



<https://doi.org/10.11646/zootaxa.4514.3.8>

<http://zoobank.org/urn:lsid:zoobank.org:pub:3B8AA0DA-0638-4049-BDF6-9B040591EAF2>

Aquilargilla gen. nov., a new genus of Sterrhinae from China with description of two new species (Lepidoptera, Geometridae)

LE CUI^{1,2}, DAYONG XUE¹ & NAN JIANG^{1,3}

¹Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Beijing 100101, China

²University of Chinese Academy of Sciences, Shijingshan District, Beijing 100049, China

³Corresponding author. E-mail: jiangn@ioz.ac.cn

Abstract

A new genus *Aquilargilla* gen. nov., and two new species *Aquilargilla ceratophora* sp. nov., *Aquilargilla basifixa* sp. nov. are described from China. Illustrations of adults and genitalia are presented. The new genus is assigned to Scopulini on the basis of the morphological evidence. Comparisons of *Aquilargilla* with closely related genera are also provided.

Key words: morphology, Scopulini, systematics, taxonomy

Introduction

The subfamily Sterrhinae is one of the three most species-rich subfamilies of Geometridae, with more than 2900 described species in 99 genera and seven tribes in the world (Parsons *et al.* 1999; Scoble & Hausmann 2007). The species of the subfamily are distributed worldwide, except in Greenland, Iceland and some smaller islands of the Pacific (Gaston *et al.* 1995, Hausmann 2004, Sihvonen & Siljander 2005).

The Scopulini, as the largest tribe within the Sterrhinae, are a cosmopolitan group composed of 25 genera and about 900 described species (Parsons *et al.* 1999; Sihvonen 2003, 2005; Hausmann 2004; Sihvonen & Kaila 2004). Some new species of Scopulini taxa were recently described (Hausmann 2009; Sihvonen *et al.* 2010; Xue *et al.* 2018).

During the study of material obtained from recent expeditions and re-examination of the collection of IZCAS and ZFMK, we found an interesting new genus in the subfamily Sterrhinae. Our morphological study shows that the new genus falls clearly within the tribe Scopulini on the basis of the following characters: the medial ridge on the epinotum of the male metathorax is absent; the posterior margin of the 8th tergite is concave; the uncus and gnathos are absent; the socii are separate; the valvula and the sacculus of the valva are separate; the signum is an oval field of small separate spines, pointing away from the centre (Holloway 1997; Hausmann 2004; Sihvonen & Kaila 2004; Sihvonen 2005). Moreover, the new genus has some features in common with some taxa of the genus of *Dithalama* and *Somatina* in the male 8th tergite and the genitalia.

However, *Aquilargilla* gen. nov. described in this paper is distinctive from existing genera within the tribe Scopulini in the combination of the following characters: the male antennae is sub-quadrirpinate; the posterior margin of the male 8th tergite has a pair of narrow spine-like processes; the anterior margin of the male 8th sternite is strongly concave, and the cerata are horn-like, arising from the ventral side of the mappa; the inner margin of the tegumen has one or two pairs of processes; the juxta is quadrate and with a pair of lateral lobes.

The aim of this paper is to describe the new genus *Aquilargilla* gen. nov., its type species *Aquilargilla ceratophora* sp. nov. and another new species *Aquilargilla basifixa* sp. nov., to provide clear diagnostic characters in relation to other genera, and to illustrate the adults and genitalia.

Materials and methods

Specimens of *Aquilargilla* were obtained from the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS) and Forschungsmuseum Alexander Koenig, Bonn, Germany (ZFMK). Terminology for wing venation follows the Comstock-Needham System (Comstock 1918) as adopted for Geometridae by Scoble (1992) and Hausmann (2001); that for genitalia follows Pierce (1914, reprint 1976), Klots (1970) and Nichols (1989). Photographs of moths were taken with a digital camera. Composite images were generated using Auto-Montage software version 5.03.0061 (Synoptics Ltd). The plates were compiled using Adobe Photoshop software 7.0. Ink (Adobe Systems Software Ireland Ltd).

Taxonomy

Aquilargilla gen. nov.

Type species. *Aquilargilla ceratophora* sp. nov.

Gender feminine.

