



A study on the genus *Glaucorhoe*, with descriptions of two new species from China (Lepidoptera: Geometridae: Larentiinae)

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Abstract

Chinese material of the Palearctic geometrid genus *Glaucorhoe* Herbulot is reassessed, with the description of two new species *G. magaria* **sp. nov.** and *G. exilaria* **sp. nov.** Illustrations of adults and genitalia of all the species are provided.

Key words: Lepidoptera, Geometridae, *Glaucorhoe*, new species, China

Introduction

The genus *Glaucorhoe* was erected by Herbulot (1951) based on the type species *Cabera unduliferaria* Motschulsky, 1860, mainly on characters of the male genitalia. The genus is placed in the tribe Xanthorhoini as defined by Pierce (1914). Prout (1938) considered *Emmelesia albostrigaria* Bremer, 1864 as a subspecies of *G. unduliferaria*, and named a new subspecies *G. unduliferaria geraea* from Kunkala-Shan, Sichuan, China. Xue & Zhu (1999) provided the first records of *G. unduliferaria albostrigaria* (Bremer, 1864) in Northeast China, which was treated as a synonym by Scoble (1999). Choi (2002) recorded *G. unduliferaria* (Motschulsky, 1861) in Korea.

When two specimens of *Glaucorhoe* from Qinghai and Henan provinces were selected for molecular analysis to reconstruct the phylogeny of the Larentiinae, we discovered that their sequences differed at 81 variable sites in the investigated 661 bp fragment of the COI gene (i.e., 12.25 percent sequence divergence; GenBank accession nos. EU797613, EU797614). These specimens from Qinghai and Henan province were postulated to differ at the species level (Hebert *et al.* 2003). Following up on these molecular data, we conducted further morphological analysis on a series of specimens of this genus from different localities in China. The results from the morphological study parallel the molecular findings: material from Qinghai and Gansu, as well as from Shaanxi have different genitalia from material collected in Heilongjiang, Shanxi, Henan, Hubei, Sichuan as well as in Jilin where there is some variability in genitalic characters (unfortunately, DNA sequences could not be obtained from older Shaanxi specimens in museum collections, and no new material has been taken despite many expeditions around Mt. Taibaishan during the past 20 years). Accordingly, we herein recognize two new species of *Glaucorhoe* from the Chinese fauna.

Materials and methods

Specimens studied were obtained from the following institutions: the Collection of the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS); the Collection of the Northwest Agriculture and Forestry University (NWAUFU); Zoologische Staatssammlung, Munich, Germany (ZSM); Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany (ZFMK); and Museum für Naturkunde der Humboldt-Universität zu Berlin, Germany (MNHU).

Taxonomy

Glaucorhoe Herbulot, 1951

Glaucorhoe Herbulot, 1951, *Revue Fr. Lepid.*, 13: 26.

Type species: *Cabera unduliferaria* Motschulsky, [1861] 1860, *Etudes Ent.*, 9: 36, by original designation.

Redescription. *Body*: Antennae filiform in both sexes, male with short cilia, length of each segment in the middle longer than width. Frons flat, bearing a cluster of developed forelock under the frons. Proboscis well developed. Labial palpus rough scaled, about 1/4–1/3 length extending beyond frons. Foreleg normal. Hind tibia with two pairs of spurs, the length of inner ones about two times the outer ones in each pair. Male with a pair of well developed coremata between the seventh and eighth sternite.

Wing-shape: Forewing with costal margin protuberant at base, slightly concave in the middle and shallowly arced beyond middle; apex nearly rectangle and obtuse; anal angle rounded; outer margin curved and slightly wavy; inner margin straight. Hindwing with costal margin straight; apex and anal angle rounded; outer margin wavy; inner margin straight. Both wings grey to yellowish grey, with several white wavy transverse lines.

Venation (Fig. 1): Forewing: with two areoles, the first areole small. R_1 diverging before the distal angle of the second areole, R_5 from the distal angle, M_1 shortly stalked with lower margin of areole, cell slightly shorter than half length of forewing, discocellulars curved in the middle, the lower part strongly slanted outwards; M_3 and CuA_1 separate. Hindwing: $Sc+R_1$ anastomosing with R_s to near the end of cell; R_s and M_1 stalked; discocellulars incurved above middle, M_2 slightly close to M_1 ; M_3 and CuA_1 separate; 3A present.

Male genitalia. Uncus long and stout, coniform, strongly sclerotized, ciliate. Tegumen moderately sized. Valva short and narrow, divided into two parts: costal lobe and sacculus; costal lobe slightly sclerotized, with posterior end rounded or occasionally nearly truncate, with a row of dense setae ventrally; sacculus membranous, ventral margin slightly to moderately protruding and sclerotized at base, posterior end blunt or sometimes slightly pointed. Saccus triangular, blunt. Juxta a transverse, curved sclerotized band at base, with a short process extending anteriorly and a long arm extending posteriorly at both ends. Aedeagus long and narrow, cornutus a row of spines on vesica, manica with a cluster of spines.

Female genitalia. Apophyses anteriores very short, apophyses posteriores long and narrow. Tergum, pleurum of the eighth segment and sterigma strongly sclerotized, forming a large complex, armor-shaped sclerite. Ostium bursae and ductus bursae sclerotized. Corpus bursae small, longer than ductus bursae, membranous, without signum.

