

TWO NEW SPECIES OF CAENIDAE (EPHEMEROPTERA)
FROM SRI LANKA

Tomas Soldán and Vladimír Landa

Institute of Entomology, Czechoslovak Academy of Sciences,
Branisovská 31, 370 05 České Budejovice, Czechoslovakia

ABSTRACT

Two new species, *Clypeocaenis femorisetosa* sp.n. (mature male and female nymphs) and *Brachycercus gilliesi* sp.n. (mature male and female nymphs, egg) from two localities in Sri Lanka are described and figured. Critical characters distinguishing them from remaining species of respective genera are keyed and discussed. The latter species represents a remarkable distributional extension of the predominantly Holarctic genus *Brachycercus*.

INTRODUCTION

Although the generic classification of the family Caenidae showing a very high species diversity especially in the tropics seems to be still unclear in many respects, there are several well defined genera with characteristic sets of morphological characters in the nymphal stage representing clearly derived phyletic lineages within the family. Of these, Oriental *Clypeocaenis* Soldán and predominantly Holarctic *Brachycercus* Curtis have been subjected to an extensive revision recently (Soldán, 1983, 1986). This paper dealing with the description of two additional species is given to complete our recent taxonomic knowledge of the respective genera.

Brachycercus gilliesi sp.n.

Mature larva (Figs. 1-9): Body length 6.5 mm, length of cerci 2.9 mm. Head dark brown, occipital area paler, eyes and ocelli black, ocellar tubercles yellowish brown; lateral tubercles rounded at apex and approximately as long as eye width; medial tubercle smaller, bluntly pointed and shorter by 1/3 than lateral ones. Antenna white or whitish yellow, unicolorous; pedicel conspicuously long, moderately tapered distally, about 4 times as long as scape (scape : pedicel length ration 13 : 45); pedicel covered with stout and long sparse bristles (Fig. 2). Labrum about 2.5 times as broad as long, only slightly produced anterolaterally (ratio length : width 16 : 29), anterior

margin nearly straight with stout simple marginal bristles. Lateral margins with several short hairs (Fig. 1). Hypopharyngeal lingua oblong-shaped with moderately convex lateral margins. Superlinguae rounded, not produced anterolaterally with nearly straight lateral margins (Fig. 5). Mandibles with a group of 9-12 long lateral bristles; outer and middle incisor of right mandible equal in length, width and shape of distal bluntly pointed teeth; inner incisor of the same length but narrower by $1/2$ at base; molar part of right mandible with especially long and laterally denticulated chitinous projections; middle incisor of left mandible as long as slightly bent outer one but narrower and straight, inner incisor as long as $2/3$ of middle one; inner margin of left mandible with several bristles (Fig. 6). Basal segment of maxillary palps strong, as broad as maximal width of galeo-laccinial part of maxilla, with stout spines on its inner margin. Glossae with straight anterior margin, paraglossae of the same width, rounded; distal segment of labial palps nearly symmetrical, pointed, ventrally with numerous bristles in basal half and two regular rows of stout spines, dorsally with 7-8 submarginal pointed spines (Fig. 3).

Pronotum about 2.5 times as broad as long (ration length : width 1.3 : 3.8), light brown, darker in middle and with well apparent paired transversal lateral ridges and unpaired longitudinal ridge which is apparent also in midline of mesonotum. Mesonotum yellowish brown with darker smudges and a pair of dark brown diffuse spots near wing pad bases. Metanotum with similar colour patterns, its posterior margin with well apparent medial pointed projection. Thoracic sterna flat and almost without protuberances, anterior mesosternal protuberance only slightly indicated.

Legs unicolorous, covered with sparse long bristles, margins of femora and inner margins of distal portions of tibiae and tarsi with rows of pointed spines. Claws slender, as long as $1/2$ of tarsi, without denticles (Fig. 9).

