

The adult stage of *Languidipes corporaali* (Lestage, 1922), new status and the validity of *Povilla* (Navás) (Ephemeroptera: Polymitarcyidae: Asthenopodinae)

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The male imago of *Languidipes corporaali* (Lestage, 1922), new status (Ephemeroptera: Polymitarcyidae: Asthenopodinae), is described for the first time based upon adults associated with females. The male is distinguished from *Povilla* by the large eyes, short tarsi of forelegs, absence of a styliiger plate and a triangular basal cell at the fork of CuA–CuP in the forewing. Based on examination of series of females of *Povilla* from localities in Africa and Asia, an apparent third intercalary in the Cu field of *Povilla* females is a not infrequent population variation in the genus. Following examination of the holotype photograph of *Povilla adusta*, the present generic concept of *Povilla* is considered valid. New records for *Languidipes corporaali* include Malaysia and Thailand.

Keywords: Ephemeroptera; Polymitarcyidae; *Languidipes*; *Povilla*; taxonomy

Introduction

Languidipes corporaali (Ephemeroptera: Polymitarcyidae) was originally described by Lestage (1922) as *Asthenopus corporaali* based upon a single female imago from the Indonesian island of Java. The species has also been recorded from the Indonesian island of Simalur (= Simeulue) west of Sumatra (Ulmer 1939–40; Hubbard 1984). The nymphal stage was described by Ulmer (1939–1940). Hubbard (1984), revised the genus *Povilla* and placed *Povilla corporaali* in a new subgenus *Languidipes*. The male imago of this species is described below and *Languidipes* is elevated to full generic status.

Materials and methods

Male and female specimens were photographed and collected together in the field and immediately stored in 75% ethyl alcohol. Males were also associated with

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previously known females from morphological characters and similar colour patterns. Legs and wings were removed and slide-mounted for detailed study. Figures were composed with the aid of a camera lucida. Collections (and their acronyms) housing materials used in this study include: Florida A&M University, Tallahassee (FAMU); and Texas A&M University, College Station (TAMU).

Material examined

Languidipes corporaali (Lestage, 1922): MALAYSIA: Pos Chiong (Temengor) 31-V-2006, I.A. Ghani, 3 ♂ (TAMU), 2 ♂, 1 ♀ (FAMU); THAILAND: Thailand, by R. Khwai Noi, 18 km above Nam Tok, at light 0505 h, 18-II-1990, M.T. Gillies (?), 1 ♂ subimago (FAMU); JAVA occ./Siteo Goenoeng/b. Soekaboemi/1000 m, 14-VI-1931, Lieftinck, 1 ♀ (neotype, FAMU). *Povilla adusta* Navás, 1912: Tanganika Territory, lac Tanganika, baie de la Molagarasi. 24-II-1947, Mission d'Exploration Hydrobiologique du lac Tanganika, 6 ♀ (det. Demoulin 1956, FAMU); GHANA: Lake Volta, Akosombo, 10-I-1981, 14 ♀ (FAMU); NIGERIA: MW State, Benin 8-IV-1973, J. Medler, 1 ♂ (FAMU). *Povilla adamanensis* Hubbard, 1984: SOUTH ANDAMAN ISLAND: stream near ricefield at Bimbleton, 22-XII-1976, F. Starmühlner, 1 ♂ subimago (holotype, FAMU). *Povilla* sp.: THAILAND: Phayao Prov., Phayao Lake. At light. 29-V-1999, C.W. O'Brien, 51 ♀ (FAMU).

Results

Genus *Languidipes* (Hubbard, 1984) (Figures 1 – 7)

Asthenopus (partim): Lestage, 1922:34.

Povilla (partim): Ulmer, 1924:34, 1939–40:466. 595.

