Systematics and Biology of Heterocera

A tribute to Sigeru Moriuti

TINEA Vol. 18 (Supplement 3)
The Japan Heterocerists’ Society
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| Agriothera elaeocarpophaga    | Digitivalva artemisiella |
| Moriuti, 1978                | Moriuti, 1972            |
| (Amphitherididae)            | (Acrolepiidae)           |

| Ypsolopha longus             | Swammerdamia sedella     |
| Moriuti, 1964                | Moriuti, 1977            |
| (Ypsolophidae)               | (Yponomeutidae)          |

| Saridoscelis kodamai         | Prays lambda              |
| Moriuti, 1961                | Moriuti, 1977            |
| (Yponomeutidae)              | (Yponomeutidae)          |

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Prof. Sigeru MORIUTI

at Phu Rua, Loei, Thailand
August 1987
in the course of lepidopterological Expedition
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Preface

The community of lepidopterists, especially those interested in Lepidoptera systematics and phylogeny, lost a great leader and a professional lepidopterist of high attainments with the passing of Sigeru Moriuti on 23 September 2001.

Sigeru Moriuti was born in Osaka on 7 March 1933. He was educated at Ikuno Junior High School in Osaka, the Ikuno High School in Osaka and the Faculty of Agriculture of Naniwa University in Osaka (present Osaka Prefecture University), and graduated with an Agriculture Master's degree in 1957. During his time at university, he studied the systematics of Lepidoptera under the guidance of the late Professor S. Issiki. For 34 years, from 1962 to 1996, he worked in the Entomological Laboratory of Osaka Prefecture University, where he followed a career progressing from research assistant to the Professor of the laboratory. In 1966–1967, he studied the systematics of Microlepidoptera at the Zoologische Sammlung des Bayerischen Staates, Munich, supported by a stipend from the Alexander von Humboldt Foundation. He received his Agriculture Doctor's degree from Kyushu University in Fukuoka in 1973, with a doctoral dissertation entitled “A monographic study of Yponomeutidae s. lat. (Lepidoptera) of Japan”.

The major focus of his research interest was formed during his early years, and persisted right up until his death: the phylogenetics and systematics of the Microlepidoptera. He published a number of papers on Microlepidoptera systematics, and a large monograph entitled “Fauna Japonica, Yponomeutidae s. lat. (Insecta: Lepidoptera)” (Keigaku Publishing, Tokyo) in 1977. This resulted in the description of numerous new taxa. In 1982 a comprehensive book of Japanese moths in two volumes entitled “Moths of Japan” (Kodansha, Tokyo) was published, in which he treated 8 superfamilies, 26 families, 456 species (Micropteroidea-Gelechioidea).

He played an important part in the Lepidopterological Expeditions of the University of Osaka Prefecture (present Osaka Prefecture University) to Thailand (1981–1988) supported by the Japanese Ministry of Education, Science and Culture, the main fruits of which were the “Microlepidoptera of Thailand 1–3 (1987–1995)” (edited by him), which has been widely appreciated by Lepidopterists the world over. The scientific output during his career was enormous, including a total of 84 scientific papers.

He was a great teacher, encouraging and stimulating ideas on Microlepidoptera systematics. All who met him were instantly captivated by his vivid enthusiasm and energy, and the strength of his encouragement to others. His research legacy including his extensive Microlepidoptera collection will undoubtedly serve as an inspiration for those studying Microlepidoptera for many years to come. We have pleasure in dedicating this volume to the memory of our great researcher and leader, Sigeru Moriuti.

Yutaka Arita and Mamoru Owada

July 2005
序 文

鱗翅類研究者、特に鱗翅類の分類学や系統学に関心のある人々にとって、2001年9月23日の森内茂先生のご逝去は偉大な指導者を失っただけでなく、高い学識をもったプロの鱗翅類研究者を失うこともありました。

森内先生は1933年3月7日大阪でお生まれになりました。先生は大阪府立生野高等学校を卒業後、大阪府立浪速大学（現、大阪府立大学）農学部にご入校し、1957年に修士課程を修了され、この大学時代には、故一色周知教授の指導の下で鱗翅類の分類学を学ばれました。そして1962年から1996年の34年間、大阪府立大学昆虫学研究室の助手を皮切りに研究者生活を始められ、1995年には同研究室の教授となりました。1966-1967年にはアレクサンダー・フォン・フンボルト財団の助成によりドイツ連邦共和国のバイエルン州立大学動物学研究所に留学し、小蛾類の分類学に関する研究に専念され、1973年には「日本産スガ（果蛾）科の総合的研究」により九州大学から農学博士の学位を授与されました。

森内先生の研究の中心テーマである小蛾類の系統学と分類学への関心は若い時に形成され、ご逝去に至るまで保ち続けられました。先生は小蛾類の分類学に関して数多くの論文を発表され、中でも1977年に出版された大著「日本動物誌・スガ科（広義）（昆虫綱：鱗翅目）」（啓学出版、東京）では多くの新しい分類群の記載をされました。1982年に出版された日本の蛾の包括的な図鑑「日本産蛾類大図鑑」（講談社、東京）では、コバネガ上科からキバガ上科に至る8上科26科456種にのぼる蛾を分担執筆されています。

1981年から1988年におこなわれた文部省科学研究費による大阪府立大学タイ国鱗翅目昆虫調査では重要な役割を果たされました。この調査の成果は先生の編集による「タイの小蛾1-3巻」（1987-1995年）に結実し、世界中の鱗翅類研究者の高い評価を受けています。総計84編の論文を含め、先生が生涯に残された科学的成果は圧倒なものです。

森内先生はまた小蛾類の分類学を前進させるとともに、後に続く人たちに刺激を与える偉大な教師でもありました。先生に出会った誰もが先生の研究への意気込みやエネルギー、それに厚情な人柄に魅了されました。先生の瑰大な小蛾類のコレクションを含む研究遺産は、今後の小蛾類を研究する人たちにとって大切な助けとなることは疑いありません。私たちはここに追悼の意を表し、この論文集を偉大な研究者であり指導者である森内茂先生に捧げます。

2005年7月

有田豊, 大和田守
Bibliography of Sigeru Moriuti

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The following list of publications on entomology written by Sigeru Moriuti is enumerated chronologically during the years 1956 to 1996.

1956

1957

1958

1960

1961

1962
1963

1964
17. Glyphipterix semiflavae Issiki and the allied new species from Japan (Lepidoptera: Glyphipterigidae). Rev. Ent. Japan 16: 60–63, pls. 9–10. [Coauthored with T. Saito.]

1965

1966

1968

1969
1971


1972


32. Two new economically important species of Microlepidoptera infesting larch in Japan (Lepidoptera: Coleophoridae and Tortricidae). *Kontyū* 40: 254–262.

1973


34. Taxonomic notes on the yponomeutid genera *Psychromnestra* and *Macrophanta* (Lepidoptera: Yponomeutidae). *Tyô to Ga* 24: 49–54.

1974


1975


42. Kontyū no Kaikata [How to rear Insects], II. 248 + vii pp. Bunken-Shuppan, Osaka. (In Japanese.) [Coauthored with M. Nagai.]

1976


1977


46. New and unrecorded gelechioid moths from Japan taken by Mr Watanabe in the island of Yakushima. *Tinea* 10: 119–129.

47. Two new species of Microlepidoptera from Japan: a *Gerontha* (Tineidae) and a *Telphusa* (Gelechiidae). *Tinea* 10: 131–136.

1978


1981


1982


52. A new and an unrecorded species of *Thecobathra* (Lepidoptera, Yponomeutidae) from Thailand. *Tyō to Ga* 33: 61–64.


1983


1984


1985

60. Thai species of *Periacma* Meyrick and its allied two new genera (Lepidoptera: Oecophoridae). *Bull. Univ. Osaka Pref.*, (B) 37: 19–50. [Coauthored with T. Saito & A. Lewvanich.]


1986


1987

64. Taxonomic and biological studies of lepidopterous insects in Southeast Asia, with contributions to the agriculture and forestry of the areas: the lepidopterological expeditions of the University of Osaka Prefecture to Thailand. *Microlep. Thai.* (1): 1–4. [Coauthored with H. Kuroko.]


1989


71. Eleven new species of *Gerontha* from Southeast Asia, with notes on others (Lepidoptera: Tineidae). *Microlep. Thai.* (2): 87–112.


1992


1993


76. *Paralida triannulata* Clarke (Lepidoptera: Gelechiidae) new to the fauna of Thailand. *Tyô*
to Ga 44: 75–76. [Coauthored with T. Ueda.]

77. Copromorpha pleurophanes Meyrick (Lepidoptera, Copromorphidae), a copromorphid moth new to the fauna of Thailand. Tinea 13: 273–278.


1994

79. Larva and pupa of Eurhodope dichromella Ragonot (Lepidoptera: Pyralidae). Tyô to Ga 45: 42–46. [Coauthored with T. Kadohara.]


1995

82. Records of three species of Matsumuraeses (Lepidoptera: Tortricidae) from Thailand. Microlep. Thai. (3): 79–85. [Coauthored with F. Komai.]

1996


84. Aganaine moths (Lepidoptera: Noctuidae) from Thailand in the collection of the Entomological Laboratory, University of Osaka Prefecture. Bull. Univ. Osaka Pref. (B) 48: 25–43.
Discovery of a primitive hepialoid moth of the genus Ogygioses
(Lepidoptera, Palaeosetidae) from central Vietnam

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Abstract  A new species of a primitive hepialoid moth of the palaeosetid genus Ogygioses Issiki et Stringer, 1932, O. moriutii Owada et Jinbo, sp. nov., is described from Bach Ma, central Vietnam. By the characteristics of the male antenna, hindtibia and genitalia, this species is considered more closely related to the three Taiwanese species, O. caliginosa Issiki et Stringer, 1932, O. eurata Issiki et Stringer, 1932 and O. issikii Davis, 1995 than to continental O. luangensis Kristensen, 1995 from Northeast Thailand.

The genus Ogygioses was described on the basis of two small fragile hepialoid species, O. caliginosa and O. eurata, from Taiwan, and was surmised to have an affinity to primitive Australian families of the Palaeosetidae and the Anomosetidae (Issiki & Stringer, 1932a, b). This genus and its related genera, Genustes Issiki et Stringer, 1932 from Assam and Osrhoes Druce, 1900 from Columbia, were tentatively included in the family Palaeosetidae (Robinson & Nielsen, 1984; Kristensen & Nielsen, 1994; Davis et al., 1995; Kristensen, 1999).

Kuroko (1990) briefly reported the adult behavior of O. caliginosa, the type species of Ogygioses, observed at Alishan (2,000–2,270m), central Taiwan, that is, the habitat, resting site, resting posture, swarming and factors of swarming. In 1995, Davis et al. revised this genus strictly, and added a new Taiwanese species, O. issikii, and a new Thai species, O. luangensis, the latter of which is the first record of this genus in Continental Asia. In the course of joint research on the insect fauna of Vietnam, conducted by the National Science Museum, Tokyo, and the Institute of Ecology and Biological Resources, Hanoi, the junior author collected a male moth of Ogygioses in the Bach Ma National Park, central Vietnam, on 3rd November 2001. We subsequently searched for additional moths in every possible habitat, though our efforts were in vain.

The moth is almost intermediate between O. luangensis and O. eurata in the wing maculation. It is worth noting that the Vietnamese moth has a well enlarged hind tibia, with a prominent hair pencil. This organ is also developed in all the Taiwanese species, though it is not so developed in O. luangensis from NE Thailand (Davis et al., 1995). In this paper, we describe this interesting moth as new to science.

This study is supported by the Grant-in-aid No. 13575015 for Field Research of the Monbusho International Scientific Research Program, Japan.

Ogygioses moriutii sp. nov. (Fig. 1)

Male. Length of forewing: 7 mm; expanse: 13.5 mm. Head covered roughly with long dark brown scales. Antenna dark brown dorsally, yellowish brown ventrally; intercalary sclerite between scape and pedicel of “primitive lepidopteran type”. Labial palpus with long brown

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and yellowish scales. Thorax covered roughly with long brown scales. Forewing generally orange brown in terminal and dorsal areas, and dark brown in costal and central areas, irroration with small spots of bluish scales. Hindwing dark brown, inner area slightly paler, cilia orange ochre in apical area, dark brown in the others. Foreleg moderate. Midtibia (Fig. 11) rather large, densely covered with long straight whitish scales. Hindtibia (Figs 8, 10) developed, with a long whitish hair pencil. Abdomen dark brown, whitish grey ventrally. Genitalia (Fig. 5) rather small; pseudoteguminal arms rather stout; truleum short and stout; ventrocaudal margin of vinculum widely bilobed; valva broad and short, slightly constricted at middle, with many rather short bristles, the sockets of which are markedly swollen.

Holotype. Male (Fig. 1), C Vietnam, Thua Thien Hue, Bach Ma, 1,200 m alt., 3. XI. 2001, U. Jinbo leg., Genitalia slide No. NSMT 2584 δ, preserved in the National Science Museum, Tokyo.

Habitat (Fig. 4). Moist undergrowth of a good secondary forest near a stream.

Discussion

Davis et al. (1995) did not clearly differentiate the male genitalia of the three Taiwanese species. However, those of O. caliginosa (Fig. 7) are larger than those of O. eurata (Fig. 6), and the valva of O. eurata is slenderer than that of O. caliginosa. In the male genitalia of O. moriutii (Fig. 5), the size is similar to that of O. eurata, and the valva is shorter in proportion and broader than that of O. eurata; the bristles of the valva are longer than those of O. caliginosa; the truleum is the shortest of the three Ogygyioses species examined in this study. Judging from the illustration of Davis et al. (1995, fig. 99), the sockets of bristles on the valva of O. luangensis are not so swollen as in the other species; the pseudoteguminal arms are rather stout, and somewhat resemble those of O. moriutii. The male genitalia of O. issikii (Davis et al., 1995, fig. 98) are similar to those of O. moriutii, except for the pseudoteguminal arms, which are not so stout as in O. moriutii and O. luangensis.

The wing maculation of O. moriutii (Fig. 1) is similar to those of O. eurata (Fig. 2) and O. luangensis (Davis et al., 1995, fig. 9). The ground colour of the forewing of O. moriutii is orange brown, while it is paler in O. eurata, and is paler golden yellow in O. luangensis and O.issikii. The pattern of blackish scales and bluish small markings also differs between these species. The bronzey brown forewing of O. caliginosa (Fig. 3) is markedly different from the other Ogygyioses species. Apart from this, O. moriutii is easily separated from O. issikii (Davis et al., 1995, figs 7-8) by the hindwing lacking a pale yellowish base, and from O. luangensis by the absence of a large yellowish spot at the centre of the forewing.

In the male antenna, the intercalary sclerite of O. moriutii is the “primitive lepidopteran type” of the three Taiwanese species (Davis et al., 1995, figs 11, 25). On the other hand, the Thai species O. luangensis has a different type of intercalary sclerite, the “normal hepalial type” (Davis et al., 1995, fig. 77). Davis et al. (1995) suggested the possibility that the “primitive type” intercalary sclerite in Taiwanese Ogygyioses is an autapomorphic character reversal. Ogygyioses moriutii from central Vietnam belongs to the group of the Taiwanese species in this respect.

As in the three Taiwanese species, the hind tibia of O. moriutii is markedly enlarged, and bears a long hair pencil (Figs 8, 10), while it is not so enlarged and modified in O. luangensis from NE Thailand (Davis et al., 1995, fig. 81). In O. moriutii, a sheath-like projection extends beyond the base of first tarsus (Fig. 8), and this state is similar to that of O. eurata. On the other hand, it is not so elongate in O. caliginosa (Figs 9, 13). Similar modification of hind tibia is found in the related genera Genustes from Assam (Issiki & Stringer, 1932b, fig. 6 D) and Osrphoes from Colombia (Kristensen & Nielsen, 1994, fig. 12).
Davis et al. (1995, figs 53–56) illustrated the naked pleural region of A2 in O. eurata, and suggested that “trough (= the naked pleural fold) may receive hindwing hair pencil fold when wings folded, as well as hindtibial hair pencil”. In O. caliginosa, this naked region extends to A4, and apparently fits to the hindtibial organ with a long hair pencil (Fig. 13). In some dried specimens of Ogygioses caliginosa, the naked pleural region is either exposed (Fig. 13) or concealed in a fold (Fig. 14). As was suggested by Davis et al. (1995), it is quite likely that the pleural fold may receive the hair pencil of the hindtibia, though such a condition is not observed in dried specimens. In derived hepialid moths, the hind leg is highly specialized (Kuznetsov, 1967, fig. 37 G), and is usually inserted into a pocket in the pleural region of the basal abdomen. The compound organ of the hindtibia and the abdominal pleural fold found in Ogygioses may be a prototype of the abdominal pocket, which invaginates the specialized hindleg, found in derivative hepialid moths.

The midtibia of O. moriutii (Fig. 11) is densely covered with long straight whitish scales, which may be connected with the hindtibial hair pencil (Fig. 10). In O. caliginosa, scales on the midtibia are a mixture of long straight ones and ordinary long ones with widened tips (Fig. 12).

The holotype specimen of Ogygioses moriutii was collected by sweeping in the undergrowth of a secondary forest (Fig. 4) by Jinbo, who was not aware of the individual on a leaf or twig. The following day, he searched for additional moths in environments similar to the collection site. Owada by contrast looked for the moths along a cutting for a road with weeds and roots overhanging from the upper edge of the bank. Such a habitat is one of the main resting sites and swarming places of O. caliginosa Issiki et Stringer (Kuroko, 1990). Unfortunately, our efforts were in vain. After this research trip, Owada and Y. Arita visited the Bach Ma National Park in July 2002 and May 2003, and searched for this small moth in the daytime, but they were unable to find it. The flying period of this species seems to be restricted to the autumnal season.

Judging from the characteristics of the male antenna, hindtibia and genitalia, O. moriutii is closely related to the three Taiwanese species, and these four species form a homogeneous group.

Other material examined


Ogygioses eurata: Taiwan, Chiayi, Fenchihu ca 1,400m in alt., 2 ♂, 15. VII. 1984, Y. Arita leg., Genitalia slide No. 2583 ♂, Arita collection 2003, in NSMT. These two males were identified on the basis of the illustrations of male adults, the key to the species of Ogygioses and the description of the wing maculation by Davis et al. (1995, figs 5–6, pp. 1248, 1253–1254). The moths are rather small (expanse, 13–14 mm), and the genitalia (Fig. 6) are also smaller than those illustrated by Davis et al. (1995, fig. 95).

NSMT: National Science Museum, Tokyo.
OPU: Osaka Prefecture University, Sakai.
Checklist of the genus *Ogygioses* Issiki et Stringer, 1932

*Ogygioses caliginosa* Issiki et Stringer, 1932

*Ogygioses eurata* Issiki et Stringer, 1932

*Ogygioses moriutii* Owada et Jinbo, sp. nov.

*Ogygioses issikii* Davis, in Davis *et al.*, 1995

*Ogygioses luangensis* Kristensen, in Davis *et al.*, 1995

Acknowledgement

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References


摘要
大和田守・神保学闘：ベトナム中部で発見されたコウモリガ上科の原始的な属
Ogygioides（鱗翅目，ムカシコウモリガ科 [新称]）
台湾からIssiki & Stringer (1932a,b) によって記載された属Ogygioidesの種は、台湾から3種、タイから1種、合計4種が知られている。この属の一種をベトナム中部で発見したので新種O. moriutii Owada et Jinboとして記載し、故森内茂博士に献げた。この種は、インドシナ半島のタイから記載された本属の中では少し異質なO. luangensis Krietsen, 1995とは異なり、明らかに台湾産するO. caliginosa Issiki et Stringer, 1932、O. eurata Issiki et Stringer, 1932とO. isikii Davis, 1995に近縁である。

Postscript (by M. Owada)
In 1973, when I was a student on a graduate course at the University of Osaka Prefecture, Sakai, I made a one-month collecting trip to Taiwan from June to July. My main targets were, of course, noctuids, especially herminiine moths, and I spent a worthwhile and fruitful time at such collecting sites as Wulai, Lushan spa (Hotso), Fenchihu, Alishan, Juisui, etc. It was a little misty at Alishan, and I took a turn in a forest, where old planted trees of Cryptomeria japonica were abundant. I became aware of small moths, which were swarming under the edge of a cutting of a narrow mountain trail. I guessed they would be adelids, but, to my surprise, the moths had subdued dark wings and extremely short antennae. For a moment, I doubted if they were truly moths, but found that the wings were covered roughly with loose lepidopteran scales. Small assemblages of swarming moths were found everywhere in the forest. I brought some specimens of this interesting moth to our laboratory, and asked to Dr S. Moriuti for its systematic position. Immediately, he identified it as an Ogygioïdes species, showed me a reprint of the papers by Issiki and Stringer (1932a,b), and told me a story of his professor, Dr Syôji Issiki, whom I had never met. Dr Moriuti advised me to investigate these Ogygioides moths, and I studied the morphology of the primitive Lepidoptera for the first time. I was greatly impressed that a sclerotized aedeagus was absent in the male genitalia of this hepialoid moth. Perhaps he introduced this topic to his colleagues of the Entomological Laboratory, and Professor Dr H. Kuroko was also interested in this primitive moth. In June of the next year, 1974, I guided Dr Kuroko through a forest on Alishan, and we were fortunate to find again many swarming groups of Ogygioides caliginosa. Thirty years have passed since those days, and I would like to dedicate this Vietnamese Ogygioides to the late Dr S. Moriuti.
A partial gynandromorphic *Nemophora rubrofascia* (Christoph) from Japan
(Lepidoptera, Adelidae)

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Abstract  A partial gynandromorphic adelid moth, *Nemophora rubrofascia* (Christoph, 1882) is reported. Female characters comprise only the left eye and left antenna of the head; the remaining parts, e.g. thorax and abdomen including genitalia, represent male characters. This is the first gynandromorphic record of a nonditrysian moth. Possible mechanisms producing the adelid gynandromorph are briefly discussed.

Key words  gynandromorphy, Adelidae, nonditrysia, *Nemophora rubrofascia*, sex chromosome

Introduction

Many examples of gynandromorphic Lepidoptera, including bilateral forms, have been reported (Davis, 1994). Gynandromorphism is easily detectable when the individual of the species in question has conspicuous sexual dimorphism. In Lepidoptera, it usually occurs and is most observed in difference of wing markings. Many diurnal adelid moths including *Nemophora* species, are known to be sexually dimorphic, especially in the shape of the eyes and antennae and sometimes in the wing markings. A remarkable gynandromorphic adelid *Nemophora rubrofascia* (Christoph, 1882), collected by Dr T. Saito in Minoo, Osaka Prefecture, Japan in 1982, represents the first record of a gynandromorphic nonditrysian moth.

In this paper, I report on a field-collected gynandromorph of *N. rubrofascia* from Japan and briefly discuss causative mechanism of the adelid gynandromorph.

Materials and methods


According to Dr Saito (pers. comm.), the moth was collected by sweeping of ferns in an evergreen forest in Minoo, Osaka, where *Quercus* species are dominant. The abdomen was removed from the dried specimen and macerated for about 5 minutes in a 10% KOH heated waterbath for observing the abdomen and genitalia.

Results and discussion

The sexes of *Nemophora rubrofascia*, are normally similar in wing pattern, but sexual dimorphism in this species can be manifested in the following ways: 1) the eyes of the male are larger than those of the female; 2) the antennae of the male are long, more than 2 times as long as the forewing, thin and smooth, while those of the female are relatively short and slightly longer than the forewing, with the basal half densely covered with rough, bronzy black scales; 3) the vertex is covered with raised yellow hairs mixed with blackish brown, while the hairs are entirely yellow in the female, 4) the labial palpi are densely covered with long hairs in the male, but the hair is much scarcer and shorter in the female, 5) the frenulum of the hindwing is a single stout bristle in the male, but a series of 4–6 thinner bristles in the
Gynandromorph of *Nemophora rubrofascia*

Fig. 1. Gynandromorph of *Nemophora rubrofascia* (Christoph).

female, and 6) the hind tibiae bear erect long hairs dorsally only in the male.

In the gynandromorph specimen examined, the right eye is large, with the left eye much smaller (vertical diameter of right eye is 1.5 × the left) (Figs 1–2). The right antenna is 2.3 × as long as the forewing, but the left one is 1.1 × as long as the forewing (Fig. 1). These are typical gynandromorphic features. In contrast, the frenula of both hindwings consists of a single bristle. In both forewings, the retinaculum is present, which shows that the wings possess male characters. In addition, both wings are almost symmetrical (right and left forewing = 10.0mm, right and left hindwing = 7.5mm), which may indicate that the developmental anomaly did not develop in the wings. The labial palpi are densely covered with raised, golden brown hairs, and the hind tibiae bear long hairs dorsally which also show male characters. The abdomen is also symmetrical with normal male genitalia. The raised yellow hairs of the vertex show female charachers. Thus, in the gynandromorph, female characters are only found in the left eye, left antenna and hairs of the vertex of the head, while the thorax and abdomen including the genitalia, exhibit normal male characters.

Nickel (1983) presented four hypotheses for biological causes of gynandromorphism: 1) partial fertilization, 2) dispermy (polyspermy), 3) dispermy of binucleated egg, and 4) chromosomal elimination. Partial gynandromorphic specimens may be useful in considering causes of gynandromorphism. Celary and Wisniewski (2001) reported a gynandromorph of *Andrena helvola* (Linnaeus, 1758) (Hymenoptera; Apoidea). In this specimen, most of the body represents male features except for female characteristic facial foveae and antennae. They suggested that because bees have haplo-diploid sex determination, the unfertilized nucleus can give rise to male tissues, while the fertilized nucleus gives rise to female ones. This hypothesis represents a case of partial fertilization.

Nihei and Carvalho (2002) reported a gynandromorphic specimen of *Polietina orbitalis* (Stein, 1904) (Diptera, Muscidae). The specimen possessed a head with mostly female characteristics, while the terminalia presented a mixture of male and female features. The gynandromorphic features were restricted to the genital structures. They show other examples of similar pattern in Diptera and explained the origin of these gynandromorphs by the occurrence of recombination in a later mitotic division involving autosomal sex factor mechanism or by chromosomal elimination in a later stage of its embryological development. In the latter case, because the female is homozygous (XX), the elimination of the X-chromosome induced the partial male feature.

In the ditrysian Lepidoptera, it is known that the male is usually homozygous (ZZ) and the female heterozygous (WZ) (De Prins & Saitoh, 2003). If the gynandromorphic *N. rubrofascia* has this sex chromosome type, then the presence of partial female characteristics seems to be difficult to explain by any of Nickel's (1983) hypotheses. Recently Traut and Marec (1996, 1997) suggested that Lepidoptera originally had a ZZZZ sex chromosome mechanism like Trichoptera; the WZZZZ sex chromosome mechanism having evolved later in the ditrysian branch of Lepidoptera. If the nonditrysian *N. rubrofascia* has a ZZZZ type, then it may be possible that the partly gynandromorphic feature was caused by chromosomal elimination later in ontogeny.

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I wish to express my cordial thanks to Dr D. R. Davis (National Museum of Natural History, Washington) for critical review of the manuscript, and to Dr T. Saito (Ikeda City, Osaka) for providing me with the gynandromorphic specimen of *N. rubrofascia* reported in this paper. Dr W. Celary (Polish Academy of Science) kindly provided me with pertinent literature. I would like to dedicate this paper to the late Dr S. Moriuti who was one of our most
distinguished Japanese Lepidopterologists and was very interested in the gynandromorphic specimen discussed in this report.

References


**摘 要**

広渡俊哉：日本で見つかった部分的雌雄同体のベニオピヒゲナガ（鳞翅目、ヒゲナガ科）

ヒゲナガ科は鳞翅類の中では単門式の♀交尾器を有する原始的な一群に属し、触角や複眼の形状に顕著な性差がみられる。1982年6月、石原隆己氏によって大阪府箕面市で採取されたベニオピヒゲナガは、右の触角が♂（前翅の2.3倍）、左の触角が♀（前翅の1.1倍）、右の複眼は♂（大型で左の複眼垂直直徑の1.5倍）、左の複眼は♀の特徴をもっていた。この個体は、外見から体の左半分♀右半分♂の雌雄同体（ギナンドロモールフ）であると思われたが、翅の翅刺と保帯、脚の鱗毛、交尾器などの形態を調べたところ、すべて♂の特徴を現しており、♀の特徴は左の触角、左の複眼、頭部の鱗毛などに限って現れていると考えられた。

雌雄同体が発現するメカニズムについては諸説があるが、このうち「性染色体の欠失説」にもとづいてベニオピヒゲナガ♂個体における部分的♀の出現について考察した。一般的に鱗翅目は雌ヘテロ（♀：WZ、♂：ZZ）の性染色体をもつことが知られているが、ベニオピヒゲナガもこのタイプだとすると、性染色体の欠失によって♂個体に部分的♀の特徴が現れるという説明ができない。しかし、最近、鱗翅目の性染色体は、二門類以外の原始的な一群ではトピゲラ目と同様にZZZ型（♀：ZO、♂：ZZ）であり、WZZZ型は二門類で獲得されたのではないかと推定されるようになった（ただし、すべての二門類がWZZZ型というわけではない）。ベニオピヒゲナガがZZZ型の性染色体をもつとすれば、胚発生の後期段階で性染色体の欠失（ZZ → Z）に♀個体で部分的に♀の特徴が現れたという説明が可能である。なお、二門類以外での雌雄同体の記載は、今回のベニオピヒゲナガが初めてである。
Taxonomic study on Japanese species of the genus *Eumasia*, hitherto unknown from Japan (Lepidoptera, Psychidae) 1)

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Abstract Two new Japanese species, *E. viridilichenella* and *E. muscella*, of the genus *Eumasia* of the Psychidae are described together with illustrations of male genitalia and wing venation. The genus is newly recorded from Japan. The new species differ from the two known Palaeartic species, each from Europe and from Central Asia, in the ventrally bent ampulla of the male genitalia. Larvae of *E. viridilichenella* feed on green powderylichen mostly on tree trunks, and bear a cylindrical case covered with minute particles of the lichen; those of *E. muscella* feed on mosses usually on rocks, and bear a cylindrical case ornamented with mosses, each of which are fixed on case surface with a short silken string. The habitat of the two species is usually forested areas in contrast to the arid habitats of the two known Palaeartic species. The phylogenetic position of the genus is also discussed.


Introduction

The genus *Eumasia* was founded for the European *Coleophora parietariella* Heydenreich, 1851, by Chrétien (1904). The type species was first described as a species of the family Coleophoridae, and then it was assigned to the genera *Tinea* and *Dysmasia* of the family Tineidae. Chrétien (1904) transferred the species to the family Psychidae based on the presence of the anal hair tuft (corethogyne) on apical region of the female abdomen and the cylindrical larval case not flattened as often found in the Tineidae. The first character is currently considered as one of the important autapomorphies of the Psychidae (Saigusa, 1962, Robinson, 1988, Davis & Robinson, 1999). After the description of *Eumasia*, this genus was described again as *Kruegeria* in 1920 by Müller-Rutz based on *Bankesia crepusculella* Müller-Rutz, 1920, which is a synonym of *Eumasia parietariella*. The generic name *Kruegeria* is a junior homonym of *Kruegeria* Schmidt, and was synonymized in 1981 by Koçak (Nye & Fletcher, 1991). In the Palaeartic Region the genus had been represented by only the type species for a long time till Solyanikov (1986) described the second Palaeartic species, *Eumasia montanella* from Tajikistan.

We found two species of *Eumasia* in Honshu and Kyushu, Japan. They are very similar to the known Palaeartic species in the peculiar wing venation of the genus and the fundamental structure of the male genitalia. However, some details of the male genitalia are distinctly different from those of the known species. In this paper we described them as new species and mention their biology including structure of larval cases. The genus *Eumasia* was once recorded by Sonobe (1995), who recorded *Eumasia arinatella* (Walker) or its ally from Tochigi Pref., Honshu. Judging from his statement and illustrations, he probably mistook the case of this species for that of a tineid also mentioned in the same paper. If this inference is

1) This study was in part supported by a Grant-in-Aid for JSPS fellowships from the Ministry of Education, Science, Sports and Culture, Japan (No. 15007615).
correct, the cylindrical larval case of this species mentioned above seems to be that of a psychid, probably assignable to the genus Ceratosticha Meyrick, 1935. The larvae of this species is rather common on stone-walls of road side and rocks in open places in Japan. We have never found any true Eumasia species constructing a slender cylindrical case covered with only minute sand-grains in Japan.

The taxonomic position of Eumasia in the Psychidae is not well clarified. Sauter and Hättenschwiler (1991) included the genus in the Psychidae, but treated it under “incertae sedis”. A short discussion on its systematic position is also given in this paper.

Description

Genus Eumasia Chrétien, 1904


Small-sized moths with fully developed lanceolate wings in both sexes, filiform antennae, no ocelli, 3-segmented labial palpi, no maxillae, 9 veins in forewing, obsolete discoidal cell and trifurcate Rs+M1+M3 in hindwing, peculiar valvae, deep membranous invagination of diaphragma, and long broad saccus in the male genitalia. Larvae bear a long cylindrical case, and feed on lichens and mosses.

Head moderately large, distinctly swollen on postvertical area; compound eye large, well protruded, with its vertical diameter more than 2/3 of head height; lateral ocelli absent. Narrow posterior region of vertex clothed with long hair-like scales rather roughly projecting dorsally or dorsolaterally; dorsal surface of vertex densely clothed with long slender scales, which are not roughly directed dorsally but curved ventrally overlapping anterodorsal to anterior regions of cranium as a fluffy bundle that also covers antennal pecten; in frontal aspect the bundle more or less tapering apically (ventrally). Antenna filiform, nearly as long as forewing excluding fringe; scape enlarged, slightly flattened, 2 × as long as wide, 3 × as long as pedicel or longer than basal 3 flagellomeres taken together, with anterior pecten dense and consisting of long hair-like scales 2 × as long as width of scape; pedicel simple; in males flagellomeres short, middle flagellomeres nearly 2 × as wide as long, 2/3 as thick as long; apical flagellomeres more slender; flagellomeres dorsally covered with scales, ventrally with sensory hairs as long as thickness of flagellomeres and often arising from weakly raised minute tubercles; ventral surface of most flagellomeres weakly projected except for basal region, so that flagellum in lateral aspect appearing somewhat dentate; female flagellomeres more slender than male ones, cylindrical, and covered with scales on entire surface, without sensory hairs. Labial palpus 3-segmented, slightly shorter than head, 2 basal segments short, 2 × as long as wide, clothed with long, hair-like, roughly erect scales; 3rd segment slender, in males 3–4 × as long as thick, 1.5–2.0 × as long as basal segments, covered with decumbent scales; in female the 3rd segment shorter than in male. Maxillary palpus represented by one small oblong segment apically bearing piliform scales; galea entirely obsolete.

Thorax dorsally covered with short scales; tegula clothed posteriorly with long hair-like scales; no specialized long scales on mesoscutellum. Fore tibia short, ca. 0.4 × as long as fore femur, with epiphysis much reduced and covered with a brush of long scales; fore tarsus shorter than 4 × length of tibia; mid tibia short, with a pair of apical spurs, posterior spur longer, nearly as long as tibia; hind tibia roughly clothed with long piliform scales, with each pair of median and apical spurs.
Wings long and narrow; forewing lanceolate, pointed apically; hindwing slender and pointed apically. Forewing venation: Discoidal cell elongate, 2/3 as long as wing, without accessory cell, and with faint M stem which does not fork in the cell, discocellulars faint; Rs 3-branched, R2 and R3 united into a single vein; Rs absent, Rs ending on costa slightly proximal to wing apex; R5 and M1 usually stalked, sometimes from point of anterodistal corner of discoidal cell; M2 absent; CuA1 and CuA2 short; CuP hardly traceable in its basal half; A1+A2 ending on posterior margin more or less proximad of 1/2 length of wing, cell A1 nearly 1/3 as long as united A1 and A2. Hindwing venation: Sc and R1 forming a small wide triangular cell basally; Sc+R1 running close to costa and ending on it on apical 1/3 of wing; discoidal cell absent; Rs, M1 and M3 forming a trifurcate vein, which emits M3 before the middle of wing; Rs ending slightly proximad of wing apex; stem of CuA fork long, consequently its branches short; CuP untraceable; A1 and A2 very short.

Upperside of forewing covered with broad scales, yellowish white to light yellowish brown in ground colour, and marked with darker, usually pale brown to dark brown irregular speckles or short striae, sometimes forming more or less distinct bands or dots; fringe consisting of long piliform and often apically long-forked scales or long scales with slender shaft and widened, dentate apical region. Upperside of hindwing covered with broad scales, yellowish white to pale yellowish brown; fringe scales similar to those of forewing, but longer and more slender, those on middle of posterior margin of wing 1.5–2.0 × as long as wing width.

Abdomen covered with broad scales; apical region of male abdomen fringed with longish piliform scales; female with dense long corethrogynie, anal hair tuft, thinly covered with long piliform scales as long as corethrogynie itself. Male 8th abdominal segment with a pair of coremata (group of specialized scales in a small pouch).

Male genitalia peculiar for psychids: Dorsum moderately large, triangular in lateral aspect, in dorsal aspect broadly and evenly rounded posteriorly, without hook-like uncus. Vinculum broadened ventrally, and its ventral half transformed into a large saccus, which is 1–2 × as long as height of ring, broad basally, tapered to pointed anterior apex; upper region of posterior margin of vinculum strongly thickened as an inner ridge which serves as a condyle for proximal margin of outer wall of valva; diaphragma sunk into coelom as a deep membranous invagination. Valva with ampulla moderate or large in size, bearing long fine bristles directing proximally on inner surface, harpe shorter than ampulla, consisting of densely setiferous dorsal lobe and strongly sclerotized apical part of varied shape bearing several outstanding setae on posterior submargin; depth of incision between ampulla and harpe varying between species, extremely deep in one species; no vallum penis formed; costa extending anteriorly as a broad transstitial arm comprising lateral wall of the diaphragma invagination; sacculus more or less isolated from the rest of valva and both sacculi united into a juxta-like short ventral sclerite occupying posterior region of ventral wall of manica. Phallus moderately or very long, slender and almost straight, with dorsal projection at apex; no prominent cornuti present.

The genus *Eumasia* in temperate Eurasia consists of the two known species and two new Japanese species here described. The two known species inhabit rather arid places, while the Japanese species mostly live in forests. In addition to them we have another unnamed species from temperate northern Myanmar. Therefore the genus seems to be widely spread in both of arid and forested areas with temperate climate in Eurasia, particularly in China. The genus *Eumasia* is also known from several species from the Oriental Region (Sri Lanka and India) and Northern Africa (Morocco) (Beccaloni *et al.*, 2005). It seems to be uncertain whether some of them truly belong to this genus or not.
Key to the Palaearctic species of the genus *Eumasia* mainly based on male genitalia.

