

***Centroptella (Chopralla) papuanica* Kluge, 2021 (Ephemeroptera, Baetidae) from Batanta Island (New Guinea), with description of the male imago**

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ABSTRACT: The Mátra Museum of the Hungarian Natural History Museum conducts a long-term exploration of the biodiversity of Batanta Island in West Papua (Indonesia), focused on selected groups of insects. Numerous mayflies of different stages were collected during the field campaigns as well. In this study, we report the mayfly *Centroptella (Chopralla) papuanica* Kluge, 2021 (Ephemeroptera, Baetidae) from Batanta, hitherto known from a single locality on the main island of New Guinea. Larvae, subimagos and imagos are illustrated, the male imago is described for the first time. Further, we obtained mitochondrial DNA data (COI) from a few specimens.

Introduction

Currently, the Mátra Museum of the Hungarian Natural History Museum in collaboration with other research organizations is running a research program on the biodiversity of Batanta Island (Indonesia, West Papua). The research program primarily focuses on various insect groups; initiated in 2010, it is expected to continue for several more years (for details see KOVÁCS *et al.* 2015, 2025, KALTENBACH *et al.* 2025b).

The mayfly fauna of New Guinea, the second largest island of the world after Greenland, is characterised by a low number of families and genera (for details see KALTENBACH *et al.* 2025b), but very diverse on species level in some groups like *Labiobaetis* Novikova & Kluge, 1987 and *Papuanatula* Lugo-Ortiz & McCafferty, 1999 (LUGO-ORTIZ & MCCAFFERTY 1999, LUGO-ORTIZ *et al.* 1999, KALTENBACH & GATTOLLIAT 2018, 2021, KALTENBACH *et al.* 2021, 2023, 2025a, 2025b), and also the tribe Thraulini (Leptophlebiidae; SARTORI & SALLES 2025). Contrary to *Labiobaetis* and *Papuanatula*, the genus *Centroptella* Braasch & Soldán, 1980 did not radiate in New Guinea. Just two species were reported so far, *Centroptella (Centroptella) breviseta* Kluge, 2021 and *Centroptella (Chopralla) papuanica* Kluge, 2021 (KLUGE 2021).

The concept of *Centroptella* and related genera or subgenera was debated during the last decade, and a substantial number of new species was described from different regions (MARLE *et al.* 2016, SALLES *et al.* 2016, KLUGE 2017, SHI & TONG 2019, SROKA *et al.* 2019, KLUGE *et al.* 2020). Recently, a review of *Centroptella* was presented by KLUGE (2021). *Centroptella s. l.* has a large distribution in the Eastern Hemisphere, the subgenus *Chopralla* Waltz & McCafferty, 1987 is widely distributed in the Oriental region and New Guinea (KLUGE 2021). Here, we report *Centroptella (Chopralla) papuanica* from Batanta Island, hitherto known from the main island of New Guinea. Larvae, subimagos and imagos are illustrated, the male imago is described for the first time.

Material and methods

The material was collected by the second author on the island of Batanta (Indonesia, West Papua) together with colleagues and a local team during several trips from 2014–2025. The larvae were collected by kick-sampling and preserved in 70–96% ethanol, winged stages were attracted by light (Xenon HDI bulb, 35 W, 6000 K) in or close to the riverbed and also preserved in 70–96% ethanol. Later, association of winged stages with the larvae was done by genetics (COI). Eggs were extracted from a female subimago.

The dissection of specimens was done in Cellosolve (2-Ethoxyethanol) with subsequent mounting on slides with Euparal liquid, using an Olympus SZX7 stereomicroscope.

DNA of part of the specimens was extracted using non-destructive methods allowing subsequent morphological analysis (see VUATAZ *et al.* 2011 for details). We amplified a 658 bp fragment of the mitochondrial gene cytochrome c oxidase subunit 1 (COI) using the primers LCO 1490 and HCO 2198 (FOLMER *et al.* 1994). Sequencing was done with Sanger's method (SANGER *et al.* 1977). The genetic variability between specimens was estimated using Kimura-2-parameter distances (K2P, KIMURA 1980), calculated with the program MEGA11 (TAMURA *et al.* 2021). The GenBank accession numbers are given in Table 1.

