

New species of the Family Baetidae from the Philippines (Insecta, Ephemeroptera)

By INGRID MÜLLER-LIEBENAU

With 15 figures in the text

Abstract

A collection of baetine mayfly nymphs from the Philippines is studied. The nymph of one new species of the genus *Pseudocloeon* and the nymphs of 4 species of the genus *Baetis* are described; these are the first species records of the genus *Baetis* from the Philippines.

Introduction

Three genera of the family Baetidae are previously known from the Philippines: *Cloeon* LEACH (4 species), *Procloeon* BENGTTSSON (1 species) and *Pseudocloeon* KLAPALEK (1 species). No species of the genus *Baetis* is mentioned before (HUBBARD & PESCADOR, 1978). The only species of *Pseudocloeon*, *Ps. boettgeri* (ULMER, 1924 ♂; nymph unknown) also occurs in Sumatra. Two new genera and species of the same collection, *Jubabaetis pescadori* and *Platybaetis edmundsi*, were described in advance (MÜLLER-LIEBENAU, 1980). Five additional species are described in this paper, one of the genus *Pseudocloeon* sensu KLAPALEK (MÜLLER-LIEBENAU, 1981), and 4 of the genus *Baetis* as a new record in this island group. The specimens were collected on the island of North Luzon by Dr. M. L. PESCADOR, Florida A & M University, Tallahassee, Florida, Dr. D. PIMENTAL, Dr. E. H. GLASS and Miss C. R. REALON, University of the Philippines, Manila.

Descriptions

Pseudocloeon atoki sp. n.

Fig. 1, 6, 10

Material: 3 nymphs, one of them mature. Atok Stream, Benguet.

Description: For morphological details see Fig. 1. Body length ca. 6.1 mm, cerci ca. 8.5 mm, terminal filament reduced to one segment. — Hind wing pads minute, narrow, inserted a little above hind corner of metatergum. — 7 pairs of abdominal gills with smooth margin. —

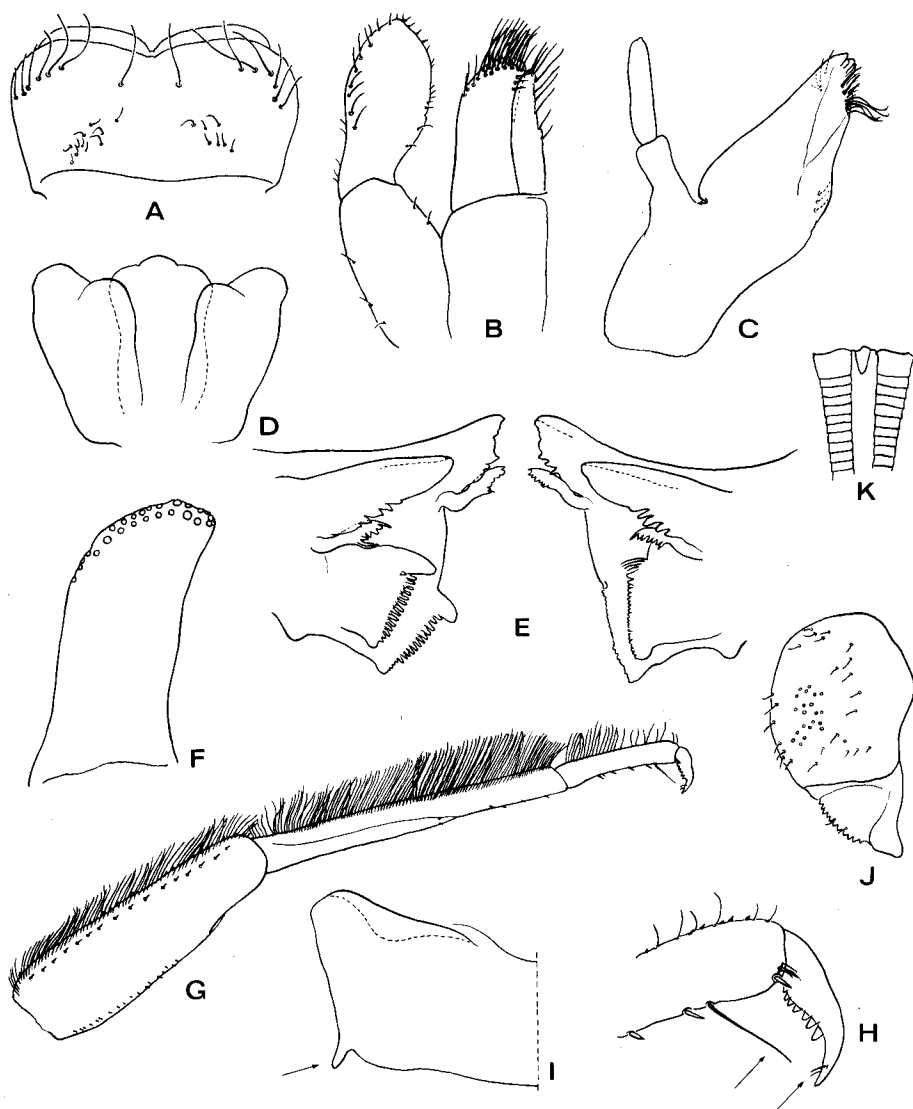


Fig. 1. *Pseudocloeon atoki* sp. n., nymph: A) labrum; B) left half of labium; C) maxilla; D) hypopharynx; E) left and right mandible (inside of the exuvia of worn mandibles canine areas of new mandibles are visible); F) paraglossa ventral; G) leg; H) claw; I) left half of metatergum with minute hind wing pad; J) paraproct; K) base of caudal filaments with reduced terminal filament.

