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THE STATUS OF *CRYPTOPENELLA* GILLIES, WITH DESCRIPTION OF A NEW SPECIES FROM SOUTHWESTERN CHINA (EPHEMEROPTERA: LEPTOPHLEBIIDAE)

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ABSTRACT. The genus *Cryptopenella* is treated as a subgenus of *Choroterpes*. Unlike *Choroterpes (Euthraulus)*, the expanded styliger plate of the male of *C. (Cryptopenella)* covers the penes. However, the nymphs of *C.* (*Cryptopenella*) resemble those of *C. (Euthraulus)*. This subgenus includes *Choroterpes (Cryptopenella) facialis* Gillies, *C. (Cryptopenella) anhuiensis* Wu & You and *C. (Cryptopenella) tumebasalis*, sp. nov. described from male and female imagos and nymphs from Yunnan Province, China. The Taiwanese species, *Choroterpes trifurcatà* Uéno (belonging to the subgenus *Euthraulus*), is treated as a different species from *C. (Cryptopenella) facialis* (Gillies).

Key words: Ephemeroptera, Leptophlebiidae, *Choroterpes*, *Cryptopenella*, China.

In 1951, Gillies established *Cryptopenella* with *Cryptopenella facialis* Gillies as the type species from Hong Kong, based on the male and female imagos, and distinguished it from other genera by its short, small penes covered ventrally by the well developed styliger. Peters & Edmunds (1970) described the nymph, which was characterized by enlarged projections on the inner corners of maxilla. However, the nymphal definition of *Cryptopenella* by Peters & Edmunds (1970) was insufficient to distinguish it from *Choroterpes (Euthraulus)* because some species of *C. (Euthraulus)* found later have similar maxillae (Kluge, 1984).

Choroterpes trifurcata Uéno was described in 1928 from nymphs collected from Taiwan. The "*Choroterpes trifurcatus*" found in Russia and Japan by other authors (*e.g.* Imanishi, 1940; Tshernova, 1952; Gose, 1963, 1980; Kazlauskas, 1963) was actually *Choroterpes (Euthraulus) altioculus* which was described by Kluge (1984) from nymphs and imagos. Kluge (1984) further suggested that *Cryptopenella facialis* is probably a synonym of *Choroterpes trifurcata*, and thus the genus *Cryptopenella* could very well be a synonym of *Euthraulus* Barnard.

Kang & Yang (1994) redescribed the nymph of *C. (E.) trifurcata* and provided additional distribution records from Taiwan. In this paper, they treated *Cryptopenella facialis* as a synonym of *Choroterpes trifurcata*, apparently following Kluge's (1984) suggestion, but provided no explanation nor description of the adult stages. The imaginal stage of *C. trifurcata* remains unknown, and I consider *Choroterpes trifurcata* and *Cryptopenella facialis* as two distinct species.

Three species of *Choroterpes (Cryptopenella)* are treated in this paper: *Choroterpes anhuiensis* Wu & You (1992), which was previously placed under *Euthraulus*, but has imaginal characters of *Cryptopenella;* a new species, *C. (Cryptopenella) tumebasalis*, sp.

nov. from Yunnan Province, China; and *C. (Cryptopenella) facialis* (Giles). The nymphs of these species can not be distinguished from *Choroterpes (Euthraulus)*, but the adults have unique characters. For this reason, I now treat *Cryptopenella* as a subgenus of *Choroterpes*. The nymph-imgo association in this paper is based on the shape of male genitalia and the color pattern of materials collected in same site and time.

Genus *Choroterpes* Eaton

Choroterpes Eaton, 1881. Entomol. Monthly Mag., 17: 194.
Euthraulus Barnard, 1932. Trans. R. Soc. S. Africa, 20: 240.
Thraululus Ulmer, 1939. Arch. Hydrobiol. (Supp.), 16: 499. Synonymized by Gillies, 1957. Proc. R. Entomol. Soc. London (B), 26: 43.
? = *Cryptopenella* Kluge, 1984. Entomol. Obozr., 63 (4): 727.
Cryptopenella Kang & Yang, 1994. J. Taiwan Museum, 47(1): 59 (objective synonym).

