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A Taxonomic Revision of *Limbatochlamys* Rothschild, 1894 with Comments on Its Tribal Placement in Geometrinae (Lepidoptera: Geometridae)

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Hong-Xiang Han, Anthony Galsworthy, and Da-Yong Xue (2005) A taxonomic revision of *Limbatochlamys* Rothschild, 1894 with comments on its tribal placement in Geometrinae (Lepidoptera: Geometridae). *Zoological Studies* **44**(2): 191-199. The geometrine genus *Limbatochlamys* is revised based on adult morphology. The lectotype of the type species, *Limbatochlamys rosthorni* Rothschild, 1894, is designated and illustrated; descriptions and illustrations are also given for *L. pararosthorni* sp. nov. (Shaanxi) and *L. parvisis* sp. nov. (Yunnan). A key for the identification of adults is provided for the genus. The systematic position of the genus in the Geometrinae is also briefly discussed. http://www.sinica.edu.tw/zool/zoolstud/44.2/191.pdf

Key words: Taxonomy, Review, *Limbatochlamys*, New species, China.

The Geometrinae is one of the 4 largest subfamilies of the Geometridae, itself one of the largest families of the Lepidoptera, which is characterized by the presence of structurally unique tympanal organs at the base of the abdomen, and by having larvae lacking several pairs of prolegs; members are popularly known as "inchworms" because of their looping mode of progression. With about 2440 named species in 269 genera, the Geometrinae is the smallest of the 4 subfamilies, and has an almost worldwide distribution (Minet and Scoble 1999, Scoble 1999). About 350 species in 61 genera of Geometrinae have been recorded in China. The present study is part of a wider survey of the Geometrinae in China, intended to lead to a volume of the Fauna Sinica devoted to this subfamily.

The tribal classification of this subfamily has steadily evolved over the years, but as a result of concentration on regional faunas, no integrated tribal structure on a global scale has yet been achieved (Minet and Scoble 1998). Ferguson (1969 1985) classified the North American fauna into 5 tribes, and Inoue (1961) classified the Japanese genera into 13 tribes. Holloway (1996) adopted 2 tribes, Dysphaniini and Geometrini, based on the Asian fauna; the latter included almost all geometrine genera except for the genus *Dysphania*, with the result that other groupings which had previously been treated at the tribal level were reduced to subtribes. Holloway recognized 9 subtribes among the Bornean fauna, the members of two of which, the Pseudoterpnini and the Geometrini, are relatively robust and large-bodied, while the rest are flimsier-bodied. Pitkin (1996) accepted the details of Holloway's classification at the subtribal level, but restored the taxa to the tribal level to obtain a more-lucid and balanced grouping. Hausmann (2001) followed Pitkin's concept of tribes. For the limited purposes of the current paper, we follow the same concept.

The genus *Limbatochlamys* was originally

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described by Rothschild (1894) as a member of the Geometrinae based on *L. rosthorni* from China, the only species known at that time. Prout (1912) tentatively suggested that *Limbatochlamys* was related to *Tanaorhinus* Butler, 1879. Since then, there has been no further study of this genus, no further species have been found, and no further attempt to place the genus in a higher classification has been made. The genus is of some interest in that it does not obviously fit into any of the tribal concepts, for the reasons discussed below.

Having checked a long series of *Limbatochlamys* specimens in the collections of the Institute of Zoology, Chinese Academy of Sciences, Beijing and the Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany, we found 2 further undescribed species, closely related to *L. rosthorni*. This provided an opportunity to provide an expanded definition of *Limbatochlamys*, and to reconsider its taxonomic relationships. Hence the purpose of this article is to describe the 2 new species from China, to compare them with *L. rosthorni*, to provide a key to the species, and to discuss the relationships of the species and the systematic position of the genus within the Geometrinae.

MATERIALS AND METHODS

Specimens of *Limbatochlamys* were obtained from the following institutions: Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS); The Natural History Museum, London, UK (BMNH); and Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK). Terminology follows Nichols (1989) for external features and Klots (1970) for genitalia. Photographs of adult moths and their genitalia were taken with a Nikon Coolpix 5000 digital camera.

TAXONOMIC ACCOUNTS

Limbatochlamys Rothschild, 1894

Limbatochlamys Rothschild, 1894, Novit. zool. 1: 540.
Type species: *Limbatochlamys rosthorni* Rothschild, 1894, Novit. zool. 1: 540, pl. 12, fig. 9. by original designation.

