Australian Journal of Taxonomy
Open-access, online, rapid taxonomy
https://doi.org/10.54102/ajt

First record of *Papuanatula* (*Papuafiliola*) in Australia (Ephemeroptera: Baetidae): reassignment of *Platybaetis gagadjuensis* Suter, 2001 and biogeographic implications

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Abstract

Platybaetis gagadjuensis Suter, 2001, an Australian mayfly species originally assigned to the genus *Platybaetis* Müller-Liebenau, 1980, has long presented morphological inconsistencies with its generic placement. Recent comparative analyses have demonstrated that this species fully corresponds to the newly established subgenus *Papuafiliola* Kaltenbach, Kluge & Gattolliat, 2025. The description of this subgenus, and its placement within the genus *Papuanatula* Lugo-Ortiz & McCafferty, 1999, entails a significant revision of the generic concept and diagnostic characters. Accordingly, we formally propose the new combination *Papuanatula (Papuafiliola) gagadjuensis* comb. nov. This reassignment does not require any modification to the existing diagnoses of the genus or subgenus. *Papuanatula (P.) gagadjuensis* comb. nov. can be distinguished from the other known species in *Papuafiliola* by the dark brown pattern on femora, the shape of the femora, the shape of the gills, the degree of development of the thumb-like projection on segment II of the labial palp and the distribution of small unpaired dorsal protuberances on abdominal tergites I–V. This transfer marks the first record of *Papuanatula* in Australia and extends the known range of *Papuafiliola* beyond New Guinea. The occurrence of this lineage in northern Australia further supports biogeographical connections between New Guinea and Queensland, already recognized in other mayfly genera such as *Caenis* Stephens, 1835, *Prosopistoma* Latreille, 1833 and *Labiobaetis* Novikova & Kluge, 1987 / *Pseudocloeon* Klapálek,1905. With the new combination *Platybaetis* is restricted to the Oriental realm and is absent from Australasia.

Cite this paper as: Gattolliat J-L, Kaltenbach T & Suter PJ (2026). First record of *Papuanatula* (*Papuafiliola*) in Australia (Ephemeroptera: Baetidae): reassignment of *Platybaetis gagadjuensis* Suter, 2001 and biogeographic implications. *Australian Journal of Taxonomy* 114: 1–6. doi: https://doi.org/10.54102/ajt.5j2ge

urn:lsid:zoobank.org:pub:E15C0014-72F2-4D20-987A-C3CEC9C64D9D

This paper was submitted on 19 September 2025 and published on 4 February 2026 (2026-02-03T20:25:15.741Z). It was reviewed by two anonymous reviewers and edited by Subject Editor Nicole Gunter under the guidance of Associate Editor Tom May. Australian Journal of Taxonomy. ISSN: 2653-4649 (Online).

Introduction

The genus *Platybaetis* Müller-Liebenau, 1980 was originally described from the Philippines to include highly adapted Baetidae (Ephemeroptera) species living on wet rocks projecting out of the water. These nymphs exhibit a large, dorsoventrally flattened body, especially in the head, prothorax, and legs, and possess a highly reduced paracercus. The genus currently includes ten species in the Oriental realm and one species reported from Australia. *Platybaetis* was first recorded in Australia during a survey in the Northern Territory (Suter 1992), then reported from a site in Queensland and incorporated into the generic key to Australian Baetidae nymphs (Suter 1997). The species was first presented in 1998 during the IX International Conference on Ephemeroptera in Tucumán (Argentina), but remained undescribed until its formal publication as *Platybaetis gagadjuensis* Suter, 2001, based on nymphs and male subimagos, in the proceedings of the same conference (Suter 2001). In the interim, Lugo-Ortiz & McCafferty (1999) described the genus *Papuanatula* Lugo-Ortiz & McCafferty, 1999 (see details below). The new species was assigned to *Platybaetis* due to the dorsoventrally flattened nymph, broad prognathous head, absence of hindwings, flattened femora and a row of long blunt setae along the dorsal margins of femora and tibiae. However, significant discrepancies were noted, particularly in the small body size, the absence of femoral patches, the shape of the mouthparts, and the number of pairs of gills (Suter 2001). In their revision of the genus *Platybaetis*, Kluge and Novikova (2011) were the first to question the generic placement of *P. gagadjuensis*, although they did not propose a new assignment. Subsequent authors confirmed the misattribution but were likewise unable to provide a satisfactory alternative (Sutthinun et al. 2018; Vasanth et al. 2025).

