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The *taeniaticornis*-group of genus *Apanteles* Foerster (Hymenoptera, Braconidae, Microgastrinae) from China with one new species

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Abstract

The *taeniaticornis*-group of genus *Apanteles* Foerster from China is revised, in which a total of 3 species are recorded and illustrated. One new species, named, *A. parectangular* Liu & Chen, **sp. nov.** is described and illustrated, and a key to Chinese species of the *taeniaticornis*-group, is provided.

Keywords

China, Microgastrinae, new taxon, *taeniaticornis*

Introduction

The *taeniaticornis*-group was erected by Nixon (1965) along with other 43 species groups of *Apanteles* s. l. Six species were originally included in this group, which were largely characterized by the long metacarp and wedge shape of tergite I. Mason (1981) kept this group in the genus *Apanteles* s. str in his comprehensive reclassification of Microgastrinae which is preferred and used by most researchers worldwide (Fernandez-Triana et al. 2020). No other references had mentioned this group till one new species, *A. cuneiformis* Song et Chen, 2004, was reported from China and was defined as a member of the *taeniaticornis*-group by Chen and Song (2004). All members of this group are distributed in the Oriental region except for *A. conon* Nixon, 1965 which also occurs in Eastern Palaearctic (Papp, 1974).

The *taeniaticornis*-group is easily confused with other species-groups of the genus *Apanteles*, especially the *ater*-group, for their well-defined, sharp areolation of propodeum and setoseless and more or less concave vannal lobe beyond its widest part of hind wing, but it may be distinguished from other similar species-groups by characters combining the following: metacarp (vein 1-R1) rather long, often many times longer than its distance from the apex of marginal cell (from six times to nearly touching the apex of marginal cell); hind wing moderately broad, the length of the 1-M hardly shorter than the distance between its distal extremity and the apex of the vannal lobe; median and submedian cell densely setose all over; T1 narrowly wedge-shaped, its horizontal surface at least twice as long as wide across the hump; propodeum with complete, sharply defined areolation; ovipositor sheath same length of the hind tibia.

Before this study, there were two species belonging to *taeniaticornis*-group reported from China (Chen & Song, 2004). Here, we describe one new species of this group from China as a part of an on-going project on the revision of the Chinese Microgastrinae (Zeng et al. 2011a, b; Liu et al. 2014, 2015, 2016, 2018, 2019, 2020; Song et al. 2014).

Materials and methods

Specimens studied are deposited in the Parasitic Hymenoptera Collection of Zhejiang University, Hangzhou, China (**ZJUH**) and Hunan University of Arts and Science (**HUAS**). Each dried specimen is tagged with a unique voucher code.

Descriptions and measurements were made using a stereomicroscope (Zeiss Stereo Discovery V8). All photographs of the wasps were taken and processed using a digital camera KEYENCE VHX-2000C. The images were further processed using Adobe Photoshop CS6. Morphological terms for body structures and measurements follow Nixon (1965) and Mason (1981). The veins follow the modified Comstock-Needham system (van Achterberg 1993). The terminology of the cuticular sculpture follows Harris (1979). Abbreviations used in this research are as follows: POL = postocellar line, OOL = ocular-ocellar line, OD = ocellar diameter; T1 = 1st tergite of metasoma, T2 = 2nd tergite of metasoma, T3 = 3rd tergite of metasoma.

Taxonomy

Key to species of the *taeniaticornis*-group of the genus *Apanteles* Foerster from China

1 T1 not strongly constricted apically (Fig. 3g); interspaces of punctures on mesoscutum obviously bigger than their diameter, largely polished at middle and posterior parts (Fig. 3i); hind coxa entirely yellow (Fig. 3c) .... ***A. parectangular* Liu & Chen, sp. nov.**

– T1 strongly constricted apically (eg. Fig. 1h); interspaces of punctures on mesoscutum at most indistinctly bigger than their diameter, at most polished at posterior part (eg. Fig. 2g); hind coxa largely brown (Fig. 1f)..... **2**

2 Scutellar sulcus broad and deep (Fig. 2g); vein r of fore wing 1.3× longer than 2-SR (Fig. 2b)..... ***A. cuneiformis* Song & Chen, 2004**

– Scutellar sulcus narrower and shallower (Fig. 1d); vein r of fore wing 1.9× longer than 2-SR (Fig. 1g) ..... ***A. conon* Nixon, 1965**

Chinese species of the *taeniaticornis*-group of *Apanteles*

***Apanteles conon* Nixon, 1965**
Fig. 1

Apanteles conon Nixon, 1965: 124. Type in Natural History Museum, London. Chen et Song 2004: 38.