Head and body: Antenna of male shortly bipectinate, length of longest rami as long as diameter of antennal shaft. Rami in female much shorter or serrate. Frons densely scaled. Labial palpus short with 2nd segment rough-scaled and 3rd segment much shorter. Ventral side of thorax and femora densely hairy. Hind tibia with 2 pairs of spurs, not dilated in male. Tarsomere spinulose. Dorsal side of abdomen without crested scales. Male abdomen without setal patches on 3rd sternite, 8th sternite weakly sclerotized.

Wing shape and markings: Wing large, forewing length 25~37 mm. Forewing costa moderately arched with apex acute and slightly falcate. Hindwing with apex rounded, tornal region slightly produced, hind margin extended. Both fore- and hindwings with outer margin rounded. Forewing background olive-green; costal area with a pale greyish-yellow band running from wing base to apex. This pale greyish-yellow band located from costa to upper margin of cell and R_{2-5}, then directly to apex along R_4, banded by distinct black line. Hindwing pale greyish-brown, tinged with pale pink in most areas and olive-green in terminal area. Both forewing costal band and most areas of hindwing speckled with dark brown. Postmedial line of forewing composed of a row of small dots on veins (*L. rosthorni* and *L. pararosthorni*) or of a weakly dentate line (*L. parvisis*); postmedial line of hindwing dark brown, dentate. Underside pale, tinged with pale pink, speckled with reddish-brown and dark brown.

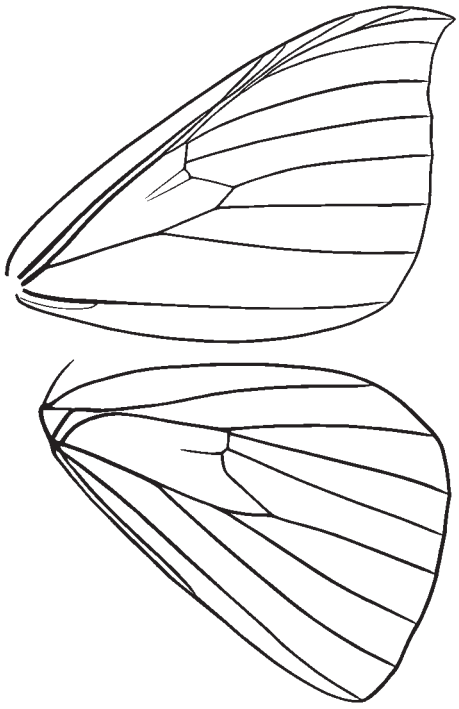


Fig. 1. Venation of *Limbatochlamys rosthorni* Rothschild.

Venation (Fig. 1): R_1 of forewing arising from cell, shortly stalked with Sc at middle; R_2 to R_5 stalked, R_2 diverging from stalk before R_5; M_1 and R_{2-5} separately arising from cell (*L. rosthorni* and *L. parvisis*) or shortly stalked (*L. pararosthorni*); cell nearly 1/2 middle length of forewing; M_3 free. Hindwing: Sc+R_1 running close to cell near base, Rs arising from before upper angle of cell (*L. rosthorni* and *L. pararosthorni*) or from upper angle of cell (*L. parvisis*); 3A present.

Male genitalia: Uncus slender and long, finger-like, basal part broadened and triangular; socii narrower than uncus, about 1/2 length of uncus; gnathos with a posteromedial process with apex acute or rounded; costal margin and sacculus of valvae well-sclerotized; valvulae membranous; transtilla weakly sclerotized, flake-like; juxta membranous; with coremata. Aedeagus short and thick, with sclerotized extended projection, terminal 1/2 sclerotized, vesica with acute cornutus.

Female genitalia: Areas around ostium bursae strongly sclerotized; lamella postvaginalis wrinkled and strongly sclerotized; ductus bursae short, corpus bursae broad; signum well developed, bicornute.