In 1999, Lugo-Ortiz and McCafferty described the new genus *Papuanatula* for a large and diverse collection of Baetidae from New Guinea. They described six new species characterized by femora bearing a row of long, dense setae along the outer margin; a similar row of long, dense setae on the tibiae and tarsi; absence of femoral patches on all legs; absence of a very long subapical seta on the ventral margin of tibiae; claw with at least one posterior seta; gills on abdominal segments II to VII; a strongly reduced or vestigial paracercus; glossae of the labium much shorter than the paraglossae and lingua of hypopharynx with a bunch of spine-like setae (Lugo-Ortiz & McCafferty 1999). Part of these characters overlap with those found in *Platybaetis*. However, the two genera can be reliably distinguished by features of the mouthparts and legs. Recently, a revision of *Papuanatula* was undertaken, resulting in the description of twenty new species from New Guinea and Sulawesi (Kaltenbach et al. 2025). As part of this work, the new subgenus *Papuafiliola* Kaltenbach, Kluge & Gattolliat, 2025 was established to accommodate two new species that retain part of the main diagnostic features of *Papuanatula,* but differ significantly in several aspects: the labrum is not enlarged and widest at the base and bears only a few simple submarginal setae (as opposed to a row of abundant feathered setae in *Papuanatula* s. str.); the mandibles have shortened incisors (not blade-like as in *Papuanatula* s. str.); and the labial palp features a distomedian projection on segment II (Kaltenbach et al. 2025). The inclusion of these two species, along with the subgenus *Papuafiliola*, in *Papuanatula* necessitated a redefinition of the genus (Kaltenbach et al. 2025). In particular, the degree of mandibular canine fusion and the setation of the labrum, originally regarded as generic characters by Lugo-Ortiz and McCafferty (1999), were later reassessed as subgeneric features (Kaltenbach et al. 2025). While working on this revision, the authors noted that *Platybaetis gagadjuensis* matches the concept and diagnostic features of the new subgenus *Papuafiliola* exactly. However, they refrained from formally proposing the transfer pending direct examination of the type material.

Results

Based on the original description and the examination of original material, we confirm that *Platybaetis gagadjuensis* fully fits the diagnostic characters of the genus *Papuanatula* as redefined in Kaltenbach et al. (2025) and of the subgenus *Papuafiliola*. We therefore propose the new combination *Papuanatula (Papuafiliola) gagadjuensis* (Suter, 2001) below.

Discussion

The description of the subgenus *Papuafiliola* and its inclusion within the genus *Papuanatula* have profoundly reshaped the generic delimitation of *Papuanatula*. Several diagnostic characters previously regarded as generic have become restricted to the subgenus *Papuanatula*. *Platybaetis gagadjuensis* clearly did not conform to the original concept of *Papuanatula* as defined by Lugo-Ortiz and McCafferty (1999), which explains why Suter (2001) assigned it to the genus *Platybaetis*. However, *Papuanatula (Papuafiliola) gagadjuensis* comb. nov. fully meets the generic and subgeneric diagnoses as amended in Kaltenbach et al. (2025), justifying the transfer of the species from *Platybaetis*. This new combination does not require any additional modification to the diagnostic characters of the genus or subgenus. The assignment of this Australian species to *Papuafiliola* strengthens the morphological and taxonomic cohesion of the subgenus, confirms the validity of the diagnostic characters supporting its recognition, and clearly supports *Papuafiliola* as a monophyletic lineage. It further corroborates the close affinity between *Papuanatula* and *Papuafiliola*, but at the same time raises questions regarding the subgeneric rank of the latter. The extent and consistency of the differences between the two taxa may indicate that *Papuafiliola* should be more appropri-

ately treated as a distinct genus rather than as a subgenus of *Papuanatula*.

The Australian species can be distinguished from the other species currently described in the subgenus *Papuafiliola* by the dark brown pattern on femora, the shape of the femora; the shape of the gills, the degree of development of the thumb-like projection on segment II of the labial palp: this projection is less developed in *P. (P.) gagadjuensis* than in the other species. In addition, small unpaired protuberances are present on tergites I–V in *P. (P.) gagadjuensis*, whereas they occur on all abdominal tergites in *Papuanatula (Papuafiliola) tuberculata* Kaltenbach, Kluge & Gattolliat, 2025, and are entirely absent in *Papuanatula (Papuafiliola) stenophylla* Kaltenbach, Kluge & Gattolliat, 2025 (Kaltenbach et al. 2025).

Only a limited number of specimens mounted on microscope slides are currently available for study. Morphological variation has been observed among these specimens, particularly with respect to the degree of development of the thumb-like process on the second segment of the labial palp, as well as the presence and development of small protuberances on the abdominal tergites. In light of the high species diversity documented in New Guinea, it is plausible that examination of additional material will reveal that the genus *Papuanatula* comprises more than a single species in Australia.