Diagnosis. Vertex between the eye and the posterior ocellus shiny with superficial fine punctures; ocelli big, posterior imaginary tangent to fore ocellus transecting the posterior pair; antenna slightly longer than body length, with penultimate antennomere 1.4× longer than wide; punctures on mesoscutum coarse, interspaces not bigger than their diameter, punctures indistinctly confluent above the hind polished area; areola on propodeum open anteriorly, V-shaped apically, with strong costulae, three posterior fields smooth without carinae; pterostigma big, 2.3× as long as its widest part, vein 1-R1 1.5× longer than pterostigma, 7.5× as long as its distance from the apex of the marginal cell, r 2.4× longer than 2-SR, angled at their meeting; T1 strongly wedged-shaped, 4.6× longer than hind width, turned-over part with rugose punctures laterally, T3 2× as long as T2; legs mostly yellow, hind coxa brown; ovipositor sheath about as long as hind tibia.

Variation. Body length 3.0–3.2 mm.

Male. Similar to female, except for antenna distinctly longer than body length, penultimate antennomere 2× longer than wide, and T2 higher.

Host. Unknown.

Material examined. ZJUH: 1♀, Shaxian, **Fujian**, 1980.XII, Gong Weili, No. 810003; 4♀♀, Mt. Wuyi, Fujian, 1988.IX.7, Lin Changfu, Nos. 20005691, 20005687,

