Polyplectropus species (Trichoptera: Polycentropodidae) from China, with consideration of their phylogeny

Youwen J. Li & John C. Morse
Department of Entomology Department,
Clemson University, SC 29634-0365, USA

Abstract: Six species of the genus *Polyplectropus* are recorded from the People's Republic of China. All the species are new to science. A key to the males is given. The larva of *Polyplectropus nanjingensis* sp. nov. is illustrated. The phylogenetic relationships among these species and with *Polyplectropus* species of the New World are discussed.

Key words: male genitalia, larva, new species, caddisflies

Introduction

The genus *Polyplectropus* was established by Ulmer (1905) based on a species from Brazil. Flint (1968) transferred into it several North American species assigned previously in *Polycentropus* Curtis, 1835. He also synonymized with *Polyplectropus* the genera *Cordillopsyche* Ulmer, 1913 (Flint, 1967) and *Ecnomodellina* (= *Ecnomodes*) Ulmer, 1962 (Flint, 1968). For adults, the main difference between *Polyplectropus* and *Polycentropus* is that the forewing fork of R2+3 (Fork 1) is absent in *Polyplectropus* while present in *Polycentropus*.

The larva of the genus was first described by Flint (1964) as Genus C and later identified by him (Flint, 1968) as a species of this genus. The larva probably is *Polyplectropus charlesi* (Ross, 1941), which is distributed in Mexico and the southwestern United States. In the same paper, Flint also described the larva of another species from Dominica. In these two species, each anal claw has long teeth on its ventral margin, quite distinctive from the untoothed condition of *Polycentropus*. However, the larva of *Polyplectropus gedehensis* Ulmer, 1951, from Indonesia (Java), has no such teeth (Ulmer, 1957). In the current study, we find that the larva of *Polyplectropus nanjingensis*, sp. nov., from China also lacks these teeth.

Flint (1968) suspected that many Old World species of "*Polyplectropus*" are not true congenerics, not belonging to the same monophyletic group as the New World species. Bueno-Soria (1990) analyzed the phylogeny of 22 species from Mexico and Central America. He confirmed that those *Polyplectropus* species from this region belong to a monophyletic group and may be subdivided into five species-groups according to their phylogenetic relationships. The intention of the paper is not to conduct a worldwide revision of the genus. Rather, we are going to extend Bueno-Soria's pioneer work to species from China and to other close relatives from Asia. We are hoping to infer a phylogeny of the world species of the genus in the future to address Flint's suspicion.

Up to now, 121 species (excluding the species described in this paper) have been placed in the genus *Polyplectropus*, among which 62 species are Oriental, 41 species Neotropical, 12 species Australasian, 3 species Nearctic, and 2 species East Palearctic. Previously, no species have been reported from China, although there are some records in adjacent areas, such as Far East Russia (Arefina, 1996), Japan (Ulmer, 1908) and Southeastern Asia (Malicky, 1993 and 1995). All the Chinese species reported here are new to science. Five species are distributed in the Oriental Biogeographic Region, one in both the Oriental and the East Palearctic Biogeographic Regions.

Materials and Methods

All specimens were collected by using 15-watt ultraviolet light traps and are preserved in 75% ethyl alcohol. All genitalia used for illustrations were cleared with 10% KOH and each set is now kept in glycerine in a microvial in a vial of 75% ethanol with the rest of the specimen. Type specimens are deposited in Nan-jing Agricultural University (NAU), PRC, and the Clemson University Arthropod Collection (CUAC), South Carolina, United States of America. The larva of *Polyplectropus nanjingensis*, sp. nov., was associated by rearing mature larvae to adults.

The terminology for head and thorax warts is that of Ivanov (1990). Terms for male genitalia and wing venation are from the dissertation of Hamilton (1986).

Polyplectropus Ulmer

Polyplectropus Ulmer, 1905: 103. Type species: *Polyplectropus flavicornis* Ulmer, monobasic.
Ecnomodes Ulmer, 1911: 17. (Flint 1968: 21; preoccupied by Turner, 1903, in Lepidoptera).
Type species: *Ecnomodes buchwaldi* Ulmer, 1911, monobasic.
Cordillopsyche Banks, 1913: 238. (Flint 1967: 6). Type species: *Cordillopsyche costalis* Banks, 1913, monobasic.
Ecnomodellina Ulmer, 1962: 5, replacement for *Ecnomodes* Ulmer 1911. (Flint 1968: 21). Type species: *Ecnomodes buchwaldi* Ulmer, 1911, monobasic.
Genus C Flint, 1964: 467. (Flint, 1968:21).

Adults. Length of body with folded wings about 5-7 mm. Body color in alcohol brown, forewings brown with numerous white spots and darker anterior margins, hind wings paler. Forewings (Fig. 2) each with Forks 1, 2, 3, 4, and 5 (f.1, f.2, f.3, f.4, f.5) and with discoidal cell (DC) and median cell (MC) closed. Hindwings (Fig. 3) with Forks 2, 5 and with DC and MC open. Tibial formula 3-4-4.

Head (Fig. 1). Frontal warts (fron.) fused with antennal warts (ant.), forming "_/"-shape in frontal view. Preocellar warts (pre.) round, without distinctive edges, located closely behind angles of frontal and antennal warts on each side. Ocellar warts (oce.) long ovoid, each with anterolateral end more acute than posteriomesal corner. Occipital (occ.) warts kidney-shaped, each with posterior end enlarged, anterior end extended almost to base of antenna. Pronotum with medial pronotal warts (med.pro.) large, almost covering tergum; lateral pronotal warts (lat.pro.) smaller. Mesonotum with pair of round scutal warts (scu.) and a bigger ovoid scutellar wart (scutl.).