Shape of labrum, mandibles, maxilla and maxillary palpus more *Baetis* like than typical *Pseudocloeon*. — Legs: outer margin of femur, tibia and tarsus of all three legs with a single row of long, fine and feathered bristles. A conspicuous bristle on inner margin of tarsus near apex. —

Pronotum and color pattern as in Fig. 6. Surface and posterior margin of terga as in Fig. 10. Terga with long and hyaline tube like bristles; posterior margin between spines with cone shaped hyaline bristles.

Holotype: 1 nymph in alcohol: Philippines: Mountain Prov., Atok Stream, Atok, Benguet, 2. 10. 1967, leg. M. L. PESCADOR, D. PIMENTEL & E. H. GLASS. Zool. Staatssammlung München. — Paratypes: 2 slide preparations of whole nymphs and 1 slide preparation of mouthparts in my collection in Plön. Same locality as holotype.

The male imago of *Pseudocloeon boettgeri* described by ULMER (1924) has been collected in the southern island of Mindanao (Dansalan), Philippines, and in South Sumatra¹. The nymph of this species is not known (MÜLLER-LIEBENAU, 1981). The nymph of *Pseudocloeon atoki* sp. n. was collected in Northern Luzon, a northern island of the archipelago at an altitude of 1600—2200 m. The nymph of *Ps. atoki* sp. n. is clearly different from *Ps. sp.* 1 ULM. from South Sumatra. The most striking characteristics of the nymphs of both species are:

<i>Pseudocloeon atoki</i> sp. n. (Fig. 1)	<i>Pseudocloeon</i> sp. 1 ULM. (1939) (MÜLLER-LIEBENAU 1981, Fig. 4)
Labrum:	
tapered basically	rounded on outer margins
Labial palpus:	
inner apical lobe on 2nd segment	inner apical lobe clearly developed
nearly not developed	
Mandibles:	
with outermost group of canines	all canines of general shape
fused into a longer blade	
Legs:	
tibia of all three legs with 1 row of	tibia of all three legs with two rows
long, fine bristles	of bristles, one row of long, fine
	bristles, other row short on tibia of
	1st leg, increasing in length on 2nd
	and 3rd leg
Claws:	
with two small bristles near apex	without bristles near apex
Terminal filament:	
reduced to one segment	reduced with few segments

¹ ULMER (1924) mentions, that one ♂ and 1 ♀ of *Ps. boettgeri* (in alcohol), Wai Lima, Lampongs, South Sumatra, 6. XII. 1921, KARNY leg. are stored in the Museum Bogor (Buitenzorg). According to recent information by Dr. S. ADISOEMARTO, Museum Zoologicum Bogoriense, Bogor, Indonesia, these specimens are in very bad condition and are of no use for study. One ♀, stored in the same Museum and labeled "*Pseudocloeon* sp.", leg. KARNY, which I have seen, is a *Baetis* sp.

DEMOULIN (1969, Fig. 4) described the nymph of *Pseudocloeon* sp. 2 from the Bismarck Archipelago which resembles the above described *P. atoki* sp. n. with respect to the labrum, 2nd and 3rd segment of labial palpus, maxillary palpus and mandibles; a longer bristle at inner margin of tarsus near apex also is present. But the species from Bismarck Archipelago has only 6 pairs of abdominal gills (II—VII), which is unusual in the genus *Pseudocloeon*.

Baetis luzonensis sp. n.

Fig. 2, 7, 11

Material: 1 nymph, not fully mature. Mountain Prov., Sumigar Stream, Banaue.

Description: For morphological details see Fig. 2. Body length ca. 8.0 mm; caudal filaments of normal length. — Hind wing pads not developed. — 7 pairs of abdominal gills. — The mandibles of the dissected specimen are fairly worn out. Inside the exuvia new mandibles are nearly fully developed and show the original shape of the canine area of the mandibles (Fig. 2 E). — Numerous scales and scale bases as on terga on all leg segments. — Pronotum and color pattern as in Fig. 7. Surface and posterior margin of terga as in Fig. 11; no spines at posterior margin.

This species differs from the nymphs of any European species group in the combination of morphological characteristics as shown in Fig. 2 and by having no spines at posterior margin of terga.

Holotype: 1 slide preparation of nymph: Philippines, Sumigar Stream, Sumigar Banaue, Mountain Prov., 3. X. 1967, leg. M. L. PESCARDOR. Zool. Staatssammlung, München.

Baetis realonae sp. n.

