

On the taxonomic history of *Phyllocnistis* Zeller, 1848 (Gracillariidae)

JURATE DE PRINS¹ & AKITO Y. KAWAHARA²

¹ Royal Museum for Central Africa, Leuvensesteenweg 13, B-3080 Tervuren, Belgium; email: jurate.de.prins@africamuseum.be

² Department of Entomology, University of Maryland, 4112 Plant Sciences Building, College Park, MD 20742 USA; email: kawahara@umd.edu

Abstract. For over 150 years, the proper taxonomic placement of *Phyllocnistis* Zeller has remained largely uncertain. The genus shares morphological and life history traits with several different families of Microlepidoptera, and these characteristics have made it challenging for microlepidopterists to correctly place the genus. *Phyllocnistis* includes *P. citrella* Stainton, a globally important economic pest of citrus. We review the taxonomic history of *Phyllocnistis* and provide a comprehensive list of references.

Introduction

The leaf-mining genus *Phyllocnistis* Zeller, 1848 is an example of a poorly studied genus whose taxonomic placement has vacillated between many different families. Eighty seven species of *Phyllocnistis* are described worldwide (De Prins & De Prins 2005, 2009), 36 from the Oriental region, 17 from Australasia, 15 from the Palaearctic, and 12 each from the Nearctic and Neotropical regions. Only five are known to occur in the Afrotropical region (De Prins & De Prins 2005, 2009). The distribution of most species is restricted to one biogeographical region. However, five species cross biogeographical boundaries: *P. saligna* (Zeller, 1839) occurs in the Palaearctic, Afrotropical, and Oriental regions, *P. selenopa* Meyrick, 1915 in the Oriental and Australian regions, *P. toparcha* Meyrick, 1918 in the Palaearctic and Oriental regions, and *P. vitegenella* Clemens, 1859 has a Holarctic distribution. *Phyllocnistis citrella* Stainton, 1856 has a cosmopolitan distribution. There are currently more than 800 publications on *Phyllocnistis*, most of which focus on the pest species *Phyllocnistis citrella* (Fig. 1).

Phyllocnistis is very similar to the Lyonetiid genus *Leucoptera* Hübner, 1825 in forewing pattern, but differs in having a smoothly-scaled head. Unlike most genera of Gracillariidae, all larval feeding instars of *Phyllocnistis* are sap feeding, creating a long, slender, serpentine, subepidermal mine, containing a dark median frass line deposited under the leaf epidermis. There are no tissue-feeding instars, hence no granular frass, but only three sap-feeding instars and one non-feeding, highly specialized, spinning instar. The mine terminates in a slightly enlarged cavity, usually near the edge of the leaf in which the last instar constructs a flimsy cocoon and pupates (Emmet 1985; Davis 1987, 1994; Davis & Robinson 1998; Parenti 2000). *Phyllocnistis* is very successful in its ability to exploit a wide range of host plants as it feeds on 26 plant families (Davis 1987; De Prins & De Prins 2009). Some species of *Phyllocnistis* (e.g., *P. citrella*) are cosmopolitan, fast spreading pests, causing substantial economic damage (Davis 1994; Heppner 1995; Heppner & Dixon 1995; Hoy 1996; Causton *et al.* 2006; Jahnke *et al.* 2006, 2007). For the Species of *Phyllocnistis* can often be distinguished



Fig. 1. *Phyllocnistis citrella* Stainton. Italy, Piemonte, Asti, fraz. Valgera, 120 m, 2–15.11.2002, e.l. *Citrus* sp., leg. G. Baldizzone, coll. MHNG. Forewing length ca. 2 mm.

by pupal morphology (Kawahara et al. 2009). The present paper aims to summarize the taxonomic history of *Phyllocnistis*.

Taxonomic history

Zeller (1848) described *Phyllocnistis* as a genus of “leaf-mining moths with eye caps” placing it just after *Lyonetia* Hübner, 1825 (Fig. 2). Soon thereafter, Herrich-Schäffer (1853–1855) placed *Phyllocnistis* in Tineidae, together with many other genera of small Lepidoptera. Stainton, in his lists (1854a–c, 1859), placed *Phyllocnistis* in the family Lyonetidae [sic], and this was followed by Frey (1856) and Wocke (1861, 1871). According to Stainton (1854a) the family Lyonetiidae contained five genera: *Bucculatrix* Zeller, 1839, *Cemiostoma* Zeller, 1848, *Lyonetia* Hübner, 1825, *Opostega* Zeller, 1839, and *Phyllocnistis* Zeller, 1848. However, in his lecture of 7 January 1856 to the Entomological Society of London, Stainton (1856) presented ‘*Phyllocnistis citrella* Atkinson in litt.’ as a new species of Indian Microlepidoptera feeding on *Citrus*. Stainton did not place this global economic pest into any of the then recognized lepidopteran families. He only indicated that the new species was similar to the European *Phyllocnistis saligna* (Zeller, 1839) and *P. suffusella* (Zeller, 1847). Wocke (1861) added *Phyllobrostis* Staudinger, 1859 to the list of Lyonetidae [sic] and later (1871) added *Opogona* Zeller, 1853. At about the same time, Herrich-Schäffer