20005692, 20005700; 1♀, Mt. Wuyi, Fujian, 1989.XI.1, Wang Jiashe, No. 964568; 1♀, Chibi, Yongqin, Fujian, 2002.IX.17, Liu Jinxian, No. 20023635; 2♀♀, Dazhulan, Fujian, 1991.X.6, Chen Xuexin, Nos. 920343, 920354; 2♀♀, Qingliu, Fujian, 1986. VI.20, Qi Shicheng, Nos. 965199, 9651200; 1♀, Antongmu, Fujian, 1981.IX.29, Fei Juyi, No. 20004167; 2♀♀, Mt. Longxi, Jiangle, Fujian, 1991.VII.16/IX.30, Liu Changming, Nos. 20007164, 20007209; 3♀♀2♂♂, Mt. Wuyi (Tongmucun), Fujian, 2009. IV.17/15, Wang Manman, Nos. 200900409, 200900398, 200900411, 200900408, 200900545; 6♂♂, Mt. Wuyi (Qili), Fujian, 2009.IV.18, Zeng Jie, Nos. 200900618, 200900650, 200900639, 200900647, 200900646, 200900642; 1♂, Mt. Wuyi (Sangang), Fujian, 2009.IV.17, Zeng Jie, No. 200900481; 1♂, Mt. Wuyi (Pikeng), Fujian, 2009.IV.21, Zeng Jie, No. 200900503; 1♂, Sangang, Fujian, 1981.V.6, Han Ying, No. 20003920; 1♂, Guanxian, **Sichuan**, 1980.VIII.1, He Junhua, No. 803037; 1♀, Hangzhou, **Zhejiang**, 1981, Lou Xiaoming, No. 930324; 1♀, Mt. Tianmu, Zhejiang, 1987.VII.21, Lou Xiaoming, No. 874572; 2♀♀, Mt. Fengyang, Longquan, Zhejiang, 2003.VIII.7/10, Liu Jingxian, Nos. 20055581, 20048319; 1♀, Mt. Jiulong, Suichang, Zhejiang, 1994.VIII.18, Can Ping, No. 944261; 2♀♀, Mt. Longwang, Anji, Zhejiang, 1996.VI.26, Zhao Weichun, Nos. 963915, 963916; 1♀, Mt. Jiulong, Suichang, Zhejiang, 1993.VIII.31, Chen Xuexin, No. 939685; 1♀, Mt. Tianmu (Jinshanmen), Zhejiang, 1999.VIII.6, Zhao Mingshui, No. 20002876; 4♀♀, Hangzhou, Zhejiang, 1989.VI.24/XI.10, He Junhua, Nos. 893118, 893108, 893311, 896960; 2♀♀, Liuheta, Hangzhou, Zhejiang, 2001.V.19, Piao Meihua, Nos. 200702186, 200702187; 1♀, Songyang, Zhejiang, 1992.XI.1–XII.9, Chen Hanlin, No. 934062; 1♀, Hangzhou, Zhejiang, 1991.V.28, He Junhua, No. 911118; 1♂, Mt. Tianmu (Xianrending), Zhejiang, 2011.VII.25–29, Liu Zhen, No. 201102651; 1♀, Mt. Tai, Taian, **Shandong**, 1997.VII.17, Chen Xuexin, No. 974014; 1♀, Yuexi, **Anhui**, 1981.V.16, Yang Fuan, No. 820593; 1♀, Shenlongjia (Honghua, 900m), **Hubei**, 1982.VIII.25, He Junhua, No. 825390; 1♀, Mengxiu, Ruili, **Yunnan**, 1981.V.2–6, He Junhua, No. 812956; 1♀, Jianfengling, **Hainan**, 2007.VI.7, Liu Jinxian, No. 200702381; 1♀, Meitan, **Guizhou**, 1982.VI.2, Xia Huaien, No. 824620; 1♀, Fengxi, Meizhou, **Guangdong**, 2003.VII.29, Chen Jujian, No. 20048632; 1♀, Mt, Yunji, Xinfeng, Guangdong, 2003.VII.20, Li Ping, No. 20053969; 1♀, Fengkai, Guangdong, 1992.V.16, Ma Yun, No. 921135; 3♀♀, Nanling, Fuyuan, Guangdong, 2004.V.8/2003.VII.23, Xu Zaifu, Nos. 20049641, 20049592, 20049143; 2♂♂, Dianba (900m), Wenxian, **Gansu**, 1998.VI.16, Ma Yun, Nos. 984241, 984332; 1♂, Yingtaogou, Xiangshan, **Beijing**, 1992.VII.6, Lin Naiquan, No. 20004394; 5♂♂, Shouka, **Taiwan**, 2011.V.30, Tang Pu, Nos. 201105461, 201105456, 201105455, 201105483, 201105454; 1♂, Mt. Dongmao, Taiwan, 2011.VI.4, Tangpu, No. 201104500; 1♂, Mt. Beishou, Gaoxiong, Taiwan, 2011.V.29, Tang Pu, No. 201104487; 2♂♂, Duonalindao, Taiwan, 2011. VI.13, Tang Pu, Nos. 201104994, 201104953; 9♂♂, Mt. Wugong, Gaoxiong, Taiwan, 2011.VI.15, Tang Pu, Nos. 201104826, 201104837, 201104838, 201104844, 201104846, 201104847, 201104855, 201104821, 201104827; 1♂, Mt. Nantou, Taiwan, 2011.VI.19, Tang Pu, No. 201104794;