Fig. 3, 8, 12

Material: 20 nymphs. Molawin Creek, College, Laguna.

Description: Morphological details are shown in Fig. 3. Body length 4—5 mm; cerci 4.5—5.5 mm, terminal filament less than half the length of cerci. — Hind wing pads not developed. Gills present on abdominal segments 1—7. — Pronotum and color pattern as in Fig. 8. Surface of abdomen and posterior margin of terga are shown in Fig. 12.

Baetis realonae sp. n. is different from any of the European species groups. It appears closely related to *B. luzonensis* sp. n. but differs by having spines at the posterior margin of the terga. Both species have a bristle at inner margin of the claw which is inserted between the two apical denticles (Fig. 3 H).

Holotype: 1 nymph in alcohol: Philippines: Laguna Prov., Molawin Creek, College, 28. July 1977, leg. C. R. REALON. Zool. Staatssammlung,

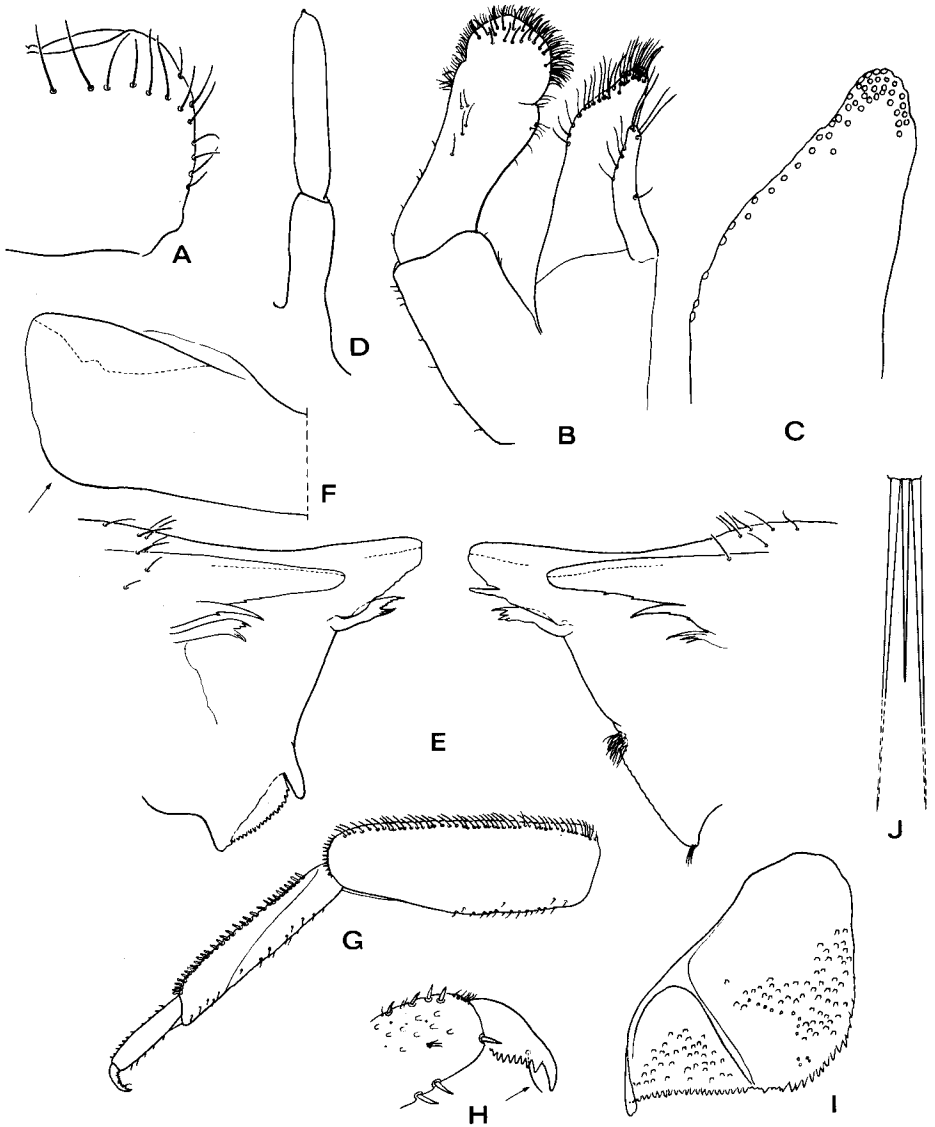


Fig. 2. *Baetis luzonensis* sp. n., nymph: A) right half of labrum; B) left half of labium; C) apex of glossa, ventral; D) maxillary palpus; E) left and right mandible (inside of the exuvia of worn mandibles canine areas of new mandibles are visible); F) left half of metatergum (no hind wing pads); G) leg; H) claw; I) paraproct; J) caudalfilaments.

München. — Paratypes: 17 nymphs in alcohol in the collection of Dr. PESCADOR. 2 slide preparations in my collection in Plön. All same locality as holotype.

