

On the Trichoptera of Batanta Island (Indonesia, West Papua, Raja Ampat Archipelago) IV.

JÁNOS OLÁH & TIBOR KOVÁCS

ABSTRACT: This paper, the fourth in the Batanta Island series on Trichoptera, contains 29 new records of 12 caddisfly species collected during our systematic and concentrated diversity survey on the Batanta Island. The monobasic macronematine genus *Leptopsyche*, known only from a single lost male specimen, is discovered in the island and represented by two new species: *Leptopsyche kormos* sp. n., *Leptopsyche vilagos* sp. n. A new hydropsychnine genus *Batantapsyche* with *Batantapsyche juhászi* sp. n. type species is described. The differential diagnosis of the new genera in the *Hydropsyche* genus subcluster of the *Hydropsyche* genus cluster is elaborated in a matrix table. A large and dark hydropsychnine species, *Hydropsyche sotet* sp. n. is described as a sibling of *Hydropsyche lapos* Oláh, 2015 described from Arfak Mts of the main island.

Introduction

Our Trichoptera collecting effort on the Batanta Island of New Guinea faunal region that is on the last unexplored biodiversity region of the world has produced already 3 papers (OLÁH 2012, 2013, 2014) and further species records and descriptions are presented in this paper. We have installed UV light traps as well as collected specimens from white sheet illuminated either by Honda generator or by battery powered lamps.

The material including all holotypes and paratypes is preserved in 70–80% alcohol and is deposited in the collection of the first author (Oláh Private Collection = OPC) under protection by the Hungarian Natural History Museum (Budapest).

Taxonomical part

HYDROPSYCHIDAE Curtis, 1835

Macronematinae Ulmer, 1905

Baliomorpha barna Oláh, 2012 – **Indonesia**, West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (1♂, OPC). West Papua, Batanta Island, valley of Kalijakut River, 00°52'52.0", 130°38'8.0", 16.02.2015, at light, T. Kovács, P. Juhász, Kris (1♂, OPC). West Papua, Batanta Island, valley of Weras Stream, 00°49'51.2", 130°38'00.0", 300 m, 08.02.2015, at light, T. Kovács, P. Juhász (1♂, OPC).

Baliomorpha mariannae Oláh, 2012 – **Indonesia**, West Papua, Batanta Island, Teluk Warai, stream, 00°50'51.0", 130°35'14.0", 11.02.2015, at light, T. Kovács, P. Juhász (5♂, 7♀, OPC). West Papua, Batanta Island, valley of Waridor River, 00°51'51", 130°33'41", 04.02.2015, at light, T. Kovács, R. Horváth, P. Juhász (1?, OPC). West Papua, Batanta Island, valley of Warmon Creek, between the lower and upper waterfall, (00°50'04.50", 130°42'54.01"–00°50'23.25", 130°42'35.18"), 21.01.2014, T. Kovács, R. Horváth, P. Juhász (2♂, OPC). West Papua, Batanta Island, valley of Weras Stream, 00°49'51.2", 130°38'00.0", 300 m, 08.02.2015, at light, T. Kovács, P. Juhász (3♂, OPC).

Leptopsyche McLachlan, 1866

Leptopsyche McLachlan, 1866 – MCLACHLAN (1866): 266–267. Type species: *Leptopsyche gracilis* McLachlan, 1866 (monobasic). „Habitat in insula Dorey (Wallace). In Mus. Saundersiano”.

Leptopsyche McLachlan, 1866 – BRAUER (1868): 408. Included in his genus determination table of the Hydropsychidae family.

Leptopsyche McLachlan, 1866 – ULMER (1905): 88. Included in his genus determination table of the Macronematinae subfamily.

Leptopsyche McLachlan, 1866 – ULMER (1907a): 33–34. Included in Macronematinae Monograph. McLachlan’s original wing venation redrawn as right side wing mirror of the original left wings. The type specimen according to the The Natural History Museum, London is not available, not seen and not examined.

Leptopsyche McLachlan, 1866 – ULMER (1907b): 160. Brief genus description with redrawn wing venation.