Male genitalia (Figs. 7-11). Sternum IX (s.IX) largest component of male genitalia, saddle-shaped, tapering dorsad in lateral view (Fig. 7), variably concave on posterior and anterior margins in ventral view (Fig. 8). Terga IX and X (t.IX+X) fused, much smaller than sternum IX, square or triangular, with or without pair of processes (Fig. 9). Superior appendages (sup.app.) simple or forked; with vertical acute process in some American species (Bueno-Soria 1990); with dorsobasal process (d.b.sup.app.) projecting above tergum IX+X in most American species (Bueno-Soria 1990), under tergum IX+X in most Asia species (Fig. 7). Inferior appendages (inf.app.) each single-segmented (Fig. 8), sometimes divided dorsoventrally or with mesal dent; ventral branches of inferior appendages occasionally fused mesally at base (Bueno-Soria 1990). Phallus (pha.) simple tube (Fig. 10) or with pair of internal spines (parameres) inside membrane (Bueno-Soria 1990). Subphallic sclerite (subph.sc.) present in many Asian species, below phallus, square or triangular, with mesal incision on posterior margin in most cases and with ventrolateral processes in some species (Fig. 11).

Larva (Figs. 29-33). Larva of this genus with typical characteristics of polycentropodids. Species from Asia with anal claws obtusely curved and without ventral teeth (Fig. 31; Ulmer, 1957). Species from America with anal claws each curved at right angle and with long ventral teeth (Wiggins, 1996).

Polyplectropus species from China:

Polyplectropus acuminatus, sp. nov., Dong-zhi and Jin-xian, An-hui Province.
Polyplectropus acutus, sp. nov., Ma-cheng, Hu-bei Province.
Polyplectropus curvatus, sp. nov., Cong-an, Fu-jian Province.
Polyplectropus explanatus, sp. nov., Wu-yi Mountain area of Jiang-xi Province, Yu-shan and Wu-yuan, Jiang-xi Province.
Polyplectropus involutus, sp. nov., Wu-yi Mountain area of Jiang-xi Province.
Polyplectropus nanjingensis, sp. nov., Nan-jing, Jiang-su Province; Huan-shan, Shaan-xi Province.

Key to *Polyplectropus* species from China (males)

1.Superior appendages forked (Fig. 7) 2
1'.Superior appendages not forked (Fig. 18) 4

2(1).Inferior appendages each with dorsal process curved mesad (Figs. 12, 14) .... *Polyplectropus involutus*, sp. nov.
2'.Inferior appendages without dorsal processes (Figs. 7, 8) 3

3(2').Inferior appendages each with apex narrower than base in ventral view (Fig. 5) .... *Polyplectropus nanjingensis*, sp. nov.
3'.Inferior appendages each with apex broader than base in ventral view (Fig. 8) .... *Polyplectropus explanatus*, sp. nov.

4(1').Inferior appendages slender and without processes or teeth (Fig. 26), subphallic sclerite without ventral processes (Fig. 28) .... *Polyplectropus curvatus*, sp. nov.

4'.Inferior appendages forked (Fig. 18), subphallic sclerite with ventral processes(Fig. 19) 5

5(4').Inferior appendages deeply forked, each with dorsal branch half as long as body of appendage (Fig. 18).. *Polyplectropus acuminatus*, sp. nov.
5'. Inferior appendages shallowly forked, each with dorsal branch much shorter than body of appendage (Fig. 20) .... *Polyplectropus acutus*, sp. nov.

Polyplectropus nanjingensis, sp. nov.
(Figs. 1-6, 29-33)

Adult. Length of body with folded wings: 6.57-7.30 mm (N = 21).

Male genitalia (Figs. 4-6). Sternum IX with posterior margin with pentagonal excision, anterior margin with V-shaped excision. Tergum IX+X short, triangular, with posterior corner round. Superior appendages forked, each with dorsal branch short and sharp, about $^1/_3$ as long as ventral branch; ventral branch broad and round at apex, with small tooth on mesal side; with dorsobasal process needle-like and recurved under tergum IX, reaching apices of inferior appendages. Inferior appendages each compressed at base, narrowing from middle to apex, with sharp point at apicoventral corner. Subphallic sclerite round, with slight incision on posterior margin at middle. Phallus simple tube, directed dorsad in basal third, then caudad, with truncate apex.

Larva (Figs. 29-33). Mature larva about 10 mm long. Body mostly white in alcohol. Head darker, with two paler areas around eyes and with numerous small dark muscle scars in posterior half. Pronotum fully sclerotized with dark muscle scars posteriorly; trochantin acute. Meso- and metanota membranous, with broad purplish band along dorsal meson extending from mesonotum to end of abdomen. Abdomen with longitudinal line of setae on each side from abdominal segments I to IX. Anal legs each with dorsal plate forming an "X," its claw smooth, without ventral teeth, gradually curved slightly ventrad.

Holotype male. Zhong-shan-ling, Nan-jing, Jiang-su Province, 18 May 1993, 100 m elevation, collected by Li and Lu (NAU). Paratypes: 17 males, same data as holotype (15 males NAU, 2 males CUAC); 3 males, Wu-long-qiao, Hua-shan, Shaan-xi Province, 7 June 1992, 575 m elevation, collected by C. Sun (NAU); 17 larvae, Zhong-shan-ling, Nan-jing, Jiang-su Province, 15 May 1993, collected by Li and Lu (from among which 3 larvae reared to adult males) (12 larvae and reared adults NAU, 2 larvae CUAC).

Diagnosis. The male genitalia of the new species are very similar to those of *Polyplectropus nocturnus* Arefina, 1996, and *Polyplectropus explanatus*, sp. nov., in unforked inferior appendages each with truncated apex and acute posteroventral corner and in superior appendages each divided into a short slender dorsal branch and a broader ventral branch. However, this species and *P. explanatus* are different from *P. nocturnus* in that the dorsal branch of each superior appendage is acute (truncated in lateral view in *P. nocturnus*), each superior appendage is without a ventrobasal process (with this process in *P. nocturnus*), and the apicoventral corner of each inferior appendage is more acute than in *P. nocturnus*. The difference between this species and *P. explanatus*, sp. nov., is also obvious: The dorsal branch of each superior appendage is about $^1/_3$ as long as the ventral branch in this species (more than $^2/_3$ as long as the ventral branch in *P. explanatus)* and the apex of each inferior appendage is narrower than the base in this species in ventral view (apex broader than the base in *P. explanatus*).

