

A taxonomic study of the genus *Antitrygodes* (Lepidoptera: Geometridae: Sterrhinae) with two newly recorded species from China

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Abstract: A taxonomic study of the genus *Antitrygodes* Warren, 1895 in China was conducted. Two species, *Antitrygodes vicina* (Thierry-Mieg) and *Antitrygodes cuneilinea* (Walker), are reported for the first time from China. Description and diagnoses for these species are provided and illustrations of adults and genitalia are presented. The species list for this genus of the world is also provided.

Key words: Scopulini; taxonomy; list

中国蟹尺蛾属研究及两新记录种记述（鳞翅目：尺蛾科：姬尺蛾亚科）

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摘要: 研究了姬尺蛾亚科蟹尺蛾属 *Antitrygodes* Warren, 记述 2 中国新记录种: 小斑蟹尺蛾 *Antitrygodes vicina* (Thierry-Mieg) 和楔纹蟹尺蛾 *Antitrygodes cuneilinea* (Walker), 提供了种的形态描述、鉴别特征、成虫和外生殖器图, 以及世界物种名录。

关键词: 岩尺蛾族; 分类; 名录

Introduction

The genus *Antitrygodes*, 1895, a small and rare genus of the tribe Scopulini in the subfamily Sterrhinae, was originally established by Warren (1895), with *Macaria divisaria* Walker (1861) as the type species. Scoble (1999) listed 12 species of this genus, among which Warren (1896, 1897) described *A. parvimacula* and *A. dentilinea* from Papua New Guinea and Sierra Leone, Prout (1914–1918, 1932, 1938) named five species and five subspecies from the Indo-Australian region and Africa, and Viette (1977) added *A. herbuloti* and *A. malagasy* from Madagascar. Holloway (1997) summarized the characters of this genus, described *A. pseudagrata* from Borneo, upgraded the subspecies *A. agrata vicina* to species, and gave a valid status to *A. restricta*, which was a manuscript name. The most recent addition was made by Hermosa (2006) who described *A. mariarosae* from the Philippine Islands. At present, a total of 15 species are included in *Antitrygodes*.

Sihvonen (2005) synonymized *Antitrygodes* and another 19 genera with *Scopula* Schrank,

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based on morpho-cladistic results, and transferred all species of *Antitrygodes* into *Scopula*. However, Hausmann (2004) and Öunap (2010) refused to adopt the treatment of Sihvonen (2005) for the convenience of traditional classification, and retained these genera as valid, including *Antitrygodes*, but they did not reject the possibility that *Antitrygodes* belongs to the wider concept of *Scopula*. In this work, we prefer to follow the treatment of Hausmann (2004) and Öunap (2010).

Before this work, only one species *A. divisaria* was recorded in China. In this present work, two species are reported from China for the first time. Descriptions of these species and illustrations of the adults and genitalia are provided. A worldwide species list for this genus is also provided.

Material and methods

Specimens of *Antitrygodes* used in this study are deposited in the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS). Other cited museums where materials are deposited are BMNH (the Natural History Museum, London, United Kingdom) and MNHN (Muséum National d'Histoire Naturelle, Paris, France). Dissection and preparation of genitalia followed the standard procedure published by Robinson (1976). Genitalia were placed into Canada balsam and mounted on a slide. Wing venation term follows the Comstock-Needham System (Comstock 1918) as adopted for Geometridae by Scoble (1992) and Hausmann (2001). Terminology for the genitalia is based on Pierce (1914, reprinted 1976), Klots (1970) and Nichols (1989). Photographs of the moths were taken with digital cameras. Composite images were generated using Auto-Montage software version 5.03.0061 (Synoptics Ltd). Plates were compiled using Adobe Photoshop software.

Taxonomy

Antitrygodes Warren, 1895

Antitrygodes Warren, 1895: 90. Type species: *Macaria divisaria* Walker, 1861.