Notes – *Leptopsyche* with very long antennae and open discoidal cell on forewing is a monobasic macronematine genus described and still known only from a single male specimen collected in West Papua, Dorey and deposited originally in Mus. Saundersiano. Probably the deposited type specimen is lost. We have collected several male and female specimens of two new *Leptopsyche* species from Batanta Island, West Papua and describe them here.

As characterized in the original genus description the antennae, legs and gonopods are very slender. Probably this inspired Robert McLachlan, the author to name this genus, (“*leptos*” thin, fine, slender, weak in Greek) as well as the new species (“*gracilis*” slender, thin, scarce, slim in Latin). The anterior wing is very peculiar with open discoidal cell, usually closed in most hydropsychine genera. The open discoidal cell is combined with stalked fork III on forewing. This character combination gives a clear generic character. In the key to the Old World genera of Macronematinae BARNARD (1984) has distinguished the *Leptopsyche* genus by discoidal cell absent in forewing and fork III stalked in both wings.

Leptopsyche gracilis McLachlan, 1866 – MCLACHLAN (1866): 267.

Notes – The description of the genus *Leptopsyche* and the species *Leptopsyche gracilis* is based on a single male specimen collected by Alfred Russel Wallace in Insula Dorey (Dorey now called Manokwari, the capital of West Papua) during his stay there from April through June 1858 and deposited in “Mus. Saundersiano.” According to the information provided by Benjamin Price, Curator of Small Orders, The Natural History Museum London (25.02.2014), “Mus. Saundersiano seems to mean the private collection of W. W. Saunders, Esq., F.R.S., V.P.L.S. We have a large number of Saunders’ specimens in our beetle collection but I have looked for *Leptopsyche gracilis* and cannot find any specimens in our collection or the associated database.”

According to the original short species description in Latin and in English, the forewing has apex slightly brownish-ochreous; forewing length is 12 mm. Description is accompanied by a simple genital drawing in lateral view. We have experienced that Robert McLachlan’s drawings are very precise even if they are simple due to intact, but dry state of the genitalia without clearing (OLÁH et al. 2015). He characterized the genital structure: “superior appen-

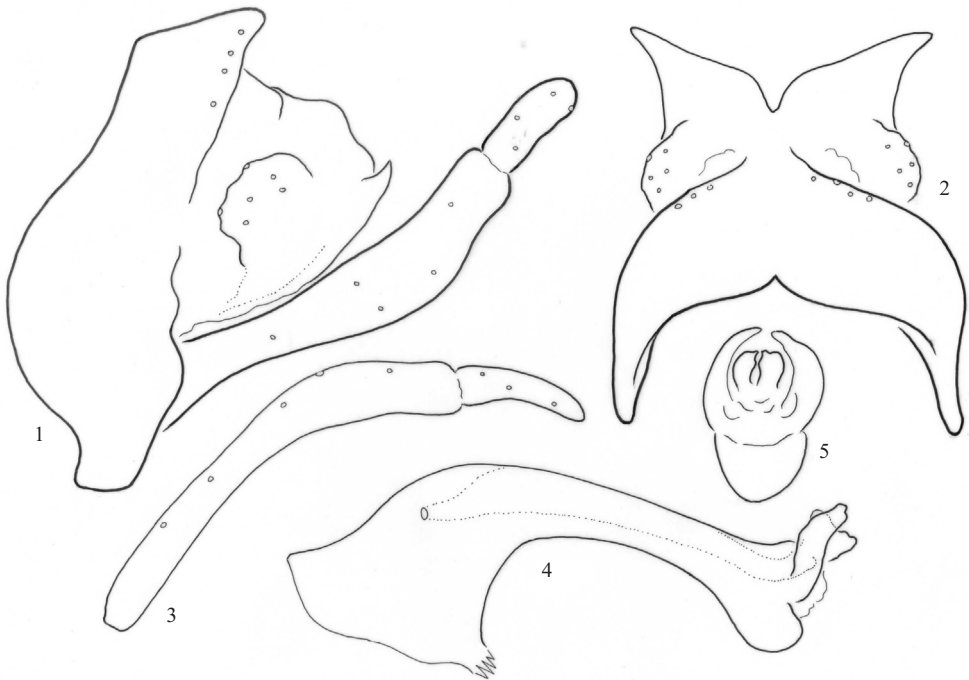
dices (segment X) very small, quadrate; inferior appendices (gonopods) long and slender, curved upwards and approximating at the tips, apparently bisarticulate, but the first joint is short and nearly concealed, penis (phallic organ) thick”.

