A Systematic Study of the Nymphulinae and the Musotiminae of Japan (Lepidoptera: Pyralidae)

YUTAKA YOSHIYASU

Abstract: The pyralid subfamilies Nymphulinae and Musotiminae of Japan are revised. In the Nymphulinae, a new genus *Potamomusa* is proposed for 2 species, *Cataclysta midas* Butler and a new species *aquilonia*. The genus *Elophila* contains 8 species belonging to 3 subgenera, *Elophila s. str.*, *Munroessa* Lange and *Cyrtogramme* subg. nov. And 4 new species, *Potamomusa aquilonia*, *Elophila* (*Munroessa*) *miurai*, *Parapoynx rectilinealis*, *Parthenodes fuscalis*, and a new subspecies of *Elophila* (*Elophila*) *interruptalis* are described and added to the Japanese fauna. *Oligostigma bilinealis* Snellen is transferred to *Parapoynx* Hübner and *Nymphula nigra* Warren is newly combined with *Parthenodes* Guenée. *Elophila* (*Cyrtogramme*) *melagynalis* (Agassiz) and *Eoophyla conjunctalis* (Wileman et South) are recorded from Japan for the first time. As a result 32 nymphuline species belonging to 9 genera are known from Japan. The immature stages of 14 species are also described for the first time.

In the Musotiminae 2 new genera, *Neomusotima* and *Melanochroa*, and 4 new species, *Neomusotima fuscolinealis*, *Melanochroa yasudai*, *Musotima dryopterisivora* and *Musotima tanzawensis* are described from Japan. Totally, the Japanese Musotiminae consist of 5 species belonging to *Musotima Neomusotima* and *Melanochroa*.

In addition, the systematic position of the Nymphulinae and Musotiminae is discussed.

Contents

Laboratory of Entomology, Faculty of Agriculture,
Kyoto Prefectural University, Shimogamo, Kyoto 606, Japan.
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1. Introduction

The Nymphulinae are a comparatively small subfamily in the Pyralidae. There are about 700 nominal species in the world. It is noted that species of this group flourish in the tropical and subtropical areas, *i.e.*, Neotropical and Oriental Regions. Although the Lepidoptera are known to be principally terrestrial, the pyralid moths belonging to the Nymphulinae are peculiar in that almost all species are aquatic in their larval and pupal stages. Moreover, the structure and behaviour of the adult females are adapted to the aquatic life in deep connection with the egg-laying habits. The aquatic species of the Nymphulinae live in a wide range of habitat, *i.e.*, the stagnant ponds or lakes to rapid streams.

However, it is recently known that some species are terrestrial, *i.e.*, *Undulambia polystichalis* Capps (Kuitert et Dekle, 1962), *Musotima acclaralis* Walker (=*Musotima dryopterisivora* sp. nov.) (Nakamura, 1978), *Nymphicula saigusai* Yoshiyasu and *Nymphicula junctalis* (Hampson) (Yoshiyasu, 1980). These terrestrial species show the differences in their life histories

to some extent.

In addition, the morphological divergences of the adults in the subfamily are also noticed. A revision of North American species of this subfamily was already made by Lange (1956), and again by Munroe (1972). Munroe (*loc. cit.*) admitted 3 tribes in the Nymphulinae. Those are Nymphulini Handlirsch, 1925, Argyractini Lange, 1956 and Ambiini Monroe, 1972. Recently Speidel (1981) raised Ambiini *sensu* Munroe to the subfamilial rank as the Musotiminae. This is a first revisional work on the Japanese Nymphulinae based on the modern taxonomic standpoint.

In the course of the present study, it is confirmed that *Ambia* Walker and *Undulambia* Lange are greatly different from the other nymphuline genera by the genitalic structures and the larval morphology. Therefore, these 2 genera are transferred from the Nymphulinae to the Musotiminae *sensu* Speidel. And 2 new genera, *Neomusotima* and *Melanochroa*, are described under the Musotiminae.

As a result of my present work, 32 species, including 5 new species and 2 unknown species, belonging to 9 genera were listed for Japanese nymphuline fauna. A new genus and a new subgenus are described in the Nymphulinae. The genus *Munroessa* Lange is treated as a subgenus of *Elophila s. lat.* together with a new subgenus *Cyrtogramme*. And a new combination is made for 5 species.

On the other hand, 5 species belonging to 3 genera, including 2 new genera, are treated here to belong to the subfamily Musotiminae, of which 4 species are described as new to science.

The specimens on which the present paper is based were derived from the following collections: Kyushu University (KU), Hokkaido University (HU), University of Osaka Prefecture (UOP), Ryukyu University (RU), Mejio University (MU), Ehime University (EU), Dr. Inoue's collection (IC), Mr. Miura's collection (MC) and Kyoto Prefectural University (KPU).

The types of the new species are deposited in Kyushu University, Fukuoka.

2. Historical review of the systematic position of the Nymphulinae *s. lat.* in the Pyralidae

Duponchel (1844) first distinguished the Nymphulinae from other subfamilies as his subtribe Nymphulites. But some European authors (Hübner, 1796; Guenée, 1854; Meyrick, 1885, and others) did not treat this as a compact group of the moths.

Hampson (1897) described many species under the Hydrocampinae on the world-wide basis and tried to indicate the phylogenetic relationship depending only on external characters. He characterized this subfamily by the vein R_2 of the forewing being stalked with R_{3+4}. For some exceptional species (*i.e.*, R_2 is free from R_{3+4}) he thought that the long maxillary palpus which is delated at the tip is important.

In his monograph of the Lepidoptera of New York and neighboring states, Forbes (1923) divided the Nymphulinae from the allied subfamily Pyraustinae by the presence of the stalked R_2 vein with R_{3+4} in the forewing. But the recent authors consider this feature is

not enough to characterize the subfamily (Sylven, 1947, Lange, 1956, and others).

The morphological work on the genitalia by Pierce & Metcalf (1938) affected the systematic study of Pyralidae as well as the other lepidopterous groups. They divided the Pyralidae into 7 subfamilies (families in their sense) and treated the Nymphulinae as an independent group. They suggested that the Nymphulinae would be included in the Pyralinae because of the well developed gnathos in the male genitalia.

Sylven (1947) examined many characters which were previously considered to be important, although his work is restricted to the Swedish specimens. He recognized the genitalic characters were of great value, but did not disregard the other external characters. Then he concluded that the Nymphulinae are designated by having the following characters: Vein R_5 in forewing free; R_2 free or stalked with R_{3+4}; R_3 and R_4 stalked; Sc ($=Sc+R_1$) in hindwing anastomosed with R ($=Rs$); M_1 free; Labial palpus curved upwards with a long narrow end joint, longer than half of the medial joint; maxillary palpus well developed with scarce and loosely fastended scales; male genitalia with a well-developed gnathos; and larvae aquatic.

Lange (1956) presented a fine revisional work for the North American species of this subfamily. He examined the type species of the genus not only from Nearctic but from the other Regions, too. He assumed that the Nymphulinae are a monophyletic origin possibly derived from the *Scoparia*-like pyraustid ancester, since "primitive" Nymphuline *Neurophyseta* has the lateral lobe on the valva of the male genitalia which is in common with *Scoparia* of the Scopariinae. Considering the adult and the larval characters, he divided the Nymphulinae into two tribes. The tribe Nymphulini Handlirsch, 1925, are distinctive in having the following characters: Forewing without vein 1A; hindwing with vein M_2; entire vein 1A present on hindwing; middle and hind legs of females lacking tibial swimming hairs; female genitalia without signum, or if present, usually arranged as compact groups of spines. The larvae of this group are plant feeders, with or without gills, often making tubes or cases of leaves in which they live. The mandibles of the larvae are small and the teeth are arranged in a semicircular fashion for feeding leaves.

Another tribe Argyractini Lange, 1956 are distinctive in having the next characters: Forewing provided with vein 1A; hindwing lacking vein M_2; vein 1A vestigial, occasionally entire; middle and hind tibiae of females with a well-developed row of swimming hairs; female genitalia without signum, or with scattered or spirally arranged thorn-like spines, or with small spines arranged in extensive bands. The larvae of this group are adapted to aquatic life, feeding on algae and diatoms on the surface of rocks under silken webs, often in fast-flowing streams, or in lakes, or springs. The mandibles of the known species are large and flattened, and the teeth are arranged in a flat plane. The known larvae have blood gills. The adult females of the known species are capable to plunge into water and deposit their eggs on rocks, sometimes several feet under water.

In his recent revision of North American species of Pyralidae, Munroe (1972) divided the Pyralidae into 3 groups, *i.e.*, Midiliformes (containing only Neotropical Midilinae), Pyraliformes (Pyralinae and other allied subfamilies) and Crambiformes (Crambinae, Nymphulinae and other allied subfamilies). The classification is mainly based on the struc-

ture of the tympanic organs with some external characters. He designated these groups as follows: Midiliformes with tympanic bullae small and widely separated; Pyraliformes with tympanic bullae separated, more or less apposed, and without praecinctorium; Crambifomes with tympanic bullae apposed along mid-ventral line, and forming two cavities between thorax and abdomen, and with praecintorium more or less developed, furnished with scales distally. He also took an account of the inter-relationship of infra-group on Pyralidae. It seems to me that he considered the Nymphulinae are a relatively primitive group in Crambiformes for reasons of: The vein CuP (Cu_2 in his sense) of the forewing present in the margin of wing in some genera (*e.g. Neoschoenobia*) and tympanic bullae simple compared with other Crambiformes; the gnathos in the male genitalia large and not fused with the tegumen. But he did not show any clear relationship among the subfamilies in the Crambiformes.

Roesler (1973) showed the intra-relationship in the pyralid subfamilies. He divided the Pyraloidea into the next 4 families: the Acentropidae, the Crambidae, the Pyralidae and the Galleriidae. And the Nymphulinae are included in the Crambidae.

Kuzunezov *et al.* (1979) also discussed the phylogenetic relationship of the Pyralidae *s. lat.* They divided the Pyralidae *s. lat.* into the Phycitidae, the Pyralidae, the Pyraustidae and the Crambidae. And the Nymphulinae are included in the Pyraustidae.

The studies of Roesler (1973) and Kuzunezov and Stekolnikov (1979) will be discussed later in detail.

Speidel (1981) stated the European genus *Acentria* should be treated as a nymphuline genus. He thought that the enlargement of the 2nd to 4th abdominal spiracles in the pupa of *Acentria* was a shared character with other nymphuline genera and recognized as an autapomorphic character for the above group. If his consideration is correct, the subfamilial name Nymphulinae can not be used. His treatment is as follow:

Subfamily Acentropinae Stephens

Acentropidae Stephens, 1835.

Synonyms: Nymphulites Duponchel, 1844; Hydrocampidae Guenée, 1869; Acentridae Speyer, 1869; Acentropodidae Wocke, 1874.

But in this paper I followed Munroe (1972) and Fletcher and Nye (1984) on the classification of Pyralidae except the Musotiminae being a distict subfamily because I could not study the specimens of *Acentria* species in detail.

3. Key to the subfamilies of Pyralidae from Japan based on adults (modified after Munroe, 1972)*

1. Praecinctorium developed; tympanic bullae fused medially (Series Crambiformes) 2
— Praecinctorium absent; tympanic bullae separated or approximated (Series Pyraliformes) 10
2. Chaetosemata present 3
— Chaetosemata absent 8
3. Male genitalia with transtilla undeveloped 4
— Male genitalia with transtilla developed 5
4. Forewing with vein CuP on wing margin; proboscis almost reduced; male genitalia with coremata

*The Peoriinae is excluded in this key.

on valval base ····· Schoenobiinae
— Forewing usually without vein CuP; proboscis well developed; male genitalia without coremata on valval base ····· Nymphulinae
5. Labial palpus usually upturned; forewing with vein R_2 stalked or fused with R_{3+4}; female genitalia with ostium bursae partly sclerotized ····· Musotiminae
— Labial palpus usually porrect; forewing with vein R_2 separated from R_{3+4}; female genitalia with ostium bursae evenly membranous ····· 6
6. Forewing usually with weakly raised patches of black scales; hindwing with cubitus not distinctly pectinated with hair-like scales; male genitalia with height of tegumen almost as long as uncus ····· Scopariinae
— Forewing without raised patches of black scales; hindwing with cubitus having hair- like scales; male genitalia with height of tegumen much longer than uncus ····· 7
7. Hindwing with cell closed, vein M_1 widely separated from Rs ····· Anchylolomiinae
— Hindwing with cell open, vein M_1 basally approximated to Rs ····· Crambinae
8. Forewing with vein 3A looped ····· Pyraustinae
— Forewing with vein 3A straight ····· 9
9. Male genitalia with gnathos poorly developed ····· Glaphyrinae
— Male genitalia with gnathos well developed ····· Evergestinae
10. Chaetosemata present; male genitalia with gnathos well developed ····· 11
— Chaetosemata absent; male genitalia with gnathos undeveloped ····· Galleriinae
11. Hindwing with veins $Sc+R_1$ and Rs fused at base ····· 12
— Hindwing with veins $Sc+R_1$ and Rs separated ····· 13
12. Forewing with veins R_3 and R_4 completely fused ····· Phycitinae
— Forewing with veins R_3 and R_4 stalked ····· Pyralinae (part)
13. Forewing above tufted with scales; hindwing with veins $Sc+R_1$ and Rs anastomosed at base ····· Epipashiinae
— Forewing above not tufted with scales; hindwing with veins $Sc+R_1$ and Rs only approximated ····· Pyralinae (part)

4. Key to the subfamilies of Pyralidae from Japan based on larvae

1. Ninth abdominal segment with 3 L setae ····· 2
— Ninth abdominal segment with 1 or 2 L setae ····· 3
2. Basal dark ring present in base of SD1 seta on 8th abdominal segment and also on the other segment(s) too ····· 4
— Basal dark ring present in base of SD1 seta only on 8th abdominal segment ····· Epipashiinae
3. Ninth abdominal segment with 1 L seta ····· 5
— Ninth abdominal segment with 2 L setae ····· Nymphulinae (part)
4. D2 seta on both sides of 9th abdominal segment arising on a same pinaculum; SD1 seta on mesothorax without dark ring ····· 6
— D2 seta on both sides of 9th abdominal segment arising on separated pinacula; SD1 seta on mesothorax with dark ring ····· Phycitinae
5. Head with O1, O2 and O3 setae on the same line ····· Nymphulinae (part)
— Head with O1, O2 and O3 setae not on the line ····· 7
6. SD1 seta with dark ring on 1st abdominal segment ····· Galleriinae
— SD1 seta without dark ring on 1st abdominal segment ····· Pyralinae
7. L2 seta reduced on 1st to 8th abdominal segments ····· Schoenobiinae

— L2 seta normal on 1st to 8th abdominal segmnents 8
8. Abdomen with pinacula undeveloped ..... Musotiminae
— Abdomen with pinacula developed 9
9. Mesothorax with 2 SV setae ..... Crambinae
— Mesothorax with 1 SV seta ..... Pyraustinae

5. Subfamily Nymphulinae Duponchel

Nymphulites Duponchel, 1844: 201.
Hydrocampinae Ragonot, 1891: 445.

Type-genus: *Nymphula* Schrank, 1802.

5.1 Historical review on Japanese Nymphulinae

The first species of the subfamily Nymphulinae described from Japan is *Nymphula corculina* (Butler, 1879) taken from Yokohama as *Oligostigma corculina* Butler. Since then Butler (1881), Pryer (1885), Leech (1889), Hampson (1896), Matsumura (1900, 1917), South (1901), Wileman (1911) and Marumo (1923) worked on Japanese species. Shibuya (1929) revised the Japanese species based on the system of Hampson (1896, 1897) and recognized 34 species and 1 variety belonging to 16 genera. Later some of these species and genera were transferred to Pyraustinae by Inoue (1954) on the basis of the male genitalia. In 1974, Inoue newly recorded 4 nymphuline species and in 1979 and 1980, Yoshiyasu described one unrecorded and 4 new species of which 2 species had been known in the wrong names in Japan. In the recent book "The Moths of Japan", Inoue (1982) added 2 described and 2 undescribed species from Japan. Twenty nine species belonging to the Nymphulinae *s. lat.* have been known from Japan up to the present.

5.2 Morphology and terminology

A. External characters

Head

Among the head characters, the labial palpus has been used as an important one (Hampson, 1896; Sylven, 1947). Here the general characters appearing in the Nymphulinae are discussed.

Frons: The area is usually rounded and smoothly scaled, not so produced and variable in color.

Vertex: This is a posterior portion of antennal base, usually a little elevated.

Antenna: The antenna is usually thick in the male and ciliate in the female. The male antenna of *Eoophyla* is compressed laterally.

Labial palpus: The palpus is 3-segmented, and more or less ascending, but it is rather porrect in *Parthenodes* and *Paracymoriza*. The sparse and long scales are arisen on the ventral surface. The 3rd segment is rather narrow and longer than 1/2 the length of the 2nd as stated by Sylven (1947).