1. Ampulla of valva strongly bent at middle; saccus 1.6–2.0 × as long as height of ring; ventromedian region of vinculum produced posteriorly into a short spatulate projection; phallus short, as long as saccus. Scales of forewing fringe with broad apical region which has several serrations ................................................................. 2
   — Ampulla of valva with evenly and weakly curved dorsal margin; saccus almost as long as height of ring; ventromedian region of vinculum simple, not produced into a projection; phallus long, nearly 2 × as long as saccus. Scales of forewing fringe only slightly broadened on apical region which has brush-like fine branches ........................................... 3

2. Ampulla without a prominent protuberance at bent region of dorsal margin; harpe with incurved posterior margin bearing apically curved setae submarginally; ventromedian projection of vinculum longer. Upperside of male forewing with pale yellowish grey ground colour; hindwing upperside grey .......................... *Eumasia viridilichenella* sp. nov. (Japan)
   — Ampulla with a prominent protuberance at bent region of dorsal margin; harpe with straight posterior margin bearing straight setae submarginally; ventromedian projection of vinculum shorter. Upperside of male forewing with almost white ground colour; hindwing upperside white .......................................................... *Eumasia muscella* sp. nov. (Japan)

3. Ampulla and harpe widely divided by extremely deep incision which extends almost to vinculum; ampulla narrower; length of valva measured from anterior extremity of transtillary arm to tip of ampulla shorter than height of ring .......................................................... *Eumasia montanella* Solyanikov, 1986 (Tajikistan)
   — Ampulla and harpe divided by much shallower incision which ends distinctly before vinculum; ampulla broader; length of valva measured from anterior extremity of transtillary arm to tip of ampulla longer than height of ring .......................................................... *Eumasia parietariella* Heidenreich, 1851 (Europe)

**Eumasia viridilichenella** sp. nov. (Figs 1, 2, 5, 8, 9, 11)

Male (Fig. 1). Vertex clothed with yellowish grey hair-like scales mixed with pale brown ones on lateral regions; scales on labial palpus dark brown on inner side, grayish yellow on outer side. Dorsal scales of antennal flagellum brown. Thoracic nota covered with grayish yellow scales mixed with brown scales scattered on entire surface; tegula covered with brown scales and clothed with long yellowish white scales posteriorly. Thoracic pleura, coxae and femora covered with yellowish white scales; scales on anterior surface of fore coxa, dorsal surface of tibiae and tarsi brown.

Wing (Fig. 11) narrow, 3.58–3.77 × as long as wide, widest at subbasal region, then slightly tapering apically, with rather narrowly pointed apex; costa weakly curved posteriorly beyond subapical region; discoidal cell 0.59–0.63 × as long as wing; stem of R+5–M1 stalk usually moderately long, 0.06–0.26 × as long as R+5; CuA1 and CuA2 longish. Hindwing narrow, 3.98–4.49 × as long as wide, strongly tapered from beyond middle to apex, with narrowly pointed apex; stem of Rs–M1 fork 0.36–0.60 × as long as Rs; branches of CuA long.

Upperside of forewing with grayish yellow ground colour, with brown spots, speckles and striae, which are irregular in shape, unclearly bordered, and more or less variable among individuals; main components of the wing marking are as follows: 5 rather prominent spots along costa, 5 smaller spots along outer margin, two (basal and median) along posterior margin, and irregular transverse short striae spreading all over wing surface; each pair of the basal spots on costa and on hindmargin, subbasal spot of costa and median spot on hindmargin, and subapical spot on costa and tornal spot of outer margin irregularly connected by strongly developed striae to become obscure bands; fringe grayish yellow obscurely
checkered with brown mostly opposite the dark spots along outer margin, the checkered brown parts more prominent in basal scale range of fringe than in apical range. In specimens darker than the illustrated holotype, forewing upperside almost reticulated with brown, and in the darkest specimens the forewing has small pale speckles on brown ground. Scales of outer range of forewing fringe hair-like and distinctly dilated on apical region, distal margin of which has several dentations about 1/3 as long as apical width of the scale.

Upperside of hind wing dark grey, fading somewhat towards anteroproximal region. Fringe also grayish, its scales similar to those on forewing, but usually longer.

Abdomen covered with dark grey scales; apical abdominal segment with a tuft of longer hair-like scales distally. Male genitalia (Fig. 9): Ring moderately broad in lateral aspect; ventromedian projection of vinculum long, nearly as long as width of median region of vinculum; saccus long, 2 × as long as ring height. Membranous invagination of diaphragma extending anteriorly to middle of saccus. Valva short and broad; ampulla narrow, directed dorsally, then strongly bent ventrally at middle, without a prominent tubercle at dorsal margin of bent region; harpe much shorter and broader than ampulla, with weakly incurved posterior margin and bluntly rounded ventrodistal region, bearing several apically curved setae along posterior submargin and many stiff setae on small dorsal projection, which extends to level of lower margin of ampulla. Phallus moderately long, 2 × as long as ring height, suprazonal region of aedeagus slightly shorter than 2 × length of subzonal region.

Measurements. Expanse 8.2–10.1 mm; forewing length 3.9–4.7 mm (including fringe); 3.6–3.9 mm (excluding fringe).

Female (Fig. 2). Similar to male, but coloration of vestiture of body and wings paler. Antenna shorter and more slender; hairs on vertex yellowish white. Thoracic nota covered with yellowish white vestiture. Wings slightly broader. Upperside of forewing with yellowish white ground colour, and marked with pale brown speckles and striae which are much more reduced and variable between specimens than in the male. Fringe of forewing also paler. Abdomen covered with greyish yellow scales; corethrogyne also greyish yellow.

Measurements. Expanse 8.5–10.2 mm; forewing length 3.8–4.8 mm (including fringe); 4.3 mm (excluding fringe).

Distribution. Japan (Honshu and Kyushu).


Taxonomic remarks. This new species is peculiar in having a ventrally strongly bent ampulla and an extremely long saccus in the male genitalia, by which it may be easily distinguished from the known Palaeartic species (see Fig. 10, male genitalia of E. parietariella). As to the wing marking, the upperside of the forewing has more distinctly bordered bands and spots in E. parietariella than in this new species. The wing fringe scales are very slender from base to apical region and apically divided into several long slender branches in the two known species, while in the new species the scales are distinctly widened apically and with several dentations on the distal margin.
Biology. The larvae of this new species inhabit old forests. They live mostly on tree trunks, sometimes on rocks, stone monuments, tombstones, etc. that are covered with green powdery lichen, on which the larvae exclusively feed (Fig. 8). The larval case (Fig. 5) is slender, cylindrical and very soft, 8–9 mm in length, 1.5–1.9 mm in diameter, spun with silk and extensively covered with minute particles of the green lichen, so that the case is extensively green, and with several dark brown narrow longitudinal stripes of various lengths which are composed by minute particles of barks. Adults were often found sitting on the tree trunks where they emerged.

*Eumasia muscella* sp. nov. (Figs 3, 4, 6, 12, 13)

Male (Fig. 3). Similar to male of *E. viridilichenella*, but slightly larger and with lighter scales, differing as follows: Hair-like scales on vertex pale yellowish white. Mesonotum covered with pale yellowish white scales, and mixed with a few darker scales close to tegulae.

Wing (Fig. 12) similar to *E. viridilichenella*, but broader, 3.42–3.44 × as long as wide, widest at middle, then rather strongly tapering apically, with more broadly pointed apex; costa more strongly curved posteriorly beyond subapical region; discoidal cell 0.64–0.65 × as long as wing; stem of R<sub>4+5</sub>–M<sub>1</sub> stalk short, 0.05 × as long as R<sub>4+5</sub>; CuA<sub>1</sub> and CuA<sub>2</sub> shorter, more strongly directed posteriorly. Hndwing narrow, 4.03–4.08 × as long as wide, weakly tapered apically beyond the middle, with rather broadly pointed apex; stem of Rs–M<sub>1</sub> fork 0.31–
0.34 × as long as Rs; branches of CuA shorter.

Upperside of forewing with almost pale yellowish white to white ground colour, marked with brown speckles and striae; these markings generally similar to those of viridilichenella females, and much more weakly developed than in viridilichenella male; no obscure bands present. Upperside of hindwing white to pale yellowish white, with fringe of the same colour.

Abdomen covered with yellowish grey scales above. Male genitalia (Fig. 13): Similar to those of viridilichenella. Ring moderately broad in lateral aspect; ventromedian projection of vinculum shorter, 1/2 as long as width of median region of vinculum; saccus shorter, 1.6 × as long as ring height. Membranous invagination of diaphragma extending anteriorly to middle of saccus. Valva short and broad; ampulla narrower, directed dorsally, then strongly bent ventrally at middle, with a prominent tubercle at dorsal margin of bent region; harpe as long as and broader than ampulla, with straight posterior margin weakly notched near ventral margin and rounded ventrodistantly, bearing several straight setae along posterior submargin and many stiff setae on rather broad dorsal projection, which does not extend to level of lower margin of ampulla. Phallus shorter, 1.6 × as long as ring height, suprazonal region of aedeagus 1.3 × as long as subzonal region.

Measurements. Expanse 9.1–10.2 mm; forewing length 4.4–4.7 mm (including fringe); 4.0–4.1 mm (excluding fringe).

Female (Fig. 4). Similar to male, but markings on upperside of forewing much more reduced, represented by fine, short striae which are often irregularly connected to form fine dark reticulation on white ground. Corethrogynae pale yellowish grey.

Measurements. Expanse 9.5–11.3 mm; forewing length 4.5–5.3 mm (including fringe); 4.4 mm (excluding fringe).

Distribution. Japan (Honshu and Kyushu).

Types: Holotype ♂, Mt. Wakasugiyama, Sasaguri, Fukuoka Pref., Kyushu, July 7, 1960, T. Saigusa (deposited in Kyushu University Museum). Paratypes: 2 ♂ 3 ♀, same locality as holotype, July 5–7, 1960, T. Saigusa; 1 ♂, Kyushu Univ. Farm, Harumachi, Fukuoka Pref., Kyushu, July 14, 1958, T. Saigusa; 1 ♂, Hirao (Minamikōen), Fukuoka-shi, Fukuoka Pref., July 2, 1960, T. Saigusa; 2 ♀, Harumachi, Fukuoka Pref., Kyushu, July 1–10, 1958, T. Saigusa. In addition to the type-series, we collected larvae of this species at some localities of
Osaka Pref. (Mt. Inunakisan) and Okayama Pref. in Honshu and Miyazaki Pref. (Kobayashishi) in Kyushu.

Taxonomic remarks. This species is very similar to Eumasia viridilichenella in the male genitalia. However, the ampulla is more strongly bent, and with a prominent tubercule at the bend, the setae on the dorsal lobe of the harpe are stronger, the posterior margin of distal region of the harpe is not evenly emarginated, the phallus, saccus and ventromedian projection of the vinculum are shorter. In addition to the male genitalic differences, the ground colour of the forewing upperside is almost whitish and distinctly paler than in the preceding species, and the upperside of the hindwing is almost white.

Biology. The larvae of this new species usually inhabit forests or shaded places in open environments such as ruins of old castle where stone-walls are shaded by trees. They live on rocks, stone monuments, tombstones, etc. that are covered with mosses, which the larvae exclusively feed on. They were sometimes found on vertical soil surfaces covered with moss along the sides of forest trails. The larval case (Fig. 6) is slender, cylindrical and harder than that of the preceding species, 8.5–9.5 mm in length, 1.4–1.8 mm in diameter, spun with silk and rather sparsely covered with minute particles of sand-grain, soil and dead plant material, and characteristically ornamented with many pieces of moss. Cut ends of moss were attached to the case surface with a short fine silk string by the larvae as if they planting the mosses on their case. The mosses are green and seem to be alive throughout the larval period, making it difficult to find larval cases among the moss.

Discussion

Systematic position of the genus Eumasia

As stated in the introduction, the type species of the genus was first described as a species of Coleophoridae, and then it was assigned to the Tineidae. The species was first referred to the Psychidae by Chrétien (1904) when he created Eumasia. The type species was also assigned to the psychid genus Bankesia, when it was described as crepusculina Müller-Rutz, and Kozhantshikov (1956) placed crepusculina in the psychid genus Taleporia. Zagulyaev (1978) treated the genus in the Psychidae, and placed it between Narycia and Fumea (=Psyche), but this arrangement seems to have no phylogenetic meaning. Sauter and Hättenschwiler (1991) included the genus in the Psychidae, but treated it as “incertae sedis”. Herrmann (1994) followed this treatment. Hättenschwiler (1997) placed Eumasia parietariella at the end of his
Psychidae chapter, and stated that it is close to Psychidae, but its systematic position is not clarified.

1) The systematic position of *Eumasia* in the superfamily Tineoidea. The combination of character states supporting monophyly of the family Psychidae was discussed by Saigusa (1962), Davis (1987), Robinson (1988), Robinson and Nielsen (1993), Davis and Robinson (1999), etc. These are summarized as follows: (1) male genitalia lack gnathos or brachia; (2) male phallus is surrounded by membranous manica, so that it is freely movable (except *Diplodoma–Dahlica* group, in which the fulutura inferior connects the ventral region of the zone of the phallus with the ventromedian region of the vinculum); (3) female 7th abdominal segment with corethrogyne extremely dense, and consisting of very fine woolly hairs, not piliform scales (in some vermiform females of Oiketicinae, the hairs of corethogyne are transformed to peculiar dust-like scales); (4) prothoracic tergal plate of larvae continuously expanded laterally to include prothoracic spiracles and lateral setae group (L1, L2, L3); (5) crochets of larval abdominal prolegs reduced and arranged in a lateral penellipse; (6) larval labrum with 4 pairs of ventral setae; (7) anal plate of larvae with pair of campaniform sensilla on anterior region; (8) just after they hatch, larvae construct a movable case circular, trigonal or quadrangular in cross section with anterior and posterior openings, and bear it till pupation (except an Oriental group constructing string-like long tubes, of which one end normally tightly attached to substratum on which their food grows.).

The genus *Eumasia* has all the above-mentioned adult characters. The larvae of the two Japanese species described above have all the larval characters. Therefore, it is certain that the genus *Eumasia* truly belongs to the family Psychidae which is characterized as a monophyletic group by the combination of the above-mentioned character states which are considered to be apomorph (excepting the plesiomorphic freely movable phallus).

2) Systematic position of *Eumasia* in Psychidae. Although *Eumasia* undoubtedly belongs to the Psychidae, it is difficult to determine its systematic position in the family. The type species were once assigned to the genera *Bankesia* and *Taleporia*, which are members of the *Diplodoma* genus group (see Saigusa, 1962). This group is considered to be monophyletic based on the following autapomorphies: harpe of male genitalia with only one spine-like seta apically; larval case trihedral; anterior spinules on dorsum of pupal abdominal segments scattered (Saigusa, 1961, 1962). However, *Eumasia* has no autapomorphies of the *Diplodoma* genus group, and it does not belong there.

As far as we know, the valva of the psychid male genitalia is distally divided into a lobe like pilose ampulla and a strongly sclerotized ventral harpe which is slender distally and bears 1 to several spine-like setae. The inner walls of the valvae also connect with the vallum penis, which is composed of the lateral region of the anellus (the vallum penis is rarely reduced as in *Kozhantshikovia* Saigusa, 1961, *Dahlica* Enderlein, 1912, etc.). The male genitalia of *Eumasia* differ from the ordinary psychid genitalia in the peculiarly shaped harpe consisting of a long setose dorsal lobe and sclerotized distal process lacking spine-like setae, instead bearing scattered simple fine setae, and in lacking a vallum penis. In addition the male genitalia of *Eumasia* have a juxta-like wide plate on the bottom of the manica, and rather isolated sacculi are fused with this plate. This structure is unique in the Psychidae. The membranous invagination of the diaphragma is also peculiar, but a similar invagination is found in the genus *Tayalopsycha* Sugimoto & Saigusa, 2002, from Taiwan (Sugimoto & Saigusa, 2002). However apart from this invagination, this genus has ordinary psychid male genitalia, and has no close relationship to *Eumasia*.

Based on the above discussion, it is considered that *Eumasia* has no close relationship, neither to any of the groups of Eurasian psychids listed by Sauter and Hättenschwiler (1991) nor to the whole Psychidae treated by Kozhantshikov (1956) and Davis (1964). If the above-
mentioned male genital characters of the Psychidae are autapomorphic to the family, *Eumasia* may be considered to be a very early offshoot differentiated from the ancestral psychids. However, our knowledge of the Psychidae, especially the “primitive” so-called Micropsychina from the subtropical and tropical zones of the world, is very limited, and the systematic position of *Eumasia* among such tropical groups needs to be clarified in the future.

**Acknowledgements**

We express our thanks to Dr. G. S. Robinson (The Natural History Museum, London) for taxonomic information on the genus *Eumasia* and useful comments on the early draft of this paper, and to Mr. M. Sakabe (Mie Pref., Japan) for the generous gift of the specimens used in this work.

**References**


摘 要

三枝豊平・杉本美華：日本未記録のEumasia属の邦産種に関する研究（鱗翅目，ミノガ科）

本州および九州から従来日本列島から未記録のミノガ科の属，Eumasiaの2新種，Eumasia viridilicheniellaとEumasia muscellaを記載した。本属の特徴は次の通り：雄雄とも発達した翅を有し，角状は系統，前翅はR3とR4が1本となり，R4が消失し，中室にMの分歧は付属室を欠く；後翅は中室を欠き，Rs，M₁およびM₂は共通の柄から分歧する；前後尾器は特異で，valvaのharpeは渦を生じる背方の葉状部と強く骨化した先端の板状部に分化する；雄雄尾器のdiaphragmaは深く体腔内に陷入し，その両側の壁にはvalvaのcostaからの延長である長い板状の骨化部が伸びる。本属はインドやスリランカ，モロッコなどに疑わしい種を含めて数種が分布するほかは，旧北区ではヨーロッパのE. paretariellaとタジキスタンのE. montanellaが知られるのみであった。

日本産の1新種，Eumasia viridilicheniellaは雄交尾器のampullaが強く下方に屈曲し，vinculumの腹中線部が豊かな出目することで，既知種と識別できる。前翅の表面の地色は淡黄灰色で褐色の斑点や短条をちりばめる。後翅表面は緑毛も含めて灰色である。本種は深い森林に生息し，樹幹や岩の上に生じる緑色の粉状地衣のみを摂食し，柔らかい円筒状のミノをつくり，その表面はこの地衣の微細な粒子で覆われている。7月上旬頃に成虫が出現する。他の1新種，Eumasia muscellaは，前種に類似するが，前翅表面の地色は黄色白色ないし白色で，褐色の斑紋の発達は悪く，雄でも前種の雌と同様の発達程度であるが，本種の雌ではさらに発達がわるく，淡色の地に微細な斑点や短条をあらわにありとめる程度である。後翅表面は緑毛も含めて白色ないし淡黄色白色である。雄交尾器のampullaはさらに強く屈曲し，屈曲部に微小さな渦を生じる。本種は森林ややや開けた樹陰のある場所に生息し，幼虫は石崖，切り通しの道の両側，樹幹などに生じる藓類を摂食し，細長い円筒状のミノには短く茎を切断して，その切り口を短い絹の紐でミノの表面に取り付ける。これらの薬は枯死しないために，ミノは藓類で覆われていて，発見が困難である。本種も7月上旬頃に成虫が発化する。

Eumasia属は模式種がColeophora属で記載され，後にヒロズミガ科に移され，さらにchrétien (1908)によってミノガ科に最終的に移された。本属の系統的関係は十分に研究されておらず，分類学的位置も未確定である。本属はミノガ科の主要な固有新種を含んでいるので，ミノガ科に属することは疑いない。しかし，雄交尾器，特にvalvaの構造やdiaphragmaの陷没など，きわめて特異な構造を有するので，ほかのミノガからかなり孤立して，初期に分化した系統枝に属すると考えられる。なお，園部（1996）が栃木県から記録したEumasia arinatella（Walker）またはその近縁種は，同時に記録されているヒロズミガの1種と取り違えられている可能性も高く，しかも，これはEumasiaとは別のヒロズミガ属Ceratostichaの1種であろう。この属は日本に2種生息し，市街地でも石崖，ブロック塚などにかなり普通に見られるものである。
Review of the family Amphitheridae (Lepidoptera: Tineoidea)

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Abstract  Taxonomic and biological notes are given on double-eye moths, family Amphitheridae (erroneously called Roeslerstammidae). The 14 genera and 57 known species in the family are mostly Australian, plus some from the Oriental tropics. One genus (Roeslerstamnia) is Eurasian to Japan. One genus of uncertain affinity (Dasycarea) is from Colombia. The family name Roeslerstammidae is shown to be invalid, based on misspelling and incorrect assignment by Bruand (1850), and subsequent new usage by Kyrki (1983) that is more recent than the older family name Amphitheridae of Meyrick (1913).

The family Amphitheridae was a favorite group of the late Prof. S. Moriuti, whom we honor in this festschrift of papers. Moriuti (1978, 1984, 1987) was the only researcher, besides Diakonoff (1955), to contribute any significant new research on the tropical species of the group since Meyrick (1914) and his catalog, or since some of the later species descriptions by Meyrick. It is an interesting family, and many of the tropical species have the curious characteristic of having their enlarged eyes divided horizontally (usually somewhat larger eyes in males than females); thus, the derivation of their common name, double-eye moths. Most adults (other than the species of the northern genus Roeslerstamnia) also have long antennae, superficially reminiscent of Adelidae, an impression enhanced even more by the bushy head scaling common to both families. However, most females in Amphitheridae also have long antennae (always short in female Adelidae). In this review, the family name is corrected and the Japanese species described in the genus Roeslerstamnia by Moriuti (1972) are reassigned to subspecies status in R. erxelebella and R. pronubella in Japan.

The Amphitheridae are a small family of 57 species, mostly Australian, with one genus getting to Europe and Japan, and a number of species in the Oriental tropics (4 sp. undescribed). The only New World member is one genus of uncertain affinity from Colombia (Dasycarea). Thus far, no species from Africa have been verified as being in the family. New Zealand has 3 species (Hudson, 1928, 1939), with Dugdale (1988) including the genus Dolichernis Meyrick, and also transferring the Australian and New Zealand genus Vanicela Walker from Heliodinidae. The species of Roeslerstamnia are Eurasian and from India: the species described in this genus from Japan by Moriuti (1972) have been found to be the same as the two species already described from Europe, and likewise for the species described from Central Asia (Budashkin and Kostjuk, 1993) and Georgia (Toll, 1958).

Although amphitherids are known from Japan and Taiwan (Moriuti, 1978; Heppner, 1992), as well as Thailand (Moriuti, 1984, 1987), none have yet been recorded for the Philippines or mainland China. Among other Oriental Region areas, some species (possibly undescribed) are reported from Malaysia, Borneo, and Sulawesi (Robinson et al., 1994). A few are known from the Philippines (W. Mey, pers. comm.). Most likely, many more species remain to be discovered. For example, the small sample thus far reported on from New Guinea resulted in the description of 9 new species (Diakonoff, 1955), and these only from one area in the western mountains, and not Papua or even most of this huge island. Moriuti (1987) also mentioned one additional Agriothera species that may be undescribed from Thailand.

In terms of the family name, it is the more common European species of the genus *Roesslerstamnia* that led Kyrki (1983) to assume one must change the family name from what for decades was called Amphitheridae, to Roesslerstamiidae, once he concluded the genus also belonged together with the traditional long-antennal species of Amphitheridae from Asia and Australia. There is, of course, no support for such a family name change within the rules of stability of higher category names of the International Code of Zoological Nomenclature. The mistaken concern that the oldest genus within a family needs to be the name-bearer of the family name is unfounded: when *Roesslerstamnia* was added to Amphitheridae, this genus became the oldest named genus as far as Kyrki (1983) was concerned, thus his name change.

Likewise, the fact that Bruand (1850) first described the family as new does not mean his older name is to be used again after 150 years of non-use. Again, the Code is clear that higher category names do not follow priority as do generic and specific names. Additionally, Bruand (1850) did not even spell the family name correctly, but instead misspelled it as “Röslerstammiæ” and while he had the genus listed (also misspelled as “Röslertammiæ”) under his new family name, none of the species now associated with the genus were referred to. Thus, to be accurate, the family name Roesslerstamiidae as used today cannot date from Bruand, since his use of the name applies to species now referred to Acropleiidae, Gelechiidae, Cosmopterigidae, and other families, and is misspelled. The use of the genus name, *Roesslerstamnia*, in the sense of Bruand (1850), does not refer to any species now in that genus. The only use of the family name Roesslerstamiidae, if even valid and not a kind of homonym of what Bruand (1850) named, would be with Kyrki (1983) as author, since he was the first to resurrect the name, in which case his priority argument disappears, since Amphitheridae dates from the work of Meyrick (1913a), seventy years before Kyrki’s paper. It is strange that recent authors would follow Kyrki (1983), simply repeating his error in using Roesslerstamiidae without question, while the Code is clear on such matters, and the history of the name just outlined also obviates any use of the name now. Without question, Amphitheridae is the correct name for this family.

The Amphitheridae species have been misplaced among other families in many cases (Heppner, 1981; Kyrki, 1983). Meyrick (1913a) first proposed the name Amphitheridae and thought them related to Plutellidae. Meyrick (1912, 1914) had some species in Adelidae, Yponomeutidae, and Plutellidae. As late as 1927, Meyrick (1927) had the European genus *Roesslerstamnia* in his concept of Yponomeutidae [sic], while others treated the genus as Acropleiidae (Moriuti, 1972; Stainton, 1854; Toll, 1958; Viramo, 1968; Werner, 1958; Zagulajev, 1981), until Kyrki (1983, 1984) clarified its status. Diakonoff (1955) also considered the group related to Yponomeutoidea. Other genera, like *Vanicola*, had been placed in Heliodinidae in the past by Meyrick (1913b). Moriuti (1978) first viewed the group as related to more primitive moths, although the relationships remained uncertain. We now classify the family within the Tineoidea, near Schreckensteiniidae (Heppner, 1998) and Douglassiidae (Davis and Robinson, 1999), although the latter authors use Gracillarioidae where Amphitheridae are placed and list Schreckensteinoidea as a separate superfamily.

The notes below give a brief summary of the world fauna of Amphitheridae as far as is known today. As already noted, Meyrick (1914) cataloged the family for what he knew at the time, but some Australian species he mixed up with Adelidae (Meyrick, 1912), as clarified by Nielsen (1996). Many still need more study, especially also the single supposed amphitherid species from South America, in the genus *Dasycarea*. The affinities of this Neotropical genus remain unclear and its placement at the end of the list does not indicate any advanced position in the family, and it may belong in another family. The checklist of taxa for Amphitheridae below has the genera somewhat in a phylogenetic arrangement, partly based on what Nielsen (1996) listed, but this is still highly tentative. The species are listed alphabetically within each genus for now. The state abbreviations for Australia are the common forms used for each state (NSW for New South Wales, Qd for Queensland, SA for South Australia, Vic for Victoria, WA for Western Australia). Localities noted for each species are the country of the
type locality and not the total known distribution, although in most cases they remain thus far only known from the type localities.

The only widespread species are the Eurasian species of *Roeslerstamnia*. Whereas the more primitive members of Amphriteridae appear to be represented by *Roeslerstamnia* (eyes not divided and antennae not developed into exceptional lengths, although still rather long), there is as yet no subfamily classification.

**AMPHITHERIDAE** Meyrick, 1913

*RÖSLERTAMMIDAE* Bruand, 1850, invalid name (genus misspelled as *Röslertamnia* and did not include any species now in *Roeslerstamnia*) [ICZN Art. 65.2]

**ROESLERSTAMMIA** Kyrki, 1983

**Röslertamnia** Zeller, 1839

*Röslertamnia* Zeller, 1839, incorr. spell.

*Chrysitella* Zeller, 1839

*Röslertamnia* Bruand, 1850, missp. [applies to Acrolepiidae]

*Röslertamnia* Stainton, 1859, missp.

*Roesslerstamnia* Sorhagen, 1886, missp.

*Rösslerstamnia* Strand, 1904, missp.

**erxlebella** (Fabricius, 1787) (*Alucita*)

a) erxlebella (Fabricius, 1787) (*Alucita*)

  - *fuscocuprella* (Haworth, 1828) (*Tinea*)
  - *chrysitella* (Treitschke, 1833) (*Oecophora*)
  - *aeneella* (Duponchel, [1839]) (*Adela*)
  - *erxlebeniella* Zeller, 1839, emend.
  - *durulguensis* Budashkin & Kostyuk, 1993

b) bella Moriuti, 1972, **new stat.**

**hemidelpha** Meyrick, 1922

- Denmark
- England
- [Austria?]
- France
- Russia
- Japan
- India (Punjab)
Review of the family Amphithieridae

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<td>((Denis &amp; Schiffermüller), 1775) (Tinea)</td>
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<td>a) pronubella</td>
<td>((Denis &amp; Schiffermüller), 1775) (Tinea)</td>
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TELETHERA Meyrick, 1913
blepharacma Meyrick, 1913
blephrama Moriuti, 1878, missp.
formosa Moriuti, 1978
karsholti Moriuti, 1987
inthawichayanoni Moriuti, 1987
n. sp. (see Robinson et al., 1994) Sri Lanka

HARPEDONISTIS Meyrick, 1893
Enchoptila Turner, 1914
gonometra Meyrick, 1893
idiopis (Turner, 1914) (Enchoptila) Australia (Vic)

MACARANGELA Meyrick, 1893
leucochrysa Meyrick, 1893
pyracma Meyrick, 1893
uranarcha Meyrick, 1893 Australia (NSW)

NEMATOBOLA Meyrick, 1893
candescens Meyrick, 1893
isorista Meyrick, 1893 Australia (WA)
orthotricha Meyrick, 1893 Australia (NSW)

HESTIAULA Meyrick, 1893
rhodacris Meyrick, 1893 Australia (Qd)

DOLICHERNIS Meyrick, 1891
chloroleuca Meyrick, 1891 New Zealand

VANICELA Walker, 1864
dentigera Meyrick, 1913 Australia (Qd)
disjunctella Walker, 1864 New Zealand
frontella Walker, 1864 New Zealand
tricolona Meyrick, 1913 Australia (Qd)
xenadelpha Meyrick, 1889 Australia (NSW)

DASYCAREA Zeller, 1877
viridisquama Zeller, 1877 Colombia

MORPHOLOGY

DIAGNOSIS. Adults small (wingspan 11–23 mm), with elongated and pointed wings, often with extended pointed apeces; head vertex rough-scaled, frons can be relatively smooth; labial palpus 3-segmented, long and upcurved (short in Roeslerstammia); maxillary palpus 1-segmented; haustellum well developed, naked; antenna filiform, long to very long; antennal pecten usually absent; compound eye large to very large, entire or divided partially divided; ocellus absent; chaetosoma absent; thoracic tympana absent; wing coupling frenulate; wing venation heteroneurous; tibial spur formula is 0-2-4; foretibial epiphysis is present; abdominal articulation tineoid; abdominal tympana absent; abdominal sternites without glands evident. Maculation is iridescent and colorful or variously marked with white or shades of tan on gray or dark brown, often with a wide wing-length horizontal silvery white streak. Larvae are

hypognathous, with 6 stemmata in a quadratic circle; prothoracic L-group trisetose; prolegs on A3–6 and A10, with uniordinal crochets in lateral penellipse (uniserial anteriorly and biserial posteriorly on each proleg, except uniserial anal prolegs). Pupae adecticus, obtect and incomplete; single row of dorsal spines on tergites A3–7; pseudo-cremaster as small hooks; antennae coiled around posterior abdomen (except shorter antennae of *Roesterstamnia*); pupa protruded at eclosion.

Adults

Adult amphitherids are most unusual in their enlarged and divided eyes. The eyes in some species are exceptionally large, especially in the portion ventral to the horizontal line of scales that divides the eyes (Fig. 6). The head morphology with scales removed can be seen in Fig. 5 and 7. Some species also have the eyes notched as part or all of the division into eye sections. A few species have the eyes less divided, or the females have this feature reduced or absent. The labial palpi are often greatly elongated, very thin and upcurved (Fig. 7), while the maxillary palpi are unisegmental and nearly vestigial. The antennae of most species are longer than the forewings, particularly in males, but do not extend beyond the forewing length in some genera (*Roesterstamnia* and *Chalcoteuces*). The females tend to have shorter

antennae than males, but most amphitherid females still have antennae longer than the forewings.

The wing venation has many plesiomorphies that easily align the family to such families as Plutellidae when only wing venation is considered, as Meyrick (1893, 1913a) and others did in the past. For example, the forewing has a vestigial chorda and discal cell median vein in some genera (Roeslerstamnia). However, many amphitherids have the discal cell greatly elongated and the forewing radial veins, thus, very short, much as in many Sesiaidae and as in Schreckensteiniidae. Most genera have the forewings somewhat pointed, although more rounded in Roeslerstamnia (Fig. 8), but genera such as the Oriental Agriothera and Telethera have the forewing apex even falcate (Figs 10–11). In the hindwings the shape is similar, while again in the Oriental genera just noted the hindwings have extended sharp points and an enlarged anal wing margin. Fringes are fairly long in most species, particularly along the anal margin of the hindwings and under the falcate protrusion of the forewing apex, but all reduced in Roeslerstamnia.

Maculation usually is distinctly shining or with white streaks in most of the tropical species (but some are dark colored) (Figs 1–4), but more somber in the Eurasian Roeslerstamnia. Several tropical species have dimorphic forms, with males different than females. Polyphenetic forms, or seasonal polyphenisms, are also known between species in Roeslerstamnia (Huemer and Segerer, 2001).

The genitalia show similarities to many groups, such as Plutellidae and Acrolepiidae. The
males have an elongated saccus and usually relatively simple valvae (Figs 12–17). The females (Figs 18–22) have the strongly sclerotized signum on the bursa typical also in such families as Acrolepiidae and Epermeniidae, but these are only superficial similarities. Male genitalia in the Australian genus *Thereutis* are somewhat similar to Schreckensteiniiidae (long saccus and extended uncus), but the uncus is actually bilobed (often less sclerotized in other genera) and the gnathos is larger and connected medially (stronger in other genera).

**Larvae**

The few amphitherid larvae that are known have characters that align them to Tineoidea, such

as prothoracic L-group trisetose and on one pinaculum, prolegs short, normal abdominal spiracles, anal shield normal, among others (Figs 23–24). Yponomeutoidea have the spiracles enlarged on abdominal segment 8 in some groups and proleg crochets usually in circles. In Amphitheridae, the proleg crochets are in a uniordinal lateral penellipse, often biserial on the posterior side of the penellipse.

Pupae

In Amphideridae, the pupae are usually modified to accommodate the greatly elongated antennae, by having the antennal sheaths looped around the pupal abdomen (Fig. 26). In genera with shorter antennae, like *Roeslerstammia*, this is not necessary so the pupae appear more normal (Fig. 25). All species known biologically in Amphideridae have pupae with dorsal spination, as is also typical for Tineoidea (not found in Yponomeutoidea or Gelechioidea).
BIOLOGY

Amphitheridae are all day-flying as adults, as far as is known (Common, 1990; Kyrki, 1983). Their large eyes in most species, especially in males, and their long antennae give an impression similar to Adelidae when active. Nonetheless, most specimens are taken at lights, as are other day-flying moths on occasion.

In the genus Vanicela, Meyrick (1889) has pointed out that there is a curious behavior where adults when resting will have their enlarged front legs stretched out to the front, with the long palpi between, while the hindlegs are appressed to the abdomen and the antennae are held back along the body, as well. Hudson (1928) also noted this behavior for V. disjunctella in New Zealand, describing the moth as fairly common on the North Island. Hudson (1928) notes the same behavior in the New Zealand genus Dolichernis, noting that this posture and the white maculation of D. chloroleuca gives the resting adults the appearance of a small dead stick. Another species Hudson (1928) listed in Dolichernis has since been found to belong in Oecophoridae (Dugdale, 1988). Other amphitherids also rest with wings appressed to the body (Common, 1990; Robinson et al., 1994).

The larvae are leafminers and leaf skeletonizers, often beginning as leafminers and then feeding externally in later instars (Common, 1970, 1990; Kyrki, 1983; Moriuti, 1972, 1978; Nielsen and Common, 1991). At least one species ties several leaves together: Agriothera elaeocarphagha from Japan (Moriuti, 1978). Likewise, Roeslerstammia larvae are first leafminers and then leaf skeletonizers (Kyrki, 1983; Viramo, 1968). In the Eurasian species, Roeslerstammia erxlebella, after the first 2 instars as leafminers, the later instars feed externally under a thin webbing on the undersides of leaves (Kyrki, 1983; Viramo, 1968). When feeding externally on host leaves, larvae of R. erxlebella make large round holes in the ventral leaf surface (Schütze, 1931). In the Australian genera Macarangela, Nematobola, and Thereutis, larval feeding is also as leafminers and then external leaf skeletonizers, but the last
Table 1. Known hostplants of Amphitheridae.