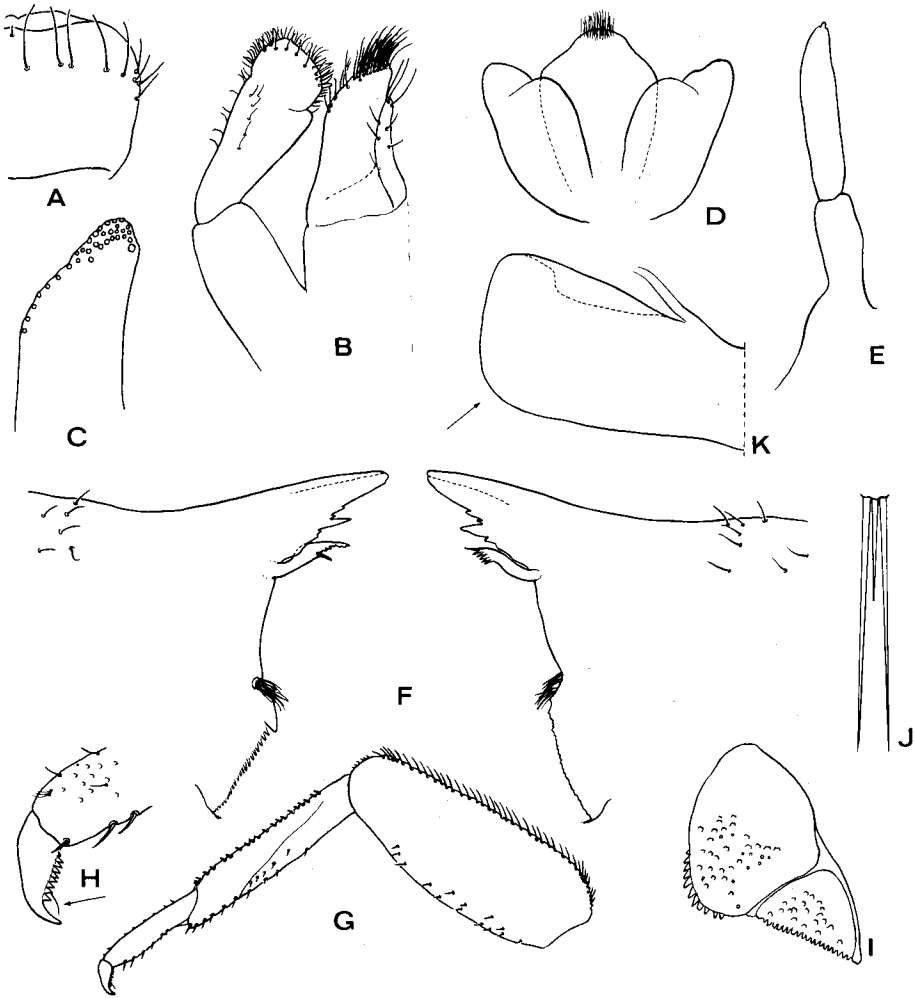


Fig. 3. *Baetis realonae* sp. n., nymph: A) right half of labrum; B) left half of labium; C) apical part of paraglossa, ventral; D) hypopharynx; E) maxillary palpus; F) left and right mandible; G) leg; H) claw; I) paraproct; J) caudal filament.

Etymology: *Baetis realonae* sp. n. is dedicated to the collector of this species, Miss C. R. REALON.

Baetis molawinensis sp. n.

Fig. 4, 9, 13

Material: 4 nymphs, 3 matured. Philippines: Laguna Prov., Molawin Creek, College.

Description: For morphological details see Fig. 4. Body length 3.9–4.2 mm; 3 caudal filaments of normal length, cerci

2.0—2.1 mm. — Hind wing pads not developed. — 6 pairs of abdominal gills (II—VII) present. — Pronotum and color pattern as in Fig. 9. — For surface and posterior margin of terga see Fig. 13.

This species is closely related to the European *atrebatinus* group. The basal segment of antennae has a small apical lobe on outer margin. All three segments of legs densely covered with scales and scale bases as on terga.

Holotype: 1 mature nymph in alcohol: Philippines. Upper surface of submerged stones, Rapids, Molawin Creek, College, Laguna; 28. July 1977; leg. C. R. REALON. Zool. Staatssammlung München. — **Paratypes:** 2 nymphs in alcohol in the collection of Dr. PESCADOR. 1 slide preparation in my collection in Plön. Same locality as Holotype.

Baetis sumigarensis sp. n.

Fig. 5, 14, 15

Material: 1 nearly mature nymph. Mountain Prov., Sumigar stream.

Description: Fig. 5 shows the morphological details. Body length ca. 4.8 mm; caudal filaments mostly broken, but terminal filament not reduced. — Hind wing pads not developed. — Probably only 6 pairs of abdominal gills developed (the gill insertions on 1st dorsal segment not clearly visible). — Pronotum and color pattern as in Fig. 14. Upper surface of abdomen and hind margin of terga as in Fig. 15. — All three segments of legs covered with scales and scale bases.