Subgenus *Cryptopenella* Gillies

Cryptogenella Gillies, 1951. Proc. R. Entomol. Soc. London (B), 20: 125 (originally described as a genus, imagos); Peters & Edmunds, 1970. Pacific Insects, 12 (1): 201 (nymph).

Imago: Similar to *Choroterpes (Euthraulus)* Barnard, 1932 except for the following: Penes small, covered by styliger plate; styliger plate thick, enlarged, extended posteriorly, with median shallow groove on ventral surface.

Nymph: Similar to subgenus *Choroterpes (Euthraulus)* Barnard, 1932.

1. *Choroterpes (Cryptopenella) tumebasalis*, sp. nov. (Figs. 1-14, 16, 19-24)

Nymph (in alcohol): body length 5.0 mm, terminal filament 6.0 mm, cerci 4.5 mm. Head capsule light brown with area between ocelli washed with dark brown; area between median ocellus and frons pale; median line of vertex pale; margins of clypeus parallel (Figs. 1-2). Mouthparts: labrum with median and apical row of hair dorsally, and 5-6 marginal denticles on the anteromedian emargination (Fig. 2), submedial clusters and submarginal hairs ventrally; anteromedian emargination broad, denticles worn. Hypopharynx as in Fig. 3. Mandibles with sparse lateral hairs; outer incisor with weakly serrated inner margin, inner incisor with weakly serrated inner and outer margins; left prostheca with 1 prominent spine (Figs. 4-5). Maxilla: a broad tooth-like projection on inner corner (Fig. 16); basal segment of maxillary palpi broad, 2nd segment with row of thick setae on inner margin and sparse hair on outer margin; apical segment covered with dense hair on both margins and surface, 2 additional bristles on inner surface basally; outer margin of maxilla with few setae, cardo with setae (Fig. 6). Labium: glossa with more thick plate-like setae on ventral surface; first segment of labial palp much broader than others; setae and bristle pattern of labium as Fig. 7.

Pronotum brown, washed with pale markings near posterior and lateral margins. Mesonotum brown, median area pale brown. Femora pale with 2 dark brown bands, one subapical, the other medial and larger. Femora with bristles, those on outer margin longer than others; additional setae on outer margins; Fore and mid tibiae with bristles on inner margin and very sparse and thin hairs on outer margin, but mid tibia with less bristles; Tarsi with several subapical hair on inner margin (Figs. 8-9). Both margins of hind tibia have bristles, those of outer margin longer, blunt tips; those on inner margin sharp; sparse setae on outer margin. Hind tarsus has few spines along inner margin and setae long outer one (Fig. 10). Claws of all legs similar, with row of denticles (Fig. 11).

Abdomen brown, median portion along median line paler. Terga 3-9 with posterolateral projections, those of terga 8-9 larger (Fig. 1). Gills: gills 1 single, longer than

others (Fig.12); gills 2-7 similar in shape but dorsal portion of each gill slimmer than ventral portion, each portion terminated into 3 projections; gills with reddish-brown pigments and well pigmented tracheae; tracheal branches more distinct in ventral portion than dorsal portion; small setae on gill margins (Figs. 13-14). Caudal filaments with dense spines and setae at joints

Male (in alcohol): Body length 6.0-6.5 mm, fore wing 6.0-6.5 mm, hind wings 1.0 mm, terminal filament 12.0 mm, cerci 10.0 mm, foreleg 4.5-5.0 mm. Body reddish-brown, compound eyes pale orange, nearly contiguous dorsally. Thorax reddish-brown; Femora with two blackish-brown markings dorsally, middle one much larger than apical one; tibiae and tarsi pale. Tarsal claws as in Fig. 23. Fore wing hyaline, pigmented at base, 5 intercalaries between CuA and CuP (Fig.19); hind wing very small (Fig. 20). Each terga of abdomen has one pair of straight dark stripes at middle dorsally, those on terga 1-6 clearer than others. Caudal filaments pale apically with several reddish basal joints.