Maxillary palpus: The palpus is 4-segmented as in the other Pyralidae. It is rather long and dilated by the scales at the apex.

Proboscis: This is well developed except for much short ones in *Elophila* (*Cyrtogramme*)

and *Neoschoenobia* as in Schoenobiinae. The scales are arisen at the base.

Legs

The legs of the Nymphulinae are much longer in the Pyralidae. In the Nearctic *Parargyractis*, the mid and hindtibiae are furnished with a row of special scales (= "swimming hair" after Lange, 1956). But no special scales are observed in the Japanese species. The spurs are moderate in length in the Nymphulinae.

Wing venation

Forewing. As mentioned in the previous paragraph, the basal anastomosis of the veins R_2 and R_{3+4} has been regarded as a good diagnosis for the Nymphulinae. But the condition of this character is very variable in the Japanese species as follows:

Elophila (Elophila) . . . . . R_2 separated from R_{3+4}
Elophila (Cyrtogramme) . . . . . R_2 anastomosed with, or separated from R_{3+4}
Elophila (Munroessa) . . . . . R_2 connated with R_{3+4}
Nymphula . . . . . R_2 anastomosed with R_{3+4}
Neoschoenobia . . . . . R_2 widely separated from R_{3+4}
Parapoynx . . . . . R_2 anastomosed with or separated from R_{3+4}
Paracymoriza . . . . . R_2 connated with R_{3+4}
Parthenodes . . . . . R_2 connated with R_{3+4}
Potamomusa . . . . . R_2 anastomosed with R_{3+4}
Eoophyla . . . . . R_2 anastomosed with R_{3+4}
Nymphicula . . . . . R_2 separated from R_{3+4}

On the other veins there is no characteristic condition except that the vein Cup is present in distal portion of the wing in the genus *Neoschoenobia*.

Hindwing. The vein $Sc+R_1$ is anastomosed with Rs for longer distance compared with the other pyralid subfamilies, especially both veins are completely anastomosed to wing margin in *Nymphicula*. The other veins are as in the other subfamilies of Crambiforms. In North American species of the Argyractini, the vein M_2 is absent or completely fused with M_3. But in the Japanese species the vein M_2 is distinct without exception.

B. Wing marking

As shown in Fig. 93, I newly designated the wing marking of the Nymphulinae. I recognized 8 line components, *i.e.*, basal line (BL), subbasal (SBL), first discal bar (DBl), 2nd discal bar (DB2), medial line (ML), postmedial line (PML), submarginal line (SML) and marginal line (MGL) from base to termen. In the case DBl is continuous posterior portion of ML, the complex line is used as antemedial line (AML). The ground components are as follows: Antemedial ground (AMG), situated between SBL and DBl; postmedial grounds (PMG) between PML and SML; submarginal ground (SMG) between SML and ML. And there are white areas besides the lines and grounds. For the convenience of the description, I named the areas as follows: Antemedial white area (AMW), situated distally to AMG; white area A (WA), a discal white portion between DBl and DB2; white area B (WB), encircled by anterior portion of ML and PML; white area C (WC) between posterior portion of ML and PML; postmedial white area (PMW), situated distally to PML;

submarginal white area (SMW) between PMG and SML. In the discal white portion of AMG white area D (WD) is sometimes formed.

C. Male genitalia

As already stated in the historical review, the study concerning on genitalia of the Pyralidae was first done by Pierce and Metcalf (1937). They designated the new terms several portions of the genitalia. The terminology of them is almost followed by Tuxen (1956). The main diagnosis used for the classification of the Pyralidae is the presence or absence of the gnathos in the male genitalia. Many authors have admitted the importance of this character and divided the family into subfamily rank by using it (Munroe, 1950, 1972; Inoue, 1954; Marion, 1956, 1975; Roesler, 1973 and so on). But so far as I know, the gnathos in my sense is present in all Japanese subfamilies except for the Galleriinae variable in shapes. For example, in the Pyraustinae, the gnathos previously known as an "agnathi", is recognized as a small lateral plate behind the tegumen posteriorly, although the cochlear is undeveloped. Here I newly designated the gnathos in consideration of other genital structures, based on Japanese Pyralidae, especially on the Nymphulinae. A new term tegumeno-ventral plate (t-v plate) is proposed in this study.

The male geni alia are composed of 13 portions as described below, including the adjacent modified segments.

Eighth tergum; A few modifications are shown in this tergum. This is membranous medially in *Parapoynx* (Nymphulinae), and is characteristic to this genus.

Eighth sternum: This is usually short in the Pyralidae and some modifications are also known. In some subfamilies, the tufts of scales are present. In some nymphuline genera (*Nymphula* and allied genera, *Parthenodes* and *Paracymoriza*), the sternum is partly membranous and the posterior margin is modified to form different processes. These processes are possibly modified as a part of ventral support of valvae and arisen idependently in each genus.

Tegumen: It is admitted being the 9th tergum, and posteriorly articulated or fused with the uncus, ventrally connected with the vinculum. In the Pyraustinae, the anterior portion is enlarged to a broad plate as a base of scale tufts (=coremata). In the nymphuline genera, the tegumen is a relatively independent plate from the vinculum, and connected with the latter by the weak sclerite or membrane. There usually exist a membranous portion called "fenestrulla" between the tegumen and the uncus. From the tegumen 3 muscles are running to the uncus (m 1)*, and tube (m 2) and transtilla or t-v plate (m 3).

T-v plate (new term): This plate is situated along the ventral margin of tegumen, articulated or fused with the uncus and the gnathos posteriorly, and the costa of valva ventrally. It appears in only the Nymphulinae and Schoenobiinae, and is enlarged to form a special, ventral process called "subteguminal process" in the Schoenobiinae. In the Nympulinae, this plate is just ventrad of tegumen, significantly expanded laterally, and have two muscles; one (m3) comes from tegumen and the other (m4) from vinculum. Because of these muscles' attachment I consider the t-v plate as an element of transtilla of valva.

*The muscles' numbers are followed after Forbes (1939).

The lacking of transtilla seen in the Nymphulinae and the Schoenobiinae indicate the possibility. Moreover, the free transtillae are admitted in some species of the Phycitinae.

Vinculum: It is said to be the 9th sternum, dorsally connected with the tegumen, and postero-laterally articulated with costa of the valva. In the Musotiminae and *Elophila s. lat.* of the Nymphulinae, the dorso-lateral portion is completely fused with the costa of valva. The vinculum is a supporting sclerite of two muscles; one is from the phallus (m6), and the other is to the costa or weakly sclerotized anellus (=t-v plate) (m4).

Saccus: It is also a component of the 9th sternum, which is reformed to an evaginate process of vinculum at mid-ventral line anteriorly. It is usually uniformly sclerotized, but in some species of the Nymphulinae it is membranous midventrally. This plate has two muscles from near zone of phallus (m7) and to juxta (m8).

Uncus: It is usually admitted as the 10th tergum, but some authors regard it a component of the 12th segment (Matsuda, 1976). In this case the 11th segment represents the cerci which are absent in the Lepidoptera. This lobe is articulated or fused with the tegumen and the gnathos proximally. In the Crambiformes, the uncus is usually well developed. In some genera of the Pyralidae the apex of it is bifurcated. In the Nymphulinae, it is usually very long and simple in shape. The muscle (ml) is inserted in the base from the tegumen.

Anal lobe: This lobe has an anus at posterior end. In the Pyralidae, only the ventral portion is sclerotized and usually called "subscaphium", where the muscle (m2) is inserted from the tegumen. Matsuda (1976) mentioned the sclerite as the element of the 13th segment.

Gnathos: This is situated in the ventral portion of the anal lobe, and articulated with the uncus, t-v plate and tegumen proximally. It takes various shapes in different subfamilies among the Pyralidae. In the Nymphulinae, it is long and furnished with well-developed "cochlear", which is formed by the posterior extension of its midventral portion. In the Pyraustinae, it is reduced to a pair of lateral small plates. The gnathos has no muscle inserted.

Phallus: The intromittent organ is called the phallus collectively. The detailed terminology for each subdivision is followed after Shirôzu (1960). There exist two kinds of muscles externally, that is one from the proximal margin to the vinculum (m6), the other from the subzonal sheath near "zone" to the saccus (m7).

Anellus: This is the intermediate membranous portion between both valvae, dorsally continuous to the base of gnathos, and ventrally extending to the juxta. In some nymphuline genera, the ventral portion of the base of gnathos is weakly or strongly sclerotized. In this study I admit the portion as a part of t-v plate. In addition, in all Nymphulinae, the portion is a wall-like structure to cover the phallus. The portion around the cuticle exterior of phallus is especially called "manica", which has many minute projections in the Nymphulinae.

Juxta: This is situated in the ventral portion of the anellus, and functions as a support of the phallus. In the Nymphulinae, no special process is formed.

Valva: It is a coxopodite of the 9th segment, although the division of coxa and stylus is

absent, therefore a unilobed structure by Matsuda (1976). The subdivision of the inner surface of the valva are as follows: *Transtilla*: It is said that the plate is a dorsal expansion of the 9th sternum in origin (Matsuda, 1976), but in higher Lepidoptera it is completely fused with the costa of valva, and is an extension of the costa. In the Pyralidae the plate has a muscle from the tegumen (m3) when it is well developed. In the Nympulinae as well as the Schoenobiinae the plate is not developed. *Costa*: This is a rather distinct tubular sclerite situated on the dorsal margin of the valva and almost extended to the apex. *Sacculus*: This plate is situated on the ventral margin of the valva, articulated or united with the juxta at proximal portion. From its proximal margin a muscle (m5) is inserted to the base of the harpe. *Ampulla*: This is situated in the postero-dorsal portion of the valva, but its distinct margin is lost in the Pyralidae. So I use sometimes "inner surface" for the place between the costa and the sacculus collectively. When there is a sclerite having stout setae or specialized setae in the corresponding area, the portion is designated as ampulla. *Harpe*: This area usually situated in the postero-ventral portion of the valva, but also not recognized as a distinct area in the Pyralidae. But the area has a muscle attachment from the sacculus (m5). *Cuculus*: As stated above, when the harpe and the ampulla are indistinct, the posterior portion of the valva is wholly named as cuculus. It is described as "inner surface" in this paper, however. *Anellifer*: This is an evenly membranous area continuing from the anellus to the inner surface of the valva. In *Nymphula* and *Elophila* of the Nymphulinae, a tuft of the scales is emitted on this portion.

D. Female genitalia

The female genitalia of the Pyralidae is fundamentaly the same to the other Ditrysian Lepidoptera. The external structures of the Nymphulinae are characteristic in the length of the intermembrane between the segments on terminal segment, the apophyses and the papilla analis. The intermembrane from the 7th segment to the papilla analis are prolonged dorsally; the apophyses are very long; the papilla analis is more or less flattened and prolonged dorsally. These modifications are due to the adaptation of the egg-laying habit of the female to the different environments. For example, the aquatic species living in the stagnant water usually lay the eggs on the underside of the host plant leaves by extending and curving their abdomen, while the species inhabiting the rapid river oviposit the eggs on the flat surface of rocks in the water and does not have the narrowing papilla analis. On the contrary, the internal organs, *i.e.*, bursa, spermatheca and so on, are not significantly modified from the other Ditrysia. But some modifications are recognized in the Nymphulinae. There are almost stable in structure in the generic level.

The following terms are used for the female genitalia in this paper.

Seventh sternum: This is a pregenitalic segment and variable in length, and in some species it is partly membranous. In the Nymphulinae, the sternum is much shorter than the 7th tergum except *Parthenodes* and *Nymphicula*.

Eighth tergum: This is a triangular-shaped sclerite in lateral view. It is usually considerably shorter than the 7th tergum in the Pyralidae. But in the Nymphulinae, it is rather narrow and relatively longer than the other subtamilies. Especially in *Parthenodes*

and *Nymphicula* the tergum is sclerotized in U- or V-shape in dorsal view.

Apophysis anterioris: It is a tubular sclerite, innerly evaginated from the anterior margin of the 8th tergum laterally. This sclerite takes a part of the protracter and the retracter of the segments by the muscles inserted on it. It is very long in the Nymphulinae.

8th sternum: The sternum is usually membranous in the Pyralidae, posteriorly furnished with setae. The setal size in the Nymphulinae is stable in generic level.

Ostium bursae: This is an entrance of the phallus of the male and the base of bursa, shifted in the posterior margin of the 7th sternum. In the Pyralidae it is usually membranous. But in the Musotiminae and Crambinae, it is partly sclerotized.

Ductus bursae: This is an evaginate duct, continuing from the ostium bursae to the circular sclerite (=bursal ring). In the Pyralidae the duct is usually membranous. In the Nymphulinae, it is furnished with many minute spinules innerly.

Bursal ring (new term): This is a circular or semicircular sclerite between the ductus bursae and the corpus bursae. This sclerite is absent in some groups of the Pyralidae. But it is distinct in the Nymphulinae and almost flat in structure. Its dorsal portion in *Nymphula* (*Cyrtogramme*) *turbata* is extended at mid-dorsal line.

Corpus bursae: The portion is situated anteriorly to the ductus bursae, where the insemination occured and the spermatophore is formed. In many cases, the term "corpus bursae" is used for the apical swollen portion, but I use it for the whole portion from the bursal ring to the apex. The apical swollen portion usually has "signum", which are consisting of many spinules. The presence or absence and the shape of it are variable in generic and specific levels, then the signum is an important character in the classification of the Pyralidae as well as of the other Lepidoptera. If the signum is present, it is recognized as a group of spinules or as some scattered large spines in the Nymphulinae.

Cervix bursae: This is membranous swollen sack arisen at the base of the corpus bursae. The sack is become as a base of the ductus seminalis if it is present. This is usually undeveloped in the Pyralidae. In the Nymphulinae, it is well developed in only *Elophila*.

Ductus seminalis: This membranous duct is used for the transportation of the sperm the bursa copulatorix to the spermatheca. The duct is originated from the base of the corpus bursae or cervix bursae and ending to "common oviduct".

Spermatheca: This is a preserving organ of the sperm from the ductus seminalis. And this term is used for the collective portion consisting of the basal gland, utricus, lagena and terminal blind gland (Callahan, 1960). The lagena is a membranous pouch at lateral side of another membranous sack, utricus. The presence of the lagena and its shape are various in generic level, and seems to be reflected in phylogeny.

Papilla analis: This is usually considered to be a complex structure of the 9th and 10th abdominal segments. Matsuda (1976) recognized the terminal soft portion with setae as the 12th segment. But in this paper the complex structure is mentioned as papilla analis. As mentioned above, the organ is flattened and dorsally extending in the Nymphulinae.

Apophysis posterioris: This is an inner evaginate tubular sclerite from the anterior margin of the papilla analis laterally. The formation and function of this are as in the apophysis anterioris. In the Nymphulinae, the apophysis is considerably long, usually longer than the

anterioris.

E. Immature stages

Mature larva

Head: Head cranium is moderately thick except that of *Eoophyla* is very flattened as in North American *Parargyractis*. The setae are more anteriorly situated than in the other leaf-eating pyralids, and the number of the setae is the same as the other pyralid larvae. Hasenfuss (1960) stated that setae O1, O2 and O3 arranging in a straight line is characteristic to nymphuline species, and this condition is usually coincident with Japanese species. But in some species O3 is a little anterior to an extention line between O1 and O2. The labrum is moderate and has 6 pairs of setae dorsally as in the other Pyralidae. In *Potamomusa* and *Paracymoriza*. the seta M2 is changed to a flat, filamentous structure as in North American genus, *Parargyractis*. The mandible is almost rectangular, having developed inner teeth. The mandible of *Eoophyla* is much elongate in relation to the feeding habit of the larva.

Thorax: The prothoracic shield of prothorax is developed, and it is noted that in *Nymphicula* and *Elophila* (*Cyrtogramme*) *nigralbalis* (Caradja), the shields are well developed to include L setae on its area. The posterior portion of the shield is narrowly swollen in *Parapoynx*. This is characteristic to *Parapoynx*. The setal map of thoracic segments is the same as in the other Pyralidae except that seta V1 is absent as well as in the Schoenobiinae. The pinaculum is undeveloped.

Abdomen: The body is cyclindrical but flattened in *Eoophyla*. It is considerably broader than thorax in the mature larva of *Elophila*. The larvae living in the stagnant water have the water-resistant structure (*Elophila*, *Nymphula* and *Neoschoenobia*) or the branched gills (*Parapoynx*) (see Yoshiyasu, 1980b). The larvae living in the river have the non-blanched gills on mesothorax to 9th abdominal segments. The types of the gills and the respiration system are mentioned in another paragraph. The setae are reduced and short except in the caudal segments. This reduction of the setae is related to the larval feeding habit in the web among the host plants, silken sheet or the portable cases. The prolegs in *Parapoynx* and *Potamomusa* and other genera living in the running water are well developed, but in *Elophila*, *Nymphula*, *Neoschoenobia* and *Nymphicula*, they are poorly developed and not adapted to walk. The crochets of the prolegs are biordinal to triordinal, and usually arranged in a complete circle, but in *Elophila* and allied genera they are semicircularly or transversely arranged. The setae of SV are variable in number in the species and genera. The maximum number of the setae on the 1st to 8th segment is 1 (8th), 2 (1st and 7th) and 3 (2nd to 6th segments). The L setae on the 9th abdominal segment are 2 in number except for *Eoophyla inouei* Yoshiyasu with 1 L seta. This is characteristic to the Nymphulinae. As far as I know, the number of L seta on 9th abdominal segment is 1 in the other Crambiformes.

