New *Baliomorpha* species (Trichoptera, Hydropsychidae) from Papua, Indonesia, with plesiomorphic state of the phallic head

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Abstract: The caddisfly species, *Baliomorpha cyclopsensis* **spec. nov.**, from the Cyclops Mts. of Indonesian Papua is described, with a brief outline of presentation and a discussion on the transformation series of the character states of the speciation traits, that is of the phallic head in the entire Hydropsychidae together with its incongruent nature.

Rangkuman: Spesies Caddisfly, *Baliomorpha cyclopsensis* **spec. nov.**, dideskripsikan dari Pegunungan Cyclops Papua, dengan outline singkat presentasi dan diskusi pada rangkaian transformasi karakter dari karakter spesiasi yaitu kepala phalilc pada seluruh Hydropsychidae bersama dengan ketidaksesuaiannya dengan alam.

Keywords: Trichoptera, new species, New Guinea, *Baliomorpha.*

Introduction

A single male specimen of an undescribed medium-sized macronematine species with a remarkable unique yellowish pattern on the brown forewing membrane was attracted to light and collected at low elevation in the Cyclops Mountains, Papua, in Indonesian New Guinea. Microscopic examination of this beautiful caddisfly species with the habitus of *Macrostemum* Kolenati, 1859 revealed that it is a new species of the Australasian genus *Baliomorpha* Neboiss, 1984. This genus is separated from the closely related *Macrostemum* by having variously divergent neutral characters on the head, the spurs and the forewing venation (Neboiss, 1984), as well as by the ancestral plesiomorphic character state of the adaptive speciation trait of the phallic head. The character state transformation series and the taxonomic incongruences of this adaptive trait is briefly outlined with the description of *Baliopmorpha cyclopsensis* **spec. nov.**

Character states of phallic head

The phallic head of *Baliomorpha* represents an intermediate character state in the Hydropsychidae along the transformation series of simplification from the plesiomorphic state of the phallic head with abbreviated, but free structures which are present in the ancestral subfamilies Arctopsychinae, Diplectroninae and Smicrideinae, in most genera of Hydropsychinae and in the ancestral genera of Macronematinae, to the much specialised apomorphic state of abbreviated plus retracted terminal structures in a few species groups in *Hydropsyche* (Hydropsychinae) and in most genera of the Macronematinae.
This simplification transformation series of the phallic structure of Hydropsychidae is realised by incremental subtraction (Oláh, 2018) through integrative organisation and not

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through selective evolution (Oláh et al., 2017). In the apomorphic state the apical head of the elongated phallotheca partially covers the abbreviated and retracted architecture of the endotheca, aedeagus and endothecal processes. In the first phase of the transformation series the prototypic fully produced endotheca, paramere and aedeagus are abbreviated into the vestigial membranous endotheca, sclerotized endothecal processes (parameres), and the phallotremal sclerites (aedeagus). In the second final phase of the transformation series these abbreviated free terminal structures are moved from the free distal position and retracted inside the cleft tip of the tubular phallotheca in most genera in Macronematinae and in the *Hydropsyche angustipennis* and *H. asiatica* species groups (Hydropsychinae). This is the most derived condition in the organisation of the transformation series of the phallic structure among hydropsychids. It is a form of specialization by simplification that could be an inherent complexity increase (Oláh et al., 2017). Complexity could be organised, not only by incremental addition but by incremental subtraction. Early plesiomorphic complexity is followed by successive reduction (McShea & Hordijk, 2013) even without evolutionary zero-force law (McShea & Brandon, 2010).

Incongruent states of phallic head

The ancestral state of the abbreviated, but still free terminal structures characterises the majority of taxa in the Hydropsychidae family. Free, not retracted structures are present on the phallic head in "almost" all genera and species of Archtopsychinae, Diplectroninae, and Smicrideinae, of the "majority" of Hydropsychinae, except the *Hydropsyche asiatica*, and the *Hydropsyche angustipennis* species groups. In the Macronematinae, both in the tribes Macronematini and Polymorphanisi, the "majority" of genera have the final apomorphic state of the phallic head with abbreviated plus retracted terminal structures: *Aethaloptera*, *Blepharopus*, *Centromacronema*, *Macrostemum*, *Oestropsyche*, *Plectromacronema*, *Polymorphanisus*, *Pseudoleptonema*, *Pseudomacronema*, *Synoestropsis*. The rest of the genera in Macronematinae, both in Macronematini and Polymorphanisi, have abbreviated, but still free, and not retracted plesiomorphic terminal structures on the phallic head: *Amphipsyche*, *Baliomorpha*, *Leptonema*, *Leptopsyche*, *Macronema* and *Protomacronema*.

The qualifiers of "almost" and "majority" used in the brief outlining of the character states refer to the general phenomenon of character incongruence equivalent with the phenomenon of a gene tree in the species tree. This brief survey on the character state of the phallic head in the Hydropsychidae family confirms that taxonomic incongruence is a general principle; its occurrence is rather a rule than an exception, creating incongruence between cladistic and taxonomic systems (Grant, 2003). In this survey we have detected the presence of taxa with ancestral plesiomorphic abbreviated, but still free structures in clades of taxa with derived apomorphic abbreviated, plus retracted structures or *vice versa* along all the taxonomic levels: species complex, species group, genus, tribe and subfamily.