verdunkelt, hat aber auf den Vorderrandfransen ebenfalls vier braune verloschene Querstriche; die zwei hintersten setzen sich bis auf die Hinterrandfransen fort. Das tief schwarze Pünktchen der Flügelspitze hat auf den Franzen hinter sich einen bräunlichen Querstrich, aus welchem das bräunliche, ziemlich lange Franzenschwänzchen hervorkommt. Die Hinterrandfransen bräunlichgrau.

Hinterflügel wie bei *Padifoliella*.

Unterseite etwas glänzend, bräunlichgrau, auf den Vorderflügeln haben die weissen Franzen um die Spitze die Zeichnung der Oberseite.

Das Exemplar in *F. v. Röslm.'s* Sammlung war aus Böhmen; das vor mir befindliche aus der *Mann'schen* wurde einzeln im Juni 1842 bei Tivoli nächst Wien an Eschen gefangen. Beide Exemplare sind Männchen.

Anmerk. In der Aufzählung der von mir in Italien gesammelten Falter habe ich eine fragliche *Lyoneletia* *sonnulentella* (von Messina und Syracus) beschrieben.

Da ich nur drei Exemplare besitze, so habe ich noch keine der Untersuchung des Flügelgäders opfern wollen. — Von *Mann* erhielt ich aus der Wiener Gegend eine *Gracilaria convolvella* n. sp., die bestimmt keine *Gracilaria*, sondern nach genauer Prüfung einerlei mit meiner *Sonnulentella* ist. Von ihr habe ich das Gäder untersucht und mich dadurch von der Richtigkeit meiner Vermutung, dass es keine *Lyoneletia* sei, überzeugt. Die Subdorsalader ist nemlich ganz einfach. Die Discoidalzelle läuft sehr spitz zu; aus der an der Basis sehr verdünnten Subcostalader läuft erst aus der Mitte, dann vor der Spitze ein Ast nach dem Vorderrande; aus der Spitze der Zelle kommt eine Ader, die erst einen Ast an den Vorderrand abgibt und sich dann in eine Gabel theilt; die Medianader, unterhalb deren die Falte deutlich ist, sendet vor der Spitze einen einzelnen Ast. Wobin diese Art gehöre, weis ich noch nicht zu bestimmen.

***Phyllocnistis* n. gen.** (Fig. 31–34.)

Caput convexum, laevigatum.

Antennae conchula parva instructae, alis anterioribus breviores.

Palpi penduli filiformes.

Alae anteriores caudatae; cellula discoidalis acuta venulas tres in marginem anticum, unam in apicem, unam in marginem posticum emittit; vena subdorsalis simplex: posteriores lanceolato-lineares, vena mediana dorso proxima venulas tres emittente.

Tibiae posticae superne setoso ciliatae.

Larva apud cuniculos agit in foliis.

Metamorphosis in cuniculo contracto.

Von dem vorigen Genus unterscheidet sich *Phyllocnistis* schon durch die überall schuppenförmige und glatt anliegende Kopfbedeckung und die kürzern, weniger feinen Fühler. Die Vorderflügel haben eine kürzere Spitze und die Hinterflügel sind breiter. Die gleichfalls glatköpfige Gattung *Cenotoma* weicht durch den völligen Mangel der Taster und die ungeschlossene Zelle der Vorderflügel etc. ab; *Opostega* hat sehr grosse Augendeckel und ein nur aus vier einfachen Adern bestehendes Adergerüst der Vorderflügel.

Auf den Vorderflügeln ist die Mittelzelle breiter als bei *Lyoneletia*, und aus der Spitze derselben gehen nur zwei aus demselben Punkt entspringende Adern in die Flügelspitze. Die Subcostalader sendet zwei Äste in den Vorderrand, deren erster viel kürzer ist als bei *Lyoneletia*, die Medianader einen in den Innenrand. Ihr ziemlich nahe ist die Flügelfalte. Die Subdorsalader ist einfach, ziemlich kurz und gebogen. — Die Hinterflügel sind auf der Wurzelhälfte breiter als bei *Lyoneletia*, aber am Vorderrande hinter der Borste gleichfalls erweitert. Die wie dort zarte Subcostalader geht bald in den Vorderrand über, um ihn in seinem übrigen Verlaufe zu verdicken. Die Medianader nimmt ihren Lauf nahe am Innenrande und hat erst einen langen Ast (bei dem ich aber ganz sicher bin, dass er die mit ihr verschmolzene Subdorsalader ist) und dann hinterwärts einen viel kürzern.

