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Four new species and two new records of *Polyplectropus* from China (Trichoptera: Polycentropodidae)

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Abstract

Four new species and 2 new records of the genus *Polyplectropus* Ulmer from China are described and illustrated. The new species include *Polyplectropus cubitalis* Zhong and Yang **sp. nov.**, from Guizhou, *Polyplectropus subteres* Zhong and Yang **sp. nov.**, from Jiangxi and Zhejiang, *Polyplectropus tridentatus* Zhong and Morse **sp. nov.**, from Guangxi, and *Polyplectropus tianmushanensis* Zhong and Yang, **sp. nov.**, from Zhejiang. Two species, *Polyplectropus ahas* Malicky and Chantaramongkol, 1993, and *Polyplectropus anakgugur* Malicky, 1995, are newly recorded from China, bringing the number of Chinese *Polyplectropus* species to 28. The newly recognized *Polyplectropus anakgugur* Group is probably monophyletic, as evidenced by ventromesal lobes of the inferior appendages short, positioned only at the bases of the inferior appendages.

Introduction

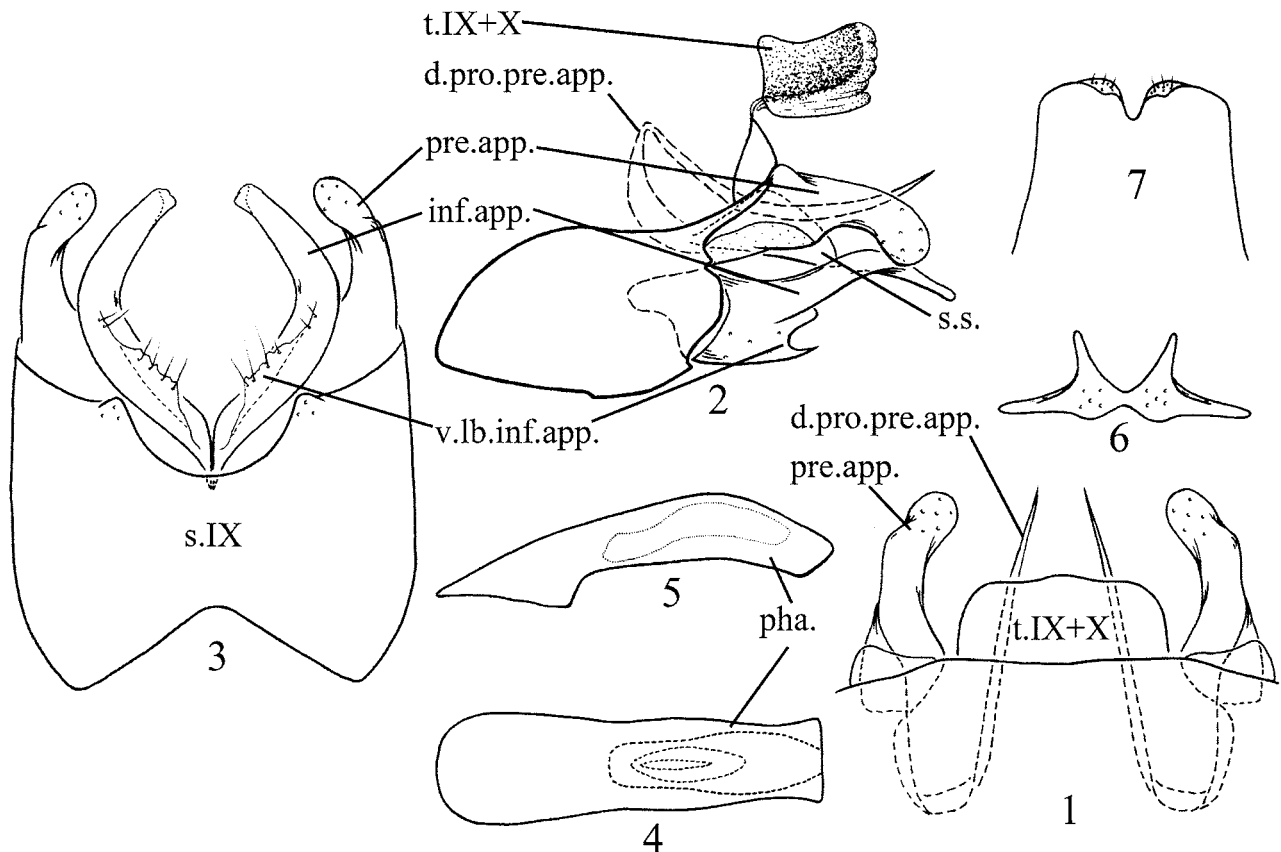
The genus *Polyplectropus* was established by Ulmer (1905) based on *Polyplectropus flavicornis* from Brazil (Li and Morse, 1997). One hundred and eighty-four species are known by the end of 2009 from all over the world except the West Palearctic Region (Malicky 2008, Zhong *et al.* 2008, Morse 2009), with most species diversity in the Oriental Region (OL, 115 species, with 1 species distributed in both Oriental and East Palearctic Regions) and the Neotropical Region (NT, 53 species), with a total of less than 20 species distributed in the Australasian (AU), Afrotropical (AT), East Palearctic (EP), and Nearctic Regions (NA). Twenty-two species presently have been documented from China (Zhong *et al.*, 2008).