Genitalia (Figs. 21-22): Approximately basal half of first segment of forceps broad, 2nd and 3rd segment shorter than first one; inner margin of forceps with short setae. Styliger enlarged, penes completely covered. Broad groove on ventral surface of styliger plate clear. Penes short, with slim apex.

Female: Body length 4.5-5.0 mm, cerci 6.0 mm, terminal filament 9.0 mm. Body reddish-brown, abdomen slightly darker than thorax. Posterior margin of sternum 7 straight, sternum 9 extended posteriorly (Fig. 24).

Diagnosis and Remarks: The males of this species are unique in the genus because of its expanded long forceps bases and short penes. The larvae have typical body shape of *Choroterpes.* The femora and gills are darker than those of congeners founded in China. Furthermore, the dorsal portions of abdominal gills are slimmer than others.

Etymology: The specific name is derived from the Latin prefix *tume* (expanded) and *basalis* (basal), indicating the long expanded base of male forceps.

Holotype: ♂, P. R. CHINA: Yunnan Province: Lijiang city: Shigu village, 25.v.1996, Coll. Chang-Fa Zhou (Nanjing Normal University collection, NJNU Coll.).

Paratypes: 5♂, 20♀, 5♂ subimagos, 5♀ subimagos , 20L, same as holotype (NJNU Coll.).

Other specimens: 2♂, 1♀, P. R. CHINA: Yunnan Province: Jingu county: Fengshan village, 8.iv.2001, Coll. Chang-Fa Zhou (NJNU Coll.).

Distribution: P. R. China: Yunnan province.

2. *Choroterpes (Cryptopenella) anhuiensis* Wu & You (Figs. 17-18, 25-26)

Choroterpes (Cryptopenella) anhuiensis Wu & You, 1992. Acta Zootaxonomica Sinica, 17 (1): 64. ♂,♀. Type: ♂,♀, des., fig. P. R. CHINA: Tangkou village (Anhui Province, Huangshan Mt.).

Nymph (in alcohol): very similar to *C. (Cryptopenella) tumebasalis,* sp. nov. Body length 4.5-5.5 mm, caudal filaments 7.5-8.5 mm. Median vertex and area around median ocellus pale, abdominal median line pale. Femora with 2 dark brown markings on both dorsal and ventral surfaces, one apical, the other median. Tibiae and tarsi pale. Gills with clear visible tracheae and branches. Caudal filaments with setae and spines at joints.

Remarks: The genital forceps of male have expanded bases but their inner margin bent progressively (Figs.25-26), without obvious elbow-like structure as in *C. (Crypto-*

penella) facialis or *C. (Cryptopenella) tumebasalis,* sp. nov. (Figs. 21-22, 27-28). The nymphs resemble those of *C. (Cryptopenella) tumebasalis,* sp. nov., both having no enlarged projections on inner margin of maxillae (Figs. 16, 17). However, they can be differentiated by the color pattern of femora and gills. The *C. (Cryptopenella) anhuiensis* has smaller markings on femora and less pigments on gills, this makes the tracheae and its branches clearer than those of *C. (Cryptopenella) tumebasalis.* sp. nov., especially dorsal portions (Fig.18). The dorsal portions of abdominal gills are slightly wider than *C. (Cryptopenella) tumebasalis,* sp. nov.