Die Miniraupe hat keine Beine; sie ist nach ihrer Struktur noch schlecht bekannt. Ihre Verwandlung in-

(1857) recognized *Phyllocnistina* as a separate group, which included three genera: *Bucculatrix*, *Cemiosoma*, and *Phyllocnistis*. On the basis of wing venation, Clemens (1859) transferred *Phyllocnistis* into *Lithocolletidae*, together with *Leucanthiza* Clemens, 1859, *Lithocolletis* Hübner, 1825, and *Tischeria* Zeller, 1839. Clemens (1859) placed these four genera in *Lithocolletidae*, but noted that his classification was in contrast to European authors who treated *Leucanthiza* and *Tischeria* as *Lyonetidae* [sic]. Unfortunately, Clemens did not indicate who the European authors were. Clemens also stated that he did not support the separation of these four genera into distinct families. At that time *Phyllocnistis* was placed in *Tineina*, which included many different genera of small moths (Clemens 1863; Zeller 1873, 1877; Chambers 1875; Frey & Boll 1876; van Deventer 1904). Stainton (1863) summarized the generic characters of twenty genera of leaf-mining Lepidoptera. He placed *Phyllocnistis* in a group with *Bucculatrix* Zeller, 1839, *Cemiosoma* Zeller, 1848, *Lithocolletis* Hübner, 1825, *Lyonetia* Hübner, 1825, and *Nepticula* Heyden, 1843. All these genera, except *Bucculatrix*, have a mining larva and *Lithocolletis* and *Phyllocnistis* pupate within the mine (Stainton 1863). Chambers (1871) noted that the larva of *Phyllocnistis* resembles the young cylindrical larva of *Lithocolletis* in general appearance and compared adult *Phyllocnistis* with the white species of *Lithocolletis*. In his work on Australian Microlepidoptera, Meyrick (1880: 136) made an attempt to classify the species he was describing and placed *Phyllocnistis* into *Lyonetidae* [sic], and stated “[*Phyllocnistis*] appears by its quite smooth head and apodal larva to be an extreme development of [*Opostega* and *Cemiosoma*]”. Heinemann & Wocke (1877) separated *Phyllocnistidae* as a separate family and included three genera within: *Phyllocnistis*, *Cemiosoma*, and *Bucculatrix*.

Even at the turn of the century, the definition and placement of *Phyllocnistis* differed among microlepidopterists. Noting similarities in early stages and habits of the American species, Busck (1900) proposed to broaden the definition of *Phyllocnistis*. He described *P. intermediella* Busck, 1900 from Florida, which has morphological features that are somewhat different from the species that had previously been described in the genus. Rebel (1901) allocated *Phyllocnistis* to the subfamily *Phyllocnistinae* along with *Bucculatrix* Zeller, 1839, *Cemiosoma* Zeller, 1848, *Opogona* Zeller, 1853, and *Opostega* Zeller, 1839, but placed *Phyllocnistinae* into family *Lyonetiidae*. Kirby (1903) divided *Lyonetiidae* into two subfamilies: *Lyonetiinae* and *Phyllocnistiinae* [sic]. Meyrick (1895) transferred *Phyllocnistis* to *Tineidae* and in 1906 he placed it along with *Epicnistis* Meyrick, 1906, *Exorectis* Meyrick, 1906, *Leucoptera* Hübner, 1825, *Nepticula* Heyden, 1843, and *Setomorpha* Zeller, 1852. Spuler (1910) recognized three species of *Phyllocnistis*, *P. suffusella* Zeller, 1847, *P. sorhageniella* Lüders, 1900, and *P. saligna* (Zeller, 1839) and placed the genus in its own family *Phyllocnistidae*. Meyrick (1915a, b) continued to include *Phyllocnistis* in *Lyonetiidae*, which he spelled in different ways (Meyrick 1915a, b, 1916, 1920, 1921a). Other authors also included *Phyllocnistis* in *Lyonetiidae* (e.g. Turner 1923; Braun 1925). Braun and Meyrick independently¹ transferred *Phyllocnistis* from *Lyonetiidae* to *Gracillariidae* (Braun 1927; Meyrick 1928a, b, 1935, 1936), and such a placement has since been widely accepted (Turner 1947; Nye & Fletcher 1991; Davis & Robinson 1998). However,

some authors have treated *Phyllocnistis* as a separate family until recently (Seksyaeva 1981; Emmet 1985; Kuznetsov & Stekolnikov 1987; Powell & Opler 2009).

