




## Redescriptions of Indian species of *Nigrobaetis* Kazlauskas (in Novikova & Kluge) 1987 (Ephemeroptera, Baetidae)

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### Abstract

The European species *Nigrobaetis gracilis* (Bogoescu & Tabacaru 1957) and more than 19 Asian and African species of *Nigrobaetis* Kazlauskas (in Novikova & Kluge) 1987 belong to the subgenus *Margobaetis* Kang & Yang 1994, which is characterized by peculiar asymmetric eggs and narrow paraglossa of larval labium. A new synonymy is established: *Nigrobaetis* (*Margobaetis*) *minutus* (Müller-Liebenau 1984) = *N. paramakalyani* Kubendran & Balasubramanian in Kubendran *et al.* 2015 = *N. sumbensis* Kaltenbach & Gattolliat 2023, **synn. n.**; winged stages (male and female imagines and subimagines) and eggs of this species are described for the first time. *N. (M.) minutus* is widely distributed on Oriental Region, being revealed in West Malaysia, Southern India, Sumba and Sulawesi islands in Indonesia. Winged stages (male and female imagines and subimagines) and eggs of *Nigrobaetis* (*Margobaetis*) *klugei* Sivaruban *et al.* 2022 are described for the first time.

**Key words:** mayflies, systematics, India, Western Ghats, Indonesia

### Introduction

At present, two species of the genus *Nigrobaetis* Kazlauskas (in Novikova & Kluge) 1987 have been reported from Southern India: *N. paramakalyani* Kubendran & Balasubramanian (in Kubendran *et al.*) 2015 and *N. klugei* Sivaruban *et al.* 2022. Till now, both species were known as larvae only. The original description of *N. paramakalyani* contained significant errors, because it was based on a mix of larvae belonging to both these species (Sivaruban *et al.* 2022). Our new material from India and other countries allows to give additional descriptions of these species and to describe their winged stages and eggs.

### Material and methods

Larvae, imagines and subimagines were associated by rearing. For this purpose, subimagines were reared from larvae in cages placed in natural current water or in containers with stagnant water; imagines were reared from subimagines in wide glass tubes closed with wet cotton and protected from direct sun light. Slides are made in Canadian balsam.

Material reported in this paper is deposited in the following institutions: (1) **ZIN**: Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia; now this material is temporarily located in the Department of Entomology of Saint Petersburg State University; (2) **AMC**: American College (Department of Zoology), Madurai, India.

In the lists of material examined, the following arbitrary signs are used: **L**—larva; **S**—subimago; **I**—imago; **L-S-I♂**—male imago reared from larva, with larval and subimaginal exuviae; **L-S♂**—male subimago reared from larva, with larval exuviae; **L/S♂**—male subimago developed under larval cuticle; **S-I♂**—male subimago reared from subimago, with subimaginal exuviae.

The term «microlepidides» is used according to Kluge (2022); the term «protopteron» according to Kluge (2005); other terms according to Kluge (2004). The noun «blank» is used to describe an unpigmented area of cuticle.

## Genus *Nigrobaetis* Kazlauskas (in Novikova & Kluge) 1987

(Figs 1–89)

Genus *Nigrobaetis*: Kazlauskas 1972: 338 (imago, larva) (unavailable name, since type species was not reported in direct form).

Subgenus *Nigrobaetis* Kazlauskas: Novikova & Kluge 1987: 13.

*Nigrobaetis*/fg1: Kluge & Novikova 2014: 227.

Type species: *Ephemera nigra* Linnaeus 1761.

**Comments.** The genus *Nigrobaetis* is divided into three subgenera, *Nigrobaetis* s. str. (= *Dipheter* Waltz & McCafferty 1987), *Takobia* Novikova & Kluge 1987 (= *Alainites* Waltz & McCafferty in Waltz, McCafferty & Thomas 1994, = *Acerbaetis* Kang & Yang in Kang, Chang & Yang 1994) and *Margobaetis* Kang & Yang in Kang, Chang & Yang 1994 (Kluge 2022). In India, the genus *Nigrobaetis* is represented by two species belonging to the subgenus *Margobaetis*.