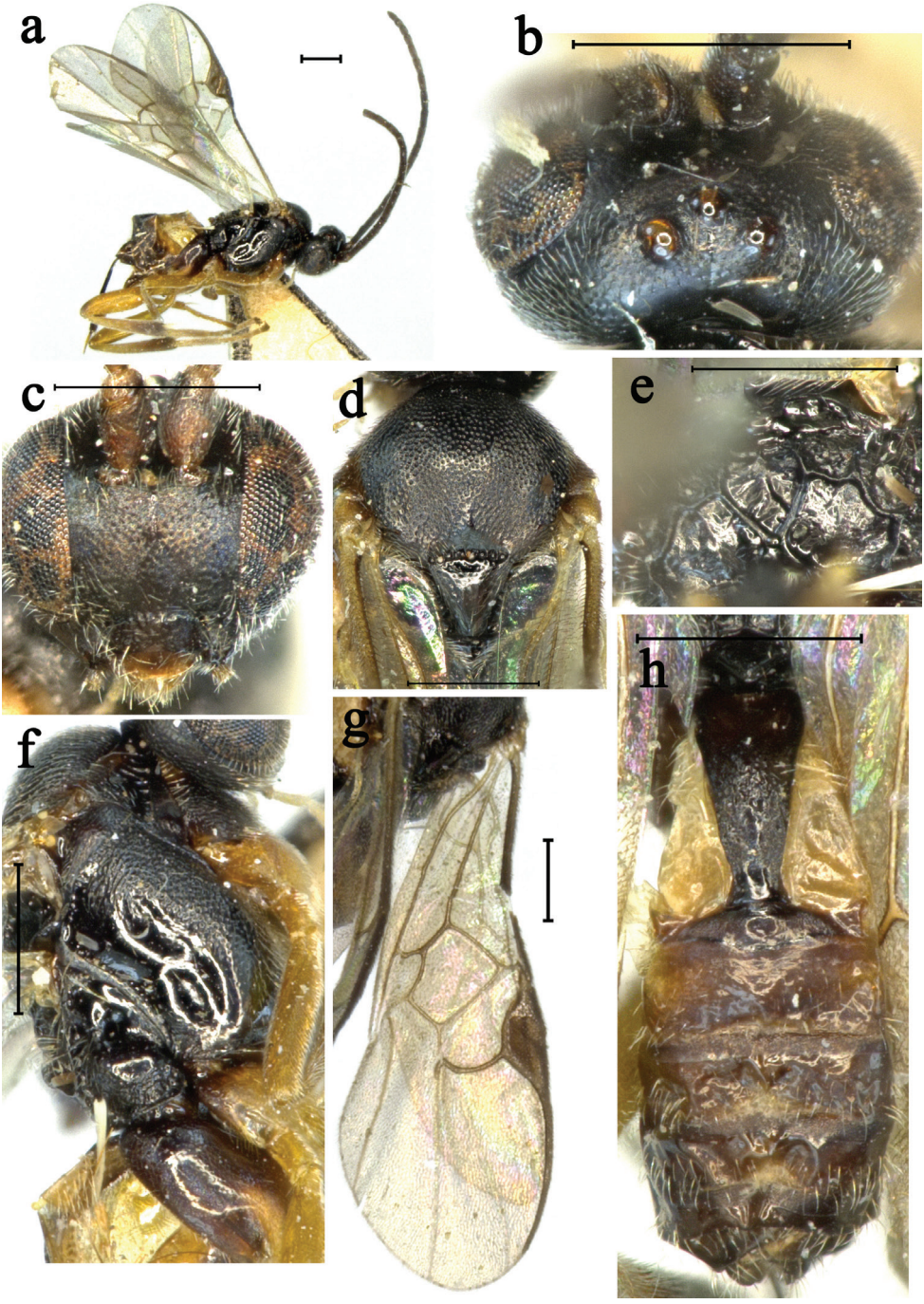

Figure 1. *Apanteles conon* Nixon, 1965 **a** habitus, lateral view **b** head, dorsal view **c** head, frontal view **d** mesosoma, dorsal view **e** propodeum **f** mesopleuron **g** fore wing **h** abdomen, dorsal view. Scale bars: 0.5 mm.

HUAS: 1♀, Bawangling, **Hainan** (malaise trap), 2020.IX.30–X.30, Chen Longlong, No. 202203542; 1♀, Mt. Limu, Qiongzhong, Hainan (malaise trap), 2020.IX.30–X.31, Chen Longlong, No. 202201705; 1♀, Haizhu Wetland, Guangzhou, **Guangdong** (malaise trap), 2021.III.20–IV.5, Liu Jingxian, No. 202200412; 8♀♀, Haizhu Wetland, Guangzhou, Guangdong (malaise trap), 2021.IV.26–V.11, Liu Jingxian, Nos. 202200200, 202200204, 202200226, 202200237, 202200263, 202200269, 202200274, 202200290.

Distribution. China (Anhui, Beijing, Fujian, Gansu, Guangdong, Guizhou, Hainan, Hubei, Hunan, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang); Indonesia; Korea; Philippines.