Placement of *Phyllocnistis* within Phyllocnistinae

Most modern authors divide Gracillariidae into three subfamilies: Gracillariinae, Lithocolletinae and Phyllocnistinae (Davis 1983; Davis & Miller 1984; Common 1990; Davis & Robinson 1998; Kuznetsov & Baryshnikova 1998; Parenti 2000; Dall'Asta *et al.* 2001; Heppner 2004; De Prins & De Prins 2005). However, some other authors have proposed to erect additional subfamilies: Oecophyllembiinae (Réal & Balachowsky 1966; Kumata 1998), Ornichinae (Kuznetsov & Stekolnikov 1987; misspelled as 'Ornichinae' (Kuznetsov & Baryshnikova 2001; Kuznetsov & Stekolnikov 2001), and Orni-xolinae (Kuznetsov & Baryshnikova 2001). In the checklist of the Moths of America North of Mexico, Davis (1983) included *Phyllocnistis* Zeller, 1848 and *Metriochroa* Busck, 1900 in Phyllocnistinae, while Kuznetsov (1981) considered *Metriochroa* Busck, 1900 belonging to Gracillariinae. Later Davis and Robinson (1998) included *Cryphiomystis* Meyrick, 1922, *Metriochroa* Busck, 1900, *Phyllocnistis* Zeller, 1848 and *Prophyllocnistis* Davis, 1994 in Phyllocnistinae. Kumata (1998) then transferred all but *Phyllocnistis* to Oecophyllembiinae based on hindwing venation and position of the larval thoracic spiracles. In the classification and checklist of the Lepidoptera species recorded in southern Africa, Vári *et al.* (2002) treated Oecophyllembiinae as a synonym of Phyllocnistinae and included *Cryphiomystis* Meyrick, 1922, *Metriochroa* Busck, 1900 and *Phyllocnistis* Zeller, 1848 into Phyllocnistinae. De Prins & De Prins (2005, 2009) recognized seven genera in Phyllocnistinae: *Angelabella* Vargas & Parra, 2005, *Corythoxestis* Meyrick, 1921b, *Eumetriochroa* Kumata, 1998, *Guttigera* Diakonoff, 1955, *Metriochroa* Busck, 1900, *Phyllocnistis* Zeller, 1848, and *Prophyllocnistis* Davis, 1994. It still remains largely uncertain whether these groups are monophyletic, and we hope that future phylogenetic studies based on morphological and molecular characters of Gracillariidae will shed light on the phylogenetic position of *Phyllocnistis*, and its placement in the classification of Gracillariidae.

Acknowledgements

Donald R. Davis, National Museum of Natural History, Smithsonian Institution, Washington D.C., is gratefully acknowledged for his continuous support and critical comments on this manuscript. We express our sincere gratitude to the librarians Willem Ellis and Godard Tweehuysen, Library of the Dutch

¹ Although the publication of Braun (1927) preceded the publication of Meyrick (1928a), we consider that both authors came to the conclusion to include *Phyllocnistis* into Gracillariidae independently and at the same time. Braun (1927) published the description of *Phyllocnistis finitima* Braun, 1927, which she placed into Gracillariidae. Meyrick (1928a) significantly revised his monumental monograph of 914 pages, which includes the identification keys of genera, species, illustrations of wing venation and short species descriptions. He recognised six genera within Gracillariidae: *Acrocercops* Wallengren, 1881, *Gracilaria* [sic] Haworth, 1828, *Lithocolletis* Hübner, 1825, *Ornix* Treitschke, 1833, *Paractopa* Clemens, 1860, and *Phyllocnistis* Zeller, 1848. The preface of his revised handbook was written on 28th September 1927, the same year as the paper of Braun (1927) was published. We believe both lepidopterists communicated with each other on the placement of *Phyllocnistis*.

Entomological Society at the Zoological Museum of Amsterdam University, for their help in searching many of the bibliographical references. We cordially thank Sergey Sinev, Zoological Institute of the Russian Academy of Sciences, St. Petersburg, for helping us to locate the publication of Zeller (1853). Bernard Landry, Museum d'histoire naturelle, Geneva, is thanked for his photograph of a *Phyllocnistis citrella* that was provided by Paolo Triberti, Museo Civico di Storia Naturale, Verona. We very much thank Willy De Prins, Zoological Museum of Amsterdam University, for sharing his passion and knowledge in finding old books and catalogues on Lepidoptera. The Belgian Science Policy Office is kindly acknowledged for granting contract MO/37/011.

