1984, STARK 1983, ZWICK 1980, 1981, 1983, ZWICK & SIVEC 1980) that has elucidated identity of most of the named but previously doubtful taxa. The one most unfortunate major gap remaining in our knowledge of Oriental *Neoperla* concerns the Chinese mainland. Types of many of the species named from there are definitely lost, others are unavailable now.

The Taiwanese representatives of *Neoperla* belong to the *clymene*- and *montivaga*-groups as defined by ZWICK (1983). The presence of the *clymene*-group already suggests close mainland affinities of the Taiwanese fauna. The absence of genus *Phanoperla* further suggests that colonisation did not occur from the very south of the Asian mainland. In fact, two species (*N. cavaleriei* and *N. sauteri*) have very close mainland affinities, but there are no apparent close relations to the various other Oriental island faunas of *Neoperla*.

Techniques used in the study of the present material are those described by ZWICK (1983). Location of material is indicated by abbreviations explained in the acknowledgements below. LFS stands for specimens in coll. ZWICK, in the Limnologische Flußstation, Schlitz. Other abbreviations are HT10, S and T, for hemitergite 10, sternite and tergite, respectively. Illustrations of penes are so orientated that their upper right

corners show the dorsal side of the penis base, as it rests in the abdomen of the male.

We would like to express our sincere thanks to all who have supported our study through loans of material, by pre-publication information on their studies on Oriental *Neoperla*, or who have kindly allowed us description of material also available to them: J. DLABOLA (National Museum, Prague; NMP), O. S. FLINT, jr. (United States National Museum; USNM), D. GEIJSKES† and P. VAN DOESBURG (Museum Leiden; ML), V. KELNER-PILLAULT† (Muséum National d'Histoire Naturelle, Paris; MNHN), the late G. MORGE and G. PETERSEN (Institut für Pflanzenschutzforschung, Eberswalde-Finow, former Deutsches Entomologisches Institut; DEI), A. F. NEWTON and assistants (Museum of Comparative Zoology, Cambridge, Mass.; MCZ), G. N. NISHIDA (BERNICE P. BISHOP Museum, Honolulu; BPBM), B. P. STARK (Clinton, Mass.) and S. UCHIDA (Tokyo).

### The *clymene*-Group

#### *Neoperla sauteri* KLAPÁLEK

(Figs. 1–4)

*Neoperla sauteri* KLAPÁLEK, 1912; Ent. Mitt. 1, 344, textfigs. 1, 2.

Small ochre species, head pattern often like Fig. 1, variable, not distinctive; in some specimens, head and prothorax are brownish. Wings light ochre, anterior branch of *Rs* with long fork, posterior one from anastomosis. There may or may not be a small terminal fork of the anteriormost branch of *Rs*.

Male: Wings 9.3–10.5 mm long. T7 with long pointed triangular extension above prominent sharp cone of T8. Sclerotization of T8 forms a median band to which granulation is restricted. T9 normal. HT10 simple, anterior processes straight, pointed, sometimes very slender. Paraprocts, cerci, sternites all simple. Penis about 0.8 mm long, tubular, undulating in side view. Sclerotization of tube with small ventral and deeper dorso-apical notch. Penis sac with triangular dorsobasal patch of strong slender cones. Ventrally, a more distal band of rapidly tapering strongly curved hooks.

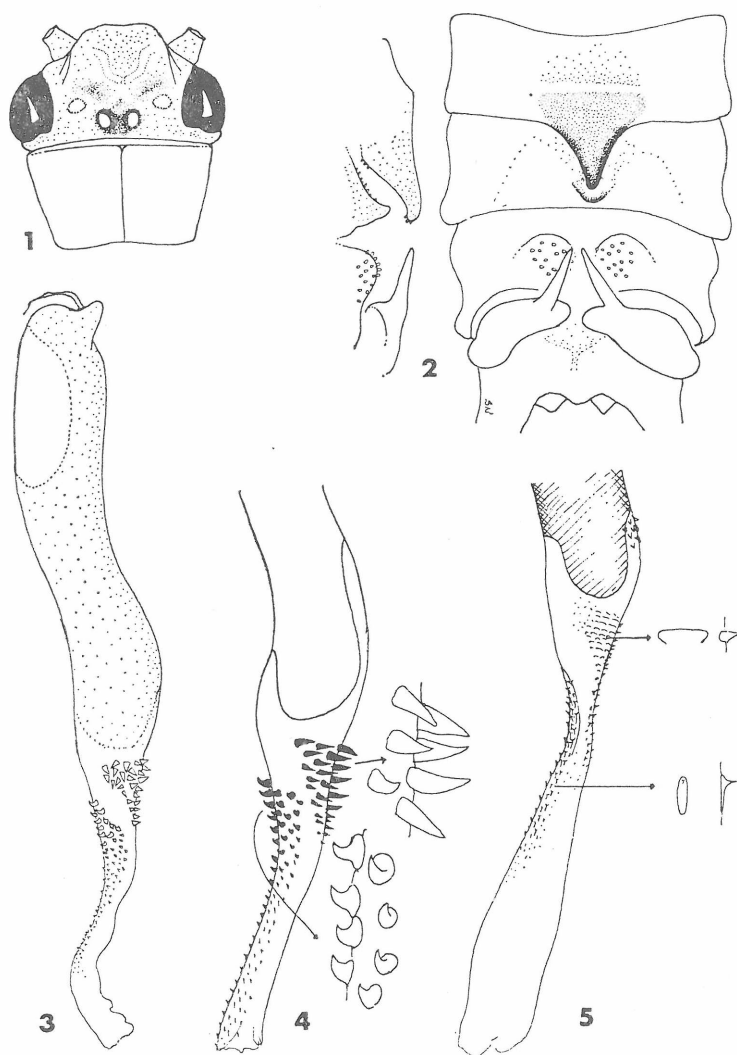
Female: Not known, compare 'Notes'.

Notes: According to the original description, only specimens taken at Anping in May 1911, and at Taihorinsho from August to December 1909 are syntypes. Specimens taken at other dates are not, even if they have been identified as *sauteri* by KLAPÁLEK. Female syntypes are listed under *N. taiwanica*, *N. sp. TW A, B, C*.

The males in the type series of *N. sauteri* belonged to two externally fairly similar but unrelated species (compare *N. taiwanica*). The present species is the only with sharply raised T8, as in the figure accompanying the original description. Males of *N. formosana* were also confused with his *N. sauteri* by KLAPÁLEK, but none of these males has type status, even though a few have type labels.

The close affinity of *N. sauteri* with *N. tortipennis* ZWICK (from Nepal, Bangladesh and Assam; ZWICK, unpublished records) is evident. The latter differs only by the following details: T8 less prominently raised, blunt; dorso-distal notch of penis tube with external asperities; armature of penis sac much smaller; compare Figs. 4, 5. This similarity suggests that *N. spec. TW B*, which is fairly similar to *N. tortipennis*, may be the female of *N. sauteri*. A decision on the possible synonymy between the two taxa should only be made when females of both will be definitely known.