Pupa

The shape of the body is almost as in the other Pyralidae. The abdomen is almost smooth, but in *Elophila* (*Cyrtogramme*) *turbata*, there are transverse clefts on the 4th to 6th abdominal segments dorsally. The setae are usually short or reduced except distinct F1 on

the frons of the head. The mid- and hindlegs are very long and far beyond the apices of the wings. In *Neoschoenobia decoloralis* Hampson, the midleg is completely recognized on ventral surface, and in the other species the midlegs are concealed by the wings. As mentioned by Yoshiyasu (1980b) and Speidel (1981), the spiracles on the 2nd to 4th (or 3rd) abdominal segments in the Nymphulinae are significantly large and protruded at the base, and those of the other segments are reduced. It is suggested that the enlargement of the spiracles is aquired in relation to the aquatic life of this subfamily. And Speidel (*loc. cit.*) considered the enlargement of the spiracle as an autapomorphic condition shared with nymphuline species. The same spiracles are appeared in terrestrial *Nymphicula*.

5.3 Key to the genera of Nymphulinae based on adults

1. Hindwing without a series of black spots on wing margin 2
— Hindwing with a speries of distinct black spots on wing margin 7
2. Forewing with vein CuP distally; wing marking indistinct, evenly unicolorous. ..... *Neoschoenobia* Hampson
— Forewing without vein CuP; both wings usually with distinct marking 3
3. Labial palpus long, porrect 4
— Labial palpus moderate in length, upturned 5
4. Forewing with veins R_2 and R_{3+4} incompletely anastomosed; antenna of male normal in shape ..... *Parthenodes* Guenée
— Forewing with veins R_2 and R_{3+4} completely anastomosed at base; antenna of male flattened ..... *Paracymoriza* Warren
5. Wings rather broad; hindwing with vein $Sc+R_1$ short stalked with Rs (1/2 or a little shorter than length of $Sc+R_1$); male genitalia with a tuft of scales on valval base; female genitalia with corpus bursae short and lacking signa 6
— Wings elongate; hindwing with vein $Sc+R_1$ long stalked with Rs (over 1/2 of length of $Sc+R_1$); male genitalia without a tuft of scales on valval base; female genitalia with corpus bursae very long and furnished with a pair of signa ..... *Parapoynx* Hübner
6. Discocellular lunule distinct in hindwing; male genitalia without fenestrula laterad of tegumen, just continuous with saccus by plate ..... *Elophila* Hübner
— Discocellular lunule in hindwing faint or absent; male genitalia with fenestrula laterad of tegumen, juxta continuous with saccus by membrane ..... *Nymphula* Schrank
7. Small in size; labial palpus slender, strongly upturned; male genitalia with uncus very long, slender ..... *Nymphicula* Snellen
— Large in size; labial palpus rather thick, weakly upturned; male genitalia with uncus moderate in length and stout 8
8. Hindwing without silvery scales on black spots; antennal base slender ..... *Potamomusa* gen. nov.
— Hindwing with silvery scales on black spots; antennal base of male thick ..... *Eoophyla* Swinhoe

5.4 Key to the genera of Nymphulinae based on larvae

1. Larvae terrestrial in life ..... *Nymphicula* Snellen
— Larvae aquatic in life 2
2. Tracheal gills present; prolegs well developed, crochets triordinal and arranged in a circle 3
— Tracheal gills absent; prolegs short, crochets biordinal and almost tranversely arranged 4
3. Tracheal gills branched; larvae living in stagnant water ..... *Parapoynx* Hübner

— Tracheal gills singly emitted in group; larvae living in rapid stream 6
4. Head pale orange to brown; body pale orange; larvae with leaf-mining and stem-boring habit ..... *Neoschoenobia* Hampson
— Head brown to blackish; body whitish; larvae usually with case-making habit 5
5. SD1 seta on prothorax situated along anterior margin of shield ..... *Nymphula* Schrank
— SD1 seta on prothorax situated in center of shield ..... *Elophila* Hübner
6. Body flattened; gills emitted on cupola-shaped expansion; mandible well developed and elongate; larvae make silken sheet on rocks where they live ..... *Eoophyla* Swinhoe
— Body cylindrical; gills emitted from flat body; mandible moderate, almost rectangular; larvae gathering host plants by silk 7
7. Head with many dark maculations ..... *Paracymoriza* Warren
— Head without special maculation ..... *Potamomusa* gen. nov.

5.5 Description

Genus *Elophila* Hübner

Elophila Hübner, 1822 : 54; Speidel, 1984 : 46.
Hydrocampus Berthold, 1827 : 485 (type-species: *Phalaena Geometra potamogata* L., 1758=*Phalaena Geometra nymphaeata* L., 1758).
Type-species: *Phalaena nymphaealis* [Denis & Schiffermüller], 1775.

Elophila (formerly has been known as *Nymphula*) has been to be one of the largest genera in the Nymphulinae until Lange's revision (1956). Lange (*loc. cit.*) revised the genus of the Nearctic Region, and subdivided it into some genera. And this study was followed by Munroe (1972) who considered *Nymphula* (=*Elophila*) contains a small number of species only distributed in Europe and temperate Asia except for one species in North America.

In the Japanese species of this genus, Inoue (1982) transferred some species belonging to *Nymphula* (*Elophila sensu* Speidel) to *Parapoynx*. But the genus of Japan is still heterogeneous. In this paper, a new interpretation is made for *Nymphula sensu* Inoue. In addition, a new subgenus is proposed, the genus *Munroessa* Lange is treated as a subgenus of *Elophila* following Speidel (1984) and a new species and one new subspecies are described. Also 2 species of *Nymphula sensu* Inoue, 1982, are transferred to *Parthenodes* Guenée.

External characters: Rather small to large, with long slender legs and broad wings. Head with frons rounded in female, slightly flattened in male. Vertex somewhat elevated. Labial palpus upturned, shorter in female; basal 2 segments with short and rather rough scaling, the 3rd smoothly scaled and acuminate. Maxillary palpus fairly prominent, rough-scaled. Proboscis variable in length. Ocellellus distinct. Antenna slightly thickned in male, filiform in female; ventral surface densely short-pilose; dorsal surface scaled, fan-shaped in male and rather roughly scaled in female.

Wing shape and venation: Forewing fairly wide, with rather acute apex and weakly sinuated termen. Discoidal cell about 3/4 as long as wing length. Vein R_1 emitted a little before end of discoidal cell; R_2 free or stalked with R_{3+4}; R_5 arising from about anterior angle of discoidal cell, almost straight; M_1 arising behind anterior angle of discoidal cell; M_2 and M_3 emitting together from posterior angle of discoidal cell; CuA_1 arising a little proximal to posterior angle of discoidal cell; CuA_2 emitting from discoidal cell at proximal 3/4; CuP absent; 1A well developed, and 2A+3A rudimentary.

Hindwing broad with narrowly rounded apex and with termen weakly excurved behind apex. Vein $Sc+R_1$ anastomosed with Rs for a short distance, shorter than 1/2 of $Sc+R_1$ beyond discoidal cell; M_1 free; M_2 and M_3 arising from posterior angle of discoidal cell; these veins curved and approximated to each other; CuA_2 emitting from discoidal cell just beyond the middle. Discoidal cell about 1/2 as long as wing length; discocellulars moderately curved.

Wing marking: Wing marking on upperside is characterized as follows: — Forewing, (1) line components so converging to posterior angle of discoidal cell that marking show symmetrical system in appearance; (2) accompanying with (1), 3 characteristic white and rounded areas formed by encircling by two components, *i.e.*, DB1 and DB2 (white area A=WA), anterior ML and anterior PML (WB), and posterior ML and posterior PML (WC); (3) in discoidal cell small white area (WD) formed; (4) SML almost extending parallely with termen, although in some species the line is interrupted by veins. — Hindwing, (1) BL and SBL almost diminished; (2) posterior portion of ML continuous to DB1 and forming a straight line; and (3) PML usually connected with discocellular lunule, which is a complex line by fusing anterior portion of ML with DB2, at posterior angle of discoidal cell.

Male genitalia: Tegumen as long as or longer than wide; t-v plate broad and roundly expanded ventrally. Vinculum short, connected with tegumen by weakly sclerotized plate, almost shorter than height of tegumen; postero-dorsal portion united with costa of valva. Saccus flat. Fenestrula absent except secondary membranous area at uncal base in the subgenus *Cyrtogramme*. Uncus variable in length. Gnathos with base completely fused with t-v plate. Anellifer of valva with a tuft of scale-like setae in group; apical margin furnished with long setae. Phallus with coecum penis well developed, about 1/2 as long as whole length of phallus; vesica with cornuti. Juxta almost continuing to saccus by a pair of sclerotized plates. In addition, 8th sternum partly membranous, with posterior projection at mid-ventral line.

Female genitalia: Ostium bursae wide. Ductus bursae rather short, ordinally with minute spines, and continuing to bursal ring near base of cervix bursae. Corpus bursae usually lacking a compact group of signa, having many scattered spinules near base of cervix bursae in *Elophila s. str.* and *Munroessa s. str.* Cervix bursae well developed. Spermatheca without lagena. Eighth tergum rather long, posterior margin with long setae; 8th sternum membranous, with long, more or less lined setae. Papilla analis long, flattened, posteriorly with setae, of which ventral ones longer than dorsal ones. Apophysis posterioris fairly longer than anterioris. In addition, 7th sternum considerably short, about 2/3 as long as the tergum.

Remarks: This genus is allied to *Synclita* Lederer, 1863 and *Contiger* Lange, 1956 of North America in having the hindwing with $Sc+R_1$ short-anastomosed with Rs, the male genitalia with posterior process of 8th sternum and the female genitalia without a compact group of signa. But *Elophila* is distinguished from the above 2 genera by the presence of a compact group of setae on anellifer and more or less specialized setae on ampulla in the valva of the male genitalia.

Key to the subgenera of *Elophila* based on abults

1. Hindwing with white line posterior to PML interrupted; male genitalia with uncus long and curved, gnathos long and narrowing to apex; female genitalia with signa distinct, grouped or scattered (East Palearctic and Nearctic) ..... *Munroessa*
— Hindwing with white line posterior to PML continuous to posterior margin near tornus; male genitalia with uncus short and apical portion blade-like in shape; female genitalia without distinct signa 2

2. Wing coloration sexually dimorphic; proboscis reduced, short; male genitalia with narrow fenestrula; female genitalia with corpus bursae short (Oriental to East Palearctic)……*Cyrtogramme* subgen. nov.
— Wing coloration not dimorphic; proboscis well developed; male genitalia without fenestrula; female genitalia with corpus bursae long (Holarctic)……*Elophila s. str.*

Key to the subgenera of *Elophila* based on larvae and pupae

1. Larva with prothoracic shield well developed, metallic black; pupa with spiracle on 2nd abdominal segment reduced……*Cyrtogramme* subgen. nov.
— Larva with prothoracic shield moderate, pale brown to brown; pupa with spiracle on 2nd abdominal segment distinct …… 2
2. Larva with head and thorax having blackish bands or spots; pupal spiracle on 2nd abdominal segment more or less smaller than those on 3rd and 4th segments……*Munroessa*
— Larva with head and thorax evenly pale brown; pupa with spiracle on 2nd abdominal segment about as long as those on 3rd and 4th segments ……*Elophila s. str.*

Subgenus *Elophila* Hübner

External characters: Relatively large, with long legs and broad wings. Frons, vertex, labial palpus and maxillary palpus as described for the genus. Proboscis well developed with basal scaling. Antenna as described for the genus.

Wing shape and venation: Forewing with costal margin straight, apex rather acute, weakly excurved behind apex, tornus rounded. Vein R_2 free; R_5 straight from anterior angle of discoidal cell; M_1 emitting from rather behind portion of anterior angle of discoidal cell; bases of M_2 and M_3 approximated each other; CuA_1 starting from a little before posterior angle of discoidal cell; CuA_2 arising at proximal 1/4 of discoidal cell. Hindwing with apex narrowly rounded, slightly incised hehind apex. Vein M_1 free, arising from anterior angle of discoidal cell; M_2, M_3 and CuA_1 as in forewing; CuA_2 emitting from discoidal cell just beyond the middle.

Wing marking: Ground components rather narrow. Three white areas, WA, WB and WC distinct, broad. PML almost parallel with termen between veins R_{3+4} and M_3, and PMW more or less continuous to posterior margin, not interrupted at M_3, though proximally retracted at the vein.

Male genitalia: Tegumen broad and slightly longer than wide; t-v plate most developed in *Elophila s. lat.* Saccus long and flat, projecting anteriorly. Fenestrula absent. Uncus short and fairly flat, almost as long as height of tegumen, straight except tip extending slightly upwards. Gnathos short, base narrow and broadened to blade-like tip, which is laterally compressed with indistinct dorsal spines. Valva long; costa with many verticle wrinkles and laterally suppressed; anellifer with a tuft of scale like setae fewer in number than in the other subgenera of *Elophila*; ampulla with 3 or 4 long, specialized setae curved inward; inner surface with a group of scale-like setae in the middle. Phallus rather long and narrow; perivesical area partly sclerotized, dorsally with some short spines and ventrally with large one(s); cornuti consisting of minute spinules. Juxta with apex bifurcated; base distinctly continuous to saccus by a pair of plates. In addition, 8th sternum sclerotized in W-shape.

Female genitalia: Ostium bursae wide. Corpus bursae relatively long, base weakly sclerotized and with many spinules at near base of cervix bursae. Eighth tergum long, anterior portion strongly excavated in dorsal view; apophysis anterioris with an acute process subbasally. Apophysis posterioris about 1.5 times as long as anterioris. In addition, 7th sternum 2/3 as long as the tergum.

Remarks: This subgenus is characteristic by having the wings broad and with the large, rounded white areas (WA, WB and WC), the male genitalia with much developed tegumen

and the female genitalia with scattered spinules on the corpus bursae.

Elophila (*Elophila*) *interruptalis* (Pryer)

Hydrocampa interruptalis Pryer, 1877 : 233, pl. 4, fig. 5 (type-locality: China).

Nymphula interruptalis: Hampson, 1897 : 139; Wileman, 1911 : 370; Shibuya, 1924 : 124, pl. 5, fig. 2; Marumo, 1942 : 8, pl. 1, fig. 1; Inoue, 1954 : 155; Mutuura, 1957 : 117, pl. 20, fig. 618; Inoue, 1982, I : 369, II : 242, pl. 44, fig. 29.

Elophila interruptalis: Speidel, 1984 : 55.

External characters: Head whitish. Frons in male a little produced, whitish; that in female evenly rounded, broader than in male, whitish except faint suffusion of brown on mid-dorsal area. Vertex with long, erect, whitish scales, and with triangular fuscous patch at mid-dorsal portion. Antenna in male about 1/2 as long as forewing length, ciliate, with scape and pedicel fuscous in outer surface, and fulvous in the other surfaces; flagellum with dorsal surface having a series of sparse and fulvous scales, and with ventral surface densely pilose. Antenna in female slenderer and shorter than in male, about 1/3 to 2/5 as long as forewing length, with outer surface of scape and pedicel paler than in male. Ocellus well developed, black. Labial palpus with basal 2 segments whitish except dorso-lateral fuscous portion; the 3rd small, conical, almost hidden by scales of basal 2 segments. Maxillary palpus whitish except for outer surface fuscous in basal 2 segments; the 4th a little widened by fulvous scales. Proboscis with base whitish scaling. Legs long, especially in male. Foreleg with anterior portions of femur and tibia fuscous, otherwise whitish. Midleg with anterior portions of femur and tibia as in forewing in color, inner tibial spur almost 1.5 times as long as outer one; in female evenly whitish. Hindleg in male whitish except fuscous tip of tibia anteriorly, that in female evenly white; mid inner spur 1.5 times as long as outer one; hind inner spur twice as long as outer one. Thorax above whitish, with fuscous suffusion on mesonotum; beneath whitish. Abdomen above whitish, with fulvous to fuscous area at anterior portion of each segment; beneath evenly whitish.

Wing shape and venation: As described for the genus.

Wing marking: Ground components pale orange. Forewing with BL fuscous. SBL representing as 2 fuscous spots near BL. AML almost parallel with termen, wide at costal region, dark brown; both sides of the line widely white. AMG pale orange, wide, posteriorly retracted along posterior margin of discoidal cell. WD formed clearly. ML started at proximal 2/5 of costal margin to posterior margin of discoidal cell obliquely, then interrupted, and continued to narrow DBl and forming WA. Posterior portion of ML slightly excurved, then forming WC with posterior portion of PML. PML started at proximal 3/4 of costal margin, almost parallel with termen to vein M_3, then retracted proximally and continuing to post DB and forming WB. PMW broad. SML from vein R_{3+4} to Cup almost parallel with termen. SMW broad, and its proximal margin undulate and weakly edged by dark brown scales. Cilia fulvous, suffused with dark brown at proximal 1/3.