Diagnosis. Holloway (1997) provided the diagnosis of *Antitrygodes*, which is summarized and modified as follows: in Sterrhinae, the genus *Antitrygodes* is distinctive in having dark green patches on a variegated grey ground; the tarsi of the hind-leg are modified into a spine-like structure; the eighth sternite usually has symmetrical lateral processes; the valvae of the male genitalia are usually complex but symmetrical; the signum of the female genitalia is expanded to the full length and breadth of the corpus bursae.

Distribution: Palearctic Region; Oriental Region; Ethiopian Region.

Antitrygodes divisaria (Walker, 1861)

Macaria divisaria Walker, 1861: 927. Syntypes 2♀, Celebes [Sulawesi]; India: Kanara (BMNH).

Antitrygodes divisaria: Warren, 1895: 90.

Distribution: China; Japan; India; Malaysia; Indonesia; Sri Lanka.

Antitrygodes divisaria perturbata Prout, 1914 (Figs. 1, 4, 6, 8, 10)

Antitrygodes divisaria perturbata Prout, 1914: 240. Holotype ♀, Formosa [China(Taiwan)]: Kosempo

(BMNH).

Redescription. Head. Antennae ciliate in male, filiform in female. Frons and labial palpus brown. Vertex white.

Thorax. Thorax with dorsal and ventral sides grayish white. Dorsal side with green dots. Hind tibia strongly dilated, with developed yellow and white hair-pencils. Tarsus about 4/5 of tibia in length.

Forewing length. ♂♀ 16–17 mm. Wings grayish white, scattered with black scales. Apex of forewing pointed, that of hindwing slightly rounded, outer margin of both wings serrate. Forewing base with a large green patch, separated by veins. Three patches present in middle area: a quadrate one in cell; one larger between vein R_5 and M_3 outside cell, with distal margin concave; and the largest quadrate one under cell. Postmedial line black brown, with gray shadow on both sides, reaching anal angle. Outside postmedial line and above vein M_3 , three small patches present between veins. Hindwing with three green patches at middle area: one nearly rectangular patch in cell; an irregular patch outside cell with outer margin protruding; a large shoe-like patch present between cell to inner margin. Postmedial and submarginal lines ochreous, blurred; the latter forming a process on vein M_2 and with a small black spot. Terminal lines on both wings greenish brown. Fringes yellow-white decorated with black scales. Underside of both wings with broad black brown postmedial bands.

Abdomen (Fig. 6). Tergite 8 of male with posterior margin shallowly concave. Posterior margin of sternite 8 with a pair of symmetrical, slender and hooked processes; anterior margin divided at middle.

Male genitalia (Figs. 4, 8). Socii divided, with dense setae at tip. Valva basally inflated, with long bristles, tip with circular protrusion. Costal process deeply bent and slender, spinose at tip, with a broad plate at ventral side. Dorsal base with one row of spines, about 4–5, outer spines long and curved, others dentate. Sacculus base with one tubercle. Saccus broad and flat. Aedeagus with posterior half narrower; vesica with irregularly sclerotized area, cornutus a long spine.

Female genitalia (Fig. 10). Apophyses posteriores slightly longer than apophyses anteriores. Region around ostium bursae sclerotized, cyathiform. Lamella postvaginalis near quadrate. Ductus bursae very short, swollen, with a sclerite near corpus bursae. Corpus bursae large, long and narrow, signum regularly arranged, each appearing as a narrow leaf and with one tip spined.