Povilla (*Languidipes*) Hubbard, 1984:31

Diagnosis

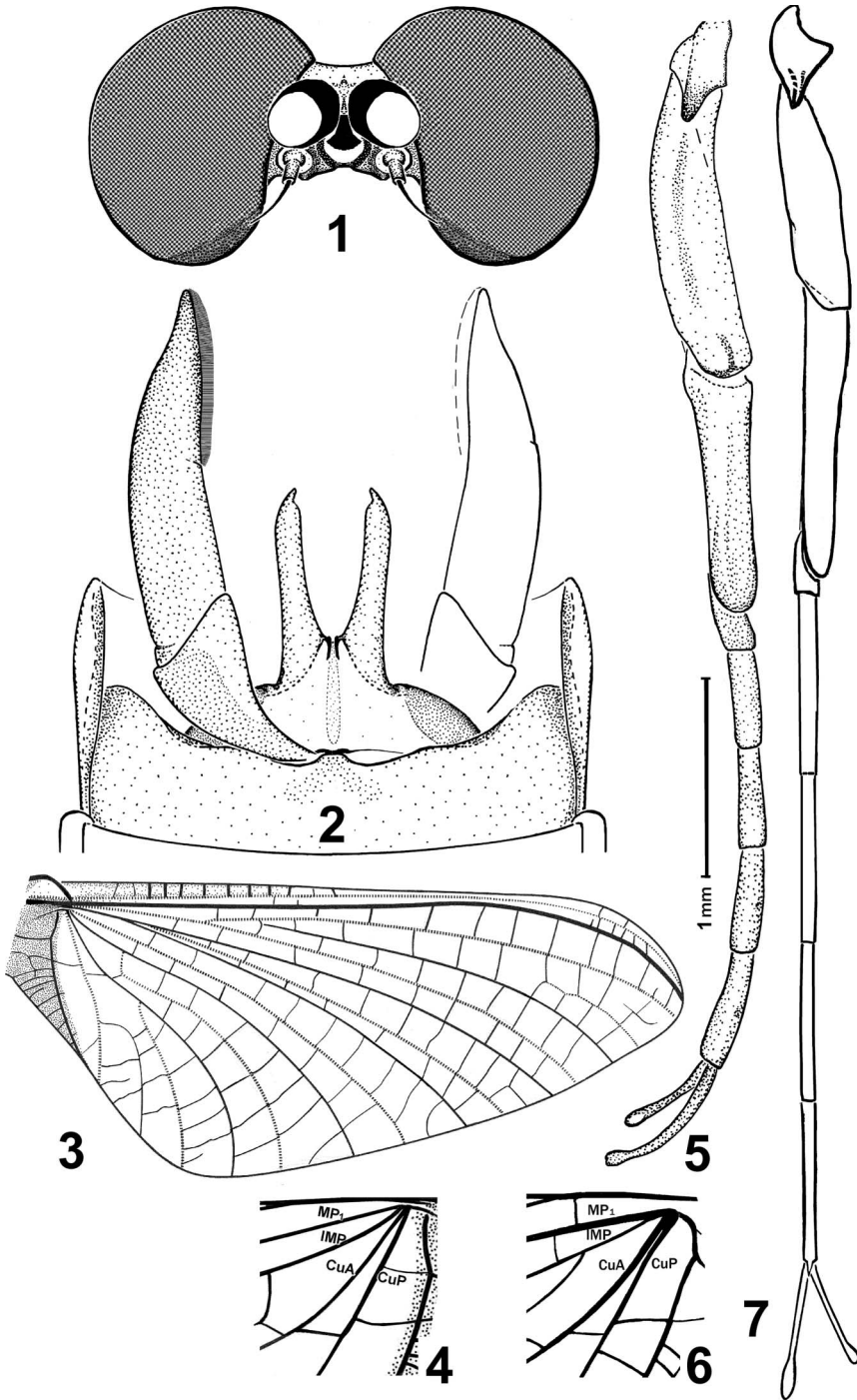
Male imago. Eyes large, separated on dorsum of head by a distance subequal to width of lateral ocellus; vein CuA and CuP separate to base forming triangular basal cell; forelegs short, with length of tarsal segments equalling length of femur and tibia combined, first tarsal segment about one-seventh length of tibia; male genitalia without remnant of styliiger plate.

Female imago and nymph.

As described by Lestage (1922), Ulmer (1924, 1939–1940) and Hubbard (1984).