References

- Braun, A. F. 1925. Microlepidoptera of Northern Utah. – Transactions of the American Entomological Society **51**: 183–226.
- Braun, A. F. 1927. Descriptions of new Micro-lepidoptera. – Transactions of the American Entomological Society **53**: 191–199.
- Busck, A. 1900. New species of moths of the superfamily Tineina from Florida. – Proceedings of the United States National Museum **23**(1208): 225–254, pl. 1.
- Causton, C. E., S. B. Peck, B. J. Sinclair, L. Roque-Albelo, C. J. Hodgson & B. Landry 2006. Alien insects: threats and implications for conservation of Galápagos Islands. – Annals of the Entomological Society of America **99**: 121–143.
- Chambers, V. T. 1871. Micro-Lepidoptera. – Canadian Entomologist **3**: 54–58, 84–88, 108–112, 127–130, 146–149, 161–166, 182–185, 205–209, 221–224.
- Chambers, V. T. 1875. Tineina of the Central United States. – Cincinnati Quarterly Journal of Science **2**: 97–121.
- Clemens, B. 1859. Contribution to American Lepidopterology. No. 2. – Proceedings of the Academy of Natural Sciences of Philadelphia (1859): 317–328.
- Clemens, B. 1860. Contribution to American Lepidopterology. No. 5. – Proceedings of the Academy of Natural Sciences of Philadelphia (1860): 203–221.
- Clemens, B. 1863. American Micro-Lepidoptera. – Proceedings of the Entomological Society of Philadelphia **2**: 4–14.
- Common, I. F. B. 1990. Moths of Australia. – Melbourne University Press, Carlton, pp. i–v, 1–535.
- Dall'Asta, U., J. De Prins & W. De Prins 2001. Preliminary checklist of Gracillariidae of the Afrotropical Region. – Zoölogische Documentatie, Koninklijk Museum voor Midden-Afrika, Tervuren, België **25**: 1–48.
- Davis, D. R. 1983. Gracillariidae. Pp. 9–11. – In: R. W. Hodges, T. Dominick, D. R. Davis, D. C. Ferguson, J. G. Franclemont, E. G. Munroe & J. A. Powell (eds.), Check List of the Lepidoptera of America North of Mexico. – E. W. Classey Ltd. and the Wedge Entomological Research Foundation, London.
- Davis, D. R. 1987. Micropterigidae, Eriocraniidae, Acanthopteroctetidae, Nepticulidae, Opostegidae, Tischeriidae, Heliozelidae, Adelidae, Incurvariidae, Prodoxidae, Tineidae, Psychidae, Ochsenheimeriidae, Lyonetiidae, Gracillariidae. Pp. 341–378, 456, 459–460. – In: F. W. Stehr (ed.), Immature insects. – Kendall / Hunt Publ. Co., Dubuque, Iowa.
- Davis, D. R. 1994. Neotropical Microlepidoptera 25. New leaf-mining moths from Chile, with remarks on the history and composition of Phyllocnistinae (Lepidoptera: Gracillariidae). – Tropical Lepidoptera **5**: 65–75.
- Davis, D. R. & S. E. Miller 1984. Gracillariidae. Pp. 25–27. – In: J. B. Heppner (ed.), Atlas of Neotropical Lepidoptera. – Dr. W. Junk publishers, The Hague, Boston, Lancaster.
- Davis, D. R. & Robinson, G. S. 1998. The Tineoidea and Gracillarioidea. Pp. 91–117. – In: N. P. Kristensen (ed.), Handbook of Zoology IV/35, Lepidoptera, Moths and Butterflies. Vol. 1. Evolution, Systematics, and Biogeography. – Walter de Gruyter, Berlin, New York.
- De Prins, J. & W. De Prins 2009. Global taxonomic database of Gracillariidae (Lepidoptera). – URL: <http://gc.bebif.be>
- De Prins, W. & J. De Prins 2005. Gracillariidae (Lepidoptera) Vol. 6. Pp. 1–502. – In: B. Landry (ed.), World catalogue of insects. – Apollo Books, Stenstrup.
- Diakonoff, A. 1955. Microlepidoptera of New Guinea. Results of the third Archbold Expedition (American-Netherlands Indian Expedition 1938-1939). Part V. – Verhandelingen der koninklijke Nederlandse Akademie der Wetenschappen, Afdeling Natuurkunde (2) **50**(3): 1–210.