Distribution. China, Russia (Amur district, Far East district, Ussuri district), Japan, Korea.

Glaucorhoe unduliferaria (Motschulsky, 1861)

Cabera unduliferaria: Motschulsky, [1861]1860, *Etudes Ent.* 9: 36. (Japan)

Emmelesia albostrigaria: Bremer, 1864, *Mém. Acad. Sci. St. Pétersb.* (7) 8 (1): 85. (Russia: Amur)

Cabera eliela: Butler, 1878, *Ann. Mag. Nat. Hist.* (5)1: 403.

Cidaria (Euphyia) unduliferaria: Prout, 1938, *In Seitz, Macrolepid. World 4 (Suppl.)*: 150.

Euphyia unduliferaria: Prout, 1939, *ibid.* 12: 282.

Xanthorhoe unduliferaria: Inoue, 1944, *Trans. Kansai Ent. Soc.* 14(1): 69.

Glaucorhoe unduliferaria: Herbulot, 1951, *Revue Fr. Lepid.* 13: 26.

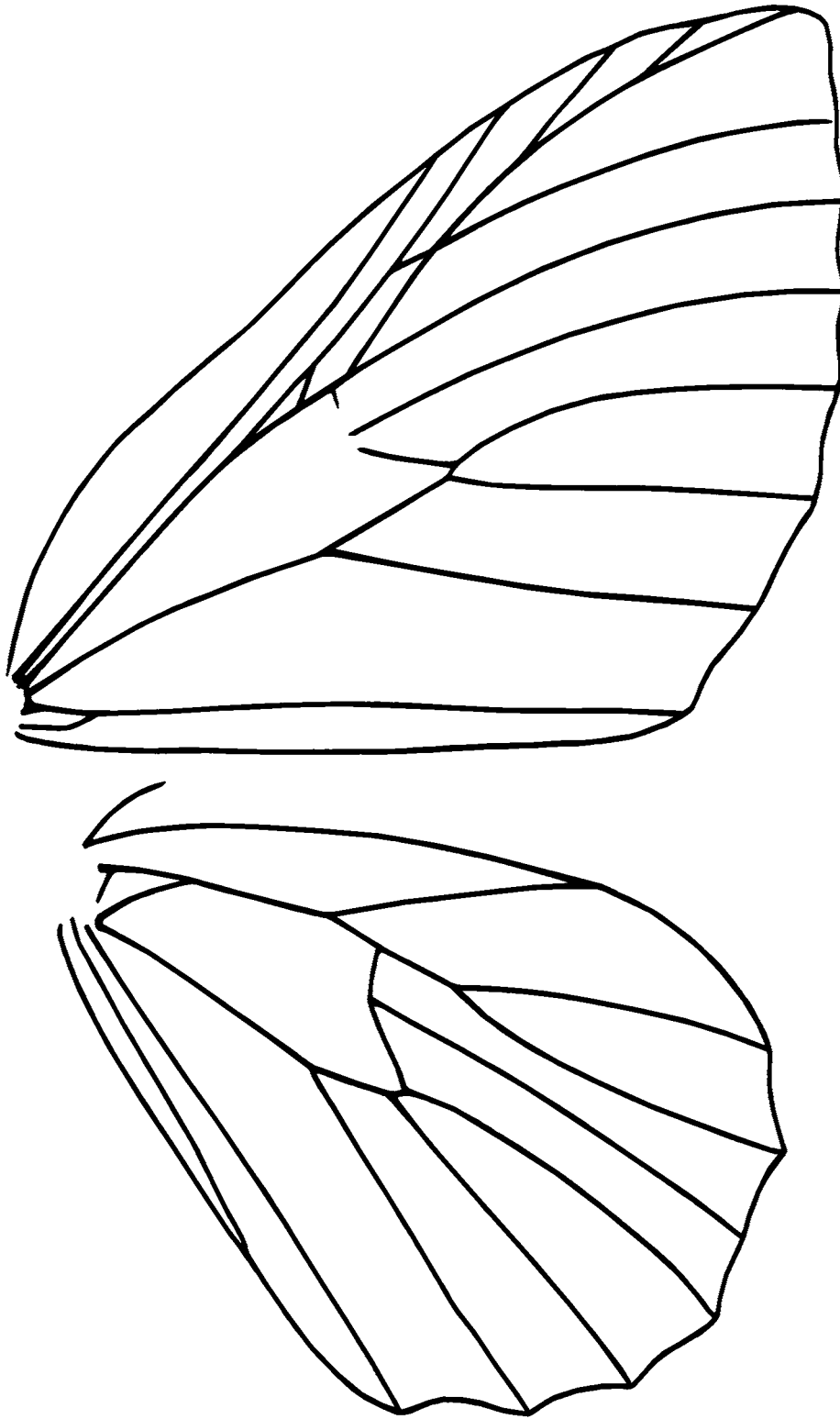
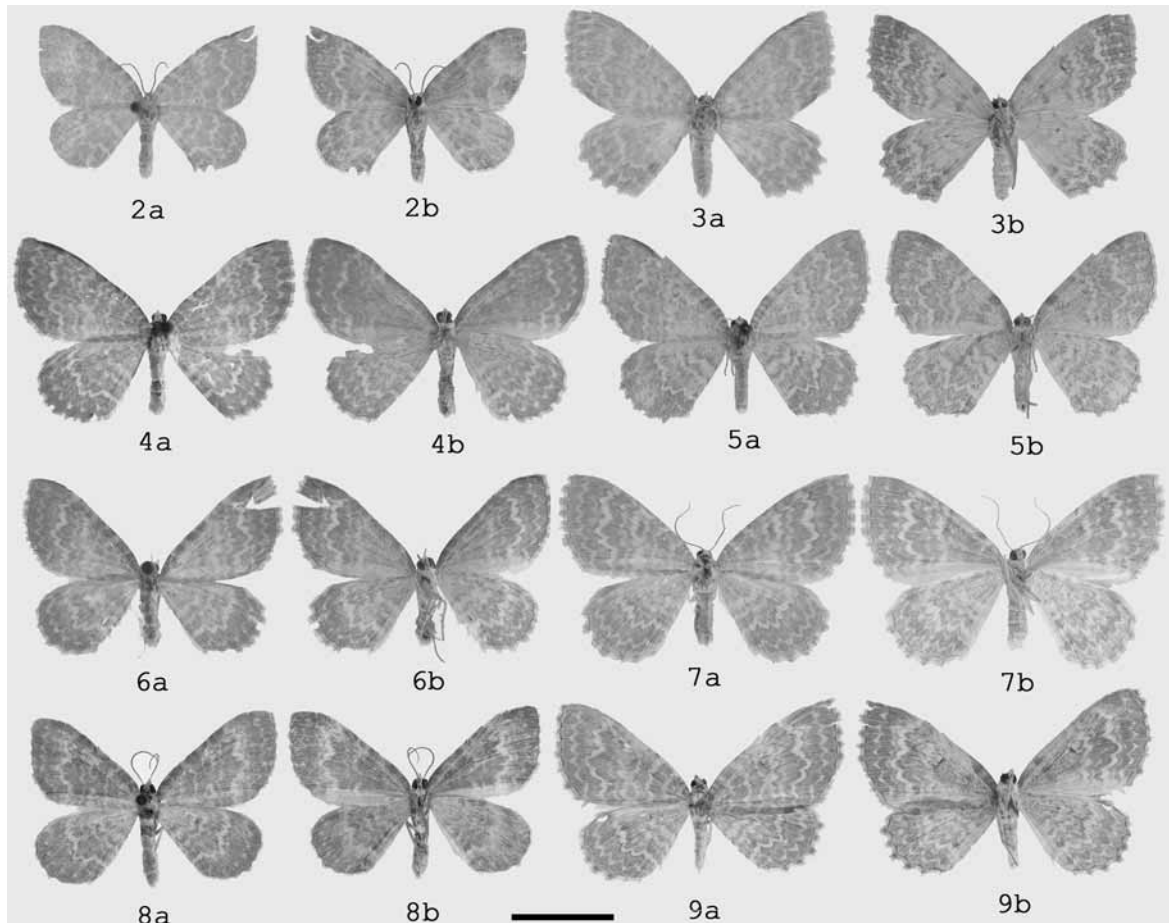