Baetis molawinensis sp. n. and *B. sumigarensis* sp. n. are closely related to the European *atrebatinus* group. Both species differ from each other by the inner lobe of 2nd segment of labial palpus; further in *B. sumigarensis* sp. n. the inner apical lobe of scape of antenna is not developed (Fig. 4D and 5F). Scales on abdominal terga are arranged much more densely in *B. sumigarensis* sp. n. than in *B. molawinensis* sp. n. (Fig. 13 and 15).

A rather similar nymph, especially with regard to the 2nd and 3rd segment of labial palpus is described by DEMOULIN (1969: 227, Fig. 2) as *Baetis* sp. 2 from Bismarck Archipelago which also has 6 pairs of abdominal gills. It differs from both *B. molawinensis* sp. n. and *B. sumigarensis* sp. n. by the shape and number of submarginal bristles on labrum: these are long and pointed and about 1 + 5 in number in *Baetis* sp. 2 from Bismarck Archipelago, while they are more stout and apically splitted and arranged in a dense row in both newly described species from the Philippines. **Holotype:** 1 slide preparation of nymph: Philippines. Mountain Prov., Sumigar stream, Sumigar Banaue, 3. X. 1967, leg. M. L. PESCADOR. Zool. Staatssammlung, München.

The following information on the ecological data of collecting sites are given to me from Dr. PESCADOR:

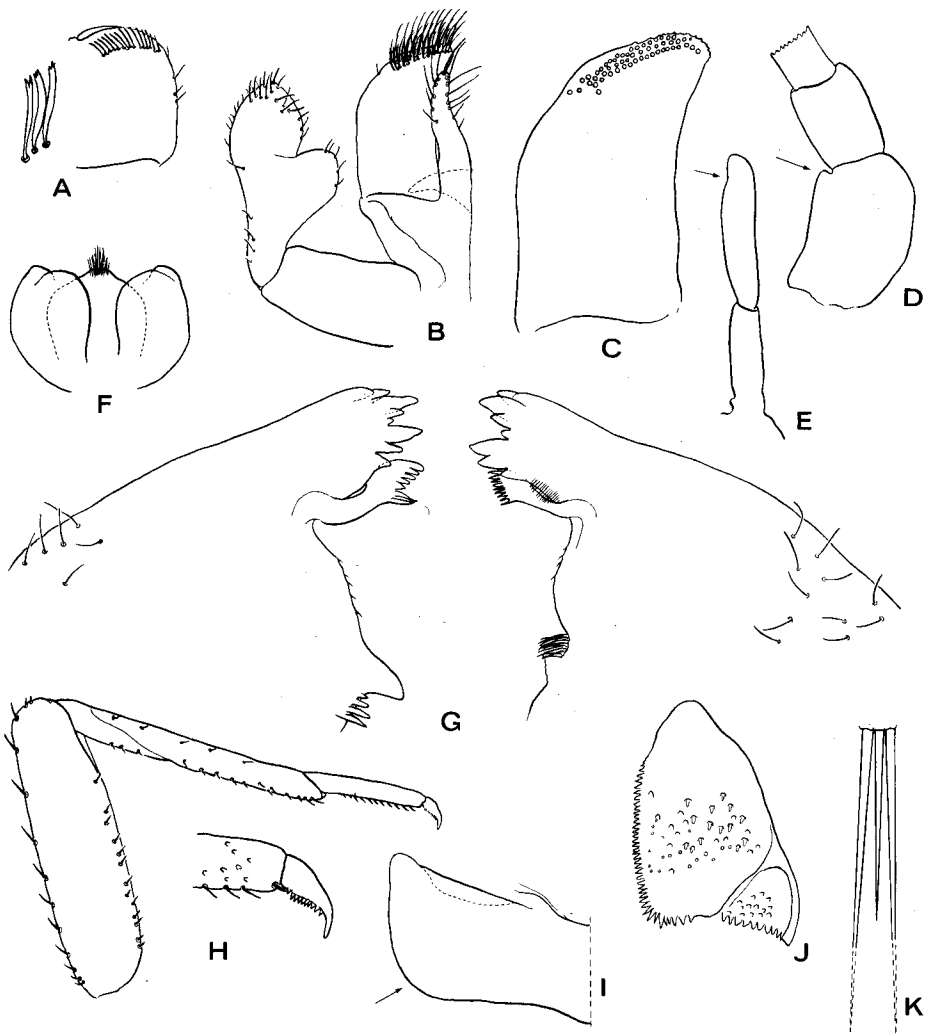


Fig. 4. *Baetis molawinensis* sp. n., nymph: A) right half of labrum (3 submarginal bristles at higher magnification); B) left half of labium; C) paraglossa, ventral; D) basal segments of antenna (inner apical lobe at scape developed); E) maxillary palpus; F) hypopharynx; G) left and right mandible; H) leg and claw; I) left half of metatergum (without hind wing pad); J) paraproct; K) caudal filaments.