Material examined: ♂ lectotype (here designated), Taihorinsho, Formosa, VIII. 1909, H. SAUTER (DEI). Paralectotypes (here designated): 2♂♂, Anping, V. 1911 (DEI and NMP). Additional material: 2♂♂, Taihorin, 7. VII. 1911 and V. 1910 (incorrect paratype labels; USNM). 1♂, Taihorin, 7. VII. 1911 (USNM, No. 24205; KLAPÁLEK det. *sauteri*, JEWETT det. *formosana*). 2♂♂, Taihorin 10 (probably: 1910); 1♂, Kosempo X. 1911 (all: SAUTER; NMP; KLAPÁLEK det. *sauteri*). 1♂, Taihorin, Formosa, H. SAUTER, 1911 (KLAPÁLEK det. *sauteri*; incorrect type-label); Rokki, Formosa:



Figs. 1–4. *Neoperla sauteri* Klapálek: head and pronotum (1), abdominal tip of ♂ (2), everted penis (3), enlarged apex of same with details of armature (4) Fig. 5. *Neoperla tortipennis* Zwick, everted penis sac with details of armature of specimen from Pokhara, Nepal

1♂, 16. V., 1♂, 12. V., 1♂, 12. VI. 34, GRESSITT leg. (all MCZ, BANKS det. *formosana*). 1♂, Taiwan (N): Taipai, Hsien, Hsintien, 100 m, 29. IX. 1957 (MAA; BPBM).

***Neoperla formosana* OKAMOTO**

(Figs. 6–8)

*Neoperla formosana* OKAMOTO, 1912; Trans. Sapporo Nat. Hist. Soc. 4, 134, fig. 21.

*Neoperla formosana* UCHIDA, 1985; Aquatic Insects 9, 159, figs. 1–5.

Ochre to brownish species, a dark spot between ocelli, no distinctive pattern. Ocelli about 1.5 diameters apart. *Rs* with 3–5 branches, the last from anastomosis.

Male: Wings 12–14 mm long. Similar to *N. sauteri*, except a little larger and except almost flat, only gently arched T8. Penis different, ca. 1.1 mm long, tubular,

almost straight. A bare dorsodistal notch in sclerotization of tube. Eversible penis sac longer than in *N. sauteri*, on dorsal side armed with triangular spinules that form a broad band basally which tapers distally. Ventral side bare except triangular patch of spinules near apex which is, at its base, in connection with end of dorsal band.

Female: Not definitely known; compare 'Notes'.

Notes: Males are very similar to the mainland *N. cavaleriei*, which we redescribe below. In view of this similarity, we have tentatively listed as *N. formosana* several Taiwanese females which we cannot distinguish from mainland females of *N. cavaleriei*.

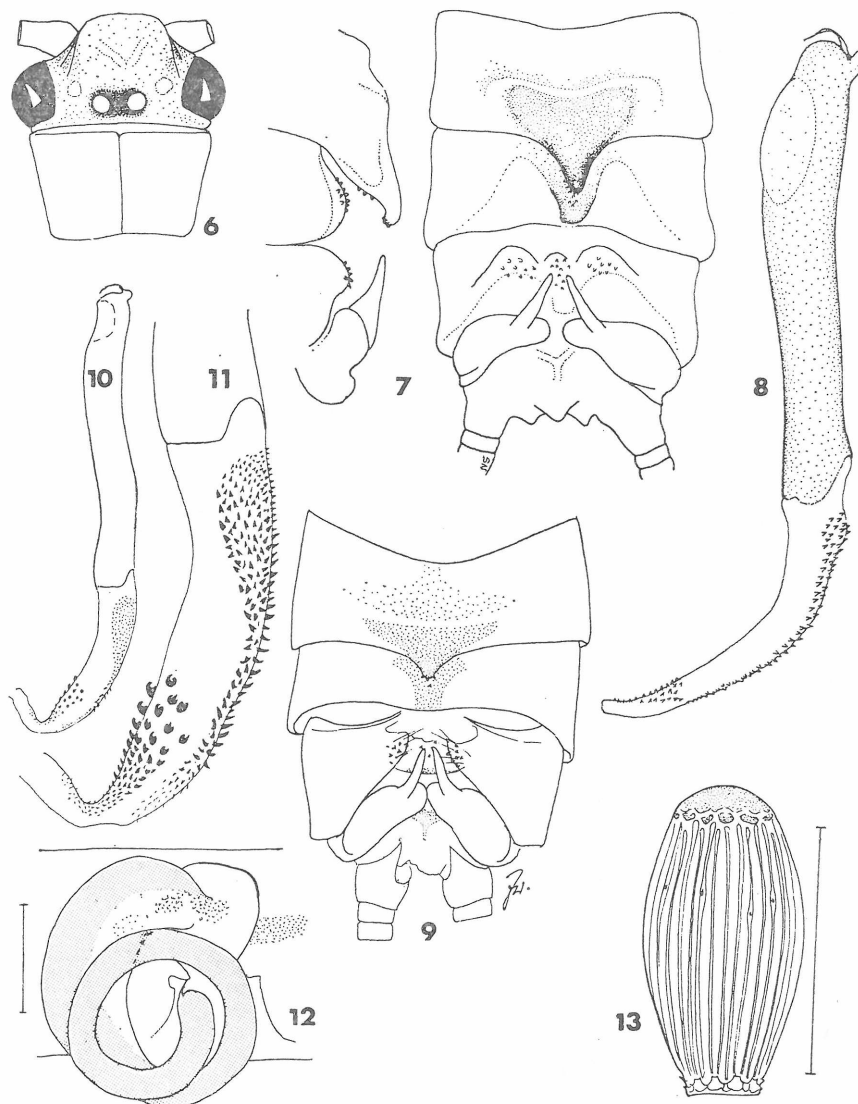


Fig. 6—8. *Neoperla formosana* OKAMOTO: head and prothorax (6), male abdominal tip (7), everted penis (8)

Figs. 9—13. *Neoperla cavaleriei* NAVÁS, mainland specimens: abdominal tip (9), everted penis (10) and its enlarged apex (11) of lectotype ♂; vagina (12) and egg (13) of paralectotype ♀, scale is 0.3 mm



Material examined: Taiwan 1♂, Suisharyo, 1911; 1♂, Suisharyo, X. 11; 1♂, Banshoryo Distr., Sokutsu, VI. 12; 1♂ Kosempo, X. 1912 (DEI); 1♂, Sokutsu, V. 1912 (NMP) (all leg. SAUTER; KLAPÁLEK det. *sauteri*; erroneously labelled syntypes of *sauteri*). 2♂♂, Tzepeng, Taitung Hsien, I.—II. 1964; 2♂♂, Chito Exp. For. 1150 m, 12.—15. X. 1957 (all MAA; BPBM). 2♂♂, 1♀, Formosa, Hassenzan, 22. VI. 34; 1♀, Suisha, Formosa, 1. VI. 34; 1♀ Rokki, Formosa, 12. V. 34 (all GRESSITT; MCZ; BANKS det.: *formosana*). 1♂, Formosa; 2♂♂, Formosa Kuau-Tao-Chi, 13.—15. XI. 1971 (Shu-chen-Chang; LFS).