Abdomen whitish yellow, terga I, II, VII, VIII and IX with a pair of wide divergent brownish bands, terga III, IV and V with unicolorous dark brown stippling, tergum X always dark blackish brown. Posterior margins of terga I - VII straight, that of tergum IX with conspicuous medial rounded projection similar to metanotal one. Abdominal sterna whitish yellow, unicolorous, without any markings. Abdominal segments I, II and IX without any distinct posterolateral spines. Spines of segment III triangular, bent, asymmetrical and bluntly pointed, as long as about $1/2$ of spines of segments IV - VI; spines of segments IV - VI of the same shape, considerably bent upward, slightly overlapping following abdominal segments in dorsal view; spines of segment VII regularly triangular, low, as long as $1/3$ of spines of segment III; dense marginal bristles on spines of segments IV - VI. Distal segment of gill 1 3 times longer apically tapered and bluntly pointed at apex, evenly covered with stout bristles as long as $2/3$ of segment's length. Gill cover nearly symmetrical with rounded posterolateral margin and well apparent triangular ridge. Gills 3 - 5 with regular brownish stippling, fringe colourless. Cerci whitish yellow, unicolorous.

Adult and subimago unknown.

Specimens examined: Mature female larva (holotype): Sri Lanka, Kandy Prov., Irigeoya stream., February 2, 1987 leg. M.T. Gillies; half grown female larva (paratype No. 1) and male exuvia (paratype No. 2): Sri Lanka, Kandy Prov., Mahaweli Ganga riv., Kandy, February 5, 1987 leg. M.T. Gillies. Holotype and paratype in alcohol, parts of paratype No. 2 on slide (Amman's lactophenol). Holotype and paratype No. 2 deposited in the collection of Dr M.T. Gillies, paratype No. 1 in the Institute of Entomology, Czechoslovak Academy of Sciences, Ceske Budejovice.

Etymology: We take pleasure to name this species for Dr. M. T. Gillies, Lewes, Great Britain, an outstanding specialist in taxonomy of the Caenidae and a collector of the type series.

Distribution and biology: Judging from its morphological characters, biology of *B. gilliesi* sp.n. does not substantially differ from that of remaining *Brachycercus* species. Also its habitats (Dr. Gillies, *pers. comm*) are very similar - larvae were collected from the surface of fine sediments in shallow water with slow current. On the contrary the finding of *Brachycercus* in Sri Lanka is surprising, representing a remarkable extension of known from distribution of the genus. This genus has not been reported from Sri Lanka so far (*cf.* Hubbard & Peters, 1978). The genus *Brachycercus* is Holarctic although very widely spread; in Palaearctic it is distributed from Algeria to Finland and Far East of the USSR, in Nearctic from S.E. states of the U. S. A. to Alaska following most probably the upper boreal distributional type (Edmunds *et al.*, 1976; Soldán, 1986). Except for Sri Lanka this genus is substituted for by the genera *Cercobrachys* and *Caenoculis* in the tropics (Oriental and Neotropic).

Differential diagnosis and discussion: *Brachycercus gilliesi* sp.n. can be distinguished from the remaining species of the genus by the following combination of characters: (1) lateral ocellar tubercles as long as the eye width, frontal tubercle smaller; (2) pedicel nearly 4 times as long as scape; (3) pronotum with a pair of transverse ridges; (4) sternal protuberances almost lacking; (5) labrum slightly laterally produced, hypopharyngeal superlinguange rounded; (6) spines of abdominal segment III - V slightly overlapping; (7) gill cover nearly symmetrical with rounded posterolateral margin. Although the eggs of *B. gilliesi* sp.n. (dissected from mature female larva) show a typical chorionic character set found in *Brachycercus* (one polar cap and numerous longitudinal costae) this species occupies a quite independent position among the 17 species of this genus. Some of its characters (*e.g.* arrangement of gill cover and posterolateral abdominal spines) approach that to the genus *Cercobrachys*. It can be easily distinguished from all remaining *Brachycercus* species by especially long (nearly 4 times as long as scape) pedicel. However, the presence of pronotal transversal ridges approaches *B. gilliesi* sp.n. to Nearctic species *B. berneri* Soldán and *Brachycercus maculatus* Berner. Using an existing key (Soldán, 1986) *B. gilliesi* sp.n. will fall into couplet 12 following the couplets 1, 6, 9 and 11. The key should be modified as follows:

- 12a. Pedicel 3-4 times as long as scape; stout and long bristles (as long as its length) on its surface (Fig. 2); projection of abdominal segment II absent; abdominal terga with a pair of contrasting dark brown wide bands; anterior margin of mesosternum slightly elevated. *Brachycercus gilliesi* **sp.n.**
- Pedicel 2-3 times as long as scape; fine bristles or hairs never as long as its length on pedicel surface; projections of abdominal segment II developed although sometimes low; abdominal terga unicolorous or with darker stippling or diffuse spots; anterior margin of mesosternum flat. **12b**
- 12b. Gill cover distinctly longer than wide (length : width 1.6 : 1.3) asymmetrical, produced posterolaterally; lateral margins of segment II straight, spines of segments III - VI narrow, 4-5 times longer than wide at base. *Brachycercus floridicola* **Soldán**
- Gill cover slightly longer than wide (length : width 1.9 : 1.8) symmetrical, rounded posterolaterally; lateral margins of segment II convex, rounded with wide triangular spine; spines of segments III - VI wider, 3 times longer than wide at base. **13**

Clypeocaenis femorisetosa sp.n.

Mature larva (Figs 10-15): Body length 3.6 (3.2-3.8) mm, length of cerci 2.2 (1.0-2.5) mm. Head pale yellowish with a pair of large diffuse brownish spots on occiput, eyes and ocelli dark grey; epicranial suture forming indistinct ridge; clypeal protrusion triangular rounded at its anterior margin reaching to 1/2 of pedicel; two stout finely ciliated setae on the anterior margin of clypeal protrusion. Antennae yellowish, slightly darker than head, flagellum of the same colour; pedicel about twice longer than scape (Fig. 13), all segments of flagellum of approximately the same length, first flagellar segment a little longer about as long as pedicel. Labrum oval, elliptic (length : width 27 : 52) with numerous bristles near the anterior margin, slightly produced anterolaterally, its lateral margins nearly straight, anterior margin slightly incurved in the middle (Fig. 10). Mandibular incisors equal in length, outer incisor twice as broad as middle one at base; inner incisors as broad as 1/4 of outer ones with tufts of line long hairs at apex (Fig. 12); mandibles with a group of 5 - 8 long filtering setae situated laterally. Hypopharynx with stout and large, oblong-shaped lingua, superlinguae narrower by 1/2, produced anterolaterally with concave outer margins. Maxillae oblong-shaped with nearly straight margins, asymmetrical with 7-8 laccinial spines; maxillary palps 2-segmented, distal segment asymmetrical with straight inner margin and evidently convex outer margin, bluntly pointed at apex and covered with bristles on its distal half (Fig. 11). Glossae oval and rounded at apex, straight, paraglossae bent, bluntly pointed and broader by 1/2 than glossae; labial palps 3-segmented, segment 2 quadrate, bent, segment 3 about twice longer, straight, triangular and pointed at apex, covered with

numerous bristles and several subapical stout spines.

Thorax yellowish or brownish yellow, pronotum slightly darker, ventral side paler; thoracic nota with inconspicuous darker smudges and strips; surface of pro- and mesonotum covered with scattered rough rounded microtrichia following future principal longitudinal veins on wing pads. Pronotum 4 times broader than long with distinct rounded anterolateral lobes. Legs yellowish with inconspicuous wide transversal brownish bands on femora, tibiae and tarsi. Ratio femur : tibia : tarsus : 55 : 48 : 44 for fore legs, 50 : 40 : 32 for middle ones and 55 : 40 : 35 for hind ones; anterior margin almost without bristles, margins of middle and hind femora with irregular rows of setae approximately as long as the femoral width. Tibial filtering setae of fore legs reaching to the end of claws (distal group) and to the end of tibiae (proximal group) (Fig. 14), setae finely plumately branched; for tarsi with oblique submarginal row of 7-8 fine and long filtering setae. Fore claws very narrow and slightly bent, middle and hind claws robust, broader and hooked. Claws with minute pointed 5-7 teeth in the middle of inner margin (Fig. 15).