The whole Mountain Province is the coldest region of the Philippines with an annual average of ca. 18 °C air temperature. Sumigar Stream is a small, swift flowing, rock-bottom mountain stream at an approximate altitude between 1660 m and 2200 m above sea level. The nymphs of *Baetis luzonensis* sp. n. and *B. sumigarensis* sp. n. were found in cracks of submerged logs on debris trapped between rocks. *Jubabaetis pescadori* and *Plytrybaetis edmundsi*

(MÜLLER-LIEBENAU, 1980) also occur in Sumigar Stream. The *A tok Stream*, Benguet, where the nymphs of *Pseudocloeon atoki* sp. n. were collected, is a moderate flowing stream. The substratum consists mainly of gravel

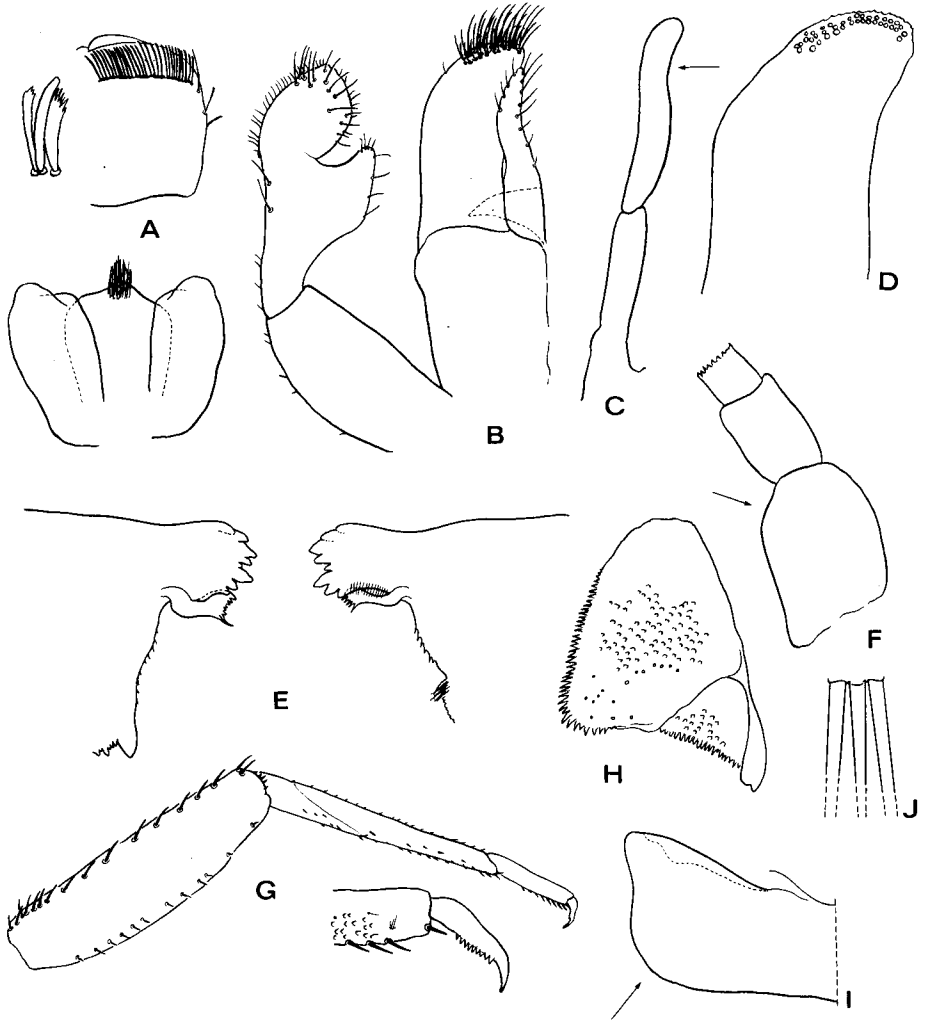


Fig. 5. *Baetis sumigarensis* sp. n., nymph: A) right half of labrum (3 submarginal bristles at higher magnification); B) left half of labium; C) maxillary palpus; D) apical part of paraglossa; E) left and right mandible; F) basal segments of antenna (with inner apical lobe at scape not developed); G) leg and claw; I) left half of metatergum (without hind wing pad); J) base of caudal filaments.

Fig. 6. *Pseudocloeon atoki* sp. n., nymph: color pattern of pronotum and abdomen.

Fig. 7. *Baetis luzonensis* sp. n., nymph: color pattern of pronotum and abdomen.

Fig. 8. *Baetis realonae* sp. n., nymph: color pattern of pronotum and abdomen.

Fig. 9. *Baetis molawinensis* sp. n., nymph: color pattern of pronotum and abdomen.