Chamorro-Lacayo studied all the New World species of *Polyplectropus*, and confirmed that they belong to a monophyletic group. The monophyly was based on a comprehensive generic-level phylogeny of Polycentropodidae (Chamorro-Lacayo 2009); she also thought that there are many differences between the New World species and Old World species and believed the Old World species are distinct from the New World species (Chamorro-Lacayo personal communication, 2008). Li and Morse (1997) analyzed the Chinese *Polyplectropus* and established the *P. inaequalis* Group (5 species in OL, 1 species in both OL and EP).

Flint suspected that many Old World species of “*Polyplectropus*” are not true congeners, not belonging to the same monophyletic group as the New World species (Flint, 1968). We also were unable to identify synapomorphic features of Old World *Polyplectropus*. However, by comparing the Chinese species with descriptions of the other species in the OL and EP Regions, 2 consistently diagnostic features were found in OL and EP species, although they are not unique globally: 1) the intermediate appendages of X are absent and 2) the subphallic sclerite, originating in the phallocrypt, is mostly trough-like with a broad, plate-like bottom.

The *Polyplectropus anakgugur* Group is newly recognized as monophyletic by the possession of the following synapomorphy: ventromesal lobes of inferior appendages are short, positioned only at the bases of the inferior appendages (the inferior appendages of these species resemble those of *Cyrrnellus*). This species group includes 6 species: *P. cubitalis* **sp. nov.**; *P. subteres* **sp. nov.**; *P. ahas* Malicky and Chantaramongkol

1993, n. rec. (China-Sichuan, Thailand); *P. anakgugur* Malicky 1995, n. rec. (China-Guangxi, Anhui, Henan, Guizhou, Jiangxi; Malaysia); *P. curvatus* Li and Morse 1997 (Fujian), and *P. prapat* Malicky 1993 (Indonesia). *Polyplectropus subteres* sp. nov. is most closely related to *P. curvatus*, as suggested by the sub-rectangular preanal appendages, each with its ventral portion expanded as an oval plate. *Polyplectropus ahas* is a sister species of the lineage composed of *P. anakgugur* and *P. prapat*, as suggested by the homologously slender preanal appendages and the divided apex of each inferior appendage. The latter 2 species share the presence of lateral processes of terga IX+X. Terms for structures of the male genitalia are from Li and Morse (1997). All the type specimens are deposited in the Insect Collection of Nanjing Agricultural University.



FIGURES 1–7. *Polyplectropus cubitalis* sp. nov., male genitalia: 1—dorsal view; 2—left lateral view; 3—ventral view; 4—phallus, dorsal view; 5—phallus, left lateral view; 6—subphallic sclerite, caudal view; 7—subphallic sclerite, ventral view. Abbreviations of structures in illustrations: d.pro.pre.app. = dorsobasal process of a preanal appendage; inf.app. = inferior appendage; pha. = phallus; s.IX = sternum IX; s.s. = subphallic sclerite; pre.app. = preanal appendage; t.IX+X = terga IX+X; v.lb.inf.app. = ventromesal lobe of an inferior appendage.

***Polyplectropus cubitalis* sp. nov. Zhong and Yang**
(Figs. 1–7)

Adult. Length of forewing 5.4–6.0 mm (N = 2). Head light brown with yellowish antennae, pronotum dark yellow, meso-, metanota and forewings light brown.

Male genitalia. Posterior margin of sternum IX with semicircular excision in ventral view. Terga IX + X short, sub-trapezoid in dorsal view. Preanal appendage approximately 4 times as long as apical width, narrowed at 1/3 distance from rounded apex in lateral view. Dorsobasal process of preanal appendage needle-like and recurved caudad at 1/4 distance from base in lateral view. Basal half of inferior appendage broad and apical half slender in lateral view, with distal end extending beyond distal end of preanal appendage; in ventral view, inferior appendages elbowed, with apical half gradually narrowed and apex slightly concave mesally; ventromesal lobe located at basal half of inferior appendage and setose, with apical “U” excision in lateral