Hindwing with BL and SBL absent. AMG narrow, faintly edged by dark brown scales. ML almost straight, continuous to posterior margin, then forming a large white area together with WA and WC. Discocellular lunule by connection DB1 with DB2. PML arising at proximal 2/3 of costal margin obliquely, and angled at vein M_3, then extending and touching to posterior portion of discocellular lunule, and ended to posterior margin near tornus. SML narrow, almost parallel with termen. SMW undulated, especially retracted distally at vein M_3. ML and cilia as in forewing.

Male genitalia: Tegumen considerably developed, slightly concave in mid-dorsal area, about 1.1 times as long as wide; t-v plate with ventral portion considerably expanded laterally and flat in dorsal view. Vinculum short, about 0.45 as long as height of tegumen, dorsally wide and narrowing to ventral portion. Saccus extending upwards. Uncus fairly flat, short, about 0.75 as long as height of tegumen, with long

setae (laterally at base and dorsally at apical portion), apex truncate in dorsal view. Gnathos weakly curved, typically blade-shaped laterally and dorso-apical denticles indistinct. Valva long, almost parallel-sided; costa narrowing to apex; sacculus almost parallel with costa, with 3 stout setae on dorsal projections near base; cucullus with 4 sickle-like special setae. Phallus short, slender, almost straight; coecum penis narrow, about 0.48 as long as whole length of phallus; perivesical area more or less swollen, with some short but distinct spines on plates; vesica with 2 large spines and anterior one present on a small and oblong plate. Juxta longer than wide, posterior margin slightly narrowed and bifurcate.

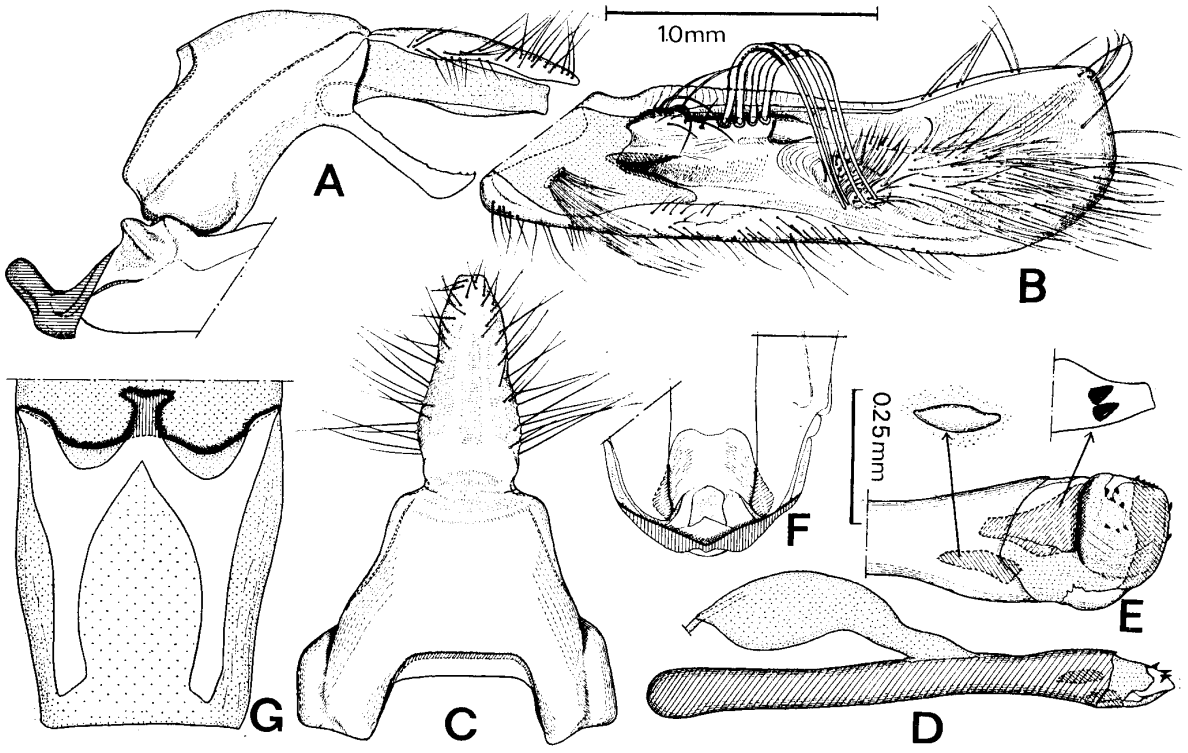

Fig. 1. *Elophila* (*E.*) *interruptalis* (Pryer), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, apical portion; F, juxta with its base; G, 8th sternum.

Female genitalia: Ductus bursae wide and membranous, about 2/3 as long as 7th sternum, with numerous spinules of which bases are joined. Corpus bursae comparatively long, about 1.8 times as long as 7th sternum, weakly sclerotized at basal 2/3 and with small spinules, apical 1/3 membranous. Eighth tergum 0.51 as long as 7th tergum, anterior margin emarginate dorsally in V-shape, posterior margin with setae not in a straight line. Apophysis anterioris 0.77 as long as 7th tergum, with subbasal narrow, ventral process. Apophysis posterioris very long, about 1.3 times as long as anterioris.

Mature larva (6th instar): Head width 1.6 mm, body length 20—32 mm.

Head: Wider than long, evenly pale brown. Seta AF1 short, equal to AF2 in length, the latter just lateral to long P1; puncture AFa anterior to AF2; A2 short, on a line combining A1 and A3; O1 short and O2 longest; O3 just on an extention line between L1 and O2; SO3 just caudal to SO2. Labrum paler than head cranium; seta M1 long, lateral to M2; puncture Ma postero-dorsal to M3. Mandible rectangular, light brown, a little longer than wide, with 5 teeth; inner teeth well developed; anterior seta from postero-ventral margin twice as long as posterior seta.

Thorax: Brownish white. Prothorax with prothoracic shield moderately developed, pale brown except for anterior and posterior dark brown margins; setae relatively short; D1 short; D2 just ventrad of D1; SD2 rather long; L1 as long as L2. Prothoracic legs of both sides with coxae attached at midventral

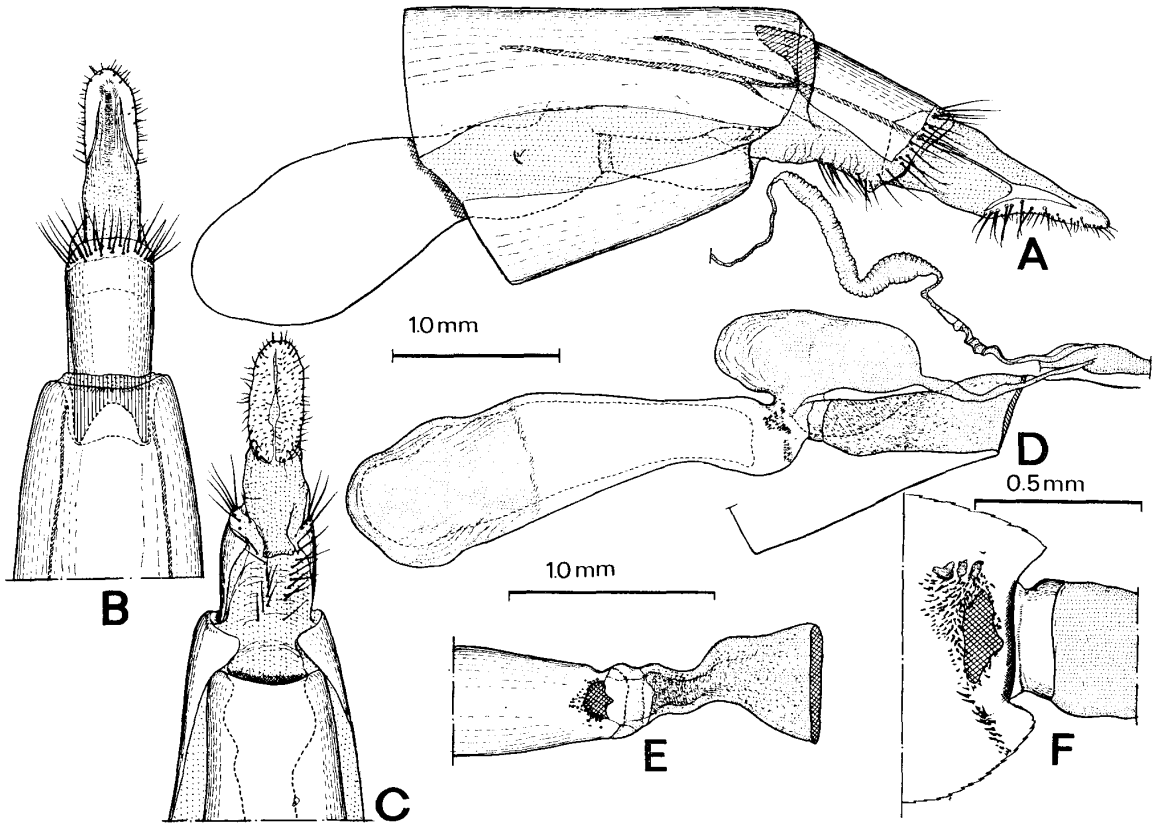

Fig. 2. *Elophila* (*E.*) *interruptalis* (Pryer), male genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, lateral view; E, base of corpus bursae, dorsal view; F, ditto, inside spinules.

line in basal portion. Meso- and metathorax with seta D1 short; D2 long, just behind D1; SD2 longest, antero-ventral to SD1; L2 lateral to L1; L3 short, antero-ventral to long L1; SV1 long.

Abdomen: Conspicuously broader than thorax, milky white suffused with pale yellow. Prolegs reduced to merely weak projection on ventral surface of body; crochets short, arranged in semicircular, biordinal, about 60 in number, anterior crochets more numerous than those of posterior side. First to 8th segments with seta D1 short; D2 longer than D1 and postero-ventral to D1; SD2 minute; L2 short, anterior or antero-ventral to longer L1; SV1 about as long as L1, and L2 and L3 shorter; number of SV, 1 on 7th and 8th, 2 on 1st and 3 on 2nd to 6th segments. Ninth segment with setae D2, SD1 and L1 long, almost same length; L2 antero-dorsal to L1. Tenth segment with anal shield undeveloped; seta SD1 longest, about 1/2 length of the segment; SD2 short, slender, lateral to short D1; anal proleg with crochets uniserial, biordinal, 11 - 14 in number.

Pupa: Body length 15.1 mm, width 3.8 m.

Head with frons slightly concave medially in dorsal view; seta F1 long; vertex with seta V1; pilifer weakly marked; maxilla long, reaching tip of midleg; hindleg a little longer than midleg. Abdomen rather wide, with spiracles of 2nd to 4th segments well developed, much protruded basally, each almost equal in size. Apical margin of 10th abdominal segment evenly rounded.

Specimens examined: 40 males and 65 females taken from Honshu (Akita, Iwate, Niigata, Tokyo, Kanagawa, Shizuoka, Aich, Gifu, Mie, Fukui, Shiga, Kyoto Osaka, Hyogo, Okayama, Yamaguchi Prefectures) and Kyushu (Fukuoka, Oita, Kumamoto Prefectures) (KU, KPU, MC, IC).

Distribution: Japan (Honshu, Shikoku, Kyushu), China, Korea.

Biological notes: The biological note of this species is given by Kobayashi (1927) as

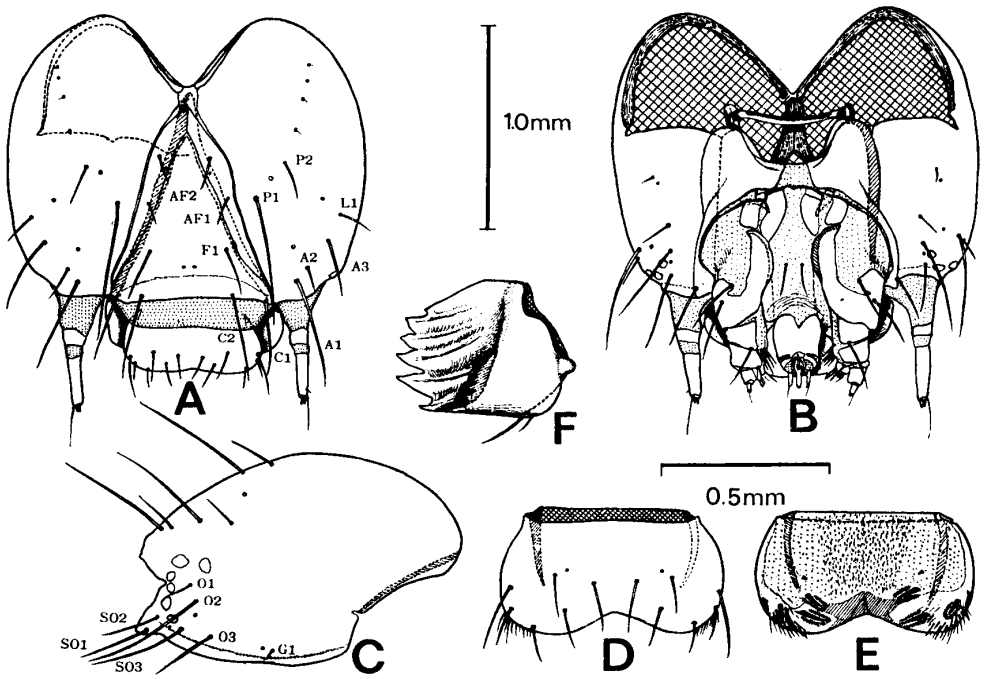

Fig. 3. *Elophila* (*E.*) *interruptalis* (Pryer), larva. A, Head, frontal view; B, ditto, ventral view; C, ditto, lateral view; D, labrum frontal view; E, ditto, ventral view; F, right mandible, inner view.

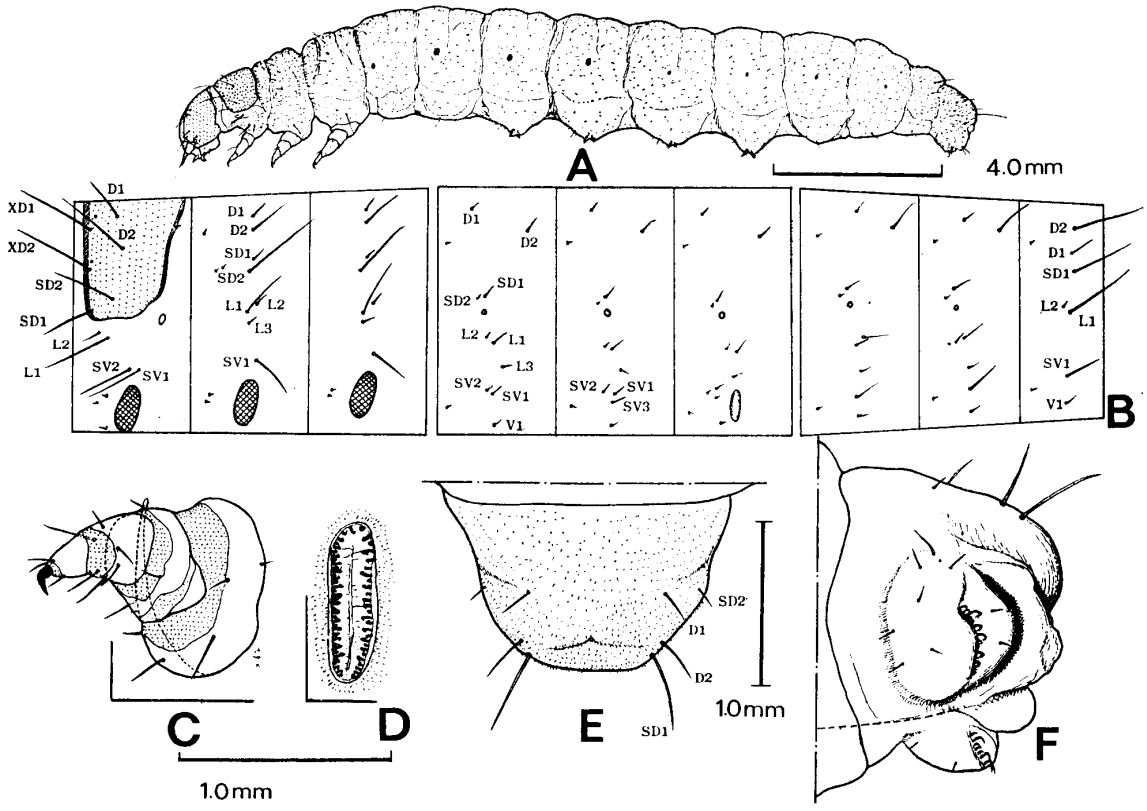

Fig. 4. *Elophila* (*E.*) *interruptalis* (Pryer), larva. A, Mature larva, lateral view; B, chaetotaxy (T1-T3: prothorax to metathorax; A1-A3: 1st to 3rd addominal segments; A7-A9: 7th to 9th abdominal segments); C, proleg; D, proleg with crochets; E, 10th abdominal segment, dorsal view; F, ditto, latero-ventral view.