Notes. Fernandez et al. (2020) examined the holotype in Natural History Museum, noting *A. conon* is possible a *Dolichogenidea* species because the punctures near the scutellar sulcus on mesoscutum do not fuse, but they kept it in *Apanteles* because other characters were invisible (such as setae beyond the widest part of vannal lobe). We had no opportunity to check the type, but checked the original description (Nixon, 1965), detailed examination from Chen and Song (2004) and Papp (1974) and characters from Chinese specimens (the typical wedged shaped T1). We also favor its placement in the genus *Apanteles*.

Apanteles cuneiformis Song & Chen, 2004

Fig. 2

Apanteles cuneiformis Song & Chen, 2004: 42.

Diagnosis. Vertex between the eye and the posterior ocellus shiny with superficial fine punctures; ocelli big, posterior imaginary tangent to fore ocellus transecting the posterior pair; antenna slightly longer than body length, with penultimate antennomere 2× longer than wide; interspaces of punctures on mesoscutum obviously bigger than their diameter, without striations at posterior end of the imaginary course of the notaulices; areola on propodeum closed anteriorly, V-shaped apically, with strong costulae, three posterior fields somewhat uneven; pterostigma big, 2.8× as long as its widest part, vein 1-R1 1.3× longer than pterostigma, 6.2× as long as its distance from the apex of the marginal cell, r 1.7× longer than 2-SR, angled at their meeting; T1 strongly wedged-shaped, 5× longer than hind width, turned-over part with rugose punctures laterally and deep concavity medially, T3 2.1× as long as T2; legs mostly yellow, hind coxa brown to black; ovipositor sheath slightly shorter than hind tibia.

Variation. Body length 2.4–2.6 mm.

Male. Similar to female, except for antenna distinctly longer than body length, penultimate antennomere 2.1× longer than wide and T2 higher.

Host. Unknown.

Material examined. ZJUH: 3♀♀, Letu, Nanjing, **Fujian**, 1991.V.23, Liu Changming, Nos. 20006107, 20006047, 20006130; 1♀, Nanjing, Fujian, 1991.VI.6, Pan Shen, No. 969562; 3♀♀3♂♂, Mt. Baxian, **Taiwan**, 2011.VI.4–5, Tang Pu, Nos. 201105226, 201105239, 201105277, 201105318, 201105273, 201105254; 2♂♂, Gaozhonglindao, Taiwan, 2011.VI.8, Tang Pu, Nos. 201105433, 201105437; 1♀,