Genus *Baliomorpha* Neboiss, 1984

The overwhelming majority of species in the genus *Baliomorpha* have an ancestral plesiomorphic state of the phallic head with abbreviated, but still free, and not retracted terminal structures, that is the endothecal processes and phallotremal sclerites on the speciation trait of phallic head are free and well discernible. However there are species in the genus with less discernible structures and therefore their taxonomic status is established with character combination with neutral characters distinguishing *Baliomorpha* from

(Australasian) *Macrostemum*. The *Baliomorpha* genus (1) has head frons without elevated pad, (not with elevated setose pad); (2) the maxillary palp has segment 1 and 2 short, subequal and segment 3 very long, (not segment 1 shorter than 2 and segment 3 only slightly longer than 3); (3) the spurs on legs are 1:4:4, (not 2:4:4); the Subcosta (Sc) on the forewing are forked at the end, (not united with R1 apically); (4) the nygma of the thyridial cell is at about middle of the cell, (not at the distal end).

***Baliomorpha cyclopsensis* spec. nov.** (Figs 1-7)

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Holotype: ♂ MZB [Museum Zoologicum Bogoriense, Cibinong, Java, Indonesia], Indonesia, Papua, Sentani, Kab. Jayapura, S 02°32'04.0'' E 140°30'47.5", 14.iv.2018, light, leg. P.J.A. de Vries.

Diagnosis: Easily distinguished from all the known species of *Baliomorpha* by its unique yellowish forewing pattern, especially by the rounded circle-shaped single eye-spot near the forewing tip. Such a beautiful yellowish forewing pattern is present at *Baliomorpha mariannae* Oláh, 2012, described from Batanta Island, Papua, Indonesia, but it has a bright yellow body, not a brown body and its forewing pattern is without the circle-shaped eye-spot on the forewing subapical. *Baliomorpha caudicea* Neboiss, 1984 and *B. echinata* Neboiss, 1984, described from Papua New Guinea, also have bold yellow blotches on the forewing, but with different patterns. The structure of the male genitalia of *B. cyclopsensis* **spec. nov.** is very similar to those of *B. echinata* but with a different lateral profile of segment X as well as with different fine structures of the abbreviated, but free, and not retracted phallotremal sclerites and endothecal processes (fig. 4).

Description: Male (in alcohol). Medium brown animal with seven yellowish light patches on forewing. Body and appendages brown, the dorsum of the mesothorax shining dark chestnut-brown. Antennae about twice as long as the forewing. Maxillary palp formula is I,II-IV-III-V. Forewing length 11 mm; Sc on the forewing with a less pigmented apical diverging fork connecting the subcosta with the costa and with radius1 apically; the nygma of the thyridial cell at about the middle of the cell; the forewing membrane is dark brown with seven yellowish patches: (1) the basal pair narrow longitudinal; (2) the middle pair with a most irregular costal patch; (3) the subapical pair with a larger costal patch; (4) a single subapical circle-shaped eye-spot.

Male genitalia: Segment IX with a short ventrum and a longer humpy dorsum; the apical margin of the pleuron with a vertical row of strong setae. Segment X is short subtriangular in lateral view; diverging with narrowing apices in dorsal view; the cerci are located in the middle based on the lateral lobes and represented by setal slightly elevated rounded lobes. Vestigial paraproct emarginating segment X ventrolaterad and forming a sclerotized rod-shaped phallic guide connecting the ventrobased part of segment X with phallotheca. The gonopods are undivided, no articulation discernible between coxopodite and harpago; straight, long rod-shaped in lateral view and arched in ventral view. Phallobase of the phallotheca right angled to the stem; phallic head with dorsal opening housing the phallotremal sclerites at the end of *ductus ejaculatoricus* as well as the elongated highly sclerotized endothecal processes.

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Distribution: Cyclops Mountains, the holotype is found at the lower southern slopes near Sentani, Papua, Indonesia.

Etymology: Species epithet "cyclopsensis" refers to the type locality of the species, the Cyclops Mountains in Papua, Indonesia, as well as to its main distinguishing character of the single circle-shaped eye-spot on the forewing tips that symbolizes the single-eyed giants, the Cyclops of Greek mythology.