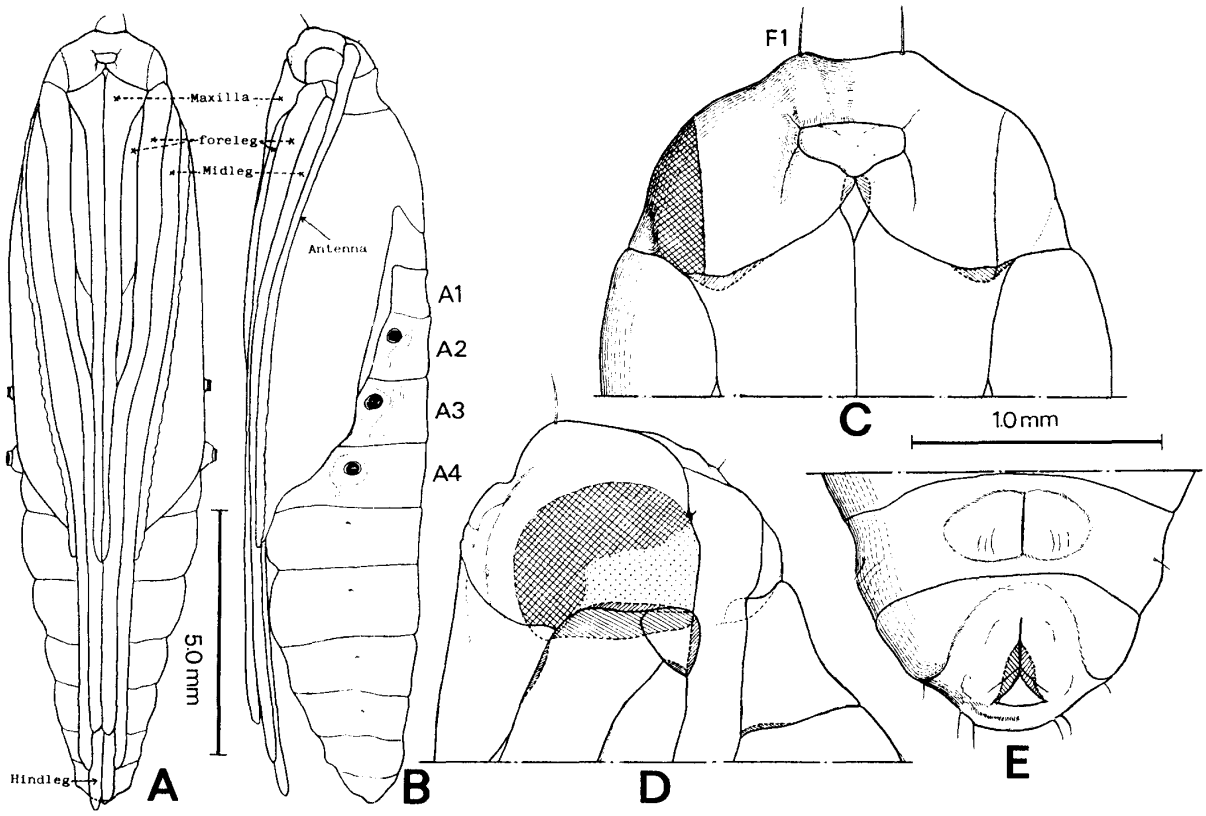

Fig. 5. *Elophila* (*E.*) *interruptalis* (Pryer), pupa. A, Male, ventral view; B, ditto, lateral view; C, head, ventral view; D, ditto, lateral view; E, apical segments, ventral view.

the pest of water lilies and also by Yajima (1947) and Nagasaki (1981). This species is commonly found in the ponds or lakes in Japan. The larvae are polyphagous as listed in another paragraph. The female lays eggs underside of the host-leaves in fan-shaped mass. According to my obsevation, the number of eggs in a mass is usually 20-50. The first instar larvae mine the leaf-tissue from the underside, or enter the space between the attached two leaves, or sometimes live on the underside and feed on the surface. In the 2nd to 6th (the last) instars, some larvae make the portable cases by two cutted pieces of the leaves, some tightly combine two leaves by silk and live in such cases. The latter habit is commonly found in the larvae on *Nymphaea* or *Brasenia* spp., and is rare for *Hydrocharis* sp. The tracheal gills are not developed on the larval body, but the water resistant structures are found from the 3rd instar larva. The larvae abandon one piece of the case and attach the new larger piece when they moult. The pupation takes place in the last instar larval case, which is attached to the leaves or the stems of the host in the water. The larvae overwinter in the midinstar (4th). This species pass through two or three generations a year, and adults appear from June to November.

Remarks: The species is common in Japan. The species is closely allied to *E. nymphaeata* (L.), but different from the latter by the presence of the pale orange wing ground and 4 sickle-like setae in the male genitalia. In *E. nymphaeata* the ground of the wing is fulvous to pale ochreous and the male genitalia is furnished with 3 sickle-like setae in the valva.

Elophila (*Elophila*) *interruptalis ezoensis* ssp. nov.

Differs from *E. interruptalis interruptalis* as follows:

External characters: Head with frons uniformly whitish, in *interruptalis* suffused with fulvous; maxillary palpus moderate, with the terminal segment not so broad as in *interruptalis*. Legs with hindcoxa darker.

Wing marking: Both wings with ground components darker as in *E. nymphaeata* L. and sometimes almost become pale fuscous; hindwing with discocellular lunule smaller, not touched with PML, while in *interruptalis* large to touch with PML.

Male genitalia: Tegumen more developed, about twice as high as vinculum, whereas in *interruptalis* the plate is about 1.5 times as high as vinculum; valva with setae on ampulla ordinally 4 in number, but in some specimens only 3 as in *E. nympheata* L.; phallus with a plate of vesica smaller, having 1 or 2 (in the case one is shorter than the other) spines, in *interruptalis* the plate has equally developed spines.

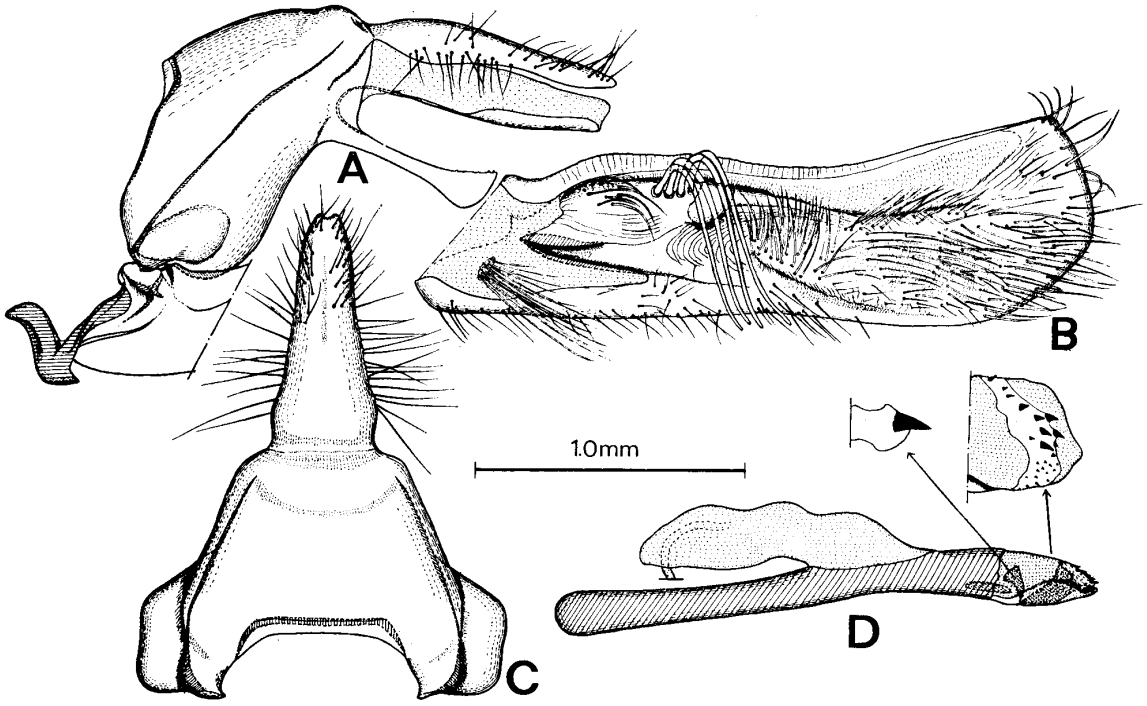

Fig. 6. *Elophila* (*E.*) *interruptalis ezoensis* ssp. nov., male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus.

Mature larva: Head with seta AF1 situated more ventrally; prothoracic shield with anterior and posterior margins more broadly darkened.

Size of forewing: Male, 10.1 mm; female, 13.2 mm.

Holotype: Male, Toroko Lake, Shibecha, Hokkaido, 3. ix. 1977 (Y. Yoshiyasu) (KU). Paratypes: 1 ♀, Shibecha, Hokkaido, 2-4. viii. 1975 (R. Sato); 4 ♂, 14 ♀, 26. viii. 1977 (K. Ôhara), 6 ♂, 13 ♀, 3-4. ix. 1977 (Y. Yoshiyasu), 7 ♂, 15 ♀, 4-5. ix. 1979 (Y. Yoshiyasu) (these all were collected at the same place as holotype) (KPU); 3 ♀, 1 ♂, Koshunai, Bibai, Hokkaido, 3-4. ix. 1977 (K. Setoya) (KPU).

Distribution: Japan (Hokkaido).

Biological notes: The larvae fed on *Polygonium* and *Trapa* spp. at Sibecha, Hokkaido. The habit of the larvae is almost as in the nominate subspecies. Number of generation is not known.

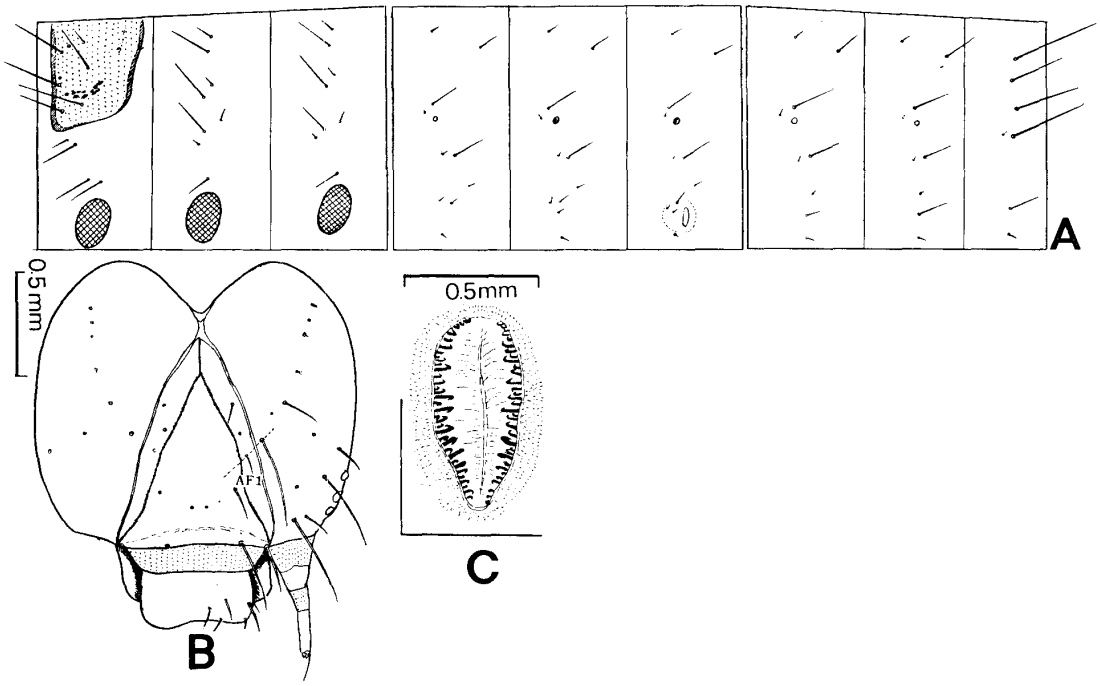

Fig. 7. *Elophila (E.) interruptalis ezoensis* ssp. nov., larva. A, Chaetotaxy; B, head, frontal view; C, proleg with chrochets.

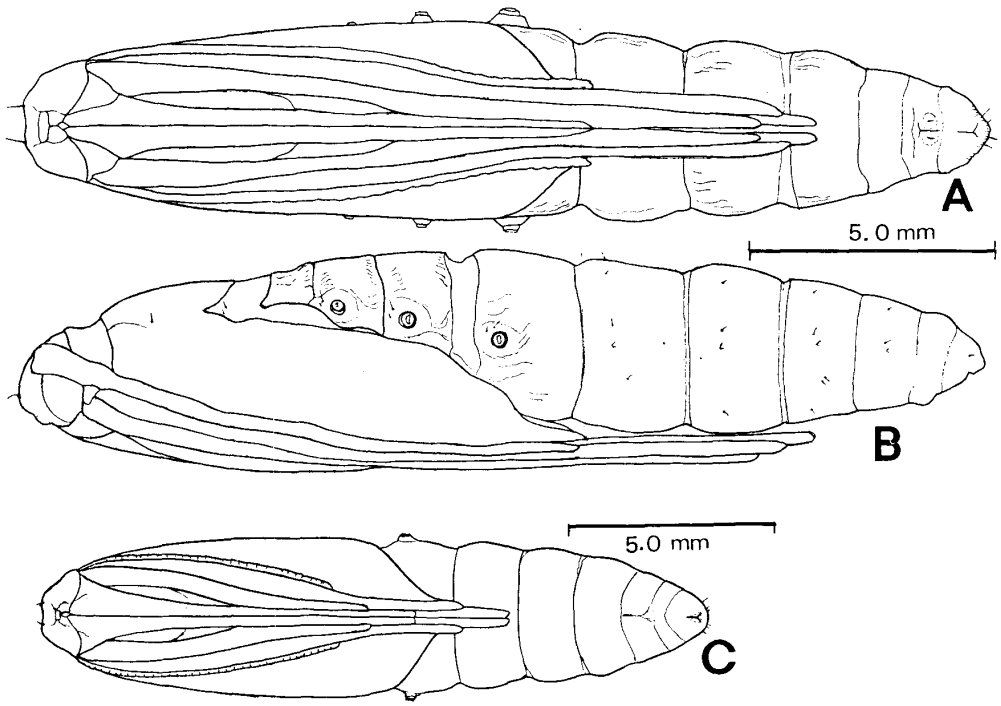

Fig. 8. *Elophila (E.) interruptalis ezoensis* ssp. nov., pupa. A, Male, ventral view; B, ditto, lateral view; C, female, ventral view.

Remarks: This new subspecies of *E. (E.) interruptalis* is confined to Hokkaido, while the nominate subspecies is distributed from Honshu to Kyushu.

Subgenus *Cyrtogramme* nov.

(cyrtos κῦρτος (=curved) + gramme γραμμθ (=line) (feminine))

Type-species: *Parapoynx turbata* Butler, 1881.

External characters: Head with frons round; vertex slightly elevated. Labial palpus upturned, with thicker scales on ventral surface than in *Elophila s. str.* Maxillary palpus porrect, moderate in length. Proboscis shortest in the genus *Elophila*. Antenna in male thick; in female slenderer and longer than in male. Ocellus present.

Wing shape and venation: Forewing with apex broadly rounded; termen a little expanded at middle; tornus rounded. Vein Sc rather short, ending at costa near distal margin of cell; R_2 stalked with R_{3+4} at base; R_5 and M_1 straight; CuP absent. Hindwing with costa curved; apex rounded; termen behind apex weakly incised. Vein $Sc+R_1$ anastomosed with Rs for short distance as in *Elophila s. str.*

Wing marking: Differs from *Elophila s. str.* as follows: Forewing with WA, WB and WC narrower. PML running from costa outwardly to vein R, then acutely retracted and strongly excurved to vein M_2, and again retracted to posterior angle of discoidal cell, and ending to proximal 1/2 of posterior margin. SML interrupted by veins. SMW also interrupted and narrower. Hindwing with SBL representing a darker spot. PML more straight to posterior margin, thence usually not touched with discocellular lunule. Otherwise as in forewing.

Male genitalia: Distinguishable from *Elophila s. str.* as follows: Tegumen short and wide. Vinculum almost as long as height of tegumen. Uncus longer than tegumen, with membranous portion at base. Gnathos variable in shape. Valva apically wider and more rounded; ampulla with more flat and shorter sickle-like setae. Phallus shorter; coecum penis more developed; posterior portion broader.