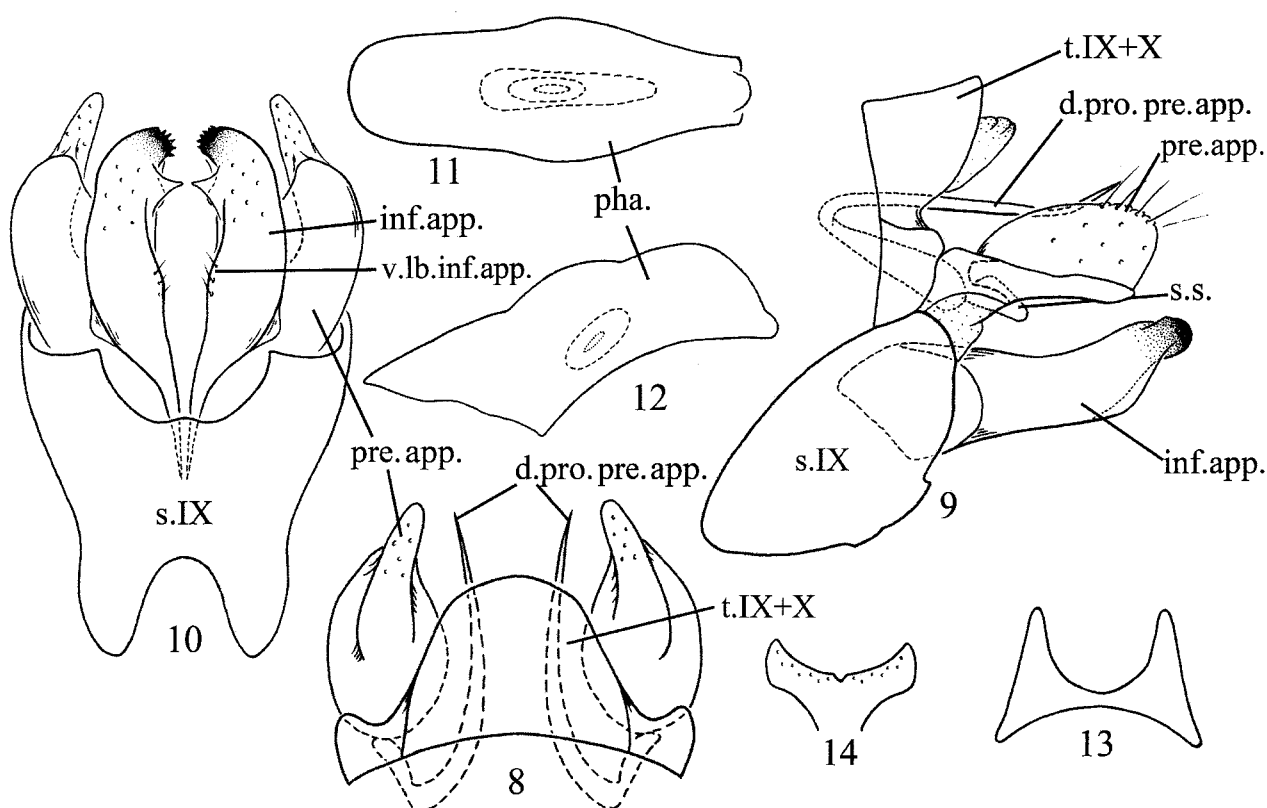
view; in ventral view, with apical margin toothed irregularly. Subphallic sclerite trough-like, with lateral walls strongly erect and bottom expanded horizontally in caudal view; in ventral view, its apex with mesal “U” excision. Phallus simple tube, about 4 times as long as average width.

Holotype: male, Guizhou Province, Chi-shui County, 28.34°N, 105.42°E, Hu-shi-zhen, Nan-zhu-lin-chang, Jin-sha-gou, Gong-ye-gan-gou, 9 November 1995, Coll. WANG Bei-Xin, SUN Chang-Hai. Paratype: 1 male, same data as holotype.

Diagnosis. This new species belongs to the *P. anakgugur* Group and is very similar to *Polyplectropus anakgugur* Malicky 1995, from Malaysia. It differs in that 1) the basal half of inferior appendage is broad and the apical half slender in lateral view (equally wide in *P. anakgugur*); 2) terga IX+X has no process (with a pair of horn-shaped processes in *P. anakgugur*); 3) the apex of the subphallic sclerite has a mesal “U” excision (a broad excision, with the mesal portion strongly protruded and with a small notch at its center in *P. anakgugur*).

Etymology. The species name is a Latin adjective *cubitalis* (= cubital) to indicate the shape of inferior appendages in ventral view.

Distribution. China (Guizhou).



FIGURES 8–14. *Polyplectropus subteres* sp. nov., male genitalia: 8—dorsal view; 9—left lateral view; 10—ventral view; 11—phallus, dorsal view; 12—phallus, left lateral view; 13—subphallic sclerite, caudal view; 14—subphallic sclerite, ventral view.

***Polyplectropus subteres* sp. nov. Zhong and Yang**

(Figs. 8–14)

Adult. Length of forewing 4.1–4.4 mm (N = 3). Head light brown with yellowish antennae, pronotum yellow, meso-, metanota and forewings light brown.

Male genitalia. Posterior margin of sternum IX with broad “U” excision and small median protrusion in ventral view. Terga IX + X forming large mesal lobe in dorsal view. Preanal appendage sub-rectangular in lateral view, with dorsal portion apically blunt and ventral portion plate-like in dorsal view. Dorsobasal

process of preanal appendage recurved caudally 160 degrees at 1/3 distance from base, with acute distal end not quite reaching apex of preanal appendage. Inferior appendage sub-cylindrical with highly sclerotized, rounded apex in lateral view; in ventral view, apex covered with tiny teeth, the appendage with mesal triangular lobe subapically; ventromesal lobe of inferior appendage only slightly protruded at base of appendage. Subphallic sclerite deeply trough-like, easily seen in caudal view, apex with broadly rounded excision and small, median notch, in ventral view. Phallus forming simple tube, about 3 times as long as average width.

Holotype: male, Jiangxi Province, Mt. Wu-Yi National Nature Preserve, Li-tou-jian Stream, 27°58'49" N, 117°51'43" E, alt. 375–404 m, 5 June 2005, Coll. SUN Chang-Hai, ZHOU Chang-Fa, ZHOU Xin. **Paratypes:** 1 male, Jiangxi Province, Mt. Wu-Yi National Nature Preserve, Lei-gu-ling Stream, 27.99142°N, 117.89111°E, alt. 424 m, 4 June 2005, Coll. YANG Lian-Fang, Christy Jo GERACI; 1 male Zhejiang Province, Mt. Tian-mu, 30.4°N, 119.5°E, San-mu-ping, alt. 780 m, 14 July 1998, Coll. WU Hong.