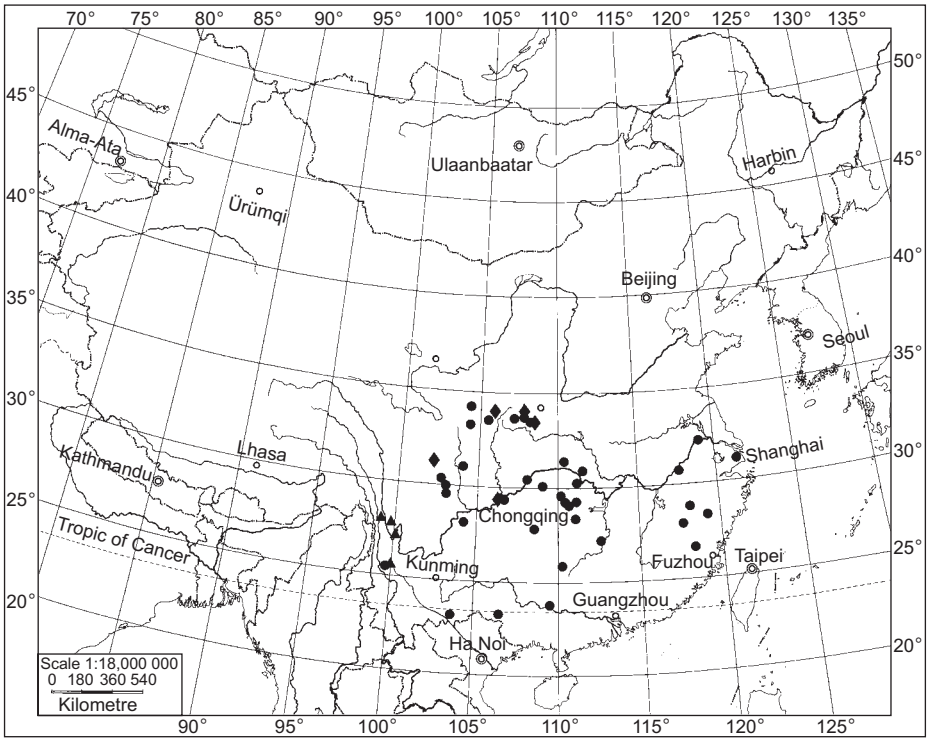
Diagnosis: The most-obvious synapomorphy for the genus is the unique coloration of the insects, with the wings pale green all over apart from a broad fawn streak along the costa. The combination of a strong undivided uncus with socii of the shape illustrated in the male genitalia is also unique.

Biology: Unknown.

Geographical distribution (Fig. 2): This genus is only known from China and is restricted to the northern margin of the Oriental region. It is widely distributed from southern China, to the southern slope of the Qinling region (in the southern part of Gansu and Shaanxi Provinces), extending westward to the edge of the Hengduan Mountains (Yunnan Prov.), and southward to most parts of southeastern China. All specimens were collected from lowlands to mountain areas, with an altitudinal range of 800~2700 m.

Key to the species of *Limbatochlamys*

Note: construction of a key is rendered difficult by the existence of variations in the presence and absence of discal spots and postmedial markings, as noted in the text. Most specimens of rosthorni and parvisis will key out using the following key without reference to the genitalia, but a few specimens can only be distinguished from



● *L. rosthorni* Rothschild ♦ *L. pararosthorni* sp. nov. ▲ *L. parvisis* sp. nov.

Fig. 2. Distribution of *Limbatochlamys* Rothschild.

pararosthorni by examination of genitalia. Hence the latter can only be distinguished with certainty by dissection.

1. Discal spots present on forewing underside or hindwing upper side.....*L. rosthorni*
   Discal spots absent from forewing underside and hindwing upper side.....2
2. Forewing upper side postmedial line continuous.....*L. parvisis*
   Forewing upper side postmedial line consisting of spots on veins.....3
3. Male valvae without costal process; female genitalia with short, almost globular corpus bursae.....*L. parvisis*
   Male genitalia with costal process; female genitalia with elongate corpus bursae.....4
4. Costal process of male valvae strongly expanded subterminally; female genitalia with trapezoid lamella postvaginalis.....*L. rosthorni*
   Costal process of male valvae without subterminal expansion; lamella postvaginalis in female genitalia strongly extended laterally.....*L. pararosthorni*

Limbatochlamys rosthorni Rothschild
(Figs. 3-7)

Limbatochlamys rosthorni Rothschild, 1894, Novit. zool. 1: 540, pl. 12, fig. 9. Lectotype m, [China]: Interior of China (W of Ichang?) here designated (BMNH).

Diagnosis: Typical *L. rosthorni* with discal spots on upper side of hindwing, with postmedial line and discal spots on underside of forewing. Male genitalia with costal margin of valvae strongly sclerotized, and subapical area expanded into a dorsal lobe; apex of costal process long and slender, extending beyond valvula.