Female genitalia: Also differs from *Elophila s. str.* as follows: Corpus bursae without any spines of signa. Bursal ring flat, with dorsal projection middorsally. Cervix bursae relatively well developed, in some species larger than corpus bursae.

Remarks: The new subgenus is distinguishable from *Elophila s. str.* by the wing and the male and the female genitalia as mentioned above. As far as I know, the subgenus contains some closely related species group distributed in the Oriental to the Palearctic regions.

The larvae live in the stagnant water as in *Elophila s. str.* However, the case-making habit of these 2 subgenera is dissimilar. The larva of *Cyrtogramme* make the case by gathering several small fragments of the leaves of hosts, while the case is made of 2 broad fragments of the leaves in *Elophila s. str.* as well as in *Elophila* (*Munroessa*).

Key to the species of *Elophila* (*Cyrtogramme*) based on adults

1. Wings short, broadly suffused with fuscous, leaving a characteristic yellowish discocellular lunule; female genitalia with cervix bursae as long as corpus bursae····· *E.* (*C.*) *melagynalis* (Agassiz)
— Wings moderate in length, with lines and white areas distinct; female genitalia with cervix bursae shorter or longer than corpus bursae ····· 2
2. Forewing with vein R_2 separated from R_{3+4}; hindwing with PML separated from discocellular lunule; male genitalia with setae on valval ampulla stout; female genitalia with cervix bursae shorter than corpus bursae ····· *E.* (*C.*) *nigralbalis* (Caradja)
— Forewing with vein R_2 anastomosed with R_{3+4} at base; hindwing with PML touched with discocellular lunule; male genitalia with setae on valval ampulla slender; female genitalia with cervix bursae much longer than reduced corpus bursae ····· *E.* (*C.*) *turbata* (Butler)

Key to the species of *Elophila* (*Cyrtogramme*) based on larvae and pupae

1. Larva with head having long AF setae, and with L setae of prothorax present on prothoracic shield;

pupa with 4th to 6th abdominal segments smooth; host plants confined to aquatic ferns……
……*E. (C.) nigralbalis* (Caradja)

— Larva with head having short AF setae, and with L setae of prothorax separated from prothoracic shield; pupa with 4th to 6th abdominal segments forming horizontal clefts dorsally; host plants wide in range……*E. (C.) turbata* (Butler)

Elophila (*Cyrtogramme*) *turbata* (Butler)

Parapoynx tubata Butler, 1881: 586; Pryer, 1885: 61.

Nymphula turbata: Meyrick, 1894: 10, 470; Hampson, 1896: 192; Leech, 1901: 433; Shibuya, 1928: 141, 143; Matsumura, 1931: 1044; Inoue, 1954: 155; Mutuura, 1957; 118, pl. 20, fig. 622 (♀).

Leparodes floralis Leech, 1889: 71, pl 4. fig. 1. (♂)

Hydrocampa sultschana Ragonot, 1894: 174.

Parthenodes sutschana Hampson, 1900: 384 (♀).

Nymphula responsalis: Inoue, 1982, I: 370, II: 242, pl. 55, fig 23. (♀).

Elophila turbata: Speidel, 1984: 58.

External characters: Head with frons evenly fulvous; vertex fulvous scattered with brown scales. Labial palpus fulvous to whitish except for dark brown 2nd and base of 3rd segments. Maxillary palpus fulvous with 2 dark brown rings at medial and near apex. Proboscis short, almost as long as width of eye. Antenna of male 1/2 as long as forewing length, fulvous dorsally; that of female 2/5 as long as forewing length, dark brown dorsally. Ocellus distinct, blackish. Legs long, fulvous to whitish except for anterior surface of forefemur and tibia dark brown and each tarsal tip darkened; midinner spur twice as long as outer one; hind inner spurs 1.5 times (in male) or 1.2 times (in female) as long as outer ones. Thorax and abdomen above fulvous to pale ochreous in male and dark brown in female, and beneath paler.

Wing shape and venation: As described for the subgenus.

Wing marking (male): Ground components yellowish fulvous. Forewing with BL unclear. SBL fuscous, continuous to fuscous AML at upper portion. Distal margin of AML angled in discoidal cell. AMG broad, yellowish fulvous and darker at upper portion, proximal margin undulate and distal margin acutely oblique outwards in discoidal cell and running to posterior margin of discoidal cell and waving to posterior margin. Discal ring and WD obscure or absent. ML wedge-shaped, fuscous, making an obtuse angle with costa, diminished in discoidal cell, the lower portion waved and yellowish fulvous. DB1 faintly recognized and DB2 indistinct. WA wedge-shaped, WC rather broad, and WB hardly recognized. PML relatively narrow, oulique and fuscous at costa, retracted at vein R_{3+4} and running sinuously to vein M_3, then anteriorly retracted and continuing to posterior margin. PMG widened, evenly pale fulvous, its proximal margin almost parallel with PML, not continuous with the latter, scattering some dark brown scales. SML curved, its upper proximal margin with zigzaged edge, distal margin darker at upper portion. SMG evenly pale fulvous. Cilia whitish, with darker line at proximal 1/3 of lower termen.

Hindwing with AML restricted at lower portion, fuscous. AMG pale fulvous with distal margin broad, fuscous. ML almost straight, yellowish fulvous, with proximal margin narrowly fuscous, distal margin indistinct. DB represented by a narrow line. PML almost straight, slightly expanded at vein M_1, fuscous at upper portion and becoming pale fulvous to tornus. Cilia as in forewing.

Wing marking (female): Ground components dark brownish. Forewing with BL fuscous. SBL oblique, light fuscous, unclear at upper portion. AML broad, distal margin undulate. AMG wide, evenly dark brown, both margins strongly undualte, its distal one acutely extending to posterior angle of

discoidal cell and continuous to PMG, and curved inwards, then ended at about 1/2 of posterior margin. Discal ring unrecognizable and WD reduced to small in size, in some specimens obsolete. ML relatively narrow, brown, making an obtuse angle with costa, and extending to discoidal cell, then interrupted there, and started behind discoidal cell, and waving to posterior margin. WA wedge-shaped, not so broad as in male. DB1 and DB2 indistinct, brownish. Discocellular lunule brown. PML emitting at 4/5 of costa, narrow, retracted at vein R_{3+4}, then abruptly and strongly excurved to vein M_2, diminished there, and starting at posterior angle of discoidal cell, ending to posterior margin sinuously. WC broad, but narrower and more curved than the other species of *Cyrtogramme*, and scattering some fuscous scales. SML almost parallel with termen, proximal margin zigzaged at upper portion and distal margin darker at same portion. SMG evenly brownish. Cilia fulvous with darker line at proximal 1/3 of termen.

Male genitalia: Tegumen as long as wide, anterior margin with ridge well developed. T-v plate roundly expanded in dorsal view. Vinculum almost as long as or slightly shorter than height of tegumen Saccus relatively small. Fenestrula triangular in dorsal view at uncal base. Uncus short, almost as long as height of tegumen, with several setae laterally, base rather wide and evenly tapering to apex, dorsal spines indistinct. Gnathos short, apical portion triangularly widened and depressed laterally, with 4 or 5 dorsal spines. Valva short, with base wide, apical margin broadly rounded; costa short, with indistinct vertical wrinkles seen in the subgenus *Elophila*; ampulla with flat, specialized setae of which 3 are long and large; medial portion ventrad of ampulla weakly sclerotized, with long setae; inner surface furnished with many setae. Phallus short; coecum penis straight and slender, about 0.5 as long as whole length of phallus; carina penis thickened by encircling sclerotized plate which has 3 large projections; vesica with cornuti which are consisting of many spinules near entrance of aedeagus. Juxta rectangular, bifurcated at apex. In addition, 8th sternum with posterior margin sclerotized in W-shape.

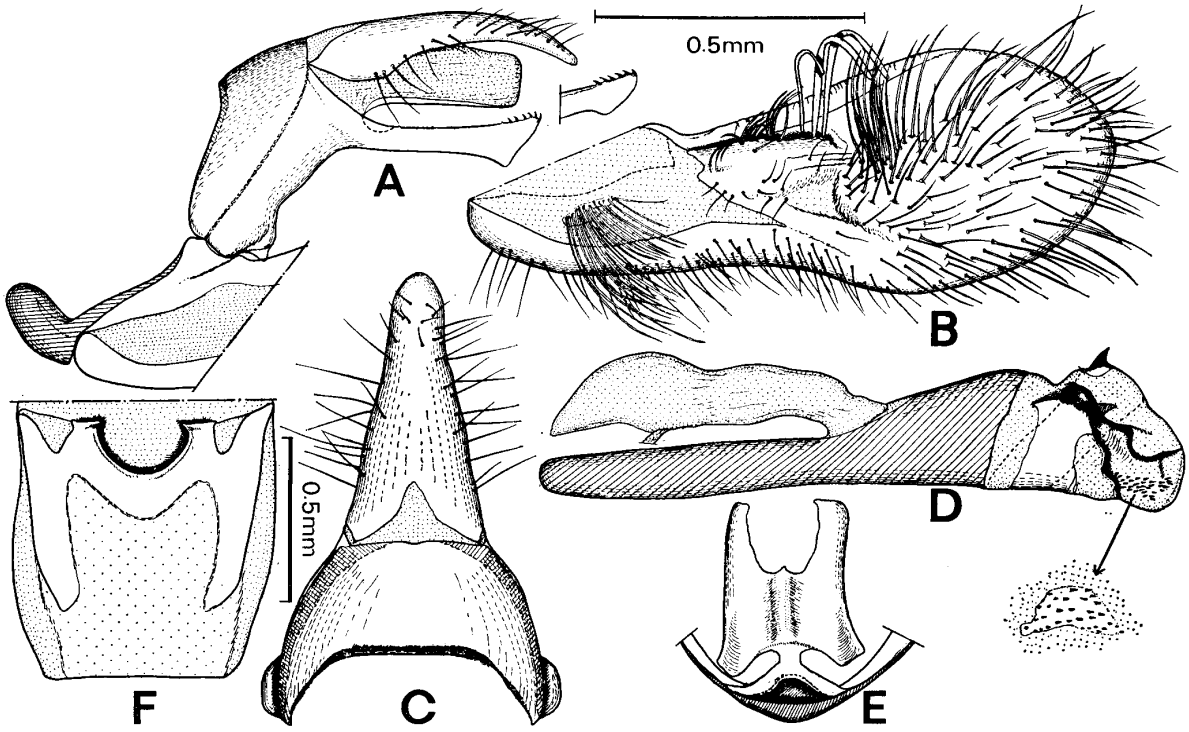

Fig. 9. *Elophila* (*C.*) *turbata* (Butler), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta with its base; F, 8th sternum.

Female genitalia: Ostium bursae fairly wide. Ductus bursae rather long, equal to 7th sternum. Bursal ring very wide, with small indistinct projections and middorsal portion acutely elevated. Corpus

bursae reduced to a small pouch near bursal ring ventrally. Cervix bursae large and rounded, then it seems to be a part of bursa copulatorix. Spermatheca with spiral sclerotized plate small and short. Eighth tergum evenly scleotized, 0.47 as long as 7th tergum, with long posterior setae on a straight line. Apophysis anterioris slender without projection at subbasal portion. Papilla analis with a series of long setae rather reaching to more posterior portion than the other species of *Cyrtogramme*. Apophysis posterioris 1.47 times as long as anterioris.

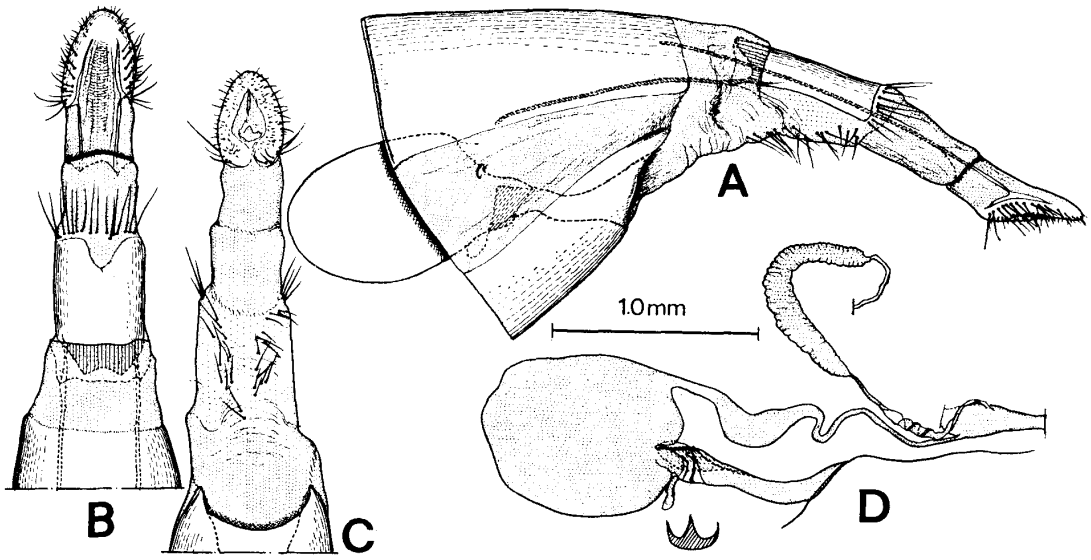

Fig. 10. *Elophila* (*C.*) *turbata* (Butler), female genitalia. A, Lateral view; B, 8th to 10th segements, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, lateral view.

Size of forewing: Male, 6.8 mm; female, 8.0 mm.

Mature larva (5th instar): Head width 1.1 mm, body length, 15 - 20 mm.

Head: Wider than long, evenly metallic blackish except lateral whitish portion near ocelli. Seta AF1 short, as long as AF2; puncture AFa dorsal to AF1; P1 rather long, ventro-lateral to AF1; P2 short, dorsolateral to P1; A2 also short, just dorsal to long A1; O1 short; O2 long situated near O1; O3 shifted anteriorly, then not on a line between O1 and O2; SO1 SO2 and O3 situated on a line. Labrum moderate in size, blackish brown; seta M3 almost as long as LA1, a little dorsal to M1. Mandible almost rectangular, with 5 teeth; inner teeth well developed; 2 setae from postero-ventral margin long, equal in length.

Thorax: Greyish white. Prothorax with prothoracic shield well developed, evenly metallic blackish; prothoracic legs with coxae on both sides fused at midventral line; setae XD relatively long; D2 a little caudal to a vertical line combining D1 and SD2; L2 short, antero-lateral to L1. Meso- and metathorax with coxae of both sides separated at base; chaetotaxy as in *Elophila interruptalis*.

Abdomen: Much broader than thorax, milky white. Anterior portions of 1st to 8th segments expanded dorsally, especially in 8th segment. Prolegs weakly expanded; crochets almost transversely arranged and anterior series of crochets slightly longer, biordinal and about 40 in total number. In 1st to 8th segments, seta D1 short; D2 thrice as long as D1, postero-ventral to D1; L2 short, just lateral to L1; number of SV setae, 1 on 8th, 2 on 1st and 7th, and 3 on 2nd to 6th segments, respectively. Ninth segment with seta D1 nearer to D2 than to slender SD1; L2 short, lateral to L1. Tenth segment with anal shield not sclerotized, only recognized by darker coloration; setae D1, D2 and SD1 almost longitudinally arranged and SD1 longest; SD2 short and slender, ventral to D1; anal proleg with crochets uniserial, biordinal, 12 - 14 in number.

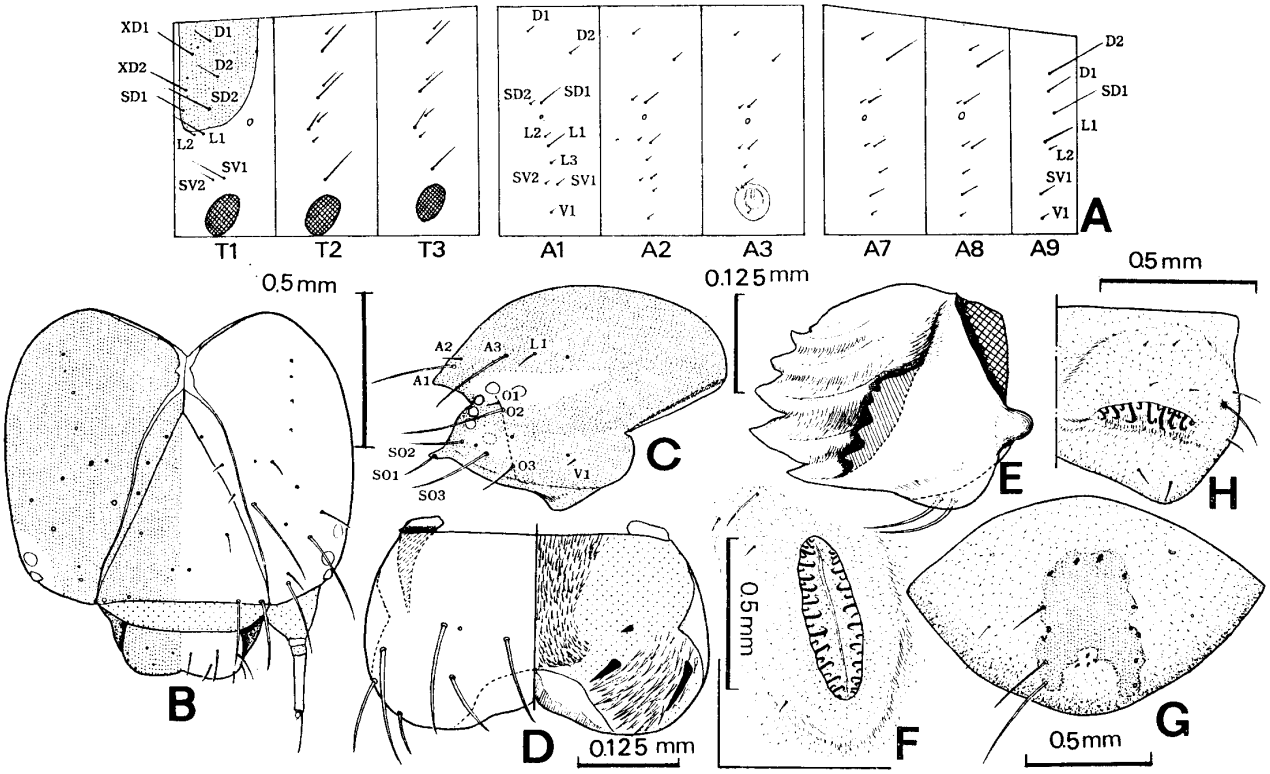

Fig. 11. *Elophila* (*C.*) *turbata* (Butler), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, proleg with crochets; G, 10th abdominal segment, dorsal view; H, ditto, anal proleg with crochets.