***Leptopsyche kormos* sp. n. (Figs 1–5, 11, 13)**

Diagnosis – The largest species of the genus and distinguished from the other two species by the sooty black forewing apex; easily differentiated from *Leptopsyche vilagos* sp. n. by the rounded undivided cercus, by the more curved and more bulky gonopods, by the very high phallobase and by the different pattern of the endothecal and phallosomal sclerite complex.

Description – Male (in alcohol). Large animal. Antennae slender about three times the length of the wings. Maxillary palp formula I-III-IV-II-V. Forewing length 18 mm; the apex of forewing sooty black, except one light, unicolor pharate male without any pattern; forewing venation with open discoidal cell and fork III is stalked on both wings.

Male genitalia. Segment IX short. Segment X high and short in lateral view with lateroapical pointed process; in dorsal view this lateroapical pointed process narrowing gradually. Cerci rounded both in lateral and dorsal view. The coxopodite of the gonopods is arching both in lateral and ventral view and bulking subapicad. Phallic organ with rather high vertical basal section; the horizontal stem has straight dorsum and concave ventrum in lateral view; the



Figs 1–5. *Leptopsyche kormos* sp. n. holotype male: 1 = genitalia in left lateral view; 2 = genitalia in dorsal view; 3 = left gonopod in ventral view; 4 = phallic organ in left lateral view; 5 = phallic apex in caudal view

apex of the stem with a very produced and rounded ventroapical ending in lateral view; the pair of endothelial processes elongated and freely projecting dorsad, slightly S-forming in lateral and half-circled in caudal view; a pair of phallosomal sclerite located between them. The sclerotized complex of the endothelial and phallosomal sclerites is less distinct.

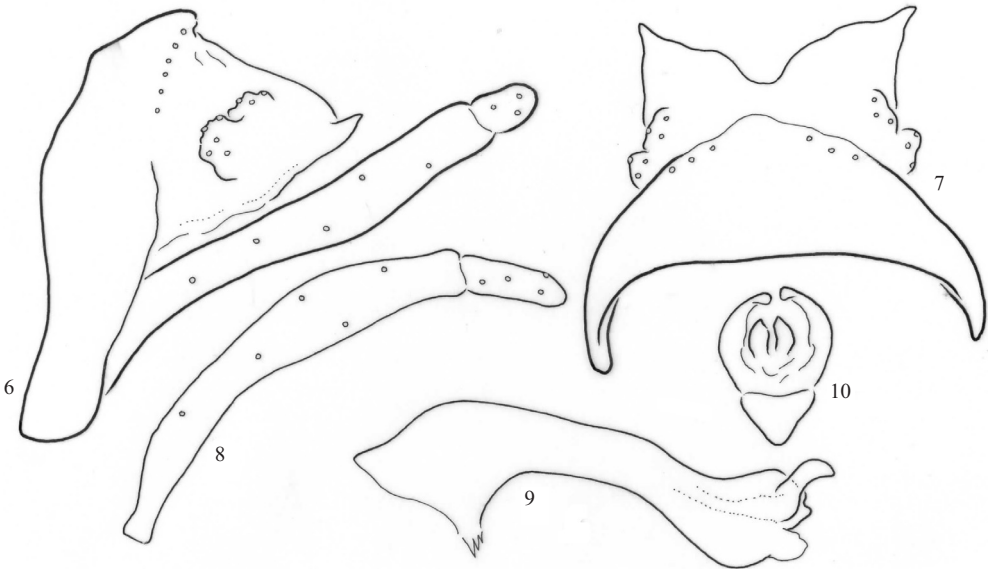
Type material – Holotype: **Indonesia**, West Papua, Batanta Island, Welebed, valley of Kalijakut River, 00°53'12.88", 130°38'16.40", 23.01.2014, at light, T. Kovács, R. Horváth, P. Juhász (1♂, OPC). Paratypes: same as holotype (1♂, 2♀, OPC). West Papua, Batanta Island, Welebed, valley of Kalijakut River, 00°53'12.88", 130°38'16.40", 23.01.2014, UV light trap, T. Kovács, R. Horváth, P. Juhász (1♀, OPC). West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (1 pharate ♂, OPC).