Photographs of whole specimen were taken using a Canon EOS 6D camera and processed with Adobe Photoshop Lightroom and Helicon Focus v. 5.3 software. Pictures of larval, subimaginal and imaginal structures were taken with an Olympus SC 50 camera attached to an Olympus BX43 microscope, processed with Olympus cellSens v. 3.2 software. SEM pictures were taken using a FEI Quanta 250 FEG Scanning Electron Microscope (Thermo Fisher). Photographs were subsequently enhanced with Adobe Photoshop Elements 13 software.

The distribution map was created with the online tool SimpleMapper (SHORTHOUSE 2010).

The terminology follows KLUGE (2004).

Abbreviations: MM = Mátra Museum of the Hungarian Natural History Museum of the Hungarian National Museum Public Collection Centre, Gyöngyös (Hungary), MZL = Naturéum, Cantonal Museum of Natural Sciences, Lausanne (Switzerland).

Table 1. Sequenced specimens (L = larva, SI = subimago, I = imago) of *C. (Ch.) papuanica*

Specimen voucher catalogue #	Stage	GPS coordinates		GenBank # (COI)	GenSeq Nomenclature
GBIFCH01221782	I ♂	00°53'43"S	130°36'39"E	PX930436	genseq-4 COI
GBIFCH00975911	L	00°52'27"S	130°37'52"E	PX930441	genseq-4 COI
GBIFCH00975910	L	00°52'16"S	130°37'46"E	PX930440	genseq-4 COI
GBIFCH00975868	SI ♀	00°52'27"S	130°37'52"E	PX930439	genseq-4 COI
GBIFCH00975867	SI ♂	00°52'27"S	130°37'52"E	PX930438	genseq-4 COI
GBIFCH00975866	SI ♂	00°52'27"S	130°37'52"E	PX930437	genseq-4 COI

Results

Centropetella (Chopralla) papuanica Kluge, 2021 (Figs 1–4)

Material examined. Indonesia, West Papua, Batanta Island, valley of Tanjung Lampu River, 175 m, 00°53'43"S, 130°36'39"E, 18.02.2020, at light, 1 ♂ imago, leg. T. Kovács, R. Horváth, P. Juhász (on slide, GBIFCH01221782, thorax in alcohol, GBIFCH00975806, MZL) – Kalijakut River, 420 m, 00°52'27"S, 130°37'52"E, 09.02.2024, 4 larvae, leg. T. Kovács (2 larvae on slides, GBIFCH00975911, GBIFCH01221851, MZL; 2 larvae in alcohol, GBIFCH00975912, MM) – Kalijakut River, 420 m, 00°52'27"S, 130°37'52"E,



Figure 1. *Centroptella (Chopralla) papuanica*: **a** = larva, dorsal view; **b** = larva, ventral view; **c** = male subimago, dorsal view; **d** = male subimago, ventral view; **e** = female subimago, dorsal view; **f** = female subimago, ventral view; **g** = female subimago, foreleg; **h** = female subimago, hind leg; **i** = male subimago, fore tarsus. Scale bars: 1 mm (**a-f**), 50 μm (**g, h**), 20 μm (**i**)