FIGURE 1. Venation of *Glaucorhoe unduliferaria geraea* (Prout).



FIGURES 2–9. Adults of *Glaucorhoe*. 2, *G. unduliferaria unduliferaria* (Motschulsky) (♂, Jilin); 3, *G. unduliferaria unduliferaria* (Motschulsky) (♀, Heilongjiang); 4, *G. unduliferaria geraea* (Prout) (♂, Sichuan); 5, *G. unduliferaria geraea* (Prout) (♀, Hubei); 6, *G. magaria* Wu & Xue, **sp. nov.** (♂, Gansu); 7, *G. magaria* Wu & Xue, **sp. nov.** (♀, Gansu); 8, *G. exilaria* Han & Xue, **sp. nov.** (♂, Shaanxi); 9, *G. exilaria* Han & Xue, **sp. nov.** (♀, Shaanxi). (a, upperside; b, underside) Scale bar = 1 cm.

***Glaucorhoe unduliferaria unduliferaria* (Motschulsky, 1861)**

Figs. 2–3.

Redescription. *Body:* Head, dorsum of thorax and abdomen white to yellowish-white. Frons white. Labial palpus yellowish-white, in male slightly darker than female.

Wings: Length of forewing: ♂13–14 mm, ♀14–15 mm. Wings yellowish-grey, tinged with yellowish brown; transverse lines white. Forewing: subbasal, antemedial and medial lines shallowly arced, slightly wavy; middle area with two white lines, the proximal one broad, usually indistinct, the distal one wavy, narrow and weak; postmedial line distinct, serrate, with a large pointed angle between M_3 and CuA_1 ; submarginal line dentate, slightly gloomy; terminal line dark grayish brown, interrupted at ends of veins. Hindwing: lines (from the proximal line of the middle area to submarginal line) continuous with that of forewing. Fringes concolorous with wings. Underside: dull brown; lines same as that of upperside, but dull and indistinct, especially on the proximal half of forewing; forewing with a very weak dark brown discal spot.