Abdominal terga dark yellow or yellowish brown, tergum II distinctly darker, dark brownish, another brownish spot usually in the middle of tergum VII; terga VIII and IX with darker smudges near the posterior margin. Tergum II with conspicuous, finger-like protrusion in the middle of posterior margin; this protrusion rounded and only slight tapered apically, covered with fine microtrichia; tergum VII with distinct rounded protuberance near posterior margin. Surface and posterior margins of abdominal segments covered with pointed small spines of triangular shape. Posterolateral spines of abdominal segments well developed pointed and narrow. Gill cover quadrate, approximately as broad as long, with marginal row of rounded plumately branched short spines, inner margins with several stout and pointed bristles; surface of gill cover covered with numerous microtrichia. Gill with faint dark brown stippling and fringe simple or bifid. Cerci yellowish, unicolorous. Adult and subimago unknown.

Specimens examined: Mature female larva (holotype), mature male larva (paratype No. 1), 6 larvae oo (further paratypes): Sri Lanka, tributary of Kelani Ganga riv., March 12, 1969 leg. J. Dvorak. Holotype in alcohol, parts of paratypes on slides, deposited in the Institute of Entomology, Czechoslovak Academy of Sciences, Ceske Budejovice.

Etymology: *femorisetosa* = combination of latin femur and setosus (= having or bearing conspicuous setae).

Distribution and biology: Although known only from its type locality, *C. femorisetosa* sp.n. seems to be much more distributed in Sri Lanka and most likely identical with an undescribed species cited by Hubbard & Peters (1984) from numerous localities. Judging from the ecological demands of other species of this genus (cf. Soldan, 1983) and from the conditions at the type locality, larvae of *C. femorisetosa* sp.n. prefer the sites of medium size streams and river with stony bottom and swift current which are only slightly polluted. Localities of this type seem to be common at higher altitudes of

Sri Lanka (for further details of physico-chemical characteristics see Fernando, 1965; Costa & Starmuehlner, 1972 and Hubbard & Peters, 1984).

The genus *Clypeocaenis* was originally thought to be exclusively Oriental (Soldán, 1978). Since then it has been found in equatorial Africa (Petr, 1970; Soldán, 1983) and it is probably distributed in southern part of Africa as well. Although the Oriental-Ethiopian distribution of *Clypeocaenis* probably does not represent the consequence of the drift of the Indian plate from Madagascar (absence of *Clypeocaenis* in Madagascar and its presence in Iran - Demoulin, 1970; Edmunds, 1979; Soldan, 1978) the possible Gondwanian origin of this element in Sri Lanka's mayfly fauna could be taken into consideration. Except for Kimminsula (Leptophlebiidae) and some unnamed genera of this family (Hubbard & Peters, 1984) all the biogeographical elements of mayflies in Sri Lanka consist of the derivatives of relatively much younger fauna which differentiated in Asia (e.g. Tertiary mountain elements and others).

Differential diagnosis and discussion: Clypeocaenis femorisetosa sp.n. can be distinguished from other *Clypeocaenis* species by the following combination of characters: (1) clypeal protrusion rounded, with only two long setae on its margin; (2) genal costae with teeth; (3) antennal segments as long as or longer than 1/2 of pedicel; (4) femora with long bristles; (5) gill cover slightly longer than broad, oblique ridge not developed; (6) terga VII and VIII with medial protuberance; (7) segment 2 maxillary palps asymmetrical and bluntly pointed and (8) segment 3 of labial palps with subapical spines. *C. femorisetosa* is related to *C. afrosetosa* Soldán (distinguished by characters 2, 4, 5, 6 and 8) and closely related to *C. bisetosa* Soldán the couplet of which it will probably fall in when using the Soldán's (1983) key. This key should be modified as follows:

- 3(4). Clypeal protrusion with only two setae; middle and hind femora with bristles at most as long as femoral width; hind margin of tergum VII with well developed rounded protuberance; medial projection of tergum II with small pointed microtrichia.(to 3a)
- 3a (3b). Clypeal protrusion oblong-shaped and prominent, reaching to distal portion of pedicle; flagellar segments of antennae much shorter near the base of flagellum; fore femora without filtering setae; medial projection of tergum II pointed. *Clypeocaenis bisetosa* Soldán
- 3b (3a). Clypeal protrusion rounded, semicircular, reaching to distal portion of scape; flagellar segment approximately equal in length; fore femora with several long filtering setae on anterior margin; medial projection of tergum II rounded at apex.*Clypeocaenis femorisetosa* sp.n.
- 4 (3). Clypeal protrusion with more than 2 (at least 4) setae; middle and hind femora with bristles longer than femoral width, hind margin of tergum VII without protuberance; medial projection of tergum II without