- Emmet, A. M. 1985. Phyllocnistidae. Pp. 363–368. – In: J. Heath & A. M. Emmet (eds.), The Moths and Butterflies of Great Britain and Ireland. Vol. 2. – Harley Books, Colchester.
- Fletcher, T. B. 1929. A list of the generic names used for Microlepidoptera. – Memoirs of the Department of Agriculture in India. Entomological Series **11**: i–ix, 1–244.
- Frey, H. 1856. Die Tineen und Pterophoren der Schweiz. – Verlag von Meyer und Zeller, Zürich, pp. i–xii, 1–430.
- Frey, H. & J. Boll 1876. Einige Tineen aus Texas. – Entomologische Zeitung, herausgegeben von dem entomologischen Vereine zu Stettin **37**: 209–228.
- Haworth, A. H. 1828. Lepidoptera Britannica sistens digestionem novam insectorum lepidopterorum quae in Magne Britannia reperiuntur, larvarum pabulo, temporeque pascendi, expansione alarum; mensibusque volandi; synonymis atque locis observationibusque variis. Pars IV cum indice finali. – R. Taylor, London, pp. 512–609.
- Heinemann, H. & M. F. Wocke 1877. Die Schmetterlinge Deutschlands und der Schweiz systematisch bearbeitet von H. v. Heinemann. Nebst analytischen Tabellen zum Bestimmen der Schmetterlinge. Zweite Abtheilung. Kleinschmetterlinge. Band II. Die Motten und Federmotten. Heft II. – C. A. Schwetschke und Sohn, Braunschweig, pp. i–vi, 1–102, 376–826.
- Heppner, J. B. 1995. Citrus leafminer (Lepidoptera: Gracillariidae) on fruit in Florida. – Florida Entomologist **78**: 183–186.
- Heppner, J. B. 2004. Leafminer moths (Lepidoptera: Gracillariidae). Pp. 1274–1275. – In: J. L. Capinera (ed.), Encyclopedia of entomology. Vol. 2. – Kluwer Academic Publishers, Dordrecht, Boston, London.
- Heppner, J. B. & W. N. Dixon 1995. Potential spread of *Phyllocnistis citrella* (Lepidoptera: Gracillariidae: Phyllocnistinae) in the United States. – American Entomologist **41**: 110–113.
- Herrich-Schäffer, G. A. W. 1853–1855. Systematische Bearbeitung der Schmetterlinge von Europa, zugleich als Text, Revision und Supplement zu Jakob Hübner's Sammlung europäischer Schmetterlinge. Fünfter Band. Die Schaben und Federmotten. – G. J. Manz, Regensburg, pp. 1–394, index separate, without pagination.
- Herrich-Schäffer, G. A. W. 1857. Sammlungen des Vereines. 5. Insecten. – Correspondenz-Blatt des zoologisch-mineralogischen Vereines in Regensburg **11** (1–2): 17–24, (3–5): 33–70.
- Heyden, C. 1843. [no title]. – Amtlicher Bericht der Versammlung der Naturforscher Mainz **20**: 208.
- Hoy, M. A. (ed.) 1996. Managing the citrus leaf miner. – Proceedings from an international conference. April 22–25, 1996, Orlando, Florida, pp. 1–119.
- Hübner, J. 1816–1826. Verzeichniss bekannter Schmettlinge [sic]. – J. Hübner Verlag, Augsburg, pp. 1–431, pls. 1–72.
- Jahnke, S. M., L. R. Redaelli & L. M. G. Diefenbach 2006. Parasitism in *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae) in citrus orchards in Montenegro, RS, Brazil. – Neotropical Entomology **35**: 357–363.
- Jahnke, S. M., L. R. Redaelli, L. M. G. Diefenbach, & F. K. Dal-Soglio 2007. Structure and composition of the assemblage of parasitoids associated to *Phyllocnistis citrella* pupae Stainton (Lepidoptera: Gracillariidae) in citrus orchards in southern Brazil. – Neotropical Entomology **36**: 746–751.
- Kawahara, A. Y., K. Nishida, D. R. Davis 2009. Systematics, host plants, and life histories of three new *Phyllocnistis* from the Central Highlands of Costa Rica (Lepidoptera, Gracillariidae, Phyllocnistinae). – Zookeys, in press.
- Kirby, W. F. 1903. The butterflies and moths of Europe. – Cassel and Company, London, Paris, New York and Melbourne, pp. i–lxxii, 1–432.
- Kumata, T. 1998. Japanese species of the subfamily Oecophyllembiinae Réal et Balachowsky (Lepidoptera: Gracillariidae), with descriptions of a new genus and eight new species. – Insecta Matsumurana, New Series **54**: 77–131.
- Kuznetsov, V. I. 1981. Gracillariidae (Lithocolletidae). Pp. 149–311. – In: G. S. Medvedev (ed.), Keys of the insects of the European part of the USSR **4**(2). [English translation, 1990 – E. J. Brill, Leiden, New York, København, Köln, pp. 199–410].
- Kuznetzov, V. I. & S. V. Baryshnikova 1998. Brief catalogue of the mining moths of the fam. Gracillariidae (Lepidoptera) of Russia and adjacent countries. – Proceedings of the Zoological Institute of the Russian Academy of Sciences **274**: 1–60.