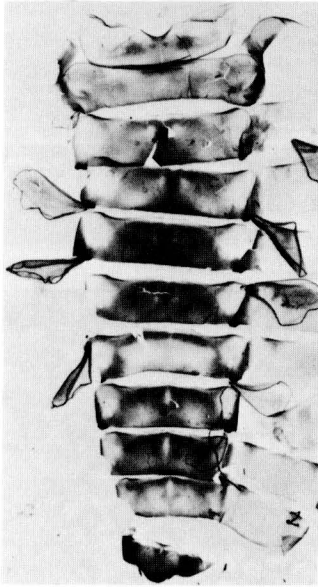
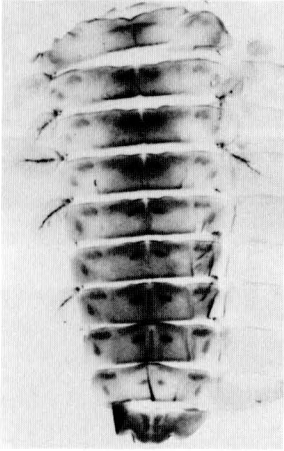
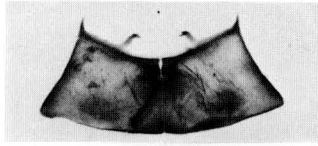


Fig. 6

Fig. 7

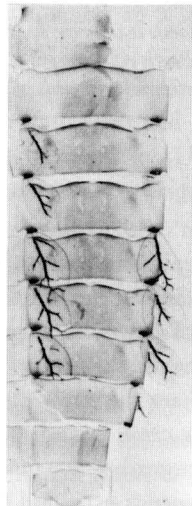
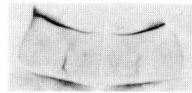
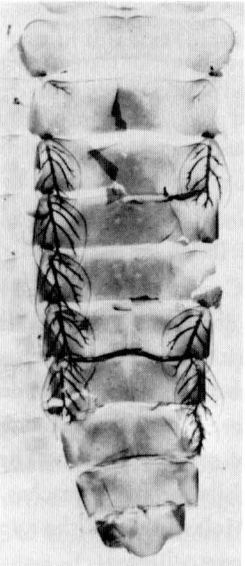
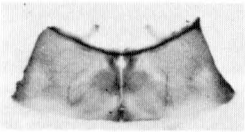


Fig. 8

Fig. 9

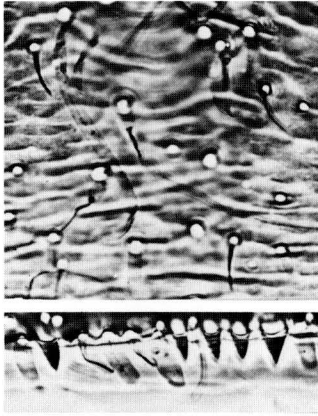


Fig. 10

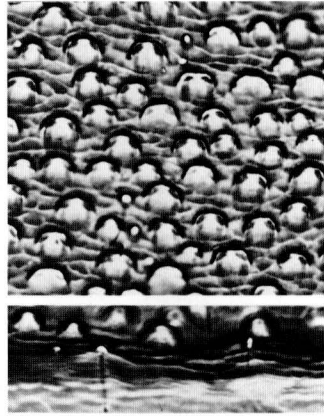


Fig. 11

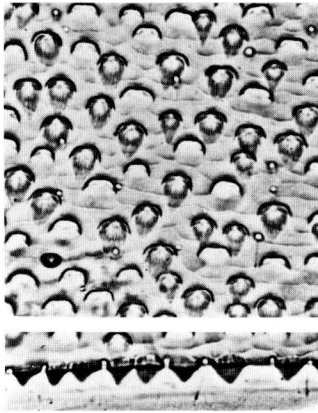


Fig. 12

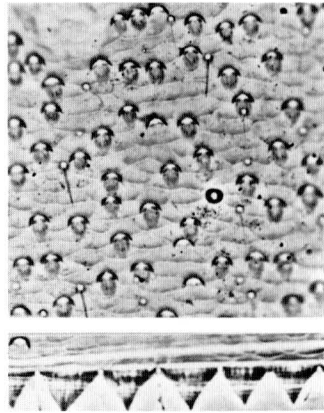


Fig. 13

Fig. 10. *Pseudocloeon atoki* sp. n., nymph: surface and posterior margin of targa.

Fig. 11. *Baetis luzonensis* sp. n., nymph: surface and posterior margin of targa.

Fig. 12. *Baetis realonae* sp. n., nymph: surface and posterior margin of targa.

Fig. 13. *Baetis molawinensis* sp. n., nymph: surface and posterior margin of targa.

and medium sized stones with trapped twigs and leaves where the nymphs were collected.

Realon's (1979) descriptions of Molawin Creek are as follows: Molawin Creek runs from an elevation of about 1,300 ft. above sea level to 0. The substratum is mainly a mixture of sand and clay except for the upper reaches where it is mainly of coarse shifting sand. Along the banks of the creeks are thick stands of trees and shrubs (eg. Cycadaceae, Gretaceae, Pandaceae and Araceae) whose leaves are the streams principal source of organic detritus. The upper reaches of the creek are relatively unpolluted while the lower reaches receive effluents from nearby human settlements. — In Molawin Creek the nymphs of *Baetis molawinensis* sp. n. and *B. realonae* sp. n. were collected.