Specimens examined. **China**, Fujian (IZCAS): 1♀, Shaxian, 1973; 1♂ Huaan, 13-VI-1981; **China**, Guangdong (IZCAS): 1♂, Guangzhou, Shipai, 18-VIII-1958, coll. Linyao WANG; 1♂, Shixing, Chebaling, 330 m, 01–02-VIII-2013, coll. Dayong XUE; 1♂, Shenzhen, Dapengbandao, 4 m, 10–13-V-2015, coll. Rui CHENG; 1♂1♀, Heshan, 10-X-2002, 17–18-XII-2002, coll. Binlan ZHANG; **China**, Hainan (IZCAS): 1♂, Yinggeling, Nankai, Mohaocun, 336 m, 15–16-IV-2010, coll. Nan JIANG; 1♂, Qiongzong, Limushan, Qijiacun, 657 m, 06–07-IV-2010, coll. Nan JIANG; 1♂, Wuzhishan, 727 m, 06-XII-2007, coll. Jing LI; 4♂4♀, Jianfengling, 09-VII–08-IX-1979, 15-XI-1981, 08-XI–07-XII-1982, 09-VIII-1983, coll. Maobin GU; **China**, Guangxi (IZCAS): 2♂, Fangcheng, Fulong, 200–500 m, 23–26-V-1999, coll. Wenzhu LI; 1♀, Nanning, Linkesuo, 16-IX-1980, coll. Jijian WANG; 1♂, Xishuangbanna, Xiaomengyang, 1000 m, 03-IX-1957, coll. Shuyong WANG.

Distribution: China (Fujian, Taiwan, Guangdong, Hainan, Guangxi, Yunnan); Japan.

Note. The nominate subspecies is distributed in India, Malaysia, Indonesia and Sri Lanka.

***Antitrygodes vicina* (Thierry-Mieg, 1907)** (Figs. 2, 5, 7, 9, 11), new record to China

Trygodes vicina Thierry-Mieg, 1907: 271. Syntypes 3♂, India: Khasi Hills.

Antitrygodes agrata vicina: Prout, 1938: 192.

Antitrygodes vicina: Holloway, 1997: 69.

Redescription. Head. Antennae ciliate in male, filiform in female. Frons with lower half whitish and upper half dark brown. Labial palpus short. Vertex white. Tegula white with base ocherous, decorated with black scales.

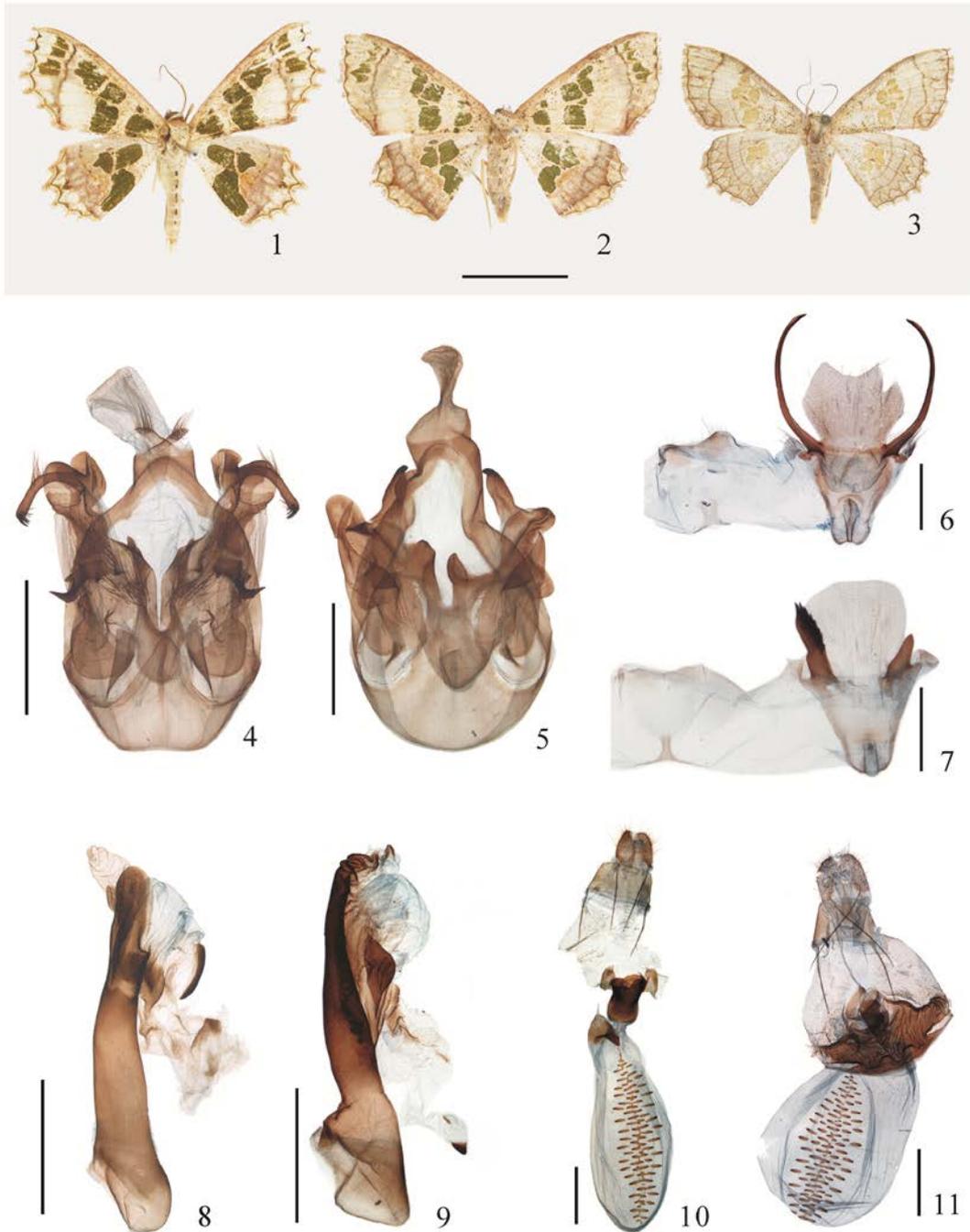
Thorax. Thorax with dorsal and ventral sides white, decorated with black dots on dorsal sides. Hind tibia strongly dilated, with hair-pencil; the tarsi of the hind-leg modified into a spine-like structure.