*Neoperla cavaleriei* (NAVÁS)

(Figs. 9—13)

*Ochthopetina cavaleriei* NAVÁS, 1922; Broteria, Ser. Zool. 20, 49.

*Neoperla kachin* STARK & SZCZYTKO, 1979; Aqu. Ins. 1, 221, only the ♀, figs. 5—10.

Wings 10.5—14.0 mm long. Anterior branch of *Rs* forked, foremost vein sometimes with additional terminal fork; posterior branch from anastomosis simple. Ocelli 1.5 diameters apart in males, little more in females. Ochre, black ocellar rings plus sometimes a dark spot on clypeus, pattern vague, not distinctive. Outer face of tibiae, mainly near subgenual organ, indistinctly infusate.

Male: Sternites, paraprocts and cerci simple. A few granules on lower side and at tip of short triangular process of T7. T8 flat, its sclerite posteriorly tapered, few granules in its centre. T9 and HT10 normal; anterior process almost straight, a little pointed, stout.

Penis tubular, slightly sinuous, a dorsoapical notch in sclerotization. Everted sac shorter than tube, curved to ventral side, tapering to tip. A dorsobasal patch of spinules tapers towards apex, turning into three rows of slender hooklets near middle of sac and into a patch of irregular delicate spicules more distally. Ventral side of sac bare basally, a patch of large, strongly curved hooks near middle. Towards apex, they become smaller, are less curved and appear like minute spicules near tip.

Female: S8 simple, except transverse brownish band just basally from midlength. Vagina small, simple, coiled receptacular stalk forms about 1.5 circles. Its armature restricted to convex side of wide base, covering all of its width distally.

Egg oval, 0.38 mm long. In side view, about 15 bare ribs separate narrow sulci, each with three irregular rows of punctures, median one interrupted where micropyles occur. A single row of meshes on short, not constricted collar. Opercle wide, blunt, with single basal ring of punctate polygons separated by very neat impunctate band from irregularly punctate remainder of opercle.

Notes: NAVÁS did not state number or sex of specimens before him. Spelling of specific name and type information in ILLIES (1966), who lists it as doubtful species *inquirenda*, require correction. All specimens with the published collection data and bearing NAVÁS' identification labels are syntypes in the sense of ICZN, even though a single female in the collection was labelled holotype. The male is here chosen as lectotype. Sexes are thought to be conspecific because they have been taken together repeatedly over a wide geographical range. We believe that the female ascribed to *N. kachin* is not that species, but *N. cavaleriei*.

Mainland specimens listed above are all morphologically similar. We have, however, seen a number of additional males from the South East Asian mainland that show the same general pattern of penis armature, but differ in details, like more delicate spinules, presence of a single mid-dorsal row of spinules, or ventral spinules extending further basad. Where females have been taken together with such males, they could not be distinguished from the female syntypes.

Material examined: Lectotype ♂, 3♀♀ paralectotypes (here designated): Kouy-Tcheou, reg. de Pin-Fa, PÉRE CAVALERIE 1908 (MNHN). — Additional material: 1♂, 1♀, Tonkin, reg. de Hoa-Binh, A. DE COOMAN 1928 (MNHN); NAVÁS det.: *luteola*. 1♀, S. China, Kwangtung, Tien-wu Shan W. of Canton, 7.—12. VII. 1950 (GRESSITT; BPBM). 1♂, Laos, Vientiane Prov., Ban Van Lue,

15. II. 1967 (BPBM). 1♂, 1♀, Thailand, Trang Prov., Chong, 29. IV. 1960 (COHER & BEALES; USNM). 1♂, Khow Sai Dow, Trong, Lr Siam, 1000 ft., Jan.—Feb. 1899 (ABBOTT; USNM; JEWETT det.: *luteola*). 1♀, Thailand, Chiangmai Prov., Fang (Agr. Exp. Stn.), 600 m, 14. VI. 1965 (ASHLOCK; BPBM).

***Neoperla uniformis* BANKS**

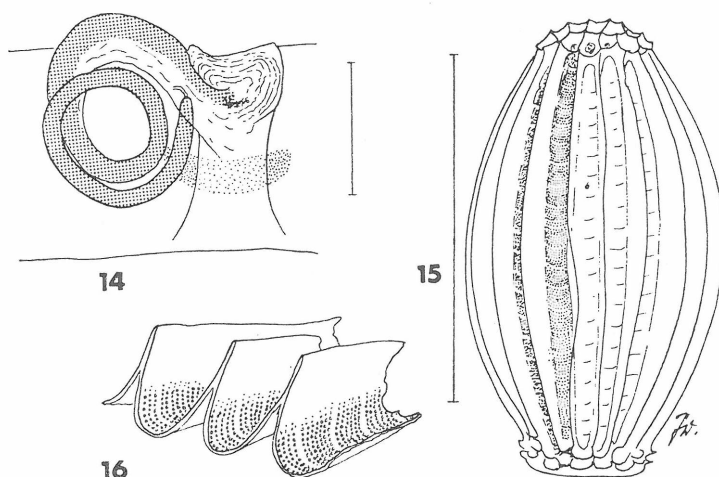
(Figs. 14–16)

*Neoperla uniformis* BANKS, 1937; Philippine J. Sci. 62(3), 272.

Wing 17–18 mm long. The last of 5 branches of *Rs* originates from anastomosis. Ocelli almost 2 diameters apart. Dark ochre, ocellar rings blackish, faded in paralectotype.

Male: Unknown.

Female: A crescentic brown mark on S8, no other external modifications. Vagina typical of *clymene*-group, coiled stalk of receptacle forms about 1.5 circles. Its wide basal third with unarmed membraneous concave side, distally entirely spinulose.



Figs. 14–16. *Neoperla uniformis* BANKS, lectotype ♀: vagina (14; scale is 0.5 mm), egg (15; scale is 0.3 mm) and details of chorion (16)

Egg ca. 0.34 mm long, oval. In side view, approx. 10 broad sulci. Punctuation irregular, fine. Series of faint transverse crests run across sulci. Straight ribs form impunctate high flanges connected to very deep punctate meshes on small opercle and to impunctate meshes on collar. Collar not constricted. Anchor attachment in deep regular cavity. Micropyles simple, in depressions in upper third.