Etymology – *kormos*, from “kormos” sooty black in Hungarian, refers to the dark black colour of the forewing apex.

***Leptopsyche vilagos* sp. n. (Figs 6–10, 12, 13)**

Diagnosis – Middle sized species of the genus and distinguished from the other two species by the light forewing apex without any pattern; easily differentiated from *Leptopsyche kormos* sp. n. by the divided cercus, by the less curved and less bulky gonopods, by the low phallobase and by the different pattern of the endothelial and phallosomal sclerite complex.

Description – Male (in alcohol). Large animal. Antennae slender about three times the length of the wings. Maxillary palp formula I-III-IV-II-V. Forewing length 14 mm; the apex of forewing light; forewing venation with open discoidal cell and fork III is stalked on both wings.



Figs 6–10. *Leptopsyche vilagos* sp. n. holotype male: 6 = genitalia in left lateral view; 7 = genitalia in dorsal view; 8 = left gonopod in ventral view; 9 = phallic organ in left lateral view; 10 = phallic apex in caudal view

Male genitalia. Segment IX short. Segment X high and short in lateral view with lateroapical pointed process; in dorsal view this lateroapical pointed process narrowing gradually then abruptly, this result in a convex apical margin of both lobes in dorsal view. Cerci subdivided visible both in lateral and dorsal view. The coxopodite of the gonopods is almost straight in lateral and slightly arching in ventral view and bulking subapicad. Phallic organ with low vertical basal section; the horizontal stem downward curving subapicad in lateral view; the apex of the stem less produced ventroapicad; the pair of endothelial processes elongated and freely projecting dorsad, slightly S-forming in lateral and half-circled in caudal view; a pair of phallosomal sclerite located between them. The sclerotized complex of the endothelial and phallosomal sclerites is less distinct.

Type material – Holotype: **Indonesia**, West Papua, Batanta Island, valley of Waridor River, 00°52'09.66", 130°32'11.54", 18.01.2014, at light, T. Kovács, P. Juhász, R. Horváth (1♂, OPC). Paratypes: West Papua, Batanta Island, Teluk Warai, stream, 00°50'51.0", 130°35'14.0", 11.02.2015, at light, T. Kovács, P. Juhász (1♂, 3♀, OPC). West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (1♂, OPC). West Papua, Batanta Island, right side stream of Forum River, 00°52'22.7", 130°27'45.1", 13.02.2015, at light, T. Kovács, R. Horváth, P. Juhász (1♀, OPC).

Etymology – *vilagos*, from “világos” clear, light, plain in Hungarian, refers to the light colour of the forewing apex.

Macrostemum auriferum Neboiss, 1984 – **Indonesia**, West Papua, Batanta Island, between Arefi and Teluk Warai, valley of „dried estuary of a stream” (= valley of Weras Stream), 00°49'29.03", 130°38'28.68", 27.01.2014, UV light-trap, T. Kovács, R. Horváth, P. Juhász, (1♀, OPC). West Papua, Batanta Island, valley of Weras Stream, 00°49'51.2", 130°38'00.0", 08.02.2015, at light, T. Kovács, P. Juhász (19♂, 5♀, OPC).

Macrostemum warmon Oláh, 2013 – **Indonesia**, West Papua, Batanta Island, valley of Weras Stream, 00°49'51.2", 130°38'00.0", 08.02.2015, at light, T. Kovács, P. Juhász (2♂, 1♀, OPC).

Hydropsychinae Curtis, 1835

Abacaria sima Oláh, 2013 – **Indonesia**, West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (1♂, OPC).

***Batantapsyche* gen. n.**

Type species – *Batantapsyche juhaszi* sp. n. by original designation, from Batanta Island, West Papua, Indonesia.