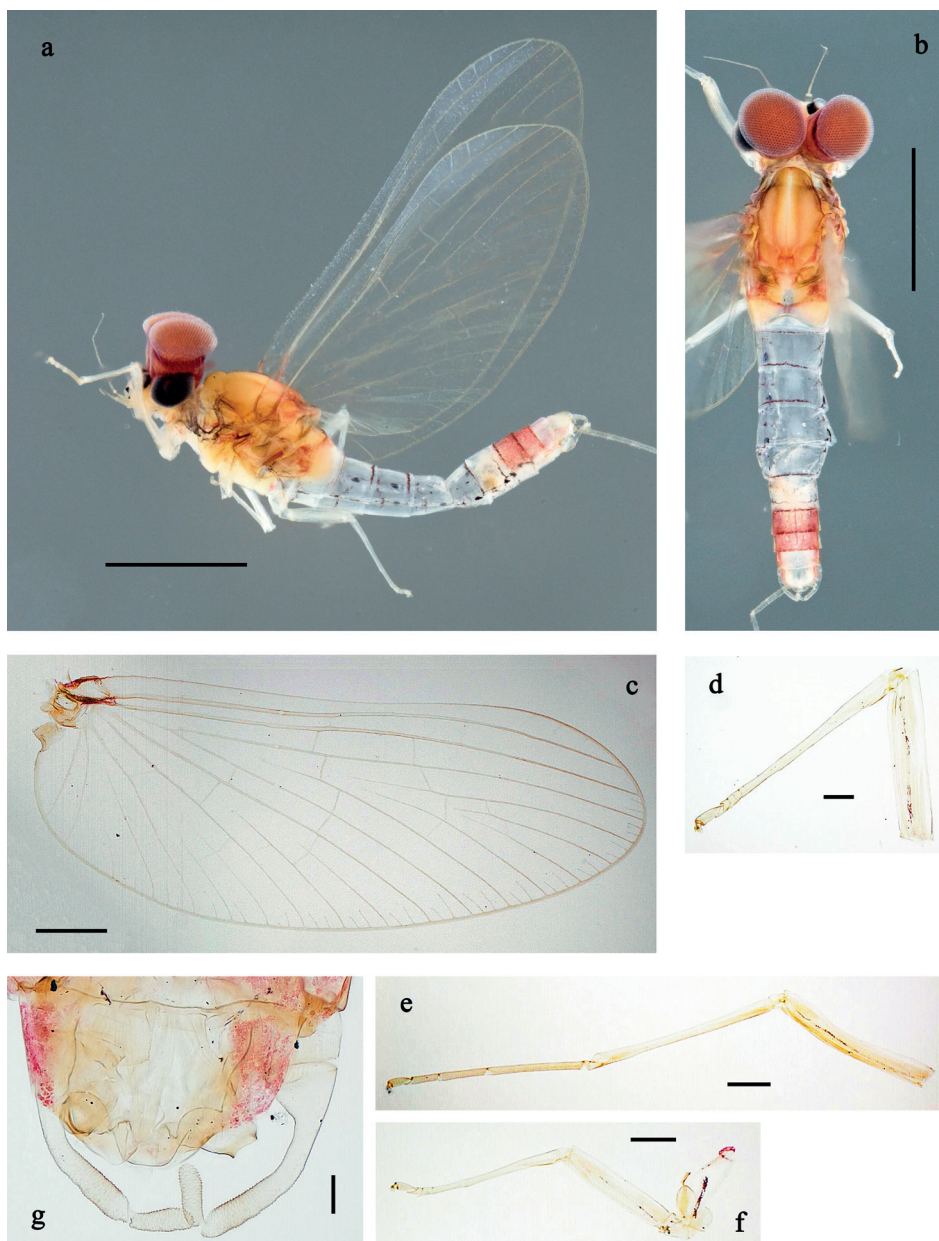


Figure 2. *Centroptella (Chopralla) papuanica*, male imago: **a** = habitus, lateral view; **b** = habitus, dorsal view; **c** = forewing; **d** = middle leg; **e** = foreleg; **f** = hind leg; **g** = genitalia. Scale bars: 1 mm (**a**, **b**), 200 µm (**c**), 100 µm (**e**, **f**), 50 µm (**d**), 20 µm (**g**)