<table>
<thead>
<tr>
<th>Plants</th>
<th>Moths</th>
<th>Localities</th>
<th>Records</th>
</tr>
</thead>
<tbody>
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<td>Aceraceae</td>
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</tr>
<tr>
<td>Acer sp.</td>
<td><em>Roeslerstammia erxlebella</em></td>
<td>Finland</td>
<td>Viramo (1968)</td>
</tr>
<tr>
<td>Betulaceae</td>
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<td></td>
<td></td>
</tr>
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<td>Alnus sp.</td>
<td><em>Roeslerstammia pronubella</em></td>
<td>Germany</td>
<td>Hartmann (1880)</td>
</tr>
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<td>Betula sp.</td>
<td><em>Roeslerstammia erxlebella</em></td>
<td>Finland</td>
<td>Viramo (1968)</td>
</tr>
<tr>
<td>Corylaceae</td>
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</tr>
<tr>
<td>Corylus sp.</td>
<td><em>Roeslerstammia erxlebella</em></td>
<td>Germany</td>
<td>Lienig and Zeller (1846)</td>
</tr>
<tr>
<td>Corylus avellana</td>
<td><em>Roeslerstammia erxlebella</em></td>
<td>Germany</td>
<td>Hartmann (1880)</td>
</tr>
<tr>
<td>Elaeocarpaceae</td>
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<tr>
<td><em>Elaeocarpus reticulatus</em></td>
<td><em>Amphithera heteroleuca</em></td>
<td>Australia</td>
<td>Common (1990)</td>
</tr>
<tr>
<td><em>Elaeocarpus sylvestris</em></td>
<td><em>Agriothera elaeocarpophaga</em></td>
<td>Japan</td>
<td>Moruiti (1978)</td>
</tr>
<tr>
<td>Epacridaceae</td>
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</tr>
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<td>Leucopogon juniperinus</td>
<td><em>Thereutis sp.</em></td>
<td>Australia</td>
<td>Common (1990)</td>
</tr>
<tr>
<td>Melichrus urceolatus</td>
<td><em>Thereutis chionozyga</em></td>
<td>Australia</td>
<td>Common (1990)</td>
</tr>
<tr>
<td>Styphelia viridis</td>
<td><em>Thereutis schismatica</em></td>
<td>Australia</td>
<td>Meyrick (1893)</td>
</tr>
<tr>
<td>FAGACEAE</td>
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<tr>
<td>Nothofagus cunninghamii</td>
<td><em>Chalcoteuches phlogera</em></td>
<td>Tasmania</td>
<td>McQuillan (1986)</td>
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<tr>
<td>Proteaceae</td>
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<td>Banksia sp.</td>
<td><em>Macaranga pyraca</em></td>
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<td>Meyrick (1893)</td>
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<td>Banksia paludosa</td>
<td><em>Macaranga leucocrysa</em></td>
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<td>Common (1990)</td>
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<tr>
<td>Persoonia lanceolata</td>
<td><em>Nematobola candescens</em></td>
<td>Australia</td>
<td>Meyrick (1893)</td>
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Few hostplants are known for Amphitheridae (Table 1 summarizes the known hostplants). Meyrick (1893) noted *Nematobola candescens* on *Persoonia lanceolata* (Proteaceae). Larvae in this species are first leafminers and in later instars turn to leaf skeletonizing on the surface of the host leaves. In *Thereutis schismatica*, Meyrick (1893) noted feeding as a leaf skeletonizer on *Styphelia viridis* (Epacridaceae), but thought the younger instars might also be leafminers at first. Common (1990) notes *T. chionozyga* taken from *Melichrus urceolatus* (Epacridaceae) and a possibly undescribed species of the genus was reared from *Leucopogon juniperinus* (Epacridaceae). For *Macaranga pyraca*, Meyrick (1893) noted that adults were found resting on *Banksia* (Proteaceae), and Common (1990) gives *Banksia paludosa* as the hostplant for *M. leucochrysa*. Moriuti (1978) reported his new species *Agriothera elaeocarpophaga* feeding on leaves of *Elaeocarpus sylvestris* (Elaeocarpaceae) in Japan. In *A. elaeocarpophaga*, the larvae tie several leaves together when feeding, rather than the simple leaf skeletonizing the other species thus far known biologically have been shown to do. *Amphithera heteroleuca*, from Australia, has been reared on *Elaeocarpus reticulatus* (Elaeocarpaceae) (Common, 1990). The Tasmanian species, *Chalcoteuches phlogera* feeds on *Nothofagus cunninghamii* (Fagaceae) (McQuillan, 1986). The other known species in *Chalcoteuches*, *C. chlorantha*, was collected in the *Nothofagus* forest zone in the highlands of western New Guinea (Diakonoff, 1955).

In Europe, *Roeslerstammia erxlebella*, has been recorded mostly on leaves of *Tilia* spp.
Table 2. Distribution among known countries (numbers refer to how many species are in each country, so totals add up to more than the world fauna for each genus).

<table>
<thead>
<tr>
<th>Species</th>
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<th>New Zealand</th>
<th>Papua</th>
<th>Indonesia</th>
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</tbody>
</table>

Note: species in brackets ([ ]) from Brunei, Malaysia and Sulawesi (Indonesia) refer to undescribed species (Robinson et al., 1994). Papua here refers to all of New Guinea. The single Telethera recorded from Japan is only found in the Ryukyu Islands, not mainland Japan.

(Tiliaceae), but also Corylus spp. (Corylaceae) (Hartmann, 1880; Sorhagen, 1886; Lienig and Zeller, 1846); more recently on Acer sp. (Aceraceae) and Betula (Betulaceae) (Viramo, 1968). Moriuti (1972) did not record any hostplant for the subspecies in Japan. For the European sister species, Roesslerstamnia pronubella, Hartmann (1880) recorded Alnus sp. (Betulaceae) and Tilia sp. (Tiliaceae) as hostplants.

The pupae have the long antennae wrapped around the body in those species with the typical elongated antennae in adults. The cocoon is a simple white cocoon, usually made in a leaf edge turned partially over, as noted by Meyrick (1893) for the Australian species Nematobola candescens. This is likewise noted and illustrated by Common (1990) for the genus Thereuts in Australia, and by Moriuti (1978) for Agriothera elaecarpophaga. Common (1990) notes at least one species which possibly pupates in leaf litter, but this is unconfirmed. The pupae are protruded from the cocoon during adult eclosion.

Various authors note multiple generations for the tropical species (Common, 1990; Moriuti, 1978). The northern Palearctic Roesslerstamnia species have at most 2 generations per year (Hartmann, 1880; Huemer and Segerer, 2001; Kyrki, 1983; Moriuti, 1972; Schütze, 1931; Sorhagen, 1886). Only a single generation is recorded in such areas as northern Finland (Viramo, 1968).

DISTRIBUTION

As already noted, the family Amphitheridae is primarily known thus far from the Australian and Papuan regions, with 37 species (Common, 1970, 1990; Diakonoff, 1955; Dugdale, 1988; Hudson, 1928, 1939; Meyrick, 1889, 1891, 1893, 1930; Nielsen, 1996; Nielsen and Common, 1991; Turner, 1900, 1913, 1914, 1923, 1927, 1939). Further species are mostly in Southeast Asia, where 20 species are recorded (Diakonoff, 1951; Heppner, 1992; Meyrick, 1907, 1921; Moriuti, 1978, 1984, 1987; Robinson et al., 1994). Only Roesslerstamnia occurs in Europe, east to Japan, although 2 additional species of the genus occur in India (Agassiz, 1996; Budashkin, 1995; Budashkin and Kostjuk, 1993; Buszko and Baraniak, 1985; Huemer and
Segerer, 2001; Kyrki, 1983; Meyrick, 1927; Moriuti, 1972; Sorhagen, 1886; Stainton, 1854, 1859; Strand, 1904; Viramo, 1968; Zagulajev, 1981; Zeller, 1839). The single species of *Dasycorea* is from Colombia (Zeller, 1877), but possibly belonging to another family. Amphitheridae are thus far not recorded from such places as China, Korea, Pacific Islands, or Africa.

In the New World, only the single species from Colombia is known of, but Fletcher (1929) transferred this genus to Amphitheridae without comment. The abdomen of the holotype of *D. viridisquamata* Zeller is missing (K. Tuck, pers. comm.) and superficially the unique specimen looks like a species of Plutellidae or Acrolepididae. No other specimens of the species are known thus far. The unique holotype shows rather short antennae but the labial palpi appear to be like many amphitherids, thus, at most with some relationship to *Roeslerstamnia*.

Table 2 gives a brief overview of the known species distribution.

**Acknowledgments**

My thanks to Y. Arita for organizing this festschrift in honor of Prof. Moriuti. Figures are from papers by Common (1990), Kyrki (1983), Moriuti (1978, 1984, 1987), and Stainton (1854), plus originals taken by M. Owada (National Science Museum, Tokyo, Japan) for a project on Taiwan Lepidoptera (Heppner, 2005). W. Mey (Zool. Museum, Berlin) noted some Amphitheridae from the Philippines.

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摘 要

John B. Heppner：Amphitheridae ナガヒゲア科（鱗翅目，ヒロソウ上科）の概説

Amphitheridae（ナガヒゲア科）（訳注1）は世界で14属57種が知られ，主にオーストラリア区や東洋区
の熱帯に分布する。ヨーロッパから日本にかけてはRoesslerstamnia（ヒカリハココ属）が分布している。森
内教授は本科に興味をもち，Meyrick（1914），Diakonoff（1955）などとともに，東洋熱帯のこの科の
研究に貢献した。本科は，日本，台湾，タイ，そしてマレーシア，ポルネオ，スラウェシなどから少数
の種が報告されているが，フィリピンや中国本土では発見されていない。また，Diakonoff（1955）は
ニュージーニアのわずか1地域からAmphitheraの9新種を記載したが，それ以外の地域では充分な調査が
行われており，多くの未記載種が存在すると思われる。本科の熱帯に分布する種の多くが大きな
複眼をもち，複眼が水平方向に鰭状で区切られ（英名はdouble-eye moths）（訳注2），触角がヒゲナガ
のように長い（ナガヒゲアでは￥でも長い）という特徴をもつ。

Kirki（1983）以来，Roesslerstammiidae（ヒカリハココ科）が本科の名称として用いられてきたが，Bruand
（1850）による科の設立は誤った繰り“Röslertammiidae”（属名は“Röslertamnia”）と不適切な指定にも
とづくもので，命名規約上無効である。その後Kirki（1983）は繰りを修正しRoesslerstammiidaeを規約上
の有効名として示したが，本稿では科の名称としてそれより前にMeyrick（1913）によって設立された
Amphitheridaeを使用することを提案した。

Morititi（1972）はRoesslerstamnia bella（アトキヒカリバコガ）とR. nitidella（ムヒカリハコガ）の2新
種を日本から発表したが，本稿ではそれぞれRoesslerstamnia erxlebella（Fabricius, 1787）とR. pronubella
Amphitheriidae の系統位置は Kirk (1983, 1984) の研究までさまざまな見解があったが、現在ではヒロスコガ上科で Schreckensteiniidae に近縁 (Heppner, 1998)、あるいは、ホソガ上科で Douglassiidae に近縁 (Davis & Robinson, 1999) のように推定されている。

形態的特徴
成虫：上記のように複眼が大きく、上下に分かれているが、複眼が分割しない種もある。ラビアル・バルブス（下唇顔）は通常よく発達する。触角はふつう前翅よりも長いが、Roeslerstammiidae と Chalcocetes では前翅を越えない。翅脈相は原始的な状態が多くみられ、翅脈相だけみると Meyrick などが指摘したように Plutellidae（クチブサガ科）に類似している。翅長部は幾分短くが、Agriothera や Telethera では線状に突出する。交尾器はクチブサガ科や Acrolepiidae（アトヒゲガ科）のものと似ている。
幼虫：ヒロスコガ上科の特徴（前胸の L 刺毛が3本で同一基板 pinaculum 上にあること、腹脚が短く、腹部の気門が腹脚と一致）をもつ。スガ上科では腹部第8節の気門が肥大する。
蛹：ナガヒゲガ科では、触角が長く腹部の周りをループしている。ただし、触角が短い Roeslerstammiidae では通常の蛹と同じ、文献上蛹が知られているすべて種で、背面の刺をもつ。これは、ヒロスコガ上科の特徴であり、スガ上科やキバガ上科ではみられない。

生態
知られるかぎり成虫は昼行性であるが、大部分の成虫は灯火で採集されている。

Vanicella や Dolichernis では、成虫が静止時よく発達した前脚を前方に伸ばし、長いバルブスを前に伸ばして、触角を前方に伸ばして腹部に密着させるという奇妙な習性をもっている。このような成虫の静止姿勢と白い斑紋は、枯れ枝を思わせる（訳注4）。幼虫は若齢時に葉に潜り、その後外から摂食する。少なくとも1種（Agriothera elaeocarpophaga エボトノキナガヒゲガ）では葉を数枚つづる（訳注5）。また、Roeslerstammiidae では蛹、Roeslerstammiidae では蛹、Roeslerstammiidae では蛹において、表皮より葉を広げて潜り、その後は葉裏に薄く糸を張って潜る。

寄主植物としては、Roeslerstammiidae ではカエデ科、カバノキ科、シナノキ科など、Amphitheriidae, Agriothera ではホトノキ科、Thereutis ではエバクリス科、Macaranga ではヤマモガシ科などが知られている（Table 1）。

（文責：広渡俊哉）

訳注1. 日本産蛾類大図鑑（森内, 1982）のナガヒゲガ科 Amphitheriidae とヒカリバコガ科 Roeslerstammiidae を含む。この 2 つの科は Kyjki (1983) によりその近縁性が指摘され、最近では同科として扱われている。

訳注2. 東洋区に分布し、日本の八重山諸島にも分布する Telethera blepharacma Meyrick には、森内教授により「ヨツメガヒゲガ」の和名が与えられている。

訳注3. Moriuti (1972) が記載した Roeslerstammiella bella（アトヒカリバコガ）と R. nitidella（ムヒカリバコガ）は、最近ではそれぞれ Roeslerstammiella erstelbellla (Fabricius, 1787) と R. promubella (Denis & Scheffermüller, 1775) のシノニムとして扱われていた。

訳注4. 表紙に示されたホトノキナガヒゲガ Agriothera elaeocarpophaga Moriuti（斎藤寿久博士撮影）は同様の静止姿勢を示し、枯れ枝のように見える。

訳注5. 「葉を数枚つづる」という記述は Moriuti (1978) に基づくが、斎藤寿久博士によると本種は全幼虫期を通じて、葉をつづることはないという。
A new species of the genus *Bedellia Stainton* (Lepidoptera, Bedelliidae) from Thailand

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**Abstract** A new species, *Bedellia moriutii* Kuroko, is described from Thailand. The larvae of this species are leafminers, feeding on the leaves of *Thunbergia fragrans* (Acanthaceae), not on the Convolvulaceae.

**Key words** Bedelliidae, *Bedellia moriutii*, new species, Thailand, *Thunbergia fragrans*, Acanthaceae.

The genus *Bedellia* is a small genus. The species hitherto described number only 15 species throughout the world, though about 10 species from the Hawaii Islands remain undescribed. Hostplants, as far as is known, are restricted within the Convolvulaceae, except for Hawaiian endemic species (Urticaceae, Gramineae, Cyperaceae, Libiacae) (Zimmerman, 1978: 749-751). Discovery of the larva of this *Bedellia* species on *Thunbergia fragrans* (Acanthaceae) is remarkable.

The type material is preserved in the collection of the Entomological Laboratory, College of Agriculture, Osaka Prefecture University, except paratypes (1 ♂, 1 ♀) preserved in the collection of The Natural History Museum, London.

**Bedellia moriutii** sp. nov.

Adult (Fig. 1). Length of forewing 3.0-3.3 mm (♂); 3.6-3.8 mm (♀).

Face whitish-ochreous sprinkled with dark brown; tuft whitish-ochreous mixed with brownish or fuscous hairs; labial palpi whitish-ochreous. Antenna as long as forewing, whitish-gray annulated with dark fuscous. Thorax whitish-ochreous, sprinkled with fuscous. Posterior

![Fig. 1. Bedellia moriutii sp. nov., ♀. Scale: 2 mm.](image-url)
Figs 2–5. *Bedellia moriutii* sp. nov. 2. Wing venation, ♂. 3. Male genitalia, ventral view. 4. Male genitalia, lateral view. Scale: 0.2 mm. 5. Female genitalia. Scale: 0.4 mm.

Fig. 6. *Bedellia somnulenta* Zeller. Male genitalia, lateral view. Scale: 0.2 mm.
tibiae ochreous irroration with dark fuscous externally, whitish-ochreous hairs above. Abdomen pale grayish-fuscous above, ochreous irroration with dark fuscous beneath. Forewings somewhat slenderer in ♂ than in ♀; yellowish-ochreous, sometimes tinged with brown, dotted with dark fuscous, generally densely dotted on costal area and apical half, sparse on basal half; cilia pale grayish-ochreous. Hindwings gray, cilia pale grayish-ochreous. Wing venation is normal for this genus (Fig. 2).

Male genitalia (Figs 3–4). Valva rather narrow, elliptical gently curved upward, transtilla very long, about 1/3 as long as valva, apical half tapered triangularly but not pointed, without any spine at apical end; saccus trianguloid, pointed at bottom (anterior edge); aedeagus broadened on apical 1/3 and bilobed at apex, covered with rather large sclerotized anellus, the ventral side of which bends downwards. Generally, the anellus of this genus is small and weak as shown in B. somnulentalla (Fig. 6).

Female genitalia (Fig. 5). Ostium bursae faintly sclerotized; corpus bursae elliptical, containing a big elliptical dotted structure, a spindle-shaped signum with a curved ridge and some spines and two smaller trianguloid leaflets anteriorly.


Remarks. Some species of Bedelia (ipomoella Kuroko, 1982, terenodes Meyrick, 1915, cathareuta Meyrick, 1911, orchilella Walsingham, 1907, ehikella Szöcs, 1967, somnulentalia Zeller, 1847 etc.) have a spine at the apical end of the valva. But some other species (enthrypta Meyrick, 1928, minor Busck, 1901, silvicolella Klimesch, 1968, opilismentella Swezey, 1912 etc.) lack such a spine. This new species belongs to the latter group. This species is very similar to B. minor Busck in the shape of valva and anellus. But it can be distinguished by the shape of the saccus, which is trianguloid and pointed at bottom in moriutii but bluntly curved in minor. The hostplant is also quite different. The larva of minor
feeds on sweet potato. Quite similar to *B. silvicolella* Klimesch, particularly in the shape of the saccus. But the latter is distinguishable by the shape of the valva with a round apex. Moreover, in the female the shape of the signa is quite different.

**Distribution.** Thailand (Chanthaburi).

**Host plant.** *Thunbergia fragrans* Roxb. (Acanthaceae).

**Biological notes.** The larvae of this species make a mine along the midrib or a lateral vein on the leaves of *Thunbergia fragrans*, forming an irregular blotch of full depth. In the early stages it is dark brown, but later pale brown, containing a dark frass-line (Fig. 7).

**Etymology.** The specific name is dedicated to the late Dr Sigeru Moriuti who contributed as a member of the lepidopterological expedition of the University of Osaka Prefecture to Thailand in 1987.

**Acknowledgements**

The hostplant was identified by Mr Ko Seto, Nara (who was previously on the staff of Osaka Museum of Natural History) and Mrs Jirayupin Chantara Prasony, Kasetsart University of Thailand. I wish to express my hearty thanks to both of the above mentioned botanists.

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**摘 要**

黒子 浩：タイ国からの*Bedellia*属の1新種（鱗翅目, ウリガオハモノリガ科）

タイ国南東部のチャンタブリー県において獲獲の植物から飼育した*Bedellia*属の1種を新種として記載した。本属の食草は、ハワイ諸島に分布する固有種を除いては、ウリガオ科植物（Convolvulaceae）に限られていたが、本種の食草はキツネノマグ科（Acanthaceae）に属し特異である。
Immature stages of two species of the genus Deuterogonia (Lepidoptera, Oecophoridae) in Japan, with remarks on the systematic position of the genus

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Abstract. Immature stages of two species of the genus Deuterogonia, D. pudorina (Wocke, 1857) and D. chionoxantha (Meyrick, 1931), are described and illustrated in detail for the first time. The systematic position of the genus is discussed.

Key words: Lepidoptera, Oecophoridae, Deuterogonia, immature stages, systematic position, Japan.


In November 1999, I collected several micromoth larvae under a slight web on dried fungus and under bark on a dead branch of Quercus serrata in Yamadano, Hakusan-cho, Mie Prefecture. They were reared at room temperature. Fortunately some moths, Deuterogonia pudorina, emerged in April to May 2000. At a later stage, in April 2001, I found several larvae closely similar to D. pudorina living under the bark of dead branches of Carpinus tschonoskii infested by fungus and of Fagus crenata in Mt. Izumikatsuragisan, Osaka Prefecture, and some larvae living in a slight web among dried fungus (Daedaleopsis tricolor) and bark on a dead branch of Prunus × yedoensis in Mt. Inunakisan, Osaka Prefecture. From these larvae, the adults of Deuterogonia chionoxantha emerged in May 2001. Additionally I obtained eggs of both species which pinned moths deposited in collecting boxes and first instar larvae, which hatched from the eggs.

In the following, I describe and illustrate in detail the morphological characters of the larvae and pupae of these two Deuterogoniid species for the first time and discuss the systematic position of the genus Deuterogonia.

Terminology used for the larval setae follows Hinton (1946), and partially Stehr (1987).

Deuterogonia pudorina (Wocke, 1857)


*Parocystola pudorina*: Meyrick, 1922, Genera Ins. 180: 97-98.

**Description**

Mature larva (Figs 3, 11–25)

Average length 10 mm. Head dark brownish black. Body blackish brown, slightly tinged with purple, and with ochreous ventrally and caudally; thorax somewhat darker than the abdomen; prothoracic shield nearly black; anal shield concolorous with prothoracic shield, scattered with somewhat paler small dots; peritreme of spiracles blackish brown; pinacula somewhat darker than the body color; thoracic legs blackish brown, tibiae pale brown, with claws blackish brown. Adfrontal areas just extending to epicranial notch (Fig. 11); six stemmata arranged in semi-circle, stemma III, IV and V very close to each other (Figs. 12, 13); each stemma with a blackish pigment (Fig. 13). An elliptical submental pit situated on
the ventral side of the head (Fig. 14). Mandible with five teeth as illustrated in Fig. 15. Labrum as in Fig. 16. Prothoracic leg with apical area of the femur expanded inwards (Fig. 17). Ventral proleg with pale brownish black slender plate on the inner side; crochets biordinal, complete circle with 39–44 in number, the outer row being fewer in number (Fig. 18). Anal prolegs with biordinal crochets arranged in semi-circle, 29–34 in number (Fig. 19).

Chaetotaxy (Figs 11–13, 20–25)

Cranial setae as shown in Figs 11–13; F1 long, located to middle of frontoclypeal region; AF2 longer than AF1; P1 very long, at the level of AF2; P2 slightly below the level of P1; Pb located above the level of P1, and approximate to P1 than P2; A3 very long, slightly below the level of Pa; S2 very long, equidistant from L1 and S3. Thorax (Figs 20, 21): on prothorax (Fig. 20) L group setae trisetose; on meso- (Fig. 21) and metathorax, D1 and D2, SD1 and SD2, and L1 and L2 on a common pinaculum, respectively. Abdomen (Figs 21–25): pinaculum ring of SD group setae on 1st–8th segments with a small posterior pore, respectively (Fig. 25); SD1 seta on 9th segment normal (not hair-like as observed in many gelechioid larvae); L group setae on 9th segment trisetose, L1 and L2 on a common pinaculum; SV group setae on 1st and 7th segments bisetose, 2nd–6th segments trisetose and 8th unisetose; anal shield as in Fig. 24.


First instar larva

Average length 1.2 mm. Head and prothoracic shield pale smoky brown; body whitish, tinged with pale pink.

Egg

Milky white, tinged with pale brown about 2–3 days after. Somewhat long oval in shape; the major axis about 0.4 mm, and minor axis 0.28 mm; small triangular patterns of fine raised ridges showing over the surface. Egg period about 10 days.

Pupa (Figs 4, 5, 41–44)

Average length 10 mm. Yellow brown, with cremaster dark brown. Maxillary palpus
reaching to the proximo-lateral angle of maxilla. Labial palpus exposed, about 1/4 the length of maxilla. Maxilla long, extending beyond tip of prothoracic leg. Prothoracic femur exposed. Tips of mesothoracic legs not concealed by the antennae (Fig. 41) (This state is also recognized in Coleophoridae, but is unusual among Gelechioidae). Tips of antenna and metathoracic legs reaching to near the anterior margin of 6th abdominal segment (Fig. 42). Hindwings concealed by forewings near the anterior margin of 3rd abdominal segment (Fig. 42). Cremaster slenderly protruding, with four paired, slightly curved, setae: two pairs about in middle and the other two pairs on caudal end (Fig. 44). Dorsum of abdomen without spines (Fig. 43). Condyles not observed. Wing pattern showing through pupal skin just before emergence (Fig. 5).


Distribution. Japan (Hokkaido, Honshu, Shikoku, Kyushu); Taiwan; Korea; China; Russia; Europe.

Host. Dried fungus (scientific name unknown) and dead bark of *Quercus serrata* Murray.

Biological notes

The larva lives in a slight web among dried fungus and under bark on a dead branch of *Quercus serrata*, and feeds on dead wood and dried fungus. Pupation takes place in a dense white silken cocoon in the larval nest, and the larval exuvia is discarded from the open end of the cocoon (Fig. 4). Pupal period about two weeks. Pupa does not protrude from the cocoon prior to emergence of adult. As shown in Figs 1 and 2, the adults have a characteristic resting posture: the head almost touching the substrate; the antenna laid along the costa of the wing; the body raised high obliquely from the substrate; the pro- and mesothoracic legs extended at right angles to the body, and the metathoracic leg extended posteriorly, of which the tip touches the substrate. Before resting on the substrate, the adult moves the body up and down repeatedly. Adults are attracted to light at night. Univoltine. Hibernation takes place in middle instar larva.

*Deuterogonia chionoxantha* (Meyrick, 1931)


Description

Mature larva (Figs 8, 26-40)

Average length 10 mm. Head ochreous brown. Body somewhat brownish dark grey; thorax more or less darker than abdomen, paler posteriorly and on lower part; prothoracic shield concolorous with head; peritreme of spiracles pale blackish brown. Thoracic legs pale blackish brown; tibiae pale ochre, with claws brown. Anal shield concolorous with body, scattered with small paler dots. Pinacula pale blackish brown. Adfrontal areas just extending to epicranial notch (Fig. 26); sterna III, IV and V close to each other (Figs 27-28); each sterna with a blackish pigment, (Fig. 28). An elliptical submental pit (Fig. 29) present. Mandible and labrum as shown in Figs. 30 and 31. Terminal area of prothoracic femur expanded internally (Fig. 32). Ventral proleg with pale brownish black slender plate on inner side, crochets biordinal, arranged in a complete circle with 38-48 in number, the outer row being fewer (Fig. 33). Anal proleg with crochets biordinal, semi-circular, with 31-35 in
number (Fig. 34).

Chaetotaxy: Cranial setae as shown in Figs 26–28. F1 long, slightly ventrad to middle of frontoclypeal region; AF2 longer than AF1, AFa approximate to AF1 than AF2; P1 very long, at the level of AF2; P2 slightly above the level of P1; Pb located above the level of P1, and approximate to P1 than P2; A3 very long, at the level below Pa; A2 very short, approximate to A1 than A3; S2 very long, equidistant from L1 and S3. Thorax (Figs 35–36) and abdomen (Figs 36–40) same as in the preceding species, *D. pudorina*.


First instar larva and egg

The coloration and the morphological characters of this species are essentially the same as in the preceding species, *D. pudorina*.

Pupa (Figs 9, 10, 45–48)

Average length 5 mm. Yellow brown, with cremaster dark brown; the wing pattern showing through pupal skin just before emergence (Fig. 10). Maxillary palpus reaching the proximolateral angle of the maxilla. Labial palpus exposed. Maxilla extremely long, reaching to just before tip of forewing. Prothoracic femur exposed. Tips of mesothoracic legs are concealed by the antennae (Fig. 45). Tips of metathoracic legs exposed (Fig. 45). Antennal tips
Immature stages of *Deuterogonia*


extending to the level of metathoracic legs. Hindwings concealed by forewings at the anterior margin of 3rd abdominal segment (Fig. 46). Cremaster slenderly protruding, with six paired slightly curved setae: four pairs about in middle and two pairs on caudal end (Fig. 48). Dorsum of abdomen without any spines (Fig. 47). Condyles not observed.

In pupal characters, *D. chionoxantha* is separated from *D. pudorina* as follows: the maxilla is extremely long, the tips of the mesothoracic legs are concealed by the antennae, and the cremaster has six paired setae.

Material examined. 1 ♀, reared from larva feeding on the bark of dead branch of *Aralia elata* infested by fungi, Honshu, Mt. Inunakisan, Osaka Pref., 28. IV. 2001 (T. Saito), fixed on 13. V. 2001; 2 ♂, reared from larvae, in a slight web among dried fungi and under bark of the dead branch of *Prunus × yedoensis*, same locality, 28. IV. 2001 (T. Saito), fixed on 14. V.


Host. Bark of dead woods of *Carpinus tschonoskii* Maxim., *Fagus crenata* Blume and *Aralia elata* (Miq.) Seemann infested by fungi (dried condition, scientific name unknown) respectively, and dried fungus (*Daedaleopsis tricolor*) and dead bark of *Prunus × yedoensis* Matsumura.

Biological notes

This species has essentially the same habits as the preceding species, *D. pudorina*. The resting posture of the adult is shown in figs 6 and 7.

Remarks

The systematic position of the genus *Deuterogonia* Rebel, 1901 remains unclear at present, mainly because the morphology and biology of immatures have been hardly investigated. Toll (1964) alone mentioned that “The moth was bred from oak galls evoked by Cynipidae. This dose not indicate, however, that the larva always lives in galls. It is possible that it enters galls only to pupate…” The genus has been often included in the subfamily Deuterogoniinae of the Oecophoridae (e.g., Toll, 1964; Lvovsky, 1974, 1999; Moriuti, 1982; Park, 1983; Palm, 1989; Heppner, 1998), and several authors (e.g., Lvovsky, 1996; Parenti, 2000) placed the genus in the independent family Deuterogoniidae. On the other hand, Leraut (1992) suggested that the Deuterogoniidae should be assigned to a tribe of the subfamily Cryptolechiinae of the Elachistidae. Hannemann (1997) treated the genus as species incertae sedis. Hodges (1998), also, assigned the genus to the subfamily Deuterogoniinae of the Elachistidae in his latest gelechioid systematics.

The main characteristics of the immature stages of the genus are as follows. Larvae: 1) an elliptical shaped submental pit situated on ventral side of the head; 2) stemma III, IV and V very close to each other; 3) prothoracic leg with apical area of the femur expanded inwards (this state occurs in some oecophorid genera: *Borkhausenia* Hübner, 1825, *Callimodes* Leraut,
1989, *Casmaria* Walker, 1863, *Martyringa* Busck, 1902, *Promalactis* Meyrick, 1908 (Saito, unpublished data); 4) on 1st–8th abdominal segments, pinaculum ring of SD group setae accompanied with a small posterior pore, respectively (Minet (1989) already pointed out that this also occurs in his XS group consisting of 9 families among Gelechioidae); 5) SD1 seta on 9th abdominal segment is normal (not hair-like). Pupae: 1) labial palpus and prothoracic femur exposed; 2) antennae not touching at meson; 3) condyles absent.

The immature morphology conflicts with Hodges's family placement of this genus. The larval characters 1)–4) and pupal character 3) are not shared by the Elachistidae sensu Hodges (1998) (the presence of the condyles in the pupa is the only synapomorphy of his Elachistidae). Rather, these characters are commonly observed in the Oecophoridae sensu auct. Consequently I conclude the genus *Deuterogonia* should be placed in the family Oecophoridae.

**Acknowledgements**

I would like to express my sincere appreciation to the late Dr S. Moriuti, for his prolonged direction. I also thank to Dr F. Komai, Osaka University of Arts, for giving valuable support on the subject.

**References**


摘 要

斎藤寿久：Deuteronogia 属（マルハキバガ科）の幼生期と属の分類学的定位について

*Deuteronogia*属は世界で10種が知られているだけの小さな属で、日本からは4種が記録されている。しかし、その幼生期がまったく知られていないこともあって、これまでキバガ科のなかにおける位置が定まらなかった。すなわち、研究者によっては、マルハキバガ科の1亜科として、または単独の科として、あるいはクサモリグリ科の亜科としてなど、さまざまな取り扱われていた。筆者は最近、広葉樹の枯枝の樹皮下と菌類に侵された広葉樹の枯枝に張られた糸の巻きから得た2種の幼虫を飼育したところ、この属の2種、アヤメオビマルハキバガ*D. pudorina* (Wocke, 1857) とカタキオビマルハキバガ*D. chionoxantha* (Meyrick, 1935) の成虫が羽化し、その幼虫および蛹の興味ある形態についての観察を得た。すなわち幼虫は頭部腹面にサブメンタル・ビットを有すること、前胸部脚の末端が内側に拡張すること、第1-8胸節のSD刺毛群のリング状になった基板に小孔をもつことなどクサモリグリ科の幼虫にはみられない形質が認められた一方、マルハキバガ科の多くの属の幼虫と共通するこれらの形態を有することが観察された。さらに蛹では、腹部側面にcondyleと呼ばれる構造が認められず、これら幼生期の形態的特徴から判断して、*Deuteronogia*属はクサモリグリ科に属するのではなく、マルハキバガ科に属するものと思われる。
Four new species of the genus *Frisilia* Walker from Thailand
(Lepidoptera, Lecithoceridae, Lecithocerinae)

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*Abstract* In a taxonomical study, based on the insect collection of Osaka Prefecture University collected from Thailand, four species of the genus *Frisilia* Walker, *F. forficatella*, *F. astiana*, *F. spriella*, and *F. moriutii*, are described. Photographic images of moths and their male genitalia for the new species are provided.

*Key words* Taxonomy, description, *Frisilia*, Thailand

The genus *Frisilia* Walker, belonging to the subfamily Lecithocerinae, is characterized by the atypical labial palpus with a long, strongly angled 2nd segment and a minute 3rd segment in the male, contrasting with a roughly scaled 2nd and normally slender 3rd segment in the female, and by a sclerotized vertical ridge on the inner surface of the 1st–2nd sternite. Those characters are considered to be autapomorphic characters for the genus. The forewing is normally elongate, with well visible discoidal dots and frequently with a plical spot on the upper surface, and with a row of scales along the plical fold developed on the upper surface. The abdomen has no spines on the tergite.

The genus is mostly distributed in the Oriental Region, with a few exceptions known from the southern border of the Palearctic Region, e.g. *F. crossophaea* (Meyrick) and *F. sulcata* Meyrick from Assam and Sikkim, N. India, and *F. triturata* Meyrick from Afghanistan. After the type species, *F. nesciatella* Walker, 1864, was described from Sri Lanka, Meyrick (1887, 1906, 1910, 1914, 1929, 1935) described an additional 18 species from the Oriental Region, and one species, *F. compsootoma* Meyrick, from S. Africa. Diakonoff (1967) described a species, *F. drimyla* from the Philippines, and Gozmány (1978) described *F. chinensis* from China. Recently Wu and Park (1999, 2001) described six new species from Sri Lanka. Consequently 26 species are known in the world, but no species has been reported from Thailand.

*Materials and methods*

The new species are described, based on specimens deposited in the Osaka Prefecture University, Osaka, Japan, which were collected in the lepidopteran expeditions to Thailand during 1983–1987 by Japanese workers. A part of the specimens was also collected from Thailand by Mr. O. Karsholt and his colleagues in 1984. The color standard for the description of the adults followed Kornerup and Wanscher (1983).

*Description*

**Genus Frisilia** Walker, 1864


Type: *Frisilia nesciatella* Walker, 1864 [TL: Sri Lanka].
Frisilia forficatella Park, sp. nov. (Figs 1, 5–7, 7a–b, 11)

Diagnosis. The new species is superficially similar to *F. senilis* Meyrick, 1910 or *F. sejuncta* Meyrick, 1929, but it can be easily separated from both by the male genitalia, especially the different shape of the valva and the long, bifurcate caudal lobe of the juxta.

Description. Male. Wingspan 14.5–15.0 mm. Head with appressed brownish yellow scales. Basal joint of antenna elongate, covered with dark brown scales ventro- apically; flagellum brownish orange with brown annulations. Labial palpus atypical (Figs 5–6); first segment as long as 1/3 of 2nd segment, angled at basal 1/3; 2nd segment strongly angled before middle; basal portion with long scale-tufts projecting anteriorly, brownish orange rough scales dorsally; distal portion longer than basal portion, more cylindrical, lying above basal portion, bent downward, sparsely speckled with dark brown scales on outer surface apically, golden yellow on inner surface; 3rd segment minute, invisible, concealed in long scale-tufts of 2nd. Tegula and thorax brownish yellow. Forewing elongate, pale brownish orange, dark brown scales scattered irregularly on upper surface; discoidal dot dark brown, large, at middle of cell; plical spot as large as discoidal dot; with a row of seta-like scales along plical fold from near base; dark brown scales scattered along costa before 1/4; costa almost straight; apex more or less acute; termen strongly oblique, almost straight; fringes concolorous with brownish median line. Venation with R₃ stalked with R₄+₅ beyond half; R₄ and R₅ stalked beyond half of R₄; R₅ to termen; M₁ far from R₃+₄ at base; M₂ and M₃ coincident; CuA₁ and CuA₂ coincident. Hind wing pale gray, trapezoidal; costa almost straight; apex produced; termen slightly concave at middle; Rs and M₁ with long stalk; M₂ extended into cell, far from M₃ at base; M₃ and CuA₁ coincident. Sclerotized ridge on 2nd sternite of abdomen about 2/3 length of the segment (Fig. 11). Caudal margin of 8th sternite weakly concave medially and that of 7th sternite strongly convex. Female is unknown.

Male genitalia (Figs 7, 7a–b). Gnathos relatively short. Costal bar (bridge-like band connecting tegumen and valva) well-developed, with small triangular protrusion medially. Valva broad basally; cucullus tongue-shaped, densely setose on inner surface with a few stout hair-like setae near base; ventral margin with a protuberance at basal 3/5, with a thorn-like setae beyond; sacculus slender, extended prior to protuberance. Juxta shield-shaped; caudal process strong, heavily sclerotized, exceeded distal end of tegumen, deeply forked apically. Saccus almost round anteriorly. Aedeagus slender, slightly shorter than valva; cornuti consist of a pair of thorn-like, heavily sclerotized projections in vesica: one sickle-shaped and the other less bent.

Type. Holotype. ♀, Thailand, Loei, Phu Run, ca. 800 m, 15–19 VIII 1987 (Moriuti, Saito, Arita, Yoshiyasu), gen. prep. no. 4998/Park. Paratype. 1 ♀, Chiang Mai, Doi Pui, ca. 325 m, 15–30 X 1984 (Karsholt, Lomholdt, Nielsen), Zool. Mus. Copenhagen, gen. prep. no. 5011/Park.

Distribution. Thailand.

Etymology. The specific name is derived from Latin, *forfex* (= fork), corresponding to the shape of the caudal process of the juxta in the male genitalia.

Remarks. *F. dipsia* Meyrick, *F. rostrata* (Meyrick), and *F. ancylosana* Wu & Park have a long, taenoid median process of the juxta, but they are not forked distally. This new species and the following two new species are closely related by the similar shape of the process of the juxta with a well developed fork distally.
Frisilia asiana Park, sp. nov. (Figs 2, 8, 8a)

Diagnosis. The new species is superficially similar to the preceding species, but differs from the latter by the narrower forewing with almost vertical termen and smaller discoidal dot. The male genitalia are also similar to those of the preceding new species, Frisilia forficatella sp. nov., but the caudal process of the juxta is a stouter and U-shaped distal process, contrasting with the V-shaped fork in the latter, and the protuberance on the ventral margin is less produced.

Description. Male. Wingspan 17.0 mm. Head, antenna, and labial palpus similar to those of the preceding species. Forewing coloration similar to that of preceding species, but the shape differs from it in the following respects: narrowed distally, costa arched beyond 4/5, apex not produced, termen more or less truncate, almost vertical. Ground color light orange, speckled with dark brown scales irregularly, especially dense along costa basally; discoidal dot small, plical spot large; with a row of seta-like scales along plical fold from near base; fringes concolorous with median brownish line. Venation differs from the preceding species: Rs absent on forewing. Hind wing pale gray, trapezoidal; apex strongly produced, acute; termen strongly oblique; Rs and M₁ stalked at middle; M₃ and CuA₁ stalked beyond 2/3. Sclerotized ridge on 2nd sternite of abdomen weaker and shorter than that of the preceding species. Caudal margin of 8th sternite very concave medially and that of 7th sternite strongly convex.
Female is unknown.