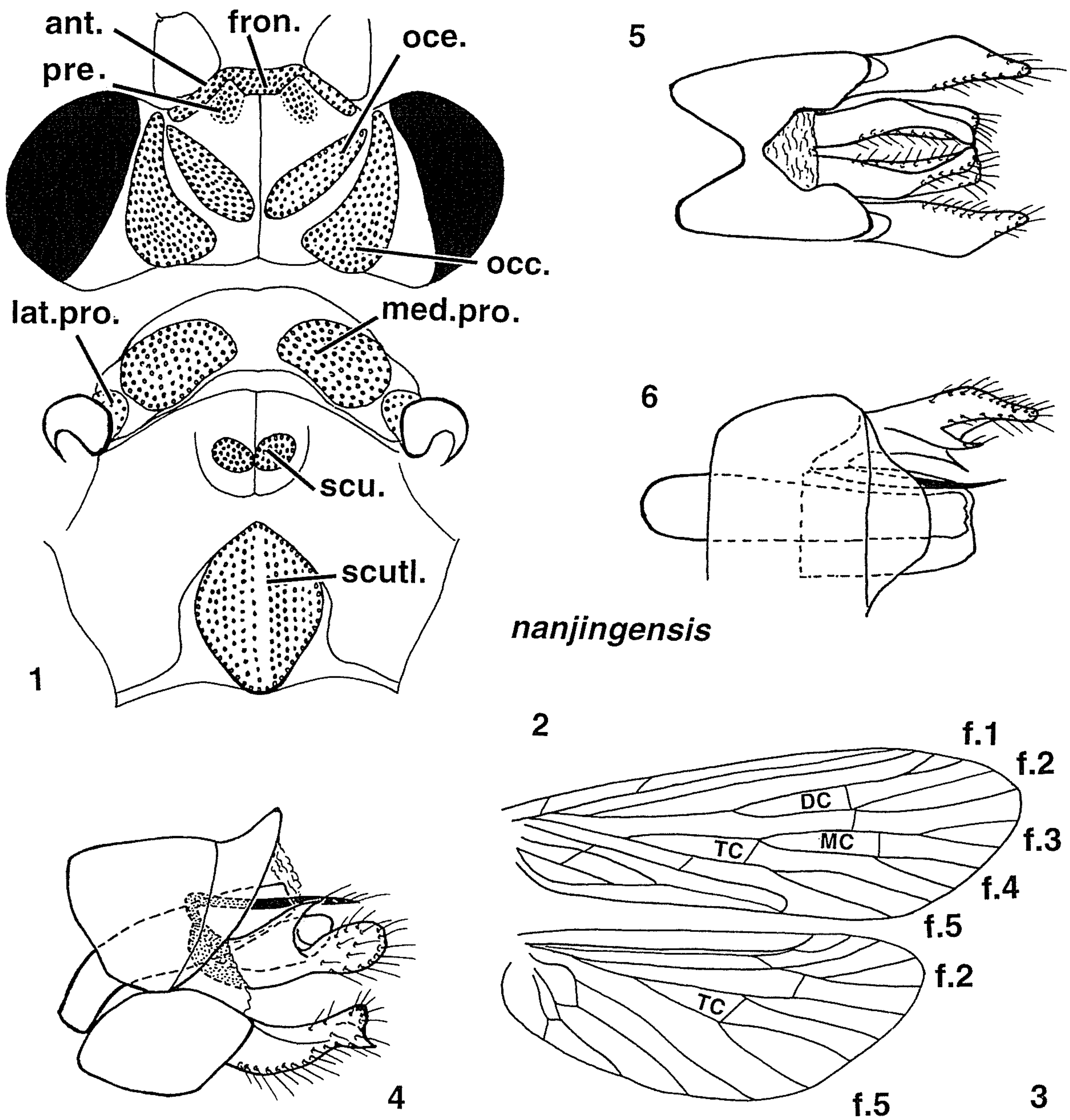
Etymology. Nan-jing, capital city of Jiang-su Province, is the type locality of the new species.

Distribution. The species has been found in Nan-jing, Jiang-su Province, Oriental Biogeographic Region and Huan-shan, Shaan-xi Province, East Palaearctic Biogeographic Region.

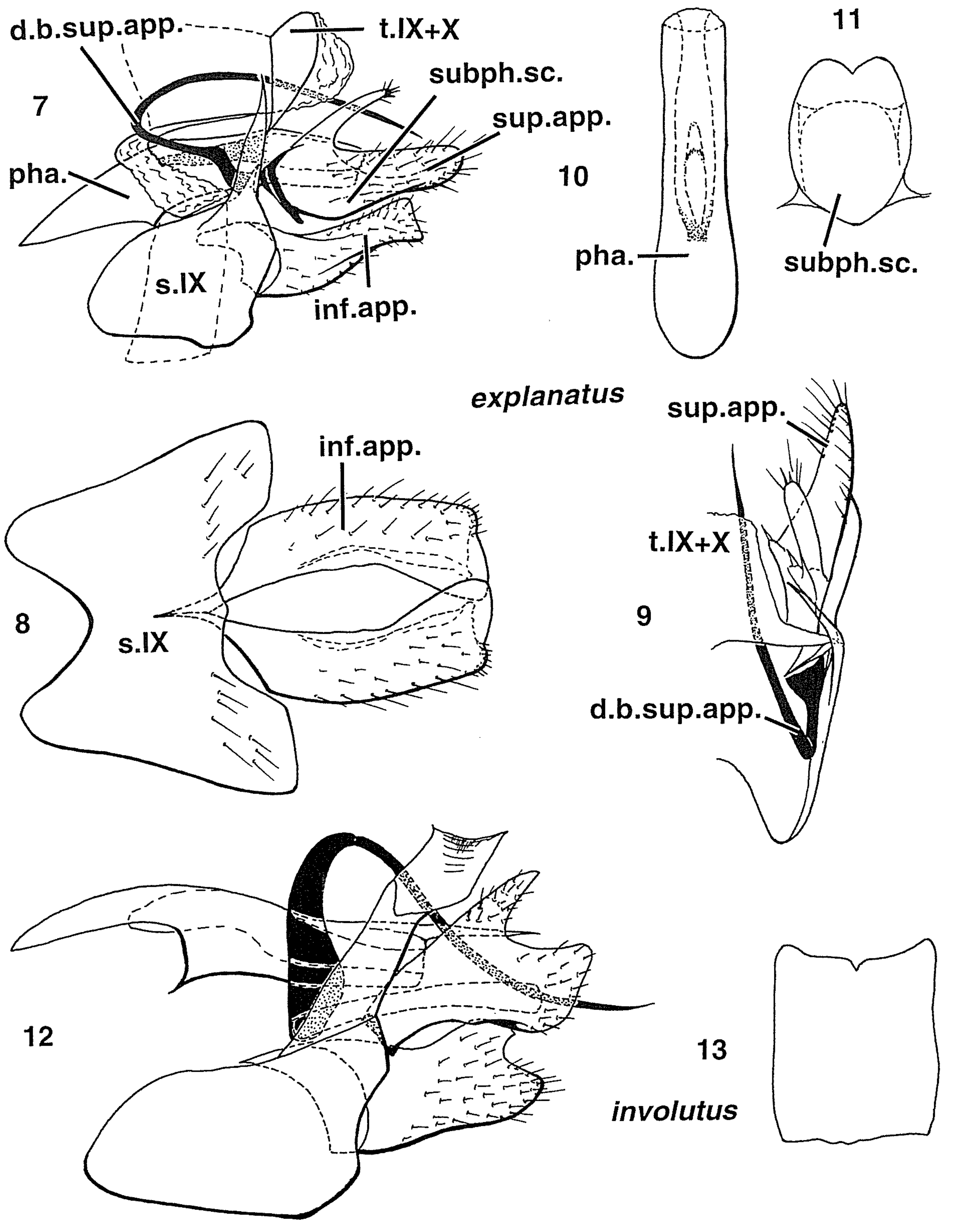
Polyplectropus explanatus, sp. nov.
(Figs. 7-11)