- Kuznetsov, V. I. & S. V. Baryshnikova 2001. Review of Palaearctic genera of the gracillariid moths (Lepidoptera, Gracillariidae), with description of a new subfamily Ornixolinae Kuznetsov et Baryshnikova, subfam. n. – *Entomologicheskoe Obozrenie* **80**: 96–120.
- Kuznetsov, V. I. & A. A. Stekolnikov 1987. Functional morphology of the male genitalia and notes on the classification and phylogenetic relationships of mining moths of superfamily Gracillarioidea (Lepidoptera). – *Entomologicheskoe Obozrenie* **66**: 52–65.
- Kuznetsov, V. I. & A. A. Stekolnikov 2001. New approaches to the system of Lepidoptera of world fauna. – Nauka, St. Petersburg, pp. 1–462.
- Lüders, L. 1900. Beitrag zur Kenntnis der Lepidopterengattung *Phyllocnistis*. Pp. 1–33, pls 1–4. – In: Beilage zum Bericht Realschule in St. Pauli über das Schuljahr 1899–1900. Lüteke & Wulf, Hamburg.
- Meyrick, E. 1880. Descriptions of Australian Micro-Lepidoptera. III Tineina. – *Proceedings of the Linnean Society of New South Wales* **5**: 132–182.
- Meyrick, E. 1895. A handbook of British Lepidoptera. – Macmillan and Co, London, New York, pp. i–vi, 1–843.
- Meyrick, E. 1906. Descriptions of Australian Tineina. – *Transactions and Proceedings of the Royal Society of South Australia* **30**: 33–66.
- Meyrick, E. 1915a. Exotic Microlepidoptera – Marlborough, **1**(11): 321–352.
- Meyrick, E. 1915b. Descriptions of South American Micro-Lepidoptera. – *Transactions of the Entomological Society of London* (1915)(2): 201–256.
- Meyrick, E. 1916. Exotic Microlepidoptera – Marlborough, **1**(20): 609–640.
- Meyrick, E. 1918. Exotic Microlepidoptera – Marlborough, **2**(6): 161–192.
- Meyrick, E. 1920. Exotic Microlepidoptera – Marlborough, **2**(12): 353–384.
- Meyrick, E. 1921a. Descriptions of South African Micro-Lepidoptera. – *Annals of the Transvaal Museum* **8**: 49–148.
- Meyrick, E. 1921b. New Microlepidoptera. – *Zoologische Mededeelingen* **6**: 145–202.
- Meyrick, E. 1922. Exotic Microlepidoptera – Marlborough, **2**(18): 545–576.
- Meyrick, E. 1928a. A revised handbook of British Lepidoptera. – E. W. Classey, pp. i–vi, 1–914.
- Meyrick, E. 1928b. Exotic Microlepidoptera – Marlborough, **3**(13): 385–416.
- Meyrick, E. 1935. Exotic Microlepidoptera – Marlborough, **4**(19): 577–608.
- Meyrick, E. 1936. Exotic Microlepidoptera – Marlborough, **5**(1–2): 1–64.
- Nye, I. W. B. & D. S. Fletcher 1991. The generic names of moths of the World. 6. Microlepidoptera. – Natural History Museum Publications, London, pp. i–xxix, 1–368.
- Powell, J. & P. A. Opler 2009. Moths of western North America. – University of California Press, Berkeley, Los Angeles, London. 369 pp.
- Parenti, U. 2000. A Guide to the Microlepidoptera of Europe. – Torino, pp. 1–426.
- Réal, P. & A. S. Balachowsky 1966. Famille des Gracillariidae (= Lithocolletidae). Pp. 309–335. – In: A. S. Balachowsky (ed.), *Entomologie appliquée à l'agriculture*. Tome 2. Lépidoptères. – Masson et Cie éditeurs, Paris.
- Rebel, H. 1901. II Theil: Famil. Pyralidae – Micropterygidae [sic]. Pp. i–xxxii, 1–411, 1–368. – In: O. Staudinger & H. Rebel, *Catalog der Lepidopteren des Palaearctischen Faunengebietes*. – R. Friedlander & Sohn, Berlin.
- Seksyayeva, S. V. 1981. Phyllocnistidae. Pp. 311–312. – In: G. S. Medvedev (ed.) *Keys of the insects of the European part of the USSR* **4**(2). [English translation, 1990 – E. J. Brill, Leiden, New York, København, Köln, pp. 411–412].
- Spuler, A. 1910. Die Schmetterlinge Europas. Mit über 3500 Figuren auf 95 Tafeln und 505 Abbildungen im Text. 3. Auflage von Prof. E. Hofmann's Werk: Die Groß-Schmetterlinge Europas. Vol. 2. – Schweizerbarthsche Verlagshandlung, Stuttgart, pp. 1–523.
- Stainton, H. T. 1854a. Lepidoptera: Tineina. Pp. i–viii, 1–313, pls. 1–10. – In: *Insecta Britannica*. Vol. 3. – Lovell Reeve, London.
- Stainton, H. T. 1854b. List of the specimens of British animals in the collection of the British Museum. Part XVI. Lepidoptera. – By order of the Trustees, London, pp. 116–162.
- Stainton, H. T. 1854c. List of British Tineina for interchange among collectors. – Newman, London, pp. 1–8.