This new combination represents the first record of the genus *Papuanatula* and subgenus *Papuafiliola* in Australia, thereby extending their known distribution southward. This finding, however, is not unexpected given the well-documented biogeographic connections between Queensland and New Guinea in the Ephemeroptera including the Caenidae (*Caenis* Stephen, 1835*,* see Suter et al. 2023), Prosopistomatidae (*Prosopistoma* Latreille, 1833*,* see Pearson and Penridge 1979), Baetidae (*Labiobaetis* Novikova & Kluge, 1987/ *Pseudocloeon* Klapálek,1905*,* see Webb and Suter 2011), and the Ephemerellidae (*Austremerella* Riek, 1963, see Riek 1963 and Suter and Mynott 2013). Conversely, the new combination indicates that *Platybaetis* is no longer present in Australia; the genus is thus widely distributed in the Oriental region but absent from the Australasian region.

Taxonomy

Papuanatula (Papuafiliola) gagadjuensis (Suter, 2001) *comb. nov.*

Diagnosis

Nymph:

Body length: 2.8–4.0 mm.

Mouthparts: Labrum short and wide at base, dorsally with few submarginal, simple setae (Fig. 1). Mandibles with short incisor fused apically (Figs 2-4). Hypopharynx: lingua with a patch of very strong setae apically (Fig. 5). Labium: glossae reduced, shorter than paraglossae, slender except proximally (Fig. 6). Segment II of labial palp with a thumb-like projection; segment III conical (Fig. 7). Maxilla typical of the subgenus, palp with two segments subequal to the galealacinia. Segment I equal to 0.8 of segment II (Fig. 8). Antenna showing basal segments of uniform size (Fig. 9).

Legs: dorsal margin of femora and tibiae with a regular row of long blunt setae (Figs 10-12). Femoral patch absent. Ventral margin of tarsi with a row of regular tiny setae. Claws with a row of 8-10 short denticles and a long, arched posterior seta on posterior side near distal denticle (Fig. 13).

Hindwing pads absent.

Distal margin of tergites I–V (I–VIII in some specimens) with small unpaired protuberance (Figs 14-15). Surface shagreen; distal margin with regular pointed spines (Fig. 15).

Simple, elongate gills present on segment II to VII (Fig. 16).

Paraproct enlarged without posterior prolongation; distal margin with numerous short subequal triangular spines; cercotractor with numerous short subequal spines (Fig. 17).

Paracercus reduced to less than twenty segments, without lateral setae (Fig. 18).

Subimago:

Body length: 3.0 mm.

Wing with pair intercalary veins on cubital margin; pterostigma with 3 crossveins (Fig. 2 in Suter 2001). Hindwings absent. Fore femora with dark brown marks on lateral side; tarsi covered by pointed microlepides (Fig. 19). Turbinate eyes rounded dorsally.

Specimens Examined

1 larva. ARRS South Alligator River at Gimbat OSS station. N.T. [Northern Territory]. Drift. 132°36′ Long. E / 13°35′ Lat. S. 19/04/[19]89-20/04/[19]89. P. Suter (PS) and A. Wells (AW). Slide reference PS435.