Notes: Flanged eggs occur in several unrelated species in China, Sumatra and Borneo. One of these is a member of the *montivaga*-group. There is no risk of confusion because details of chorion and vagina differ clearly.

Material examined: Formosa: ♀ lectotype (here designated), Hassenzan, 22. VI. 1932; ♀ paralectotype, Urai, 3. V. 1932 (both L. GRESSITT; MCZ type no. 20195; the third syntype, from Fun-kiko, is misassociated, see *N. spec. TW D*). 1♀, Formosa, Kuan-Tao-Chi, 13.—15. XI. 1971 (Shu-chen- Chang; LFS).

**Unassociated Females of the *clymene*-Group**

The following females cannot be assigned to known males at present because their appearance, in particular the pattern on head and pronotum, is not distinctive. The first species, *N. spec. TW D* is distinctly larger than the remaining three, where wing

length is 11–12.5 mm. The three small species agree in having a more or less expressed brownish mark on S8, as in Fig. 23.

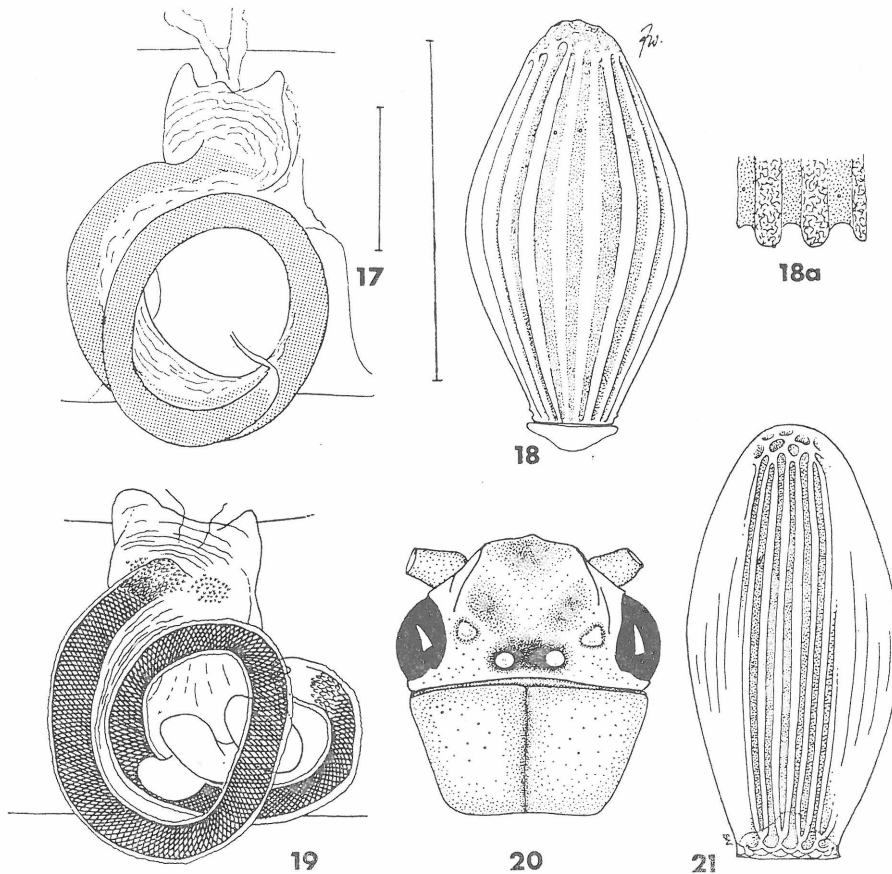
*Neoperla* spec. *TW D*

(Figs. 17, 18)

Wings 16–19 mm long, *Rs* with 4 branches. Sternite simple. A light brown spot divided by narrow pale transverse line on S8. Vagina simple, normal. Receptacular stalk describes about 1.5 full circles, its basal half with extensible inner portion.

Egg oval with narrow ends, ca. 0.35 mm long. No collar, ca. 20 straight ribs run down to edge of mushroom-shaped anchor inserting in deep cavity. Opercle reticulate, punctate areas polygonal. Sulci irregularly punctate, micropyles in upper third. Impunctate ribs rough, distinctive, covered by minute irregular vermiculations. In profile, they appear as very low elevations.

Material examined: 1♀, misassociated paralectotype of *N. uniformis*, Funkiko, 8. VI. 1932 (GRESSITT; MCZ, type No. 20195). 2♀♀, Tzepeng, Taitung Hsien, I.—II. 1964; 3♀♀, Chito Exp. For., 1150 m, 12.—15. X. 1957 (all MAA; BPBM). 1♀, Formosa, 2. VIII. 1969 (LFS).



Figs. 17–18. *Neoperla* spec. *TW D*: vagina (17) and egg (19), with detail of chorion (18a), scales are 0.3 mm

Figs. 19–21. *Neoperla* spec. *TW B*: vagina (19), head and prothorax (20), egg (21)

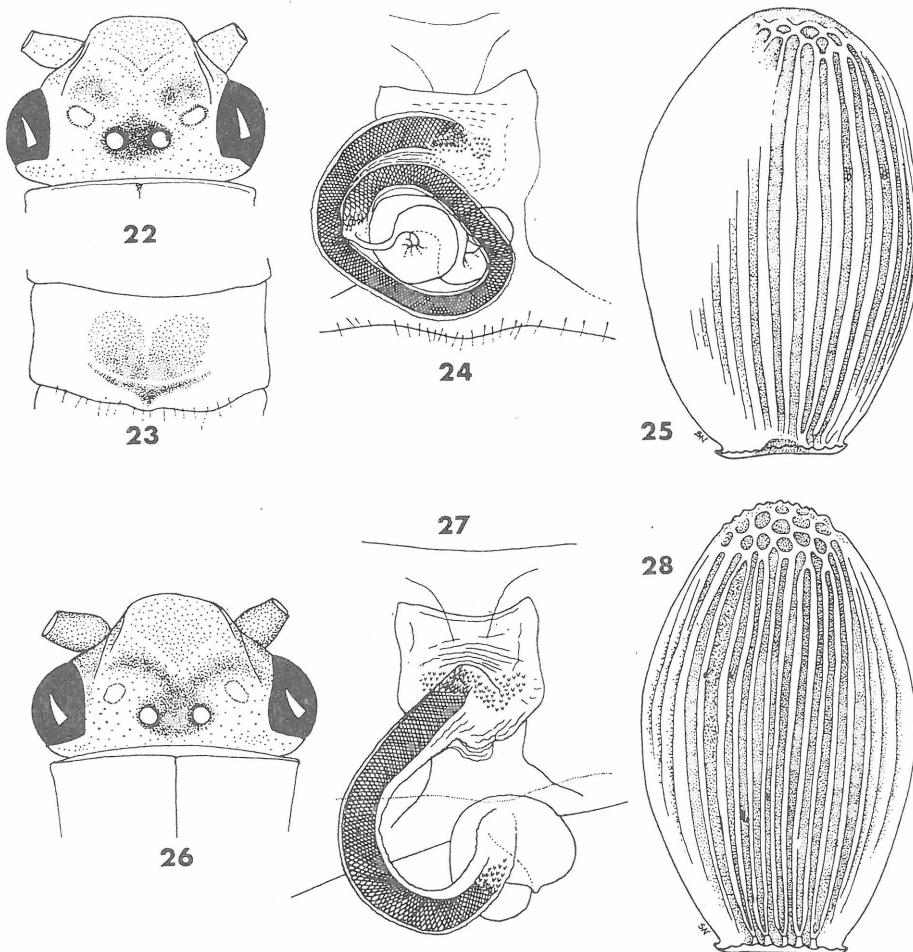
*Neoperla* spec. *TW B*

(Figs. 19–21)