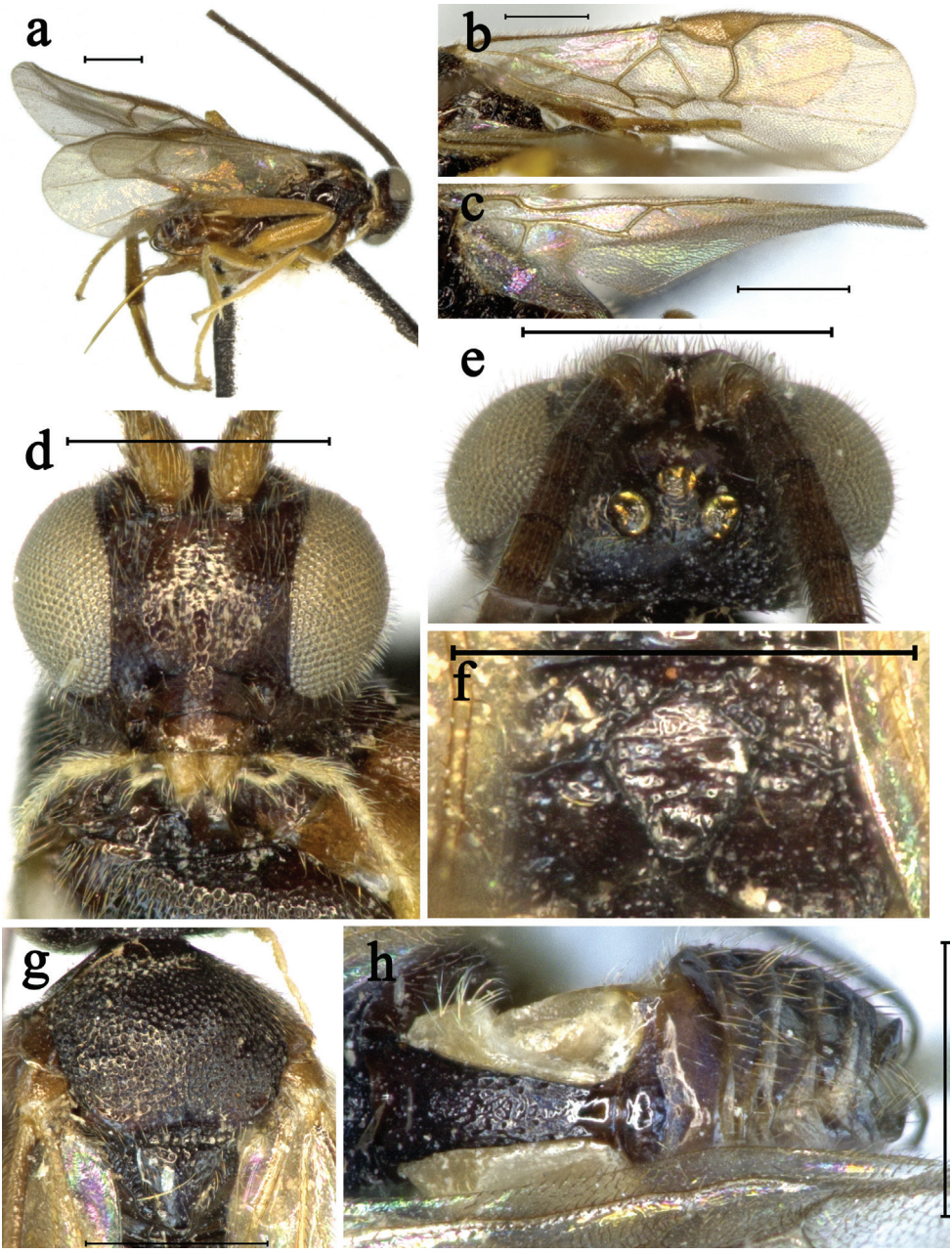

Figure 2. *Apanteles cuneiformis* Song & Chen, 2004 **a** habitus, lateral view **b** fore wing **c** hind wing **d** head, frontal view **e** head, dorsal view **f** propodeum **g** mesosoma, dorsal view **h** abdomen, dorsal view. Scale bars: 0.5 mm.

Sanchahe, Xishui, **Guizhou**, 2000.IX.22, Li Guiren, No. 200102301; 1♀, Changqiangou, Xishui, Guizhou, 2000.IX.29, Ma Yun, No. 200102730.

Distribution. China (Fujian, Guangdong, Guizhou, Taiwan, Yunnan).

***Apanteles parectangular* Liu & Chen, sp. nov.**
https://zoobank.org/033C1CE0-A0CE-4F27-8F85-3C63525E7220
Fig. 3

Description. Female. Body length 2.5 mm, fore wing length 3.0 mm (Fig. 3a).

Head. Transverse in dorsal view, 2× as wide as long, 1.2× wider than mesoscutum. Vertex between the eye and the posterior ocellus shiny with undefined punctures (Fig. 3d). Temple slightly shiny with superficial, indistinct puncture, strongly constricted behind eyes from dorsal view. Face (Fig. 3h) shiny with shallow punctures, transverse, 0.8× as high as wide, inner margin of eyes parallel-sided. Ocelli big, posterior tangent to anterior ocellus hardly touching posterior pair of ocelli, distance between anterior and a posterior ocelli distinctly shorter than diameter of a posterior ocellus, POL:OD:OOL = 3.5:2.5:4.5 (Fig. 3d). Antenna distinctly longer than body length, penultimate antennomere 1.5× longer than wide (Fig. 3e).

Mesosoma. Length:width:height = 48.0:36.0:27.5. Mesoscutum (Fig. 3i) slightly shiny with strong, sparse punctures, interspaces obviously bigger than diameter of puncture, punctures largely disappeared at middle and posterior parts where it is shinier and smoother than elsewhere. Scutellar sulcus straight, broad with carinae in between. Scutellum highly shiny, smooth without punctuation except for some undefined small punctures laterally. Lateral polished field of scutellum reaching half-length of scutellum, carinae obsolescent anteriorly. Propodeum (Fig. 3f) highly shiny, smooth, areolation strongly, well defined, V-shaped apically and closed basally, costulae strongly, well defined. Mesopleuron (Fig. 3c) highly polished, anterior part shallowly, finely punctate except for slightly rugose on top, sternaulus smooth, broad and concave.