Diagnosis – This new genus belongs to the *Hydropsyche* genus cluster without digitate cerci present in the *Hydromanicus* and *Cheumatopsyche* genus clusters as well as forewing crossvein m-cu is distant from crossvein cu, not close (OLÁH & JOHANSON 2008). It forms a new subcluster together with the *Hydropsyche-Orthopsyche-Schmidopsyche* genera having 1,2,3,5 forks present on hindwing. By having both the discoidal and median cells open on hindwing, *Batantapsyche* gen. n. is most close to *Schmidopsyche*, only forewing median cell closed, not open (Table 1). However its genital structure is similar to *Orthopsyche*, an endemic hydropsychid genus distributed in New Zealand and New Caledonia (OLÁH et al. 2006). *Batantapsyche* gen. n. has typical phallic structure far from the *Schmidopsyche* genus, and very similar to the *Orthopsyche* genus: (1) movable well-sclerotized endothelial process;

(2) well-developed phallosomal sclerite; (3) membranous ventral endothelial lobe. According to the trait combinations of the phallic organ *Batantapsyche* diverged from *Orthopsyche* in isolation far from the known distributional area of its ancestral genus.

Table 1. Differential diagnosis of genera in the *Hydropsyche* genus subcluster of the *Hydropsyche* genus cluster: 1 = forewing median cell; 2 = hindwing discoidal cell; 3 = hindwing median cell; 4 = hindwing crossvein m-cu; 5 = hindwing forks; 6 = male spur formula; 7 = female spur formula

	1	2	3	4	5	6	7
<i>Batantapsyche</i>	closed	open	open	present	1,2,3,5	144	?
<i>Hydropsyche</i>	closed	closed	closed	absent	1,2,3,5	244	244
<i>Orthopsyche</i>	closed	closed	open	absent	1,2,3,5	244	244
<i>Schmidopsyche</i>	open	open	open	present	1,2,3,5	144	244



Figs 11–12. *Leptopsyche kormos* sp. n. and *L. vilagos* sp. n. in lateral view: 11 = *L. kormos* sp. n. 12 = *L. vilagos* sp. n.



Fig 13. *Leptopsyche kormos* sp. n. and *L. vilagos* sp. n.

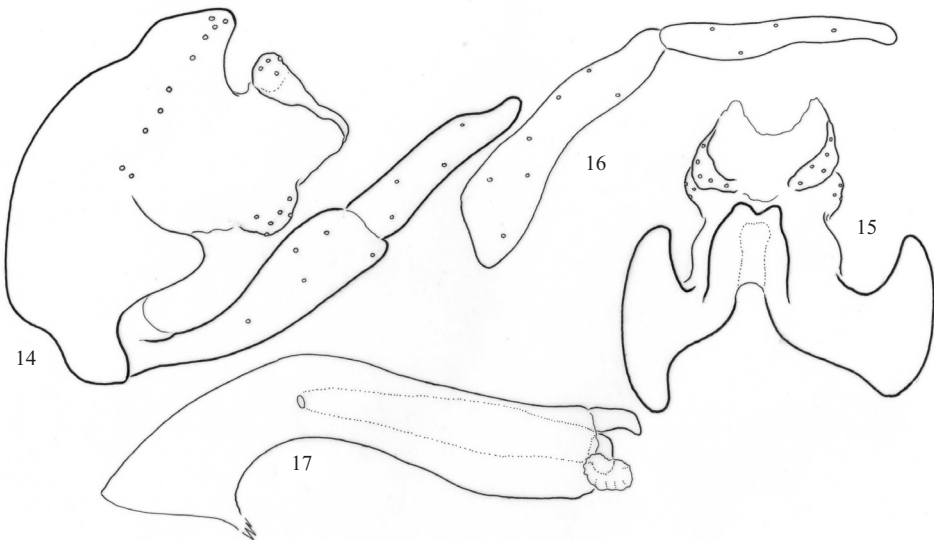
Schmidopsyche having almost identical phenotypic modifications at least in hindwing venation structures diverged in the Himalayas (Sikkim) from its ancestor of the widely distributed *Hydropsyche* genus. Similar hindwing modifications in *Schmidopsyche* and *Batantapsyche* are produced by random non-additive, epistatic polygenic interactions somehow regulated and realised in neofunctionation or in reversal of sleeping dormant or silenced gene complex fragments preserved in genome switched off or relegated to non-coding segments of DNA.