Specimens examined: P. R. CHINA: Anhui Province: Huangshan Mt.: Tangkou village, ♂ (holotype), vii.1987, Coll. T. Wu & J. Zhang (NJNU Coll.); 10♂, 20♀,10L, same data as holotype (NJNU Coll.); Anhui Province: Dongzhi County: 1♂ subimago, vi.1981, Coll. Daisou You (NJNU Coll.); Henan province: Songxian Ct., Tianchi Mt., 20♂, 30♀, 10♂ subimagos, 20♀ subimagos, 100L, 14.vi. 2004, Coll. P. Li & C-F Zhou (NJNU Coll.); 5♂, 2♀, 2♂2♀ subimagos, 20L, same as the former (FAMU Coll.); Guizhou Province: Guiding county: Changming village, 2♂, 3♀, 7L, 8.ix.2000, Coll. C-R Li & C-F Zhou (NJNU Coll.).

Distribution: Southern and Central China.

3. *Choroterpes (Cryptopenella) facialis* (Gillies), comb. nov. (Figs. 15, 27-28)

Cryptopenella facialis Gillies, 1951. Proc. R. Entomol. Soc. London (B), 20: 127. ♂, ♀. des., fig. Types: ♂, ♀, P. R. China: R. Shingman (Hong Kong); Peters & Edmunds, 1970. Pacific Insects, 12(1): 201. nymph, des., fig.

?= Choroterpes trifurcatus Kluge, 1984. Entomol. Obozr., 63 (4): 727.

not *Choroterpes trifurcatus* Uéno, 1928. Mem. Coll. Sci. Kyoto Imp. Univ. B, 4: 40; Kang & Yang, 1994. J. Taiwan Museum, 47(1): 59.

Remarks: Characters which distinguish this species from others of *Choroterpes (Cryptopenella)* include the longer projection on the inner corner of nymphal maxilla (Fig. 15), and gill tracheae with few branches. The forceps of males have a strongly expanded bases with a strong angle on the inner margin. The penes slightly extended out of styliger (Figs. 27-28).

Specimens examined: P. R. CHINA: Hong Kong: R. Shingman, 1♂ (paratype, in slide), 1L , 22.iii.1947, Coll. M. T. Gillies; New Territories: Lamtsuen river, 3♂, 1♀, 17-23.iv.1994, Coll. M. Salas; Taipo Kau forest, 1L, 28.x.1983, Coll. D. Dudgeon (FAMU Coll.).

Distribution: China: Hong Kong.

Key to the known species of *Choroterpes (Cryptopenella)* (male imago)

1. Forceps with a strongly expanded bases with a strong angle on the inner margin (Figs. 21, 22, 27, 28).....2
-- Forceps with expanded bases but their inner margin bent progressively (Figs. 25-26) ..... *C. (Cryptopenella) anhuiensis* Yu & You
2. Forceps of males with relatively longer expanded bases (Figs. 21, 22)..... ..... ***C. (Cryptopenella) tumebasalis*, sp. nov.**
-- Forceps of male with very short expanded bases (Figs. 27-28) .... *C. (Cryptopenella) facialis* (Gillies)

Key to the known species of *Choroterpes* (*Cryptopenella)* (mature nymph)

1. Maxilla with very long and distinct projection on the inner corner (Fig. 15) .... *C. (Cryptopenella) facialis* (Gillies)
-- Maxilla with short and indistinct projection on the inner corner (Figs. 16-17).....2
2. Gill tracheae with few branches, especially in dorsal portions of them (Fig. 13) .....***C. (Cryptopenella) tumebasalis*, sp. nov.**
-- Gill tracheae with more clear braches in both dorsal and ventral portions (Fig. 18) ..... *C. (Cryptopenella) anhuiensis* Yu & You