Legs. Hind coxa shiny and smooth, impunctate basally. Spines on outer side of hind tibia not dense. Inner spurs of hind tibia 2/5 length of hind basitarsus, outer spur 1/3. Basitarsus of hind leg distinctly longer than tarsomeres 2–4 (24.0: 19.0), claws of moderate size.

Wings. Pterostigma 2.9× as long as its widest part. Vein 1-R1 1.4× longer than pterostigma, nearly touching apex of marginal cell (Fig. 3b). Vein r arising from middle of pterostigma, distinctly inclined outwards, 1.1× longer than width of pterostigma, r 1.4× longer than 2-SR, indistinctly angled at meeting, 2-M half-length of 2-SR and slightly shorter than 1-SR, 2-SR+M shorter than m-cu, the latter about the length of r. First discal cell of fore wing 1.3× wider than high. Second submarginal cell of hind wing 1.3× wider than high. Vein cu-a of hind wing slightly curved. Hind wing not broad, the length of the 1-M as long as the distance between its distal extremity and the apex of the vannal lobe. Vannal lobe beyond its widest part somewhat concave without obvious setae.

Metasoma. 0.7 length of mesosoma. T1 narrowly wedged-shaped, not strongly constricted apically, basal width to apical width 1.4:1.0, basal 1/3 concave, turned-over part 2.1× longer than wide across the hump, obscure with obsolescent punctures laterally, longitudinal channel obvious with transversal carinae inside, apical tubercle highly polished and smooth (Fig. 3g). T2 shiny and polished, transverse, 4× wider than long in middle, slightly curved apically. T3 as long as T2. Tergites posterior to T2 polished,