Pupa: Body length 7.5 - 11.1 mm, width 2.0 - 2.8 mm.

Body evenly pale brown. Head with frons rather flat in dorsal view; seta F1 moderate; vertex with short seta V1; pilifer rather clearly recognized; maxilla short, reaching to proximal 2/3 of wing length; antenna extending to apex of wings. Thorax with foreleg ending a little beyond apex of wings; midleg long, far beyond apex of wings; hindleg longer than midleg. Abdomen rather stout; spiracle of 2nd segment completely concealed by wings sheath, but those of 3rd and 4th segments well developed and protruded at bases; posterior 1/2 of 4th to 6th segments with granulate punctures; dorsal surfaces of 5th to 7th segments with characteristic crevices of which anterior and posterior edges are dentate with many minute setae; posterior margin of 10th segment broadly rounded without special setae.

Specimens examined: 35 males and 85 females from Honshu (Akita, Iwate, Niigata, Nagano, Tokyo, Kanagawa, Gifu, Aichi, Mie, Shiga, Kyoto, Osaka, Wakayama, Hyogo, Okayama, Shimane, Yamaguchi Prefectures), Shikoku (Kagawa, Ehime, Kochi Prefectures), Kyushu (Fukuoka, Saga, Oita, Kumamoto, Miyazaki, Kagoshima Prefectures). Yakushima Is., Amami-Oshima Is., Okinawa-Honto Is. (KU, KPU, UOP, IC, MC).

Distribution: Japan (Hokkaido, Honshu, Shikoku, Kyushu, Yakushima Is., Amami Iss., the Ryukyus), China, Amur, Ussuri, Korea, Taiwan.

Biological notes: The host plants are enumerated as follows: *Spirodela polyrhiza*, *Hydrocharis dubia*, *Trapa japonica*, *Nymphaea* spp. and *Azolla* sp. But most of the larvae of this species are found on *Spirodela polyrhiza* in the field. The eggs are laid on the underside of the leaf as in *Elophila interruptalis* (Pryer). The mean number of the eggs in a mass is 21 (n=20). The first instar larvae mine the leaves or enter the space between the two leaves of hosts. The 2nd instar larvae cut off the small pieces from the leaf to make the portable

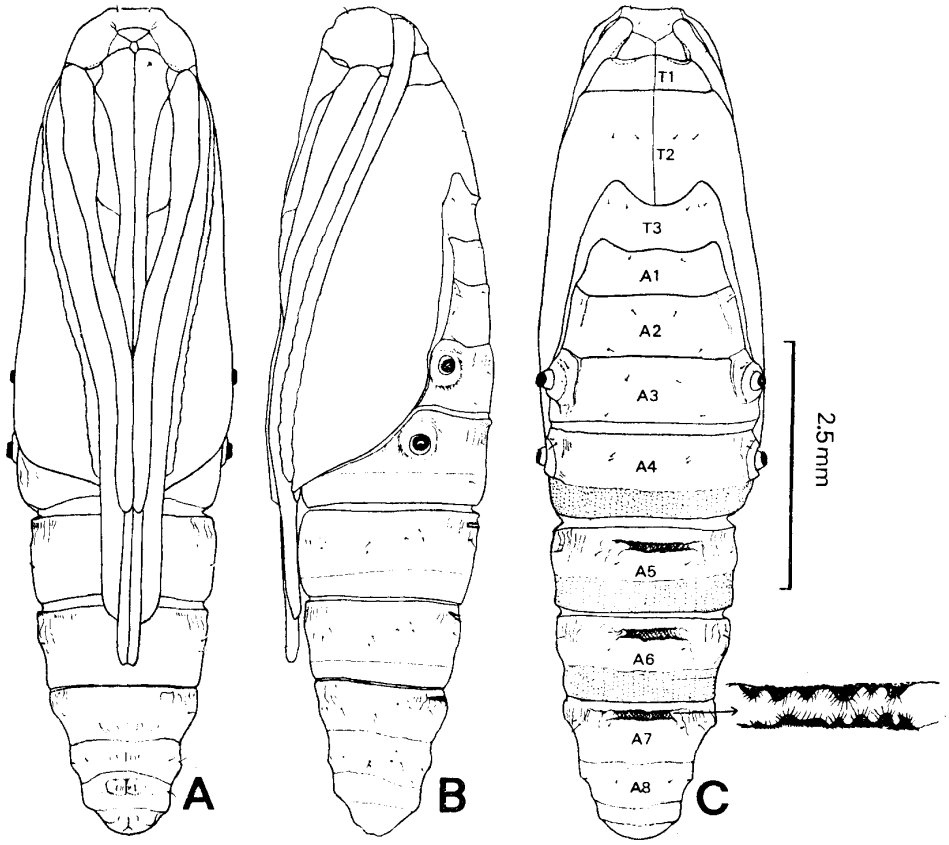

Fig. 12. *Elophila* (*C.*) *turbata* (Butler), pupa. A, Male, ventral view; B, ditto, lateral view; C, ditto, dorsal view.

cases, and feed on the surface of the hosts. The spiracles of body are undeveloped until the 2nd instar, and respirate through the body wall as in the other *Elophila* species. The next instar larvae enlarge the cases by adding another fragments of leaves to older ones and the water resistant structures are developed on the surface of the body. In this time the larvae have distinct spiracles and respirate through them. The 4th to last (5th) instar larval cases are almost as in 3rd, but are larger in size than in the preceding larval cases and made by gathering many pieces of leaves as in the psychid larvae. The pupation takes place on the underside of host-leaves in the tightly attached last instar larval case. The adults are collected from May to October and the species may be multivoltine.

Remarks: This species is most common in the Japanese nymphuline moths and distributed through the country.

This species is closely related to *Elophila responsalis* (Hampson) occurred in the Oriental region, but separable from the latter by having the male genitalia with longer sickle-like setae on valval ampulla and the female genitalia with shorter bursal ring.

Elophila nigralbalis **(Caradja)**

Nymphula diffualis nigralbalis Caradja, 1925: 329 (type-locality: Lienping, Guangdong, China).

Elophila nigralbalis: Speidel, 1684: 61.

Nymphula enixalis: Shibuya, 1928: 124 126, pl. 5, fig. 7; Marumo, 1942: 13, pl. 1, fig. 3; Mutuura, 1957: 118 pl. 20, fig. 623; Inoue, 1982, I: 370: II: 242, pl. 44, fig. 34 (♀).

External characters: Head with frons rounded, whitish. Vertex elevated, whitish, mixed with fuscous and fulvous. Labial palpus more strongly upturned than in *turbata*, basal 1/2 fuscous and apical 1/2 whitish; apex of 3rd segment not pointed. Maxillary palpus porrect, moderate in length, whitish. Probocis short, as long as width of head, basally with whitish scales. Antenna in male thick, scape and pedicel with dorsal surface fuscous, other whitish, flagellum densely pilose throughout, dorsally with scarse, fuscous scales on each segment. Antenna in female ciliate, dorsally with fulvous and fuscous scales alternately, ventral setae shorter and fewer than in male. Ocellus distinct, distant from eye, just posterior to base of antenna.

Wing shape and venation: Forewing with costa straight; apex rounded; termen evenly curved; tornus broadly rounded. Hindwing with termen slightly incised behind apex and more evenly curved to tornus than in *enixalis*.

Wing marking: Forewing with BL almost fuscous. SBL parallel with termen, fuscous. AMG light brown suffused with dark scales, distal margin more angulated in cell than in *enixalis*. WD indistinct. Anterior discal bar wedge-shaped, outerly oblique to posterior angle of cell, and connected with ML there. Discocellular lunule pale ochreous. WA rounded, and WB narrow and C-shaped. PML started from 3/4 of costa, strongly oblique to vein R_{3+4}, angulate there and excurved to vien M_3, retracted to posterior angle of cell, and running parallel with termen, and ended at 1/2 of posterior margin. WC obscurely marked, PMG ochreous to fuscous, in female darker. SML rather interrupted into some fragments, that of cell M_3 shifted proximally. SMW indistinct in male, but widely present in female. SMG white and MGL absent. Cilia whitish except for fuscous band at proximal 1/3.

Hindwing with BL absent. SBL representing small, fuscous spot behind cell. AMG fuscous mixed with ochreous scales in male, evenly fuscous in female. Component band of anterior DB and ML straight or slightly excurved, in *enixalis* sinuous and curved. Posterior portion of PML rather excurved to tornus. PMG fuscous suffused with light brown. SML almost parallel with termen. MGL light brown, and ended to vein 1+2A. Cilia as in forewing.

Male genitalia: Resembles to *enixalis*, but different in next characters: Tegumen shorter; t-v plate not clearly seperated from dorsal tegumen. Vinculum slightly shorter and more erected. Uncus flat and more curved ventrally with many setae latero-dorsally. Gnathos longer, with distinct dorsal spines apically, whereas in *enixalis* having some shorter spines at apex. Valva with anellifer so developed that invaded to middle of valva ventrally, ampulla having 3 shorter spines, in *enixalis* with 4 long curved spines, inner surface with a group of scale-like setae on posterior portion of sickle like spines. Phallus longer; coecum penis slenderer, about 0.57 as long as whole length of phallus; cuticle exterior membranous in posterior to base of bulbus ejaculatorius; vesica with 2 groups of cornuti, its anterior one with a strong, horn-like spine on large sclerotized plate and posterior one continuing to suprazonal sheath which has a small spine.

Female genitalia: Distinguished from allied species *enixalis* as follows: Bursal ring wider, slightly clavated in mid-dorsal portion. Apophysis anterioris with base broader, and usually having distinct ventral process.

Size of forewing: Male 4.8-5.7 mm 5.3 mm in mean, n=12), female 6.3-7.3 mm (6.8 mm in mean, n=35).

Specimens examined: 12 ♂ (all specimens from the Ryukyus), 35 ♀, from Honshu (Kyoto, Osaka Prefectures) and Shikoku (Kochi Prefecture) and Kyushu (Fukuoka Prefecture) and the Ryukyus (Ishigaki-jima and Iriomote-jima Iss.) (KU, KPU, UOP, IC).

Mature larvae (5th instar): Head width, 0.8 mm, body length 11-15 mm.

Closely allied to *E. (C.) turbata*, in coloration and structures, but can be seperated from the latter in the following points: Body smaller in size. Head with setae AF1 and AF2 longer; ventral surface of

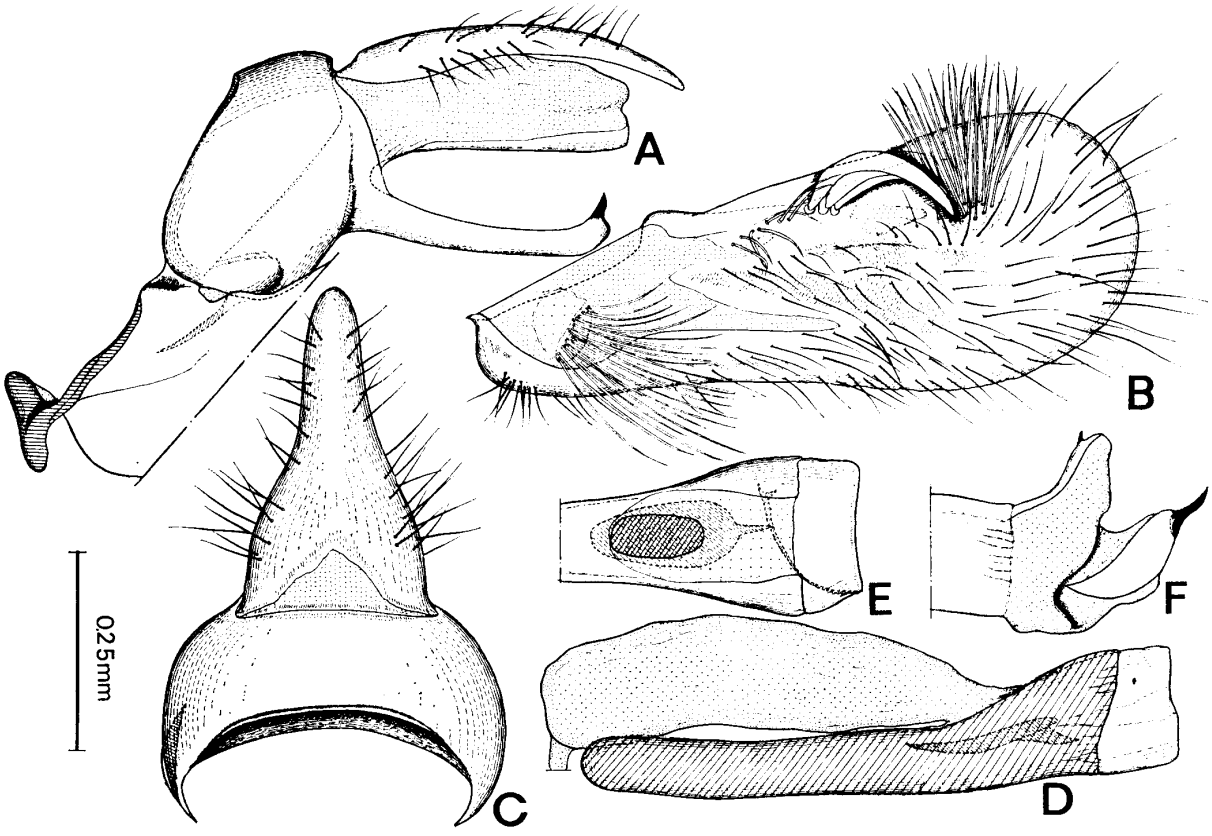

Fig. 13. *Elophila* (*C.*) *nigralbalis* (Caradja), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, apical portion, dorsal view; F, ditto, cornutus.

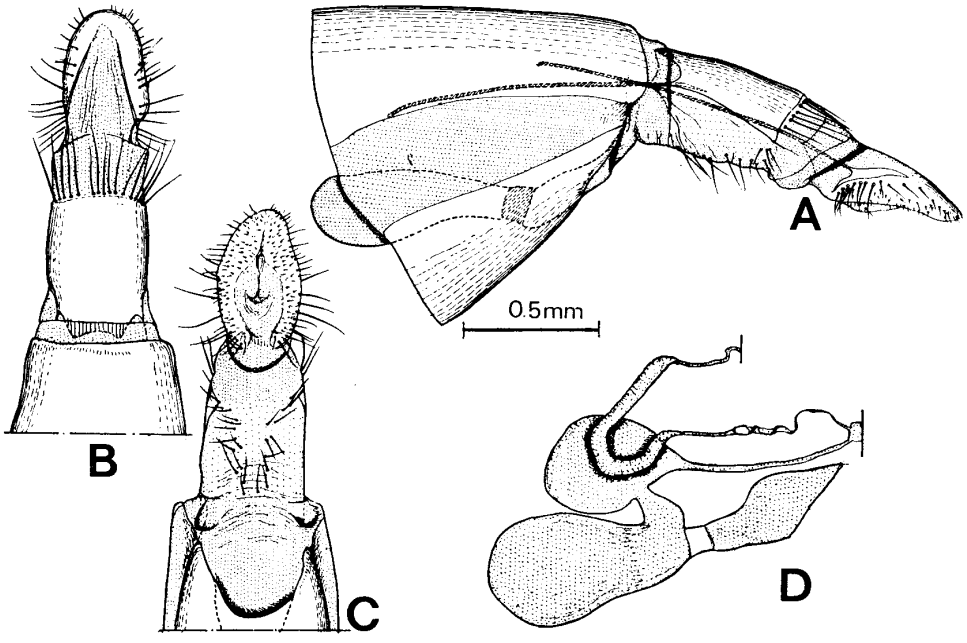

Fig. 14. *Elophila* (*C.*) *nigralbalis* (Caradja), female genitalia. A, Lateral view; B, 8th to 10th segments; dorsal view; C, ditto, ventral view; D, bursa and spermatheca, lateral view.

labrum having a small sclerite in lateral portion. Thorax with prothoracic shield so more developed that include two L setae on its ventral margin. Abdomen with anal shield narrower and irregular in shape. Seta P2 longer, shifted more anteriorly and just behind of P1.