Male genitalia (Figs. 10, 11, 16, 17, 22). General characters as in redescription of the genus. The costal lobe slightly longer than sacculus; the width and the shape of costal lobe of valva somewhat various in different specimens, in some materials, the end of the costal lobe cone-shaped and distinctly narrower than the mid-

dle width (Fig. 10). Long setae at the end of costal lobe curved and pointed inwards. Length of saccus about 1/4 of uncus.

Female genitalia (Fig. 26). As in redescription of the genus.

Material examined. IZCAS: Heilongjiang: Yabuluoni, 1940.VII.29–30, 2♀; Heilongjiang: Dailing, 390 m, 1962.VII.28, 1♀; Heilongjiang: Wuchangxian Victory Forest Farm, 1970.VII.8, 1♀; Jilin: Manjiang, 1955.VII.20, 12♂2♀; Jilin: Changbaishan, 1974.VIII.21, coll. Yang Zhiming, 1♀; Jilin: Linjiang Daxi Forest Form, 1983.VIII.25, coll. Wu Zhengliang & Hua Baozhen, 1♂ (ex. coll. NWAUFU). NWAUFU: Jilin: Naozhi Yonghu, 1983.VII.23, coll. Wu Zhengliang & Hua Baozhen, 2♀. ZSM: Pogradina, Mandchourie, 1913, 1♂; Russia, Vladivostok, 1921.VIII.9, leg. Berg, 1♀; Vladivostok, Sibérie Or., 1925.VIII.4, 1♂; ibidem, 1925.VIII.6–8, 5♂; Russia-SE, vladivostoc env., 1989.VII.18, leg. A. Berg, 1♂; Russia S. R., Vladivostok dist. 20, Nachodka, 1994.VII, leg. Kuznetsov, 5♂6♀; Japan, Yatsugatake, Nagano Pref., 1946.VII, 3♂2♀. ZFMK: Gaolintse (Manchuria), 1949.VII.18, leg. V. Alin, 1♂; Mandschuria Maoerschan (= Mauschan), VII, 1♀; Utikongo (500 m) im Kon-gosan (Mittel-Korea), 1940.VII.25, H. Höne, 1♀. MNHU: Amur, 1♂1♀; Amur centr. (Radde), 1903, M. Horb, 2♂; Wladivostok, S. Ussurigebiet, 1921.VII.25, N. Kardakoff, 3♂; Narva, S. Ussurigebiet, 1921.VII.29, N. Kardakoff, 1♂; Japonia (Nikko), W. Blthgen, 1; Japan, coll. H. Pryer, 1♂1♀.

Distribution. China (Heilongjiang, Jilin, Inner Mongolia), Russia (Amur district, Far East district, Ussuri district), Japan, Korea.

Glaucorhoe unduliferaria geraea (Prout, 1938)

Figs. 4–5.

Cidaria (Euphyia) unduliferaria geraea: Prout, 1938, *In Seitz, Macrolepid. World 4* (Suppl.): 150, pl.14: a. (Sichuan: Kunkala-Shan)

Euphyia unduliferaria geraea: Prout, 1939, *ibid.* 12: 282.

Glaucorhoe unduliferaria geraea: Xue and Zhu, 1999, *In Fauna Sinica, Insecta*, Vol. 15: 606.

Redescription. *Wings*: Length of forewing: ♂13–15 mm, ♀16 mm. Body slightly larger than that of nominate subspecies *G. unduliferaria unduliferaria*; wings more greyish, yellowish-brown tone nearly invisible; lines narrower than that of *G. unduliferaria unduliferaria*. The proximal line in middle area of forewing and the first line of hind wing quite narrow, linear.

Male genitalia (Figs. 12, 13, 18, 19, 23). As in redescription of the nominate subspecies. Posterior end of costal lobe nearly truncate (Fig. 12).

Female genitalia (Fig. 27). As in redescription of the genus.

Material Examined. IZCAS: Shanxi: Huoxian, 1550 m, 1972.VII.28–29, coll. Wang Shuyong, 2♂; Henan: Songxian Baiyunshan, 1400 m, 2003.VII.9, coll. Lv Yanan, 1♂; ibidem, 1300 m, 2002.VII.19–25, 1♀; Hubei: Shennongjia, 1800 m, 1981.VIII.1–2, coll. Han Yanheng, 2♀; Sichuan: Gonggashan Yanzigou, 2350 m, 1983.VI.8, coll. Chai Huaicheng, 1♂; Sichuan: Nanping Jiuzhaigou, 2500 m, 1983.IX.4, coll. Wang Ruiqi, 1♂; ibidem, 2600 m, 1983.IX.4, coll. Chai Huaicheng, 1♀. ZFMK: Tien Tsuen [Sichuan], 1897, ex. RP. Déjean, 1♂; Mou-Pin, 1897, ex RP. Déjean, 1♀; Mokanshan, Prov. Chekiang, 1930, H. Höne, 1♀. MNHU: Wa-Shan [Sichuan], 6000 ft, 1889.VI, coll. A. E. Pratt, 1♂1♀; Pu-tsu-Fang [Sichuan], 9820 ft, 1890.VI & VII, coll. Native, 1♂.

Distribution. China (Shanxi, Henan, Zhejiang, Hubei, Sichuan).

Glaucorhoe magaria Wu & Xue, sp. nov.

Figs. 6–7.