***Batantapsyche juhaszi* sp. n. (Figs 14–18)**

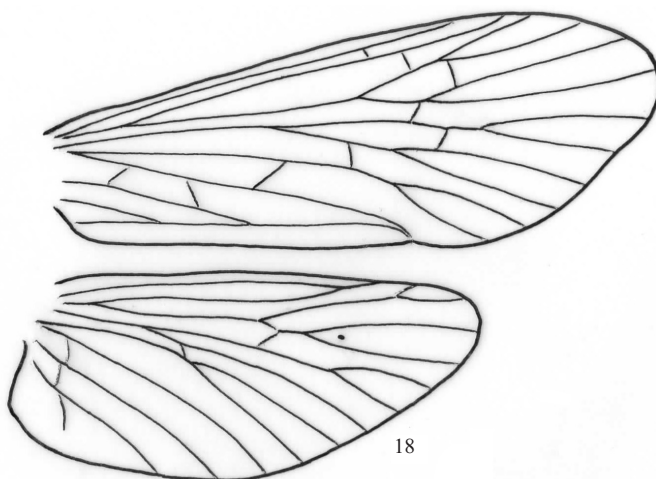
Diagnosis – Trait combinations of wing neuration and genital structure listed in genus diagnosis separate this hydropsychnine from its relatives as a type species of a new genus.

Description – Male (in alcohol). Medium sized, dark-winged animal with bicolored body. Head, antennae, palps, prothorax, mesoscutellum and forelegs bright yellow; mesothorax, metathorax, midlegs, hindlegs and abdomen castanean dark brown. Hind wing discoidal and median cell open. Maxillary palp formula I-IV-II-III-V. Spur formula 144. Forewing length 7 mm.

Male genitalia. Segment IX fused annular and short; anterior margin rounded; its median keel short with granulose dorsal surface, sloping upward posterad; apical lobe on posterolateral margin rounded. Lateral intersegmental profile between the ninth and tenth segments forms deep excision. Segment X short and high; lateral setose area, the cerci much developed rounded hump located near ventroapical margin; dorsoapical setose lobes moved back toward intersegmental excision forming a pair of asymmetric setose crescent lateraql rim in dorsal view. The coxopodit of the gonopod shorter than the apex of segment X, harpago broad almost parallel-sided in lateral view, constricted dorsoapicad in lateral view. Phallic organ with downward turning phallobase, broad endophallus middle of the phallosome; the head of phallosome consists of a pair of vertically elongated rounded phallosomal sclerite, a pair of very low sclerotized endothelial process and a pair of membranous lateral rounded lobes on the ventroapical region.



Figs 14–17. *Batantapsyche juhaszi* sp. n. holotype male: 14 = genitalia in left lateral view; 15 = genitalia in dorsal view; 16 = left gonopod in ventral view; 17 = phallic organ in left lateral view



Figs 18. *Batantapsyche juhaszi* sp. n. holotype male: 18 = wing venation

Type material – Holotype: **Indonesia**, West Papua, Batanta Island, valley of Warmon Creek, upper waterfall, 00°50'23.25", 130°42'35.18", 20.01.2014, at light, T. Kovács, P. Juhász (1♂, OPC).

Etymology – The type species of *Batantapsyche* new genus is dedicated to the collector, Péter Juhász, who has participated in the organisation as well as in the field collections on the virgin and difficult terrain of the Batanta Island.

Cheumatopsyche sorra Oláh, 2013 – **Indonesia**, West Papua, Batanta Island, Welebed, valley of Kalijakut River, 00°53'12.88", 130°38'16.40", 23.01.2014, at light, T. Kovács, R. Horváth, P. Juhász (12♂, OPC). West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (1♂, OPC).