Description. *Head.* Antennae sub-quadripectinate (longly bipectinate with short additional branches from base, ventral side of each segment) in male; filiform in female. Forewing length: ♂♀ 14–16 mm. Frons slightly protruding. Vertex usually pure white. Labial palpi slightly extending beyond frons. *Thorax.* Male hind tibia without spurs, not dilated and without hair-pencil in male, two pairs of spurs present in female. Frenulum well developed in both sexes. Forewing with apex pointed, hind wing with apex rounded. Postmedial line wavy. Discal spots on fore- and hind wings usually black and faint. *Venation.* Forewing with one or two areoles within species; veins R₂₋₄ always from apical angle of areole, veins R₁ and R₅ distally or directly from apex; veins R₅ and R₂₋₄ sometimes shortly stalked. Vein M₂ closer to M₁; Veins M₃ and CuA₁ unstalked. Hind wing with veins Rs and M₁ usually short-stalked, sometimes separate and from apical of discal cell; M₃ and CuA₁ separated.

Abdomen. Male 8th tergite with posterior margin concave and forming a pair of narrow spine-like lateral processes. Male 8th sternite with anterior margin strongly concave, cerata horn-like, arising from ventral side of mappa, mappa rounded.

Male genitalia. Uncus and gnathos absent. Socii composed of a pair of small processes. Tegumen with one or two pairs of processes on inner margin. Valvula and sacculus separate. Juxta quadrate with a pair of lateral lobes. Coremata present (easily lost during preparation). Saccus concave medially. Aedeagus strongly curved; vesica with a small patch of tiny spines.

Female genitalia. Papillae anales rounded. Lamella antevaginalis well developed; lamella postvaginalis not developed. Ostium sclerotized. Ductus bursae narrow. Corpus bursae large and elongate; signum with a patch of small and scobinate sclerites, pointing away from longitudinal axis.

Diagnosis. The male antennae in *Aquilargilla* is sub-quadripectinate and uncommon in the tribe Scopulini, which is similar to *Idea serpentata* (Hüfnagel, 1767) of the tribe Sterrhini, but the rami in *Aquilargilla* are much longer. The posterior margin of the male 8th tergite in *Aquilargilla* is concave and forms a pair of lateral spines; this character is also present in the type species of the genus *Dithalama* (*D. cosmospila* Meyrick, 1888). The shape of the male 8th sternite in *Aquilargilla* is unique in the Scopulini, as the anterior margin is strongly concave, and the cerata are present, arising from the ventral side of the mappa. In the male genitalia, the processes on the inner side of the tegumen in *Aquilargilla* are atypical but not unique among the Scopulini, as a similar structure is found in *Somatina mendicaria* (Leech, 1897) and *Dithalama*. The juxta in *Aquilargilla* is unique in the Scopulini, as it is quadrate with a pair of lateral lobes.

Etymology. The generic name is derived from the Latin dark (aquilus-) and clay (argilla), corresponding to the dark colour of the wings of the type species. The name is to be regarded as feminine.

Remarks. The DNA work was attempted but failed in our study.

***Aquilargilla ceratophora* sp. nov.**

(Figs 1–2, 4–6, 10, 12)

Description. *Head.* Antennae with dorsal side blackish grey, base diffused with white scales; sub-quadruplicate in male, pectinations about twice diameter of shaft covered with long cilia, V-shaped process arising from base of shaft with long cilia apically (Fig. 12); filiform with very shortly cilia in female. Frons black on posterior part and becoming gradually pale anteriorly. Vertex pure white. Labial palpi black dorsally, yellowish grey ventrally, slightly extending beyond frons. *Thorax.* Patagia yellowish brown to grey. Tegulae covered with grey coloured scales. Hind tibia not dilated, without spurs in male and with two pairs of long spurs in female. Hind tarsus in male about three-quarters of hind tibia. Forewing with apex pointed and slightly falcate, outer margin straight; hind wing with apex rounded. Wings blackish grey or greyish brown with transverse lines narrow, wavy, black and indistinct. Forewing with costa deep-coloured. Discal spots short, bar-shaped, black and indistinct; postmedial lines forming a small acute protrusion on vein M_2 ; fringes greyish black on all wings.

Abdomen. Male 8th tergite concave on posterior margin, with two sclerotized lateral spines (Fig. 5). Male 8th sternite strongly elongate, strongly concave on anterior margin, cerata stout, horn-like, connected to each other at base (Fig. 6).