Forewing length. ♂♀ 16–17 mm. Patches and wing shape are similar to *A. divisaria*. Forewing base with three patches, the middle one large, and anterior and posterior ones quite small. Four patches present in middle area, a large quadrate one in cell, accompanying by a broad right-angled patch outside; a small triangular patch between cell and base of vein CuA₂; and one larger nearly quadrate patch below vein CuA₂. Middle line indistinct. Postmedial line black brown, ocherous near anal angle, gently curved, reaching anal angle. Outside postmedial line and above vein M₃, four small patches present between veins, the anterior two crescent-shaped, the posterior two larger, the third one with lateral protrusion at base and the fourth one with lateral process at tip. Hindwing with four green patches recognizable in middle area: a small patch above cell, a large quadrate patch in cell as on forewing, an irregular patch outside with outer margin protruding, and a crescent patch below cell. Postmedial line black brown, slightly concave between veins M₁ and M₃; submarginal line ocherous and brown, thicker, forming a pointed process on vein M₂, almost straight on other parts; area between postmedial and submarginal lines ocherous and brown, and with veins concolours with transverse lines. Terminal line on both wings greenish brown; fringes whitish mixed with ocherous and brown scales. Underside of both wings with wide black brown postmedial bands.

Abdomen (Figs. 7). Abdomen with dorsal and ventral sides whitish, dorsal side with small dark patches on segments 2–4. Sternite 8 with a pair of asymmetrical stout processes, left process with proximal side spinose, right process smooth and tapering, about one-half length of the left one. Tergite 8 with posterior margin slightly concave.

Male genitalia (Figs. 5, 9). Socii fused into dumbbell-shaped process, with middle part narrow, base large and tip swollen. Valva asymmetrical: left valva with tip rounded; costal process large, thick, tip pointed and bent, with a small pointed ventral process at base; saccular process slender. Right valva undeveloped, costal process bearing a blunt ventral protrusion; saccular process short and pointed. Juxta developed, with posterior half separated, connected with costa laterally. Saccus large and rounded. Aedeagus with anterior part wide, several spines present at middle, wrinkled near end, with a hummocky process on manica; cornutus a small triangular process on vesica.