Externally similar to *N. sauteri* and *N. formosana* and the following two small species. Vagina very similar to *N. spec. TW D*, long coiled receptacle with somewhat less expressed wide basal section. The only really distinctive characters are found in the eggs.

Eggs elongate oval, 0.34 mm long, with narrow poles. Collar distinct, with a row of meshes, a very deep concavity for anchor attachment present. Chorion densely striate, sulci narrow, with few irregular lines of punctation, straight bare ribs narrow. Opercle distinctly reticulate, sometimes except very tip.

Notes: This might be the female of *N. sauteri*. The narrow prominent collar and the dense striation of the eggs resemble *N. formosana*, but the wide and blunt irregularly punctate, non-reticulate opercle of the latter is distinctive.



Figs. 22–25. *Neoperla* sp. *TW A*: head (22), subgenital plate (23), vagina (24) and egg (25)

Figs. 26–28. *Neoperla* sp. *TW C*: head (26), vagina (27) and egg (28)

Material examined: 1♀, XI. (probably of the material collected by SAUTER, who used similar roman numerals on some labels, KLAPÁLEK det. *sauteri*); 1♀, Taiwan (N), Taipei, Hsien, Hsientien, 100 m, 19. IX. 1957 (MAA; BPBM).

*Neoperla* spec. *TW A*

(Figs. 22–25)

S8 varies from almost simple as in Fig. 23 to presence of short, narrow transverse subgenital plates. Vagina normal and simple, coiled spinulose receptacular stalk forms about 1.5 circles.

Egg ca. 0.33 mm long, oval. *Ca.* 15 bare straight ribs in side view, sulci densely and irregularly punctate. Collar reduced to narrow bare rim. A few punctate polygons at base of opercle, its remainder irregularly punctate.

Material examined: Taiwan: paralectotypes (here designated) of *N. sauteri*: Taihorinsho, 2♀♀, VIII; a third ♀ lacks abdomen, identity doubtful, 1♀, X. 1909; 1♀, Anping, V. 1911 (all SAUTER; DEI). 4 additional paralectotypes of *N. sauteri* (here designated; in NMP) from Taihorinsho, 2♀♀, VIII. 09, 1♀, X. 09, and 1♀, Anping, V. 11, as well as of 4 non-types originally identified by KLAPÁLEK (Taihorin 10, 3♀♀; 1 fragment from Suisharyo, X. 11; all leg. SAUTER, in NMP) have not been examined in detail and remain unidentified, but may also be the present species.

*Neoperla* spec. *TW C*

(Figs. 26–28)

S8 simple. Vagina normal and simple. Coiled spinulose base of receptacle short, forming not even a single ring.

Eggs ca. 0.32 mm long, very similar to preceding species, but reticulation on lid very deep and pronounced everywhere.

Material examined: 1♀, Taiwan (S). Kuraru, 5. V. 1935 (GRESSITT; BPBM).

The *montivaga*-Group

*Neoperla signatalis* BANKS

(Figs. 29–31)

*Neoperla signatalis* BANKS, 1937; Philippine J. Sci. 62(3): 273; Fig. 5.

Front wing 10 mm long, *Rs* branches first shortly beyond, in one wing at anastomosis; anterior branch forked again. Ocelli fairly small: see Fig. 31. Generally ochre, with dark brown to blackish pattern on head and pronotum as in Fig. 31, anterior portion of mesonotum brownish.

Male genitalia: T7 with broad bluntly rounded posterior sclerite beset with spinules. A band of spinules on its declivous portion in middle of T7, opposite narrow raised process of T8, which is spinuliferous in front. T9 medially depressed, without spinules, setation rather uniform, no distinct groups of longer setae. Hemitergites 10 simple, with very broad blunt median lobe and strongly curved anterior processes with blunt tips.

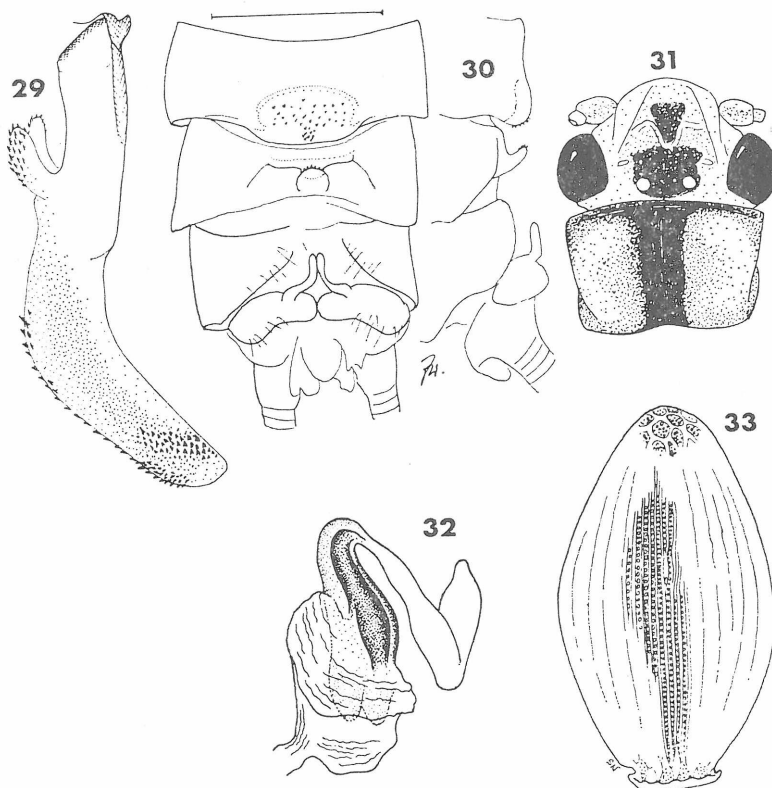
Penis sclerites typical of *montivaga*-group. Ventrally before apex a pair of elongate lobes, each with large hooks on its outside. Everted sac simply tubular, gently curved dorsad, longer than penis tube. Sac covered with very fine asperities except along dorsal edge. Asperities distinctly larger along sides where they form bands. Large hooks form an irregular ventral band. It is apically widened and almost confluent with two oblique dorsolateral patches of similar hooks at tip.