Male genitalia (Fig. 4). Uncus and gnathos absent. Socii narrow and short, acute at apex. Tegumen flatted apically, with a pair of stout spine-like processes on inner margin. Valvula broad at basal part, narrow and digitiform at terminal part; sacculus with terminal half finger-like, sharply narrower than basal half and narrower than valvula, a short lateral process present at base of outer margin. Juxta quadrate and concave on posterior margin, with a pair of semicircular lateral lobes, covered with tiny spines on edge. Saccus developed and inflated and concave medially. Aedeagus strongly curved medially and sclerotized, anterior part broad, slightly pointed apically; cornutus a small spinulose patch.

Female genitalia (Fig. 10). Papillae anales oval. Apophyses anteriores about two-thirds of apophyses posteriores in length. Lamella antevaginalis broad and wrinkled, weakly sclerotized; lamella postvaginalis not developed. Ostium strongly sclerotized. Colliculum developed. Ductus seminalis arising from posterior part of ductus bursae. Ductus bursae weakly sclerotized and narrow posteriorly, gradually broadened towards corpus bursae. Corpus bursae larger and oval; signum a large drop-shaped patch of small scobinate sclerites, arranged symmetrically along longitudinal axis.

Diagnosis. The new species can be distinguished from *A. basifixa* by the following characters: the cerata of the male 8th sternite are stouter apically than in *A. basifixa*, and the distance between the cerata is shorter in *A. basifixa*; in the male genitalia, the inner processes of the tegumen are single, short and stout, while *A. basifixa* has two pairs of inner processes of the tegumen, the posterior one is slender and the anterior is one small and rounded at tip; the aedeagus is more strongly curved than in *A. basifixa*; in the female genitalia, the ostium is less sclerotized in *A. basifixa*.

Material examined. Holotype, ♂, **CHINA: Fujian** (IZCAS): Wuyi Shan, Sangang, 700 m, 25–26.VII.2006, coll. Xie Juan (slide No. 3359). Paratypes. **Hubei** (IZCAS): 1♂, Xingshan, Longmenhe, 1300 m, 14.VI.1993, coll. Li Hongxing; 1♂, Shennongjia, Songluo, 920 m, 31.VIII.1981, coll. Han Yinheng; 2♂, Zigui, Jiulingtou, 100–150 m, 11–13.VI.1993, coll. Yao Jian; 1♂, Badong, Sanxia Linchang, 130 m, 26.VI.1993, coll. Yao Jian. **Hunan** (IZCAS): 1♂1♀, Hengyang, Nanyue Linchang, 4–9.X.1980, coll. Li Jutao (slide Nos 3362 & 3363). **Fujian** (IZCAS): 2♂, Sangang, 20.VIII.1979, 3.VII.1982, coll. Song Shimei & Qi Shicheng; 1♂, Wuyi, 4.VII.1982, coll. Jiang Fan. **Guangdong** (IZCAS): 3♂1♀, Renhua, Danxia Shan, 130 m, 28–29.V.2013, coll. Cheng Rui. **Fujian** (ZFMK): 2♂2♀, Kuatun, 2300 m, 27. 40n. Br. 117. 40ö. L. 27.V.1938, 29.V.1938, 26.VI.1938, 22.VI.1946, J. Klapperich & H. Höne (Fukien).

Distribution. China (Hubei, Hunan, Fujian, Guangdong).

Etymology. The species is named on the basis of Greek word *ceratophorus*, 'horn bearing', which relates to the horn-like spurs on the posterior margin of the male 8th sternite.