Discussion

Kluge (2004) suggested that the accuracy of the generic name *Povilla* and type species *Povilla adusta* Navás were 'doubtful' because the figure given by Navás (1912) showed two extra cubital intercalaries (one short and one long) in the cubital field, a condition Kluge had never observed in *Povilla* (Kluge 2004, p. 267). Further, he stated that 'If the name *Povilla adusta*, type species of genus, is incorrectly applied, then the genus doesn't exist . . .'. Because of this confusion, it was necessary to first validate the concept of *Povilla*.



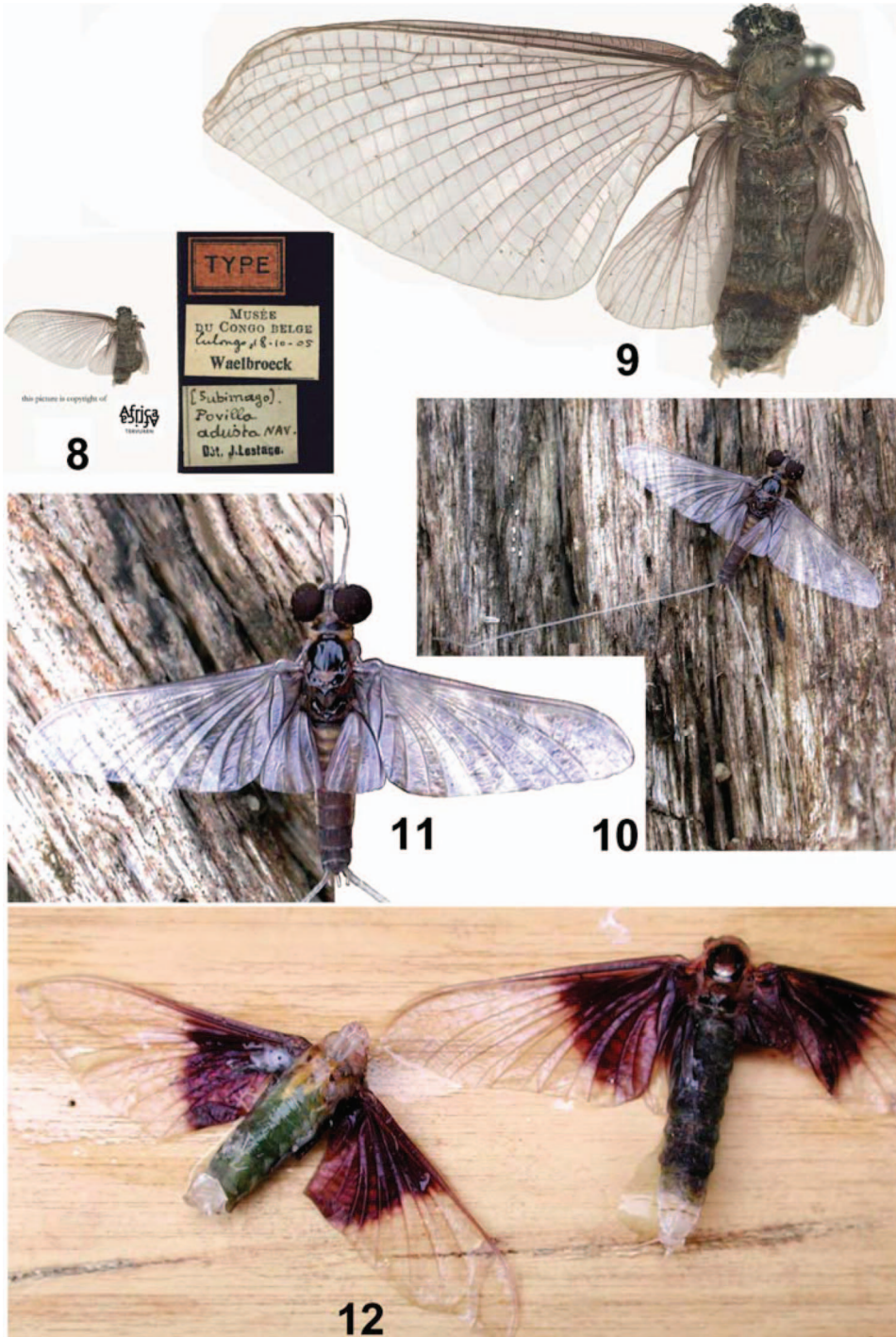
Figures 1–7. (1–5) *Languidipes corporaali*, male imago. (1) Head, anterior view; (2) genitalia, ventral view; (3) forewing; (4) detail of basal cubital cell of forewing; (5) foreleg. (6, 7) *Povilla adusta*, male imago. (6) Detail of basal cubital cell of forewing; (7) foreleg. In Figure 3, concave veins are shown by stippled lines; Figures 5 and 7 are drawn to the same scale (scale bar = 1 mm).