Male genitalia (Figs 8, 8a). Gnathos broad medially; apical part short, acute. Costal bar sclerotized; median process triangular, not sharply pointed. Valva broad basally; cucullus elongate, slender, as long as basal part, densely setose on inner surface, with batch of setae near base; costa and ventral margin almost parallel; sacculus slender, with batch of setae medially; protuberance on ventral margin less produced. Caudal process of juxta stout, not longer than distal end of tegumen, forked into U-shape apically. Saccus moderate. Aedeagus stout, globular basally; cornuti consist of a pair of heavily sclerotized asymmetrical lobes.

Type. Holotype. ♂, Thailand, Loei, Phu Run, ca. 800 m, 15–19 VIII 1987 (Moriuti, Saito, Arita, Yoshiyasu), gen. prep. no. 5013/Park. Paratype. ♀, same data as the holotype, gen. prep. no. 5012/Park.

Distribution. Thailand.

Etymology. The specific name refers to Asia.

Frisilia moriutii Park, sp. nov. (Figs 4, 9, 9a–b)

Diagnosis. This new species is larger than the two preceding new species. The wing shape is similar to that of F. rostrata Meyrick which was described from Sri Lanka, or F. procentra Meyrick which was described from S. India, with broader forewings. However, the male genitalia are similar to those of the preceding species, but the ventral margin lacks a protuberance medially, and the cornuti of the aedeagus are longer.

Description. Male. Wingspan 17.5–18.0 mm. Head light orange, somewhat roughly scaled. Basal joint of antenna elongate, golden yellow all around; flagellum golden yellow with weak annulations. Labial palpus atypical; first segment as long as 1/3 of 2nd segment, angled at basal 1/3; 2nd segment strongly angled before middle; basal portion, slightly upturned with long scale-tuft projecting anteriorly, pale brownish orange on outer surface, sparsely speckled with dark brown scales; terminal portion more cylindrical, lying above basal portion, bent downward, longer than basal portion, clothed with creamy white to pale orange scales 2/3 outwardly, speckled with dark brown scales at apical portion; 3rd segment minute, concealed in long scale-tufts of 2nd. Tegula and thorax light orange. Forewing broad, slightly broader toward apex, light orange, dark brown scales scattered on surface irregularly and along termen; discoidal and plical dots relatively small; a row of seta-like scales along plical line from near base; costa almost straight; apex more or less acute; termen oblique, concave medially; fringes concolorous with medial brownish line. Venation similar to those of the preceding new species, T. forficatella. Hind wing pale gray; apex acute; termen strongly oblique, sinuate; Rs and M1 stalked at middle; M3 and CuA1 stalked beyond 2/3. Sclerotized ridge on 2nd sternite of abdomen stronger than that of F. asiaca. Caudal margin of 8th sternite very concave medially and that of 7th sternite strongly convex. Female is unknown.

Male genitalia (Figs 9, 9a–b). Gnathos broad medially; apical part sharply pointed. Costal bar sclerotized, with large triangular process medially. Valva broad basally; cucullus elongate, as long as basal part, densely setose on inner surface, with batch of strong setae near base; ventral margin without protuberance at middle; sacculus slender, extended to conjunction with cucullus. Caudal lobe of juxta reaching to distal end of tegmen; lateral arms of apical fork short. Saccus produced anteriorly. Aedeagus stout, globular at base; cornuti consist of a pair of heavily sclerotized long bars: the slender one longer than half of aedeagus and the other strongly angled at 1/3.

Type. Holotype. ♂, Thailand, Chiang Mai, Doi Pui, ca. 1300 m, 26–27 X 1985 (Moriuti, Saito, Arita), gen. prep. no. 5001/Park. Paratype. 1 ♂, Chiang Mai, Doi Chang Khian, ca.
Figs 7–10. Male genitalia with aedeagus (a) and 7th-8th segments of abdomen (b). 7. *F. forficatella* sp. nov. 8. *F. asiana* sp. nov. 9. *F. moriutii* sp. nov. (Scale bar: 0.2 mm). 10. *F. spuriella* sp. nov.
Fig. 11. 1st-2nd abdominal segments of *F. forficatella* sp. nov., with vertical ridge (vr).
Fig. 12. Female genitalia of *F. spuriella* sp. nov. 12a. ditto, magnification. (Scale bar: 0.2 mm)

1250 m, 27 V 1983 (Kuroko, Moriuti, Saito, Arita, Yoshiyasu), gen. prep. no. 5000/Park.

Distribution. Thailand.

*Etymology.* The species is named in honour of the late Dr. S. Moriuti, who is one of the collectors of the type specimens.

*Frisilia spuriella* Park, sp. nov. (Figs 3, 10, 10a, 12)

Diagnosis. The new species is similar to *F. forficatella* sp. nov. or *F. asiana* sp. nov. but the male genitalia are different from them, lacking the long median process of the juxta. It is also resembles *F. aencylosana* Wu & Park in the shape and coloration of the forewing, but the antenna of the latter is dark brown. The male genitalia are very close to those of *F. senilis* Meyrick, which was described from N. India, but it can be differentiated by the longer cucullus and sharply pointed saccus.

*Description.* Male. Wingspan 13–13.5 mm. Head covered with light orange, appressed scales. Basal joint of antenna elongate, covered with dark brown scales ventro-apically; flagellum light orange with brown annulations. Labial palpus atypical; basal portion of 1st segment slightly upturned, pale brownish orange on outer surface, sparsely speckled with dark
brown scales; terminal portion similar to those of the preceding new species, but clothed with creamy white scales at basal 1/3 dorso-outwardly, speckled with more dark brown scales beyond it; 3rd segment also minute, concealed in scale-tufts of 2nd. Tegula and thorax light orange. Forewing elongate, light orange, paler than that of the preceding species, with dark brown scales on surface irregularly; discoidal and plical dots well-developed; with a row of seta-like scales along plical line from near base; costa almost straight; apex obtuse; termen less oblique, slightly concave at middle; fringes concolorous. Venation similar to those of the preceding species, but M\textsubscript{1} arising further from Rs at base. Hind wing pale gray; apex acute; termen slightly concave at middle; Rs and M\textsubscript{1} with shorter stalk than preceding species.

Male genitalia (Figs 10, 10a). Apical part of gnathos short, sharply pointed. Costal bar well-developed; median angle projected and sharply pointed. Valva with costal margin strongly concave before middle; ventral margin with a large, triangular protuberance at basal 3/5, concave beyond it; cucullus long, with strong setae on inner surface medially in lower half. Juxta with small median lobe, sharply pointed on anterior margin medially; lateral lobes produced with sharply pointed apex. Saccus sharply extended anteriorly. Aedeagus slender, longer than valva, bent before half way; a heavily sclerotized spatulate plate developed at dorso-lateral margin of apical part, apex pointed; cornutus a short sclerite.

Female genitalia (Fig. 12). Apophysis anterioris about 2/5 as long as apophysis posterioris. Antrum cup-shaped, weakly sclerotized. Ductus bursae narrow in posterior 1/3 and broader in anterior 2/3. Corpus bursae ovate, membranous, shorter than ductus bursae; signum a round plate with a long transverse ridge.

Type. Holotype. ♂, Thailand, Chiang Mai, Doi Pui, ca. 1300 m, 30 V 1983 (Kuroko, Moriuti, Arita, Yoshiyasu), gen. prep. no. 4999/Park. Paratypes. 1 ♂, Chiang Mai, Doi Chiang Dao, ca. 1130 m, 18 X 1984 (Karsholt, Lomboldt, Nielsen), gen. prep. no. 5003/Park; 1 ♂, Loei, Phu Luang Wildlife Sanctuary, 10–12 X 1984, 1400–1500 m, (Karsholt, Lomboldt, Nielsen), gen. prep. no. 5004/Park, Zool. Mus., Copenhagen.

Distribution. Thailand.

Etymology. The specific name refers to Latin spurius (= false).

Remarks. Several female specimens were examined by their genitalia, but none of them can be shown to match with the above new species. This problem can be solved by means of further materials collected at the same locality.

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References

摘 要

Kyu-Tek Park: ダイ国産 Frisilia 属の4新種（鱗翅目，ヒゲナガキバガ科，ホソヒゲナガキバガ亜科）

Frisilia 属はヒゲナガキバガ科ホソヒゲナガキバガ亜科に属し，成虫のラピアル・バルブスが特異であること（♀では第2節が長く，強く曲がる；♂では第2節の雛粉は楕く，3節は細長く正常である）と1-2節の腹板の内側に硬化した突起をもつ通過で特徴づけられる。これらの形質は本属の固有新形質と考えられる。成虫の前翅は通常細長く，中室上に目立った斑点を，しばしば斑状になった部分を，発達した翅に沿って1列に並んだ雛粉をもつ。腹部の背板は棘をもたない。

本属は東洋区に集中的に分布しているが，例外的に旧北区の南緯に分布する種が少数ある。今までに世界から26種が知られているが，タイ国からは未記録であった。

大阪府立大学所蔵の同大学が1983-1987年に行ったタイ国鱗翅目昆虫調査で採集された標本とコペンハーゲン大学所蔵のタイ国産標本を検討したところ，4新種を確認したので記載した。

Frisilia forficatella Park（新種）
本種は外部表象において F. senilis あるいは F. sejuncta に類似するが，♀ゲニタリアのバルブの形状とユクサの長くて2叉した尾端突起による，異種と区別できる。本種は発達したユクサの尾端突起が同様な形状を呈することにより次の2新種 F. asiana と F. moriutii に近縁である。

Frisilia asiana Park（新種）
本種は外部表象において前種 F. forficatella に類似するが，前翅がより細長いこと，ほとんど真っ直ぐな外縁をもつこと，中室上の斑点がより小さいことで区別できる。♀ゲニタリアも前種に類似すると，ユクサの尾端突起がより短くで末端がV字形でなくU字形であること，腹端の隆起が突出しないことで区別できる。

Frisilia moriutii Park（新種）
本種は前2種 F. forficatella と F. asiana よりも大きい。翅の形状は F. rostrata あるいは F. procentra に類似するが，これら2種の前翅の幅はより広い。♀ゲニタリアは F. asiana に類似するが，腹端は中央に隆起を欠き，エデアスのコルヌスティはより長い。

Frisilia spariella Park（新種）
本種は F. forficatella と F. asiana に類似するが，♀ゲニタリアのユクサの長い中央突起を欠くことにより区別できる。本種は前翅の形状と色彩において F. ancylosana にも類似するが，後者の触角は暗褐色である。♀ゲニタリアは F. senilis に酷似するが，より長いクルスと鋭く尖ったサックスをもつことにより区別できる。

（文責：那須義次）
Descriptions of immature stages of Japanese species in the genus Apatetris
(Lepidoptera, Gelechiidae)

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Abstract Larval and pupal morphology of two Japanese species belonging to the genus Apatetris
are described. This genus has some larval morphology characters that are unique among genera in
the Gelechiidae. We discuss the taxonomic relationship of the genus to them using these larval
characters, and find that some species of the genus Chrysoesthia share such unique larval
characters with Apatetris. In addition to the discussion, we give a new generic combination to
Chrysoesthia heringi (Kuroko).

Key words Larva, pupa, Apatetris, description, Japan

Introduction

In recent decades, there have been many reports on Japanese gelechiid fauna (e.g., Kanazawa,
1984; Park, 1992; Ponomarenko, 1993; Park and Hodges, 1995; Ueda, 1995, 1997; Sakamaki,
information on gelechiid species recorded over 20 years. In all, about 150 Japanese species
are known. Although many Japanese species have been recorded, little is known of the
morphology of the immature stages or their biology. This makes it difficult to revise the
taxonomy of these species, because it is not easy to collect additional specimens without
sufficient biological information. Moreover, to produce an integrated revision, we need
information on the immature stages and their biology to make comparisons with conspecific
populations and allied species in other countries.

This study describes the larval and pupal morphology and biology of Japanese species
belonging to the genus Apatetris Staudinger. In addition, we discuss the morphological
peculiarity of the genus Apatetris among genera belonging to the Gelechiidae.

Material and Methods

We collected the material used in this study from various localities in Japan. The pupae and
larvae used for observations and drawings were preserved in 75% alcohol. Some of the larvae
used for observations and drawing the chaetotaxy and mouthparts were stained with acid
fuchsin or Evans blue and mounted on slides with Canada balsam. To mount larvae, we
adopted the method described by Kumata (1977). To describe the larvae, we adopted Stehr’s
system (Stehr et al., 1987) for the body chaetotaxy and the head setae and mouthparts.

Description

Genus Apatetris Staudinger

Apatetris elaeagnella Sakamaki (Figs 1– 3, 6a–l)

[Japanese name: Gumi-hamoguri-kibaga]

Apatetris elaeagnella Sakamaki, 2000: 212.
Pupa (Figs. 6k–l)

About 3.1–3.5 mm long, 1.1–1.3 mm wide, and 0.7–0.9 mm thick. Body pale ochre, often glossy, short elliptic, twice as long as wide, flattened in thickness, and smooth. Frontal process minute. Frontoclypeal and Clypeolabral sutures indistinct; pilifer invisible; paraclypeus rudimentary, the boundary between paraclypeus and oculus indistinct. Labial and maxillary palpi invisible; maxilla extending to near the caudal margin of the 3rd abdominal segment; mesothoracic leg extending to middle of the 5th abdominal segment; antenna reaching to basal 2/3 of forewing. Forewing extending beyond the middle of the 9th segment. Hindwing entirely concealed under forewing. Spiracles slightly protruded on 2nd and 3rd abdominal segments, the protruding area oval and unsclerotized; 10th abdominal segment without cremaster.

Mature larva (Figs 2, 6a–j)

Color (Figs 2, 6g). Head mainly pale brown, with creamy white area behind ocelli laterally; adfrontal suture distinct, creamy white; ocellar area black; body creamy-white; prothoracic shield pale brown, occupying dorsal area on cephalic 1/2 of the segment and dorsal to subdorsal area on caudal 1/2; prothoracic sternum weakly sclerotized on cephalic 1/2. Thoracic legs weakly sclerotized, semitransparent brown. A purplish brown streak running dorsomedially from 3rd thoracic segment to 6th abdominal segment. Anal plate pale brown, extending to lateral areas.

Structure. Larvae 4.9–5.6 mm long. Head width 0.4–0.5 mm. Head (Fig. 6b) round, flattened, with coronal suture very short and almost invisible; seta C2 rudimentary, remaining only as a puncture, situated immediately lateral to C1; seta A2 absent, A3 immediately posterolateral to 1st ocellus; setae P1–P3 small, shorter than 1/10 of seta A3, seta P1 posterolateral to AFgroup; setae AF and AF lateral to seta F1; punctures Pb and La absent; L group absent. Stemmata in 5 pairs; the 4th stemma immediately posterior to the antenna; 5th stemma placed near the 3rd and 4th; seta S2 longest among stemmatal setae, situated ventral to 1st stemma; seta S1 postero-ventral to 3rd stemma; seta S3 and puncture Sa absent. In fig 6-b, some setae have fallen off.

Antenna (Fig. 6f) 2-segmented; 2nd segment has one long and one short seta distally, with a long and 2 short conical papillae, and 2 spines. Labrum (Figs. 6c, d) shallowly emarginated medially; median labral setae in 2 pairs; seta M1 slightly shorter than seta M2; seta L1 minute, seta L2 as long as seta L3; numerous short and long scales occurring around epipharyngeal setae; epipharyngeal setae 3 in number. Mandible (Fig. 6e) with 4 teeth, the 1st a little shorter than the 2nd, arising from just ventral of the 2nd; the 2nd longest; the 2nd to 4th nearly equal in width. Labium and maxilla formed as usual in lepidopteran larvae; spinneret cylindrical and somewhat tapering apically, as long as labrum; 2 premental setae set close to one another; postmental setae posterior to the level of longer seta of maxillary stipes.

Body wholly covered with numerous sclerotized micropatches (diameter 4–30 μm; see Figs. 6i, j) except on prothoracic shield, thoracic legs, ventral prolegs, dorsal protuberances, and anal plate. Whole setae occurring on head and body rather shorter than those of other gelechiid larvae, invisible at a glance. Thoracic legs (Figs. 6g, h) well developed, each with a single claw, with 2 short setae situated just behind the claw. Ventral prolegs situated from 2nd to 7th abdominal segments, with no plantae or crochets; a pair of dorsal membranous protuberances, situated on dorsal area between mesothorax to 7th abdominal segment. Anal plate (Fig. 6i) subtriangular, extending laterally. Anal leg little developed, round, membranous, protuberant (Fig. 6j), with some rows of short setae on the surface.

Chaetotaxy of body (Figs. 6a, i, j). On prothorax, setae D group and seta XD1 all on the prothoracic shield; setae SD group bisetose, lateral to prothoracic shield; puncture XDa present, but XDb and seta MXD1 absent. Setae L and SV group bisetose and unisetose,
Immature stages of *Apatetris*

Fig. 1. Mining leaf: *Apatetris elaeagnella* Sakamaki mining on *Elaeagnus umbellata* Thunberg.
Fig. 2. Mature larva of *A. elaeagnella* in dorsal view.
Fig. 3. A round pupating room of *A. elaeagnella* under the vertical cuticle of lower surface of a leaf.
Fig. 4. Mining leaves: *Apatetris elymicola* Sakamaki mining on *Elymus mollis* Triniius.
Fig. 5. Mature larva of *A. elymicola* picked up from its linear mine.

respectively. Chaetotaxy of meso- and metathorax is typical in this family, except for setae L group, which is bisetose in this species instead of trisetose as usually for gelechiid larvae. On abdomen, setae SV group unisetose on 1st abdominal segment, bisetose on the 2nd–7th, and absent on the 8th–9th. Setae L group also decreasing, unisetose on 8th–9th abdominal segments; setae SD group absent on the 9th.

Specimens examined. Two examples of larvae. Matumoto City, Nagano Pref., Honsyū, 4. X. 1995, Y. Sakamaki leg. (slide No. Gel-95061); more than 30 alcohol-preserved specimens collected from the same locality and Kagosima (May, and July) in Kyusyū were observed. Also about 20 pupae collected in the above two localities were observed.

Distribution. Japan (Honsyū, Kyusyū)


Biology. This species is trivoltine. Larvae are found mining leaves on host plants in late spring, mid-summer and mid-autumn. Ochreous mine is found on the upper surface of the leaf; starts from basal part of midrib; appears linear for first 10 mm, and then becomes blotch-
Fig. 6. Larval and pupal morphology of *Apatetris elaeagnella* Sakamaki. a: chaetotaxy of body. b: chaetotaxy of head. c: labrum in ventral view. d: labrum in dorsal view. e: mandible. f: antenna. g: mature larva in lateral view. h: prothoracic leg. i: 10th abdominal segment in dorsal view. j: 10th abdominal segment in ventral view (scale bar = 0.1mm). k: pupa in ventral view. l: pupa in lateral view.
shaped (Fig. 1). Under rearing conditions, mature larvae become yellowish green, get out of mine and re-mine the under-surface of a leaf to make a round pupating room and a cocoon under the abaxial epidermis of the leaf (Fig. 3). Pupae of the autumn generation overwinter on leaves. Adults emerge in early autumn, mid spring and early summer.

*Apatetris elymicola* Sakamaki (Figs 4–5, 7a–k)

[Japanese name: Hamanin’niku-kibaga]

*Apatetris elymicola* Sakamaki, 2000: 215

Pupa (Figs. 7i, j)

About 4.5–5.0 mm long, 0.9–1.1 mm wide, and 0.9–1.1 mm thick. Body glossy, amber, long, cylindrical, about 4.5 times as long as wide, smooth. Frontal process absent. Frontoclypeal and clypeolabral sutures indistinct; pilifer invisible; paraclypeus rudimentary, the boundary between paraclypeus and oculus indistinct. Labial and maxillary palpi invisible; maxilla extending above mesothoracic legs to the 5th abdominal segment; antenna reaching apical 1/7 of forewing. Forewing extending to caudal margin of the 9th abdominal segment. Hindwing entirely concealed under forewing. Spiracles scarcely protruded. Cremaster rudimentary, forming rhombic protuberance.

Mature larva (Figs 5, 7a–h, k)

Color (Figs. 5, 7g, h). Head mainly dark brown, with pale ochre area around antenna; Y-shaped white suture dividing adfrontal area, procephalon and gnathocephalon; body creamy-white; mature larvae becoming reddish slightly; prothoracic shield dark brown dorsally and creamy-white in subdorsal area; prothoracic sternum sclerotized on cephalic margin of the segment, with a Y-shaped sclerite at middle and 2 minute pinacula at caudal margin, in some individuals Y-shaped sclerite missing; all of those sclerites brown. Anal plate minimally colored.

Structure. Larvae 5.9–8.2 mm long. Head width 0.5–0.6 mm. Head (Fig. 7b) round, flattened, with coronal suture very short and almost invisible; vertical area extending posterdorsally, as long as frons; seta C1 rudimentary, remaining only as puncture, situated immediately lateral to C2; seta P1 anterolateral to AF group; setae AF1 and AF2 situated far from and posterolateral to seta F1; puncture La and Seta L group absent. Stemmata and setae SS group absent.

Antenna (Fig. 7f) 1-segmented, distally with 3 short conical papillae, 2 short setae and a long seta. The long seta is 5 times as long as length of a segment of the antennal body. Labrum (Figs. 7c, d) subrectangular, without median incision; median labral setae in 3 pairs; all the setae equally long; setae L2 and L3 long, as long as M1–M3; seta L1 minute; numerous short and long scales occurring around epipharyngeal plate; epipharyngeal setae invisible. Mandible (Fig. 7e) with 4 teeth; the 1st tooth short, arising from just ventral of the 2nd; the 2nd and 3rd nearly equal in size; the 4th and 1st nearly equal in size. Labium and maxilla formed as usual in lepidopteran larvae; spinneret cylindrical and somewhat tapering apically, about 2/3 length of labrum; 2 premental setae set close to each other; postmental setae posteriorly to the level of longer seta of maxillary stipes.

Body wholly covered with sclerotized micropatches (diameter 4–16 mm), except on prothoracic shield and sternum, thoracic legs, ventral prolegs, dorsal protuberances and anal plate. Thoracic legs rudimentary, only forming membranous protuberance, with no claws. Ventral prolegs rudimentary, membranous, somewhat protuberant, and situated from 1st to 7th abdominal segments; dorsal protuberance (Fig. 7k) membranous, situated from mesothorax to
Fig. 7. Larval and pupal morphology of *Apatetris elymicola* Sakamaki. a: chaetotaxy of body. 
b: chaetotaxy of head. c: labrum in ventral view. d: labrum in dorsal view. e: mandible. f: 
antenna. g: mature larva in dorsal view. h: mature larva in ventral view. i: pupa in ventral 
view. j: pupa in lateral view. k: membranous dorsal protuberance on 6th abdominal 
segment. Scale bar: 0.5mm.
7th abdominal segment, similar to and indistinguishable from thoracic legs and ventral prolegs. Anal plate minimally sclerotized. Anal leg little developed, round, membranous, protuberant, with some rows of short setae on the surface.

Chaetotaxy of body (Fig. 7a). On prothorax, setae D group and seta XD1 all on the prothoracic shield, seta XD2 not on prothoracic shield; setae SD group bisetose, lateral to prothoracic shield; puncture XDa present, but XDb and seta MXD 1 absent. Setae L group trisetose and SV group consisting of 3 short setae on prothorax. Chaetotaxy of meso- and metathorax is typical in this family, except for setae L group, which is bisetose in this species instead of trisetose as usually found in gelechiid larvae. On abdomen, setae L group bisetose on 1st, 2nd, 7th, and 8th abdominal segments, unisetose in the 9th; setae SV group unisetose on 1st–7th abdominal segments; on 8th–9th abdominal segments, setae SV group absent; seta D1 ventral of seta D2.

Specimens examined. 2 larval examples from Syari-Town, Hokkaido, 1. ix. 1995, Y. Sakamaki leg. (Slide No. Gel-95059); more than 30 alcohol-preserved specimens (pupae and larvae) collected from the same locality were observed.

Distribution. Japan (Hokkaido).

Host plant. *Elymus mollis* Trinius (Gramineae).

Biology. Early larvae are found mining the upper surfaces of leaves of the host plant in late summer. White mine is linear, parallel to midrib, and runs from the basal half of the leaf blade to the apex (Fig. 4). Mature larvae become reddish slightly (Fig. 5) and overwinter there. They pupate in late spring. Adults emerge in early summer under rearing conditions. This species is probably univoltine.

**Discussion**

Benander (1937) compared the larval stages of higher categories of Gelechiidae. No subsequent study has compared the larval morphology of gelechiid genera. In this section, we compare the larval morphology of *Apatebris* with other genera of Gelechiidae, and discuss the peculiarity of some characters and the taxonomic status of the genus.

Most larvae of the Gelechiidae have a three-segmented antenna (see Benander 1937. In his paper, the narrow apical segment of the antenna is regarded as two segments). The two basal segments are broad and the apical segment is narrow and about half the diameter of the basal segments. The 2nd segment usually has some sensory hairs, papillae and the narrower 3rd segment on its upper surface. In the two species of *Apatebris*, the larval antennae are reduced. In *Apatebris elaeagnella*, the narrow apical segment is absent (Fig. 6f), and in *Apatebris elymicola*, the apical and basal segments are missing (Fig. 7f). Since a reduction in the antennal segments of the larva is unknown in other Gelechiidae and allied families, this must be a distinct derived character of this genus.

The labrum is a conservative character in larvae of gelechiid moths. In gelechiid genera, the labrum is usually bilobate apically, and has three pairs of middle setae and three pairs of lateral setae on the dorsal surface, and three pairs of thick sensory hairs on the ventral surface (see Benander 1937). This arrangement and the fundamental shape of the labrum are constant in most Gelechiidae. In the two species of *Apatebris*, however, there is a pair of dense hair-like scale-tufts on the epipharyngeal plate (Figs. 6d, 7d). This is also unique among genera of the Gelechiidae.

The general gelechiid chaetotaxy has been reported in Benander (1937), Saito (1969), and Stehr et al. (1987), who indicated that the fundamental chaetotaxy of this family did not differ
from that of other gelechioid families. Nevertheless, in the genus *Apatetris* (Figs 6a, 7a) there

tend to be fewer setae in group SV on the prothorax, and in group L on the 8th and 9th

abdominal segments than in the other genera. These trends are unique among the

Gelechiidae.

In *A. elaeagnella*, setae SV group on the prothorax is unisetose (typically bisetose in

Gelechiidae). Exceptionally, some members of the genus *Chrysoesthia* Hübner have

unisetose SV on the prothorax (*C. sexguttella* (Thunberg) and *C. heringi* (Kuroko) comb. n.;

see Kuroko, 1961). Setae SV group on 8th and 9th abdominal segments are absent in both

species of *Apatetris*. Such a reduction in number of the SV group is unique in Gelechiidae.

The chaetotaxy of the body is unique also in that the L group of the 1st, 8th and the 9th

abdominal segments is 2:1:1 or 2:2:1. This is not found in other Gelechiidae (usually the L

group of the 1st, 8th and 9th is 3:3:3 or 3:3:2) with the exceptions of *Chrysoesthia sexguttella*

and *C. heringi* (Kuroko, 1961), which have 3:1:1 of L group on these abdominal segments.

Such a reduction in setae on those abdominal segments is congruent with observations in

*Chrysoesthia*. This suggests that *Apatetris* may be closely related to some members of the

genus *Chrysoesthia*.

We found that the ventral prolegs were reduced morphologically in both species and were

increased in number. Moreover, the thoracic legs were reduced into simply membranous

protrusion in *A. elymincola*. However, such reductions in body appendages, which are also

found in *Metzneria lappella*, are associated with their larval habitat (seed borer) and are

unlikely to be associated with their phylogenetic relationships (Sakamaki, unpubl data).

While the dorsal proleg-like protuberances, which are not shared with *Metzneria*, are a unique

character in Gelechiidae.

In *Apatetris*, the wings conceal the ventral surface of the abdomen in the pupa. A similar state

is also found in *Chrysoesthia, Metzneria*, and *Ptocheusa* within the Gelechiidae (Patočka,

1990). It is difficult to decide the taxonomic value of this character, because we have no idea

of its biological function.

This study revealed the morphological uniqueness of larvae belonging to the genus *Apatetris*.

Some of the unique characters are similar to those observed in some members of the genus

*Chrysoesthia*. We know little about the immature stages of other genera belonging to the tribe

Apatetruni. Sufficient knowledge might show that the characters described for *Apatetris* are

not unique and would clearly indicate a close relationship to *Chrysoesthia*.

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Immature stages of Aptetris

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**摘 要**

坂巻祥孝・鳥倉英徳：日本産 *Apatetris* 属（鱗翅目，キバガ科）の幼虫および蛹の記載

近年記載された日本産 *Apatetris* 属の2種の幼虫と蛹の形態および生活史を記載した。ギミハモグリキバガ (*Apatetris elaeagnella*) （新称）は、本州および九州に分布し、ギミ属各種の葉に斑状に潜行する。老熟幼虫は葉裏を出て近傍の葉裏の変形組織下に円形の蛹を作り蛹化する。春、初夏、秋の年3化で越冬態は蛹。幼虫は、腹部第2節から7節まで鈍爪を持つない腹脚を有する。蛹角は2節。

ハマニンクキバガ (*Apatetris elymicola*) は、北海道の遠東地域のみで採集されており、ハマニンクの葉に直線状に潜行する。成虫は初夏に出現する。年1化と考えられ、老熟幼虫で葉裏の中でそのまま越冬する。幼虫には個眼がなく、蛹角は退化して1節のみである。胸脚と腹脚は退化して鈍爪を持たない膜質の触出部となっている。腹脚は腹部第1節から7節までで、腹脚同様の触出部が背面（中胸脚から腹部第7節）にもある。

これら2種の *Apatetris* 属の幼虫形態は、キバガ科としては非常に特異な部分が多い。上唇には目立った鰭片上の毛束をもつ。また、幼虫の刺毛は他のキバガ科のものよりも短くなく、前胸節のSV刺毛は1本、そして腹部の第1、8、9節のL刺毛数も、それぞれ1本である。また、蛹角も1節または2節しかない。これらの特異性のうち、刺毛の減少については *Chrysoesthia* 属の一部（ムツモンアザキバガ、イノコズチキバガ）に同様の傾向が見られ、近縁性を示すものと考えられた。
A revision of the Japanese species of the genus Paralida Clarke
(Lepidoptera, Gelechiidae)

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Abstract The genus Paralida Clarke is revised from Japan. The type species, P. triannulata
Clarke, is redescribed and one new species is described with a series of photos and figures. The
monophyly and the systematic position of the genus are discussed using morphological features.

Introduction

The monotypic genus Paralida was erected by Clarke (1958) based on a new species Paralida
triannulata Clarke, 1958 from Japan. Subsequently this species was recorded from Thailand
(Moriuti and Ueda, 1993) and Taiwan (Park, 1995). Robinson et al. (1994) transferred
Chelaria balanaspis Meyrick, 1928 from Vietnam to the genus Paralida as the second species
of the genus. Clarke (1958) pointed out that the genus is included in the genus Hypatima if
the generic concept of Meyrick (1925) is adopted. Moriuti (1982), Park (1995) and
Ponomarenko (1997b) also recognized the affinity of the genera Paralida and Hypatima, and
placed them close together in their classifications. However, no detailed morphological study
of Paralida has ever been conducted, so the generic status and the systematic position are still
uncertain.

In this study, I revise Japanese Paralida including one new species and discuss the monophyly
and the systematic position of the genus on the basis of a detailed morphological study.

Materials and methods

For observation of the genital structures, the abdomens were macerated for about 7 minutes in
a 10% KOH heated water bath. The abdomens were transferred to water to rinse and dissect.
After staining in Chlorazol Black E, the genitalia were observed in 70% ethyl alcohol. In
some specimens, male genitalia were dissected using an unrolling technique described by
Pitkin (1986) for making genital preparation and female genitalia were prepared in standard
position. The male genital muscles were observed on the basis of the technique described by
De Benedictis & Powell (1989). For observation of the thoracic structures, whole dried
specimens were macerated for 10–15 minutes in a 10% KOH heated water bath. The
specimens were transferred to water to rinse and dissect. After staining in mercurochromne,
the thoracic structures were observed in 70% ethyl alcohol. The measurements at the
beginning of each description are minimum and maximum forewing length measured in 1/10
millimeters. The average ± S.D. is noted together with the number of measured specimens.

The terminology follows Emoto (1988) and Scoble (1992) in the meso and metathoracic
sternopleural region, Ponomarenko (1992) and Klots (1970) in the male genitalia, mainly
Klots (1970) in the female genitalia, and Birken-Smith (1974) in the male genital musculature
system.

All of the specimens are deposited in the collection of the Entomological Laboratory, Osaka
Prefecture University.

Genus *Paralida* Clarke


Head. Face and vertex with appressed scales. Proboscis developed, basal 3/4 squamose. Antenna about 3/4 length of forewing; scape without pecten. Labial palpus 3-segmented; 1st short, 2nd with broad tuft of loosely set scales or dense scale tuft divided into 3 triangular parts on under surface, 3rd with a projecting scale tuft on dorsal margin.

Wing (Figs 10–12). Forewing elongate with produced apex; pterostigma well developed from

Figs 15–16. Meso and Metathoracic sternopleural region of *Paralida*. 15. Mesothorax of *P. okinawensis* sp. n. 16. Metathorax of *P. okinawensis* sp. n.

base to R1; 12 veins; R4 and R5 out of M1, R5 to costa, M1 to apex, M3 and Cu1A parallel; several rows of lanceolate scales developed along the dorsal margin on undersurface. Hindwing trapezoidal; costal margin slightly expanded anteriorly from base to middle; 8 veins; R1 present, Rs and M1 stalked; several rows of lanceolate scales developed along subcostal area (Fig. 12).

Mesothoracic sternopleural region (Fig. 15). Episternum with anapleural cleft dividing into anepisternum and infraepisternum; infraepisternum with paracoxal suture; paracoxal suture disappearing on its upper section.

Metathoracic sternopleural region (Fig. 16). Episternum with anapleural cleft dividing into anepisternum and infraepisternum. Infraepisternum with wrinkles; median anterior margin margined by a broad sclerotized plate and produced into a broad sclerotized plate.

Pregenital abdomen (Figs 13–14). Second sternite with a distinctive pair of sternal apodemes and venulae; venulae almost straight; anterior margin deeply concave, sclerotized; central area sclerotized. Boundary of 1st and 2nd tergite with triangular plate. Eighth sternite concave or emarginate at middle in male.

Male genitalia (Figs 20–29). Symmetrical. Uncus with long, rectangular, and strongly sclerotized lobe bearing dense long hairs. Gnathos with long sclerotized hook; culititula absent. Tegumen, with strongly sclerotized ventral fold; pedunculus expanded into large circular plate and broadly separated from tegumen. Cucullus, slender, curved dorsally, dilated distally. Saccus distinct, never fused with vinculum. Valvella symmetrical, tapered to apex, with a mass of bristle-like setae; base extending to form a transtilla-like sclerite. Juxta lobe symmetrical, with semicircular window; distal margin produced into a digitate lobe. Saccus present, slender, curved dorsally. Aedeagus tapered apically, curved dorsally, without cornuti;

ductus ejaculatorius with lamina ducti ejaculatorii.

Male genital musculature (Figs 17–19). M1 (uncus depressor) large and triangular, originated from anterolateral portion of tegumen, extending posteromedially, and inserted on basal sclerite of uncus. M2 (anal tube retractor) very thin, longitudinal muscle, originated from anteromedian portion of tegumen, and inserted on anal tube. M3 (valva flexor?) originated from posteromedial portion of tegumen, extending ventrally, and inserted on ventral wall of tegumen. M4 divided into two bundles M4a and M4b; M4a (tegumen erector and valva flexor) originated from pedunculus (=parateguminal sclerite sensu Ponomarenko, 1992) and inserted on strongly sclerotized ventral fold of tegumen; M4b (valva flexor) originated from pedunculus and inserted on the sclerotized anellus. M6 divided into two bundles, M6a and
M6b; M6a (aedeagus protractor) originated from vinculum and inserted on base of aedeagus; M6b (aedeagus supinator) originated from vinculum, extending anterodorsally, and inserted on base of aedeagus. M7 (aedeagus retractor) originated from saccus, extending posterodorsally, and inserted on lateral surface of aedeagus. M10 (juxta spinator?) originated from vinculum, extending ventrally, and inserted on strongly sclerotized anterior margin of juxta lobe.


Pupa (Figs 4, 7). Slender, brownish. Surface with many minute setae. Tenth segment with hooked setae.

Remarks. The genus Paralida is superficially similar to the genus Hypatima, but distinguishable from it by the produced apex of the forewing and absence of scale tuft on the forewing (Clarke, 1958). The male genitalia are also similar to those of Hypatima, but distinguishable by the absence of the sensilla basiconica on the valvella.
Monophyly and systematic position of the genus *Paralida*.

Ponomarenko (1997a) proposed a phylogenetic relationship among genera of Chelariini + Anarsiini (= Chelariini sensu Karsholt & Riedl, 1996), based on cladistic analysis. However, the position of genus *Paralida* was uncertain in her cladogram because the morphologies of the genus were deduced from the figure of the genitalia given by Clarke (1958). Therefore she placed the genus near the genus *Faristenia* by the broken line based on the similarity of the male genitalia. Detailed morphology of Japanese *Paralida* is studied here. For clarifying the monophyly and systematic position of *Paralida*, I compared the morphological features with those of genera of Chelariini (sensu Karsholt & Riedl, 1996) shown by Ponomarenko (1997a). As a result, the genus *Paralida* is assigned to the tribe Chelariini (sensu Karsholt & Riedl, 1996) by a shared synapomorphy, viz., the presence of the additional wing coupling system. Within the tribe Chelariini, *Paralida* constitutes a monophyletic group with genera *Hypatima* and *Ethmiopsis* (*Dactylethrella* in Ponomarenko, 1997a) by a shared synapomorphy, viz., the muscle M4 divided into two bundles M4a and M4b in the male genitalia. Within this clade, *Paralida* constitutes a monophyletic group with *Hypatima* by at least two shared synapomorphies: the sited attachment portion of the muscle M7 from ventral to lateral surface of aedeagus (Ponomarenko, 1997a); the presence of the strongly sclerotized anterior margin of the juxta lobe which serves with the attachment portion of the muscle M10. Ponomarenko (1997a) regarded the shift of the attachment portion of M1 muscle to the side of the tegumen as one of the synapomorphies of *Hypatima*. However, M1 is inserted on the basal sclerite of the uncus in *Hypatima* judging from the figures of Ponomarenko (1992, 1997a). The monophyly of *Paralida* is supported here by two synapomorphies: presence of the sclerotized plate on the anterior margin of the pereiposternum in the metathorax, and the produced apex of the forewing. In the metathoracic pereiposternum region, the broad sclerotized plate on the anterior margin of the infraeposternum is seen only in *Ethmiopsis tegulifera* (Meyrick) and the genus *Paralida* (Ueda, unpublished data). This character is inferred to be apomorphic but evolved in *Ethmiopsis tegulifera* and the genus *Paralida* independently. The produced apex of the forewing, which is considered here one of the major synapomorphies of the genus *Paralida*, is never observed in other Japanese species of the Chelariini. The muscle M10 which is originated from the sacculus and inserted on the juxta is present in *Paralida*. This muscle is observed in the genera *Anarsia, Faristenia, Dendrophila, Bagdadia* (*Capidentalia*), *Ethmiopsis* (*Dactylethrella*), *Neofaculta* and *Hypatima* (Ponomarenko, 1992 and 1995). Ponomarenko (1992) considered that this muscle is M8 originating from the vinculum and inserting on the juxta. Although she inferred that the attached portion of this muscle changed from the vinculum to the sacculus, I consider the muscle is M10 because Kanazawa (1998) inferred that the absence of the M8 muscle is a synapomorphy of the family Gelechiidae within the Gelechioidea. The presence of M10 is inferred to be a plesiomorphy, but it is regarded here as one of the diagnostic characters of the Chelariini.