09.02.2024, at light, 4 ♂ subimagos, 3 ♀ subimagos, 2 ♀ imagos, leg. T. Kovács, P. Juhász (♂ subimago on slide, GBIFCH01221848; 3 ♂ subimagos in alcohol, GBIFCH01582069, GBIFCH00975866, GBIFCH00975867; ♀ subimago on slide, GBIFCH01221850, body in alcohol, GBIFCH01582068; 2 ♀ subimagos in alcohol, GBIFCH00975865, GBIFCH00975868; 2 ♀ imagos on slides, GBIFCH01582067, GBIFCH01221849, body in alcohol, GBIFCH01582071, MZL) – Kalijakut River, 545 m, 00°52'16"S, 130°37'46"E, 10.02.2024, 3 larvae, leg. T. Kovács, R. Sauyai (in alcohol, GBIFCH00975909, GBIFCH00975910, MZL) – Waibin River, between 20–45 m, 00°49'21"S, 130°45'57"E and 00°50'02"S, 130°45'25"E, 05.02.2024, 2 larvae, leg. T. Kovács (in alcohol, GBIFCH00975914, MZL).

Description. Larva (Fig. 1a, b). Description in KLUGE (2021: 124, figs 598–617); the population in Batanta displays no morphological difference to the type series from Waena (New Guinea).

Subimago (Fig. 1c–i). Body length 4.1–4.2 mm. Description in KLUGE (2021: 129, figs 621–623); the population in Batanta displays no morphological difference to the type series, except the dorsal head coloration, which is grey-brownish instead of colourless as originally described. Turbinate eyes of male dorsally dark grey-brown, faceted surfaces round.

Imago, male (Fig. 2a–g). Body length 3.9 mm. Head pale brown, antennae pale brown, turbinate eyes reddish-brown, wide, with faceted surfaces slightly oval. Thorax dorsally and laterally brown to reddish-brown (Fig. 2a, b). Forewing with membrane colourless, veins pale brown to colourless, base of RA and costal brace reddish-brown. Pterostigma with three oblique crossveins, basal two crossveins complete, distalmost incomplete (Fig. 2c). Foreleg pale brown, middle part of tibia nearly colourless (Fig. 2e); middle and hind leg very pale brown, nearly colourless. Abdominal tergum I pale reddish-brown; terga II–V nearly colourless; tergum VI pale brown; terga VII and VIII reddish; terga IX and X mostly pale brown, laterally reddish; terga I–VIII with hypodermal, dark reddish-brown, narrow, transverse streak on posterior margin. Abdominal sterna I–V nearly colourless; sterna VI–X very pale brown. Cerci colourless. Genitalia (Fig. 2g). Unistyliger apically not widened, with median and lateral margins slightly convex. Gonostylus with segment I on median side slightly convex, on lateral side almost straight. Segment II in basal 1/3 bent medially and less wide than in distal 2/3; distal part straight, equally wide over its length. Terminal segment III nearly as wide as segment II in distal part, straight, ~3x longer than wide, subdistally slightly widened at inner margin. Penial bridge with poorly expressed membranous projection between unistyligers.

Imago, female (Fig. 3a–g). Body length 4.0 mm. Description in KLUGE (2021: 129, figs 618–620); the population in Batanta displays no morphological difference to the type series. Pterostigma of forewing with variable, oblique crossveins: three complete crossveins; or two basal, complete crossveins and one distalmost incomplete; or two basal and one distalmost, incomplete crossveins, and one subdistal, complete crossvein.

Egg. Description in KLUGE (2021: 130, figs 624, 625); from the population in Batanta, eggs extracted from a female subimago display no morphological difference to the type series.