Diagnosis. This new species belongs to the *P. anakgugur* Group and is very similar to *Polyplectropus curvatus* Li and Morse 1997, from Fujian. It differs in that: 1) the dorsobasal process of each preanal appendage is recurved caudally 160 degrees, with distal end not reaching the apex of preanal appendage (recurved 90 degrees and reaching beyond the apex of the preanal appendage in *P. curvatus*); 2) the apex of the subphallic sclerite has a broadly rounded excision and median notch (a slight mesal excision occurs in *P. curvatus*).

Etymology. The species name is a Latin adjective, *subteres* (= nearly column-shaped), indicating the shapes of inferior appendages.

Distribution. China (Jiangxi, Zhejiang).

***Polyplectropus tridentatus* sp. nov. Zhong and Morse**

(Figs. 15–21)

Adult. Length of forewing 5.5–6.3 mm (N = 4). Head light brown with yellowish antennae, pronotum dark yellow, meso- and metanota brown, forewings light brown.

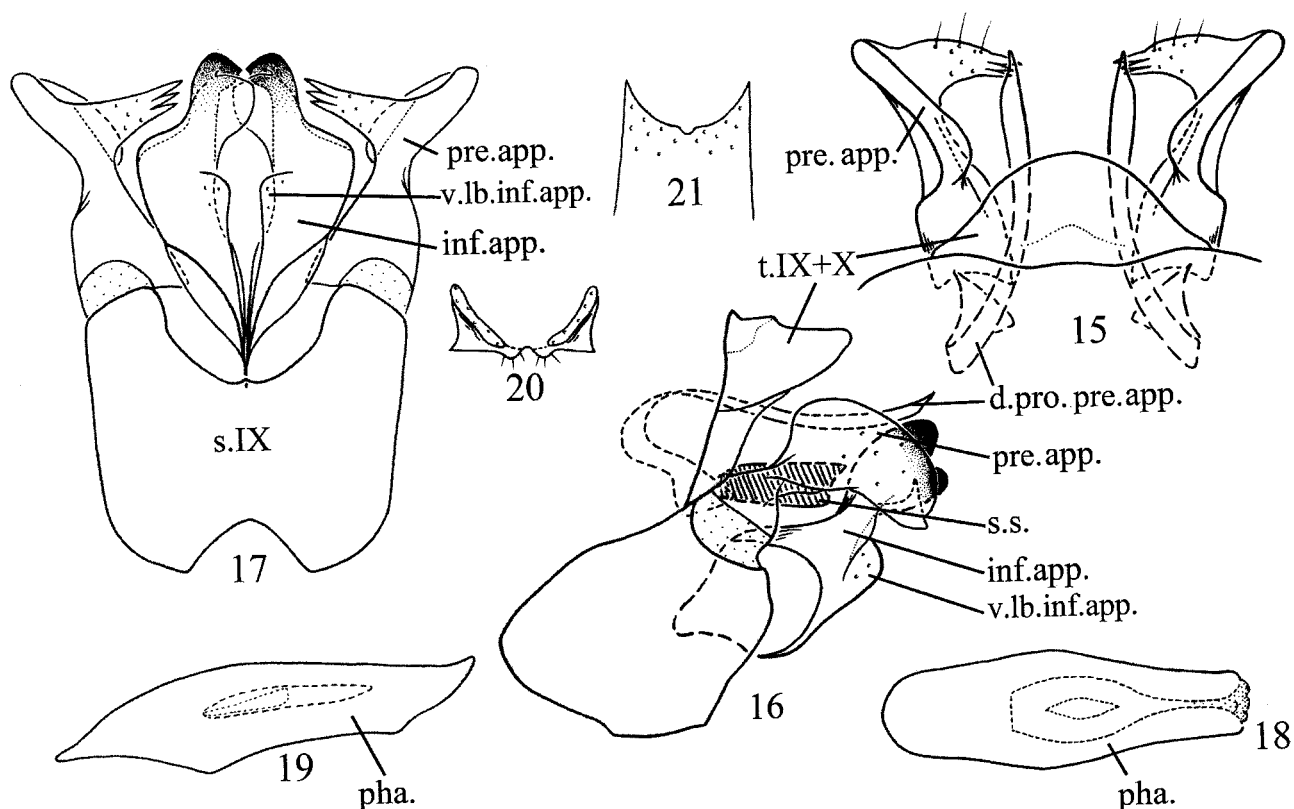
Male genitalia. Posterior margin of sternum IX with broad “U” excision mesally and small median protrusion in ventral view. Terga IX + X short, tongue-like in dorsal view. Preanal appendage narrowed abruptly at 1/3 distance from base in lateral view, basal portion cone-shaped, apical portion approximately 2.5 times as long as basal portion, sub-oval; apex of preanal appendage strongly produced mesad in large, triangular projection bearing 3 stout teeth in both dorsal and ventral views. Dorsobasal process of preanal appendage triangular basally, recurved caudad at 1/3 distance from base, with recurved portion evenly turned upward and with acute apex. Inferior appendage constricted at middle in lateral view, approximately 2 times as long as basal width, distal portion of each appendage curved mesad with bilobed apex; in ventral view, with dorsal branch more highly sclerotized; ventromesal lobe produced mesad near middle of appendage, causing appendage to appear incised at right angle at middle of appendage. Subphallic sclerite trough-like in caudal view, apex with deeply rounded excision and mesal incision in ventral view. Phallus simple tube, about 4 times as long as average width.