Adult. Length of body with folded wings: 5.5-6.60 mm (N = 19).

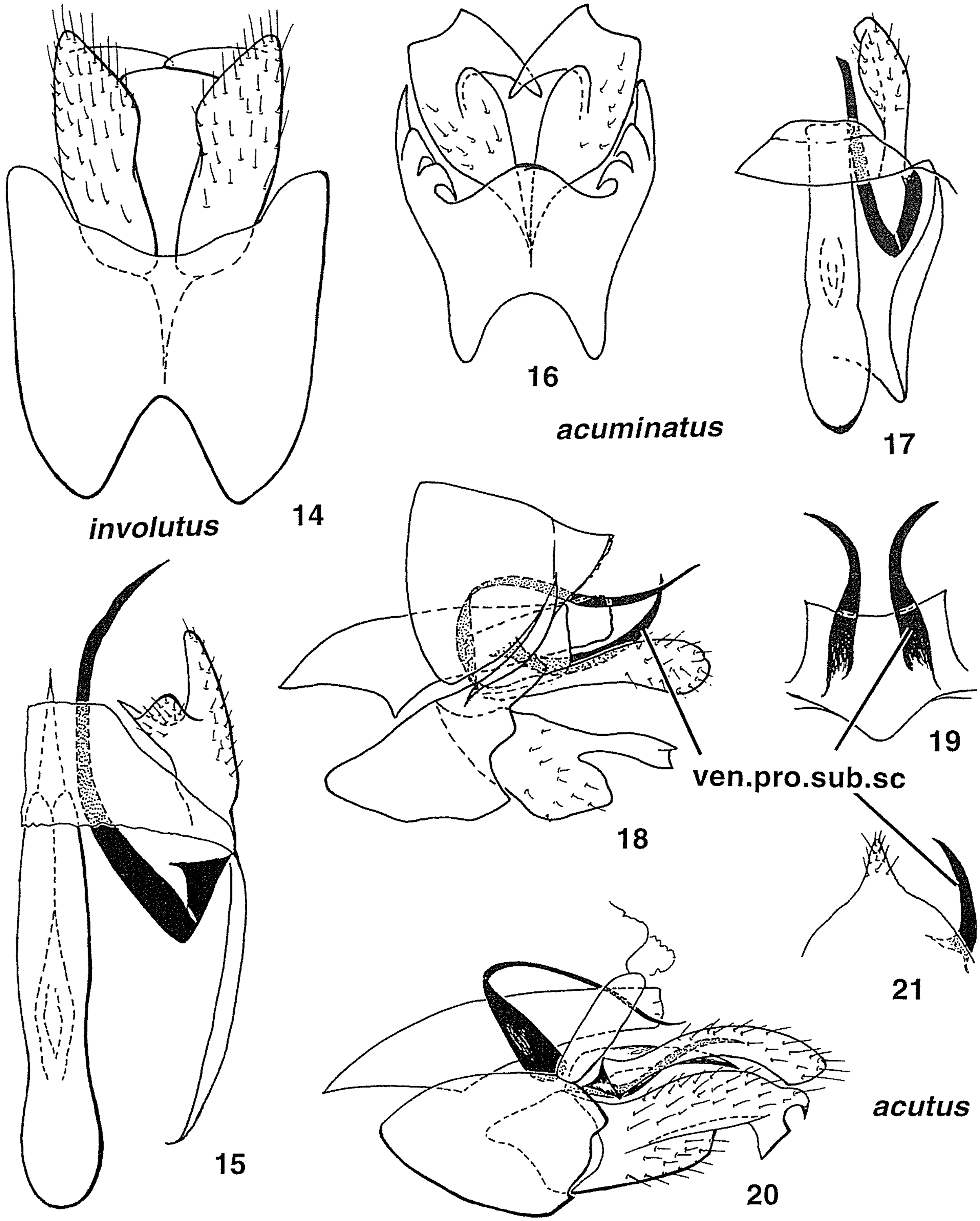
Male genitalia (Figs. 7-11). Sternum IX with posterior margin shallowly and broadly excised with slight mesal protrusion; anterior margin U-shaped. Superior appendages forked, each with dorsal branch sharp, $^2/_3$ as long as ventral branch, ventral branch tapering to blunt apex and with two small teeth on mesal side at middle; with dorsobasal process needle-like, recurved under tergum IX, extending to apices of inferior appendages. Inferior appendages compressed at base, each narrower from middle to apex, truncate at apex in lateral view; apex broader, with apicomesal corner obtuse, expanded and curved mesad slightly in ventral view. Subphallic sclerite round, with slight incision on posterior margin. Phallus simple tube, slightly curved caudad at middle, truncate at apex.