Redescription: Length of forewing: male 28~37 mm, female 38 mm. Rami of antenna in both sexes of equal length, about as long as shaft of antenna. Frons protruding, dark brown. Labial palpus greyish-yellow, 3rd segment in female not elongate. Vertex greyish-yellow, upper side of thorax greyish green, tegula with base greyish-yellow. Upper side of abdomen greyish-yellow. Forewing olive-green, with apex acute, slightly falcate; costal area with a greyish-yellow band, speckled with black, and in some areas with greyish red; postmedial line composed of a row of small dark dots on veins; terminal line black and slender, interrupted on the end of veins; fringe greyish white at base and greyish brown at tips. Hindwing with hind margin elongate; greyish-yellow, basal area of hind margin and outer marginal area with some greyish green, dotted with black; discal spots large, lunular, sometimes indistinct or even absent; postmedial line black, dentate; terminal line and fringe same as on forewing. Underside greyish-yellow and brown, terminal area densely speckled with black, forewing with a straight thick postmedial line, not reaching margins; black discal spot on forewing usually distinct, but sometimes absent; hindwing underside with a very faint discal spot, postmedial line always absent.

Male genitalia (Fig. 12): Gnathos thin, with posteromedial process with apex rounded; costal margin of valvae developed and strongly sclerotized, densely covered with small spines, with subapical area expanded into a dorsal lobe; apex of costal process long and slender, extending beyond valvula; valvula membranous, with the apex triangular; sacculus strongly sclerotized; harpe lingulate; saccus rounded. Aedeagus with sclerotized apex, and 2 sclerotized processes; cornutus acute.

Female genitalia (Fig. 13): Apophyses posteriores slender and long, about 4 times length of apophyses anteriores; ductus bursae short, corpus bursae strong, bent at upper 1/3, with bicornute signum.

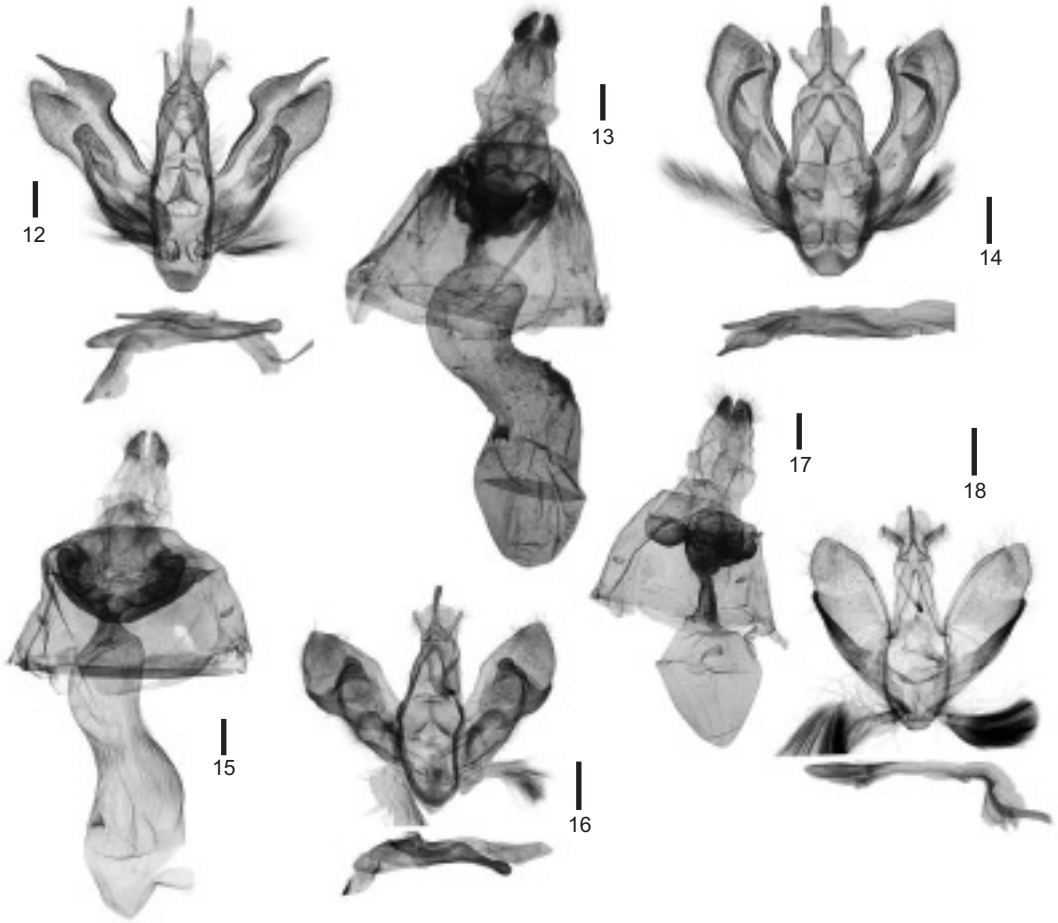
Remarks: In his original description, Rothschild did not specifically designate the type material, nor indicate how many specimens were before him. However the specimen bearing the type label in the BMNH series originates from the Rothschild collection, the whole of which passed to the Natural History Museum in 1939, and the label data match the information on habitat given by the author ("Interior of China (probably districts west of Ishang [sic])"). He adds "named after the collector", indicating that he had a particular specimen or specimens in mind. The specimen also appears to be the one illustrated in his paper. In fact, none of the other specimens in the BMNH series originate from the same collection, and were almost certainly not available to Rothschild. It thus seems reasonably certain that the specimen in question was the specimen before Rothschild: in the absence of a specific reference in his paper, it cannot be regarded as a holotype, and therefore, in order to avoid any uncertainty in the future, it is designated a lectotype below.