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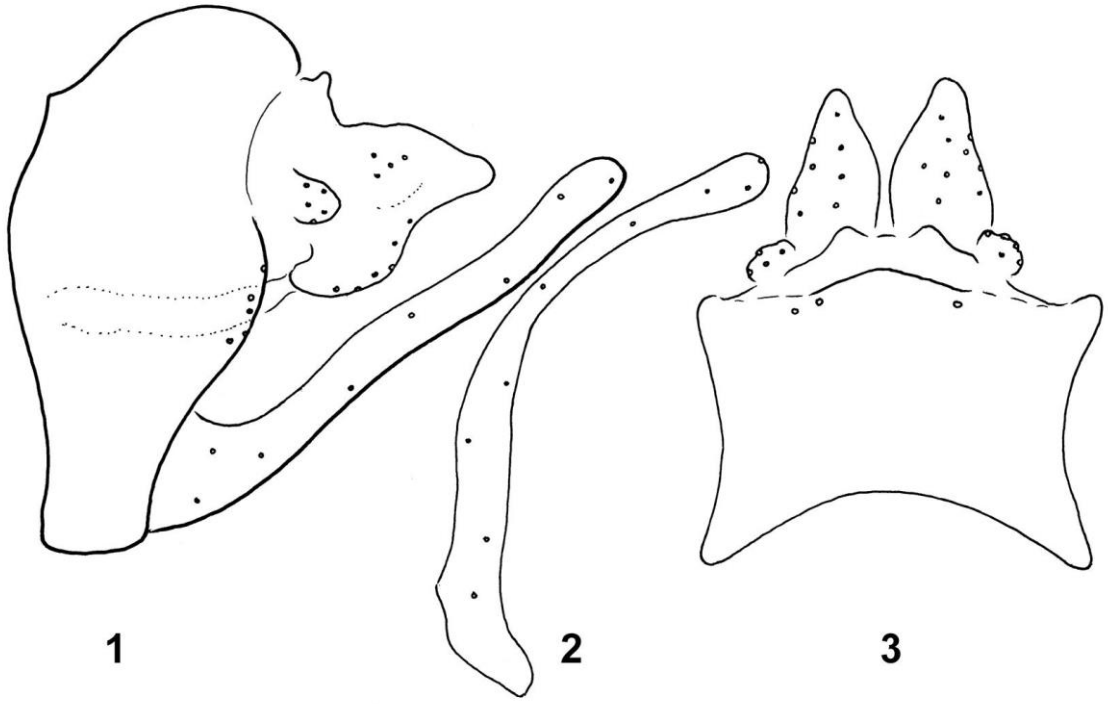
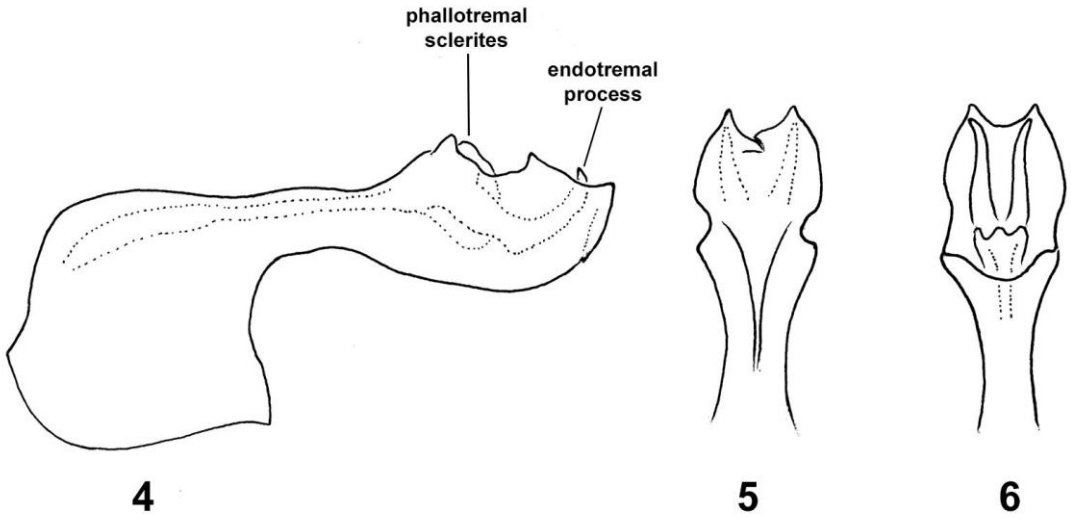


Figs 1-3. *Baliomorpha cyclopsensis* **spec. nov.** holotype, male genital structures. **Fig. 1.** Lateral view of genitalia; **Fig. 2.** Ventral view of left gonopode; **Fig. 3.** Dorsal view of segments IX-X and cerci.



Figs 4-6. *Baliomorpha cyclopsensis* **spec. nov.** holotype, male genital structures. **Fig. 4.** Lateral view of phallus; **Fig. 5.** Ventral view of phallus head; **Fig. 6.** Dorsal view of phallus head.

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Fig. 7. *Baliomorpha cyclopsensis* **spec. nov.** holotype, male. Waterfall, near Sentani, Cyclops Mountains, Papua, Indonesia [MZB] (photo: Rob de Vos).

Figs. 8-9. Habitat of *Baliomorpha cyclopsensis* **spec. nov. Fig. 8.** Waterfall near Sentani, Cyclops Mountains (photo: Rob de Vos); **Fig. 9.** View at Sentani opposite of the waterfall (photo: Peter Jan de Vries).

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