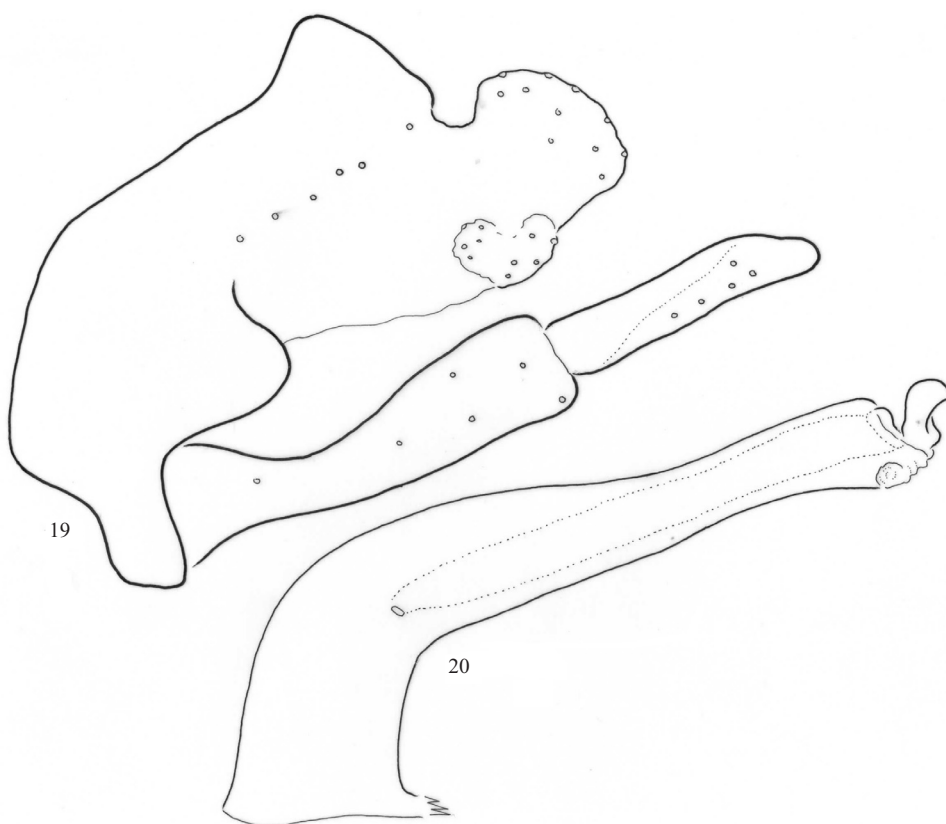
Cheumatopsyche ronbata Oláh, 2012 – **Indonesia**, West Papua, Batanta Island, valley of Waridor River, 00°52'09.66", 130°32'11.54", 03.02.2015, UV light-trap, T. Kovács, R. Horváth, P. Juhász (12♂, OPC).

Hydropsyche sabronensis (Kimmins, 1962) – **Indonesia**, West Papua, Batanta Island, Welebed, valley of Kalijakut River, 00°53'12.88", 130°38'16.40", 138 m a.s.l., 23.01.2014, at light, T. Kovács, R. Horváth, P. Juhász (6♂, OPC). West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (12♂, OPC). West Papua, Batanta Island, Teluk Warai, stream, 00°50'51.0", 130°35'14.0", 11.02.2015, at light, T. Kovács, P. Juhász (2♂, OPC). West Papua, Batanta Island, valley of Waridor River, 00°51'51", 130°33'41", 04.02.2015, at light, T. Kovács, R. Horváth, P. Juhász (9♂, OPC).

***Hydropsyche sotet* sp. n. (Figs 19–20)**

Diagnosis – This large dark animal is an incipient sibling species of *Hydropsyche lapos* Oláh, 2015 described from Arfak Mts (OLÁH 2015), but differs by having dark, almost black wings, not brown; dorsal keel on segment IX short and posterad sloping, not flat; dorsoapical setose lobe more developed and rounded, not small and quadratic; phallic organ differently shaped in lateral view; fine structure pattern of the endothelial sclerite modified.

Description – Male (in alcohol). Large dark-winged animal; wings of the less pigmented pharate male paratype is brown. Body ochraceous, dorsal thoracic sclerites little darker. Wings almost black, with a few light pointed spots and large light window along M1 ♀2.