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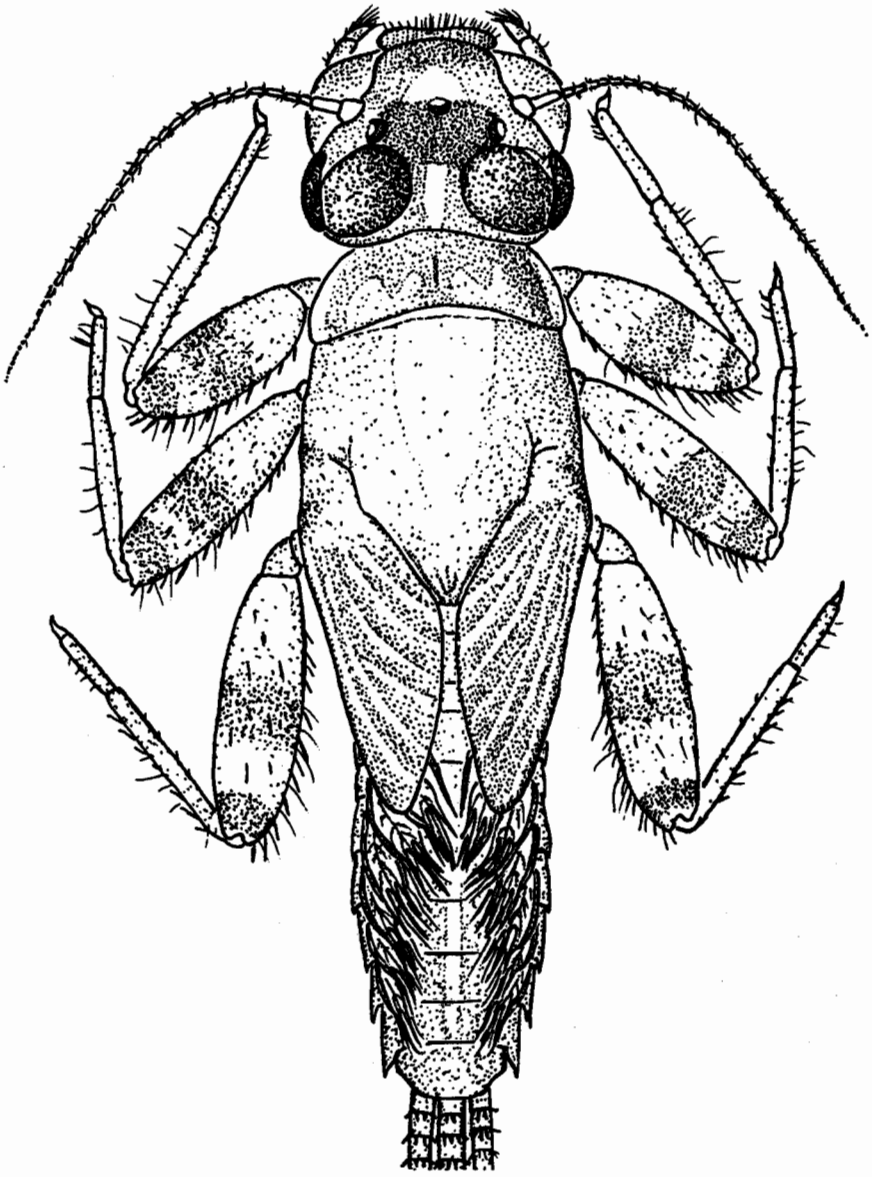
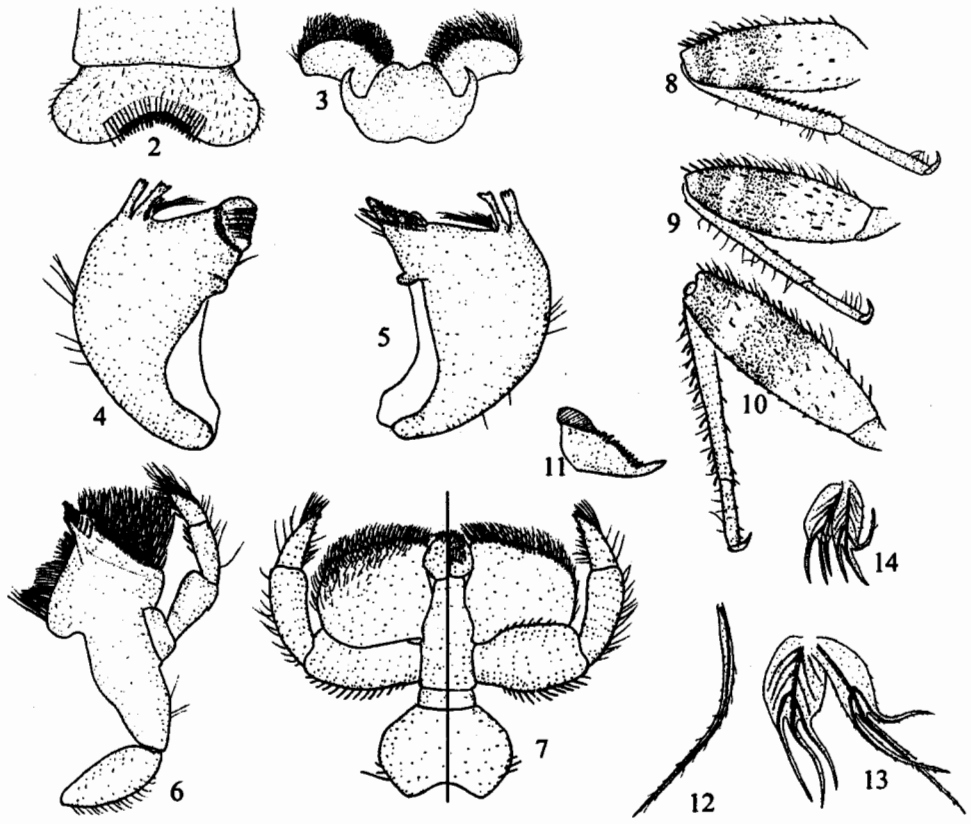
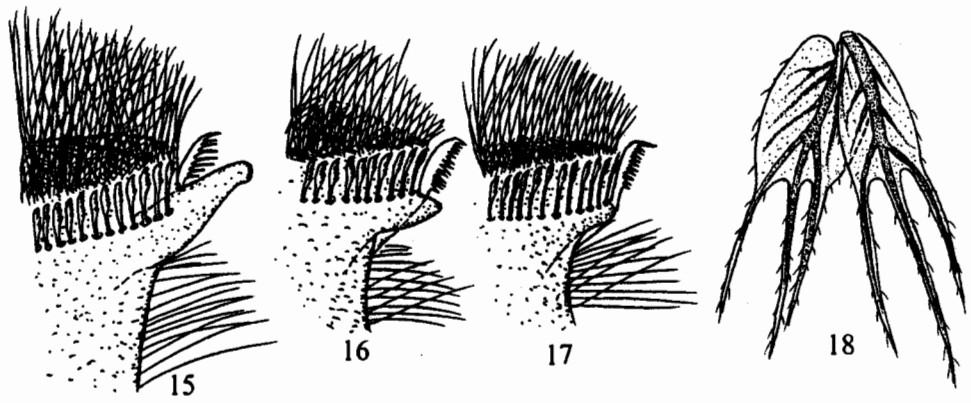