Female genitalia (Fig. 11). Apophyses anteriores and apophyses posteriores of similar length. Ostium bursae sclerotized, narrow ring-like, unconnected at posterior end. Lamella antevaginalis strongly sclerotized and wrinkled. Corpus bursae rough, signum regularly arranged.



Figures 1–11. Adults and genitalia. 1. *A. divisaria perturbata*, male (Hainan); 2. *A. vicina*, male (Hainan); 3. *A. cuneilinea*, female (Yunnan). 4, 6, 8, 10. *A. divisaria perturbata*. 5, 7, 9, 11. *A. vicina*. 4,5. Male genitalia; 6,7. Eighth segment; 8,9. Aedeagus; 10,11. Female genitalia. Scale bars = 1.0 cm (Figs.1–3); 1 mm (Figs. 4–11).

Diagnosis. On the wing pattern, *A. vicina* is close to *A. divisaria* (Fig. 1), but the green patches are smaller and the patch outside the cell is of different shapes. The male genitalia of

the two species are quite different, for example, the socii of *A. vicina* are fused but divided in *A. divisaria* (Fig. 4); the costal process is quite thick in *A. vicina* but very slender and bent in *A. divisaria*. The cornutus of the aedeagus is also different, which is a small triangular process in *A. vicina* but appears as a long spine in *A. divisaria* (Fig. 8). The asymmetrical processes on the male eighth sternite are different from the symmetrical, bent and slender processes of *A. divisaria* (Fig. 6). In the female genitalia, *A. vicina* can be differentiated from *A. divisaria* (Fig. 10) by the developed lamella antevaginalis and broad corpus bursae.

Specimens examined. **China**, Hainan (IZCAS): 1♂1♀, Yinggeling, 950–1100 m, 27-VIII–12-IX-2005, coll. Chunxiang LIU; 1♂, Wuzhishan, Shuiman, 730–900 m, 08-V-2007, coll. Songyun LANG; 1♀, Jianfengling, 09-IX-1982, coll. Peizhen CHEN; **China**, Guangxi (IZCAS), Shangsi, Hongqi Forest Farm, 350 m, 29-V-1999, coll. Wenzhu LI.

Distribution: China (Hainan, Guangxi); India.

***Antitrygodes cuneilinea* (Walker, 1863)** (Fig. 3), new record to China

Geometra cuneilinea Walker, 1863: 1752. Syntypes ♀, Hindostan [India] (OUM).

Antitrygodes cuneilinea: Prout, 1938: 192.

Redescription (female). Head and thorax similar to those of *A. vicina*. Frons dark brown, only with lower margin whitish. Tegula not ochreous at base.

Forewing length. ♀ 14 mm. Forewing base lacking green patches. Middle area decorated with small yellow-green patches (discoloured). Patches similar to those of *A. divisaria* but quite smaller. Brown middle line distinct, protruding at middle; postmedial line protruding, gently angled twice near vein M_1 and CuA_1 ; submarginal line indistinct, serrate. Hindwing with five patches, the anterior two large and posterior three smaller; medial and postmedial lines curved; submarginal line serrate, forming teeth on veins. Terminal line on both wings dark brown; fringes brown, darker on vein ends. Underside of both wings pale greyish.

Specimens examined. 1♀, **China**, Yunnan (IZCAS), Hekou, 80 m, 10-VI-1956, coll. Keren HUANG.

Distribution: China (Yunnan); India; Myanmar; Thailand; Sri Lanka; Malaysia.

Host plant. *Anthocephalus chinensis*. (From Scoble, 1999).

Diagnosis. *A. cuneilinea* can be easily distinguished by the postmedial lines on both wings, which are far from the anal angles, but reach there in *A. divisaria* and *A. vicina*. The serrate submarginal line on hindwing is also distinctive. The underside of the wings is pale grey in *A. cuneilinea*, but with a black brown postmedial band in *A. vicina* and a large black area in *A. divisaria*.

***Antitrygodes acinosa* Prout, 1932**

Antitrygodes acinosa Prout, 1932: 239. Syntype(s), São Tomé Principe: São Tomé Island (BMNH).