## Subgenus *Margobaetis* Kang & Yang 1994

(Figs 1–89)

Group *gracilis*: Novikova & Kluge 1994: 634 (egg, larva).

Subgenus *Margobaetis* Kang & Yang (in Kang, Chang & Yang) 1994: 11 (partim).

Type species: *Baetis* (*Margobaetis*) *mundus* Chang & Yang (in Kang & Chang & Yang) 1994.

**Diagnosis.** Egg more or less asymmetric: in typical case one side bluntly cone-like pointed, with surface mostly smooth; opposite side hemispheric or hemi-ellipsoid, with regularly arranged papillae and/or other relief (Figs 39–43, 86–89). Paraglossa narrower than in other *Nigrobaetis*, with apical setae arranged mostly in 2 longitudinal rows (Figs 17–18, 54; Müller-Liebenau 1969: Abb. 140e; Kaltenbach & Gattolliat 2023: figs 4b, 12b, 18b, 24b–c, 31b–c, 37d).

**Composition.** Europe: *Nigrobaetis* (*Margobaetis*) *gracilis* (Bogoescu & Tabacaru 1957).

Jordan: probably *N. (M.) vuatazi* Gattolliat & Sartori in Gattolliat *et al.* 2012 (egg structure unknown).

Arabia: *N. (M.) arabiensis* Gattolliat & Sartori 2008.

Algeria: probably *N. (M.) numidicus* (Soldan & Thomas 1983) (egg structure unknown).

Afrotropical Region: probably *N. (M.) bethuneae* Lugo-Ortiz & de Moor 2000 (egg structure unknown). In subsequent publications, some other Afrotropical species will be described.

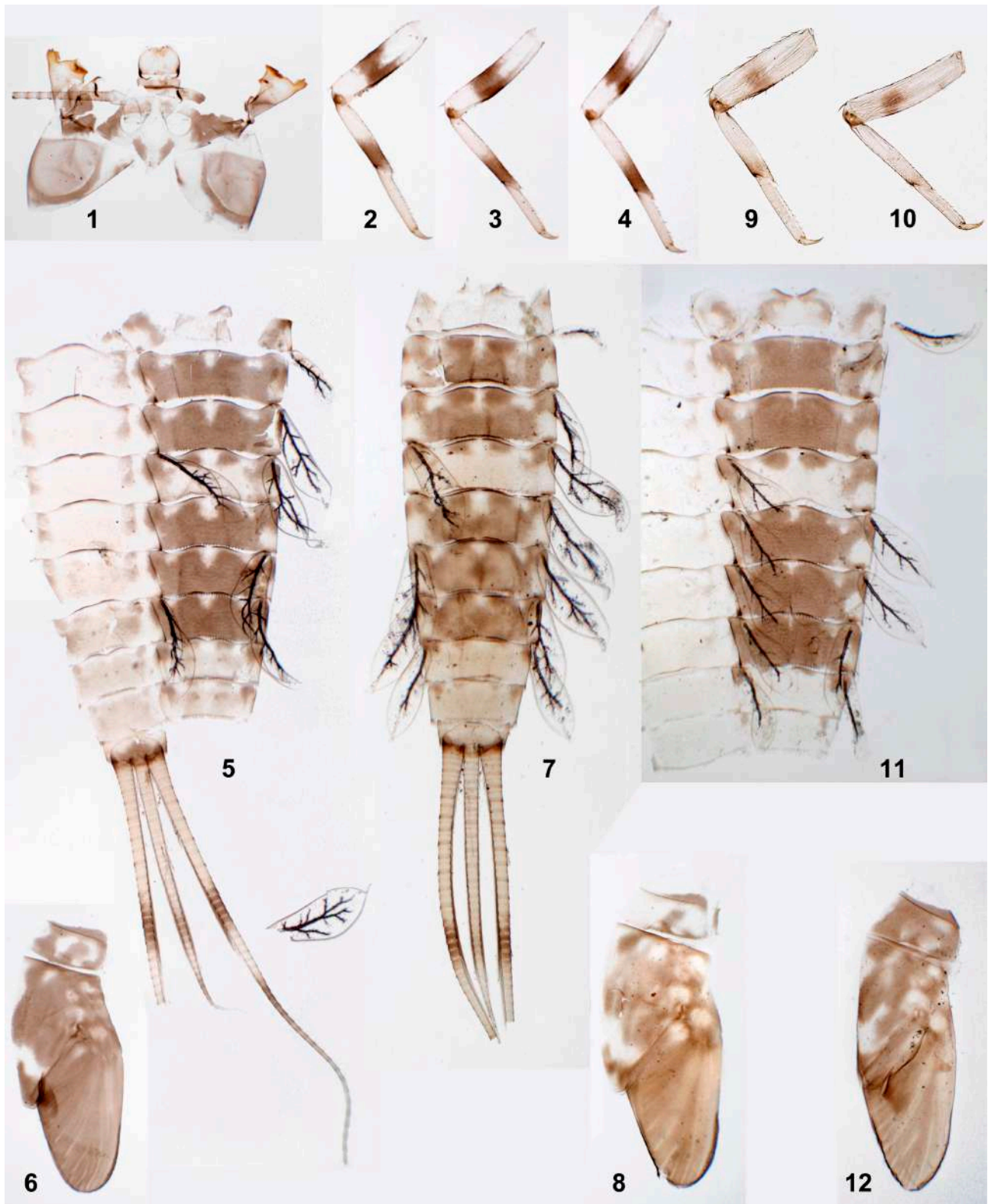
Siberia and Far East: *N. (M.) bacillus* (Kluge 1983).