**Descriptions**

*Paralida triannulata* Clarke (Figs 1, 3–5, 10, 12, 20–23, 30, 32)

*Paralida triannulata* Clarke, 1958: 2, figs 1–4; Moriuti, 1982: 283, pl.13, fig. 26; Moriuti & Ueda, 1993: 75, fig. 1; Park, 1995: 84, fig. 18; Ponomarenko, 1997b: 45.

*Paralida balanaspis*: Robinson et al., 1994: 75, pl. 7, fig. 20 (misidentification of *Chelaria balanaspis* Meyrick, 1928).

Forewing length: $\alpha$, 8.3–9.5 mm (8.73±0.49 mm on average ± S.D. of 6 specimens); $\beta$, 9.8–11.1 mm (10.61±0.59 mm on average ± S.D. of 4 specimens).

Head pale yellowish white, with median longitudinal ochreous line. Antenna pale yellowish
white, scattered with pale fuscous, with fuscous annulation at 2/3 and apex; scape pale yellowish white. Labial palpus with broad tuft of loosely set scales divided roughly into three triangular parts on under surface of 2nd segment; 2nd segment brownish, with pale yellowish white stripes on apical margin of each triangular part; 3rd nearly equal length of 2nd, with a projecting scale tuft on dorsal margin, pale yellowish white, with an obscure fuscous ring at middle. Thorax pale yellowish white, with a median longitudinal fuscous line; tegula pale yellowish white scattered with ochreous. Legs ochreous, tinged with dark brown; fore tibia with an oblique pale yellowish white ring at middle, with apical half suffused with pale fuscous; fore tarsus with pale ochreous apical ring on each segment; mid tarsus with pale ochreous apical ring on each segment; hind tibia broadly suffused with pale ochreous, suffused dorsally with pale ochreous hairs; hind tarsus with basal three segments suffused with pale yellowish white. Forewing elongate, apex produced; M1 stalked with R4+5; pale yellowish white, with indistinct ochreous streaks; a pale grayish brown suffusion on costa from before 1/3 to apex, cut by a narrow outward-oblique whitish mark at beyond 2/3; dark brownish circular mark on cell at middle; an orange streak beneath pale grayish brown costal suffusion from before 3/4 to apex; a fuscous line just above orange streak at 3/4; cilia pale ochreous, cut by an orange line at apex. Hindwing pale brownish gray; cilia ochreous, with apical half gray. Abdomen pale brownish gray above and pale yellowish white beneath.

Male genitalia (Figs 20–23). Eighth sternite with posterior margin concave at middle. Uncus long, rectangular, with rounded distal margin. Gnathos long, hook-shaped. Cucullus slightly curved dorsally, basal half slender, distal half strongly dilated; distal margin almost straight. Valvella long, about 2/5 length of cucullus, tapered to apex; apex pointed. Juxta lobe large; distal margin produced posteriorly into digitate lobe. Aedeagus slender, tapered distally, curved dorsally at middle then slightly curved ventrally near apex; apex bluntly pointed; ductus ejaculatorius with a small oblong lamina ducti ejaculatorii.


Mature larva (Fig. 3). Body length about 16mm. Head and prothoracic shield lustrous black. Thoracic legs black. Body pale whitish green. Setal pinacula black, conspicuous. Spiracles black. Prolegs bearing 28–30 crochets arranged in uniodinal lateral penellipse. Anal shield lustrous black; anal fork comb-like consisting of 8 spines. Anal prolegs with many minute brownish spines; crochets arranged in uniodinal transverse band divided by a median gap. Chaetotaxy: SV group bisetose on segments 1 and 7, trisetose on segments 2–6, unisetose on segments 8 and 9; L3 on segment 9 absent.

Pupa (Fig. 4). Body length about 10mm; brown.


Distribution. Japan (Honshu, Shikoku, Kyushu), Taiwan, Thailand.

Biology. Host plant: *Melia azedarach* L. (Meliaceae). The larvae in Osaka Prefecture fold the two edges of a leaflet of *Melia azedarach* over the midrib forming a pouch and live in it. The pupation occurs within the pouch of the leaflet.

Remarks. *Paralida triannulata* is closest to *P. okinawensis* sp. n. and the discriminating characters are noted under the latter.

**Paralida okinawensis** sp. n. (Figs 2, 6–9, 11, 13–19, 24–29, 31, 33)

Forewing length: ♂, 8.6–10.2 mm (9.64±0.41 mm on average ± S.D. of 26 specimens); ♀, 8.4–11 mm (9.78±0.58 mm on average ± S.D. of 21 specimens).

Head pale yellowish white, with an indistinct median longitudinal pale grayish ochreous line. Antenna pale yellowish white, scattered with pale fuscous, with fuscous annulation at 4/5 and apex; scape pale yellowish white. Labial palpus with broad tuft of loosely set scales divided roughly into three triangular parts on under surface of 2nd segment; 2nd segment pale ochreous, with pale yellowish white stripes on apical margin of each triangular parts; 3rd nearly equal length of 2nd, with a projecting scale tuft on dorsal margin, pale yellowish white, with obscure pale ochreous rings at base and middle. Thorax pale yellowish white, with a median longitudinal fuscous line; tegula pale yellowish white scattered with ochreous. Legs pale fuscous; fore tibia with two oblique pale ochreous rings at middle and apex; fore tarsus with pale ochreous apical ring on each segment; mid tibia with two oblique pale ochreous rings at middle and apex; mid tarsus with pale ochreous apical ring on each segment; hind tibia suffused dorsally with ochreous hairs; hind tarsus with pale ochreous apical ring on each segment. Forewing elongate, apex produced; M1 stalked with R4+5; pale yellowish white, with indistinct ochreous streaks; a brown semifusiform suffusion on costa from before 1/4 to apex, with narrow fuscous lines; a dark ochreous oblong mark just beneath costal suffusion at 2/3; termen edged with a short fuscous line beneath apex; cilia pale ochreous, with pale yellowish white basal half. Hindwing brownish gray; cilia pale brownish gray, with two ochreous shades at middle and apex.

Male genitalia (Figs 24–29). Eighth sternite with posterior margin concave at middle. Uncus long, rectangular. Gnathos long, hook-shaped. Cucullus slightly curved dorsally, basal half slender, distal half strongly dilated; distal margin rather rounded. Valvella long, about 2/5 length of cucullus, tapered to apex; apex pointed. Juxta lobe large; distal margin produced posteriorly into a digitate lobe. Aedeagus slender, tapered distally, curved dorsally at middle then slightly curved ventrally near apex; apex dull pointed; ductus ejaculatorius with small oblong lamina ducti ejaculatorii.

Female genitalia (Figs 31, 33). Apophysis posterioris about 1.5 times length of apophysis anterioris. Eighth segment sclerotized. Genital plate obcordate with honeycomb pattern. Ostium longitudinal narrow, opening at anterior end of genital plate. Ductus bursae long, slightly sclerotized about posterior 1/5, coiled twice near anterior end. Ductus seminalis arising from about middle of ductus bursae. Corpus bursae oblong. Signum strongly sclerotized, oblong, with an inward-projecting trapezoidal horn.

Mature larva (Fig. 6). Body length about 13mm. Head and prothoracic shield lustrous black. Thoracic legs black. Body pale whitish green, dark green dorsally. Setal pinacula black, conspicuous. Spiracles black. Prolegs bearing about 35 crochets arranged in uniordinal lateral penellipse. Anal shield lustrous black; anal fork comb-like consisting of 10 spines. Anal prolegs with many minute brownish spines; crochets arranged in uniordinal transverse band divided by a median gap. Chaetotaxy: SV group bisetose on segments 1 and 7, trisetose on segments 2–6, unisetose on segments 8 and 9; L3 on segment 9 absent.

Pupa (Fig. 7). Body length about 15mm; brown.

Figs 32–33. Female genitalia of *Paralida* spp. in ventral aspect. 30. *P. triannulata* Clarke. 31. *P. okinawensis* sp. n. paratype.


Distribution. Japan (Okinawa Is.).

The larvae fold the two edges of a leaflet of *Melia azedarach* over the midrib forming a pouch and live in it in spring in the Okinawa Is., Okinawa Prefecture (Fig. 8). Pupation occurs within the pouch of the leaflet.

Remarks. *Paralida okinawensis* is closest to *P. triannulata*, but separable from the latter by the brown semifusiform suffusion on costa and the absence of a circular discal mark in the external character. The male genitalia are similar to those of *P. triannulata*, but distinguished from the latter by the shape of the cucullus. The distal margin of the cucullus is rounded in *P. okinawensis*, whereas it is almost straight in *P. triannulata*. The female genitalia are also similar to those of *P. triannulata*, but distinguishable from the latter by the shape of the signum which is produced inwardly into a trapezoidal thorn in *P. okinawensis*, but into a rectangular thorn in *P. triannulata*.

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摘 要

上田達也：日本産 Paralida 属の分類学的再検討（鱗翅目, キバガ科）

Paralida 属は Hypatima 属に近縁と考えられてきたが、その単系統性や系統的な位置についての議論はなされていなかった。そこで、Paralida 属のオス交尾器筋肉系を含む詳細な形態の検討を行い、日本から 1 新種を含む 2 種を記録するとともに、本属の単系統性と、系統的な位置について議論を行った。

Paralida 属は前・後翅の二次的な連結器官の存在から Hypatima 属などで構成される Chelariini 族に所属し、オス交尾器筋肉 M4 が 2 本に分かれるという形質状態から Hypatima 属と Ethmiopsis 属と単系統群を構成することが明らかとなった。この単系統群の中で Paralida 属はオス交尾器筋肉の M7 の付着点が aedeagus の側面に移動する、juxta lobe の前縁が硬化する、という 2 つの共有派生形質から Hypatima 属と姉妹群を構成することが明らかとなった。また、Paralida 属の単系統性は後胸の parepisternum 前縁が硬化する、前翅頂が突出するという形質状態から支持された。

以下、日本産 Paralida 属 2 種の特徴、分布、生態などの概要を示す。

1. Paralida triannulata Clarke, 1958 センダンキバガ
頭部、胸部は黄褐色、前翅頂は突出し、黄褐色で前翅前縁に灰褐色斑をもつ。ラビアル・バルブス第 2 節は 3 本に分かれた毛束を持ち、第 3 節も太い。本州、四国、九州、台湾、タイに分布し、寄主植物はセンダンである。

2. Paralida okinawensis Ueda, sp. n. オキナワセンダンキバガ（新種）
頭部、胸部は黄褐色、前翅頂は突出し、黄褐色で前翅前縁に褐色斑をもつ。ラビアル・バルブス第 2 節は 3 本に分かれた毛束を持ち、第 3 節も太い。沖縄本島に分布し、寄主植物はセンダンである。
A new genus and two new species of Synanthedonini (Lepidoptera, Sesiidae) from the Oriental Region*

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Abstract A new genus Ichneumonella gen. nov. and two new species, namely I. viridiflava sp. nov. and I. hyaloptera sp. nov. are described and figured from the Oriental Region. The former species is known to occur in Thailand and Vietnam, but the latter one is described from the island of Borneo.

Key words Sesiidae, Synanthedonini, Ichneumonella gen. nov., new species, taxonomy, Thailand, Vietnam, Malaysia

The present paper, a continuation of our ongoing studies of the Oriental Sesiidae, is devoted to description of a new genus and two new species of clearwing moths of the tribe Synanthedonini (Lepidoptera, Sesiidae).

This new genus is unique among Sesiidae of the Eastern Hemisphere in that the males have a long, slender, broadened and apically bilobed appendix, which extends from the posterior-medial end of the eighth abdominal tergite (Fig. 4). Representatives of the genus Alcahtoe Edwards, 1882 (type species: Aegeria caudata Harris, 1839), which is distributed in the New World, also have a similar process. But these two genera differ from each other both superficially, and by the structure of the male and female genitalia (cp. Figs 1–8 with figs 38–39 and pl. 4, figs 24–40 in Eichlin & Duckworth, 1988). These two taxa of the Synanthedonini probably had a common ancestor, which might have lived within the region comprising present-day Southeast Asia in the late Tertiary, in the Pliocene or even in the late Miocene. However, equally possibly these appendices could have evolved independently. Either way, it is very interesting to describe such taxa of the Oriental Region for the first time.

The types of these new species are deposited in the following collections abbreviated in the text as follows:

NSMT – National Science Museum, Tokyo, Japan.
ITBC – Institute for Tropical Biology and Conservation, Universiti Malaysia, Sabah, Kota Kinabalu, Malaysia.

Ichneumonella Gorbunov & Arita, gen. nov.

Type species: Ichneumonella viridiflava Gorbunov & Arita, sp. nov.

Description. Medium-sized Synanthedon-like clearwing moths with alar expanse about 19–25 mm. Head with antenna clavate, extremely shortly ciliate in male, with hair-tuft apically; frons smooth-scaled; labial palpus smooth-scaled, upturned, extending vertex; proboscis long,

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well-developed, functional; vertex with elongate scales, slightly overlapping upper margin of frons; occipital fringe with setaceous scales. Thorax smooth-scaled, posteriorly both metepimeron and metameron without hair-like scales. Legs smooth-scaled, without hair-like scales. Abdomen smooth-scaled; in male tergite 8 with a narrow, long, slender, broadened and apically bilobed appendix, bearing medial part of anal tuft (Fig. 4). Forewing with transparent areas well-developed, cell between veins R4 and R5 exceeding distal margin of other cells; discal spot narrow; veins R1 and R2 parallel; veins R4 and R5 stalked for about a half of their length; distance between bases of veins R3 and R4+5 somewhat shorter than that between bases of veins R4+5 and M1 and M1 and M2 (Fig. 5). Hindwing transparent; discal spot undeveloped or small, extending to base of vein M2; vein M2 arising from costal third of cross-vein; veins M3 and CuA2 long stalked; distance between base of vein CuA2 and cross-vein about as long as that between cross-vein and base of vein M3; vein CuP entirely membranous; vein 1A well-developed, issuing from about middle of vein 2A; vein 2A well-sclerotized, short; vein 3A extremely thin, distinctly longer than vein 2A (Fig. 5). Male genitalia (Figs 6a–d, 7a–d) with tegumen-uncus complex relatively narrow; scopula androconialis well-developed, long, about as long as tegumen-uncus complex (Figs 6a, 7a); crista gnathi medialis long, broad, sometimes outwardly divided into two extremely narrow cristae; crista gnathi lateralis short, sometimes distinctly narrower than crista gnathi medialis; valva (Figs 6b, 7b) trapeziform-oval; crista sacculi nearly flat, covered with apically bifurcate setae; ventral crista small, covered with triangular flat-topped setae; saccus (Figs 6c, 7c) long or short, with flat or slightly rounded base; aedeagus (Figs 6d, 7d) thin, slightly shorter than length of valva; vesica with numerous, strong, irregular, beak-shaped cornuti (Fig. 6d) or with
numerous minute ones (Fig. 7d). Female genitalia (Fig. 8) with papillae analis relatively long and broad, covered with short setae; 8th tergite broad, with a broad projection anterior-ventrally, with individual short setae; posterior apophysis somewhat longer than anterior apophysis; both lamellae antevaginalis and postvaginalis undeveloped; ostium bursae narrow, at anterior margin of segment 8; antrum relatively broad, slightly broadened posteriorly, long, slightly longer than length of apophysis anterior, well-sclerotized; ductus seminalis just at anterior margin of antrum; ductus bursae membranous, narrow, about as long as apophysis anterior; corpus bursae ovoid, membranous, without signum.

Diagnosis. Males of Ichneumonella gen. nov. can easily be distinguished from all other Synanthedonini of the Eastern Hemisphere by the presence of a narrow, long, broadened and apically bilobed appendix on the 8th tergite of the abdomen (Fig. 4). By the absence of hair-like scales on the metepimeron and metameron posteriorly, wing venation and by the conformation of the valva of the male genitalia, this new genus seems to be closely related to Paranathrenella Strand, 1916 (type species: Paranathrene (Paranathrenella) formosicola Strand, 1916), but it differs by the structure of the external transparent area of the forewing (cell between veins R₄ and R₅ not exceeding distal margin of other cells in Paranathrenella) and by the conformation of the male genitalia (antrum with a narrow, finger-shaped appendix posterior-ventrally in the genus compared; cp. Fig. 8 with fig. 20 in Gorbunov & Arita, 1995, fig. 20 in Arita & Gorbunov, 1998, fig. 51 in Gorbunov & Arita, 1999 or figs 24 and 25 in Gorbunov & Arita, 2000). Ichneumonella gen. nov. is distinguishable from Anhedonella Gorbunov & Arita, 1999 (type species: Anhedonella polyphaga Gorbunov & Arita, 1999) by the forewing venation (veins R₁ and R₂ distally fused to a point in the genus compared) and by the conformation of the male genitalia (cp. Figs 6a–d and 7 a–d with fig. 49 in Gorbunov & Arita, 1999 and fig. 20a–d in Gorbunov & Arita, 2000) and female genitalia, especially by the shape of the 8th tergite and antrum (cp. Fig. 8 with fig. 53 in Gorbunov & Arita, 1999 and fig. 27 in Gorbunov & Arita, 2000). This new genus can be separated from Schimia Gorbunov & Arita, 1999 (type species: Schimia flavipennis Gorbunov & Arita, 1999) by the forewing venation (veins R₁ and R₄ distally to a short single vein R₁₋₂ in the genus compared), male and female genitalia (cp. Figs 6–8 with figs 47 and 52 in Gorbunov & Arita, 1999). Ichneumonella gen. nov. differs from Kantipuria Gorbunov & Arita, 1999 (type species: Kantipuria lyu Gorbunov & Arita, 1999) by the absence of hair-like scales on metepimeron and metameron posteriorly (with long hair-like scales in Kantipuria); forewing venation (veins R₁ and R₂ distally fused to a point in the genus compared), by the conformation of the male and female genitalia (cp. Figs 6–8 with figs 45 and 50 in Gorbunov & Arita, 1999). From Kemneriella Bryk, 1947 (type species: Kemneriella malaiseorum Bryk, 1947), this new genus is separable by the absence of hair-like scales on metepimeron and metameron posteriorly (with long hair-like scales in Kemneriella), forewing venation (veins R₁ and R₂ distally fused to a point; veins R₃ and R₄₋₅ issue from a point in the genus compared) and by the structure of the female genitalia, especially by the shape of the 8th tergite, antrum and corpus bursae (cp. Fig. 8 with fig. 42 in Gorbunov & Arita, 2001).

Bionomics. The larval biology is unknown. The moths are on the wing in April–June and November. It is possible that the species of this new genus are bivoltine.

Structure. At present, we include in this new genus the following two species: Ichneumonella viridiflava sp. nov. (type species) and I. hyaloptera sp. nov.


Etymology. The name of this new genus is derived from those of two closely related genera, Ichneumenoptera Hampson, 1893 [“1892”] and Paranathrenella Strand, 1916. Gender is feminine.
**Ichneumonella viridiflava** Gorbunov & Arita, sp. nov. (Figs 1, 2, 4, 5, 6a–d, 8)

Description. Male (holotype) (Fig. 1). Alar expanse 21.8 mm; body length 16.0 mm; forewing 9.8 mm; antenna 7.8 mm.

Head: antenna dark brown to black with dark green sheen, broadly pale yellow to white subapically; scapus dark brown to black with dark purple sheen; frons dark grey-brown with bronze sheen, narrowly white laterally; basal joint of labial palpus pale yellow, mid and apical joint exterior-dorsally dark brown to black with dark purple sheen, interior-ventrally pale yellow; vertex dark brown to black with dark green sheen; occipital fringe pale yellow to white.

Thorax: patagia dark brown to black with bright greenish sheen, with a few pale yellow scales posterior-laterally; tegula dark brown to black with strong greenish sheen, with a narrow pale yellow interior margin and a small pale yellow spot at base of forewing; mesothorax dark brown to black with bright green-blue sheen; metathorax dark brown with greenish sheen, with a small pale yellow spot laterally and with a tuft of dark brown hair-like scales with green-bronze sheen laterally; thorax laterally dark grey-brown with purple sheen, with a large pale yellow spot with golden sheen; posteriorly metepimeron and metameron white with golden sheen.

Legs: neck plate dark brown to black with purple sheen; fore coxa pale yellow with golden sheen, narrowly dark brown to black with greenish sheen interior-basally; fore femur externally dark brown with greenish sheen, internally pale yellow with golden sheen; fore tibia dorsally dark brown with greenish sheen, ventrally yellow with golden sheen; fore tarsus dorsally dark brown with greenish sheen, with a few yellow scales on basal tarsomere distally, ventrally pale yellow with golden sheen; mid coxa dark brown with greenish sheen; mid femur externally dark brown with greenish sheen, internally pale yellow with golden sheen; mid tibia dark brown with greenish sheen, mixed with yellow scales with golden sheen both medially and posteriorly; spurs yellow with golden sheen; mid tarsus exterior-dorsally dark...
brown with greenish sheen, with admixture of yellow scales distally on two basal tarsomeres, interior-ventrally yellow with golden sheen; hind coxa pale yellow with golden sheen, with a few dark brown scales with greenish sheen posteriorly; hind femur externally throughout dark brown with greenish sheen, internally pale yellow with golden sheen; hind tibia exterior-dorsally dark brown to black with dark purple sheen, with a few yellow scales both medially and posteriorly, interior-ventrally pale yellow to yellow with golden sheen, narrowly dark brown to black with greenish sheen posteriorly; spurs yellow with golden sheen; hind tarsus exterior-dorsally dark brown with greenish sheen, with admixture of yellow scales distally on two basal tarsomeres, interior-ventrally yellow with golden sheen.

Abdomen: dorsally dark brown to black with bright green sheen; tergites 2 and 3 each with a narrow pale yellow to yellow stripe posteriorly; tergites 4–7 each with a narrow, laterally broadened, pale yellow to yellow stripe posteriorly; ventrally sternite 1+2 pale yellow with golden sheen, sternite 3 dark brown with dark purple sheen with a narrow yellow to yellow-orange posterior margin; remaining sternites yellow to yellow-orange with golden sheen; lateral parts of anal tuft yellow externally and dark brown to black with green internally, medial part pale yellow with golden sheen.

Forewing: basally dark brown with dark purple-violet sheen, costal margin dark brown with dark bronze sheen, with admixture of individual pale yellow scales between Sc and R-stem; CuA-stem, anal margin and veins distally of discal spot dark brown with dark bronze sheen; discal spot narrow, nearly straight, dark brown to black with dark purple sheen; apical area narrow, distinctly broadened costally, dark brown with bronze sheen, with a few pale yellow scales between veins; transparent areas well-developed; external transparent area large, divided into six cells, cell between veins R4 and Rs distinctly exceeding distal margins of other cells; cilia dark brown with bronze sheen.

Hindwing: transparent, veins narrowly dark brown with bronze-purple sheen; discal spot narrow, cuneiform, exceeding base of vein M2; outer margin extremely narrow, about one third width of cilia; dark brown with bronze sheen, analy pale yellow.

Male genitalia (paratype, genital preparation Nos GA-241 and 1759 YA) (Fig. 6a–d). Tegumen-uncus complex relatively narrow; scopula androconialis well-developed, long, about as long as tegumen-uncus complex (Fig. 6a); crista gnathi medialis long, broad, outwardly divided into two extremely narrow cristae; crista gnathi lateralis shorter and narrower than crista gnathi medialis; valva (Fig. 6b) trapeziform-oval; crista sacculi nearly flat, covered with apically bifurcate setae; ventral crista small, covered with triangular flat-topped setae; saccus (Fig. 6c) long, about twice as long as vinculum, rounded basally; aedeagus (Fig. 6d) thin, slightly shorter than valva; vesica with numerous, strong, irregular, beak-shaped cornuti (Fig. 6d).

Female (paratype) (Fig. 2). Alar expanse 25.5 mm; body length 13.5 mm; forewing 11.5 mm; antenna 8.5 mm. Somewhat more robust than male. Thorax with tegula with pale yellow interior margin broader; metathorax pale yellow with a few dark brown scales with greenish sheen medially. Legs with interior margin of fore coxa narrowly dark brown to black with greenish sheen. Abdomen with anal tuft dark brown to black with pale yellow margins. Forewing with slightly more narrow external transparent area and with more numerous pale yellow scales on apical area between veins. Hindwing with slightly broader outer margin. Colour patterns otherwise as in male.

Female genitalia (paratype, genital preparation Nos GA-242 and 1788 YA) (Fig. 8). Papillae analis relatively long and broad, covered with short setae; 8th tergite broad, with a broad projection anterior-ventrally, with individual short setae; posterior apophysis somewhat longer than anterior apophysis; both lamellae antevaginalis and postvaginalis undeveloped; ostium bursae narrow, at anterior margin of segment 8; antrum relatively broad, slightly broadened
posteriorly, long, slightly longer than length of apophysis anterior, well-sclerotized; ductus seminalis just at anterior margin of antrum; ductus bursae membranous, narrow, about as long as apophysis anterior; corpus bursae ovoid, membranous, without signum.

Individual variability. Both males and females vary slightly in number of pale yellow and yellow scales on the thorax, abdomen and forewing. Body size varies as follows. Males: alar expanse 21.5–24.2 mm; body length 15.4–16.0 mm; forewing 9.6–11.1 mm; antenna 7.6–8.5 mm; females: alar expanse 25.5–26.0 mm; body length 13.5–13.7 mm; forewing 9.6–9.8 mm; antenna 7.6–7.9 mm.
Differential diagnosis. *I. viridiflava* sp. nov. can be distinguished from *I. hyaloptera* sp. nov., by the coloration of the tegula (with a few pale yellow scales both at base of forewing and posteriorly in the species compared), metathorax (with a tuft of yellow and brown scales with bronze sheen laterally in *I. hyaloptera* sp. nov.), neck plate (yellow to white with golden sheen throughout in the species compared), by the color of the sheen of the abdomen (dark bronze-blue in *I. hyaloptera* sp. nov.), shape of the external transparent area of the forewing (distinctly broader in the species compared) and by the conformation of the male genitalia (cp. Fig. 6a–d with fig. 7a–d).

Bionomics. The host plant and larval bionomics are unknown. The moths are on the wing in April, June and November, possible being bivoltine.

Habitat. Forest roads and borders of tropical forests.


Material examined. 1 ♂ (holotype) (Fig. 1), Vietnam, Ninh Binh Prov., Gia Vien, Cuc Phuong, 250 m, 6. VI. 1997, R. Matsumoto leg. (NSMT); 1 ♀ (paratype) (Fig. 2), same locality and date, R. Matsumoto leg. (NSMT); 1 ♀ (paratype), same locality, 2. XI. 1997, Y. Arita leg. (genital preparation Nos GA-242 and 1788 YA) (NSMT); 1 ♂ (paratype), same locality, 26. IV. 1998, T. Hirowatari leg. (IEBRC); 1 ♂ (paratype), Thailand, Khao Chamao, Chanth Buri, 400 m, 28–29. IV. 1997, M. Takakuwa leg. (genital preparation Nos GA-141 and 1759 YA) (NSMT).

Etymology. The name of this species is derived from Latin “viridis” for green and “flavus” for yellow, corresponding to the background coloration of the body.

**Ichneumonella hyaloptera** Gorbunov & Arita, sp. nov. (Figs 3, 7a–d)

Description. Male (holotype) (Fig. 3). Alar expanse 19.0 mm; body length 11.8 mm; forewing 8.5 mm; antenna 7.2 mm.

Head: antennae dark brown to black with dark green sheen, broadly pale yellow to white subapically; scapus dark brown to black with dark purple sheen; frons dark grey-brown with bronze sheen, narrowly white laterally; basal joint of labial palpus pale yellow, mid and apical joint exterior-dorsally dark brown to black with dark purple sheen, interior-ventrally pale yellow; vertex dark brown to black with dark green sheen; occipital fringe pale yellow to white.

Thorax: patagia dark brown to black with bright green-blue sheen, with a few pale yellow scales posterior-laterally; tegula dark brown to black with strong green-blue sheen, with a few pale yellow scales both at base of forewing and posteriorly; mesothorax dark brown to black with bright green-blue sheen; metathorax dark brown with purple-green sheen, with a tuft of yellow and brown scales with bronze sheen laterally; thorax laterally dark grey-brown with purple sheen, with a large pale yellow spot with golden sheen; posteriorly metepimeron and metameron white with golden sheen.

Legs: neck plate yellow to white with golden sheen; fore coxa pale yellow with golden sheen, narrowly dark brown to black with bronze-purple sheen interior-basally; fore femur externally dark grey-brown with bronze-purple sheen, internally pale yellow with golden sheen; fore tibia dorsally dark grey-brown with bronze sheen, ventrally pale yellow with golden sheen; fore tarsus dorsally dark grey-brown with bronze purple sheen, with a few pale yellow scales on basal tarsomere distally, ventrally pale yellow with golden sheen; mid coxa dark grey-brown with bronze-purple sheen; mid femur externally dark grey-brown with bronze-purple sheen, internally pale yellow with golden sheen; mid tibia dark grey-brown with bronze-purple sheen, mixed with pale yellow scales with golden sheen both medially and posteriorly;
spurs pale yellow with golden sheen; mid tarsus exterior-dorsally dark grey-brown with bronze-purple sheen, with admixture of pale yellow scales distally on two basal tarsomeres. interior-ventrally pale yellow with golden sheen; hind coxa dark grey-brown with bronze-purple sheen, with admixture of pale yellow scales with golden sheen anteriorly; hind femur externally dark grey-brown with bronze-purple sheen, posteriorly narrowly pale yellow with golden sheen, internally pale yellow with golden sheen; hind tibia exterior-dorsally dark grey-brown with bronze-purple sheen, with a few pale yellow scales both medially and posteriorly, interior-ventrally pale yellow with golden sheen, narrowly dark grey-brown with bronze-purple sheen posteriorly; spurs pale yellow with golden sheen, with admixture of dark grey-brown scales with bronze-purple sheen on external spurs; hind tarsus exterior-dorsally dark grey-brown with bronze-purple sheen, with admixture of pale yellow scales distally on two basal tarsomeres, interior-ventrally pale yellow with golden sheen.

Abdomen: dorsally dark brown to black with dark bronze-blue sheen; tergites 2 and 3 each with a narrow pale yellow stripe posteriorly; tergites 4–7 each with a narrow, laterally broadened, yellow stripe posteriorly; ventrally sternite 1+2 pale yellow with golden sheen, sternite 3 dark grey-brown with greenish sheen with admixture of pale yellow scales posteriorly, remaining sternites yellow with golden sheen; lateral parts of anal tuft yellow externally and dark brown to black with green internally, medial part pale yellow with golden sheen.

Forewing: basally dark brown with dark purple-violet sheen, costal margin dark brown with dark bronze sheen, with admixture of individual pale yellow scales between Sc and R-stem; CuA-stem, anal margin and veins distally of discal spot dark brown with dark bronze sheen; discal spot narrow, nearly straight, dark brown to black with dark purple sheen; apical area extremely narrow, dark brown with bronze sheen; transparent areas well-developed; external transparent area large, divided into six cells, cell between veins R₄ and R₅ somewhat exceeding distal margins of other cells; cilia dark brown with bronze sheen.

Hindwing: transparent, veins narrowly dark brown with bronze-purple sheen; discal spot undeveloped; outer margin extremely narrow, about one third width of cilia; dark brown with bronze sheen, anally pale yellow.

Male genitalia (holotype, genital preparation Nos GA-303 and 1848 YA) (Fig. 7a–d). Tegumen-uncus complex narrow; scopula androconialis well-developed, long, about as long as tegumen-uncus complex (Fig. 7a); crista gnathi medialis long, broad; crista gnathi lateralis extremely short and narrow; valva (Fig. 7b) trapeziform-oval; crista sacculi flat and short, covered with apically bifurcate setae; ventral crista small, covered with triangular flat-topped setae; saccus (Fig. 7c) short, slightly shorter than vinculum, flat basally; aedeagus (Fig. 7d) thin, shorter than valva; vesica with numerous minute cornuti (Fig. 7d).

Female. Unknown.

Individual variability. Unknown.

Differential diagnosis. This new species can be distinguished from *I. viridiflava* sp. nov. by some details of coloration of the body, shape of the external transparent area of the forewing and by the conformation of the male genitalia. See the “Differential diagnosis” for the previous species above.

Bionomics. The host plant and larval bionomics are unknown. The holotype was collected in May.

Habitat. The holotype was collected at a border of tropical rain forest.

Distribution. Known from the type-locality on the island of Borneo only.
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Material examined. 1 ♂ (holotype) (Fig. 3), Malaysia, Sabah, Maliau Basin, Agathis Camp, 12. V. 2001, Y. Arita leg. (genital preparation Nos GA-303 and 1848 YA) (ITBC).

Etymology. The name of this species is derived from Greek “hyalos” for transparent or glass and “pterus” for wing, and refers to its almost entirely transparent forewings.

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References


摘 要

Oleg G. Gorbunov 有田 豊：東洋区のSynanthedonini族（鰭翅目，スカンバガ科）の1新属2新種について

スカンバガ科の新属Ichneumonellaを記載し、その属に所属する2新種、I. viridiflavaおよびI. hyalopteraを記載した。前者の種はタイとヴェトナムから、後者の種はボルネオから記載された。

Ichneumonella Gorbunov & Arita, gen. nov.
新 属 IchneumonellaはAntheodonella Gorbunov & Arita, 1999, Schimia Gorbunov & Arita, 1999 およびKantipuria Gorbunov & Arita属などに似ているが前翅の翅脈や雄性ゲニタリアが異なる。

Ichneumonella viridiflava Gorbunov & Arita sp. nov. (Figs 1, 2, 4, 5, 6a–d, 8)
次種のI. hyalopteraに良く似るが、前翅の中室外方透明紋の形状が異なり、本種のほうが小さい。タイおよびヴェトナムの低地で得られている。

Ichneumonella hyaloptera Gorbunov & Arita sp. nov. (Figs 3, 7a–d)
前種のところで区別点を示した。北ボルネオの低地で一頭のみ得られた。
Some Olethreutine moths (Lepidoptera, Tortricidae) from Japan confused with or allied to other known species

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Abstract Nine new species of the subfamily Olethreutinae, *Eudemis brevisetosa* sp. nov., *Pseudohedya dentata* sp. nov., *Hedya simulans* sp. nov., *Ancylis limosa* sp. nov., *A. apicipicta* sp. nov., *Rhopalovalva moriutii* sp. nov., *Gypsonoma rivulana* sp. nov., *Epinotia tsurugisana* sp. nov., and *E. autumnalis* sp. nov., are described from Japan. The validity of *Eudemis lucina* Liu et Bai is verified with Japanese specimens.

Key words Tortricidae, Olethreutinae, new species, validity of known species, Japan.

The faunal survey of Lepidoptera in Japan has advanced more intensively since the second world war, and its results were comprehensively incorporated in the monumental work, "Moths of Japan" published in 1982, in which the late Dr Moriuti participated as one of the authors. In view of the diversity of fauna, which has recently occupied the minds of biologists, information about the so-called Micros is still insufficient, and work is still proceeding today, and will no doubt continue in the future. It is important in this process to remove the confusion in identification of species in the past, and to describe species which have been overlooked because of their superficial resemblance to other known species. This article aims to make a contribution in this respect. The material herein used will be deposited in the collection of the University Museum, Hokkaido University, Sapporo.

*Eudemis brevisetosa* sp. nov. (Fig. 1)

*Eudemis profundana*: Kawabe, 1982 (part.): 94, pl. 22, fig. 26; Oku et al., 1997: 149, fig. 12; Oku, 2003: 101 (sec [Denis & Schiffermüller, 1775]).

Expanse 15–19 mm. Head and antenna brownish grey; labial palpus externally brownish grey, the median joint expanded with dense scales, and the terminal joint exposed. Thorax greyish brown, transversely mixed with lighter scales, with a blackish posterior crest; legs ochreo-whitish, externally marked with brownish grey on fore and mid tibiae and on tarsi. Fore wing moderately broad; costa gradually arched; termen slightly oblique, rounded towards tornus; colour cinereous-grey in ground, more or less clouded with plumbeous; whitish costal stigmae gerninate, separated by dark greyish dashes; major markings dark grey with a slight purple-brownish tinge, whitish-edge outwardly; basal patch dilated towards dorsum, faintly striated with darker grey, internally mixed with plumbeous, and terminally delimited by a darker oblique line broken above middle; subsequent belt of ground colour paler towards costa, more plumbeous dorsally, turning up in a V-shape at dorsal end; central fascia more sharply defined towards costa, swelling outwards at middle, and bifurcate dorsally, the short inner branch being inserted into the incision of the V-shaped dorsal end of foregoing belt, and the outer branch narrowly connected with the pretornal patch; terminal area of ground colour diffusely mottled and striated with darker grey; within the area a circular or subquadrate preapical patch is present, bordered below with a rudimental ocelloid patch, which is indicated by a faint brownish transverse mark between paired plumbeous shades; apical spot inconspicuous; cilia dark leaden-greyish, paler towards tornus, with an indistinct whitish subbasal line. Hind wing brownish grey, slightly paler towards base; cilia
light leaden-cinereous, darker around apex of wing, with a dark subbasal line. Abdomen brownish grey.

Male genitalia (Fig. 11). Similar to *E. porphyra* rather than to *E. profundana* in the robust tegumen, the shorter valva, in costal length a little or hardly exceeding the height of the tegumen including uncus, and the shorter ventral spines of the saccus. Distinct points from *E. porphyra* as follows: ventral wall of tuba analis longitudinally sclerotized, constituting a narrow subscaphium; valva somewhat narrower than that of *E. porphyra*; hair-like ventral spines in a row facing outwards, and assembled to form a definite patch at basal 1/3 of the row.

Female genitalia (Fig. 12). Quite similar to *E. profundana*, and distinguishable only by the sterigma having a shorter lamella antevaginalis, of which the length is obviously less than the width of the ostium bursae (Fig. 13).


Distribution. Japan (Honshu).

Host plant. *Quercus serrata, Q. acuta*, and *Prunus verecunda*.