Holotype: male, Guangxi Province, Tian-lin County, Mt. Cen-wang-lao Provincial Forest Preserve, Yao-shan Gou, tributary of Bu-liu River, County Road 794 marker 52.7 km, 24.47080 N, 106.35784 E, alt. 1223 m, 9 Jun 2004, Coll. YANG Lian-Fang, Christy Jo GERACI. **Paratypes:** 1 male, same data as holotype; 2 males, Guangxi Province, Tian-lin County, Mt. Cen-wang-lao Provincial Forest Preserve, unnamed tributary of headwaters of Bu-liu River, waterfall at County Road 794 marker 37.9 km, 24.41275 N, 106.38207 E, alt. 1422 m, 8 Jun 2004, Coll. YANG Lian-Fang, Christy Jo GERACI.

Diagnosis. This new species is very similar to *Polyplectropus tharah* Malicky and Chantaramongkol 1993, from Vietnam. It differs in that: 1) inferior appendage has its apex divided into 2 broad and rounded lobes (not divided in *P. tharah*); 2) each preanal appendage is narrowed abruptly at 1/3 distance from base in lateral view (not narrowed in *P. tharah*); and 3) the apex of subphallic sclerite with deeply rounded excision with a mesal incision at the middle (“V” shape mesal excision with lateral teeth in *P. tharah*).

Etymology. The species name is a Greek adjective *tridentatus* (= tridentate) in reference to the tridentate subapicomeres of each preanal appendage in dorsal and ventral views.

Distribution. China (Guangxi).



FIGURES 15–21. *Polyplectropus tridentatus* sp. nov., male genitalia: 15—dorsal view; 16—left lateral view; 17—ventral view; 18—phallus, dorsal view; 19—phallus, left lateral view; 20—subphallic sclerite, caudal view; 21—subphallic sclerite, ventral view.

***Polyplectropus tianmushanensis* sp. nov. Zhong and Yang**

(Fig. 22–28)

Adult. Length of forewing 5.6–6.1 mm (N = 2). Head brown with dark yellowish antennae, pronotum dark yellow, meso- and metanota light brown, forewings light brown.

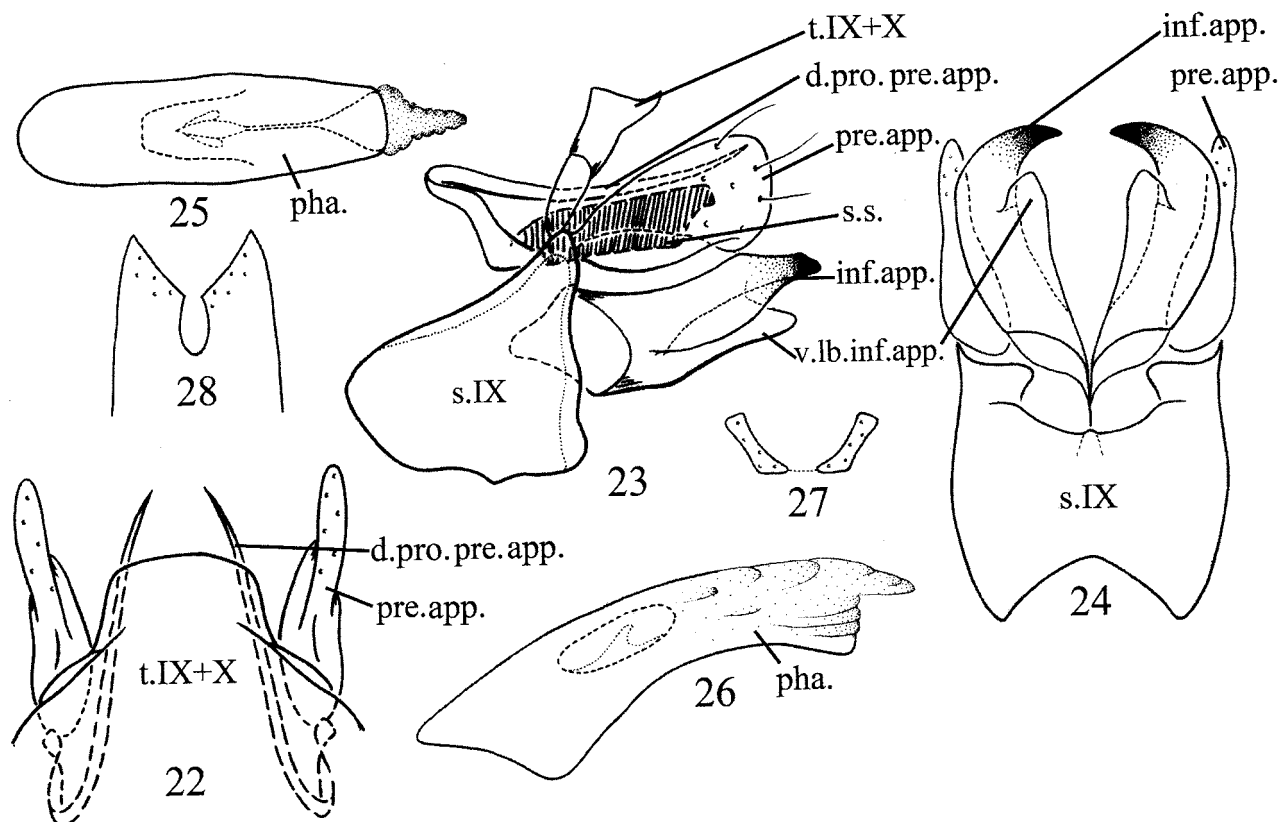
Male genitalia. Posterior margin of sternum IX with mesal trapezoidal excision and small median protrusion in ventral view. Terga IX + X short, sub-trapezoidal, 1/3rd as long as width in dorsal view. Preanal appendage sub-rectangular, narrowed at base in lateral view, 2 times as long as height of distal margin. Dorsobasal process of preanal appendage enlarged basally, recurved caudad at 1/3 distance from base, with recurved portion evenly turned upward in lateral view. Inferior appendage gradually narrowed at distal 1/3rd, with apex highly sclerotized and extending beyond tips of preanal appendage; ventromesal lobe of inferior appendage well developed, forming subapical process in lateral and ventral views; in ventral view, apex of inferior appendage acute, strongly curved mesad; apex of subapical ventromesal lobe of inferior appendage slightly narrowed before blunt apex. Subphallic sclerite trough-like in caudal view (Fig. 27), apex deeply excised in “V” shape and with mesal oval excision in ventral view. Phallus simple tube, about 4 times as long as average width.