Biological aspects. *Centropetella* (*Chopralla*) *papuanica* was found in three of the 19 watercourses examined so far in Batanta, it seems to be rather locally distributed and rare. A part of the specimens were collected on low sections of the rivers Waibin near the northern coast (20–45 m; Fig. 4a) and Tanjung Lampu near the southern coast (175 m; Fig. 4b), and

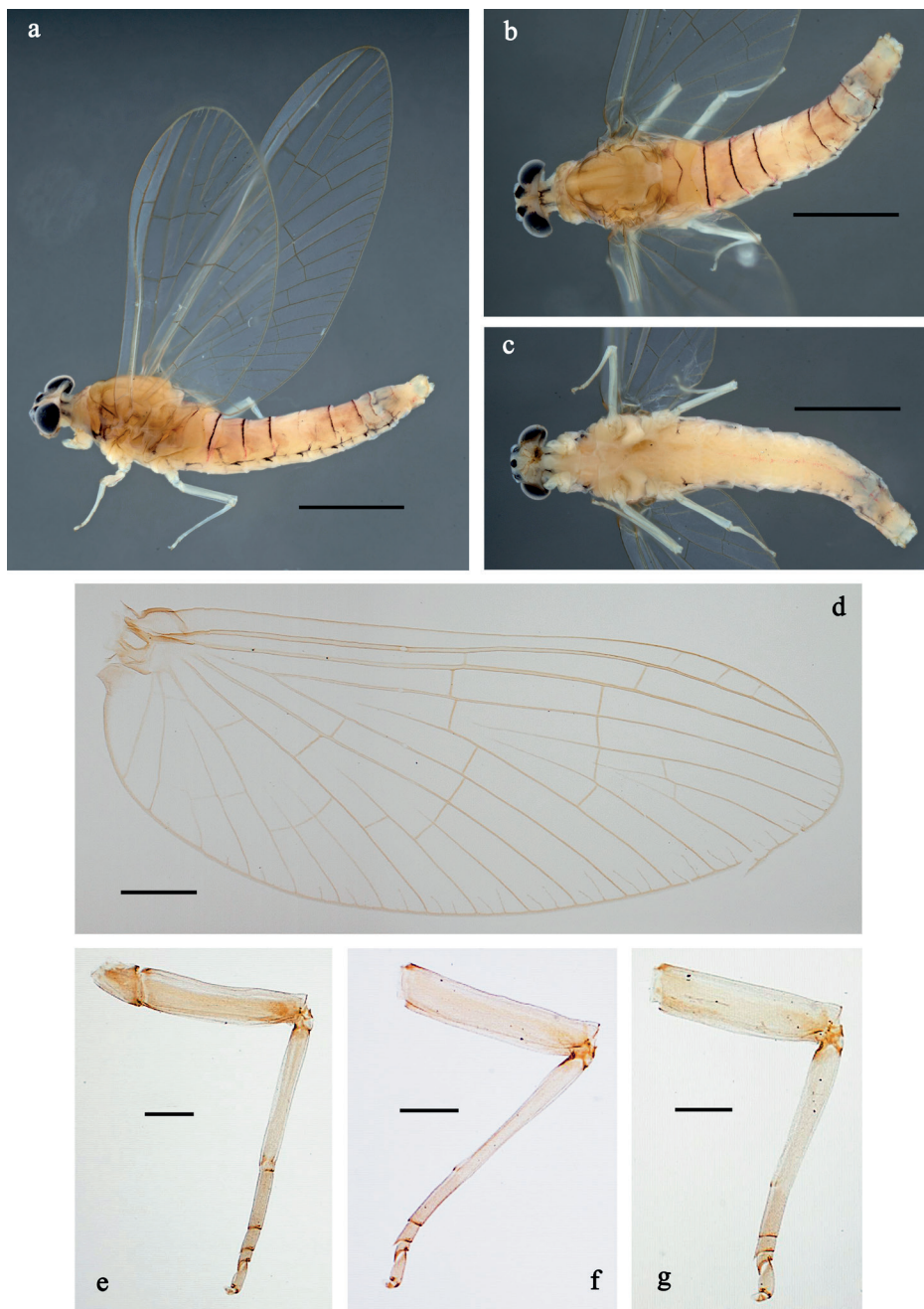


Figure 3. *Centroptella (Chopralla) papuanica*, female imago: **a** = habitus, lateral view; **b** = habitus, dorsal view; **c** = habitus, ventral view; **d** = forewing; **e** = foreleg; **f** = middle leg; **g** = hind leg.
Scale bars: 1 mm (**a–c**), 200 μ m (**d**), 100 μ m (**e–g**)