Description. *Body*: Antennae filiform in both sexes, male with short cilia, length of each segment in the mid-

dle longer than width. Frons flat, white, with a cluster of developed forelock under the frons. Labial palpus white-yellow, rough scaled, about 1/4–1/3 length extending beyond frons. Dorsum of thorax and abdomen, and upper half of lateral side of the latter dark grey mixed with white. Venter of thorax and abdomen, lower half of lateral side of abdomen whitish. Hind tibia with two pairs of spurs, the length of inner ones about two times the outer ones in each pair. Male with a pair of well developed coremata between the seventh and eighth sternite.

Wings: Length of forewing: ♂13–15 mm, ♀15–16 mm. Wings grey to yellowish-grey, intermixed with little cyan, with several white wavy transverse lines. Forewing: subbasal, antemedial and medial lines shallowly arced, slightly wavy; middle area with two white lines, the proximal one broad and often forming a narrow band, generally indistinct, the distal one wavy, quite narrow and weak; postmedial line distinct, serrate, protruding outward between M_3 and CuA_1 ; submarginal line dentate; terminal line dark grayish brown. Hind wing: lines (from the proximal line of the middle area to submarginal line) continuous with that of forewing. Fringes concolorous with wings. Underside: dull brown; subbasal, antemedial and medial lines of forewing absent, other lines same as that of upperside; discal spot visible on forewing, indistinct.

Male genitalia (Figs. 14, 20, 24). Uncus long and stout, coniform, well sclerotized, ciliate. Valva short and narrow, costal lobe quite narrow, less than one half of sacculus in width in the middle, much longer than sacculus, posterior end blunt, ventral setae much denser on both ends, the long setae at the posterior end of costal lobe straight and pointed outwards; sacculus quite short, posterior end blunt, ventral margin protruding near base, incurved in the middle. Saccus triangular but blunt. Juxta, aedeagus as in redescription of the genus.

Female genitalia (Fig. 28). As in redescription of the genus.

Diagnosis. The wing pattern of *G. magaria* is close to that of *G. unduliferaria*. The new species is characterized by its male genitalia: the costal lobe of the valva is longer and narrower than the sacculus, whereas in *G. unduliferaria* the costal lobe is only slightly longer and narrower than the sacculus; long setae at the posterior end of costal lobe are straight and pointed outwards in *G. magaria*, not curved and pointed inwards as in *G. unduliferaria*; the ventral margin of the sacculus in *G. magaria* is more protuberant than in *G. unduliferaria*.

Material Examined. Holotype, ♂, Gansu: Yongdeng Liancheng, 2000 m, 1987.VIII, coll. Meng Feng (IZCAS). Paratypes (9♂13♀): IZCAS: Gansu: Yongdeng Turgou, 2280 m, 1991.VII.25–29, coll. Xue Dayong, 3♂3♀; ibidem, 2600 m, 2005.VIII.8, coll. Xue Dayong, 1♀; Gansu: Yongdeng Liancheng, 2100 m, 1987.VII, coll. Meng Feng, 1♂; ibidem, 1900 m, 1987.VIII, coll. Meng Feng, 1♂; ibidem, 1900 m, 1987.VII, coll. Meng Feng, 1♀; ibidem, 2000–2100 m, 1987.VIII, coll. Meng Feng, 2♀; Gansu: Yongdeng Liancheng Forest Farm Turgou, 2600 m, 2005.VIII.8, coll. Li Jing, 2♂1♀; ibidem, coll. Han Hongxiang, 4♀; Qinghai: Huzhu Beishan Forest Farm Langshidang, 2600 m, 2005.VIII.7, coll. Han Hongxiang, 2♂1♀.

Etymology. The name is derived from the Latin *magus* (magic).

Distribution. China (Gansu, Qinghai).