Female: not known; compare *N. klapaleki*!

Notes: BANKS disposed of both sexes, female syntypes are presently not available. His figure of the last male segment shows nothing that could serve identification. ILLIES (1966) therefore listed *signatalis* as "*species inquirenda et incertae sedis*". It is a member of the *lushana*-subgroup (sensu ZWICK & SIVEC, 1980) which is widespread

in Asia. Other strongly pigmented species of this subgroup are known to us from Manchuria and Japan, but all differ clearly in their genitalia.

Material examined: ♂, lectotype, 2♂♂, paralectotypes (here designated): Urai, Formosa, IV-1-32/L. GRESSITT collector/Type (or paratype; MCZ, 20192).



Figs. 29–31. *Neoperla signatalis* BANKS, paralectotype ♂: everted penis (29), abdominal tip (30), head and prothorax (31); scale is 0,5 mm

Figs. 32, 33. *Neoperla klapaleki* BANKS: vagina (32) and egg (33)

***Neoperla klapaleki* BANKS**

(Figs. 32, 33)

*Neoperla klapaleki* BANKS, 1937; Philippine J. Sci. 62, 273; pl. 1, fig. 2.

*Neoperla klapaleki* — SIVĚC, 1984; Biol. vestn. 32: 105.

A detailed redescription of this species *inquirenda* (ILLIES 1966) from types is presented by SIVĚC (1985). We only include figures of vagina and egg, for comparison with the other species.

There is the distinct possibility that the present species is in fact the female of *N. signatalis*. Both are pale yellow species with similar black markings on head and prothorax, and male types of *N. signatalis* have in fact been taken together with the female paratypes of *N. klapaleki*. The presumed difference in size of ocelli was not impressive, but body size differs: wing length of *N. signatalis* is 10, of *N. klapaleki* 19 mm.

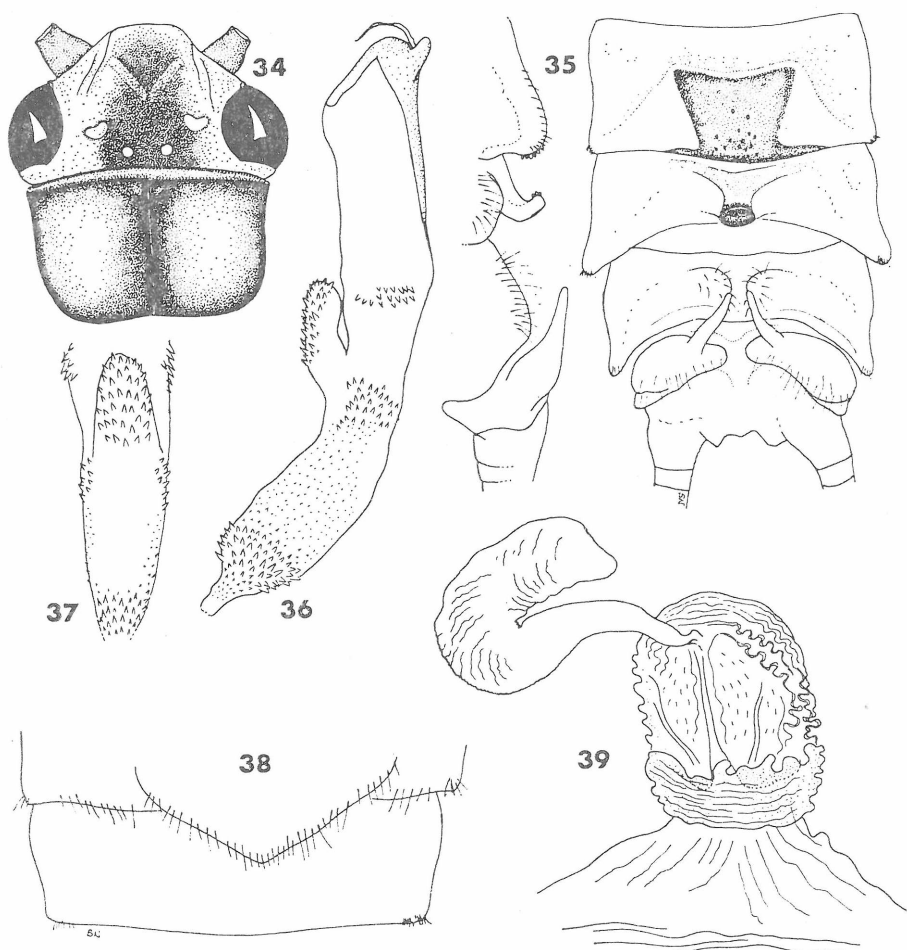
***Neoperla costalis* (KLAPÁLEK), spec. propr.**

(Figs. 34–39)

*Formosina costalis* KLAPÁLEK, 1913; Suppl. Ent. 2: 117; pl. 3, figs. 3, 6.

Wings 10–14 mm long. *Rs* with 3–4 branches. Brown species with ochre underside and bases of femora. *C*, *Sc*, crossveins and membrane between them light yellow. Head and prothorax with contrastive yellow and dark brown pattern, pronotal epipleurae also dark. Note that ocellar mark extends well to outside of small ocelli and is not distinctly separate from mark on clypeus.

Male: T7 with broad hardly projecting sclerotization, some sharp granules mainly distally. T8 with raised narrow knob, spinuliferous in front. T9 and HT10 not distinctive. Sternites and cerci simple. Penis typical of *montivaga*-group, with a few spinules on tube distally on sides and very few ventrally. Everted sac with spinose recurved ventrobasal lobe, lateral patches of spinules near its base. Rest of everted sac tubular, with fine asperities and strongly spinulose apex.



Figs. 34–39. *Neoperla costalis* KLAPÁLEK: head and prothorax (34), everted penis (36), ventral view of everted sac (37), male abdominal tip (35), ♀ subgenital plate (38) and vagina (39)

Female: Subgenital plate large, triangular, with transverse rugosities. Vagina typical of *montivaga*-group, strongly folded, membranous, receptacle simple, no distinctive armature or pattern. Eggs not available.

Notes: The intact male syntype from Sokutsu is not available. *N. costalis* is not a synonym of *N. hatakeyamae* OKAMOTO, 1912, as suggested by KLAPÁLEK (1921) and since then generally assumed (ILLIES, 1966). *N. hatakeyamae* had been named from a single female from Echigo, Honshu, Japan (and not "Kosempo (Japan)", as erroneously stated in ILLIES, 1966). Recent studies by S. UCHIDA indicate that *N. hatakeyamae* does not occur on Formosa; in fact, no *Neoperla* species is shared with Japan (in litt.).