Figs 19–20. *Hydropsyche sotet* sp. n. holotype male:
19 = genitalia in left lateral view; 20 = phallic organ in left lateral view

Median cell on hind wing present. Maxillary palp formula I-III-IV-II-V. Spur formula 244. Forewing length 13 mm.

Male genitalia. Segment IX fused annular and short; its median keel short with granulose dorsal surface, sloping down posterad; apical lobe on posterolateral margin rounded. Lateral intersegmental profile between the ninth and tenth segments forms a short and deep excision. Segment X short and low; lateral setose area, the cerci crescent-shaped and located near apical margin; dorsoapical setose lobes dominating on the lateral profile of segment X as a pair of dorsad shifted rounded setose plate. The coxopodit of the gonopod shorter than the apex of segment X, harpago broad almost parallel-sided in lateral view, twisted flat in ventral view. Phallic organ with high downward turning phallobase, broad endophallus middle of phallosoma, a pair of vertically high phallosomal sclerite, a pair of S-shaped sclerotized endothelial process and a membranous subapical region ventrally with laterad directed small lobe.

Type material – Holotype: **Indonesia**, West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (1♂, OPC). Paratypes: same as holotype (1♂, 1 paratype ♂, OPC).

Etymology – *sotet* from “sötét”, dark in Hungarian, refers to the wing colour.

Hydropsyche tuskes Oláh, 2013 – **Indonesia**, West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (11♂, OPC). West Papua, Batanta Island, Teluk Warai, stream, 00°50'51.0", 130°35'14.0", 11.02.2015, at light, T. Kovács, P. Juhász (1♂, OPC). West Papua, Batanta Island, valley of Waridor River, 00°51'51", 130°33'41", 04.02.2015, at light, T. Kovács, R. Horváth, P. Juhász (1♂, OPC).

CALAMOCERATIDAE Ulmer, 1905

Anisocentropus horvathi Oláh, 2012 – **Indonesia**, West Papua, Batanta Island, Welebed, „waterwork”, valley of Kalijakut River, 00°53'22.85", 130°38'25.91", 23.01.2014, UV light-trap, T. Kovács, R. Horváth, P. Juhász (2♂, 3♀, OPC). West Papua, Batanta Island, valley of Kalijakut River, 00°52'49.1", 130°38'4.9", 16.02.2015, UV light-trap, T. Kovács, P. Juhász, Kris (4♂, 2♀, OPC). West Papua, Batanta Island, Teluk Warai, stream, 00°50'51.0", 130°35'14.0", 11.02.2015, at light, T. Kovács, P. Juhász (5♂, 3♀, OPC). West Papua, Batanta Island, valley of Weras Stream, 00°49'51.2", 130°38'00.0", 300 m, 08.02.2015, at light, T. Kovács, P. Juhász (25♂, 18♀, OPC). West Papua, Batanta Island, valley of Waridor River, 00°51'51", 130°33'41", 04.02.2015, at light, T. Kovács, R. Horváth, P. Juhász (1♂, OPC).

Anisocentropus illustris McLachlan, 1863 – **Indonesia**, West Papua, Batanta Island, valley of Waridor River, between 00°52'6.6", 130°31'30.0" and 00°52'09.66", 130°32'11.54", 03.02.2015, singled from stream canopy, T. Kovács, R. Horváth, P. Juhász (1♂, OPC).

LEPTOCERIDAE Leach, 1815

Triplectidinae Ulmer, 1906

Triplectides dombos Oláh, 2014 – **Indonesia**, West Papua, Batanta Island, Teluk Warai, stream, 00°50'51.0", 130°35'14.0", 11.02.2015, at light, T. Kovács, P. Juhász (1♂, OPC). West Papua, Batanta Island, valley of Kalijakut River, 00°52'52.0", 130°38'8.0", 16.02.2015, at light, T. Kovács, P. Juhász, Kris (2♂, OPC).

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János OLÁH
Tarján u. 28.
H-4032 DEDRECEN, Hungary
E-mail: profolah@gmail.com

Tibor KOVÁCS
Mátra Museum of Hungarian Natural History Museum
Kossuth Lajos u. 40.
H-3200 GYÖNGYÖS, Hungary
E-mail: koati@t-online.hu

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