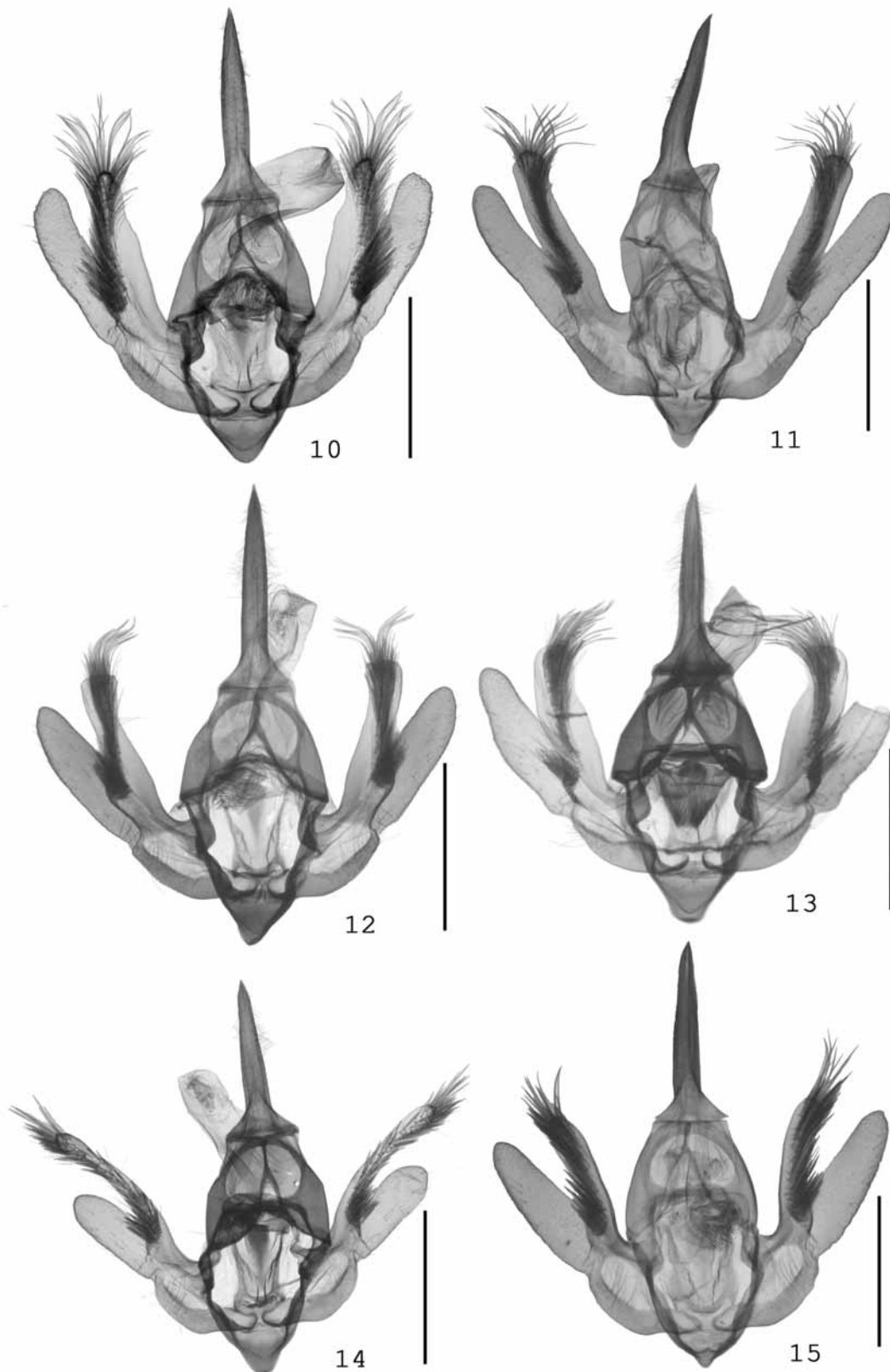
Glaucorhoe exilaria Han & Xue, sp. nov.

Figs. 8–9.

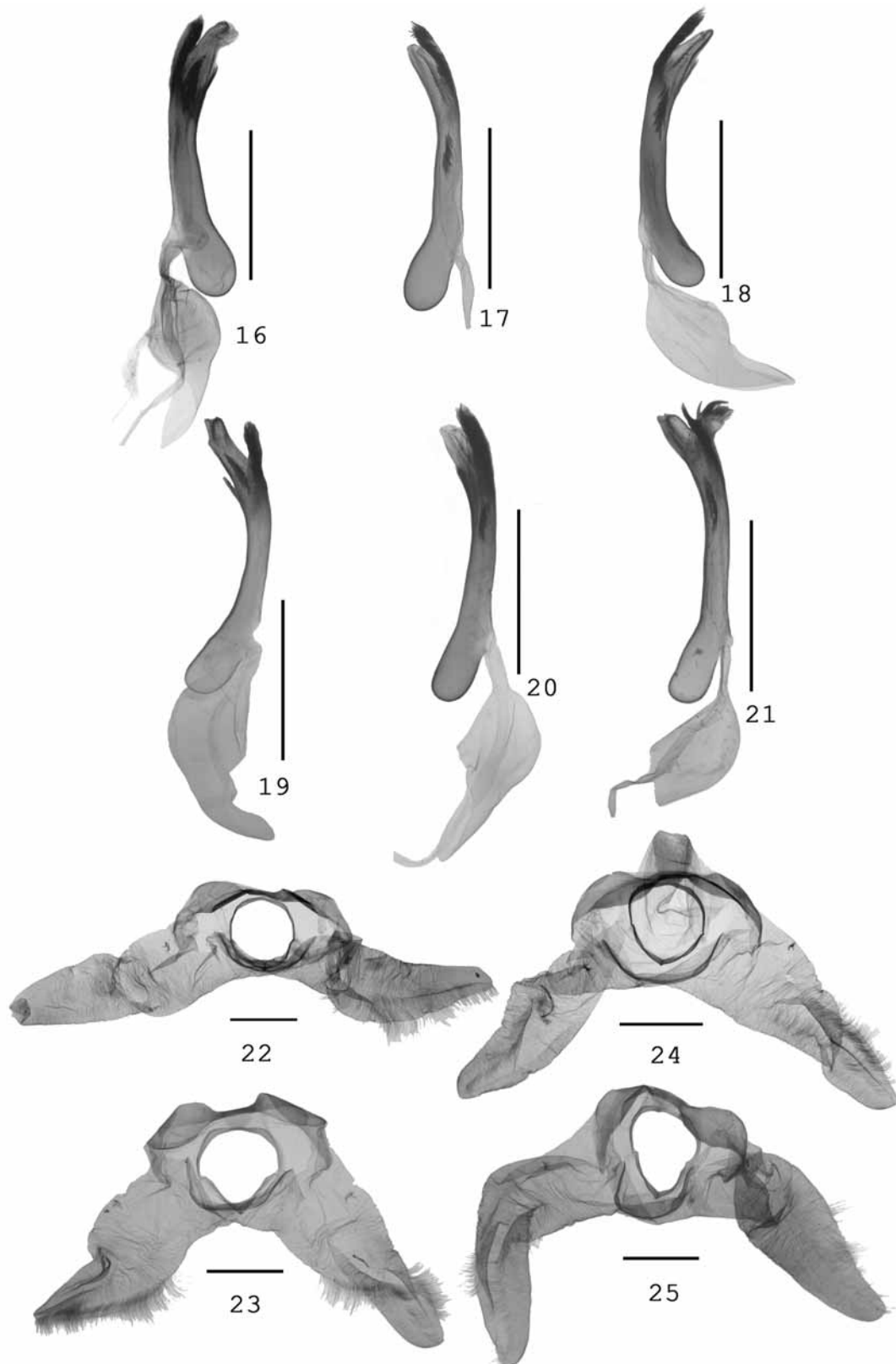
Description. *Body:* Head, body and wing patterns same as the previous two species. Length of forewing: ♂13–14 mm, ♀14–15 mm.