Holotype: male, Zhejiang Province, Mt. Tian-mu. 30.4°N, 119.5°E, Xian-ren-ding, alt. 1500 m, 20 July 1998, Coll. ZHAO Ming-Shui. Paratype: 1 male, Zhejiang Province, Mt. Tian-mu, 30.4°N, 119.5°E, San-mu-ping, alt. 780 m, 21 July 1999, Coll. ZHAO Ming-Shui.

Diagnosis. This new species is very similar to *Polyplectropus rostriformis* Zhong *et al.* 2006 from Anhui, in the general shape of the male genitalia. It differs from it in that: 1) apicolateral margin of each inferior appendage is broadly rounded (the outer apical angle is in right angle in *P. rostriformis*); 2) the dorsobasal process of each preanal appendage is arc-shaped with apex straight (sinuate in *P. rostriformis* with hooked apex); and 3) the apex of the subphallic sclerite is deeply excised in a “V” shape with a mesal oval excision (deeply excised in a “V” shape with a mesal “V” shape excision in *P. rostriformis*).

Etymology. The species name derives from “Tian-mu-shan,” the type locality of this new species.

Distribution. China (Zhejiang).



FIGURES 22–28. *Polyplectropus tianmushanensis* sp. nov., male genitalia: 22—dorsal view; 23—left lateral view; 24—ventral view; 25—phallus, dorsal view; 26—phallus, left lateral view; 27—subphallic sclerite, caudal view; 28—subphallic sclerite, ventral view.

***Polyplectropus ahas* Malicky and Chantaramongkol 1993. New record for China**
(Figs. 29–35)

Polyplectropus ahas Malicky and Chantaramongkol 1993: 451, male.

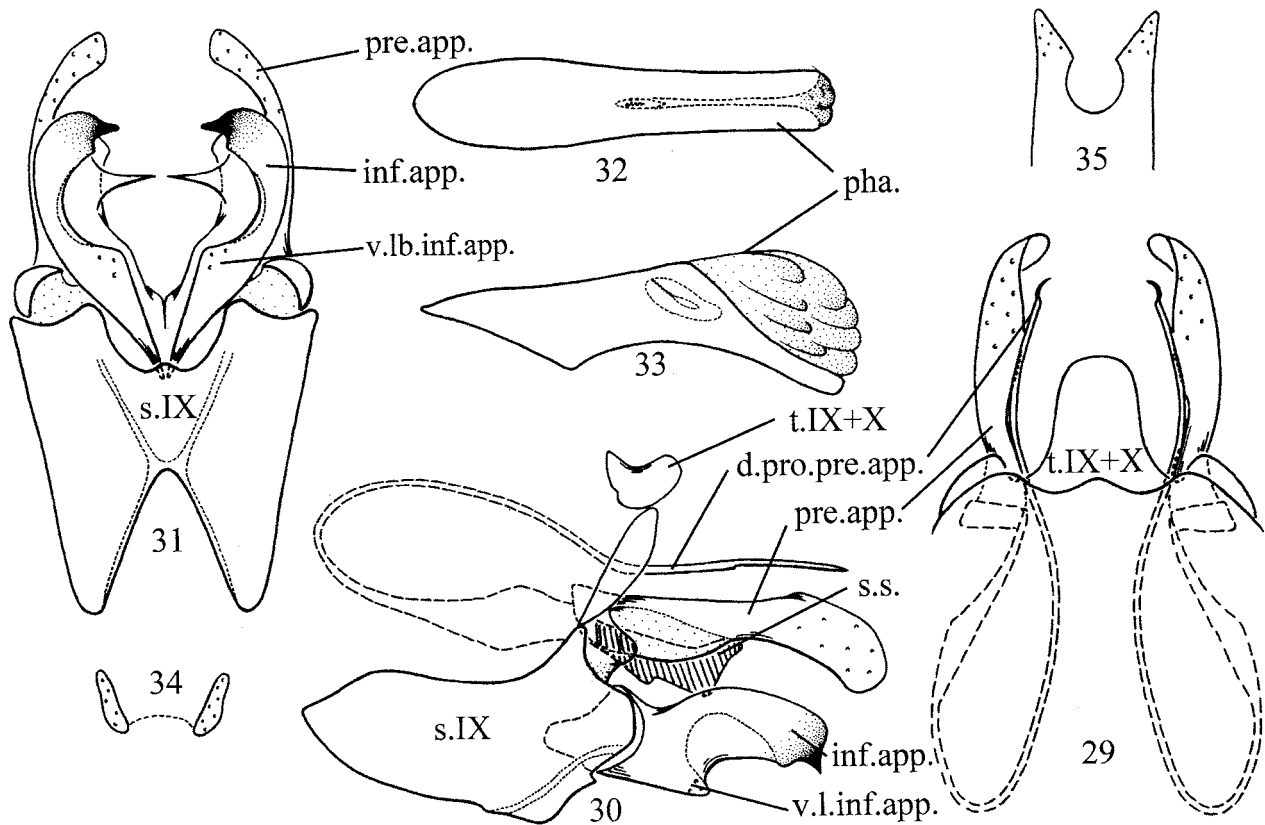
Adult. Length of forewing 6.6–7.1 mm (N = 4). Head brown with dark yellowish antennae, pronotum light brown, meso- and metanota brown, forewings brown.