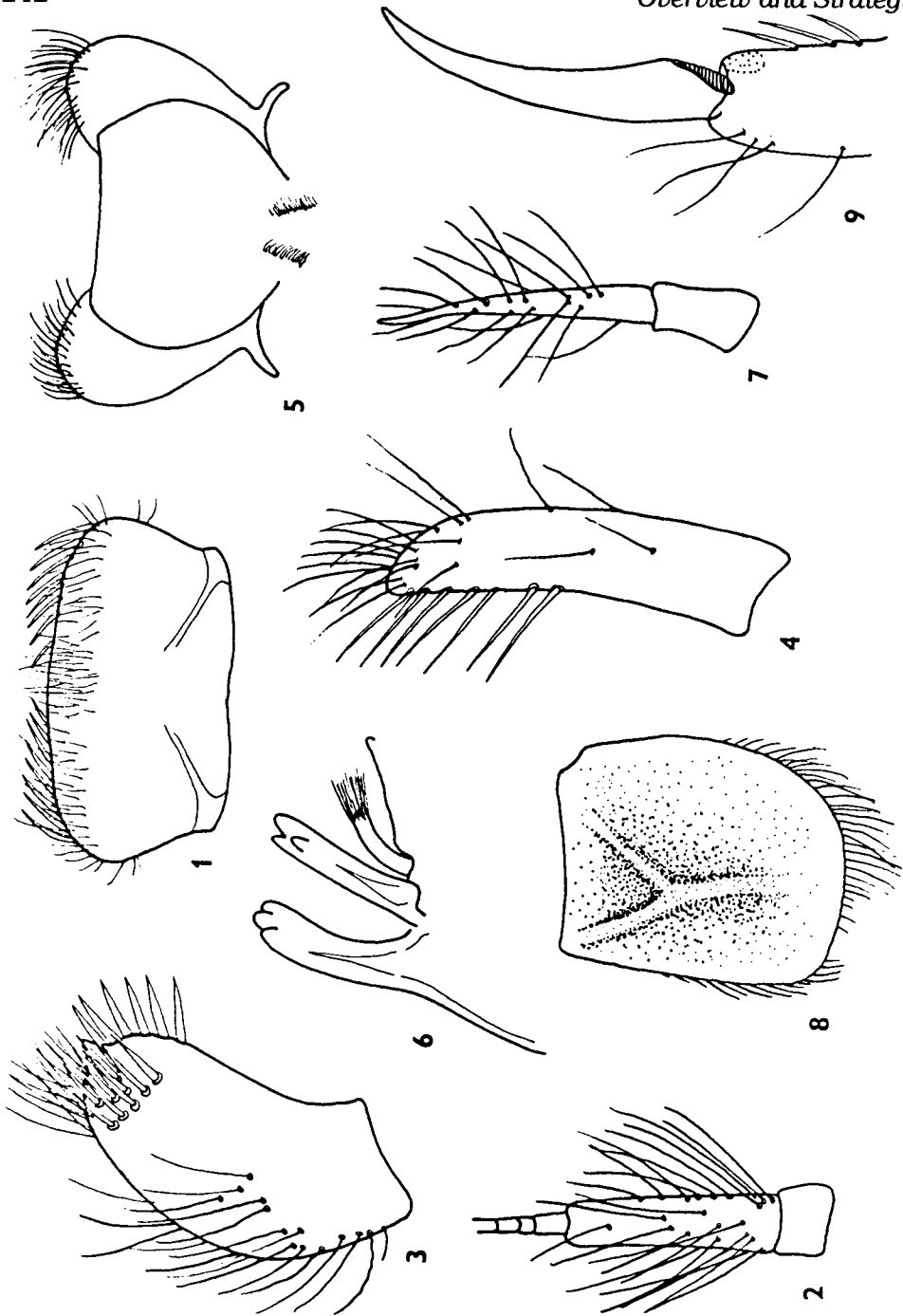
microtrichia or with longitudinal blackened ridge.(to 5)