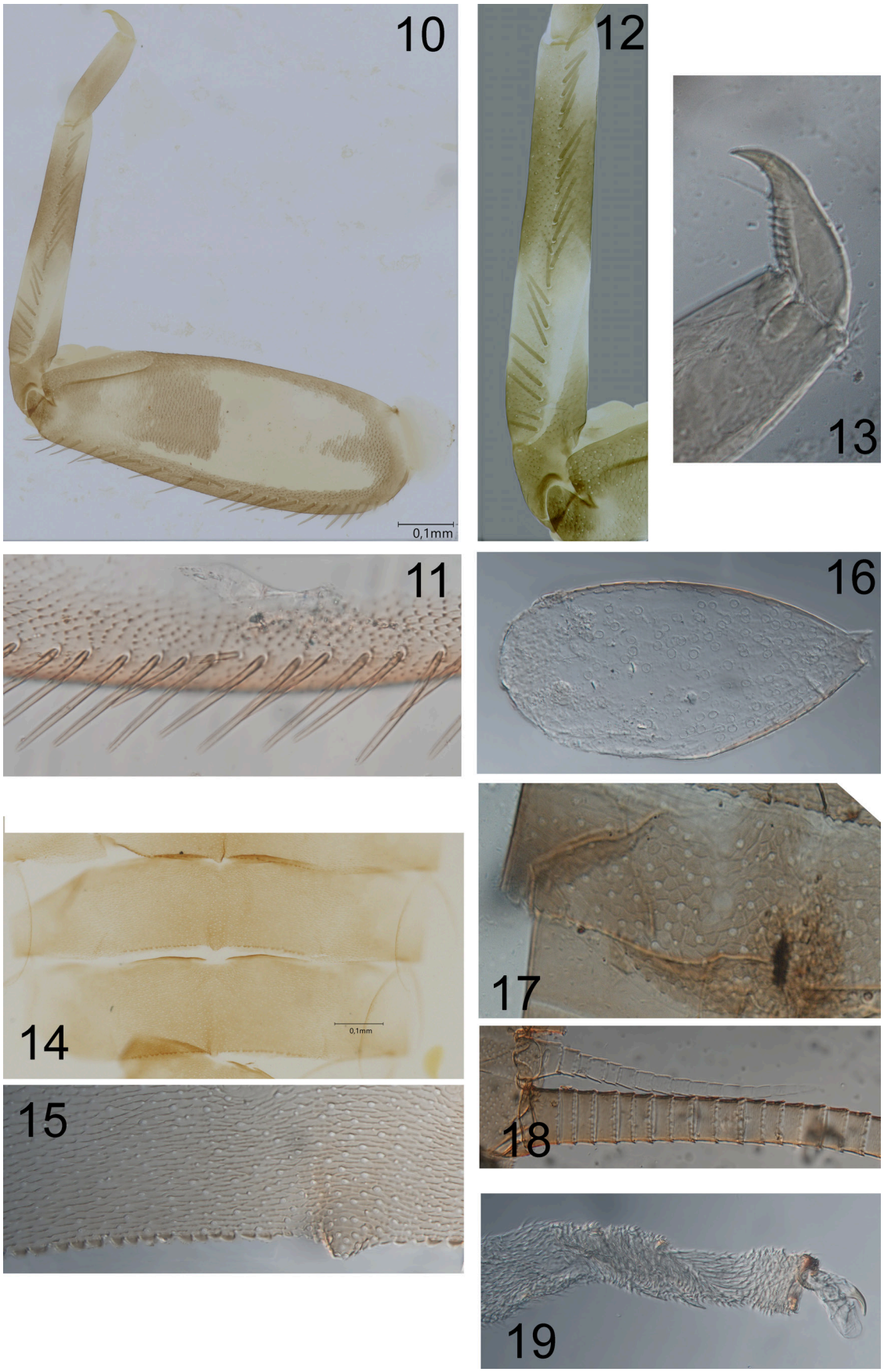
1 larva. South Alligator River N.T. [Northern Territory]. 132°36′ Long. E / 13°36′ Lat. S. 14/05/[19]88. PS and AW. Slide Reference PS436.

1 larva. South Alligator River at Gimbat. 20/4/[19]88. PS and AW 132°36′ Long. E / 13°35′ Lat. S. Slide reference PS437.

1 larva. South Alligator [River. Northern Territory. 132°36′ Long. E / 13°36′ Lat. S.]. 14/05/[19]88. PS and AW. Slide reference 43616.

1 subimago. South Alligator River, Fisher Ck junction. NT [Northern Territory]. 132°34′ Long. E / 13°34′ Lat. S. Blue light 19/20-4-[19]89. PS. Slide reference PS437.

Figures 1-9. *Papuanatula (Papuafiliola) gagadjuensis* comb. nov., nymphal morphology: **1** Labrum; **2** Right mandible; **3** Canines and prostheca of right mandible; **4** Left mandible; **5** Hypopharynx; **6** Labium; **7** Labial palp; **8** Maxilla; **9** Antenna. Images not to scale.



Figures 10-19 *Papuanatula (Papuafiliola) gagadjuensis* comb. nov., nymphal and subimaginal morphology: **10** Leg; **11** Dorsal margin of femora; **12** Dorsal margin of tibia; **13** Claw; **14** Terga III, IV and V; **15** Posterior margins of abdominal tergum IV; **16** Gill IV; **17** Paraproct; **18** Cercus and paracercus; **19** Tarsi and claws of subimago. Images not to scale.

1 larva. QLD [Queensland]. Freshwater Ck. At Crystal Cascade, Caravan Park nr Cairns. 145°42′ Long. E / 16°55′ Lat. S. 8 Jun[e] [20]08. [JM] Webb et al. Acquisition number JWA585.

1 larva. Queensland. Fisher Creek at Palmerston Highway. 26/06/2008. JM Webb, JH Hawking, S Moore, PJ Suter. Acquisition number JWA782.

All material deposited in the Australian National Insect Collection (ANIC) CSIRO Canberra. Label data is standardised and was transcribed verbatim with additional inferred information provided in square brackets.

Disclosures

The authors have no conflicts of interest.

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