***Aquilargilla basifixa* sp. nov.**

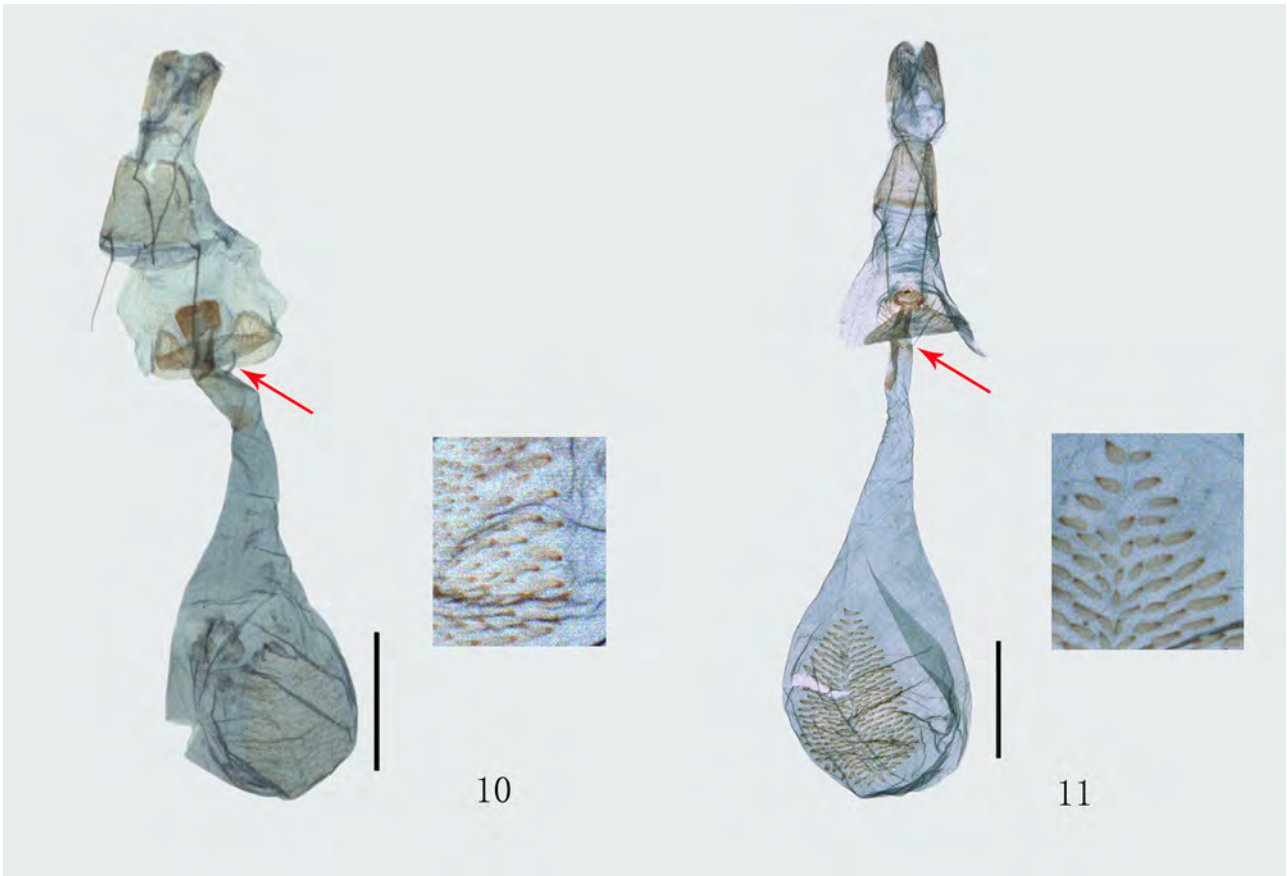
(Figs 3, 7–9, 11)

Description. This new species is externally almost identical to *A. ceratophora*. Male 8th sternite with cerata slender horn-like.

Male genitalia (Fig. 7). Uncus and gnathos absent. Socii small and narrow, acute at apex. Tegumen with two pairs of processes on inner margin, posterior one slender and acute at tip, anterior one small and rounded at tip. Valvula and sacculus digitiform at terminal half; a short finger-like process present at base of valva. Juxta broad and quadrate, concave on posterior margin, with a pair of semicircular lobes on lateral side with spines on edge. Saccus inflated, concave medially. Aedeagus slightly curved, cornuti weak.



FIGURES 1–9. *Aquilargilla* gen. nov. 1–3. Adult. 1. *A. ceratophora*, male, one areole, Fujian, China (holotype, IZCAS); 2. *A. ceratophora*, male, two areoles, Hunan, China (paratype, IZCAS); 3. *A. basifixa*, male, Sichuan, China, two areoles (holotype, IZCAS). Scale bar = 1 cm. 4–6. *A. ceratophora*, Fujian, China (holotype, IZCAS). 4. Male genitalia, P means the posterior pair of processes on inner margin of the tegumen; 5. Male 8th tergite; 6. Male 8th sternite; 7–9. *A. basifixa*, Gansu, China (paratype, IZCAS). 7. Male genitalia, P means the posterior pair of processes on inner margin of the tegumen, A means the anterior pair of processes on inner margin of the tegumen; 8. Male 8th tergite; 9. Male 8th sternite. Scale bar = 1 mm.