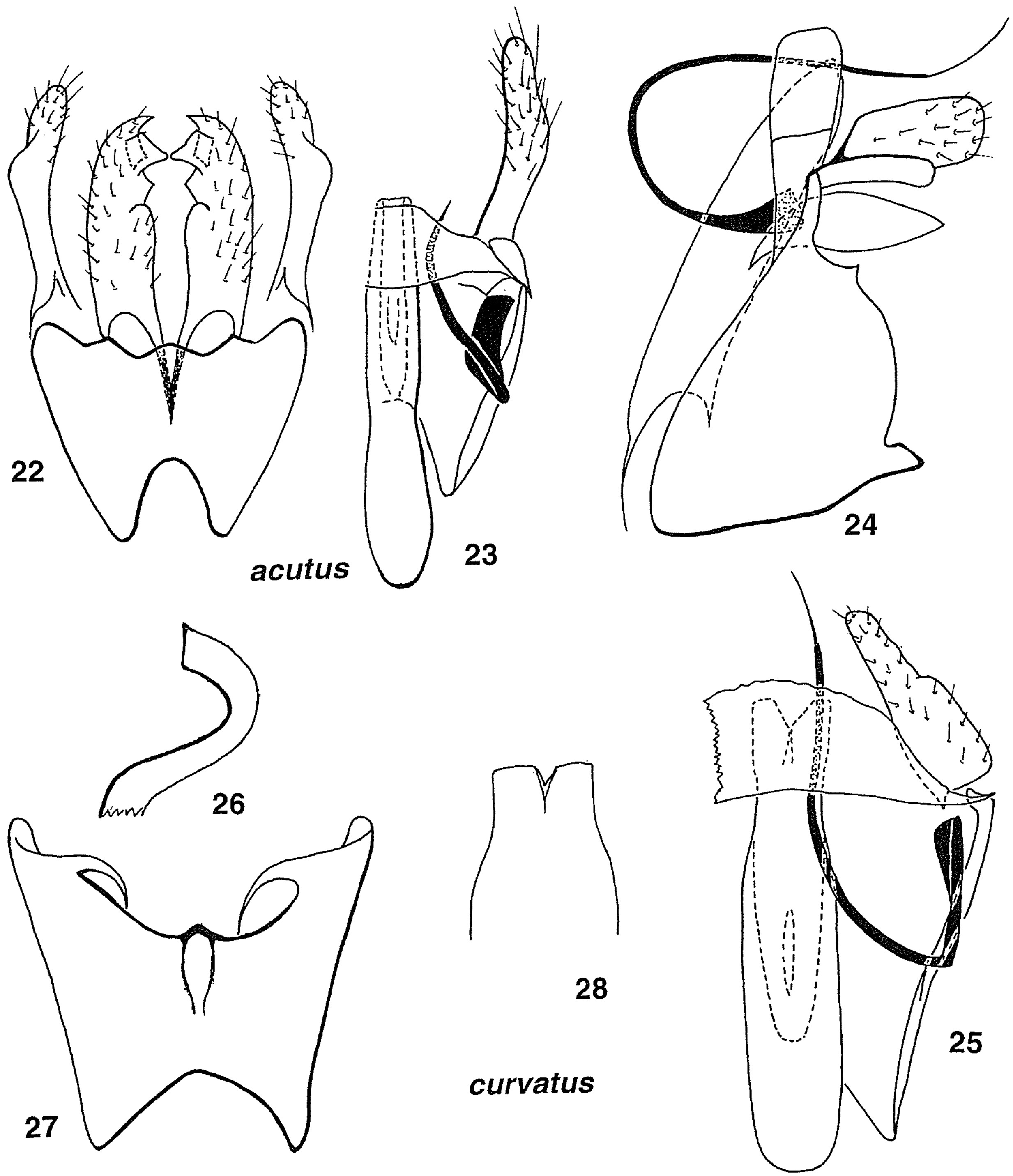
Figs. 1-6, adult male of *Polyplectropus nanjingensis*, n. sp. 1, head, pro- and mesonota dorsal, with flagella and wings omitted; 2, right forewing, dorsal; 3, right hindwing, dorsal; 4, genitalia, lateral; 5, genitalia, ventral, right inferior appendage omitted; 6, genitalia, dorsal, left side omitted. ant. = antennal wart; DC = discoidal cell; f.1 = Fork 1; f.2 = Fork 2; f.3 = Fork 3; f.4 = Fork 4; f.5 = Fork 5; fron. = frontal wart; lat.pro. = lateral pronotal wart; MC = median cell; med.pro. = median pronotal wart; occ. = occipital wart; oce. = ocellar wart; pre. = preocellar wart; scu. = scutal wart; scutl. = scutellar wart; TC = thyridial cell.