Male genitalia (Figs. 15, 21, 25). Uncus long and stout, coniform, well sclerotized, ciliate. Valva with posterior ends of costal lobe and sacculus blunt, the former slightly shorter and distinctly narrower than the latter, slightly more than one half of sacculus in width; the long setae at the posterior end of costal lobe straight and pointed outwards; ventral margin of sacculus protrudent near base. Saccus short, with a tiny blunt process. Juxta, aedeagus as in redescription of the genus.

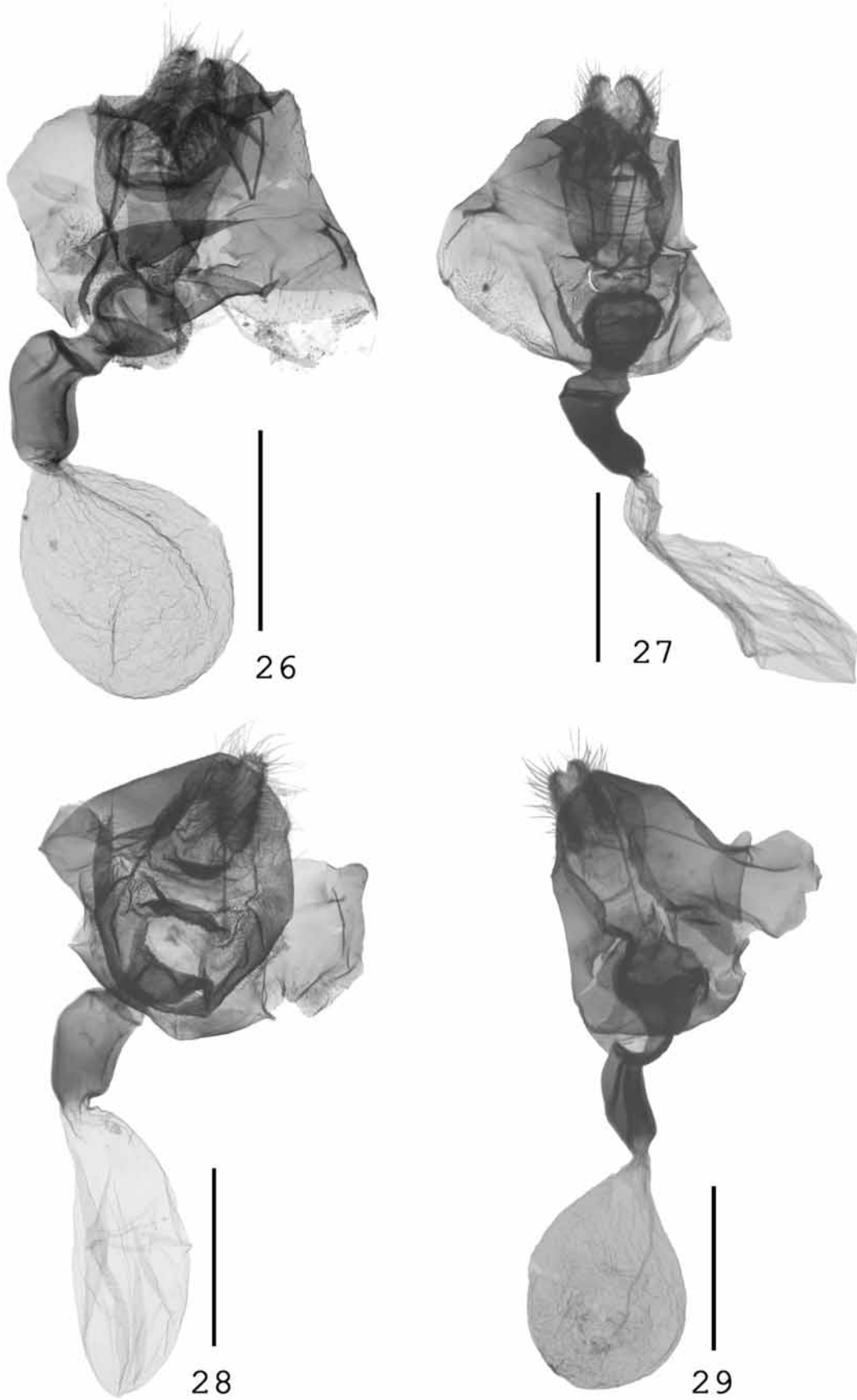
Female genitalia (Fig. 29). As in redescription of the genus.