Eliane De Coninck of the Royal Museum for Central-Africa (Tervuren, Belgium) generously prepared a photograph of the holotype female of *P. adusta* (Figures 8, 9) which fits the present concept of *Povilla*. The specimen is in good condition and the venation is essentially as illustrated by Navás (1912). What is considered as a fourth intercalary by Kluge (2004) is not as illustrated by Navás and resembles a marginal cross vein. Also, the chain of cross veins reaching from the wing base through AA to MP₂, which defines the lineage (Kluge 2004), is clear on the specimen although not shown in figure 1 of Navás (1912).

In comparative material of *Povilla adusta*, one of six females from Lake Tanganyika had the extra intercalary and modified marginal vein as in Navás (1912). This variation was not found in females from Lake Volta, but was present in five females from Thailand. Of these, three had the third intercalary on both forewings (and one had an indication of a short fourth intercalary); two had an extra intercalary on one wing (although on one of these the intercalary only runs through three cross veins); a sixth female had an aberrant cubital field. Although a little larger than average, these specimens all fell within the total size range for the sample. From these data, we conclude that the presence of an extra cubital intercalary is within the population variation of females of *Povilla*, and that the present concept of *Povilla* is correct.

Languidipes is elevated from its present subgeneric status to full generic status because it is distinct from *Povilla* in the structure of the styliger, male eyes and characters of the wings and forelegs. Male imagos of *Languidipes* can be distinguished from *Povilla* by the following characters. In *Languidipes*, the compound eyes are large, dorsolateral and are separated on the vertex of the head by a distance a little greater than width of a lateral ocellus (Figures 1, 11); in *Povilla*, the compound eyes are lateral and separated on the vertex of the head by a distance greater than twice the width of a lateral eye. Because of the large eyes of *Languidipes*, the ocelli are in front of the eyes (Figure 1), but in *Povilla* the ocelli are on the anterior vertex of the head between the eyes. In the forewings of *Languidipes*, vein CuA is recurved (Hubbard 1984, figure 4), but it is nearly straight in *Povilla* (Hubbard 1984, figures 1, 5, 6). The width of the *Languidipes* forewing is less than half its length; in forewings of *Povilla*, the width is equal or a little greater than half the length. In males of *Languidipes*, CuA and CuP diverge at the base (Figures 3, 4) but in *Povilla* they are approximate or parallel basally in the basal cell (Figure 6). The forelegs of *Languidipes* are short (Figure 5), less than half the body length, with the first tarsal segment about one-seventh the length of tibia, and tarsal segments 2–5 subequal in length except segment 5 a little longer. In *Povilla*, male forelegs (Figure 7) are relatively long with the first tarsal segment short, about one-tenth length of tibia; tarsal segments 2–5 subequal in length except segment 2 a little longer. Also, the male genitalia of *Languidipes* lack the median remnant of the styliger plate (Figure 2) which characterises *Povilla*.

Although the forceps of *Languidipes* appear to be two-segmented, there is an indication of a fusion in the distal segment which appears to represent a fusion of two segments. This condition is much clearer in the subimago than in the imago. The mesonotal suture is also distinct, although not clear in Figure 11.