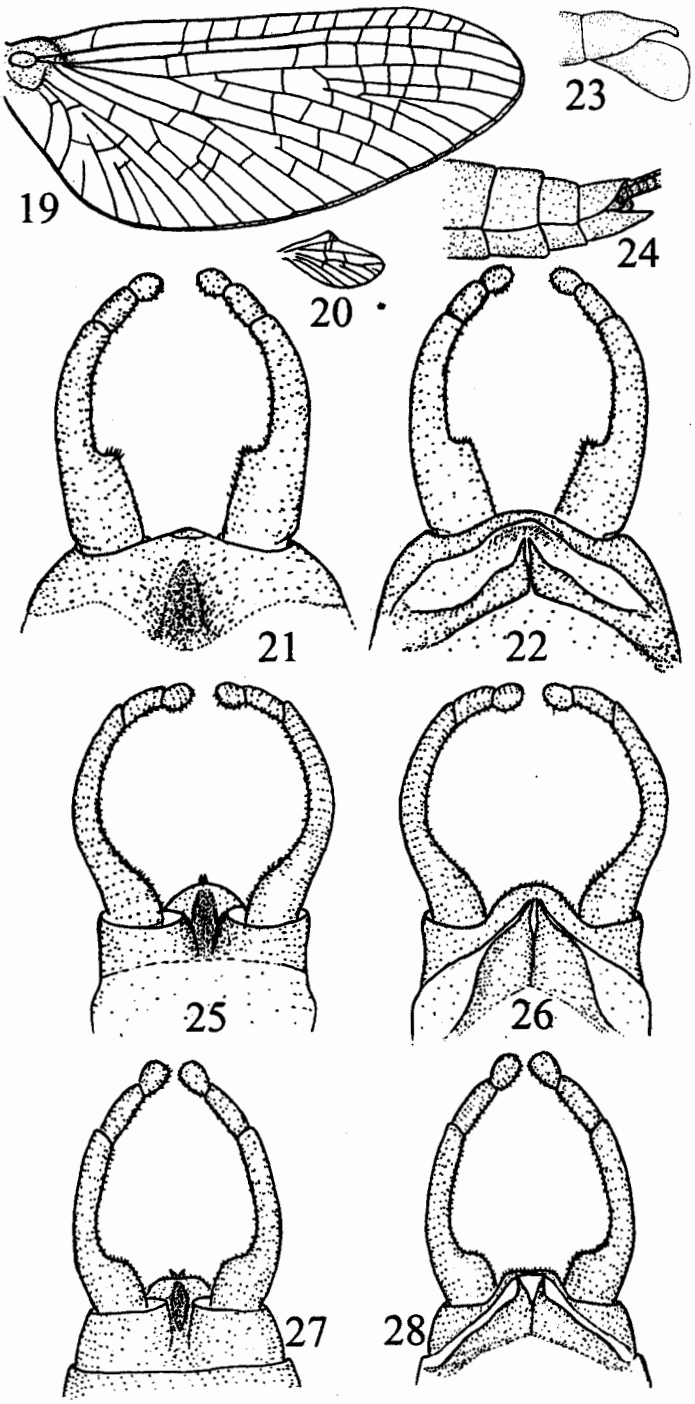
Fig. 1, *Choroterpes (Cryptopenella) tumebasalis,* sp. nov.: male nymphal habitus.