FIGURES 10–15. Male genitalia. 10, *G. unduliferaria unduliferaria* (Motschulsky) (Jilin); 11, *G. unduliferaria unduliferaria* (Motschulsky) (Jilin); 12, *G. unduliferaria geraea* (Prout) (Henan); 13, *G. unduliferaria geraea* (Prout) (Sichuan); 14, *G. magaria* Wu & Xue, **sp. nov.** (Gansu); 15, *G. exilaria* Han & Xue, **sp. nov.** (Shaanxi). Scale bar = 1 mm.



FIGURES 16–21. Aedeagus. 16, *G. unduliferaria unduliferaria* (Motschulsky) (Jilin); 17, *G. unduliferaria unduliferaria* (Motschulsky) (Jilin); 18, *G. unduliferaria geraea* (Prout) (Henan); 19, *G. unduliferaria geraea* (Prout) (Sichuan); 20, *G. magaria* Wu & Xue, **sp. nov.** (Gansu); 21, *G. exilaria* Han & Xue, **sp. nov.** (Shaanxi). **22–25.** Coremata. 22, *G. unduliferaria unduliferaria* (Motschulsky) (Jilin); 23, *G. unduliferaria geraea* (Prout) (Sichuan); 24, *G. magaria* Wu & Xue, **sp. nov.** (Gansu); 25, *G. exilaria* Han & Xue, **sp. nov.** (Shaanxi). Scale bar = 1 mm.



FIGURES 26–29. Female genitalia. 26, *G. unduliferaria unduliferaria* (Motschulsky) (Jilin); 27, *G. unduliferaria gergaea* (Prout) (Henan); 28, *G. magaria* Wu & Xue, **sp. nov.** (Gansu); 29, *G. exilaria* Han & Xue, **sp. nov.** (Shaanxi). Scale bar = 1 mm.

Diagnosis. The wing shape and patterns of *G. exilaria* are close to those of *G. unduliferaria* and *G. magaria*, but it differs genitally: the length of the saccus is less than 1/5 of the uncus in *G. exilaria*, shorter than in *G. unduliferaria* and *G. magaria*, in which the length of the saccus is circa 1/4 of the uncus; in *G. exilaria*, the middle width of the costal lobe is slightly more than one half of the sacculus, whereas in *G. magaria*, the middle width of the costal lobe is less than one half of the sacculus, and in *G. unduliferaria* both parts are almost the same width; *G. exilaria* also differs from *G. unduliferaria* and *G. magaria* in having a costal lobe shorter than the sacculus; *G. exilaria* is distinguishable from *G. unduliferaria* in that the long setae at the posterior end of costal lobe are straight and pointed outwards.

Material Examined. Holotype, ♂, Shaanxi: Taibaishan Shangbaiyun, 1956.VII.24 (NWAUFU). Paratypes (31♂22♀): IZCAS: Shaanxi: Taibaishan Shangbaiyun, 1954.VII.24, 1♂; ibidem, 1956.VII.24, 1♂1♀; Shaanxi: Taibaishan Dadian, 1956.VII.24–27, 3♂ (ex. coll. NWAUFU). NWAUFU: Shaanxi: Taibaishan Shangbaiyun, 1956.VII.23–24, 3♂; Shaanxi: Taibaishan Dadian, 1956.VII.25–26, 2♂1♀; Shaanxi: Taibaishan Ping'anshi, 1956.VIII.1, 1♀. ZFMK: Tapaishan im Tsingling, Sued-Shensi (China), 1935. VII.23, H. Höne, 1♂; ibidem, 1935.VII.29, 1♂; ibidem, Ca. 1700 m, 1936.V.19, 1♂; ibidem, 1936.VII.12, 1♀; ibidem, 1936.VII.25, 1♂; ibidem, 1936.VIII.5-9, 7♂3♀; ibidem, 1936.VIII.12-13, 2♂4♀; ibidem, Ca. 3000 m, 1936.VI.15, 1♂; ibidem, 1936.VIII.9-12, 2♂4♀; ibidem, 1936.VIII.19, 1♀; Kansu mer., Tsing-schui, Liu-pin-schan, 2000 m, VII, 3♂2♀; Kansu orient, H wei si, Tsinlingschan montes occ., 1500 m, V, 1♀; Kansu mer. or., Lihsien, Peilingschan mer., 3000 m, VII, 1♂1♀; Minchow, Süd-West-Kansu, 2000-3000 m, 1933.VII, coll. Dr. Wehrli, 1♂1♀; Tauchow, Süd-West-Kansu, 2000-3000 m, 1933.VII, coll. Dr. Wehrli, 1♂; Niamushan, 30 km östl Tauchow, S-W-Kansu, 1933.VII, coll. Dr. Wehrli, 1♀.

Etymology. The name is derived from the Latin *exilis* (tiny).

Distribution. China (Shaanxi, Gansu).

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