Continental China: probably *N. (M.) trialbus* Li *et al.* 2023 (egg structure unknown).

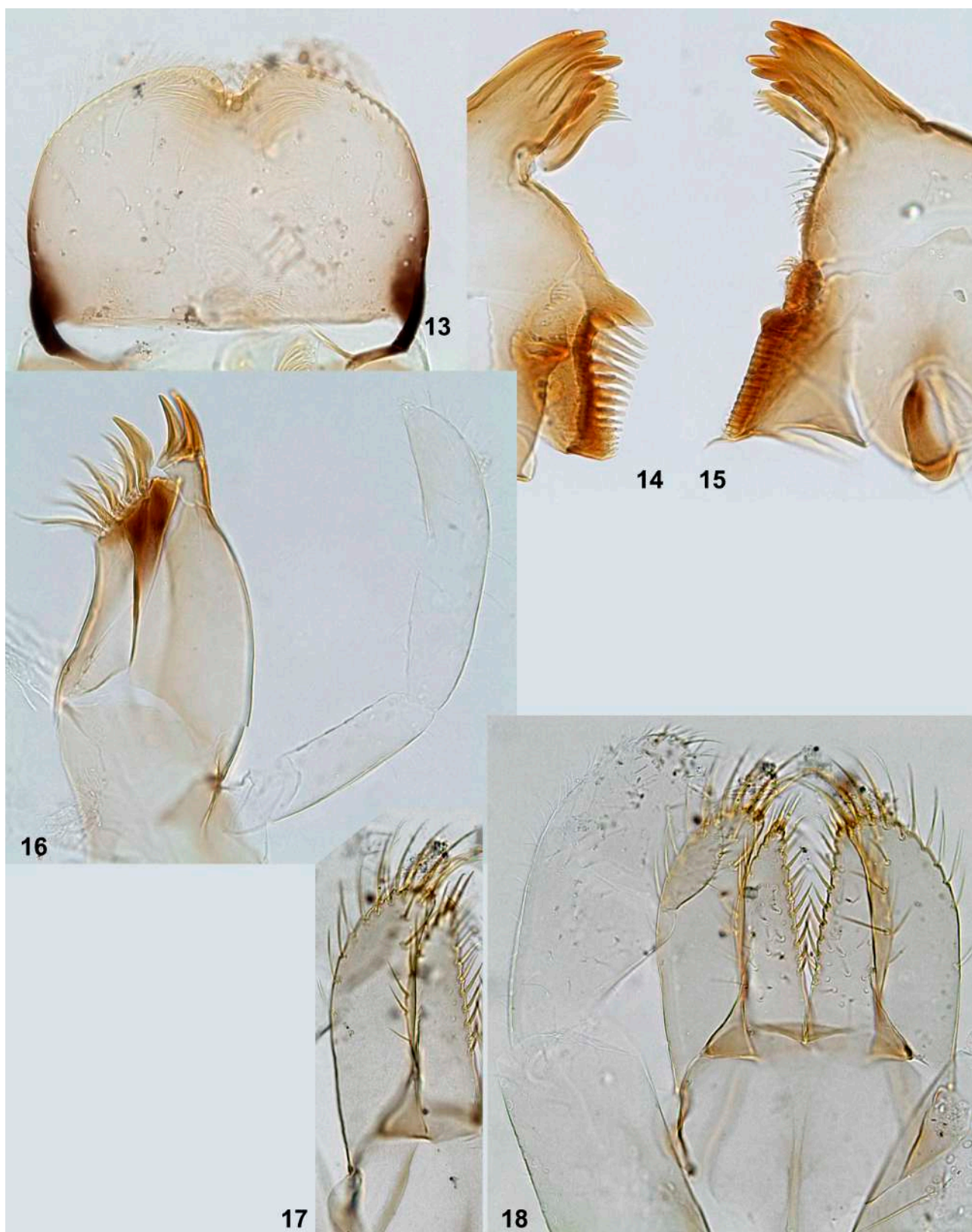
Taiwan: *N. (M.) tatuensis* (Müller-Liebenau 1985) (= «*Baetis taiwanensis*»: Kang *et al.* 1994), *N. (M.) mundus* (Chang & Yang in Kang *et al.* 1994). Probably also *N. (M.) facetus* (Chang & Yang in Kang *et al.* 1994), *N. (M.) terminus* (Chang & Yang in Kang *et al.* 1994) (egg structure unknown).