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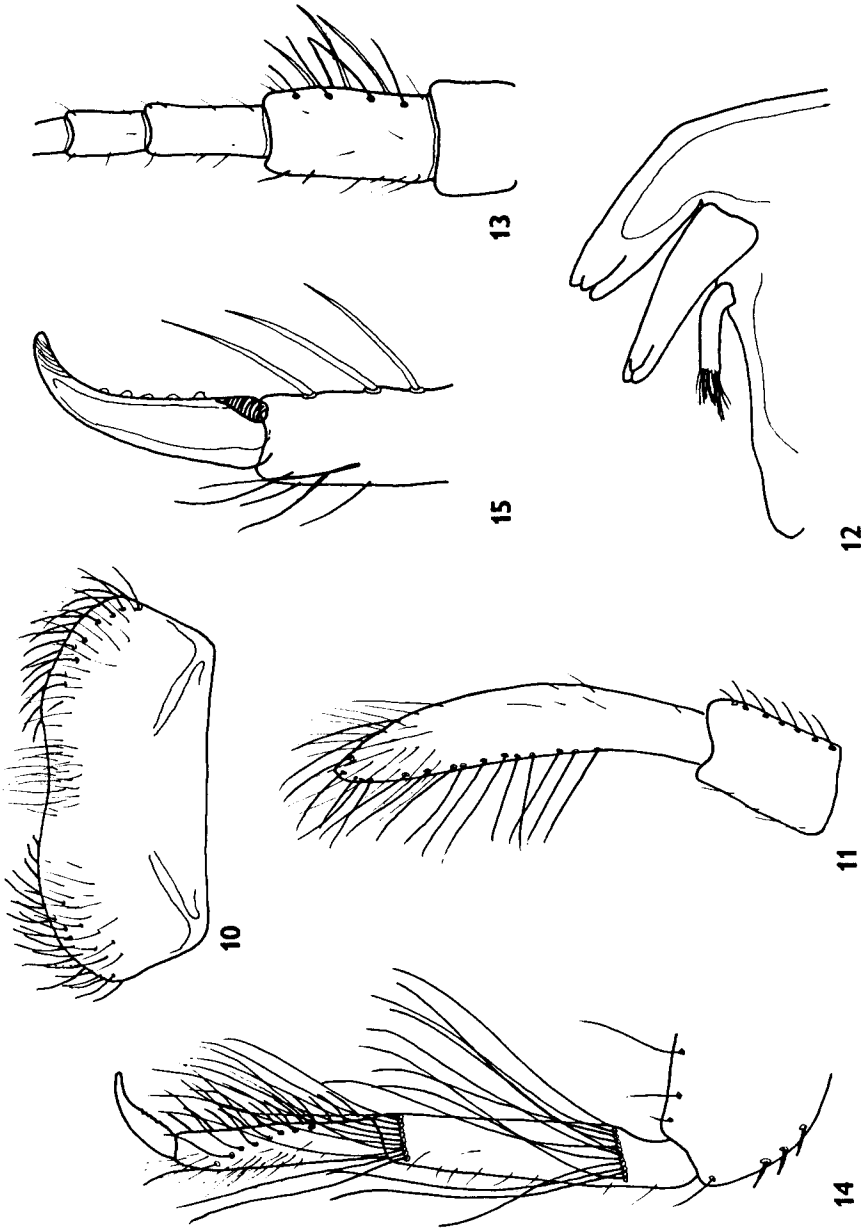
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Figs 1-9: *Brachycercus gilliesi* sp.n. 1 - labrum, 2 - base of antenna, 3 - distal segment of labial palps, 4 - distal segment of maxillary palps, 5 - hypopharynx, 6 - mandibular incisors, 7 - gill 1, 8 - gill cover, 9 - fore claw.



Figs 10-15: *Clypeocaenis femorisetosa* sp.n. 10 - labrum, 11 - maxillary palpus, 12 - mandibular incisors, 13 - base of antenna, 14 - fore leg, 15 - fore claw.