Materials examined: China: Lectotype: ♂, label data: "W of Ichang, China", "Limbatochlamys rosthorni. Type!, Rothsch. Nov. Zool. 94 pl. XII f.9", Rothschild Bequest BM 1939-1 (BMNH); 1 ♂, [Hubei]: Changyang, June 1888. (BMNH); 1 ♂, Kiangsu [Jiangsu], Nanking [Nanjing], Longtan, 7 June 1933, coll. H. Höne (BMNH); 1 ♂, Sichuan: Moupin, June 1890 (BMNH); 2 ♂♂, 1 ♀, Shanghai, coll. Höne (ZFMK); 4 ♂♂, 4 ♀♀, Jiangsu, Longtan, 13~21 June 1933, coll. Höne

(ZFMK); 1 ♂, Zhejiang, Wenzhou, July 1939, coll. Höne (ZFMK); 7 ♂♂, Zhejiang, Ost. Tianmu-shan,1500 m, 11 Apr.~29 July 1931, coll. Höne (ZFMK); 2 ♂♂, Hunan, Hoeng-Shan, 900 m, 15 June 1933, coll. Höne (ZFMK); 1 ♀, Fujian, Guadun, 2 Sept. 1938, coll. Höne (ZFMK); 1 ♂, S. O. Szechuan [Chongqing], Nanchuan, Ginfu-Shan [Jinfu-Shan], June 1929, coll. Friedrich (ZFMK); 1

Figs. 3-11. Adults (except Fig. 5.) **3.** *Limbatochlamys rosthorni* Rothschild, lectotype (BMNH); **4.** ditto, underside; **5.** Labels of lectotype specimens of *L. rosthorni*; **6.** ditto, (IZCAS); **7.** ditto, underside; **8.** *L. pararosthorni* sp. nov., holotype (IZCAS); **9.** ditto, underside; **10.** *L. parvisis* sp. nov., holotype (IZCAS); **11.** ditto, underside (scale bar = 1 cm).