Oriental Region: *N. (M.) minutus* (Müller-Liebenau 1984) (= *N. paramakalyani* Kubendran & Balasubramanian in Kubendran *et al.* 2015 **syn. n.**; = *N. sumbensis* Kaltenbach & Gattolliat 2023 **syn. n.**), *N. (M.) klugei* Sivaruban *et al.* 2022. Probably also species with unknown egg structure—*N. (M.) mirabilis* (Müller-Liebenau 1984), *N.*

(*M.*) *gombaki* (Müller-Liebenau 1984), *N. (M.) plures* Kaltenbach & Gattolliat 2023, *N. (M.) palawus* Kaltenbach & Gattolliat 2023, *N. (M.) suma* Kaltenbach & Gattolliat 2023, *N. (M.) borneus* Kaltenbach & Gattolliat 2023, *N. (M.) kaliman* Kaltenbach & Gattolliat 2023. Described and figured eggs of *N. plures*, *N. suma* and *N. kaliman* (Kaltenbach & Gattolliat 2023: figs 7, 27, 40) are immature, have no definite shape and have no chorion structure. In subsequent publications, some other Oriental species will be described.



**FIGURES 1–12.** *Nigrobaetis (Margobaetis) minutus*, larvae. 1–6, specimen from Madurai; 7–8, specimen from Erumeli; 9–12, specimen from Pinrang (Sulawesi). 1, exuviae of head; 2–4, exuviae of fore, middle and hind legs; 5, 7, 11, exuviae of abdomen; 6, 8, 12, exuviae of pronotum and mesonotum; 9, 10, fore and hind legs.



**FIGURES 13–18.** *Nigrobaetis* (*Margobaetis*) *minutus*, larval mouthparts. 13, labrum; 14–15, left and right mandibles; 16, maxilla; 17, paraglossa (focus on dorsal side); 18, labium (focus on ventral side).