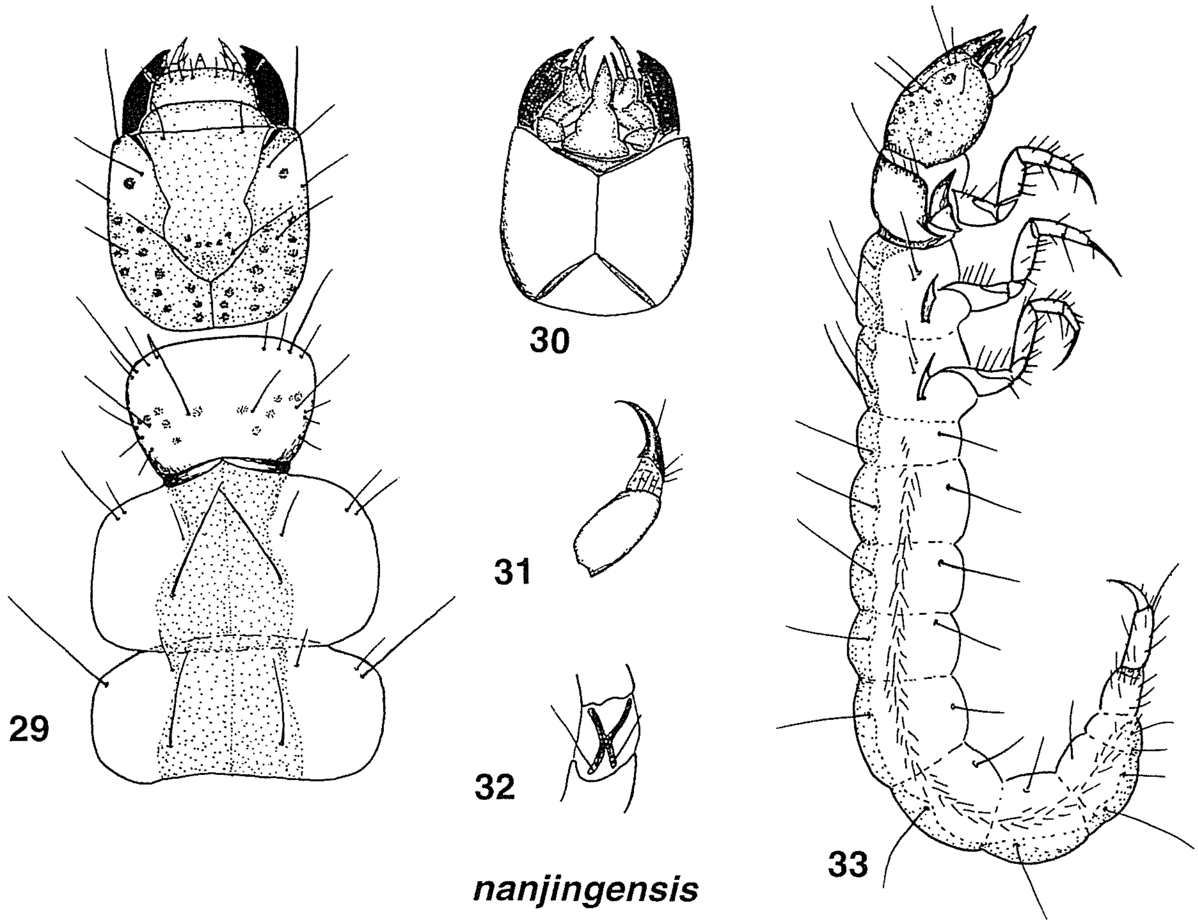
Figs. 7-13, adult male genitalia of *Polyplectropus* species; 7-11, *P. explanatus*; 12-13, *P. involutus*. 7 and 12, left lateral views; 8, ventral view; 9, dorsal view, right side omitted; 10, phallus, dorsal view; 11 and 13, subphallic sclerite, ventral view. d.b.sup.app. = dorsobasal process of a superior appendage; inf.app. = inferior appendage; pha. = phallus; s.IX = sternum IX; subph.sc. = subphallic sclerite; sup.app. = superior appendage; t.IX+X = tergum IX+X.



Figs. 14-21, adult male genitalia of *Polyplectropus* species; 14-15, *P. involutus*; 16-19, *P. acuminatus*; 20-21, *P. acutus*. 14 and 16, ventral views; 15 and 17, dorsal views; 18 and 20 left lateral views; 19 and 21 subphallic sclerite, ventral views. ven.pro.sub.sc. = ventrolateral process of subphallic sclerite.



Figs. 22-28, adult male genitalia of *Polyplectropus* species; 22-23, *P. acutus*; 24-28, *P. curvatus*. 22 and 27, ventral views; 23 and 25 dorsal views, with right side omitted; 24, left lateral view; 26, right inferior appendage, ventral view, base omitted; 28, subphallic sclerite, ventral view.



Figs. 29-33, Larva of *P. nanjingensis*, sp. nov. 29, head and thorax, dorsal view; 30, head, ventral view; 31, right anal claw, lateral view; 32, basal plate of right anal proleg, dorsal view.

Holotype male. 38 km N. of Cong-an, 2 km within Province border at 80 km marker, Jiang-xi Province, 26 May 1990, 550 m elevation, collected by Sun (NAU). Paratypes: 8 males, San-qing-shan, Shuang-xi-he, 80 km S. of Yu-shan, Yu-shan County, Jiang-xi Province, 27-28 May 1990, 470 m elevation, collected by Morse and Sun (6 males NAU, 2 males CUAC); 4 males, Qin-hua River, Wu-yuan County, 57 km N. of Wu-yuan, Jiang-xi Province, 25 May 1990, 250 m elevation, collected by Morse and Yang and Sun (NAU).

Diagnosis. As stated previously, the species is very similar to *P. nocturnus* Arefina, 1996, and *P. nanjingensis*, sp. nov., in their male genitalia. The differences among them are explained above in the diagnosis of the latter species.

Etymology. *Explanatus*, Latin, "pressed, flattened," referring to the apex of each inferior appendage.

Distribution. The species has been found only in the type locality in Jiang-xi Province, Oriental Biogeographic Region.

Polyplectropus involutus, sp. nov.

(Figs. 12-15)

Adult. Length of body with folded wings: 6.94 mm (N = 1).

Male genitalia (Figs. 12-15). Sternum IX with posterior margin shallowly concave, anterior margin with V-shaped excision. Superior appendages each forked about one-third of length, with dorsal branch sharp and slightly shorter than ventral branch; ventral branch broad and truncate at apex; with dorsobasal process needle-like, recurved beneath tergum XI+X, exceeding apices of other appendages. Inferior appendages each broader at base and apex, slightly narrower at middle; forked at apex, with apicodorsal projection finger-shaped, curved mesad. Subphallic sclerite square, with slight incision at middle of posterior margin. Phallus with acute apicodorsal lobe, about one-third as long as phallus.

Holotype male. 38 km N. of Cong-an, 2 km within Province border at 80 km marker, Jiang-xi

Province, 26 May 1990, 550 m elevation, collected by Sun (NAU).

Diagnosis. The species is very similar to *Polyplectropus inaequalis* Ulmer, 1927, in the apically truncated ventral branch of each superior appendage. However, the new species has an apicodorsal finger-like projection of each inferior appendage which is absent in *P. inaequalis*.

Etymology. *Involutus*, Latin, "curved inward," referring to the shape of the dorsal branch of each inferior appendage

Distribution. The species has been found only in the type locality of the species in Wu-yi Mountain area of Jiang-xi Province, Oriental Biogeographic Region.

Polyplectropus acuminatus, sp. nov.
(Figs. 16-19)

Adult. Length of body with folded wings: 5.40-7.60 mm (N = 10).