This species was described by Malicky and Chantaramongkol, but the original illustrations are quite simple. Our drawing provides more detailed characters including the dorsal view of the male genitalia, dorsal and left lateral views of the phallus, and ventral and caudal views of the subphallic sclerite.

This species belongs to the *P. anakgugur* Group.

Material examined. 5 males, Sichuan Province, Ya-an, 29.59°N, 102.59°E, tributary of Zhou-gong River, 8 June 1996, Coll. WANG Bei-Xin.

Distribution. China (Sichuan); Thailand.



FIGURES 29–35. *Polyplectropus ahas* Malicky and Chantaramongkol, male genitalia: 29—dorsal view; 30, left lateral view; 31—ventral view; 32—phallus, dorsal view; 33—phallus, left lateral view; 34—subphallic sclerite, caudal view; 35—subphallic sclerite, ventral view.

***Polyplectropus anakugur* Malicky 1995** New record for China
(Figs. 36–52)

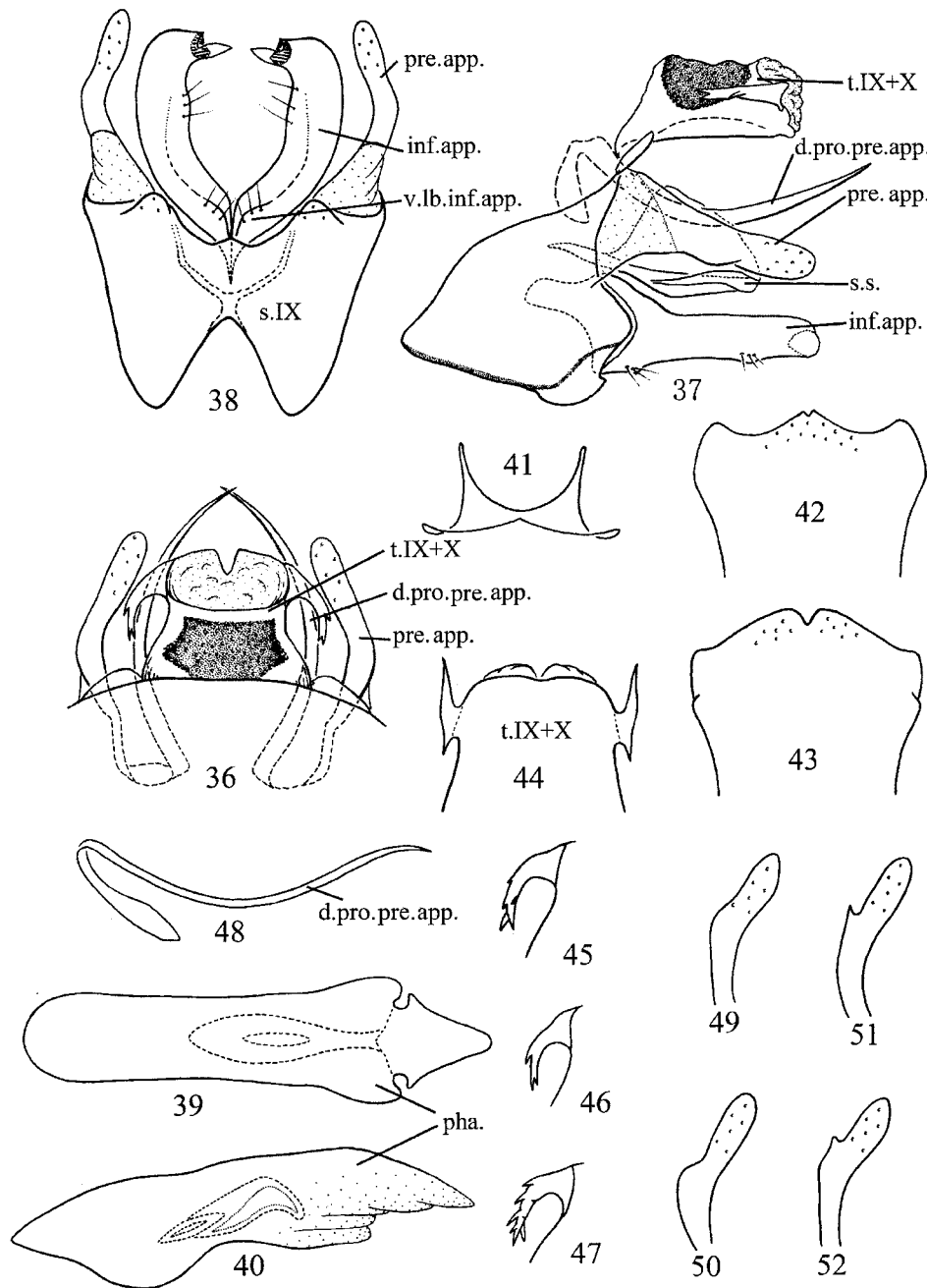
Polyplectropus anakugur Malicky 1995: 19, male.