This insect has been regarded as conspecific with *E. profundana*, because of the close affinity in general marking pattern of the fore wing. *E. brevisetosa* is however less variable in colour than *E. profundana*, the fore wing never becoming whitish in ground colour, and always lacking a whitish dorsal blotch between basal patch and central fascia. In the male genitalia, *E. brevisetosa* exhibits decided differences from *E. profundana* as described above. The differences from *E. porphyra* are less conspicuous but definite, particularly in the hair-like ventral spines of the saccus; in the latter species, those spines are uniformly dense over the whole span of the row (Bentinck & Diakonoff, 1968; Kuznetsov, 2002; Oku et al., 1997; Razowski, 2001). In the female genitalia, *E. brevisetosa* is distinguished from *E. profundana* only by the length of the lamella antevaginalis, but the distinction is clear cut; in *E. profundana*, the length of the lamella antevaginalis is nearly identical with the width of the ostium bursae (Bentinck & Diakonoff, 1968; Razowski, 2001). Major host plants of *E. brevisetosa* are undoubtly *Quercus* species. Its occurrence on *Prunus* recorded above may reflect an accidental transfer. In passing, the male adult figured by Issiki (1957) as *E. profundana* can be identified with *E. porphyra*, judging from the basal patch of the forewing being obsolete at its costal half. It is very likely that true *E. profundana* is not distributed in Japan.

*Eudemis lucina* Liu et Bai (Fig. 2)

*Eudemis lucina* Liu et Bai, 1982: 167–168, pl. 1, fig. 3, pl. 2, fig. 16; Oku, 2003: 102, fig.

*Eudemis profundana*: Kawabe, 1982 (part.): 94, pl. 22, fig. 27; Park & Ahn, 1988: 97, figs 7, 12; Byun et al., 1998: 110, 219, 248 (nc [Denis et Schiffermüller, 1775]).
Eudemis lucina is characterized externally by the blackish forewing with pale rosy-brownish basal patch and preapical area. The adult has been described and illustrated repeatedly as quoted above, and the detailed external description is omitted here. Liu & Bai (1982) named E. lucina based on a single female adult, and compared it with E. porphyran (Hübner). In genitalic structures, however, E. lucina is more analogous to E. profundana than to E. porphyran in having an elongate valva in the male and a broader papilla analis in the female. The genitalia described below are therefore compared with those of E. profundana with reference to Bentinck & Diakonoff (1968), Kuznetsov (2002), and Razowski (2001).

Male genitalia (Fig. 14). Tegumen and valva long and slender; costal length of valva somewhat exceeding height of tegumen including uncus; subbasal angle of sacculus very obtuse, but not rounded as in E. profundana; among hair-like ventral spines of sacculus, those assembled basad forming a compact patch, longer and denser than the others on the outer side, but not so extremely elongate as in E. profundana.

Female genitalia (Fig. 15). Quite similar to E. profundana, with the following differences: sterigma smaller, little longer than one half of papilla analis; median part of lamella postvaginalis apparently longer, exposed behind lateral lobes (Fig. 16).

Material examined. Many adults from Hokkaido [Oshima Prov.], and Honshu [Aomori, Iwate, Miyagi, Yamagata, Fukushima, and Tochigi Prefectures] collected during early July to late September by I. Date, N. Doi, T. Inoko, S. Yamauchi, and myself.

Distribution. Central China (Hubei), Korea, and Japan (Hokkaido, Honshu).
Host plant. *Quercus serrata*, *Q. dentata*, and *Q. mongolica*.

In Japan and Korea, the present species has been identified with *E. profundana*, in spite of the remarkable difference in coloration of fore wing between them. The identification was due to the resemblance in genitalic structures, particularly in the elongate valva of the male. However, the genitalic differences pointed out above are sufficient in themselves for the recognition of *E. lucina* as a valid species. Adults are highly phototactic, and the annual number of individuals caught by a light trap operated every night reached more than 1,000 in successive years at Tsunatori, Morioka. Adults of *E. brevisetosa* and *E. porphyryana* trapped were, in contrast, very scarce there, even though their larvae were more abundant than those of *E. lucina* in surrounding woods.

**Pseudohedyta dentata** sp. nov. (Fig. 3)


Expanse 17–22 mm. Head pale greyish brown, with some darker scales; antenna shortly ciliated in male; labial palpus ascending, largely ochreo-whitish, the median joint thickly scaled, touched with dark grey below its apical end, and the terminal joint brownish grey, shortly exposed. Thorax pale greyish brown with darker transverse streaks, with a blackish posterior crest; legs ochreo-whitish, externally marked with brownish grey on tibiae and tarsi. Fore wing rather elongate suboblong; costa arched towards base; termen slightly oblique, straightened below obtuse apex; tornus rather flattened; ground colour light ochreous brown, more or less infuscated; major markings more greyish or darker brownish; basal patch diffusely striated with dark grey, angulate at middle; subsequent belt of ground colour distinctly paler on costal 1/3 edged with 2 pairs of whitish strigulae, thence beyond a constrictio much suffused with plumbeous, reticulated with dark grey towards dorsum; central fascia dark greyish and oblique on costa, thereafter more brownish and dilated outwards into an acute tooth at about costal 1/4; a dark grey longitudinal streak below the tooth delimiting the dorsal part of the fascia, which projects outwards below the streak, and is separated from the preceding belt only by being a somewhat darker colour without plumbeous suffusion; costal area beyond the fascia somewhat orange-ochreous, with 5 pairs of whitish costal strigulae separated by dark grey dashes; the most basal strigula followed behind by a leaden-metallic streak along upper edge of central fascia, and the mid one by a similar streak sinuously reaching an obscure pale spot on the termen below its apex; semicircular preapical blotch brownish, marked with 2 longitudinal blackish strigae above and an irregular dark reticulation beneath; ocelloid patch of ground colour containing 3 longitudinal black streaklets, in contact with preapical blotch above, continued below to a reticulated preortal patch, and laterally restricted by paired leaden-metallic streaks, of which the inner one is prolonged up and bent basad to below the subcostal tooth of the central fascia, and the outer one reaches the preapical blotch; narrow terminal area shaded outwards, broken by a pale subapical spot; cilia cinereo-ochreous, with a blackish basal line and a terminal shade, both of which are broken twice around tornus, and the latter is once more below the apex of the wing. Hind wing dark brownish grey, slightly paler towards base; cilia ochreous white, infuscated towards tornus, with a dark subbasal line. Abdomen brownish grey.

Male genitalia (Fig. 17). Uncus robust, hooked but obtuse apically; socius small, drooping; subscaphium developed into a large basket-like structure with an upright median dilation, hanging from shoulders of tegumen, dentate around its angulate bottom and occasionally at the upper end of the median dilation (Fig. 18); valva slender, sinuate; cucullus broadest at about middle, with a cluster of strong spines at base; ventral ridge of cucullus dilated towards base of valva, and joined with ventral margin of sacculus; hair-like spines along this conjunct part arranged in a curved row; aedeagus short, without cornuti.
Female genitalia (Fig. 19). Papilla analis rather broad, pointed caudally, and narrowed anteriorly; sterigma semicircular, raised into a trapezoidal median projection posteriorly, and slightly angulate at middle of arched anterior margin; ostium bursae small triangular, opened at caudal end of median projection of sterigma, anteriorly connected with a narrow spindle-shaped longitudinal slit; ductus bursae much elongated, initially with slender colliculum; bursa copulatrix elliptical; signa large horn-like, roughly equal-sized.


Distribution. Japan (Hokkaido, Honshu).

The present species has been overlooked, presumably owing to its superficial resemblance to *P. gradana* (Christoph). It is externally distinguishable from *P. gradana* by the larger size, the median joint of the labial palpus having a dark subapical spot, and the fore wing being clouded with plumbeous colour between the basal patch and central fascia. In relation to the last point, a similar clouding is occasionally seen in *P. gradana*, but is predominantly due to greyish or blackish elements. The characteristic points of *P. dentata* are found in the dentate subscaphium in the male and the ostium bursae connected with a slit of the sterigma in the female, both of which separate *P. dentata* from the other congeneric species. Adults were abundant at Maruyama, Sapporo, and often collected below *Picea* trees.

*Hedyta simulans* sp. nov. (Fig. 4)


Expanse 22–26 mm. Head dark brownish grey with paler scales on sides; antenna with darker scape; labial palpus rather short, correct, externally brownish grey, with pale ochreous terminal joint shortly exposed. Thorax dark brownish grey, transversely paler in front and at middle, with a pale median spot on tegula, and with a blackish posterior crest; legs ochreo-whitish, externally marked with brownish grey on fore and mid ones; tibial hair-pencil of hind leg in male ochreo-whitish, reaching beyond the end of tibia. Fore wing rather elongate, in male somewhat oval with obtuse apex and a somewhat oblique termen slightly rounded, while in female more squarish; colour dark brownish grey at basal 3/4 partially mixed with orange-brownish, and irregularly mottled with leaden grey particularly at mid and terminal parts; a paler fascia at middle of this dark area pronounced on costa with vestigial whitish strigulae, dorsally diffuse and shaded outwardly by leaden grey; subterminal area creamy white, with 5 pairs of whitish strigulae separated by dark greyish dashes along costa, with a transverse shade at middle, and with a faint leaden mark above tornus representing a vestigial ocelloid patch; large apical patch orange brown, narrowly dilated basad below costal strigulae, dorsally more greyish and narrowed to above tornus, with several black dots in an arched row along the inner margin; blackish apical spot diffuse; cilia leaden grey except for whitish tornal part, lighter towards base, with a dark grey subbasal line. Hind wing light brownish grey, darker towards apex; dorsal fold in male narrow; cilia cinereous with a dark subbasal line. Abdomen greyish brown.

Male genitalia (Fig. 20). Uncus broadly furcate at top, tufted below obtuse lateral ends; sacci small and narrow, drooping; subscaphium weak, elongate triangular; valva long and slender, deeply excavate beyond terminal angle of sacculus; two patches of elongate thorns present before and beyond the ventral excavation respectively, both set on outer surface of
valva (Fig. 21); stout spines along ventral margin of cucullus coming into a compact assemblage at basal angle; another cluster of smaller spines on outer edge of basal cavity of valva; aedeagus short, without cornuti.

Female genitalia (Fig. 22). Papilla analis rather broad, subrhomboidal; sterigma transverse suboblong, densely covered with dark spinules arranged in a net-work of small circles, with a wide and short caudal projection, on which ostium bursae opens in a Y-shape; ductus bursae moderately long, initially with short colliculum; bursa copulatrix large spherical; horn-like signa rather small.

Some Olethreutinae moths from Japan


Distribution. Japan (Hokkaido, Honshu).

Host plant. Tilia japonica.

This species was once recorded as H. perspicuana from Japan (Oku, 1998). Externally, it seems difficult to separate H. simulans from H. perspicuana, by reference to the illustrated descriptions of the latter species (Kennel, 1908; Kuznetsov, 2001; Liu et al., 1981; Liu & Li, 2002). They are also similar to each other in genitalia, but a few distinctions are detectable in the following details. In the male, H. simulans has two patches of elongate thorns on the outer surface of the valva, while H. perspicuana has three patches (Kuznetsov, 2001; Razowski, 1971; Liu & Li, 2002). In the female, the caudal projection of the sterigma is much wider than long in H. simulans, while it is approximately as wide as long in H. perspicuana. Possibly the latter species is a continental element in the Far East, and does not extend its distribution into Japan.

Ancyliis limosa sp. nov. (Fig. 5)


Expanse 13.5–15 mm. Head greyish brown, with concolourous antenna and whitish face; labial palpus porrect, ochreo-whitish, externally greyish brown towards base, the median joint rough scaled, and the terminal joint shortly exposed. Thorax largely same colour as head; tegula whitish, mottled with orange-ochreous towards base; legs cinereo-whitish, externally marked with dark grey except for hind femur and tibia. Fore wing rather elongate; costa gently arched; apex acutely falcate; termen strongly sinuate below apex, and then rounded to tornus; creamy white basal area dilated dorsally, more or less tinged with ochreous yellow, with dark greyish striigulae along costa; large dorso-basal patch semi-pyriform, blackish with a chestnut-reddish tinge, edged above with shining white; central fascia oblique and dark brownish grey on costa, subsequently suffused with ochreous and dilated outwards to constitute an acute angle, thence diffuse and narrowed to above posterior fold, and whitish-edged outwards; the angular part of fascia including a subparallel pair of longitudinal black streaks, which are followed basad by shorter whitish ones; costal area beyond central fascia orange-ochreous, marked along edge with 5 pairs of very oblique whitish striigulae separated by dark greyish dashes, the basalmost striigula emitting a leaden-silvery stria along upper margin of central fascia, and the preapical one touched behind with a spot of similar colour; falcate apical end edged above and below with white dashes extending across cilia, of which the lower one is divided by a blackish line; tornal area pale leaden or silvery grey, mixed with ochreous brown, usually marked with an oblique subdorsal spot of dark grey, which is often followed by a pretornal shade along dorsum; terminal line whitish, with 4 minute blackish dots below apex; cilia ochreous grey, darker towards falcate apex, divided below it by a whitish dash, and paler towards tornus. Hind wing light brownish grey; cilia paler at its base and towards tip, with an indistinct darker subbasal line; veins M3 and Cu1 united; dorsal fold in male narrow, concealing a yellowish hair-pencil. Abdomen brownish grey.

Male genitalia (Fig. 23). Uncus not specialized; top of tegumen notched at middle; socius rounded subquadrar, less than twice as long as wide; valva rather short, with a rod-like projection at terminal end of sacculus, beyond which the ventral margin is semicircularly excavate; cucullus rather stunted, widest at about basal 1/3, and narrowed towards rounded apex; aedeagus large, approximately as long as costa of valva; cornuti deciduous, abundant.
Female genitalia (Fig. 24). Papilla analis slender, slightly arched; sterigma very short and transversely dilated, with a thin ante-lateral thickening broken before the rounded lateral ends; lamella antevaginalis not erect as is usual in the badiana-complex of Ancylis, but simply bordering ostium bursae in front; antrum nearly as long as wide; ductus bursae rather short; bursa copulatrix large, elongate oval, internally covered with transparent granules; signa rather wide, subtriangular with acute apices pointing anteriorly, and approximately equally wide at base.

Holotype. $\delta$, Honshu [Iwate Pref.]: Hebizuka, Tamayama Village (20. VI. 1997, T. Oku). Paratypes. Honshu [Iwate Pref.]: same data as holotype, 1 $\delta$ 2 $\varphi$; Gandô, Tamayama Village, 1 $\delta$ (25. VI. 1967, T. Oku); Yanagisawa, at foot of Mt. Iwate, Takizawa Village, 2 $\varphi$ (19. VI. 1968 & 14. VI. 1973, T. Oku); Sotoyama dam, Morioka, 1 $\delta$ 1 $\varphi$ (5. VI. 1995, N. Doi); Kuzakai, Kawai Village, 1 $\delta$ (4. VII. 1965, T. Oku), 1 $\delta$ 1 $\varphi$ (5. VI. 1966, T. Oku), 3 $\delta$ 1 $\varphi$ (11. VI. 1967, T. Oku), 2 $\varphi$ (23. VI. 1978, Y. Nasu).

Distribution. Japan (Honshu).

This species is placed in the subgenus Ancylopera, according to the venation of the hind wing and to the absence of an erect uncus in the male genitalia. Superficially, it is quite similar to the badiana-complex in the subgenus, the Japanese representatives of which were identified with A. badiana ([Denis et Schiffermüller]), A. paludana (Barrett), and A. mandarinana Walsingham (Huemer & Tarmann, 1977; Issiki, 1950; Kawabe, 1982; Walsingham, 1900). In genitalic structures, however, A. limosa differs from these species of the badiana-complex as follows: in the male, the terminal end of the sacculus is narrowly produced, but not angled; in the female, the lamella antevaginalis is not erect, and the two signa are approximately equally wide at base. Externally, also, A. limosa is distinguishable from them by the darker-coloured head and the forewing furnished with whitish streaklets within the angular part of the central fascia. Adults were detected from swampy places intervening between forested areas at mid heights of Iwate Prefecture. The flight period restricted to early summer suggests a univoltine life-cycle for the species. A similar univoltine life-cycle is known in A. habeleri Huemer et Tarmann inhabiting Tirolian highlands of central Europe, but A. habeleri differs from A. limosa in having a reddish brown dorso-basal patch on the fore wing (Huemer & Tarmann, 1997; Razowski, 2001).

Ancylis apicipicta sp. nov. (Fig. 6)

Ancylis sp. 2: Oku, 2003: 115.

Expanse 11.5–14 mm. Head and antenna dark greyish brown; labial palpus rather short, porrect, externally greyish brown mixed with lighter colour, the median joint rough-scaled, and the terminal joint shortly exposed. Thorax dark brownish grey, with tegula whitish-tipped; legs pale ochreo-cinereous, externally marked with brownish grey, more distinctly on hind tarsi. Fore wing rather broad; apex shortly but distinctly falcate; termen vertical above middle, oblique and slightly rounded towards tornus; basal patch dark grey, mottled with dark plumbeous, diffusely striated with blackish, and obtusely angulate at middle; subsequent belt leaden grey with a dull gloss, faintly striated with darker colour, mixed with pale orange brown towards dorsum, and marked with 2 pairs of whitish strigulae separated by blackish dashes on costa; central fascia dark grey, distinct on costa, thence gradually obsolescent with dispersion of deep orange brown towards a diffuse pretornal patch; terminal area beyond the fascia orange-brownish, marked with 4 pairs of costal strigulae similar to the foregoing ones; the most basal strigula followed by an oblique leaden-silvery streak interrupted before reaching ocelloid patch, and the next strigula by another similar streak to below falcate apex; a white longitudinal dash below apex, divided by a blackish line, extended across cilia; ocelloid patch indicated by a transverse leaden-silvery marking above tornus, diffusely edged
with pale brownish terminally; terminal line narrowly blackish at its median half; cilia leaden grey with duplicate darker subbasal lines around apex of wing, divided below it by a whitish dash, thereafter paler towards tornus with an obscure subbasal shade. Hind wing brownish grey, occasionally paler in female; cilia lighter in colour, with a darker subbasal line; dorsal fold in male narrow, semi-open, without hair-pencil.

Male genitalia (Fig. 25). Uncus long bifurcate, gradually bent behind at middle; socius drooping, about 2.5 times as long as wide; valva slender, gradually narrowed towards apical portion, which is slightly dilated; terminal projection of sacculus short and pointed; aedeagus somewhat variable in length (that figured is one of the longer ones); cornuti short, arched thorn-like, more than one hundred in number, irregularly assembled.

Female genitalia (Fig. 26). Papilla analis slender, tapering posteriorly; sterigma rudimental, represented by narrow lateral lobes obliquely connected with caudal edge of cup-shaped antrum; ductus bursae rather short; bursa copulatrix ovate; one of signa closer to cervix bursae, very wide at base, extraordinary in shape, the keel not obliquely declined behind as usual in the genus, but rounded posteriorly, and the apical end narrowly prolonged and directed forward; another signum much narrower at base, arched sword-like.


**Distribution.** Japan (Honshu).

*Ancyliis apicipicta* described here may be closely related to *A. arctitenens* Meyrick. We find much difficulty in discriminating between them by means of male genitalia. Despite this, the present material convincingly represents a distinct species, because the larger signum with a peculiar shape in the female genitalia permit us to separate *A. apicipicta* not only from *A. arctitenens* but also from other related species. Furthermore, there are external distinctions between *A. apicipicta* and *A. arctitenens*. In comparison with the present species, *A. arctitenens* has a somewhat narrower fore wing, of which the cilia are ochreo-whitish but not leaden-greyish, the interspace between basal patch and central fascia is more whitish, and the terminal area of the wing ochreo-brownish rather than orange-brownish. The host plant of *A. apicipicta* is unknown, but it may be suggestive that adults were repeatedly collected at the northern foot of Mt. Hayachine, where *Ulmus davidiana* was commonly grown. *A. arctitenens* is known to occur on *Ulmus parvifolia* in the warmer southwest of Japan (Oku, 1989). It seems possible that the habitat ranges of these two related species may be segregated from each other in relation to distribution of the respective host plants.

**Rhapalovalva moriutii** sp. nov. (Fig. 7)

Expanse 16–17 mm. Head ochreous brown, greyish on sides of crown, with whitish face; antenna greyish brown; labial palpus whitish, the median joint strongly expanded with dense scales, externally tinged with reddish-fulvous towards its top and base, and the terminal joint shortly exposed. Thorax brownish grey, irregularly mottled with pale ochreous on tegula; legs cinereo-whitish, externally marked with greyish brown on tibiae and tarsi. Fore wing elongate, with slightly arched costa, falcate apex, obliquely sinuate termen, and rounded
tornus; colour orange-ochreous brown in ground, overlaid with greyish brown more thickly towards base and dorsum, often sparsely between veins towards termen, and scarcely in post-apical portion; a longitudinal subcostal fascia ochreo-whitish from base to before apex, bifurcate outwards with narrower and more diffuse dorsal branch; fine costal strigulae whitish, indistinct towards base of wing; those on terminal half of costa followed dorsally with faint silvery-leaden marks, which are joined into a subcostal stria extending to a whitish dash on termen below apex; ocelloid patch atrophied into an indistinct plumeous overlay above tornus, reaching beyond middle of wing upwards; fine terminal line dark grey up to falcate apex; cilia cinereo-ochreous, tipped with pale leaden grey. Hind wing dark brownish grey; cilia leaden grey, with a pale basal line. Abdomen brownish grey.

Male genitalia (Fig. 27). Uncus erect, slender and hooked; socius semicircular; subscaphium a sclerotized ring with a few peripheral dentations; valva short and wide, deeply excavate beyond sacculus; cucullus subquadrate, rounded at upper terminal corner, with a pollex on its ventro-basal angle produced below; harpe present above terminal angle of sacculus, haired and angulate outwards apically; aedeagus small, narrowed at apical half; several deciduous cornuti, thin and lanceolate in a compact bundle.

Female genitalia (Fig. 28). Very weak in general, more or less transparent, many parts hardly visible without staining; papilla analis narrow, straight; 2 pairs of minutely spined patches transversely arranged on membrane behind ostium bursae, which is surrounded anteriorly with a narrow crescent structure; mid part of sternite in front of ostium bursae slightly raised to form a flattened quadrate plate with duplicate posterior edge in double steps; ductus bursae very narrow, rather short; bursa copulatrix large ovate; one of signa elongate, straightened, horn-like, the other very strongly bent in a U-shape.


Distribution. Japan (Honshu, Kyushu).

Adults of the present species are reminiscent of Ancylis sativa Liu at a glance in shape and colouring of fore wing. But contrary to this superficial impression, the genitalic characters clearly indicate that the species belongs to the genus Rhopalovalva. R. moriutii is similar to R. catharotorna (Meyrick) in possessing a short valva with a deep ventral excavation, but differs from the latter species by the shorter socius (see Kuznetzov, 2002). Full comparison between them is however impossible at present, since the female of R. catharotorna has not been described. The adults shown above were caught in the southern coastal area of Honshu and in northern Kyushu. This suggests that the distribution of R. moriutii in Japan may be restricted to warmer areas. The species is named in honour of the late Dr S. Moriuti, who kindly provided me with helpful information on some southern species of Olethreutinae.

Gypsonoma rivulana sp. nov. (Fig. 8)

Gypsonoma sociana: Oku & Tateyama, 1983 (part.): 35, fig. 2 (nec Haworth, 1811).


Expanse 13–15 mm. Head and antenna rather dark brownish grey; labial palpus ascending along face, externally concolourous with head, the median joint rather roughly scaled beneath, and the terminal joint shortly exposed. Thorax largely same colour as head; legs cinereo-whitish, externally marked with dark brownish grey with exception of hind femur. Fore wing moderate; costa arched at basal 1/3, straighter beyond this point; termen a little oblique, very slightly rounded; colour whitish in ground, slightly tinged with cinereo-ochreous, minutely dusted with yellowish white over dark greyish major markings; basal patch mottled with
leaden grey, angulate on posterior fold; subsequent whitish belt narrowed at middle, with some dark grey dots on costa and dorsum; central fascia more blackish on costa, thence dilated and diffuse, marked with a longitudinal black streak in discal cell, mottled with leaden or silvery grey, internally more or less mixed with ochreous brown, and interrupted immediately above distinct pretornal patch, which is blackish, subtriangular, and inclined outwards; whitish terminal area slightly clouded with leaden or silvery grey except for extreme costa and tornal part, marked with dark grey costal stiglomata and a diffuse greyish subapical blotch, the latter connected with dark greyish apical spot and terminal streak through irregular shades, and dorsally tinged with ochreous; cilia dark leaden grey, paler towards tornus, narrowly ochreo-whitish along base, and whitish-tipped below apex of wing. Hind wing dark greyish brown; cilia lighter towards base and tip, with a darker subbasal line. Abdomen brownish grey.

Male genitalia (Fig. 29). Tegumen rounded at top; socius semicircular; valva rather broadly excavate beyond sacculus; terminal angle of sacculus acutely produced; cucullus rounded, with a vestigial naked brim at middle of terminal edge; harpe represented by a transverse fold along outer margin of basal cavity, furnished with elongate hairs at upper end; aedeagus of ordinary type; coremata composed of some hairs, which are elongate but not specialized, and easily detached after boiling in KOH solution.

Female genitalia (Fig. 30). Papilla analis declined outwards posteriorly, and thus appearing in situ as if narrowed behind, but broad throughout if expanded; sternigma transverse suboblong, about 1/3 as long at middle as wide, angulate at lateral ends of arched anterior margin, and rounded at posterior corners; ostium bursae opening on short caudal projection of sternigma below bilobed cover; antrum narrow, twisted, about twice as long as sternigma; ductus bursae short, widened towards spherical bursa copulatrix; signa rather small, horn-like.

Holotype. ♂, Honshu [Iwate Pref.]: Aburaden, Yuzawa, Morioka (21. VI. 1979, N. Doi).

Distribution. Japan (Honshu).

A male adult of the present species was recorded as an aberrant individual of *G. sociana* (Oku & Tateyama, 1983). Examination of additional specimens including females proved the previous identification to be erroneous (Oku, 2003). The present form is closely related to *G. contorta* Kuznetzov described from the Primorye region, Russian Far East, to which it is quite similar not only in genitalic structures but also in marking pattern of fore wing. One possible view arising from this is that the present form might be a subspecies of *G. contorta* endemic to Japan. Nevertheless, it is considered here to be a distinct species, based on the following differences in comparison with the published figures of *G. contorta* (Kuznetzov, 1966, 2002): fore wing clearly whitish in ground colour, with termen less rounded; in male, terminal angle of sacculus more acute and projected; and in female, papilla analis wider and characteristically declined outwards posteriorly. Adults of *G. rivulana* were obtained principally in willow bushes at the water’s edge along a river and a reservoir for paddy field irrigation.

*Epinotia tsurugisana* sp. nov. (Fig. 9)

Expanse 12–12.5 mm. Head dark ochreous grey, mixed with greyish white on face; antenna deep brownish grey, annulated with whitish, in male strongly biciliate-fasciculate, and in female pubescent; labial palpus rather short, porrect, externally same colour as head, the
median joint rough scaled, and the terminal joint shortly exposed. Thorax dark ochreous grey; legs creamy white, externally marked with dark grey on fore and mid tibiae and on tarsi. Fore wing rather elongate, gradually dilated towards termen; costa arched at base, straighter beyond this, without fold in male; termen oblique, very slightly sinuate; colour dark brownish grey, partially sprinkled with orange brown, interspersed by mixture of plumbeous or silvery grey and cinereous white; these multicoloured elements in male duller in tone, while in female brighter and contrasting with each other, creating a somewhat mosaic-like pattern; basal patch indistinct, indicated by dominance of darker elements at basal 1/3 of wing; central fascia similarly indistinct, from middle of costa to dorsum before tornus, and dilated dorsally; interspace between these patches and fascia obscurely defined, not isolating a pale dorsal patch; whitish costal strigulae very thin, partially obsolescent; only the outer 4 of these strigulae distinctly visible, followed by irregular leaden-silvery striae, of which the most basal is short and transverse, the median two are extended below to lateral edges of ocelloid patch, and the terminal one reaches a whitish dot on termen below apex; ocelloid patch obscure, laterally restricted by leaden-silvery streaks above tornus; cilia brownish grey, paler towards base, with a blackish subbasal line broken by a whitish dot below apex, and by similar ones around tornus. Abdomen dark brownish grey.

Male genitalia (Fig. 31). Uncus very shortly bifid at top; socius strongly curved at middle, narrowed apically; valva bulging subbasally on costa; sacculus not angulate at terminal end, with a cluster of stout spines above it; neck of cucullus obscure, indicated by a slight ventral concavity beyond sacculus; cucullus narrowed towards middle, densely haired along ventral
margin, and elliptically dilated at apical portion; aedeagus straight, with several thorn-like cornuti.

Female genitalia (Fig. 32). Papilla analis rather short and broad, rounded laterally; antrum large and tubular, about 3 times as long as wide; ductus bursae moderate, with median sclerotization; bursa copulatrix spherical; one signum closer to cervix bursae, flattened squarish, and the other very small conical; 7th abdominal sternite heavily sclerotized laterally and caudally, with remarkable oblique wrinkles.


Distribution. Japan (Shikoku: Mt. Tsurugisan).

This species is similar to *E. pygmaeana* (Hübner), a notorious pest of *Abies* and *Picea*, in the fasciculate antenna of the male and in the wing shape. These and the obvious affinity in the signa of the female genitalia may suggest a close relation between these two species. *E. tsurgisiana* is distinguishable from *E. pygmaeana* by the smaller size, by the fore wing lacking a paler dorsal patch, and by the following genitalia details: in the male, the bifid apical part of the uncus is very short, the socius is distinctly curved at middle, and the valva is prominently bulging subbasally on the costa; in the female, the antrum is very large, and the 7th sternite strongly wrinkled. Adults were caught in a climax forest of *Abies veitchii* growing on the upper slope of Mt. Tsurugisan, the highest peak of Shikoku, and nowhere else so far. It is of interest, in this connection, that the *Abies* forest in Shikoku mentioned above is far isolated from the major distribution range of *Abies* species in northern areas.

**Epinotia autumnalis** sp. nov. (Fig. 10)


Expanse 14.5–17.5 mm. Head greyish brown, with some ochreous scales; antenna brownish grey, shortly ciliated, more thickly in male; labial palpus porrect, greyish brown, paler towards base, the median joint rather roughly scaled, and the terminal joint shortly exposed. Thorax similarly coloured to head; legs ochreo-cinereous white, the fore and mid ones externally marked with brownish grey, and spotted with darker colour on the two terminal hind tarsal joints. Fore wing rather elongate; costa gradually arched, without fold in male; termen oblique, not sinuate; colour brownish in ground, occasionally more orange or ochreous, striated with darker colour, and more or less clouded with grey or leaden grey, in its extreme form obscuring markings apart from pretornal patch; basal patch obsolete at costal half, distinguishable only by its dorsal part being darkened towards the terminal margin and gradually inclined outwards; just beyond this is a paler dorsal patch, weakly pronounced and diffuse outwards; central fascia substantially absent, replaced by 2 oblique striae somewhat thicker than others; semicircular pretornal patch always distinct, darker than other markings; short costal strigulae cinereo-whitish, indistinct towards base of wing, more or less touched behind with submetallic leaden grey; the terminal four of these strigulae followed behind by submetallic leaden streaks, of which the most basal is obliquely extended to the ocelloid patch and the other three are convergent on the way to termen below apex; ocelloid patch pale submetallic leaden grey, faintly edged with light ochreous, divided by a transverse inflow of ground colour, containing a few longitudinal darker strigae; cilia cinereo-ochreous, darker towards tip, with a distinct dark subbasal line interrupted above paler tornal part. Hind wing light brownish grey, darker towards apex; cilia cinereo-grey, with pale basal and dark subbasal lines. Abdomen ochreous grey.
Male genitalia (Fig. 33). Uncus bifid at apical 1/3, slightly bent back (Fig. 34); socius a half crescent, extremely thickened along ventral margin; valva slightly narrowed towards apical 1/4, and then slightly bent inwards; terminal angle of sacculus rounded; a cluster of stout spines set on this angle, slightly but distinctly remote from ventral edge of sacculus; aedeagus slightly arched; cornuti thorn-like, somewhat lanceolate, about 20 in number.

Female genitalia (Fig. 35). Papilla analis rather narrow, straight; sterigma dilated posteriorly in a Y-shape, scattered with long spines; antrum short, covered with dark minute spinules; ductus bursae shortly sclerotized at middle; bursa copulatrix spherical; signa flattened horn-like with obtuse apices; 7th abdominal sternite sclerotized laterally and caudally, plain or very weakly wrinkled, without distinct grooves.


Distribution. Japan (Hokkaido, Honshu).

Male adults illustrated by Kawabe (1970, 1982) as Epinotia rubriana Kuznetsov are referred to E. autumnalis described here. It differs from E. rubricana in the fore wing as follows: termen not concave below apex, costal fold in male absent, and preornal patch distinct. It is likely that the confusion between these two species pointed out above resulted from the similarity of genitalic structures. The differences between them are given below, using abbreviation of the species names as Ea and Er, respectively. In the male, uncus bent back slightly in Ea (Fig. 34), and strongly in Er (Fig. 36); ventral margin of socius thickened extremely in Ea and weakly in Er; and spine cluster set on terminal angle of sacculus remote from ventral edge in Ea and close to it in Er. In the female, caudal end of sterigma much dilated laterally in Ea, and slightly in Er; and the 7th abdominal sternite with no groove in Ea, and with a large one on either side in Er. Adults of E. autumnalis are abundant in drier places in colder highlands and northern areas, where Betula ermanii prospers. The species presumably depends upon the Betula tree as a larval food plant there. Besides, some adults were detected from a lower hill, Mt. Hiei, in the warmer southwest. This suggests that some alternate host (s), presumably also of the genus Betula, may exist there. E. rubricana is, on the other hand, uniquely specialized to Alnus japonica growing in a humid environment (Kuznetsov, 1968; Oku, 1971, 2003). Their seasonal occurrence also differs. The flying time of E. autumnalis in northern Japan begins at earliest in mid August immediately after the hottest season has passed, and is prolonged until October. The flight of E. rubricana in the same area begins during June long before the arrival of the hottest season, and comes to an end at latest by early September (Kawahara, 2002; Oku, 1971, 2003).

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References


摘 要

奥 俊夫：他の既知種と混同されていたか、または近似種のある日本産ヒメハマキガ亜科の種（ハマキ科）

本報では、近似種と誤認識されていたか、あるいは見過ごされていたと思われる9新種を記載し、さらに検討不十分であった1種が独立種であることを確認し、その形態的特徴を明らかにした。

Eudemis brevisetosa sp. nov. ツママルモンヒメハマキ (Fig. 1)

従来、E. profundana (Denis et Schiffermüller) と同定されていたが、日本産は前翅に白斑を現すことがなく、交尾器においても特に雄では明らかな差があるので、これを独立種とみなした。寄主はコナラとヒダカガシが確認されたが、稀にサクラ類からも得られた。なお、サクラ類に常発するE. porphyra (Hübner) サクラマル-モンヒメハマキは本種に近似し、時に混同されるが、前翅の基部線の前半が薄くて判然としないことが異なっている。

Eudemis lucina Liu et Bai ナカグロマルモンヒメハマキ (Fig. 2)

日本産蛻類大図鑑（講談社）にE. profundana の1型として図示されたが、外観および雌のsterigmaが小さいことは、中国湖南省から記載されたE. lucina に一致する。雄交尾器は本報で初めて図示したが、saccus下端の曲曲および彼毛の形状はE. profundana と異なっている。本種の交尾器は前種とも相違するので、E. lucina は独立種とみなしてよいと思われる。北海道および本州の関東以北で、コナラ、カシワ、ミズナラから採集された。

Pseudohedya dentata sp. nov. ハイナミスキヒメハマキ（新称） (Fig. 3)

外観はP. gradana (Christoph) ナウカオビスキヒメハマキに似るが、やや大きく開張17〜22mm、下脇髪第2節中部の下方が黒、前翅は多少とも灰色をおびてくすみ、基部線と中央条紋の間は鈍色に帯る。雄交尾器のsubscaphiumがよく発達し、その下部、時には上端にも前突起を有するのが特徴である。北海道および本州の関東以北で成虫を得たが、寄主は不明。札幌市以南に多い。

Hedyia simulans sp. nov. ナガウスツマヒメハマキ (Fig. 4)

アジア大陸産のH. perspicuana (Kennel) に似ていて、日本からこの名で記載されていたが、雌交尾器のvalvaの外観中央部近に生じる顕著な刺毛束がH. perspicuana では3個あるのに対し、本種では2個しかない。雌交尾器ではsterigma菌毛がより幅広く突出する。これらの差異からみて別種と考えられた。北海道および本州の中部以北で得られた。幼虫はシナノキに寄生した1例がある。

Ancylis limosa sp. nov. オオセモノカガバヒメハマキ（新称） (Fig. 5)

Ancylis 属のbadiana 群に属する種は外観・交尾器とも互いによく似ているが、本種は雄交尾器のsaccus末端部が凹曲るのでなく、棒状に突出すること、雌交尾器のsterigmaが横長の帯状で交尾孔の前に直立する板状構造を欠く点が特徴である。同群の日本産種からは、頭部が暗色であること、中央条紋内の対をなす黒細条紋が微細な白色を伴うことによって区別できる。岩手県や山形県の林間湿地に多産するが、他地域は調査不足。初夏に羽化し、年1回発生する。

Ancylis apipecta sp. nov. ツマノアカガバヒメハマキ（新称） (Fig. 6)

形態は西日本でアキリレで発生するA. arcitenens Meyrick に近似し、雄交尾器では識別困難であるが、前翅の翅頂部が淡褐色をなすなど、色彩が著しく異なり、雌交尾器のsignaの1個が前方に細長く突出する独特の形状をなすため、別種と考えられる。岩手県山形県のハルニレ自生地で採集された。

Rhopalovalva morii sp. nov. モリウチヒメハマキ（新称） (Fig. 7)

前翅に基部からカギ状の翅頂に向かう斜線条紋が存在し、一見Ancyliis sativa Liu ナツメサイズガバヒメハマキに似ているが、開張16〜17mmと大きく、交尾器は明らかにRhopalovalva 属の特徴を示す。恐らくR. catharotorna (Meyrick) グダリパリヒメハマキに近縁と思われるが、本種はsociaが短く、色彩も非常に異異なる。比較的温暖な地方に分布するものので、本州の伊豆地方そして福岡の蘇我山で採集されている。
いる。種名は故森内教授に献げた。

Gypsonoma rivulana sp. nov. ヒロオビネグロヒメハマキ（新称）（Fig. 8）
通常より淡色の1個体が、誤って G. sociana (Haworth) として記録されていたが（館山・奥, 1983）。本種は G. sociana のように顔面が白くない。前翅の中央条線は前縁のすぐ後で急に抜がり、中室に黒い短縁紋を有し、鈍色や銀灰色を混入するのが特徴である。形態的には沿海州産の G. contorta Kuznetzov に近似するが、前翅の地が白く斑紋と対照的であるなどの差が認められる。岩手県盛岡市で採集。成虫は水辺のヤナギ群落に生息する。

Epinotia tsurugisana sp. nov. タルギクシヒゲヒメハマキ（新称）（Fig. 9）
雄の触角に顕著な拡状突起があること、および交尾器の形態からみて E. pygmaenana (Hübner) に近縁の種であることは疑いないが、開張 12mm 強と小さく、前翅に淡色の後縁紋がないので容易に識別できる。四国山脈の主峰剣山のシラビソ林に多産し、他地方では発見されていない。剣山特産の可能性がある。

Epinotia autumnalis sp. nov. ツチイロヒメハマキ（Fig. 10）
過去に E. rubricana Kuznetzov と混同されたことがあり、日本産蛾類大図鑑にもこの名で図示されたが、雄の前翅にcostal fold がなく、前翅外縁が翅頂下でくぼんでいないので、明らかに別種である。北海道、本州のダケカンバ林に多く、寒冷地や高地では8月から羽化するが、盛期は月末から9月にかけてあり、成虫は初霜の頃まで生存している。なお、その E. rubricana も日本に分布し、低湿地のハンノキに発生するためムモンハンノメムシガと呼ばれるが、成虫は夏期に活動し、晚秋までは生存しない。
New record of *Noduliferola abstrusa* Kuznetzov (Lepidoptera, Tortricidae, Olethreutinae) from Japan, with description of the immature stages

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Abstract  *Noduliferola abstrusa* Kuznetzov is newly recorded from Japan. The adult is redescribed and the immature stages are described for the first time, with illustrations of the adults, genitalia and immature stages. The larva bores into the stem of *Vitex rotundifolia* (Verbenaceae), which is recorded for the first time as host plant of the species. The genus is newly added to the Japanese moth fauna. All known species in the genus are listed.