Male genitalia (Figs. 16-19). Posterior margin of sternum IX convex at middle and with two pairs of lateral projections curved anteriad, connecting sternum to bases of subphallic sclerite and superior appendages; anterior margin with U-shaped excision. Superior appendages not forked, broader at apex than at base in lateral view; with dorsobasal process needle-like and recurved beneath tergum IX+X, reaching apices of superior and inferior appendages. Inferior appendages forked; dorsal branch slender in lateral view and recurved mesad and anteriad, with apicolateral corner concave in ventral view; ventral branch less than half as long as dorsal branch, 2X as wide as dorsal branch in lateral view, but ½ as wide as dorsal branch in ventral view. Subphallic sclerite nearly rectangular, with pair of slender acute spines underneath slightly shorter than basomesal processes of superior appendages. Phallus truncate at apex.

Holotype male. Feng-shu-cun, Qiou-pu-qian River, 11 km SE. of Dong-zhi, Dong-zhi County, An-hui Province, 7 July 1990, 30 m elevation, collected by Morse and Yang (NAU). Paratypes: 9 males, Song-cun, Ding-xi River, Jin-xian County, 33 km E. of Jin-xian, An-hui Province, 8 June 1990, 120 m elevation, collected by Morse and Yang (7 males NAU, 2 males CUAC).

Diagnosis. The species is similar to *Polyplectropus acutus*, sp. nov., in possessing lateral spines under the subphallic sclerite. The inferior appendages of the species are deeply forked as in *Polyplectropus matthatha* Malicky and Chantaramongkol, 1993, and most species from the New World (Bueno-Soria, 1990). However, the inferior appendages in *P. acutus*. are not as deeply forked as in this species. The subphallic sclerite is rectangular, not triangular as in *P. acutus*. There are no ventral processes of the subphallic sclerite in *P. matthatha* and the New World species.

Etymology. *Acuminatus*, Latin, "acuminate," referring to the big acute mesad process of each inferior appendage.

Distribution. The species is found in the type localities in southern An-hui Province, Oriental Biogeographic Region.

Polyplectropus acutus, sp. nov.
(Figs. 20-23)

Adult. Length of body with folded wings: 6.2-7.30 mm (N = 4).

Male genitalia (Figs. 20-23). Posterior margin of sternum IX with three short and broad dents; anterior margin with U-shaped excision. Superior appendages not forked, slightly clavate, and each slightly curved ventrad to apex; with dorsobasal process needle-like and recurved beneath tergum IX+X, reaching just beyond apex of tergum. Inferior appendages each compressed and broad at base and with deep rectangular excision beyond middle in lateral view; with shallow fork at apex, dorsal branch acute and hooked ventrad, ventral branch subrectangular. Subphallic sclerite triangular, with posterior corner acute on posterior margin and with ventral projection on each side extending only to apex of sclerite. Phallus truncate at apex.

Holotype male. Ma-cheng County, 27 km N. of Ma-cheng, Tong-jia-chong River, Hu-bei Province, 27 July 1990, 150 m elevation, collected by Morse and Yang (NAU). Paratypes: 9 paratypes, same data as holotype (7 males NAU, 2 males CUAC).

Diagnosis. The species is similar to *P. acuminatus*, sp. nov., in possessing lateral projections of the subphallic sclerite. The differences are stated above in the diagnosis of that species. Its inferior appendages are somewhat like those of *Polyplectropus anakempat* Malicky, 1995, with the shallow apical fork whose dorsal branch is acute and whose ventral branch is subrectangular. However, in the new species, the basomesal process of each superior appendage is not forked and tergum X is without lateral processes seen in *P. anakempat*.

Etymology. *Acutus*, Latin, "abruptly sharpened," referring to the shape of the posterior corners of the subphallic sclerite.

Distribution. The species is known only at the type locality in Hu-bei Province, Oriental Biogeographic Region.

Polyplectropus curvatus, sp. nov.
(Figs. 24-28)

Adult. Length of body with folded wings: 5.1 mm (N = 1).

Male genitalia (Figs. 24-28). Sternum IX with posterior margin broadly concave and with protruding ridge at meson, anterior margin with broadly U-shaped excision; inner posterior margins with pair of sclerotized strips articulating with bases of inferior appendages. Superior appendages each with short, slender base; apical four-fifths broad and subrectangular in lateral view; in dorsal view, apical half narrower than basal ½, apex blunt; with dorsobasal process needle-like and recurved beneath tergum IX+X, exceeding apices of superior appendages. Inferior appendages each slender, S-shaped in ventral view, with apex truncate and directed mesad. Subphallic sclerite subrectangular, posterior margin with short, narrow incision at middle. Phallus narrowed at apex in dorsal view, incised at middle.

Holotype male. 29 km N. of Cong-an City, at 480 km marker, Fu-jian Province, 29 May 1990, 408 m elevation, collected by Morse and Yang (NAU).

Diagnosis. The species is somewhat similar to *Polyplectropus prapat* Malicky, 1993a in the slender, mesally curved inferior appendages. However, these species are quite different. In the new species, each superior appendage has a more slender base in lateral view (these are the same thickness throughout their length in *P. prapat*); tergum IX+X lacks lateral spines present in *P. prapat*; and the apex of each inferior appendage is truncate and without an acute tip (round and with a small ventral tip in *P. prapat*).

Etymology. *Curvatus*, Latin, "curved," referring to the S-shaped inferior appendages in ventral view.

Distribution. The species has been found only at the type locality in Fu-jian Province, Oriental Biogeographic Region.

Phylogenetic considerations

Apparently, *P. nanjingensis*, *P. explanatus*, *P. nocturnus*, *P. inaequalis* and *P. involutus*, belong to the monophyletic *P. inaequalis* Group, as suggested by their forked male superior appendages. *Polyplectropus nanjingensis* is most closely related to *P. nocturnus*, as suggested by the apicoventral corner of each inferior appendage with a conspicuous tip. *Polyplectropus explanatus* is a sister species to the above lineage based on the truncate apex of each inferior appendage and the short mesal process of each superior appendage. The relationships of the lineage composed of the above three species with *P. inaequalis* and *P. involutus* are undecided yet.