Figs. 2-14. Nymphal structures of *Choroterpes (Cryptopenella) tumebasalis,* sp. nov.: 2, labrum; 3, hypopharynx; 4, left mandible; 5, right mandible; 6, maxilla; 7, labium (left: dorsal view, right: ventral view); 8, fore leg, 9, mid leg; 10, hind leg; 11, fore claw; 12, gill 1; 13, gill 2; 14, gill 7.



Figs. 15-17. Inner apex of maxilla: 15, *Choroterpes (Cryptopenella) facialis* (Gillies); 16, *C. (Cryptopenella) tumebasalis*, sp. nov., 17, *C. (Cryptopenella) anhuiensis* Wu & You. Fig. 18, gill 3 of *C. (Cryptopenella) anhuiensis* Wu & You.



Figs. 19-28. Imaginal structures of *Choroterpes (Cryptopenella)* spp. 19-24. *Choroterpes (Cryptopenella) tumebasalis* sp. nov.: 19, fore wing; 20, hind wing; 21, genitalia in ventral view; 22, Genitalia in dorsal view; 23, fore claw; 24; terminal part of female abdomen (lateral view). 25-26. *Choroterpes (Cryptopenella) anhuiensis* Wu & You: 25, genitalia in ventral view; 26, genitalia in dorsal view; 27-28. *Choroterpes (Cryptopenella) facialis* (Gillies): 27, genitalia in ventral view; 28, genitalia in dorsal view.