Key words Tortricidae, *Noduliferola*, larva, pupa, *Vitex rotundifolia*, Japan

In 1997, the third author, Murase found an olethreutine larva boring into the stems of *Vitex rotundifolia* (Verbenaceae) on the seashore at Iwashiro, Wakayama, Japan. When the adults emerged, we identified them as *Noduliferola abstrusa* Kuznetzov, 1973, which is hitherto known only from the male holotype from Nanjing, China. Since 1998, we have studied the biology and the distribution of this species.

In the following lines we redescribe the species, with description of immature stages and a biological note. The adult female and immature stages are described for the first time. Material examined is preserved in the collections of Y. Nasu and F. Komai. We wish to acknowledge Dr K. Maetō, Kobe University, for identifying a parasitoid species.

*Noduliferola abstrusa* Kuznetzov (Figs 1–19)

[Japanese name: Hamagō-hime-shinkui]


Diagnosis. This moth has a protruding forewing apex, a narrow costal fold in the male, and a grayish brown ground color with a conspicuous dark brown semicircular patch in the middle of the forewing (Figs 1, 2). The male genitalia are characterized by a narrow tegumen, a pedunculus with a tuft of very long scales and a large blade-like valva (weakly sclerotized) (Fig. 10). The female genitalia are characterized by a large circular ostium bursae and by the sclerotized lateral walls of the ductus bursae protruding into the corpus bursae.

Adult (Figs 1–2). Male. Wing expanse 10–13 mm. Head grayish brown. Antenna light grayish brown. Labial palps grayish brown, the second segment dark brown ventrally, the third segment dark brown. Thorax and tegula grayish brown, tips of scales yellowish. Forewing (Figs 8–9) elongate, apex protruding. Sc to basal 1/3 of costa, R₄ and R₅ stalked, in discal cell vestigial M-stem sometimes present, M₃ and CuA₁ approximated basally, CuA₁ strongly curved apically, CuP indistinct. Costal fold narrow, beyond middle of costa, the fold containing many long yellow-brown scales arising from the stem of the R vein (the scales
Figs 1–7. Adults of *Noduliferola abstrusa* Kuznetzov. 1. female. 2. resting posture. 3. costal fold of male forewing (arrow: scales arising from the stem of R vein). 4. scales arising from the stem of R vein in male forewing. 5. the reverse side of flap of the costal fold. 6. caudal segments of male abdomen, dorsal. 7. *ditto*, lateral. Arrows of Figs 6–7: a tuft of thick scales from enlarged lobe on pedunclus.

partly protruding from the fold, indicated by an arrow in Fig. 3) (Figs 3–4) and numerous whitish yellow spatulate scales on the inner side of the fold (Fig. 5). Ground color grayish brown, dark brown on apex. Costa with three pairs of whitish yellow-brown strigulae from apex to apical end of costal fold. A gray streak along termen. Many sinuous whitish yellow-brown streaks running from costa to dorsum across whole wing. A conspicuous dark brown semicircular patch on the middle of wing, lighter dorsally. Cilia whitish yellow-brown, brownish on apex. Hindwing (Fig. 8) trapezoid, Rs and M1 stalked, CuP indistinct, 3A absent. Color light grayish brown, cilia concolorous with wing.

Male genitalia (Figs 10–12). Tergite 8 enlarged, forming a dorsal cover over the genitalia
(Figs 6–7, 12). Tegumen narrow. Pedunculus with an enlarged lobe bearing a tuft of very long thick scales. Uncus triangular, tip pointed. Tuba analis dorsally with a pair of small horn-shaped sclerites (Fig. 11, small arrow). Socius small, setose (Fig. 11, large arrow). Gnathos well sclerotized. Valva large, blade-like, weakly sclerotized; basal opening small, basal process long; cucullus weakly sclerotized, setose, apex pointed, with a tuft of thick setae and a long spine-like seta at ventral angle. Aedeagus short, cone-shaped, vesica with 25–37 cornuti.

Female. Wing expanse 11–14 mm. Similar to male, but costal fold absent, Sc vein reaching to middle of costa in forewing, and four pairs of costal strigulae from apex to middle and brown patch on middle of costa (the patch sometimes connected with a conspicuous dark
Scale of Fig. 11: 0.1 mm.
brown patch on middle of wing).

Female genitalia (Fig. 13). Papilla analis large, flat. Apophysis posterioris shorter than apophysis anterioris. Ostium bursae large, circular, located in deep incision on posterior edge of sternite 7; lamella postvaginalis strongly sclerotized. Seventh sternite broadly sclerotized, strongly sclerotized in both lateral edges of the posterior incision. Ductus bursae entirely sclerotized, the lateral walls elongated anteriorly, with rounded tips protruding into the corpus bursae. Corpus bursae oval; signa two, horn-shaped.

Mature larva (Figs 15, 18). Length 10–12 mm, slender. Head pale brown, with black pigmentation on latero-posterior edge and ocellar area. Spinneret slender, tapered at distal end. Prothoracic shield and thoracic legs pale brown. Body yellowish white. Pinaculum small, darker than body color. Setae short, pale. Anal plate pale brown. Anal fork present, four- to six-forked (Fig. 18H), sometimes prongs fused almost completely (Fig. 18I). An oval plate, the function of which is unknown (Komai, 1999: 27), appearing antero-dorsad from ventral prolegs on abdominal segments 3–6 (Fig. 18E). Crochets unordinal; 21–29 in number on ventral prolegs, 16–21 on anal prolegs.

Chaetotaxy (Fig. 18). SV group on abdominal segments 1, 2, 3, 7, 8, and 9 consisting of 2, 3, 3, 2, 2 and 2 setae, respectively. On abdominal segment 9, D2s on common pinaculum; D1 and SD1 on common pinaculum; L group trisetose, on common pinaculum.

Pupa (Figs 17, 19). Length about 7 mm. Color yellow-brown. Clypeus with three pairs of setae, anterior pair long, rarely absent. Abdominal segment 10 with a pair of hooked setae.


Host plant. Verbenaceae: Vítex rotundifolia L. f.

Biological note. The larva bores into the top of the stem of Vítex rotundifolia (Fig. 15), ejecting frass (Fig. 14, arrow). Fully-grown larvae overwinter in the stem of the host-plant. In summer, the larva vacates the larval habitat, and cuts a leaf transversely at two points of the host plant margin and folds it over, constructing a pupal case (Fig. 16). Pupation takes place
in the case (Fig. 17). Based on field-collected moths and rearing records, adults fly from May to June and from August to October in Wakayama. The moth has two or three generations in a year.


Distribution. China (Kiangsu Province), Japan (western Honshū, Shikoku, Kyūshū, Ryūkyū).

Remarks. Noduliferola Kuznetzov, 1973 (type species: N. abstrusa) is a small genus of the subfamily Olethreutinae distributed in East and South-East Asia and the Australian region.


N. abstrusa Kuznetzov, 1973. China (Kiangsu Province), Japan.
N. atriplaga (Clarke, 1976) (Duessa). Southern Mariana Islands (Rota, Guam).
N. hylica (Diakonoff, 1984) (Microclita). Indonesia (Sumba).
N. marquesana (Clarke, 1986) (Duessa). Marquesas Islands.
N. phaeostropha (Clarke, 1976) (Duessa). Southern Mariana Islands (Rota).
N. pleurogramma (Clarke, 1976) (Duessa). Eastern Caroline Islands (Kusaie).

The present genus is allied to the following genera, Gypsonoma Meyrick, 1895, Neoanathamna Kawabe, 1978, Mehteria Koçak, 1981 (replacement name for Geephyroneura
Fig. 18. Larval chaetotaxy of *Noduliferola abstrusa* Kuznetzov. Head, frontal (A); head, lateral (B); prothorax, lateral (C); metathorax and A1, lateral (D); A6, lateral (E); A7–A9, lateral (F); A10, dorsal (G); anal forks (H, I). Scales of A–G: 0.5 mm. Scales of ‘oval plate appearing antero-dorsad from ventral proleg’ in E, H and I: 0.1 mm.

References


New record of Noduliferola abstrusa from Japan


摘 要

那須義次・駒井古実・村瀬ますみ：日本新記録のハマゴウヒメシシクイ（新称）（鱗翅目，ハマキガ科，ヒメハマキガ亜科）とその幼生期の記載

著者の一人村瀬は1997年に和歌山県南部町岩代海岸に生じているハマゴウVitex rotundifoliaの枝に産する鱗翅類幼虫を発見した。羽化成虫を検討したところ、日本新記録のハマキガの1種*Noduliferola abstrusa* Kuznetsov,1973 ハマゴウヒメシシクイであることが判明した。その後、日本各地の海岸でもハマゴウに寄生している種が得られた。本種は中国江蘇省南京近くで採集された1♂に基づいて記載されたものである。♂と幼生期の形態および寄主植物についてはじめて報告される。本属は東アジア、東南アジアとオーストラリアに分布し、現在のところ9種が知られる。

成虫。前翅の長さは10～14mm。前翅は緑色でコケダ・ホウルドをもつ。前翅の特徴は灰褐色で、中央に暗褐色の半円形纹をもつ。♂魚尾は細長いテゲメン、非常に長い鱗毛の束を有するベドウシクルスと硬質な翅状のバルバをもつ。♀魚尾は大きな円形のオステウム・プルサとコルプス・プルサの中に突出する側壁を有するプックス・プルサをもつ。

幼虫。体長は10～12mm、細長い。頭部と前胸背骨は淡褐色、胴部は黄白色。4～5鰭の尾毬（時に癒合する）をもつ。

蛹。体長は7mm。体色は黄褐色、クリペックスは3対の刺毛をもつ。腹部第10節は1対の鰭状刺毛をもつ。

生態。幼虫はハマゴウの当枝の主に先端部に産り、枝内部をトンネル状に摂食し、細かい糸を外に排出する。成熟幼虫は枝から脱出し、葉の緣を折り曲げて蛹室をつくり、中で蛹化する。越冬は枝の中で幼虫態でおこなわれる。和歌山県では成虫は5月～6月と8月～10月に見られ、年2～3化する。

分布。中国（江蘇省）、日本（本州西部、四国、九州、琉球）。
Systematic study of the genus *Phiaris* Hübner (Lepidoptera, Tortricidae) from Korea and Japan, part III

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Abstract  In the third part of this study on the genus *Phiaris* Hübner, eight species belonging to the four species-groups, the *hydrangeana*-, *semicremana*-, *exilis*-, and *electana* groups are treated. Among them, one species, *komaii* sp. nov., is described as new to science, and one species, *subelectana* (Kawabe) is newly transferred to this genus from *Olethreutes*. Adults and genitalia of both sexes are illustrated. Host plants are listed. A key to species of the *electana*-group is provided.

Key words  Lepidoptera, Tortricidae, Olethreutinae, *Phiaris, komaii* sp. nov., Korea, Japan, taxonomy

Introduction

The present paper is the third part of my revision of the tortricid genus *Phiaris* Hübner from Korea and Japan. It deals with a revision of the four species-groups, the *hydrangeana*-, *semicremana*-, *exilis*-, and *electana*-groups, including eight species in all. The 1st part (Bae, 2000a) treated the *pryerana* - and *ineptana*-groups, and the 2nd part (Bae, 2000b) the *olivana*-group. This paper was supported by the Korea Research Foundation grant made in the program year of 1997 (KRF-97-001-00041), and forms a part of the “Systematic study of the genus *Phiaris* Hübner (Lepidoptera; Tortricidae) from East Asia”.

The material examined is based on the following collections (abbreviations in brackets): Center for Insect Systematics, Chuncheon [CIS], Korea; Department of Biology, University of Incheon, Incheon [UIB], Korea. Most of the Japanese materials with holotypes will be deposited in the collection of the Entomological Laboratory, Osaka Prefecture University, Sakai, Japan. Abbreviations for the provincial names in Korea are as follows: GG- Gyeonggi; GN- Gyeongnam; GW- Gangwon. For the distribution range in the Korean Peninsula, three divisional words are used: North- North Korea (Democratic People’s Republic of Korea), South- South Korea (Republic of Korea).

Systematic accounts

The *hydrangeana*-group

This group is characterised by having extremely broad valva (about three times as broad as the diameter of the aedeagus) (Bae, 2000a). This group comprises a single species, *P. hydrangeana* Kuznetzov from Korea and Japan.

*Phiaris hydrangeana* (Kuznetzov) (Figs 1, 9, 16, 23, 30)

*Olethreutes hydrangeana* Kuznetzov, 1969: 352, figs. 1, 2. Type locality: Russia (Kuril Is.: S. Kunashir).

*Olethreutes hydrangeana*: Oku, 1972: 3; Kuznetzov, 1973: 133; Kawabe, 1982: 1: 107, 2: 170, pl. 24, fig. 16, pl. 284, fig. 11, pl. 291, fig. 16.


Genus *Phiaris* from Korea and Japan, III

Wing-expanse. ♀ 13.5–16 mm, ♂ 16–17 mm. Wing markings as in Fig. 1. Male secondary sexual characters: Hair pencil of hindleg gray, 0.5 times as long as tibia. Dorsum of hindwing with a slender marginal roll, reaching from base to beyond tornus.

Male genitalia (Figs. 9, 16). Uncus small, cone-like, hooked; socius narrow, not drooping; gnathos membranous, only perceptible laterally. Valva longitudinally folded at middle, basal two thirds very broad; cucullus separated from sacculus by a longitudinal furrow, the apical portion narrow, covered with weak hairs, the basal lobe bearing a group of setae and with a row of variable sized, stout, spines, forming a fringe along the inner margin; sacculus with a row of spine-like setae at apical 1/3, partly hidden beneath the lobe of sacculus. Aedeagus short, truncate, with an indistinct small cornutus.

Female genitalia (Figs. 23, 30). Seventh sternite normal tormricid shape. Sterigma complex large, nipple-shaped, densely aciculate around ostium bursae. Ostium bursae small, aciculate. Ductus bursae long; callicum short, tubular; corpus bursae moderate in size, without signum.


Distribution. Korea (North), Japan (Hokkaido, Honshu, Shikoku), Russia (Kunashir Is).

Flight period. May to July.


Remarks. This species is easily recognized by the forewing having an ochreous white ground color and by the shape of the central fascia. The male genitalia are characteristic with extremely large and broad valva.

**The *semicremana*-group**

This group is characterized by the presence of a distinctly pointed prominence at the ventro-caudal margin of the sacculus. This group includes a single species, *P. semicremana* (Christoph) from Japan and Russia.

*Phiaris semicremana* (Christoph) (Figs 2, 10, 17, 24, 31)

*Penthina semicremana* Christoph, 1881: 77-78. Type locality: Russia (Amur).
*Cynolomia semicremana* Kennel, 1916: 433, pl. 18, fig. 9; Caradja, 1916: 59.
*Phiaris semicremana* Kuznetzov, 2001: 262, fig. 155-3.

Wing-expanse. ♀ 14.5–16.5 mm, ♂ 15–16 mm. Wing markings as in Fig. 2. Male secondary sexual characters: Hair pencil of hindleg dark gray, as long as tibia. Dorsum of hindwing with a cylindrical roll, reaching from base to tornus, the roll separated from middle of dorsum.

Male genitalia (Figs. 10, 17). Uncus narrow, shortly bifurcated at apex; socius narrow and
short; gnathos a slender band. Valva long and narrow, fairly broad before middle, folded at middle; cucullus clavate, with an irregular row of strong spine-like setae along basal part; sacculus with a distinctly pointed prominence at ventro-caudal margin, with a tuft consisting of 20–25 variable sized spine-like setae at the apical lower margin of the sacculus, and with a row of 10–12 spine-like setae near the basal cavity. Aedeagus short, truncate, without cornutus.

Female genitalia (Figs. 24, 31). Seventh sternite with a membranous inner pocket at posterior part. Sterigma rounded, partly aciculate, with large lateral plates, and rather expanded around ostium. Ostium bursae small, narrow. Ductus bursae moderate in size; colliculum tubular, narrow; corpus bursae simple, without signum.


Distribution. Japan (Hokkaido, Honshu), Russia (Amur and Primorye).

Flight period. July to August.

Host plants. Unknown. Found in broad-leaved forests and attracted to light in Hokkaido.

Remarks. This species is distinguished from other species of the genus by the forewing with the central fascia overlaid with pale yellow, and by the male genitalia which possess a distinct ventro-caudal prominence in the sacculus.

The exilis-group

This group is characterized from other members by the following characters: (i) the uncus is very short or atrophied, (ii) the valva is strongly folded at the middle part, and (iii) the cucullus has a narrow neck in the middle part (Baè, 2000a). The group comprises two species, P. exilis (Falkovitch) and P. komai sp. nov.

Phiaris exilis (Falkovitch) (Figs 3, 11, 18, 25, 32)

Olethreutes exilis Falkovitch, 1966: 39, figs. 1, 2; Oku, 1972: 4; Kuznetsov, 1967: 56, 1973: 125; Kawabe, 1982: 1: 109, 2: 170, pl. 24, fig. 34, pl. 285, fig. 8, pl. 292, fig. 8. Type locality: Russia (Primorye: Samodon ls.).


Wing-expande. ♂ 10–12 mm, ♀ 11–14 mm. Wing markings as in Fig. 3. Male secondary sexual characters: Hair pencil of hindleg gray, as long as tibia. Dorsum of hindwing with a clavate roll, reaching from base to tornus, whitish, the roll separated from dorsal edge.

Male genitalia (Figs. 11, 18). Tegumen without shoulders; uncus short, cone-shaped, sparsely haired; socius long, narrow; gnathos membranous. Valva long, narrow, with large basal cavity; cucullus long, with two lobes at lower base and middle portion, with stout spine-like setae along outer margin; sacculus long, narrow, strongly concave at above ventro-caudal margin, with simple and rounded apical lobe, with tuft consisting of 9–12 strong spine-like setae at apical margin. Aedeagus long, twice as long as caulis, slightly curved, truncate at apex; vesica with three or four stout spine-like cornuti.

Female genitalia (Figs. 25, 32). Seventh sternite normal tortricid shape. Sterigma moderately small, weakly sclerotized, with two small, sclerotized plates at dorsum of posterior margin. Ostium bursae funnel-shaped, not aciculate. Ductus bursae moderately long, twice as long as corpus bursae; colliculum rather long, broader posteriorly, sclerotized; corpus bursae moderate in size; signum a small, indistinct plate, consisting of numerous sclerites.

Distribution. Japan (Hokkaido, Honshu), Russia (Primorye).

Flight period. June to September.

Host plant. Unknown.

Remarks. This small species is superficially very similar to opacalis Bae, but easily recognized from it by the larger colliculum in the female genitalia.

Phiaris komaii sp. nov. (Figs 4, 12, 19, 26, 33)

Wing-expanse. ♂ 10–12 mm, ♀ 12.5–14 mm. Head yellowish ochreous, tinged with gray; tufts on vertex suffused with brownish gray. Antenna dark gray; ventral surface scattered with yellowish white. Labial palpus pale ochreous; median segment apically not expanded, its outside suffused with gray; terminal segment pointed and porrect, sometimes irrorate with pale gray. Thorax including posterior crest dark brown, scattered with yellowish ochreous on dorsal side, brilliant pale gray on ventral side. Fore and midlegs ochreous, partly suffused with gray; mid-tibia with two distinct grayish spots at base and subapex. Hindleg pale ochreous, outside of tibia overlaid with dull gray. All tarsi with five rather shorter brownish rings. Abdomen dark gray on dorsal side, grayish ochreous on ventral side; anal tufts ochreous, slightly tinged with gray.

Forewing (Fig. 4). Broad, elongate; costa and termen slightly curved outwards; apex truncate. Ground color yellowish ochre, irregularly striated with lustrous bluegray and blackish brown. Costal strigulae distinct, consisting of four pairs of geminate yellowish white striae on apical half of costal margin. Markings dark brown or fuscous, partly mixed with ochre; basal patch well-defined or diffuse, outer edge convexly sinuate; central fascia defined, the inner edge more or less straight, the outer edge with a strong projection at middle and emarginate above and below; pretornal patch rather distinct, subtriangular; terminal patch elongate ovate, truncate at top; apical spot small, diffuse. Cilia yellowish ochre, with a dark brownish subbasal line. Hindwing elongate-ovate, dark gray; apex rather rounded. Cilia pale gray, with a dark gray subbasal line.

Male secondary sexual characters: Hair pencil of hindleg dark brownish gray, as long as tibia. Dorsum of hindwing with a cylindrical roll, reaching from base to beyond tornus.

Male genitalia (Figs. 12, 19). Uncus almost atrophied; socius long, narrow and drooping. Valva long, broadly folded at middle; cucullus rather long, with narrow neck at middle, expanding below neck, with a row of long and short spine-like setae on basal lower margin; sacculus long, concave at middle, with a horn-shaped setae on apical lobe, and with tuft of short spine-like setae near basal cavity. Aedeagus short, with tapering apex, and with a carina on apex of its left wall; cornutus absent.

Female genitalia (Figs. 26, 33). Eighth abdominal segment strongly sclerotized, with two concave pockets at anterior-lateral sides. Seventh sternite simple. Sterigma large, well-sclerotized, aciculate, divided from lamella antevaginalis and lamella postvaginalis, the lamella antevaginalis elongate, with two prominences near ostium bursae, the lamella postvaginalis concave at middle part of posterior edge. Ostium bursae wide, rounded, cup-
shaped, slightly sclerotized. Ductus bursae moderate in size; colliculum rudimentary, corpus bursae simple, with numerous sclerites.


Distribution. Japan (Honshu, Shikoku).

Flight period. May to July.

Host plant. Unknown.

Etymology. The name of this new species is dedicated to Prof. F. Komai, an excellent tortricid specialist, Osaka University of Arts, who collected the paratype of this species.

Remarks. This new species is very similar to Celypha aurofasciana (Haworth), but differs distinctly from the latter in the genital characters: in the male, the uncus is atrophied; in the female, the 8th abdominal segment is largely sclerotized, with two concave pockets at anterior lateral sides.
The electana-group

This group is characterized by the following characters: (i) the forewing is blackish brown with a yellowish orange band at basal 1/3, (ii) the sacculus has a lobe at the ventral margin and forms a deep excavation beyond 1/2 of it, and (iii) the uncus is pointed apically (Bae, 2000 a, b). This group comprises three species, P. electana (Kennel), P. subelectana (Kawabe), and P. tsutavora (Oku).

Key to the species of the electana-group of genus Phiaris Hübner

1. Head orange brown; median segment of labial palpus without dark brownish marking

   — Head pale ochreous; median segment of labial palpus tinged with dark brown

   ....................................................................................................................... tsutavora (Oku)

   ....................................................................................................................... 2

2. Male sacculus projecting at middle, abruptly curved and forming a deep excavation beyond half of it; female sterigma without sclerotized lateral plate (Fig. 14)

   ....................................................................................................................... subelectana (Kawabe)

   — Male sacculus gently curved beyond half of it; female sterigma with sclerotized lateral plate (Figs 5, 34) ................................................................. electana (Kennel)

Phiaris electana (Kennel) (Figs 5, 13, 20, 27, 34)

Penthina electana Kennel, 1901: 257-258. Type locality: Russia (Primorye: Suchan).

Argyroproce electana: Kennel, 1916: 418, pl. 17, fig. 36; Issiki, 1957: 72, fig. 355; Okano, 1959: 262, pl. 175, fig. 31; Yasuda, 1969: 93, pl. 46, fig. 181.


Wing-expanse. ♂ 14.5–18 mm, ♀ 16–19 mm. Wing markings as in Fig. 5. Female forewing coloration similar to male, but the space between basal patch and central fascia somewhat broader than that of male. Male secondary sexual characters: Hair pencil of hindleg gray, 0.9 times as long as tibia. Dorsum of hindwing with a narrow spindle-shaped roll, reaching beyond tornus.

Male genitalia (Figs. 13, 20). Uncus short, narrow, slightly hooked, sparsely covered with short hairs; socius not drooping; gnathos membranous, dilated at middle. Valva folded before middle, broader in basal half; cucullus narrow, with a compact group of dense and strong spine-like setae near base; sacculus gently curved beyond half, with a tuft comprising about 20 strong spine-like setae along apical margin. Aedeagus short, truncate, with two stout spine-like cornuti.

Female genitalia (Figs. 27, 34). Papilla analis long, very narrow. Seventh sternite slightly concave at posterior margin, with narrow limen. Sterigma rather large, aciculate, incised posteriorly almost as far as ostium bursae, with large wing-shaped plates. Ostium bursae opening at end of a wide tubular protuberance of the sterigma, with a small emargination at ventral edge. Ductus bursae shorter and narrower than that of tsutavora; colliculum sparsely aciculate, narrow than that of tsutavora; corpus bursae moderate in size, without signum.


Distribution. Korea (South), Japan (Honshu, Shikoku, Kyushu), China, Russia (Amur and Primorye).

Flight period. May to July.

Host plants. Japan: Deutzia crenata Sieb. et Zucc., D. scabra Thunb. (Saxifragaceae); Weigela coraeensis Thunb. (Caprifoliaceae).

Remarks. This species is closely allied to the next species, subelectana. This species is on average larger (14.5–19 mm) than the latter (12.5–16.5 mm) in the forewing expanse, but it is hardly distinguishable without examination of the genitalia. This species is also similar to P. subelectana and P. tsutavora in superficial appearance. The discriminating characters are mentioned under the remarks on P. tsutavora. The moths fly from May to June in the mountain areas.

Phiaris subelectana (Kawabe), comb. nov. (Figs 6, 7, 14, 21, 28, 35)

Olethreutes subelectana Kawabe, 1976: 46, figs. 11, 20, 30, 1982: 1: 107, 2: 170, Pl. 24, fig. 11, Pl. 284, fig. 9, Pl. 291, fig. 13. Type locality: Japan (Toyama Pref.: Ormaki).


Wing-expanse. ♂ 12.5–15 mm, ♀ 13–16.5 mm. Wing markings as in Figs 6, 7.

Male genitalia (Figs. 14, 21). Uncus short, narrow and sparsely covered with short hairs; socius not drooping; gnathos membranous, dilated at middle. Valva folded at middle, broader in basal half, with a prominence at costa; cucullus narrow, with a tuft of long and strong spine-like setae along basal margin; sacculus projected at middle, abruptly curved and forming a deep excavation beyond half way point, with a tuft of strong spine-like setae at apical margin. Aedeagus short, truncate, without cornutus.

Female genitalia (Figs. 28, 35). Papilla analis similar to that of electana (Kennel). Seventh sternite slightly convex at lateral side, with narrow limen. Sterigma smaller than that of electana (Kennel), bell-shaped, aciculate, without lateral plate. Ostium bursae opening at end of a wide tubular protuberance, with a long emargination at ventral edge. Ductus bursae more than twice as long as corpus bursae; colliculum rather long, sclerotized, simple; corpus bursae small, without signum.


Distribution. Japan (Honshu, Shikoku, Kyushu), Russia.

Flight period. May to June.


Remarks. The discriminating characters are mentioned under the remarks on tsutavora (Oku).
and electana (Kennel). This species probably has a single annual generation, with flight in May to June. The larvae feeds in spun leaves of the host plants. Pupation takes place in the larval habit. It overwinters as an egg.

**Phiaris tsutavora** (Oku) (Figs 8, 15, 22, 29, 36)


Wing-expanse. ♂ 15–16 mm, ♀ 17–18 mm. Wing markings as in Fig. 8. Female forewing coloration similar to male, but the space between basal patch and central fascia broader than that of male. Male secondary sexual characters: Hair pencil of hindleg pale gray, 0.7 times as long as tibia. Dorsum of hindwing with ill-defined marginal roll reaching from base to tornal half.

Male genitalia (Figs. 15, 22). Uncus short, narrow, sharply hooked, sparsely covered with short hairs; socius not drooping; gnathos membranous, narrow at middle. Valva folded at middle, with broad basal half; cucullus narrow, with a tuft of strong setae along the lower margin of basal half; sarcus angulate, acute at basal third and apex, with two clusters of spine-like setae at apical and near cavity. Aedeagus short, with truncate apex; cornutus absent.

Female genitalia (Figs. 29, 36). Seventh sternite rather sclerotized, slightly emarginate at middle of posterior edge. Sterigma rather large, aciculate, incised posterior edge, with large wing-shaped plates. Ostium bursae opening at end of a wide tubular protuberance at middle. Ductus bursae moderate in size, twice as long as corpus bursae; colliculum membranous, broader posteriorly; corpus bursae moderate in size, without signum.


Distribution. Japan (Honshu).

Flight period. June to July.

<table>
<thead>
<tr>
<th>Table 1. Comparison of the genital characters of three related species.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male genitalia</strong></td>
</tr>
<tr>
<td>Shape of sacculus</td>
</tr>
<tr>
<td>gently curved</td>
</tr>
<tr>
<td>Projecting at middle, with a deep excavation 1/2 of it</td>
</tr>
<tr>
<td>acutely angulate at basal 1/3 and apex</td>
</tr>
<tr>
<td>Cluster of setae on sacculus</td>
</tr>
<tr>
<td>one</td>
</tr>
<tr>
<td>one</td>
</tr>
<tr>
<td>two</td>
</tr>
<tr>
<td>Cornutus</td>
</tr>
<tr>
<td>two, spine-like</td>
</tr>
<tr>
<td>absent</td>
</tr>
<tr>
<td>absent</td>
</tr>
<tr>
<td>Female genitalia</td>
</tr>
<tr>
<td>Papilla analis</td>
</tr>
<tr>
<td>slender</td>
</tr>
<tr>
<td>slender</td>
</tr>
<tr>
<td>short, broad</td>
</tr>
<tr>
<td>Sterigma</td>
</tr>
<tr>
<td>wing-shaped, lateral plates present</td>
</tr>
<tr>
<td>bell-shaped, lateral plate absent</td>
</tr>
<tr>
<td>wing-shaped, lateral plates present</td>
</tr>
</tbody>
</table>

Remarks. This species is similar to P. electana and P. subelectana in superficial appearance, but is separated from them by the broader yellowish orange band in the forewing and the genitalia characters (Table 1).

Acknowledgments

I would like to express my sincere gratitude to honorary Prof. T. Yasuda and Assoc. Prof. T. Hirowatari, for their critical review of the manuscript and continuous encouragement in this study. I am greatly indebted to Profs. M. Ishii and the late S. Moriuti, the late Mr A. Kawabe, for their helpful suggestions and encouragement. My cordial thanks are due to Dr F. Komai, Dr Y. Nasu, Dr T. Oku, honorary Prof. H. Kuroko, and Dr T. Kumata. I thank also the following entomologists for their generous help in obtaining specimens, Prof. K. T. Park, Dr B. K. Byun, Dr Y. Arita, late Mr K. Fujisawa, Mr T. Mano, Dr K. Kamijo, Mr H. Kumamoto, Dr M. Wakabayashi, Drs T. Ueda, T. Iwasaki, M. Aoyagi, Y. Nakatani, and Messrs K. Ikeuchi, M. Uenishi; Dr M. K. Paek, Dr N. H. Ahn, Mr B. W. Lee, and Mr C. M. Lee.

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略 要
Yang-Seop Bae：韓国と日本産Phiaris属（繭蛾目，ハマキガ科）の分類学的研究（III）
本論文では韓国と日本産Phiaris属7種群の内，hydrangeana，semicremana，exilis，electana種群を扱った。
なお，本論文のパート1（Bae, 2000a）ではpiryerana，inceptana種群を，パート2（Bae, 2000b）ではolivana種群を扱った。

Hydrangeana種群
本種群は極端に幅広いバルパ（エデアゲスの直径の約3倍）をもつことで特徴づけられる。本種群は次種のみから成る。

Phiaris hydrangeana（Kuznetsov） ゴトウズルヒメハマキ
本種は前翅の黄土白色の極地と中带の形状により容易に識別できる。
分布：韓国（北），日本（北海道，本州，四国）。
寄主植物：Hydrangea petiolarisツルアジサイ（ゴトウズル）（ユキノシタ科）。

Semicremana種群
本種群はサッカルスの卵端方端に明瞭な尖った突起をもつことにより特徴づけられる。本種群は次種のみから成る。

Phiaris semicremana（Christoph） ウワミズヒメハマキ
本種は前翅中に褐色がかかることで他種と区別できる。
分布：日本（北海道，本州），ロシア（極東部）。

Exilis種群
本種群は，(1) ウンクスは非常に短いか萎縮する，(2) バルパは中央部で強く折りたたまれる，(3) ククル
スは中央部に狭いくびれをもつことで特徴づけることができる。本種群は P. exilis と P. komaii (新種) から成る。

*Phialis exilis* (Falkovitch) マグラチビヒメハマキ

本種は外部表皮では P. opacalis カゲマグラチビヒメハマキ (新称) に酷似するが、♀ゲニタリアにおいてより大きなコリキュールムをもつことで区別できる。

分布：日本 (北海道・本州)、ロシア (沿岸州)。

*Phialis komaii* Bae (新種) ウシタキオビヒメハマキ (新称)

本種は Celypha aurofasciana (Haworth) コケキオビヒメハマキに類似するが、♀ゲニタリアのウシクスが萎縮すること、♀では腹部8節が大きく硬化し、前側方に2個の凹んだポケットをもつことにより区別できる。

分布：日本 (本州・四国)。

*Electana* 種群

本種群は、(1) 前翅は黒褐色で基部1/3のところに黄色があったオレンジ色の帯をもつ、(2) サックルスは腹端に1個の隆起をもち、サックルスの1/2を越えたところに深い凹みが形成される、(3) ウシクスは先端は尖ることで特徴づけることができる。本種群は3種から成る。

*Philoris electana* (Kennel) ウツギヒメハマキ

本種は次種に近縁である。本種は次種 (間隔 12.5-16.5mm) に比べると平均的に大きい (間隔 14.5-19mm) が、ゲニタリアの剖検なしに区別は困難である。本種と次種の区別点は下表のとおりである。

分布：韓国 (南)、日本 (本州・四国、九州)、ロシア (極東部)。

寄主植物：*Deutzia crenata* ウツギ、*D. scabra* マルバウツギ (ユキノシタ科)；*Weigela coraeensis* ハコネウツギ (スイカズラ科)。

*Philoris subelectana* (Kawabe) 新結合 ニセウツギヒメハマキ

分布：日本 (本州・四国、九州)、ロシア。

寄主植物：*Deutzia crenata* ウツギ、*D. scabra* マルバウツギ (ユキノシタ科)。

*Philoris tsutavora* (Oku) ツタキオビヒメハマキ

分布：日本 (本州)。

寄主植物：*Parthenocissus tricuspidata* ツタ (ブドウ科)。

<table>
<thead>
<tr>
<th>ウツギヒメハマキ</th>
<th>ニセウツギヒメハマキ</th>
<th>ツタキオビヒメハマキ</th>
</tr>
</thead>
<tbody>
<tr>
<td>♀ゲニタリア</td>
<td>サックルス</td>
<td>サックルスの刺毛群</td>
</tr>
<tr>
<td>サックルス</td>
<td>サックルスの刺毛群</td>
<td></td>
</tr>
<tr>
<td>サックルスの刺毛群</td>
<td>1個</td>
<td>1個</td>
</tr>
<tr>
<td>コルストゥス</td>
<td>2個、辺状</td>
<td>無</td>
</tr>
<tr>
<td>♂ゲニタリア</td>
<td>パピラ・アナンサリス</td>
<td></td>
</tr>
<tr>
<td>ステリオマ</td>
<td>綿状、細板有</td>
<td>綿状、細板無</td>
</tr>
<tr>
<td></td>
<td>短く、幅広い</td>
<td>短く、幅広い</td>
</tr>
</tbody>
</table>

なお、*P. opacalis* と *P. komaii* の和名は那須が与えた。前者は種小名の日本語訳から、後者はホロタイプの産地名にちなんだ。

（文責: 那須義次）
A new species of the Acentropinae (Crambidae), with remarks on its conservation

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Laboratory of Applied Entomology, Graduate School of Agriculture, Kyoto Prefectural University, Shimogamo, Kyoto 606-8522, Japan

Abstract A new acentropine species, Parapoynx moriutii, of the Crambidae is described from Honshu, Japan. The female genitalia of P. rectilinealis are first shown for comparison with those of P. moriutii. The characteristic features of this new species and importance of conservation of Parapoynx species are discussed.

Key words Parapoynx, aquatic insect, conservation, wetland.

The genus Parapoynx belonging to the Acentropinae (=Nymphulinae) is widely distributed in the world and is represented by approximately 50 species (Speidel, 1984; Yoshiyasu, 1985; Robinson et al., 1994, Speidel & Mey, 1999). Seven species have been recorded in Japan, of which 5 species are also known in other countries of South-East Asia and East Asia (Yoshiyasu, 1985; Speidel & Mey, 1999). The larvae of these species of Parapoynx are peculiar in having branched tracheal gills, by which they are able to respire in stagnant water (Yoshiyasu, 2005). However, due to environmental changes such as water pollution and reclamation of wetlands, this group of moths has become rare in recent years (Yoshiyasu and Kamoshida, 2000). It is in this context that I discovered an undescribed species belonging to the genus Parapoynx in Osaka Prefecture, Honshu. Comparing this species with other Japanese and foreign species of this genus, I came to the conclusion that this species is new to science. In this work I describe the species and provide information on the biology and locality of this new species with the purpose of enhancing the conservation of Parapoynx species.