FIGURES 10–11. Female genitalia of *Aquilargilla* **gen. nov.** 10. *A. ceratophora*, Hunan, China (paratype, IZCAS); 11. *A. basifixa*, Gansu, China (paratype, IZCAS). The red arrow shows the point of origin of the ductus seminalis. Scale bar = 1 mm.



FIGURES 12. Male antennae of *A. ceratophora*. The red arrow shows the short branch on the ventral side of each segment of the male antennae.

Female genitalia (Fig. 11). Papillae anales oval. Apophyses anteriores about two-thirds of apophyses posteriores in length. Lamella antevaginalis rounded and wrinkled. Ostium weakly sclerotized. Colliculum narrow. Ductus seminalis arising from posterior part of ductus bursae. Ductus bursae partly sclerotized posteriorly,

widening gradually. Corpus bursae oval; signum drop-shaped composed of small and scobinate sclerites opposed to longitudinal axis.

Diagnosis. See under *Aquilargilla ceratophora* sp. nov.

Material examined. Holotype, ♂, **CHINA: Sichuan** (IZCAS): 1♂, Emei Shan, Qingyinge, 800–1000 m, 15–17.IX.1957, coll. Lu Youcai (slide No. 5297). Paratypes. **Gansu** (IZCAS): 2♂2♀, Wenxian, Tielou, 1450 m, 24.VII.1999, coll. Zhu Chaodong (slide No. 3815); 2♀, Chengxian, Feilongxia, 1020 m, 4.VII.1999, coll. Yao Jian (slide No. 3361). **Sichuan** (IZCAS): 13♂, Emei Shan, Qingyinge, 800–1000 m, 17–30.VI.1957, 15–17.IX.1957, coll. Zhu Fuxing *et al.*; 2♂, Wanxian, Wang'erbao, 1200 m, 11.VIII.1993, coll. Song Shimei (slide No. 5298); 3♂, Guanxian, Qingcheng Shan, 700–1000 m, 23.V.1979, 4.VI.1979, coll. Shang Jinwen & Gao Ping (slide No. 5299); 1♂, Luding, Moxi, 1550 m, 12.IX.1982, coll. Wang Shuyong (slide No. 3360). **Sichuan** (ZFMK): 1♂, Chasseurs Indigènes des Missionnaires de Tà-t sien-Loû, 1906; 1♀, de Tà-t sien-Loû, à Mou-Pin, Mai, Juin, 1892, Chasseurs Thibétains; 1♀, Siao-Lou, 1900, Chasseurs Indigènes. **Chongqing** (IZCAS): 1♂, Youyang, Taohuayuan scenic spot, 983 m, 26.V.2017, coll. Li Henan (slide No. 5300).

Distribution. China (Gansu, Sichuan, Chongqing).

Remarks. A male specimen labeled ‘Tschang Tang, Tibet’ From ZFMK (1♂, Tibet, Tschang-Tang, Dsagar-Berge, 4500 m, Juli, ex coll. Wehrli, 17/55.) has clearly different antennae and male genitalia. It should be treated as another new species of *Aquilargilla* (D. Stüning, pers. comm.). However, since the single specimen is in bad condition and the locality is dubious, more specimens need to be collected and studied to enable it to be described in future.

Etymology. The species is named on the basis of Latin word *basifixus*, which relates to the processes arising from the base of the tegumen.

Acknowledgements

We sincerely thank Dr. Dieter Stüning (ZFMK) for his constructive comments, the identification of specimens, and for providing data of the specimens of the new species in ZFMK. We express our sincere thanks to Sir Anthony Galsworthy (Scientific Associate, the Natural History Museum, London, UK) for his valuable linguistic corrections. We express our sincere thanks to Dr. Hongxiang Han (IZCAS) for giving us helpful comments. We are grateful to all collectors whose contributions made our work possible. We also appreciate the work of Ms. Yang Chao in preparing some specimens and dissection. This project was supported by the National Science Foundation of China (grant No. 31672331, 31872966, 31872967), the Ministry of Science and Technology of China (No. 2015FY210300), and a grant from the Key Laboratory of Zoological Systematics and Evolution (Chinese Academy of Sciences, grant No.Y229YX5105).