♂, Shaanxi, Taibai, Huangbaiyuan, 17 July 1980, coll. Yinheng Han; 1 ♂, ibidem, 1750 m, 13 July 1980; 1 ♂, Shaanxi, Ningshan, Huoditang, 1580 m, 26 July 1998, coll. Jian Yao; 1 ♂, ibidem, coll. Decheng Yuan; 1 ♂, Shaanxi, Liuba, Miaotaizi, 1350 m, 19 July 1998, coll. Xuezhong Zhang; 1 ♀, Gansu, Dangchang, 1800 m, 7 July 1998, coll. Jian Yao; 1 ♀, Gansu, Wenxian, Qiujiaba, 2350 m, 28 June 1998, coll. Jian Yao; 7 ♂♂, 1 ♀, Gansu, Kangxian, Qinghe Linchang, 1450~1650 m, 15 July 1998, coll. Jian Yao; 1 ♀, ibidem, 1400 m, 8 July 1999, coll. Jian Yao; 5 ♂♂, Gansu, Wenxian, Shanwangmiao, 1500 m, 28 July 1999, coll. Jian Yao; 1 ♂, Zhejiang, Lishui, July 1979; 2 ♂♂, Hubei, Hefeng, 1240 m, 25 July 1989, coll. Wei Li; 4 ♂♂, ibidem, 31 July 1989; 1 ♂, Hubei, Hefeng, Fenshuiling, 31 July 1989, coll. Wei Li; 3 ♂♂, ibidem, coll. Longlong Yang; 1 ♂, ibidem, 1240 m, 21 July 1989, coll. Wei Li; 1 ♂, 1 ♀, Hubei, Lichuan, Xingdoushan, 800 m, 22 July 1989, coll. Wei Li; 7 ♂♂, Hubei, Xingshan, Longmenhe, 1350 m, 14~16 July 1993, coll. Shimei Song; 1 ♀, Jiangxi, Qianshan Nongkesuo, 8 July 1980; 1 ♂, Hunan, Cili, 16 July 1981; 1 ♂, ibidem, 25 June 1981; 1 ♀, Hunan, Anhua, June 1981; 1 ♂, Hunan, Sangzhi, Tianpingshan, 1300 m, 11 Aug. 1988, coll. Yixin Chen; 3 ♂♂, Hunan, Dayong, Zhushitou, 11 Aug. 1988, coll. Yixin Chen; 1 ♂, Fujian, Nanping, Dafeng, 11 June 1981; 8 ♀♀, Guangxi, Miaoershan, 800~1600 m, 2~15 July 1985, coll. Chenglai Fang; 1 ♂, 4 ♀♀, ibidem, coll. Ziqing Wang; 1 ♀, Guangxi, Longsheng, Baiyan, 1150 m, 20 June 1963, coll. Chunguang Wang; 1 ♂, Guangxi, Longnan, Anji Shanchang, 23 May 1981; 3 ♂♂, Guangxi, Napo, Defu, 1350 m, 18~19 June 2000, coll. Wenzhu Li; 1 ♂, ibi-



Figs. 12-18. Genitalia. **12.** Male genitalia of *Limbatochlamys rosthorni* Rothschild (IZCAS Geom-369); **13.** Female genitalia of *L. rosthorni* Rothschild (IZCAS Geom-380); **14.** Male genitalia of *L. pararosthorni* sp. nov. (IZCAS Geom-00376); **15.** Female genitalia of *L. pararosthorni* sp. nov. paratype (IZCAS Geom-00374); **16.** Male genitalia of *L. parvisis* sp. nov. (IZCAS Geom-00371); **17.** Female genitalia of *L. parvisis* sp. nov. (IZCAS Geom-00372); **18.** Male genitalia of *Psilotagma decorata* Warren (IZCAS Geom-363) (Scale bar = 1 mm).

dem, 19 June 2000, coll. Jian Yao; 1 ♂, Guizhou, Fanjingshan, Heiwanhe, 550 m, 3 June 2002, coll. Guoqing Mai; 4 ♂♂, Sichuan, Wanxian, Wangerbao, 1200 m, 12 Aug. 1993, coll. Shimei Song; 1 ♂, Sichuan, Mianzhu; 1 ♂, Sichuan, Emeishan, 12 June 1974, coll. Ziqing Wang; 1 ♂, Sichuan, Hongya, Gaomiao Mujianggang, 17 June 1981, coll. Xiaoling Wang; 1 ♂, Yunnan, Pingbian, Daweishan, 1500 m, 18 June 1956, coll. Keren Huang et al.; 1 ♂, Yunnan, Yanjin, 1080 m, 8 July 1980; 1 ♂, Yunnan, Yunlong, Shimen, Guangnan, 1700 m, 3 July 1980.

Distribution: Shaanxi, Gansu, Shanghai, Jiangsu, Zhejiang, Hubei, Jiangxi, Hunan, Fujian, Guangxi, Sichuan, Chongqing, Guizhou, Yunnan.

Biology: Unknown.

***Limbatochlamys pararosthorni* sp. nov.**
Han and Xue (Figs. 8, 9)

Diagnosis: Usually distinguishable from *L. rosthorni* by lack of postmedial line on forewing underside, and absence of discal spots on hindwing upper side and forewing underside; male genitalia different from the preceding species in the shape of costal and saccular processes; female genitalia distinct from the preceding species by having shorter ductus bursae.