Material and Methods

(1) Observation of adult genitalia

The whole abdomen of each specimen was removed and transferred to a 5% KOH solution, and boiled for several minutes. After this treatment the material was transferred to a Petri dish containing water, and its scales were carefully detached. The specimen was moved to 75% ethanol and carefully dissected and cleaned so as to observe the genitalia. The drawing of the genitalia was made in 75% ethanol under a binocular microscope.

(2) Insect rearing: One mated female collected at light (10.vii.1997) was allowed to lay eggs under laboratory conditions, and the eggs were used for rearing. Insect rearing was performed using a plastic Petri dish (dia. 9cm). The larvae were reared individually, placing filter paper on the bottom of a Petri dish and filling each dish with water to a depth of about 5 millimeters. As the host plant of this new species is not known, the host plant Potamogeton crispus L. was offered as a larval food source. The insects were placed under laboratory conditions of 25°C and 15L-9D. The plant was changed and the water renewed on a daily basis.
Results

Descriptions of new species

*Parapoynx moriutii* n. sp.

(Japanese name: Misaki-komizumeiga)

Adult. Forewing length: female 6.2 mm (N= 6). Male. 5.6 mm (N= 4).

Female (Fig. 1A). Head with vertex with raised brownish metallic scales, frons a little flattened, and whitish. Labial palpus rather narrow, weakly curved upwards, fuscous on outer surface; 3rd segment almost as long as 2nd, narrowly acute at apex. Maxillary palpus well developed, extending forwards, suffused with fuscous. Antenna a little shorter than forewing length, ciliate, dorsally with dark brown scales.

Legs long; foreleg fulvous with femur and tibia fuscous anteriorly; mid- and hindlegs fulvous to whitish; two pairs of long spurs on hind legs, with each inner spur subequal to outer spur in length.

Wings narrow, with linear markings as in *Parapoynx vittalis* and *P. rectilinealis*. Forewing. Apex rather rectangular, whereas those of *P. vittalis* and *P. rectilinealis* are rounded. Proximal area insides postmedial whitish area (PMW) suffused with fuscous, except for orange streaks along costa and anterior and posterior margins of discoidal cell. Anterior portion of PMW almost parallel with wing termen and strongly curved at vein Cu, then divergent proximally to outer margin. Submarginal white area (SMW) also parallel with termen and edged by darker submarginal line (SML). Distal ground area to SML bright orange.

Hindwing. Termen clearly concave behind apex. Proximal area whitish except for narrow medial line (ML) and broader postmedial line (PML); lines are more approximated to each other than the other *Parapoynx* species, running from costa to outer margin obliquely. Distal area to PML pale orange. SMW narrow, with anterior portion interrupted at vein Rs, and posterior one also interrupted by vein 1A+2A, whitish without metallic grey scales seen in *P. rectilinealis*. Marginal line represented by 8 blackish dots on each cell.

Male (Fig. 1B). Differs from female in the relatively smaller in size, the thicker and shorter antenna and slightly paler wing ground color.

Female genitalia (Figs 2C, 2D). Seventh sternum (7S) much shorter than the tergum (7T) as compared with other *Parapoynx* species, and membranous in posterior half, where a wide ostium bursae is present at the posterior end. Ductus bursae rather short, with numerous

![Fig. 1. *Parapoynx moriutii* n. sp. A. Holotype, female. B. Paratype, male.](image-url)
Fig. 2. Male and female genitalia of *P. moriutii* n. sp. A. Male genitalia, lateral view (left valva removed). B. male genitalia, tegumen and uncus, dorsal view. C. female abdomen, lateral view. D. female genitalia, corpus bursae, dorsal view. Scale: 0.5 mm.
granular spinules. Corpus bursae long and spherical, and ornamented with a pair of signa that are linear and whose anterior ends are approximated to each other. Apophysis posterioris a little longer than its anterioris, with a rectangular plate near the base. Papilla analis strongly curved downwards at apex, wide and densely setose.

Male genitalia (Figs 2A, 2B). Tegumen almost as long as wide in dorsal view, with anterior margin excavated. Vinculum narrow. Saccus developed, rounded laterally. Uncus moderate in length, with a few setae laterally on proximal portion, and distal half rather strongly curved downwards and narrow at apex dorsally. Gnathos developed ventrally, without distinct dorsal spines. Valva long, with many long setae along apical margin; costa without remarkable setae dorsally; a papillate projection originating from proximal portion of broad sacculus; inner surface with many setae oriented upwards. Phallus short, without cornuti.

Holotype. Female (forewing 6.1 mm) (Fig. 1A), 2.ix.1997, Misaki-cho, Osaka Pref., Y. Yoshiyasu leg. (deposited in Laboratory of Entomology, University of Osaka Prefecture). Paratypes. (Osaka Pref.): 1♂, 1♀, 10.vii.1997, 2♀, 2.viii.1997, 1♀, 2.ix.1997; Misaki-cho, Y. Yoshiyasu leg. (Wakayama Pref.): 1♀, 2.vii.2000, Wakayama City, M. Murase leg.

Distribution. Honshu (Osaka Pref. and Wakayama Pref.), Japan.

Etymology. The species epithet name is dedicated to the late Professor Sigeru Moriuti of Osaka Prefecture University, who always encouraged me to study this group of moths.

Biological notes. The specimens of this new species were collected by a light trap in the type locality (Misaki-cho, ca. 100 m a.s.l.), where rice plants were cultivated in small paddy fields that were surrounded by the lower mountains. The other locality of this species (Wakayama City, Wakayama Pref.) neighboring Misaki-cho is almost the same with respect to environmental conditions. The immature stage and host plant have not been investigated in these localities. I managed to rear larvae in the laboratory. The female deposited the eggs on the underside of floating paper in a small cup. The newly hatched larvae were successfully reared by feeding on the host plant Potamogeton crispus L. The larvae were creamy white and possessed no tracheal gills. After the 2nd instar, however, they developed tracheal gills on thoraces and abdominal segments as in other Parapoyx species, and made portable cases using the fragments of plant leaves on which they fed. Each gill becomes branched by the 3rd instar. The developmental period from the first instar larva to adult emergence is 49–56 days (n=6) under laboratory conditions of 25°C and 15L-9D. These observations may indicate that
the larvae live in stagnant water near or in the paddy field, and feed on aquatic plants growing in the water, including Potamogeton species.

Remarks. The new species is allied to P. vitallis (Bremer, 1864) and P. rectilinealis Yoshiyasu, 1985 in possessing similar wing markings and coloration. However, the new species is easily distinguished from the latter two species in having an evenly orange abdomen on the dorsal surface (Fig. 1B), whereas those of the other two species are whitish with a darker ring on each segmental margin. Differences of external and genital characters also distinguish the species, the details of which are summarized in Table 1.

Discussion

The recognition of this new species results in there being eight known species of Parapoyux in Japan. The Japanese fauna seems rich in comparison with those of other temperate regions such as North America (7 species), Europe (3) and China (7). This may be related to land use in Japan and the presence of so many wetlands in relation to paddy fields. Most wetlands are small in size and supply water for rice growing. The larvae of Parapoyux species usually live in such small-scale lowland wetlands, typically represented by ponds and marshes, and sometimes in paddy fields among lower mountain areas. Recently, however, moths of the genus are decreasing in numbers and localities (Yoshiyasu & Kamoshida, 2000). Attention is focusing on the larger wetlands of Japan as important habitats for many endangered animals and plants (Ministry of the Environment, 2002). However, there are numerous additional

### Table 1. Diagnostic characters of adults of three Parapoyux species.

<table>
<thead>
<tr>
<th>Characters</th>
<th>P. moriutii n. sp.</th>
<th>P. vitallis</th>
<th>P. rectilinealis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labial palpus</td>
<td>fuscous laterally</td>
<td>fulvous</td>
<td>fulvous</td>
</tr>
<tr>
<td>Forewing</td>
<td>indistinct</td>
<td>represented by two dots</td>
<td>indistinct</td>
</tr>
<tr>
<td>Discocellular lunule</td>
<td>anterior portion weakly curved</td>
<td>anterior portion weakly curved</td>
<td>anterior portion oblique or weakly ex-curved outerly</td>
</tr>
<tr>
<td>PMW</td>
<td>concave behind apex</td>
<td>broadly curved</td>
<td>slightly concave behind apex</td>
</tr>
<tr>
<td>Hindwing</td>
<td>anterior portion separated, whitish</td>
<td>continuous to near outer margin, whitish</td>
<td>anterior portion separated, shifted distally, silvery</td>
</tr>
<tr>
<td>Wing shape (termen)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female genitalia</td>
<td>short, spherical, with a pair of narrow signa, approximated at apex</td>
<td>long, ovoid, with a pair of broad signa, parallel-sided</td>
<td>long, ovoid, with a pair of narrow signa, parallel-sided</td>
</tr>
<tr>
<td>Corpus bursae</td>
<td>wide</td>
<td>narrow</td>
<td>narrow</td>
</tr>
<tr>
<td>Ostium bursae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male genitalia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tegumen (dorsal view)</td>
<td>almost as long as wide</td>
<td>longer than wide</td>
<td>wider than long</td>
</tr>
<tr>
<td>Uncus (lateral view)</td>
<td>strongly curved downwards to apex</td>
<td>weakly curved downwards to apex</td>
<td>strongly curved downwards to apex</td>
</tr>
<tr>
<td>Valva</td>
<td>long, without long setae on costa</td>
<td>long, without long setae on costa</td>
<td>short, with long setae on costa</td>
</tr>
</tbody>
</table>
wetlands under 1 ha that are inhabited by valuable insects and plants, and these areas are still endangered as a result of environmental change and human activity. As the larvae of *Parapoyx* species rely on respiration in water through tracheal gills protruding from the body wall, it is believed that water quality has a direct effect on the survival of this group of moths. This suggests that species with tracheal gills are much more sensitive to water pollution than other aquatic insects. For example, although *P. vittalis, P. fluctuosalis* (Zeller), *P. stagnalis (=depunctalis)* (Walker) and *P. usuriensis* (Rebel) reportedly feed on rice plants in Japan (Yoshiyasu, 1985), all of these species were very rare in my recent surveys. Additionally, *P. moriutii* n. sp. and *P. rectilinealis* are native to Japan and are restricted in their distributions. *Parapoyx rectilinealis* at present is unknown in any place other than Midoroike Pond of Kyoto city, in Kyoto, and was listed as one of the most endangered species in Kyoto (Yoshiyasu, 1885; Kyoto Prefecture, 2002), while *P. moriutii* could not be collected in the neighboring places except for a narrow area in South Osaka to North Wakayama. Taking all of these facts into consideration might suggest that all species of the genus *Parapoyx* ought to be listed in red data books in the future. Moreover, these species may represent good biological indicators of the health of wetland environments.

Acknowledgments

I am grateful to the late Prof. Sigeru Moriuti, Osaka Prefecture University, who always encouraged me to continue the taxonomic study of the pyraloid moths. My thanks are also due to Ms. M. Murase, Wakayama City, for giving me the specimens of the new species.

References


摘要

吉安 裕：ミズメイガ亜科（ツトガ科）の1新種とその保全

大阪府南部の堺市およびそれに隣接した和歌山市の丘陵農村地帯からツトガ科ミズメイガ亜科の1新種,
Parapoynx moriutii ミサキコミズメイガ（新称）を見いだし、記載した。本種成虫は P. vitalis イネコミズメイガおよび P. rectilinealis ヒメコミズメイガに斑紋が類似するが、ミサキコミズメイガでは腹部後半の背面が一定に橙黄色であるのに対し、後の 2 種では腹部は白色で各節後端に黒褐色の輪状の斑紋があることできちんと区別できる。また、これら 3 種は斑紋、翅形、雌交尾器の corpus bursae および雄交尾器の tegumen 等が異なる (Table 1)。本新種の野外における寄主植物は不明であるが、室内で産卵させて得られた幼虫に Potamogeton crispus エビモを与えて飼育したところ羽化までの発育が可能であった。この新種を加え、日本産 Parapoynx 属は 8 種となる。本属の種は、いずれも池、水田などの止水域に生息し、幼虫期において気管を通して呼吸することから、同じ水域の種と比較して水質の影響をうけやすいと考えられ、実際に全国的に個体数や分布地が減少していることもあり、局所的なミサキコミズメイガやヒメコミズメイガだけでなく、全種がレッドリスト候補の対象になりうると考えた。
Homology and taxonomic importance of the tibial hair-pencil and its related structures in the family Geometridae (Lepidoptera)

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Abstract  The tibial hair-pencil and its related structures known as a scent organ were examined in the family Geometridae. In addition to the tibial hair-pencil and the setal ornamentation of the abdominal sternum 3, a pair of lateral projections of the sternum 2 was recognized as a related structure in the subfamilies Archiearinae, Ennominae, Desmobathrinae, and Geometrinae. Similar projections were also found in the subfamily Sterrhinae. It is possible that the tibial hair-pencil and its related structures evolved at least twice in the family, that is, in the common ancestor of the family and in Larentiinae. Presence of these structures was considered to be primitive in the family and of no taxonomic importance, but these structures often showed important diversification for the taxonomic study.

Introduction

Presence of the male hind tibial hair-pencil, one of the secondary sexual characters, is found in many geometrid species (Forbes, 1948; Common, 1990; Scoble, 1992). When the hind tibial hair-pencil is present in the subfamilies Ennominae, Desmobathrinae, and Geometrinae, the hind tibia is usually swollen and has a longitudinal groove in which the hair-pencil is concealed (Inoue, 1961; Sato, 1984; Holloway, [1994], 1996). And a setal ornamentation of the abdominal sternum 3, a setal comb or a pair of setal patches, is known as a correlated structure with the tibial hair-pencil (Rindge, 1972; Sato, 1984; Holloway, [1994], 1996, 1997). While in the subfamilies Sterrhinae and Larentiinae the tibial hair-pencil is exposed and any modified setae are not found on the sternum 3 (Forbes, 1948; Holloway, 1997). Instead the hind thorax and the abdominal sternum 2 are modified in both subfamilies (Hashimoto, 1992; Holloway, 1997). In the subfamily Archiearinae the hind tibial hair-pencil has been also known (Forbes, 1948; Inoue, 1961; Hashimoto, 1997), but the related structures to the hair-pencil have been not recorded so far. The remaining three subfamilies, Oenochrominae sensu strict, Orthostixinae, and Alsophilinae, have not a tibial hair-pencil and any related characters in males (Forbes, 1948; Inoue, 1961; Scoble & Edwards, 1990; Holloway, 1996; Nakajima, 1998; Hausmann, 2001).

In his tentative phylogeny of the Geometridae, Holloway (1997) recognized two major lineages, the Sterrhinae + Larentiinae lineage and the Ennominae + Desmobathrinae + Geometrinae lineage, in the family and suggested that two lineages are segregated by the modification or the setal ornamentation of abdominal sternum 2 and the setal ornamentation of sternum 3, respectively. On the other hand, Pitkin (1996) indicated that the presence of modified setae of the sternum 3 might be homoplasious in the subfamilies Ennominae and Desmobathrinae.

In the present paper, the hind tibial hair-pencil and its related structures are examined and their homology and taxonomic importance are discussed.

Materials and methods

This study is based on 130 geometrid species listed in the appendix and partly based on
Holloway’s studies ([1994], 1996, 1997). The dried or pinned specimens, or the preserved specimens in 75% ethanol are used for observation. The leg and abdomen were detached, and were macerated in 10% KOH solution at the room temperature for 24 to 48 hours. The KOH-treated materials were washed and dissected in 75 % ethanol, after then sometimes stained with aceto-carmine, and were mounted in xylol balsam. Observations and drawings were done under the binocular stereoscope. Dried materials were used for examination by a scanning electron microscope (SEM).

The subfamily classification used here is followed Holloway (1997) and Hausmann (2001).

Results

When the hind tibial hair-pencil is present, it usually arises from inner surface near the femoro-tibial joint, but from dorsal surface in Sterrhinae. The hind tibial groove and the modified setae of abdominal sternum 3 were also recognized in Archiearinae as in the subfamilies Ennominae, Desmobathrinae, and Geometrinae. Many modified scales (Figs 14–15) were observed in the tibial groove in these subfamilies. In addition to the ornamentation of sternum 3, a pair of lateral projections, which seems to be correlated to the tibial hair-pencil, were recognized on the abdominal sternum 2 in Archiearinae, Ennominae, Desmobathrinae, and Geometrinae. In these subfamilies the postero-lateral sides of the sternite 2 are expanded and extending anteriorly, and their distal parts become free lateral projections (Figs 17, 19, 21–26, 32–34). Similar projections (Figs 35–37) were also found in male Sterrhinae with the tibial hair-pencil. This character was not recognized in females and in males without the tibial hair-pencil. In Sterrhinae and Larentiinae some modifications of the metapleuron and the hind leg usually occur in relation to presence of the tibial hair-pencil. A concavity or pouch of abdominal sternum 2 was also correlated to the hair-pencil in both subfamilies. Although only a few species were examined in the present study, the hind tibial hair-pencil and the related structures were not found in the subfamilies, Oenochrominae, Orthostixinae, and Alsophilinae.

Archiearinae (Figs 1, 14, 17–18). The hind tibia with a hair-pencil is swollen at distal 2/3 to form a groove. Inner surface of the tibial groove has many modified setae. Lateral projections of the abdominal sternum 2 are slightly free. The abdominal sterna are closely covered with many hairy and needle-like scales so that the modified setae of sternum 3 are completely concealed by the scales and easily removed by a usual removal treatment of the scales. A pair of setal patches of sternum 3 is distributed rather widely.

Ennominae (Figs 2–5, 15, 19–25). Although the tibial hair-pencil and sternum 3 setae are quite common in Ennominae, they are absent in a quite numbers too: e.g. absent in Azeliniini, Hypochrosini, Palyadini and Scardamiini, in most Baptini and Caberiiini (Holloway, [1994]; Pitkin, 2002). When the hind tibia has a hair-pencil, it is swollen to form a groove. In a few species a distal end of hind tibia is expanded beyond the tibio-tarsal joint as in Geometrinae. A pair of lateral projections of abdominal sternum 2 and the setal ornamentation of abdominal sternum 3 are usually developed, and development of these structures generally depends to that of the tibial hair-pencil. However, there are some exceptions, e.g., in Thinosteryx crocortexera the tibial hair-pencil and the setal ornamentation of abdominal sternum 3 are absent, but a reduced tibial groove and a pair of well-developed projections of the sternum 2 are present (Figs 5, 25), and in Parectropis similaria japonica the hair-pencil and the tibial groove are well-developed, but lateral projections of sternum 2 and the setal ornamentation of sternum 3 are reduced (Figs 3, 21). The setal ornamentation of sternum 3 consists of a comb-like and transverse arrangement of setae distributed densely.

Oenochrominae sensu strict (Fig. 31). The abdominal sternite 2 is well sclerotized and broad,
but shows no modification except for a tympanal organ.

Alsophilinae (Fig. 29). The abdominal sternum 2 is not modified, but has a V-shaped sclerotization interrupted at middle. This sclerotization is similar to venulae in the lower ditrysian Lepidoptera.

Orthostixinae (Fig. 30). The abdominal sternum 2 is unmodified and has not any sclerotization except for a tympanal organ.

Desmobathrinae (Figs 6, 26–28). When the tibial hair-pencil is present, the hind tibia is swollen to form a groove as in Ennominae and Geometrinae. A pair of lateral projections of the abdominal sternum 2 is well developed as in Geometrinae, but a pair of setal patches of sternum 3 is distributed longitudinally. When the tibial hair-pencil is absent, the abdominal sternum 2 is not modified and has a V-shaped sclerotization.

Geometrinae (Figs 7, 32–34). The hind tibia with a hair-pencil is swollen to form a groove, and a distal part of hind tibia is usually developed beyond the tibio-tarsal joint. The tibia is covered with short hairy scales, but in the Dysphania species densely with long hairy scales in addition to the hair-pencil. A pair of lateral projections of the abdominal sternum 2 is well developed. The setal ornamentation of abdominal sternum 3 usually consists of a pair of setal patches, but as indicated by Holloway (1996) in a few genera a single median patch (Fig. 34) distributed longitudinally and in the Dysphania species a single central patch (Fig. 32) distributed transversely like as that of Ennominae.

Sterrhinae (Figs 8–10, 12, 16A–B, 35–38). The hind tibia with a hair-pencil is swollen, densely covered with long hairy scales, and usually does not form a groove. The tibial hair-pencil in most case arises from dorsal surface of tibia near the femoro-tibial joint. Correlated with presence of the tibial hair-pencil, the hind tarsus is usually reduced, and the metaeueoxa, metameron, and abdominal sternum 2 are modified. In the tribe Rhodostrophini the metameron becomes a free flap (Fig. 16C), and the abdominal sternum 2 has a pair of long lateral projections extending postero-laterally and the modified small setae between the tympanal organs at base (Fig. 37). In the tribes Scopulini and Sterrhini the metaeueoxa and
the metameron are elongate and expanded ventrally, and the abdominal sternum 2 has a pair of short and triangle lateral projections extending outwards and a basal concavity, in which the modified scales arise. In these two tribes it was usually observed that the distal part of tibial hair-pencil is inserted in the sternal concavity (Fig. 12). However, in the genus *Somatina* of Scopulini the hind tibia has a longitudinal groove (Fig. 8), in which the hair-pencil is concealed as in the subfamilies Ennominae, Desmobathrinae, and Geometrinae. In this genus the metathorax and the abdominal sternum 2 are not modified except for a pair of lateral projections of sternum 2 extending anteriorly (Fig. 35).

Larentiinae (Figs 11, 13, 16C–D, 39–40). As shown by Forbes (1948), the hind tibial hair-pencil is present only in the tribe Trichopterygini (sensu Forbes; his Lobophorini). In other larentiine species the tibial hair-pencil was not observed. In Trichopterygini sensu Forbes the hind tibia is slender and does not form a groove, and therefore the hair-pencil is always exposed and easily removed so that it is accidentally lost in many specimens. It is well observed that a distal part of the hair-pencil is inserted in the pouch of abdominal sternum 2 (Fig 13). In that case the modified metameron and the lateral side of sternum 2 hold the hair-pencil. Associated with modification of the metameron and abdominal sternum 2, the metaeucocxa rarely becomes long and the metepimeron is also modified (Fig. 16D). Inner
surface of the sternal pouch has many ridges, numerous reticulations and many sensilla (sensilla basiconica) (Fig. 40). Although the tibial hair-pencil is often reduced or secondarily lost in the specific or the generic level of the tribe, the sternal pouch is well remained.

**Discussion**

1. Function

Although the actual function of the hind tibial hair-pencil and its related structures in the family Geometridae has not been elucidated, these have been inferred the scent secreting and dispersing organs (e.g. Sato, 1984; Scoble, 1992; Hashimoto, 1992, 1997; Holloway, [1994]). As shown in other lepidopterous families, e.g. Thyrididae (Whalley, 1974) and Noctuidae (Birch, 1970), the hair-pencil mainly functions as the scent dispersing organ, but mechanism of spread of the hair-pencil is various among the families. In the Geometridae it is considered that the male adult moves the hind leg for spread of a hair-pencil, because the proper muscles associated with a hair-pencil are not found. Presence of the scent secretion glands has also been not proved in Geometridae, but it is known that in the noctuid moth, *Phlogophora meticulosa*, the glands are present at base of the modified scales in the abdominal pockets (Birch, 1970). Therefore it is probable that the scent glands are present or the scent secretion is stored in the tibial groove in Archiearinae, Ennominae, Desmobathrinae and Geometrinae, and in the concavity or the pouch of the abdominal sternum 2 in Sterrhinae and Larentiinae, because in the tibial groove and the sternal concavity or pouch the hair-pencil is concealed or inserted and the modified scales or setae are present. Probably the scent glands are also present at the base of abdominal sternum 2, on which the modified scales are distributed, in the tribe Rhodostrophiini of Sterrhinae (Holloway, 1997).

McQuillan (1985) noticed the paired projections of sternum 2 as the antero-lateral horns in the generic description of *Mnesampela* of Ennominae, but he did not described its function and a relation with the tibial hair-pencil and sternum 3 setae. As to function of the paired projections in Archiearinae, Ennominae, Desmobathrinae, Geometrinae and Sterrhinae, it is considered that these structures show the assistant function as in Larentiinae, in which the modified metameron and lateral sides of the abdominal sternum 2 hold the hair-pencil inserting in the sternal pouch.

On function of the setal ornamentation of abdominal sternum 3 in Ennominae, Sato (1984) and Holloway ([1994]) suggested that it might serve as a means of distributing scent from the hair-pencil. There is another interpretation on function of this character, that is, the setal ornamentation supplies the scent glands, because in the noctuid moth *P. meticulosa* two kinds of secretions from the Stobb’s gland and from the abdominal pockets are necessary (Birch, 1970). Whether this interpretation is correct or not will be proved by the cytological study.

2. Homology

Holloway (1997) considered that presence of the tibial hair-pencil and setal ornamentation of the sternum 3 is an autapomorphy of the Ennominae, Desmobathrinae and Geometrinae lineage. Pitkin (1996) regarded the setal ornamentation of sternum 3 as a synapomorphy of Geometrinae and its presence in other subfamilies as homoplasious because the shape of the setal ornamentation is different among the subfamilies. However, within the subfamily Geometrinae the setal ornamentation shows some differentiation in shape, so that distinction in shape of the setal ornamentation among the subfamilies may not be a confirmed evidence of the homoplaspy. Hashimoto (1997) also regarded presence of the tibial hair-pencil among the subfamilies as a homoplasious character and inferred on combination of the hair-pencil and its related structures that the tibial hair-pencil evolved at least four times within the family, namely in Archiearinae, in Ennominae and Geometrinae, in Sterrhinae, and in
Larentiinae. In the present paper, presence of a pair of projections on the abdominal sternum 2 was recognized as a correlated character with the tibial hair-pencil in the subfamilies Archiearinae, Ennominae, Desmobathrininae and Geometrinae. And in Archiearinae the setal ornamentation of abdominal sternum 3 was also recognized as a related character to the hair-pencil as in Ennominae, Desmobathrininae and Geometrinae. Presence of three correlated structures suggests that similarity of these characters among these four subfamilies may be homologous, although the setal ornamentation shows some differentiation among them.

Holloway (1997) indicated that modification of the abdominal sternum 2 is one of the derived characters in the Sterrhinae and Larentiinae lineage. Modification of the sternum 2 is also related to the tibial hair-pencil, but in both subfamilies the related structures with the hair-pencil are different as follows. 1. The hind tibia is swollen and rarely has a groove in Sterrhinae, but slender and lacks a groove in Larentiinae. 2. The hind tarsus in most case is reduced in Sterrhinae, but normal in Larentiinae. 3. Modification of the metaeucoxa and metameron is variable mentioned above in Sterrhinae, but uniform in Larentiinae. 4. The abdominal sternum 2 has a pair of sclerotized lateral projections in Sterrhinae, but lacks in Larentiinae. 5. Base of the abdominal sternum 2 is variable in modification mentioned before in Sterrhinae, but forms always a free pouch in Larentiinae. Consequently, homology of them between Sterrhinae and Larentiinae is doubtful.

In Sterrhinae it is considered that the character states found in the genus Somatina, in which the hind tibia has a groove with the modified scales and base of the abdominal sternum 2 is unmodified, are primitive conditions, from them more modified conditions are derived in the tribes Rhodostrophiini, Scopulini and Sterrhini. Although the setal ornamentation of abdominal sternum 3 is absent in Sterrhinae, presence of a pair of lateral projections on sternum 2 in the subfamily and the primitive features in the genus Somatina suggest that these scent organs in Sterrhinae may be homologous with those of the subfamilies Archiearinae, Ennominae, Desmobathrininae and Geometrinae.

In Larentiinae presence of the tibial hair-pencil is very rare and found in only the tribe Trichopterygini sensu Forbes (1948). McGuffin (1958) considered that Trichopterygini (his Lobophorini) is a rather specialized taxon in Larentiinae and might be related to the tribe Eupitheciini on the larval characters, but Holloway (1997) regarded the tribe as a basic taxon by modification of the abdominal sternum 2. I will discuss the monophyly of the tribe in another opportunity with a taxonomic significance of the tibial hair-pencil and its related structures.

Although a homology of the shared characters is unresolved until the phylogenetic relationships among the concerned taxonomic groups are confirmed, on the basis of the interpretation mentioned above and the tentative phylogenies by Cook & Scoble (1992) and by Holloway (1997) it could be inferred that the tibial hair-pencil and its related structures evolved at least twice in the family, that is, in the common ancestor of the family and in the tribe Trichopterygini sensu Forbes of Larentiinae, and the secondary reduction occurred in several lineages and many sublineages (including species level), e.g. in Oenoichrominae, in Alsophilinae, in Orthostixinae and in sublineages of Ennominae, Desmobathrininae, Geometrinae and Sterrhinae. Recently the molecular phylogeny of the subfamilies was presented to examine critically the morphological one mentioned above (Abraham et al., 2001). There are some important differences between the morphological and molecular phylogenies, especially in the basal dichotomy of the family: in the morphological one the basal sister taxon is Archiearinae, but in the molecular one is Larentiinae. However, the molecular phylogeny also does not contradict that the tibial-hair pencil has occurred twice in the family.

3. Taxonomic importance
Presence or absence of the hind tibial hair-pencil and setal ornamentation of the abdominal sternum 3 has been often treated as a derived feature in the subfamily or tribal levels (Holloway, [1994], 1996, 1997; Pitkin, 1996, 2002). On the other hand, Rindge (1972) and Sato (1984) indicated that presence or absence of the hair-pencil is probably of more importance as a specific than a generic character in the tribe Boarmini of Ennominae. According to them, the hair-pencil and the setal ornamentation are often secondarily reduced in the species level or even in the intraspecific level in Ennominae. If the above-mentioned hypothesis is correct, presence of the hair-pencil is probably primitive so that only absence (secondary lost) is of taxonomic importance. However, the characters related to the hair-pencil show some important diversification in several taxonomic levels as follows. 1. Presence or absence of the tibial groove: when the hair-pencil is present, the tibial groove is also present (primitive), but absent (derived) in Sterrhinae, probably in the tribal levels (in the Sterrhini lineage sensu Holloway, 1997). 2. Length of the tibial groove: about 2/3 length of the tibia (primitive) in Archiearinae, but almost full length of the tibia (derived) in Ennominae, Desmobathrinae, Geometrinae and the genus Somatina in Sterrhinae. 3. Arising site of the tibial hair-pencil: the hair-pencil usually arises from inner surface of the tibia near the femoro-tibial joint (primitive) in many subfamilies, but from outer surface (derived; probably arising site turned over outwardly) in many Sterrhini lineage of Sterrhinae. 4. Development of a pair of lateral projections: free distal parts are relatively short (probably primitive) in Archiearinae, but free distal parts long (derived) in other subfamilies. This character is often secondarily reduced in relation to reduction or secondary absence of the hair-pencil in Ennominae. 5. Shape of setal ornamentation of the abdominal sternum 3: setal ornamentation consists of a pair of setal patches (primitive) in Archiearinae, in the tribe Desmobathrini of Desmobathrinae and in most Geometrinae, but a single central patch (derived) in a few Geometrinae and a comb-like and transverse arrangement of setae (derived; see Holloway, [1994]: 11) in Ennominae. In addition diversification of the meteaucoxa and metameron in Sterrhinae and Larentiinae is also regarded as a derived character. Therefore detailed examination of these structures with other characters currently used in taxonomy in the geometrid species will contribute to resolution of the homology and to construction of the phylogenetic relationships among the subfamilies or the lower taxonomic groups.

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References


Appendix

The species examined are listed by subfamily and in alphabetical order by genus and species. The species without the hind tibial hair-pencil are accompanied with asterisk.

1. Archiearinae: Archiearis parthenias (Linnaeus) (including three subspecies: ssp. parthenias (Linnaeus), ssp. bella (Inoue), and ssp. elegans (Inoue)).

2. Ennominae: Abraxas niphonibia Wehrli, Aethalura ignobilis (Butler), Agriopis dira (Butler), Alcis angulifera (Butler), Alcis jubata melanonota Prout, Amblychia insueta (Butler), Apocleora rimosata (Butler), Arichanna melanaria fraterna (Butler), Arichanna tetrica (Butler), *Biston betularia parva Leech, *Cabra griseolimbata (Oberthür), *Charispiates formosaria (Eversmann), Cleora minutaria (Leech), *Colotois pennaria ussuriensis Bang-Haas, *Corymica pryeri (Butler), Cystidia truncangulata Wehrli, *Descoreba simplex Butler, *Ectropis crepuscularia ([Denis & Schiffermüller]) Ectropis excellens (Butler), *Epholca arenosa (Butler), *Erannis golda Djakonov, Ereobemophra fulguraria consors Butler, *Euchristophia cumulata (Christoph), *Fascellina chromataria Walker, *Garaeus mirandus
mirandus (Butler), Godonela defixaria (Walker), *Hesperumia silvicola (Inoue), Hypomecis roboraria dispicens (Butler), Istruga vulpulata (Butler), Krananda latimarginaria (Leech), Krananda semihyalina Moore, Lomaspilis opis opis Butler, *Lomographa nivea (Djakonov), *Lomographa temerata ([Denis & Schiffmüller]), *Megabiston plumosaria (Leech), Menophra senilis (Butler), Milionia basalis pryeri Druce, Myrteta angelica Butler, *Nothomiza aureoloria Inoue, *Odontopera aurata (Prout), *Ophthalmitis irrorata (Bremer & Grey), Ourapteryx nivea Butler, Ourapteryx nomurai Inoue, *Pachyerannis obliquaria (Motschulsky), *Pachyligia dolosa Butler, Paradarisa clauoges kurosawai Inoue, Paradarisa consonaria (Hübner), Parectrops similaria japonica Sato, Peratophyga hyalinata grata (Butler), Phanerothys sinearia noctivolans (Butler), *Plagodis dolabraria (Linnaeus), *Plagodis pulveraria japonica (Butler), *Plesiomorpha punctiliaria (Leech), *Protoestrenia leda (Butler), Pseudernannis lomozemia (Prout), Psyla boarminata subcuneata Inoue, Rikiosatoa grisea (Butler), *Synegia ichinosawana (Matsumura), *Thinopteryx crocopherta (Kollar), *Wilemania nitobei (Nitobe), Xerodes albonotaria albonotaria (Bremer).


4. Orthostixinae: *Naxa seriaria (Motschulsky).


7. Geometrinae: Combibaena argentataria (Leech), Combibaena delicatior (Warren), Combibaena procumbaria (Pryer), *Comostola subtilaria nympha (Butler), Dysphania subrepleta subrepleta (Walker), Dysphania transucta transucta (Walker), Eucyclodes infracta (Wileman), Geometra dieckmanni Graeser, Geometra papilionaria subrigua (Prout), Jodis lactearia (Linnaeus), Jodis urosticta Prout, Maxates fuscofrons (Inoue), Maxates grandifascia (Graeser), *Neohipparchus vallata (Butler), Pingasa aignerri Prout, Pingasa alba brunnescens Prout, Tanaorhinus reciprocata (Walker), Thetidia albocostaria (Bremer).

8. Sterrhinae: Idaea biselata (Hufnagel), Idaea effusaria (Christoph), *Idaea muricata (Hufnagel), *Idaea nielseni (Hedemann), Organopoda carnearia (Walker), Probrolepis superans Butler, *Pylargosceles steganioides (Butler), Scopula confusa (Butler), Scopula floslactata claudata Prout, Scopula ignobilis (Warren), Somatina indicataria moratata Prout, *Timandra dichela (Prout), *Traminda aventiaria (Guenée).

摘 要

橋本理志：シャクガ科にみられる後肢節の毛束とそれに関係する構造の相対性と分類上の重要性について

雄成虫にみられる二次性腺器官の一つ，後肢節の毛束は，発香器官として知られ，シャクガ科の多く
の種で観察されている（Forbes, 1948; Common, 1990, Scoble, 1992）．エダシャク亜科（Ennominae），ホ
ソシャク亜科（Desmobrathinae），オオシャク亜科（Geometrinae）では，毛束をもつ場合，肢節の膨ら
みの中に毛束が収納されていて，関係する構造として第3腹板腹板上の刺毛群（刺毛列あるいは対の刺
毛群）が知られている（Ringe, 1972; Sato, 1984; Holloway, [1994], 1996, 1997）．一方，ヒメシャク亜科
（Sterrhinae）とナミシャク亜科（Larentiinae）では，毛束はふつう裸出し，第3腹板の刺毛突出を欠く変
わりに第2腹板に隠れ部あるいは囊状部を有している（Hashimoto, 1992; Holloway, 1997）．本研究では，
後肢節の毛束とそれに関係する構造について，その相対性と分類上の重要性を調べた．

フロシャク亜科（Oenochrominae），ホシシャク亜科（Orthostichinae），フユシャク亜科（Alsophilinae）で
は，毛束を確認できなかった．カバシャク亜科（Archiearinae）では，毛束を有することは以前から知
られていたが，新たに腹部第3腹板上対の刺毛群をもつことが判明した．また，カバシャク亜科，エ
ダシャク亜科，ホソシャク亜科，オオシャク亜科では，腹部第2腹板の後側部から前側方に伸長する対
の突出を有することが判った．この突出は明らかに毛束の有無と関係していた．類似した突出は，ヒメ
シャク亜科にも認められたが，ナミシャク亜科では確認できなかった．ヒメシャク亜科とナミシャク亜
科では，後肢側面の構造にも変異が認められた．

毛束とそれに関係する構造の機能については，シャクガ科では研究がなく推測の域をでないが，肢節の膨
らみや第2腹節の隠れ部あるいは囊状部には，毛束が全部あるいは一部が収納されている，その内部に
は特殊な構造などがみられたので，発香物質の分泌細胞があるか，分泌物質が貯蔵されている可能性が
考えられた．

肢節の毛束と関係して，肢節の膨らみ，第2腹板側方の突出，第3腹板状の刺毛群が，カバシャク亜科，
エダシャク亜科，ホソシャク亜科，オオシャク亜科に共通してみられることは，これらの形質が4亜科
で相当であることを示唆している．ヒメシャク亜科の毛束をもつ多くの群は，後肢側面，後肢節，第2
腹板基部における形状の変化，第3腹板の刺毛の欠如などに著しい変異が生じている点で，上記4亜科
と異なっていた．しかし，Somatina 種では肢節は膨らみ，その内部に毛束が収納されていること，後肢
側面と第2腹板基部は変化しないことなど，上記4亜科の構造と類似することから，ヒメシャク亜科の
原生的な状態を示すと考えられた．それゆえ，ヒメシャク亜科にみられる形質も，上記4亜科と起源を
一にする可能性がある．一方，ナミシャク亜科では，肢節の毛束の存在は稀で，肢節は特化せず，他の
構造もいずれの亜科とも異なっているので，本亜科で独自に進化したものと推測された．

毛束とそれに関係する構造は，さまざまな分類群レベルで重要な変化が認められることから，シャクガ
科の分類にとって重要な形質となりうる．したがって，シャクガ科の分類記載を行うに当たり，交尾器
だけでなく発香器官の有無や構造の詳細な記載が，シャクガ科内でのこれらの形質の相対性を解明し
亜科や下位分類群の系統関係の構築に貢献すると思われる．