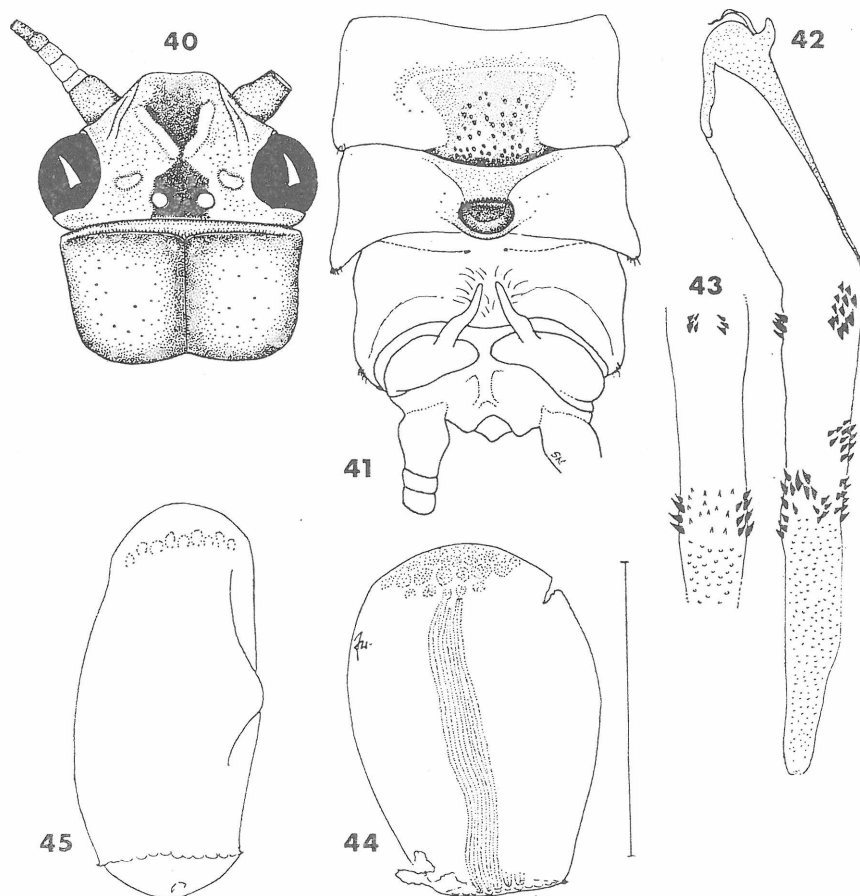
Material examined: Taiwan: ♂ lectotype (here designated), Kosempo, V. 1912 (SAUTER; DEI). Paralectotypes (here designated): 1♀, same data as lectotype (DEI); 1 specimen (abdomen missing), Sokutsu, V. 12 (SAUTER; DEI); 1♂, Kosempo X. 11 (SAUTER; NMP). Additional material: 1♂, Chikutoge, V. 1909 (SAUTER; ML).

***Neoperla taihorinensis* (KLAPÁLEK)**

(Figs. 40–45)

*Formosina taihorinensis* KLAPÁLEK, 1913; Suppl. Ent. 2: 119, pl. 3, fig. 7.

*Formosita taihorinensis* KLAPÁLEK, 1923; Colls Zool. Selys Longchamps 4(2)2, 175, fig. 51.



Figs. 40–45. *Neoperla taihorinensis* KLAPÁLEK: head and prothorax (40), male abdominal tip (41), everted penis (42), partial ventral view of everted sac (43), the two available egg fragments (44, 45; scale is 0.3 mm)



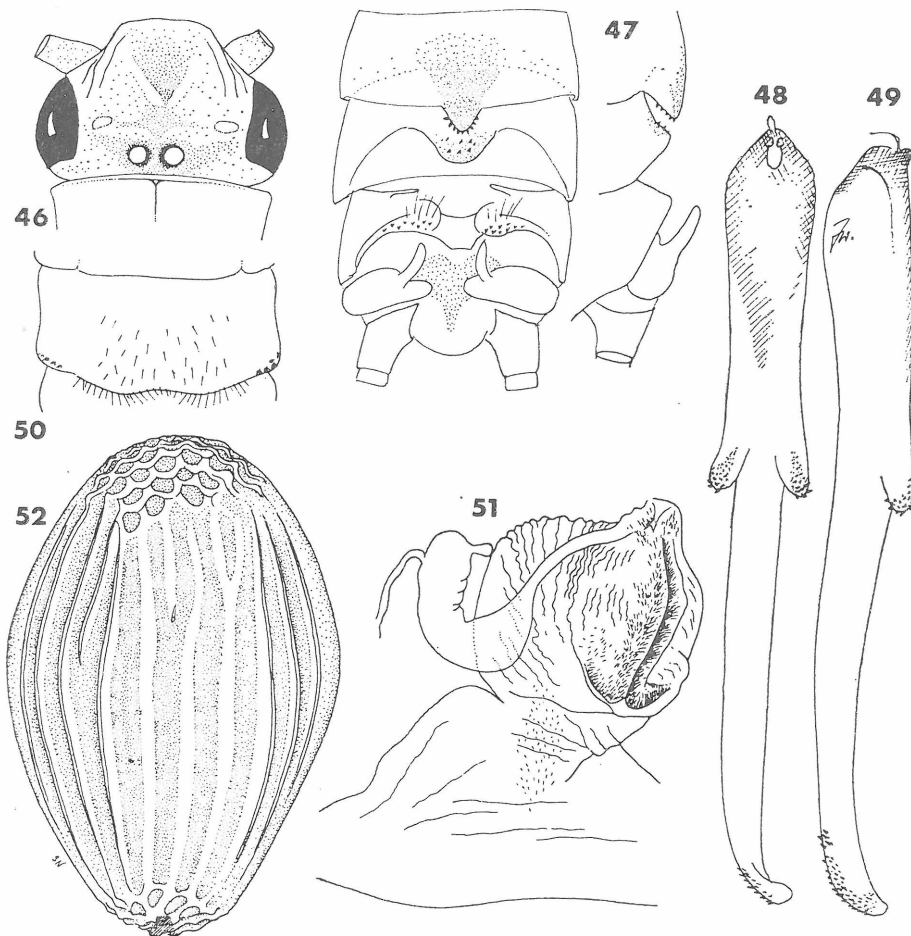
Wings 12–17 mm long. Very similar to *N. costalis*, except narrow black mark not extending to outside of ocelli, and clearly separate frontoclypeal mark. Genitalia also different.