Figure 4. *Centropomella (Chopralla) papuanica*, habitats and distribution in New Guinea: **a** = Waibin River; **b** = Tanjung Lampu River; **c** = Kalijakut River on 420 m; **d** = Kalijakut River on 545 m (photos T. Kovács); **e** = distribution (TL = type locality, Waena)

other specimens in higher sections of the Kalijakut River (420 m, 545 m; Fig. 4c, d).

Distribution. New Guinea (Fig. 4e).

Genetics. COI barcode sequences were obtained from six specimens (Table 1). No COI sequence is available from the type locality. The closest sequence of other species of the subgenus *Chopralla* has more than 17% of divergence. The intraspecific distances are always between 0 and 1%, as expected.

Discussion

The gonostyli of male genitalia have an elongated third (final) segment in *Centroptella s. l.* (KLUGE *et al.* 2020; KLUGE 2021). *Centroptella (Chopralla) papuanica* is no exception and displays also an elongated segment III of gonostylus, length ~3x width (Fig. 2g).

According to KLUGE (2021: 96), the typical colour of male imagos of the subgenus *Chopralla* is: thorax brown with reddish-brown in dorsal part and pale brown in ventral part, which is in line with the coloration of *C. (Ch.) papuanica*; abdomen either with the same coloration, or no reddish coloration on most terga, the latter is also the case for *C. (Ch.) papuanica* (Fig. 2a, b). This coloration differs from the subgenera *Centroptella* and *Crassolus* Salles, Gattolliat & Sartori, 2016, as described by KLUGE (2021: 96).

KLUGE (2021) reported vestiges of hind protoptera in all investigated mature larvae of *C. (Ch.) papuanica*, but hindwings are absent in adults. In the population of Batanta, we found mature larvae with and without vestigial hind protoptera. However, presence or absence of vestigial hind protoptera may vary, and cannot be used as a character to differentiate species. Even in the same specimen, a vestigial hind protopteron may be present on one side and absent on the other side, as shown by KLUGE (2021: figs 510, 511) for *C. (Ch.) ghatensis* Kluge, 2021 from India.

The subgenus *Chopralla* appears to be rare in New Guinea, although it can be locally abundant. Despite examining Baetidae material collected from more than 50 localities across the island, we did not identify any additional populations belonging to this subgenus. The taxon seems to be restricted to lowland and lower mountainous habitats, but absent from higher mountainous regions of New Guinea. The only other species of *Centroptella* reported from the main island is *C. (C.) breviseta*.

Acknowledgements: Most of the financial support for the field trips to Batanta came from Róbert Horváth (Ostoros, Hungary), who provided free accommodation and catering for the second author in Batanta Island. He and the Papua Paradise Eco Resort (Birie Island, Indonesia) provided the base camp and helped organise the field trips. R. Horváth and Péter Juhász (Debrecen, Hungary) helped a lot during the field work. We are also beholden to Kristian Sauyai and Ronnius Sauyai (both from Wailebet, Batanta, Indonesia), our local helpers. András Ambrus (Kópháza, Hungary) recommended the bulb for collecting winged stages of Ephemeroptera.

Our study was carried out in compliance with the Memorandum of Understanding signed by the Research Centre for Biology, Indonesian Institute of Sciences, and the Hungarian Natural History Museum.

Further, we are grateful to Céline Stoffel (MZL, University of Lausanne) for her support with lab work and preparation of the COI barcodes. Scanning electron microscopy was performed by Antonio Mucciolo at the University of Lausanne.

Finally, we are thankful to the reviewers for their valuable comments and corrections.

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