Description: Length of forewing: male 30~32 mm, female 33~34 mm. Head and body similar to *L. rosthorni*. Antenna bipectinate in both sexes, rami in male as long as and in female about 1/2 length of shaft of antenna. Forewing ground colour and streaks as in *L. rosthorni*. Teeth of postmedial line on hindwing smaller; discal spots absent. Underside greyish-yellow and brown, terminal area densely speckled with black; discal spots absent on both forewing and hindwing; forewing and hindwing usually without postmedial line, but in some specimens postmedial line faintly visible.

Male genitalia (Fig. 14): Uncus, socii, gnathos as in *L. rosthorni*; costal margin of valvae strongly sclerotized, without dense spines as in *L. rosthorni*; terminal 1/2 of costa not expanded into lobe, costal process short, with tip far from reaching end of valvula, curved at base, where valvula much broadened; valvula with membranous apex terminating in much-less acute angle than in *L. rosthorni*; sacculus sclerotized; harpe slender and acute forming a huge hooked point to base of costal process. Aedeagus with sclerotized apex, bearing a small and weakly sclerotized process, cornutus sharp, much shorter than in preceding species.

Female genitalia (Fig. 15): General structure similar to *L. rosthorni*; apophyses posteriores slender and long; apophyses anteriores reduced; ostium bursae sclerotized, lamella postvaginalis sclerotized and laterally extended on both sides; ductus bursae shorter than in *L. rosthorni*, corpus bursae strong, slightly waisted at center, with bicornute signum.

Types: *Holotype*: ♂, Shaanxi, Ningshan, Huoditang, 1580 m, 15 Aug. 1998, coll. Decheng Yuan. *Paratypes*: 1 ♂, Shaanxi, Ningshan, Huoditang, 6 Aug. 1979, coll. Yinheng Han; 1 ♂, 1 ♀, ibidem, 1580 m, 26 July 1998, coll. Decheng Yuan; 4 ♂♂, 1 ♀, ibidem, 15~18 Aug. 1998, coll. Decheng Yuan; 1 ♂, Shaanxi, Huangbaiyuan, 17 Aug. 1980, coll. Yinheng Han; 1 ♀, ibidem; 1 ♂, Sichuan, Wolong, 1920 m, 29 July 1983, coll. Shuyong Wang; 1 ♂, S. O. Szechuan [Chongqing], Nanchuan, Ginfu-Shan [Jinfu-Shan], Aug. 1929, coll. Friedrich (ZFMK); 1 ♂, Kansu, Lihsien [Lixian], Peilingschan, 3000 m, July (ZFMK).

Distribution: Shaanxi, Gansu, Sichuan, Chongqing.

Biology: Unknown.

Remarks: From the comparison of the above 2 species, we can conclude that any specimen showing even faint discal spots on the hindwing upper side or forewing underside should be *L. rosthorni*. However, a few *L. rosthorni* have only a weak postmedial line, and a few *L. pararosthorni* have the same; moreover a few *L. rosthorni* lack discal spots on the hindwing upper side, and similarly a few lack discal spots on the forewing underside, so that for certainty, the male or female genitalia must be examined, which easily distinguish this species from its congeners.

***Limbatochlamys parvisis* sp. nov.**
Han and Xue (Figs. 10, 11)

Diagnosis: Apart from the size difference, this species can be distinguished from the preceding species by the frons, which is blackish-brown only on its upper 1/3; it can be distinguished from *L. rosthorni* by the lack of a dark postmedial line on the forewing underside; it can usually be distinguished from both congeners by the presence of a more-complete forewing postmedial line, not composed of dots on the veins. The genitalia in both sexes are easily distinguished from those of its congeners.

Description: Length of forewing: male 25 mm,

female 29 mm. Smaller than the preceding 2 species. Antennae in male bipectinate, rami shorter than shaft of antennae. Antennae in female serrate. Frons with lower 2/3 greyish-yellow, upper 1/3 dark brown. Labial palpus, vertex, tegula, upper side of thorax as in congeners. Ground colour of forewing and pale costa as in the preceding 2 species; postmedial line on forewing dull green, sometimes interrupted, and normally not composed of a row of small dots on veins (with the exception of 1 female specimen) as in the other 2 species; teeth of postmedial line on hindwing much weaker than in congeners, without discal spots. Underside greyish-yellow, with tinge of pink, with sparse dark streaks; both wings lacking postmedial line and discal spots.

Male genitalia (Fig. 16): Uncus and socii as in the preceding 2 species; gnathos thick, with postermedial process with apex acute; costa weakly sclerotized, costal process completely lacking; valvae broader than in congeners, with terminal part membranous; sacculus sclerotized with a small pointed extension along ventral edge of valvae; harpe curving towards costal margin of valvae and forming a sclerotized lobe. Aedeagus with a short, thick, and strongly sclerotized dorsal process, pointed at apex; cornutus very short and stout, triangular.