- Stainton, H. T. 1856. Descriptions of three species of Indian Micro-Lepidoptera. – Transactions of the Entomological Society of London, New Series (ser. 2) **3**(8): 301–304.
- Stainton, H. T. 1859. A manual of British butterflies and moths. Vol. 2. – John van Voorst, London, pp. 217–480.
- Stainton, H. T. 1863. On the generic characters afforded by the habits of various leaf-mining Microlepidopterous larvae. – Transactions of the Entomological Society of London, (ser. 3) **1**: 604–612.
- Staudinger, O. 1859. Diagnosen nebst kurzen Beschreibungen neuer andalusischer Lepidopteren. – Entomologische Zeitung, herausgegeben von dem entomologischen Vereine zu Stettin **20**: 211–259.
- Treitschke, F. 1833. Die Schmetterlinge von Europa. Neunter Band. Zweyte Abtheilung. Schaben. Geischen. G. *Hypsolopha*–*Orneodes*. – Ernst Fleischer, Leipzig, pp. 1–294.
- Turner, A. J. 1923. New Australian Microlepidoptera. – Transactions and Proceedings of the Royal Society of South Australia **47**: 165–194.
- Turner, A. J. 1947. Contributions to our knowledge of Australian Microlepidoptera. – Proceedings of the Royal Society of Queensland **57** (1945)(7): 65–74.
- van Deventer, W. 1904. Microlepidoptera van Java. – Tijdschrift voor Entomologie **47**: 1–42, pls. 1–2.
- Vargas, H. A. & L. E. Parra 2005. Un nuevo genero y una nueva especie de Oecophyllembiinae (Lepidoptera: Gracillariidae) de Chile. – Neotropical Entomology **34**: 227–233.
- Vári, L., D. M. Kroon & M. Krüger 2002. Classification and checklist of the species of Lepidoptera recorded in southern Africa. – Simple Solutions, Chatswood, pp. i–xxi, 1–385.
- Wallengren, H. D. J. 1881. Genera nova Tinearum. – Entomologisk Tidskrift **1**(2): 94–97.
- Wocke, M. 1861. Microlepidoptera. Pp. 85–192. – In: O. Staudinger & M. Wocke, Catalog der Lepidopteren Europa's und der angrenzenden Länder. – Dr. O. Staudinger und in der Königl. Hofbuchhandlung von Hermann Burdach, Dresden.
- Wocke, M. 1871. Microlepidoptera. Pp. 201–426. – In: O. Staudinger & M. Wocke, Catalog der Lepidopteren des europaischen Faunengebiets. – Dr. O. Staudinger und in der Königl. Hofbuchhandlung von Hermann Burdach, Dresden.
- Zeller, P. C. 1839. Versuch einer naturgemässen Eintheilung der Schaben. – Isis, oder enzyklopädische Zeitung von Oken **3**: 167–220.
- Zeller, P. C. 1847. Bemerkungen über die auf einer Reise nach Italien und Sicilien beobachteten Schmetterlingsarten X. (Schluss von Isis Heft XI. Pag. 859.). – Isis, oder enzyklopädische Zeitung von Oken **11**: 881–904.
- Zeller, P. C. 1848. Die Gattungen der mit Augendeckeln versehenen blattminirenden Schaben. – Linnaea Entomologica. Zeitschrift herausgegeben von dem Entomologischen Vereine in Stettin **3**: 248–344, 57 figs.
- Zeller, P. C. 1852. Lepidoptera Microptera, quae J. A. Wahlberg in Caffrorum terra collegit: 93. – P. A. Norstedt & Söner, Stockholm, pp. 1–120.
- Zeller, P. C. 1853. Drei Javanische Nachtfalter. – Bulletin de la Société Impériale des Naturalistes de Moscou **26**: 502–516.
- Zeller, P. C. 1873. Beiträge zur Kenntnis der nordamerikanischen Nachtfalter, besonders der Microlepidopteren. Zweite Abtheilung. – Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien **23**: 201–334, pls. 3–4.
- Zeller, P. C. 1877. Exotische Microlepidoptera. – Horae Societatis Entomologicae Rossicae **13**(1–2): 3–288, (3–4): 289–493, 6 pls.



De Prins, Jurate and Kawahara, Akito Y. 2009. "On the taxonomic history of *Phyllocnistis* Zeller, 1848 (Gracillariidae)." *Nota lepidopterologica* 32(2), 113–121.

View This Item Online: <https://www.biodiversitylibrary.org/item/187383>

Permalink: <https://www.biodiversitylibrary.org/partpdf/243749>

Holding Institution

Natural History Museum Library, London

Sponsored by

Natural History Museum Library, London

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

License: <http://creativecommons.org/licenses/by-nc-sa/4.0/>

Rights: <https://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.