Figures 8–12. (8, 9) *Povilla adusta*, documentation and photograph of holotype. (10–12) *Languidipes corporaali*, photographed from living specimens. (10, 11) male (10 with cerci; 11 without cerci and with part of background removed); (12) females, female on left ventral.

***Languidipes corporaali* (Lestage, 1922)** (Figures 1–5, 10–12)

Asthenopus corporaali Lestage, 1922:142.

Povilla corporaali: Ulmer, 1924:34, 1939–1940:466, 595; Gillies, 1951:121.

Povilla (Languidipes) corporaali: Hubbard, 1984:31.

Male imago (Figures 1–5, 10–11)

Body length (in alcohol) 10–12 mm. Forewing 13–15 mm. Hind wing 4–5 mm. Cerci 28–32 mm, median caudal filament 0.6 mm.

Head. Compound eyes large, black, covering most of head (Figures 1, 11); ocelli black at base, white in distal half. Head pale brown dorsally with extensive black stippling; ventrally white. Basal antennal segments reddish brown with black stippling; distal segments white.

Thorax. Pronotum dark reddish brown with extensive black stippling; prosternum and pleuron pale; mesonotum dark blackish brown along margins, pale reddish brown medially; mesosternum pale medially, reddish brown laterally; pleuron white with black stippling; metanotum dark blackish brown. Forelegs (Figure 5) well developed; femora white with black stippling; tibiae and tarsi grey with black stippling; meso- and metathoracic legs atrophied, vestigial, non-functional, mesothoracic leg more reduced than metathoracic leg. Forewings (Figures 3, 11); wing membrane hyaline, with black stippling present at base, and along margins of costal and subcostal veins; hind wings hyaline, with black stippling present at base and along basal half of costal and subcostal veins.

Abdomen. Dorsum dark reddish-brown; some specimens with posterior half darker than anterior half; sterna whitish; cerci whitish. Genitalia (Figure 2): forceps apparently two-segmented, with a pad of fine setae along inner distal margin; penes divided for approximately three-quarters of their length, distinctly pointed at distal end.

Female imago (Figure 12)

Described by Lestage (1922), Ulmer (1924, 1939–1940) and Hubbard (1984). The present specimen is a little smaller (wing length 18.5 mm), and MA forks at about 0.06 the distance from the base to the margin. Such differences are within the known intraspecific variation for species of *Asthenopodinae*.

Nymph

Described by Ulmer (1939–40) and Hubbard (1984).

Distribution

Known from Indonesia (Java and Sumatra), Thailand and Malaysia.

Biology

Hubbard (1984) reported that nymphs burrow into wood and bamboo.

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References

- Demoulin, G. (1956), 'Ephemeroptera', in *Exploration hydrobiologique du Lac Tanganika (1946–1947). Résultats scientifiques*, Bruxelles: Institut Royal des Sciences Naturelles de Belgique, III (7), pp. 1–24.
- Gillies, M.T. (1951), 'Further notes on Ephemeroptera from India and South East Asia', *Proceedings of the Royal Entomological Society of London (B)*, 20, 121–130.
- Hubbard, M.D. (1984), 'A revision of the genus *Povilla* (Ephemeroptera: Polymitarciidae)', *Aquatic Insects*, 6, 17–35.
- Kluge, N. (2004), *The Phylogenetic System of Ephemeroptera*, Dordrecht: Kluwer Academic Publ., 442 pp.
- Lestage, J.-A. (1922), 'Description d'une espèce javanaise nouvelle (*Asthenopus corporaali* sp. nov.)', *Annales de la Société Entomologique de Belgique*, 62, 142–148.
- Navás, L. (1912), 'Notes sur quelques Névroptères d'Afrique', *Revue Zoologique Africaine*, 1, 401–410, pl. 21.
- Ulmer, G. (1924), 'Ephemeropteren von den Sunda-Inseln und den Philippinen', *Treubia*, 6(1), 28–91.
- Ulmer, G. (1939–1940), 'Eintagsfliegen (Ephemeropteren) von den Sunda-Inseln', *Archiv für Hydrobiologie*, Supplement 16, 443–692.