Adult. Length of forewing 4.5–5.8 mm (N = 9). Head brown with dark yellowish antennae, pronotum light brown, meso- and metanota brown, forewings light brown or brown.

This species was described by Malicky in 1995. There are some variations in some characters of male genitalia in Chinese specimens, including the shapes of terga IX + X, the preanal appendages and their dorsobasal processes, and the apex of the subphallic sclerite. Details of these variations and their distributions are depicted in Figs. 42–52.

This species belongs to the *P. anakugur* Group.

Material examined. 1 male, Guangxi Province, Long-lin County, Mt. Jin-zhong Provincial Forest Preserve, Duo-gui Gou, 1.5 km N of Xi-she village, 24.58245 N, 104.91415 E, alt. 1145 m, 11 June 2004, Coll. John C. MORSE, SUN Chang-Hai; 3 males, Guangxi Province, Long-lin County, Mt. Jin-zhong Provincial Forest Preserve, Nong-heng Gou, 1.3 km N of Xi-she village, 24.57867 N, 104.91399 E, alt. 1140 m, 11 June 2004, Coll. YANG Lian-Fang, ZHOU Xin, Christy Jo GERACI, Karl M. KJER; 2 males, Anhui Province, Qimen County, 29.8°N, 117.7°E, Peng-long-xiang, Xiang-dong-cun, 27 September 2003, Coll. SHAN Lin-Na, SUN Chang-Hai; 1 male, Henan Province, Xi-xia County, 33.18°N, 111.29 E, Chen-yang-ping, Gu-yu, Kui-ling River, alt. 550 m, 1 October 2002, Coll. SHAN Lin-Na, XIE Xin-Min; 1 male, Guizhou Province, Chi-shui County, 28.34°N, 105.42°E, Hu-shi-zhen, Nan-zhu-lin-chang, Jin-sha-gou, Gong-ye-gan-gou, 9 November 1995, Coll. WANG Bei-Xin, SUN Chang-Hai; 1 male, Jiangxi Province, Mt. Jiu-lian National



FIGURES 36–52. *Polyplectropus anakgugur* Malicky, male genitalia: 36—dorsal view; 37—left lateral view [showing the variation of the dorsobasal process of the right preanal appendage of specimens from Xi-xia (Henan Province), Chi-shui (Guizhou Province), and Long-lin (Guangxi Province)]; 38—ventral view; 39—phallus, dorsal view; 40—phallus, left lateral view; 41—subphallic sclerite, caudal view; 42—variation of subphallic sclerite of specimens from Xi-xia (Henan Province), Chi-shui (Guizhou Province), and Long-lin (Guangxi Province), ventral view; 43—variation of subphallic sclerite of specimens from Qi-men (Anhui Province), Xin-yi (Guangdong Province), and Mt. Jiu-lian (Jiangxi Province), ventral view; 44—variation of sternum IX+X of specimens from Qi-men (Anhui Province), Xin-yi (Guangdong Province), and Mt. Jiu-lian (Jiangxi Province), dorsal view; 45—variation of sternum IX+X of specimens from Chi-shui (Guizhou Province), dorsal view; 46—variation of sternum IX+X of specimens from Long-lin (Guangxi Province), dorsal view; 47—variation of sternum IX+X of specimens from Xi-xia (Henan Province), dorsal view; 48—variation of the dorsobasal process of the right preanal appendage of specimens from Qi-men (Anhui Province), Xin-yi (Guangdong Province), and Mt. Jiu-lian (Jiangxi Province), left lateral view; 49—variation of the right preanal appendage of specimens from Xin-yi (Guangdong Province), dorsal view; 50—variation of the right preanal appendage of specimens from Chi-shui (Guizhou Province), dorsal view; 51—variation of the right preanal appendage of specimens from Xi-xia (Henan Province), dorsal view; 52—variation of the right preanal appendage of specimens from Qi-men (Anhui Province), dorsal view.

Nature Preserve, 8.2 KM northwest of Da-Qiu-Tian, 24°34'15" N, 114°25'50" E, alt. 425 m, 10 June 2005, Coll. ZHOU Xin; 1 male, Jiangxi Province, Mt. Jiu-lian National Nature Preserve, 8.2 KM northwest of Da-Qiu-Tian, 24°35'09" N, 114°26'53" E, alt. 400 m, 10 June 2005, Coll. SUN Chang-Hai; 2 males, Guangdong Province, Xin-yi County, Da-cheng town, Da-wu-ling Nature Reserve, stream inside entrance of Reserve, 22°16'25" N, 111°11'38" E, alt. 1021 m, 26 May 2004, Coll. ZHOU X.

Distribution. China (Guangxi, Guangdong, Anhui, Henan, Guizhou, Jiangxi); Malaysia.

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