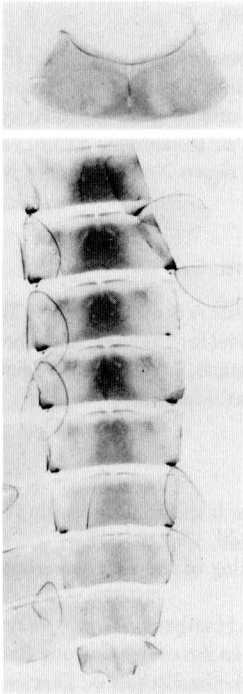


Fig. 14

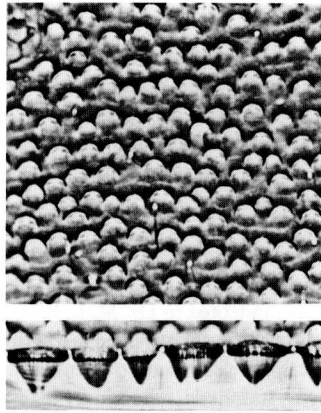


Fig. 15

Fig. 14. *Baetis sumigarensis* sp. n., nymph: color pattern of pronotum and abdomen.

Fig. 15. *Baetis sumigarensis* sp. n., nymph: surface and posterior margin of terga.

Discussion

Until now little is known about Ephemeroptera from the Oriental Region, especially from the East Asian Islands. The Philippines is the most isolated part of this area (MAYR, 1967: 53). The zoogeographical position of this archipelago, considering its historical evolution indicates all 5 species of the family Baetidae, described in this paper, probably are edemic.

Studies of baetid nymphs from Malaysia (in preparation), as well as a review of the original material of the baetid genera *Baetis* and *Pseudocloeon* from the Sunda Islands and the Philippines described by ULMER (1939) (MÜLLER-LIEBENAU, in press) show, that some of the 24 species studied are closely related.

The nymphs described by DEMOULIN (1969) as *Pseudocloeon* sp. 1 from the Philippines (Palawan) and as *Pseudocloeon* sp. 2 from the Bismarck Archipelago are different, but closely related to *Ps. atoki* sp. n. Adaptive radiation might be the origin of the species living at present in the discussed island groups.

As these are the first species records of the genus *Baetis* from the Philippines, further study of a larger material, especially reared specimens, will certainly give us a better understanding of the origin and dispersal of *Baetis* and other genera of the family Baetidae in the Oriental Region.

Zusammenfassung

Eine Sammlung von Larven der Gattungen *Pseudocloeon* und *Baetis* (Ephemeroptera, Baetidae) von den Philippinen wurde untersucht. Das Material stammt von der Insel North Luzon. Eine neue *Pseudocloeon*-Art und 4 neue *Baetis*-Arten werden beschrieben und ihre taxonomischen Beziehungen zu bekannten, nächst verwandten Arten untersucht. Aus der Gattung *Baetis* sind die 4 neuen Arten die ersten Meldungen für die Philippinen.

Acknowledgement

I am very indebted to Dr. M. L. PESCADOR, Florida A & M University, Tallahassee, Florida, who has kindly provided me with this material for studying, and who reviewed the manuscript. I also want to thank Dr. ADISEOMARTO, Museum Zoologicum Bogoriense, Bogor, Indonesia, who kindly loaned me a baetid specimen.

References

- DEMOULIN, G. (1969): Les Ephéméroptères récolté par la mission danoise du Noona Dan aux îles Philippines et Bismarck. — Entom. Medd. 37: 225—241.
- HUBBARD, M. D. & PESCADOR, M. L. (1978): A catalog of the Ephemeroptera of the Philippines. — Pacific Insects 19: 91—99.
- MAYR, E. (1967): Artbegriff und Evolution. — Parey, Hamburg, 617 p.
- MÜLLER-LIEBENAU, I. (1969): Revision der europäischen Arten der Gattung *Baetis* LEACH, 1815 (Insecta, Ephemeroptera). — Max-Planck-Gesellschaft — Dokumentationsstelle (Göttingen): 1—214.
- (1980): *Jubabaetis* gen. n. and *Platybaetis* gen. n., two new genera of the Family Baetidae from the Oriental Region. — In: Advances in Ephemeroptera Biology, ed. J. F. FLANNAGEN and E. MARSHALL, Plenum Publish. Corp., New York.
 - (1981): Review of the original material of the Baetid genera *Baetis* and *Pseudocloeon* from the Sunda Islands and the Philippines described by G. ULMER, with some general remarks (Insecta: Ephemeroptera). — Mitt. hamb., Zool. Mus. Inst. 78: 197—208.
- REALON, C. B. R. (1979): An ecological study of mayfly nymphs in Molawin Creek, Mt. Makiling Laguna. — Philipp. Ent. 4: 233—291.
- ULMER, G. (1924): Ephemeropteren von den Sunda-Inseln und den Philippinen. — Treubia 6: 28—91.
- (1939): Eintagsfliegen (Ephemeropteren) von den Sunda-Inseln. — Arch. Hydrobiol., Suppl. 16: 443—692. Stuttgart.

The author's address:

Dr. I. MÜLLER-LIEBENAU, Max-Planck-Institut für Limnologie, Abt. Allgemeine Limnologie, D-2320 Plön.