Female genitalia (Fig. 17): Apophyses posteriores about 6 times length of apophyses anteriores; ostium bursae sclerotized, with hemispherical lateral extensions; lamella postvaginalis sclerotized and wrinkled, nearly rounded; ductus bursae slender and long, about 1/2 length of corpus bursae, with a band of sclerotization on 1 side; corpus bursae comparatively small, almost globular, signum shaped like a canine tooth, with a sharp spike at each end.

Type specimens: *Holotype*: ♂, Yunnan, Zhongdian, Chongjianghe, 2300 m, 4 Aug. 1984, coll. Dajun Liu. *Paratypes*: 1 ♂, Yunnan, Zhongdian, Chongjianghe, 2200 m, 4 Aug. 1984, coll. Yixin Chen; 2 ♂ ♂, Yunnan, Lijiang, Yulongshan, 2700 m, 27 July 1984, coll. Dajun Liu; 1 ♀, Yunnan, Yunlong, Wubaoshan, 2550 m, 10 Aug. 1980; 1 ♂, [Yunnan]: Tsekou [Deqin], 1898, coll. P. Dubernard (ZFMK).

Distribution: Yunnan.

Biology: Unknown.

Discussion of systematic placement

The systematic position of the genus at the tribal level is problematic. Rothschild (1894) suggested a relationship to *Calleremites* Warren 1894, which is currently placed in the Pseudoterpnini, although without specifying reasons. In fact, both the external pattern elements and the genitalia of that genus differ substantially from those of the present genus, leaving only a slight, but not very close, similarity in the ground colour. Judging from the size and the robustness of the body, members of *Limbatochlamys* should belong either to the Geometrini or Pseudoterpnini, all other tribes being much flimsier-bodied. Prout (1912), who divided the Old World genera of Geometrinae into 6 "groups" according mainly to the external features and presence or absence of a frenulum, included *Limbatochlamys* in his group IV, which roughly equates to the present Geometrini, but with the equivocal remark that "this genus is probably related to *Tanaorhinus*, etc.; it may possibly really have more to do with the non-crested members of Group II, but the smoother scaling of the wings, their shape, and their amplitude relative to the body have induced us to regard it as belonging here." His group II is approximately equivalent to the modern Pseudoterpnini, which "probably embraces all the relatively large, robust Indo-Australian genera where the facies consists of a more-mottled forewing ground colour, with strong, crenulate fasciae" (Holloway 1996).

Although the green colour of the wings and falcate forewing of *Limbatochlamys* is reminiscent of some of the Geometrini, the strong undivided uncus in the male genitalia greatly differs from that of the Geometrini, where the processes of the uncus are always well separated; the oblique papillate ovipositor lobes in the female genitalia also highly differ from those in the Geometrini, in which the ovipositor lobes are slightly semicircular.

The structure of the uncus and the ovipositor lobes therefore preclude the placement of *Limbatochlamys* in the Geometrini. However the undivided uncus is retained in a number of genera of Pseudoterpnini: of these only 1 which we have examined has a well-developed uncus widening to a bilobed triangular base, clearly separated from the socii, as in the present genus. This is *Psilotagma* Warren, 1894, a monotypic genus based on the species *P. decorata* Warren from Bhutan, the external features of which are more-clearly related to the Pseudoterpnini than are those of *Limbatochlamys*. Externally, this species has little resemblance to members of *Limbatochlamys*. However in the male genitalia, the uncus in *P. decorata* (Fig. 18) is very similar to that in the present genus, although the socii are

rather differently shaped. *Psilotagma decorata* also has a sclerotized sacculus which might be homologous with that in *Limbatochlamys*; it lacks any sclerotized structure on the costa, but this is also lacking in one of the species of *Limbatochlamys* described above. The aedeagus and vesica are rather similar to those of *Limbatochlamys*. On the basis of the above, and the absence of any features which relate the genus to any other tribal grouping, we tentatively suggest that *Limbatochlamys* should be placed in the Pseudoterpnini, close to *Psilotagma*. *Limbatochlamys* might prove to be a sister group to *Psilotagma* within the Pseudoterpnini, but determining this would require a formal cladistic analysis of the entire Pseudoterpnini to establish the exact relationships of these taxa to each other and to other related genera.

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