Polyplectropus acuminatus is most closely related to *P. matthatha* as evidenced by their dorsoventrally divided inferior appendages. This dorsoventral division is due to a compressing of each inferior appendage, causing the mesal branch to shift to the ventral side. Therefore, these branches are not homologous with those in species from America. The two species stated above belong to the same lineage as *Polyplectropus hamatiformis* Mey, 1990, *Polyplectropus baring* Malicky, 1993a, *Polyplectropus simei* Malicky, 1993b, *Polyplectropus jorim* Malicky, 1993b, *Polyplectropus jotham* Malicky, 1993a, *Polyplectropus admin* Malicky and Chantaramongkol, 1993, as suggested by the homologue of the acute apex of lateral branch of each inferior appendage. The homologous inferior appendages each with a short subapicomesal branch and a lateral branch more or less curved mesad suggest that the above eight species cited in this paragraph and the following species belong to the monophyletic *Polyplectropus hamitiformis* Group, which also includes *Polyplectropus josaphat* Malicky, 1993a, *Polyplectropus tam* Malicky, 1995, *Polyplectropus chin* Malicky, 1995, *Polyplectropus san* Malicky, 1995, *Polyplectropus maiyarap* Malicky, 1995, *Polyplectropus anakempat* Malicky, 1995, and *Polyplectropus acutus*, sp. nov.

Polyplectropus curvatus is a sister species of the lineage composed of *Polyplectropus anakgugur* Malicky, 1995, and *Polyplectropus prapat* Malicky, 1993a, as suggested by the homologously slender inferior appendages. The latter two species share the presence of homologous lateral processes of tergum X.

So far, the only homologue we found for the genus is the fused condition of veins R2+3 in the posterior wing. Within this genus, long ventral teeth on the larval anal claws are present only in the New World species; ventral teeth of anal claws are absent in the Asian, Afrotropical, and Australasian species of *Polyplectropus* so far studied (Ulmer, 1957; Marlier, 1962; Cowley, 1978; and the current study). The teeth are long in the larvae of other Polycentropodidae genera (e.g., *Paranyctiophylax*), short in others (e.g., *Cernotina, Neureclipsis*), and minute or absent in others (e.g., *Cyrnellus, Polycentropus*). The main body of each superior appendage of the American species is more or less reduced as a hairy ear-like process. These two characters are, therefore, potentially homologous for clustering the New World species as a monophyletic group (Bueno-Soria, 1990), but not for the world species.

Acknowledgements

We are greatly indebted to Dr. Steven Hamilton for sharing his Polycentropodidae notebooks, which saved us a lot time. We are grateful to Mr. Chang-min Lu for his help in rearing *Polyplectropus nanjingensis*, n. sp., and to Prof. Lian-fang Yang and Mr. Chang-hai Sun for their help in collecting adults. This research was supported by US National Science Foundation Grant No. DEB-9318074. This is Technical Contribution No. 4295 of the South Carolina Agricultural Experiment Station, Clemson University.

References

Arefina, T. I. 1996. *Polyplectropus* Ulmer, a genus of Trichoptera (Polycentropodidae) new to the Russian fauna, with description of a new species. Aquatic Insects 18(1): 61-64.

Bueno-Soria, J. 1990. Estudios en insectos acuaticos VIII. Revision para México y Centro América del genero *Polyplectropus* Ulmer (Trichoptera: Polycentropodidae). Anales Inst. Biol. Universi. Nac. Autón. México, Ser. Zool. 61(3): 357-404.

Cowley, D.R. 1978. Studies on the larvae of New Zealand Trichoptera. New Zealand Journal of Zoology 5: 639-750.

Flint, O. S. 1964. Notes on some Nearctic Psychomyiidae with special reference to their larvae (Trichoptera). Proceedings of the United States National Museum 114(3473): 453-78.

Flint, O. S. 1968. Bredin-Archbold-Smithsonian biological survey of Dominica 9. The Trichoptera (Caddisflies) of the Lesser Antilles. Proceedings of the United States National Museum 125(3665): 467-481.

Hamilton, S. 1986. Systematics and biogeography of the New World *Polycentropus sensu stricto* (Trichoptera: Polycentropodidae). Ph.D. Dissertation, Clemson University. 257 pp.

Ivanov, V. D. 1990. Structure and evolution of setose warts of caddisflies. Latvijas Entomologs 33: 96 - 110.

Malicky, H. 1993a. Neue asiastische Köcherfliegen (Trichoptera: Rhyacophilidae, Philopotamidae, Ecnomidae und Polycentropodidae). Entomologische Beirichte Luzern 29: 77-88.

Malicky, H. 1993b. Neue Köcherfliegen (Trichoptera: Philopotamidae, Polycentropodidae, Psychomyiidae, Ecnomidae, Hydropsychidae, Leptoceridae). Linzer Biologische Beitrage, 25 (2): 1099 - 1136.

Malicky, H., and P. Chantaramongkol. 1993. Neue Trichopteren aus Thailand. Teil 1: Rhyacophilidae, Hydrobiosidae, Philopotamidae, Polycentropodidae, Ecnomidae, Psychomyiidae, Arctopsychidae, Hydropsychidae. Linzer Biologische Beitrage 25 (1): 433-487.

Malicky, H. 1995. Weitere neue Köcherfliegen (Trichoptera) aus Asien. Baueria (Lunz am See, Austria) 22: 11-26.

Marlier, G. 1962. Genera des Trichoptères de l'Afrique. Annales du Musée Royal de l'Afrique Centrale, Ser. 8, Sciences Zoologiques 109: 1-263.

Mey, W. 1990. Neue Köcherfliegen von den Philippinen (Trichoptera). Opuscula Zoologica Fluminensia 57: 1-19.

Ulmer, G. 1908. Japanische Trichopteren. Deutsche Entomologische Zeitschrift 339-355.

Ulmer, G. 1927. Einige neue Trichopteren aus Asien. Entomologische Mitteilungen 16(3): 172-182, pl. 5-6.

Ulmer, G. 1957. Köcherfliegen (Trichoptera) von den Sunda-Inseln (teil III). Larven und Puppen der Annulipalpia, unter Berücksichtigung verwandter Formen und deren Literatur aus anderen Faunengebieten. Archiv für Hydrobiologie, Suppl. 23(2/4): 109-470.