Male: Generally similar to *N. costalis*, but raised knob on T8 relatively wider. Penis clearly different, with simple straight tubular everted sac. Groups of ventroapical and apicolateral spines on outside of penis tube. Large spines on everted sac near base, except ventrally. Apical half of sac with fine scaly armature.

Female: Abdominal tip now missing, subgenital plate narrower and more pointed than in *N. costalis*, according to figure by KLAPÁLEK (1913, 1923). A few eggs have been recovered from base of abdomen.

Eggs in poor shape, ca. 0.35 mm long, plump, with very wide reticulate opercle and wide flat anchor pole surrounded by narrow rim-like collar. Chorion covered with straight single lines of fine punctures.

Notes: The original description provided no list of material, but this is contained in KLAPÁLEK (1923). All specimens had cotype (NMP) or syntype (DEI) labels, which had obviously been attached by museum curators, not by KLAPÁLEK himself.



Figs. 46–51. *Neoperla taiwanica* SIVEC & ZWICK, sp. n.: head (46), male abdominal tip (47), everted penis in dorsal (48) and lateral view (49), vagina (50) and egg (51)

Material examined: ♂ lectotype (here designated), Taihorin, Formosa, 7. V. 1911, H. SAUTER (NMP). — Paralectotypes (here designated): 1♂, 1♀, same collection data as lectotype (abdominal tip of both missing; DEI).

*Neoperla taiwanica* SIVEC & ZWICK, sp. n.

(Figs. 46–52)

Wings 11–13.5 mm long. Anterior branch of *Rs* forked, second from anastomosis simple. Ocelli small, almost 2 diameters apart. Ochre, head with brownish marks, no defined pattern (Fig. 46).

Male: T7 with tongue-shaped process spinulose along edge and on lower face. T8 with semicircular gently raised median section, a few granules on it. T9 normal. HT10 with short, outwardly curved anterior process. Penis typical of *montivaga*-group. Two spinulose lobes at sides of base of everted sac. Sac long, tubular, straight except tip curved gently dorsad. Sac bare, except few spinules at tip, mainly ventrally.

Female: Unmodified, except indistinct sinuosity of distal edge of S8. Very extensible folded vagina typical of *montivaga*-group. Simple stalk of receptacle attached anteriorly. Behind it, inner surface of vagina with fine spinules forming longitudinal bands next to median slit.

Egg distinctive, ca. 0.46 mm long, oval, about 10 straight bare ribs in side view between wide, irregularly punctate sulci. Anchor pole narrower than opercle, both covered with deep punctate meshes separated by bare crests. Anchor not observed.

Notes: Penis and egg of this otherwise very inconspicuous species are exceptional, relatives or similar species are not known.

Material examined: ♂ holotype, Taihorinsho, Formosa, H. SAUTER X. 09/*Neoperla sauteri* KLP. KLAPÁLEK det./Cotypus (paralectotype of *N. sauteri*, here designated; misassociated; NMP). Additional material: 1♀, similar labels, except "syntype", also misassociated paralectotype of *N. sauteri* (here designated; DEI).

Zusammenfassung

In der Fauna Taiwans ist die Gattung *Neoperla* jeweils mit mehreren Arten der *clymene*- und der *montivaga*-Gruppe vertreten. Die vorliegende Arbeit enthält Redeskriptionen bekannter Arten anhand der Typen und die Beschreibung einer neuen Art.

In die *clymene*-Gruppe gehören: *Neoperla sauteri* KLAPÁLEK (Lectotypus-Designation), *N. formosana* OKAMOTO, *N. cavaleriei* (NAVÁS) (Lectotypus-Designation; ursprünglich vom asiatischen Festland beschrieben, aber auch in Taiwan und der vorigen sehr ähnlich) sowie *N. uniformis* BANKS (Lectotypus-Designation; nur das Weibchen bekannt). Die bisher unbekannten Weibchen von *N. sauteri* und *N. formosana* dürften sich unter den vorläufig *Neoperla* spec. *TW A*, *TW B*, *TW C* und *TW D* genannten Weibchen befinden.

Die *montivaga*-Gruppe ist durch *Neoperla signatalis* BANKS (Lectotypus-Designation), *N. klapaleki* BANKS (vermutlich das Weibchen der vorigen Art), *N. costalis* (KLAPÁLEK) (spec. propr., Lectotypus-Designation), *N. taihorinensis* (KLAPÁLEK) (Lectotypus-Designation) und *N. taiwanica* SIVEC & ZWICK sp. n. vertreten.

Von allen genannten Arten werden die Genitalien und/oder die Eier abgebildet.

Summary

In the fauna of Taiwan, genus *Neoperla* is represented by several species of the *clymene*- and *montivaga*-groups, respectively. The present paper contains redescriptions of known species from type material, and the description of a new species.

The following species belong to the *clymene*-group: *Neoperla sauteri* KLAPÁLEK (lectotype designated), *N. formosana* OKAMOTO, *N. cavaleriei* (NAVÁS) (lectotype designated; originally described from the Chinese mainland but present also in Taiwan and very similar to the preceding species), and *N. uniformis* BANKS (lectotype designated; only the female is known). The presently unknown females of *N. sauteri* and *N. formosana* are probably among females provisionally named *Neoperla* spec. *TW A*, *TW B*, *TW C*, *TW D*.

The *montivaga*-group is represented by *Neoperla signatalis* BANKS (lectotype designated), *N. klapaleki* BANKS (presumably the female of the former species), *N. costalis* (Klapálek) (spec. propr., lectotype designated), *N. taihorinensis* (Klapálek) (lectotype designated), and *N. taiwanica* Sivec & Zwick, sp. n.

Genitalia and/or eggs of the species mentioned are illustrated.

### Резюме

В фауне Тайвана род *Neoperla* представлен несколькими видами групп *clymene* и *montivaga*. В настоящей работе приведено переописание известных видов по типовым экземплярам и описание нового вида. К группе *clymene* относятся: *Neoperla sauteri* Klapálek (обозначение лектотипа), *N. formosana* Окамото, *N. cavaleriei* (Navás) (обозначение лектотипа; сначала описан от азиатского материка, а и от Тайвана, очень близко предыдущему виду), а также *N. uniformis* BANKS (обозначение лектотипа; только самка известна). Неизвестные до сих пор самки *N. sauteri* и *N. formosana*, по всей вероятности, находятся среди самок предварительно названных *Neoperla* spec. *TW A*, *TW B*, *TW C* и *TW D*. Группа *montivaga* представлена *Neoperla signatalis* BANKS (обозначение лектотипа), *N. klapaleki* BANKS (вероятно самка предыдущего вида), *N. costalis* (Klapálek) (spec. propr., обозначение лектотипа), *N. taihorinensis* (Klapálek) (обозначение лектотипа) и *N. taiwanica* Sivec & Zwick sp. n. Изображены гениталии и/или яйца всех вышеуказанных видов.

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