References

- Butler, A.G. (1885) Descriptions of Moths new to Japan, collected by Messrs. Lewis and Pryer. *Cistula Entomologica*, 3 (29), 113–136.
- Butler, A.G. (1889) *Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum. Part 7.* London, iv + 124 pp., 18 pls.
- Comstock, J.H. (1918) *The Wings of Insects.* Comstock Publishing Company, Ithaca, New York, 430 pp.
- Gaston, K.J., Scoble, M.J. & Crook, A. (1995) Patterns in species description: a case study using the Geometridae (Lepidoptera). *Biological Journal of the Linnean Society*, 55 (3), 225–237.
<https://doi.org/10.1111/j.1095-8312.1995.tb01061.x>
- Guenée, A. (1858) Uranides et Phalénites 1. In: Boisduval, M. & Guenée, A. (Eds.), *Histoire Naturelle des Insectes, Species Général des Lépidoptères*, 10, 1–584.
- Hausmann, A. (2001) Introduction. Archiearinae, Orthostixinae, Desmobathrinae, Alsophilinae, Geometrinae. In: Hausmann, A. (Ed.), *The Geometrid Moths of Europe. Vol. 1.* Apollo Books, Stenstrup, pp. 1–282.
https://doi.org/10.1007/978-1-4757-3423-2_1
- Hausmann, A. (2004) *The Geometrid Moths of Europe. Vol. 2. Sterrhinae.* Apollo Books, Stenstrup, 600 pp.
- Hausmann, A. (2009) New and interesting geometrid moths from Dhofar, southern Oman. *Mitteilungen der Münchner Entomologischen Gesellschaft*, 99, 109–126.
- Holloway, J.D. (1997) The Moths of Borneo: Family Geometridae, Subfamily Sterrhinae. *Malayan Nature Journal*, 10, 1–242.