Distribution: Sao Tome and Principe.

***Antitrygodes agrata* (Felder & Rogenhofer, 1875)**

Trygodes agrata Felder & Rogenhofer, 1875: pl. 128, fig. 19. Syntypes ♀, Moluccas (BMNH).

Antitrygodes agrata: Prout, 1938: 192.

Distribution: Indonesia.

***Antitrygodes callibotrys* Prout, 1918**

Antitrygodes callibotrys Prout, 1918: 27. Holotype ♂, Congo Free State [Zaire]: Upper Kasai District

(BMNH).

Distribution: Congo; Uganda.

***Antitrygodes dentilinea* Warren, 1897**

Antitrygodes dentilinea Warren, 1897: 47. Holotype ♀, Sierra Leone (BMNH).

Distribution: Madagascar; Sierra Leone; Nigeria.

***Antitrygodes dysmorpha* Prout, 1915**

Antitrygodes dysmorpha Prout, 1915: 329. Syntypes ♂, Nigeria (northern): Kano (BMNH).

Distribution: Nigeria; Ghana.

***Antitrygodes herbuloti* Viette, 1977**

Antitrygodes herbuloti Viette, 1977: 64. Holotype ♂, Madagascar (east): piste d'Andapa at Ambalapaiso, 25 km W of Andapa, 725 m (MNHN).

Distribution: Madagascar.

***Antitrygodes malagasy* Viette, 1977**

Antitrygodes malagasy Viette, 1977: 64. Holotype ♂, Madagascar (east): S of Moramanga, forest on Anosibe road (MNHN).

Distribution: Madagascar.

***Antitrygodes parvimacula* Warren, 1896**

Antitrygodes parvimacula Warren, 1896: 293. Syntypes 1♂3♀, [Papua New Guinea]: [D'Entrecasteaux Islands] Fergusson Island; Tobriand Islands, Kiriwini (BMNH).

Distribution: Papua New Guinea.

***Antitrygodes parvimacula erythroconia* Prout, 1938**

Antitrygodes parvimacula erythroconia Prout, 1938: 193. Syntypes ♂♀, [Bismarck Archipelago]: Admiralty Islands (BMNH).

Distribution: Papua New Guinea.

***Antitrygodes parvimacula kirwiriensis* Prout, 1938**

Antitrygodes parvimacula kirwiriensis Prout, 1938: 193. Syntypes including ♀, [Bismarck Archipelago]: New Ireland (BMNH).

Distribution: Papua New Guinea.

***Antitrygodes parvimacula papuana* Prout, 1938**

Antitrygodes parvimacula papuana Prout, 1938: 193. Syntypes, New Guinea: Hydrographer Mountains, 2500 ft (BMNH).

Distribution: New Guinea.

***Antitrygodes parvimacula privativa* Prout, 1917**

Antitrygodes parvimacula privativa Prout, 1917: 307. Syntypes, Bismarck Archipelago: Rook[e] Island [Umboi] (BMNH).

Distribution: Papua New Guinea.

***Antitrygodes pirimacula* Prout, 1916**

Antitrygodes pirimacula Prout, 1916: 16. Holotype ♂, Dutch New Guinea [Irian Jaya]: Fak-Fak, 1700 ft (BMNH).

Distribution: Indonesia.

***Antitrygodes pseudagrata* Holloway, 1997**

Antitrygodes pseudagrata Holloway, 1997: 69. Holotype ♂, Sarawak: Gunung Mulu Nat. Park (BMNH).

Distribution: Malaysia; Philippines?

***Antitrygodes restricta* Holloway, 1997**

Antitrygodes restricta Holloway, 1997: 69. Sulawesi.

Distribution: Indonesia.

***Antitrygodes subaequalis* Prout, 1917**

Antitrygodes subaequalis Prout, 1917: 308. Syntypes ♂, [Solomon Islands]: [Santa] Isabel Island (BMNH).

Distribution: Solomon Islands.

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