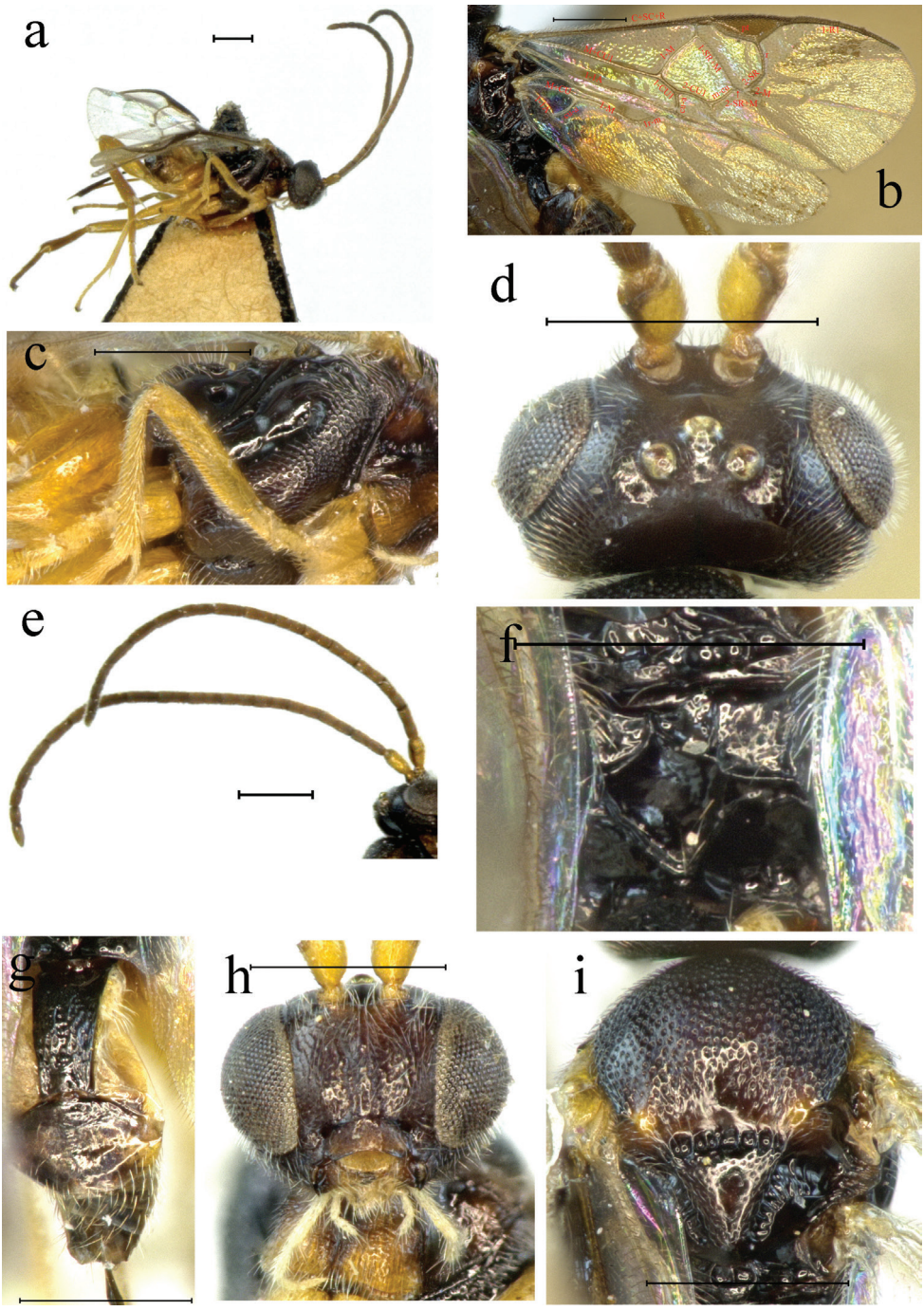

Figure 3. *Apanteles parectangular* Liu & Chen, sp. nov. **a** habitus, lateral view **b** fore and hind wings **c** mesopleuron **d** head, dorsal view **e** antenna **f** propodeum **g** abdomen, dorsal view **h** head, frontal view **i** mesosoma, dorsal view. Scale bars: 0.5 mm.

shiny, and densely pubescent. Hypopygium shorter than apex of metasoma. Ovipositor sheath slightly longer than hind tibia, narrow, evenly widened towards apex.

***Colour*.** Reddish brown to black (Fig. 3a). Tegula yellow. Palpi and spurs pale yellow. Labrum and mandible light reddish-yellow. Flagellum of antenna yellowish-brown basally, darkened towards apex, pedicel and scape bright yellow. Ovipositor sheath brown. Legs bright yellow except hind tibia and tarsus somewhat reddish-yellow. Wing membrane hyaline, slightly brownish, vein C+SC+R, 1-R1 and pterostigma brown, other veins light brown.

Variation. Body length 2.0–2.7 mm.

Male. Unknown.

Host. Unknown.

Material examined. ZJUH: *Holotype*: ♀, Linghou, **Zhejiang**, 1985.VIII.6, Chen Xuexin, No. 852530. ***Paratypes*:** 1♀, Hangzhou, Zhejiang, 1989.VI.24, Chen Xuexin, No. 893296; 1♀, Mt. Jigong, **Henan**, 1997.VII.12, Chen Xuexin, No. 975015; 1♀, Kuankuoshui Natrure Reserve (Xiangshuwan), **Guizhou**, 2010.VI.4, Chai Hongfei, No. 201004049; 1♀, Mt. Diaoluo, **Hainan**, 2006.VII.16–17, Liu Jingxian, No. 200802283; 1♀, Jianfengling (Tianchi), Hainan, 2008.XI.25, Tan Jiangli, No. 200805125; 1♀, Jianfengling, Hainan, 2008.XI.22, Tan Jiangli, No. 200805327.

HUAS: 2♀♀, Haizhu Wetland, Guangzhou, **Guangdong** (malaise trap), 2021.IV.26–V.11, Liu Jingxian, Nos. 202200268, 202200214.

Distribution. China (Guangdong, Guizhou, Hainan, Henan, Zhejiang)

Etymology. The specific name "*parectangular*" derives from the Latin, referring to the shape of T1 (indistinctly constricted apex, nearly rectangular-shaped).

Remarks. This species is similar to *A. conon* Nixon, but differs in the following: T1 not strongly constricted apically (strongly constricted in latter); punctures sparser, largely disappeared on mesoscutum (punctures more denser in latter); and hind coxa entirely yellow (largely brown in latter).

Acknowledgements

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