- Hüfnagel, J.S. (1767) Fortsetzung der Tabelle von den Nachtvögeln, welche die 3te Art derselben, nemlich die Spannenmesser (Phalaenas Geometras Linnaei) enthält. Berlinisches Magazin, oder gesammelte Schriften und Nachrichten für die Liebhaber der Arzneywissenschaft, Naturgeschichte und der angenehmen. *Wissenschaften Überhaupt*, 4, 504–527.
- Klots, A.B. (1970) Lepidoptera. In: Tuxen, S.L. (Ed.), *Taxonomist's Glossary of Genitalia in Insects*. Munksgaard, Copenhagen, pp. 115–130.
- Lederer, J. (1853) II. Abtheilung "Die Heteroceren". Verhandlungen des Zoologisch-Botanischen Vereins in Wien, 2 (Abhandlungen), 65–126.
- Meyrick, E. (1888) Revision of Australian Lepidoptera. *Proceedings of the Linnean Society of New South Wales*, 2, 621–1113.
- Leech, J.H. (1891) Descriptions of new species of Geometrae from China, Japan and Corea. *Entomologist*, 24 (Supplement), 42–56.
<https://doi.org/10.5962/bhl.part.29215>
- Leech, J.H. (1897) On Lepidoptera Heterocera from China, Japan, and Corea. *Annals and Magazine of Natural History*, Series 6, 20 (116), 65–111 + 228–248.
<https://doi.org/10.1080/00222939708680620>
- Nichols, S.W. (1989) *The Torre-Bueno Glossary of Entomology*. New York Entomological Society in cooperation with the American Museum of Natural History, New York, xvii + 840 pp.
- Parsons, M.S., Scoble, M.J., Honey, M.R., Pitkin, L.M. & Pitkin, B.R. (1999) The catalogue. In: Scoble, M.J. (Ed.), *Geometrid moths of the world: a Catalogue (Lepidoptera, Geometridae)*. CSIRO, Collingwood, pp. 1–1016.
- Pierce, N. (1914) *The Genitalia of the Group Geometridae of the British Islands*. E.W. Classey Ltd., Middlesex, xxix + 88 pp., 48 pls. [reprint 1976]
- Prout, L.B. (1912–1916) The Palaearctic Geometrae. In: Seitz, A. (Ed.), *The macrolepidoptera of the world. Vol. 4*. Verlag A. Kernen, Stuttgart, pp. 1–479, pls. 1–25.
- Prout, L.B. (1934–1935) Geometridae: Subfamilia Sterrhinae. In: Strand, E. (Ed.), *Lepidopterorum Catalogus. Pars 61, 63, 68*. W. Junk, Berlin, pp. 1–486.
- Prout, L.B. (1920–1941) The Indoaustralian Geometridae. In: Seitz, A. (Ed.), *Macrolepid. World*, 12. Stuttgart: Verlag A. Kernen, 1–356, pls. 1–41, 50.
- Schrank, A. (1802) Fauna Boica: durchgedachte Geschichte der in Baiern einheimischen und zahmen Thiere. *Fauna Boica*, 2 (2), 1–412.
- Scoble, M.J. (1992) *The Lepidoptera, Form, Function and Diversity*. Oxford University Press, Oxford, xi + 404 pp.
- Scoble, M.J. & Hausmann, A. (2007) Online list of valid and available names of the Geometridae of the World. *Lepidoptera Barcode of Life, iBOL*. Available from: http://www.lepbarcoding.org/geometridae/species_checklists.php (accessed 24 April 2018)
- Sihvonen, P. (2003) *Diversity and classification of the Scopulini (Lepidoptera: Geometridae, Sterrhinae)*. Academic dissertation, University of Helsinki, Helsinki, 18 pp.
- Sihvonen, P. & Kaila, L. (2004) Phylogeny and tribal classification of Sterrhinae with emphasis on delimiting Scopulini (Lepidoptera: Geometridae). *Systematic Entomology*, 29 (3), 324–358.
<https://doi.org/10.1111/j.0307-6970.2004.00248.x>
- Sihvonen, P. & Siljander, M. (2005) Species diversity and geographical distribution of Scopulini moths (Lepidoptera: Geometridae, Sterrhinae) on a world-wide scale. *Biodiversity & Conservation*, 14 (3), 703–721.
<https://doi.org/10.1007/s10531-004-3921-8>
- Sihvonen, P. (2005) Phylogeny and classification of the Scopulini moths (Lepidoptera: Geometridae, Sterrhinae). *Zoological Journal of the Linnean Society*, 143 (4), 473–530.
<https://doi.org/10.1111/j.1096-3642.2005.00153.x>
- Sihvonen, P. (2005) Check-list of Chinese Scopula Schrank species and an analysis of species diversity (Lepidoptera: Geometridae: Sterrhinae). *Journal of Asia-Pacific Entomology*, 8 (1), 29–36.
[https://doi.org/10.1016/S1226-8615\(08\)60069-2](https://doi.org/10.1016/S1226-8615(08)60069-2)
- Sihvonen, P. & Staude, H.S. (2010) Revision of *Isoplenodia* Prout, 1932 with new records from continental Africa (Lepidoptera: Geometridae, Sterrhinae). *Zootaxa*, 2453 (1), 25–41.
- Swinhoe, C. (1894) A list of the Lepidoptera of the Khasis Hills. Part II. *Transactions of the Royal Entomological Society of London*, 1894, 145–223.
- Warren, W. (1897) New genera and species of moths from the Old-World Regions in the Tring Museum. *Novitates Zoologicae*, 4, 1–560.
<https://doi.org/10.5962/bhl.part.21182>
- Warren, W. (1895) New species and genera of Geometridae in the Tring Museum. *Novitates Zoologicae*, 2, 82–159.
- Warren, W. (1899) New Drepanulidae, Epiplemidae, Uraniidae, and Geometridae from the Oriental and Palaearctic Regions. *Novitates Zoologicae*, 6, 313–359.
- Xue, D.Y., Cui, L. & Jiang, N. (2018) A review of *Problepsis* Lederer, 1853 (Lepidoptera: Geometridae) from China, with description of two new species. *Zootaxa*, 4392 (1), 101–127.
<https://doi.org/10.11646/zootaxa.4392.1.5>