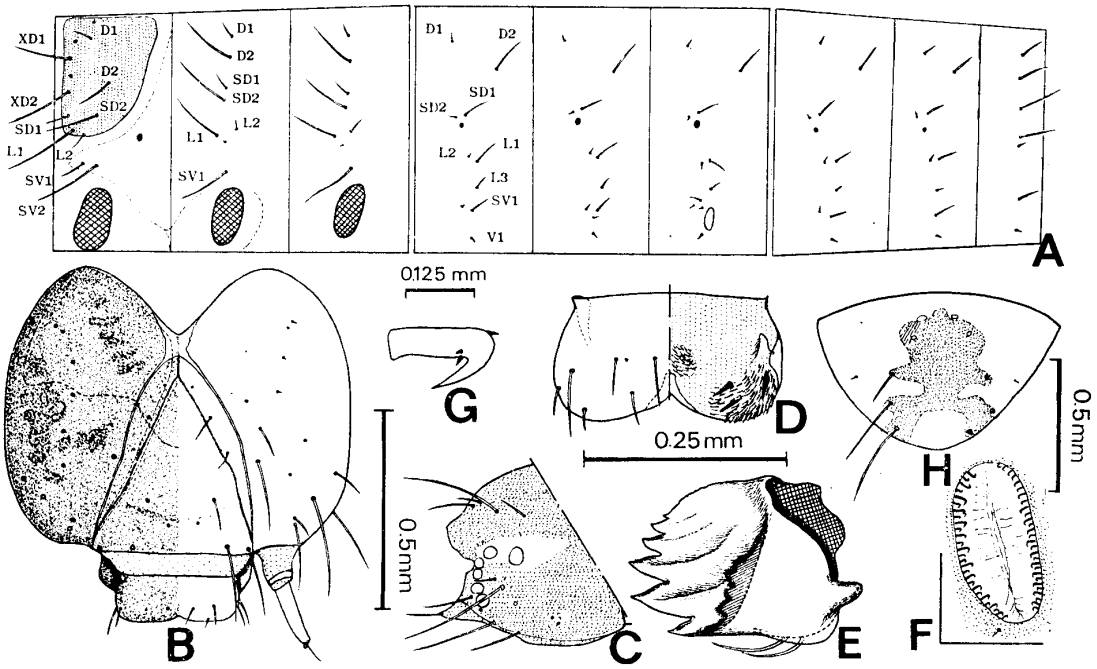

Fig. 15. *Elophila* (*C.*) *nigralbalis* (Caradja), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, crochets of proleg; G, crochet of anal proleg; H, 10th abdominal segment, dorsal view.

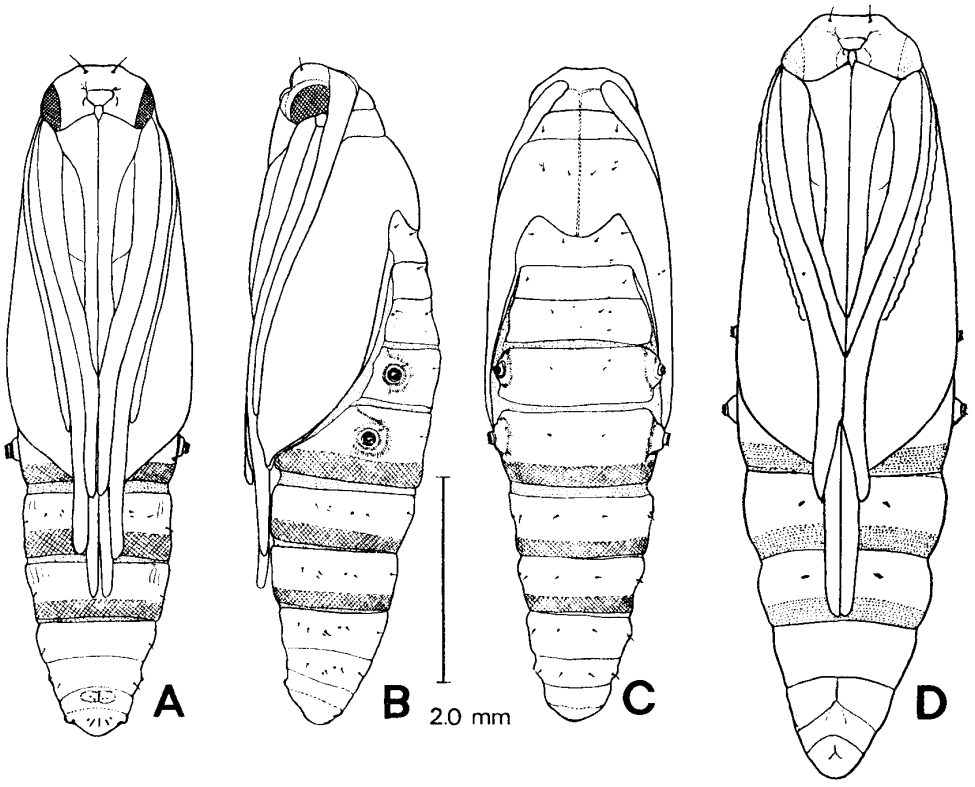

Fig. 16. *Elophila* (*C.*) *nigralbalis* (Caradja), pupae. A, Male, ventral view; B; ditto, lateral view; C, ditto, dorsal view; D, female, ventral view.

Male pupa: Body length 9.6 mm, width 1.8 mm.

Almost as in *turbata*, but differing from the latter in the following points: Body smaller in size. Head with frons having longer seta F1; antenna shorter, not reaching to wing apex. Abdomen with dorsal surface smooth, lacking characteristic crevices on 5th to 7th segments seen in *turbata*.

Distribution: Japan (Honshu, Shikoku, Kyushu, the Ryukyus), Vietnam, Indonesia. Taiwan.

Biological notes: The elliptical eggs are laid in mass underside of the host plants' leaves, *Azolla* sp. and *Marsilea quadrifolia* L. In the laboratory, *Salvinia natans* Allioni was used for rearing the larvae. All these plants belong to Pteridophyta. Just hatched larvae cut and gather the pieces of the host plant leaves, some larvae enter the intermediate hole of each leaf. After eating the surface of the leaf, the larvae change to 2nd instar larvae which add more larger pieces of the leaves. They never build the new cases upto maturation and the cases become larger in size only by adding the larger leaf pieces to the previous one. The surface of the larval body is wettable until the 3rd instar. After 4th instar they have dense water resistant structure throughout the body, especially in anterior segments, therefore the bubble of gas is retained around the body. Passing the 5th or 6th instar, the larvae attach the cases tightly to the underside of leaves for pupation. The adults emerge from the opposite side of the attached part under the water surface. The measurement of head width of the larva and the developmental period are as follows:

Head width and duration of immature stages
(20±1°C) (mean value based on 10 specimens)

	Larval stadia						Pupa
	1st	2nd	3rd	4th	5th	6th	
duration (day)	5.3	5.4	6.9	6.1	8.0	10.6	11.2
head width (mm)	0.18	0.29	0.38	0.52	0.66	0.81	—

Remarks: The Japanese specimens of this species had been treated as *Nymphula enixalis* (Swinhoe). Recently Speidel (1984) correctly identified the Japanese form as *Elophila nigralbalis* (Caradja) as well as distributed in China and Some areas of South East Asia. This species is close to *Elophila enixalis* (Swinhoe) from India to South-East Asia. The significant differences between these two species are appeared in the male genitalia, *viz.*, in *nigralbalis* the specilized setae on ampulla of valva are short and 3 in number, while in *enixalis* they are longer and 5 in number as described by Agassiz (1978).

Speidel (*loc. cit.*) cited Wang's report (1980) on host plants of this species which had wide range of host. These hosts are better to check again, because according to my rearing of this species the larvae did not feed on hosts other than the ferns.

***Elophila* (*Cyrtogramme*) *melagynalis* (Agassiz) comb. nov.**

Nymphula melagynalis Agassiz, 1978: 121.

External characters (female): Head with frons rounded, dark brown mixed with white scales. Vertex with long erect scales dark brown tinged with fulvous. Labial palpus curved upwards, basal 2 segments broad flourishing with dark brown scales outerly, the 3rd slender and dark known but apical extream acute and whitish. Maxillary palpus rather short and narrow, apex not widened. Proboscis short, about

1.5 times as long as eye. Antenna thick, short, about 2/5 of forewing length; dorsal surface of scape and pedicel dark brown, ventral surface whitish; flagellum with fanshaped, dark brown scales in each segment at dorsal, and short pilose at ventral. Ocellus distinct. Thorax above dark brown mixed with whitish and fulvous scales; beneath whitish scattered with some fuscous scales. Abdomen almost dark brown to ventral, posterior margin of each segment narrowly blackish. Legs long. Foreleg with antero-dorsal surface of coxa to 1st tarsomere dark brown, otherwise fulvous except for dark brown tip of each tarsomere. Midleg with femur to tibia and tips of tarsomeral segments dark brown, the other whitish; inner spur about twice as long as the outer one. Hindleg whitish but tips of tibia and each tarsomere dark brown; each inner spur almost as long as outer one.

Wing shape and venation: Wings rather short. Forewing with costa straight; apex broadly rounded; termen with middle portion slightly expanded. Vein Sc ended at costa of proximal 3/5; R_1 free from near at anterior angle of discoidal cell; R_2 anastomosed with R_{3+4} for about 1/2 its whole length. Bases of M_2, M_3 and CuA_1 a little apart, equidistant from each other; CuA_2 emitted at proximal 7/9 of discoidal cell; 3A absent. Discocellulars curved. Hindwing with termen weakly incised behind apex and somewhat sinuous to tornus. Vein $Sc+R_1$ anastomosed with Rs for 1/2 length of $Sc+R_1$ beyond discoidal cell; bases of M_2, M_3 and CuA_1 as in forewing; CuA_2 from proximal 2/3 of discoidal cell.

Female wing marking: Forewing with basal area dark brown and some fulvous portion at proximal extreme. AML wide, dark brown, its posterior portion behind discoidal cell more expanding distally than in *enixalis*. AMW almost parallel with termen, distinct. Discocellular lunule oblique outwardly, pale orange. DB2 broad, oblique, blackish. PML oblique from costa to vein R_{3+4}, then acutely retracted and running to vein M_3 paralleling with termen, and again retracted to posterior angle of discoidal cell, and more or less curved to posterior margin. WA, WB and WC unclear at edges and fuscous. PMG broad, dark brown but posterior 1/2 mixed with light brown scales. SML rather fragmented near to MGL, especially in posterior portion, dark brown. MGL light brown, but posterior portion changing to whitish. Cilia long and whitish with double dark brown lines at proximal 1/4 and 3/4.

Hindwing with proximal base whitish and basal area oblique, dark brown. AML as in *enixalis*, but ended at more distinct dot. DB2 narrow, dark brown, touched with postorior portion of PML, then

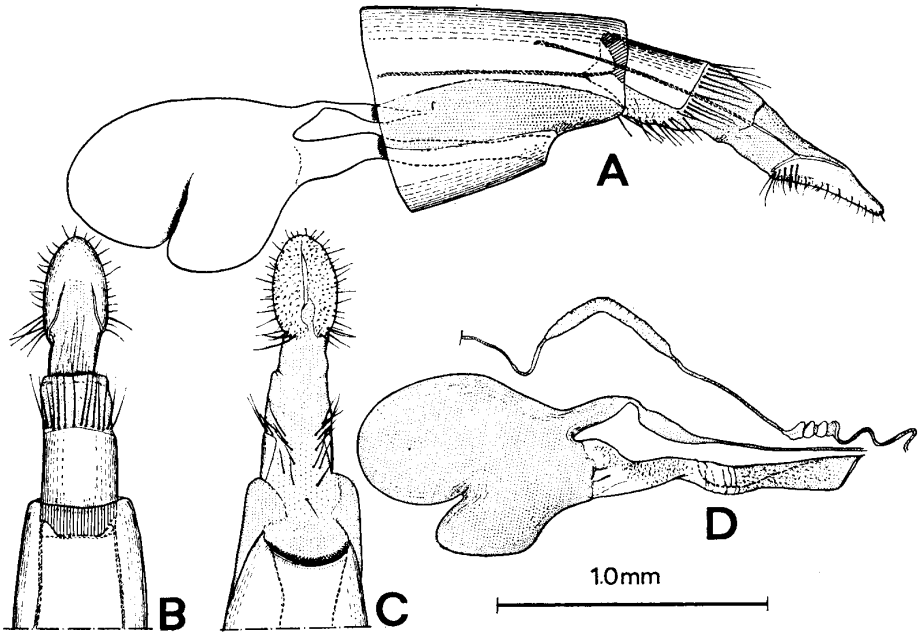

Fig. 17. *Elophila* (*C.*) *melagynalis* (Agassiz), female genitalia. A, Lateral view; B, 8th to 10th segments, lateral view; C, ditto, ventral view; D, bursa and spermatheca, lateral view.

formed a unique white area (WB+WC) anterior to the complex line. Anterior PML almost straight to vein M_3, and touched there with broad DB. WA dark brown. SML more shifted distally than in forewing, and also fragmented, dark brown. MGL unclear. Cilia as in forewing.

Female genitalia: Ductus bursae rather long. Bursal ring weakly sclerotized, with some vertical wrinkles. Corpus bursae long, 1.2 times as long as 7th tergum; base slender, weakly sclerotized, with many minute spines; tip swollen, membranous. Cervix bursae well developed, so broadly connected with corpus that seems to be a bifurcated portion of corpus bursae in appearance. Spermatheca with basal scletotized ring large, without lagena. Eighth tergum 2/5 as long as 7th tergum, with long setae at posterior margin on a straight line; 8th sternum membranous, also with long setae obliquely; apophysis anterioris slightly shorter than 7th tergum. Papilla analis elongate; apophysis posterioris 1.25 times as long as anterioris, without special plate at base.

Size of forewing: Female, 8.5 mm.

Immature stages: Unknown.

Specimens examined: 1 female, Ohara, Iriomote-jima Is., the Ryukyus, 7.x.1979 (S. Hashimoto). Exotic specimens: 1 male, 1 female (both paratypes), Enfield, England (R. D. Agassiz).

Distribution: Japan (the Ryukyus), Sri Lanka, Thailand. New to Japan.

Remarks: This species differs from the other species belonging to the subgenus *Cyrtogramme* by having the wings smaller and darker, the hindwing with straight AML, the male genitalia without specialized setae on valval ampulla and the female genitalia with "bifurcated" corpus bursae in appearance (cf. Agassiz, 1978).

Subgenus *Munroessa* Lange

Munroessa Lange, 1956: 100; Spiedel, 1984: 48.

Type-species: *Nymphula serralinealis* Barnes and Benjamin, 1924.

External characters: Moderate in size, with broad wings and long legs. Head with frons, vertex and labial palpus as in *Elophila s. str.* Maxillary palpus rather short, without apical extending scales. Proboscis well developed. Ocellus small. Antenna as in *Elophila s. str.*

Wing shape and venation: Forewing with apex narrowly rounded; termen weakly expanded at middle. Vein R_1 emitted from discoidal cell a little proximal to anterior angle; R_2 free or stalked with R_{3+4}; R_5 arising from just or a little behind of anterior angle of discoidal cell; M_1 straight; bases of M_2, M_3 and CuA_1 aproximated to each other; CuA_2 emitting at proximal 4/5 of discoidal cell; anal veins as in *Elophila s. str.* Hindwing with apex as in forewing; termen evenly rounded. Vein $Sc+R_1$ anastomosed with Rs for longer distance than in *Elophila s. str.*; M_2, M_3 and CuA_1 as in forewing; CuA_2 arising at proximal 2/3 of discoidal cell.

Wing marking: Ground components well developed. In forewing WA and WB almost narrow and not rounded except for *E. miurai* sp. nov. PML strongly oblique outwards from costa to vein R_{3+4}, then angled and excurved to vein M_3. PMW narrow, interrupted by the expansion of ground components.

Male genitalia: Tegumen shorter than wide. Vinculum connected with tegumen by membrane, almost as long as height of tegumen. Saccus rather short, not flat in lateral view. Uncus longer than that of *Elophila s. str.*, and tapered to apex. Gnathos long and evenly narrowing to apex, usually with indistinct spines at dorso-apical portion. Valva blade-like in shape, long; anellifer invaded to proximal 1/3, with a tuft of scale-like setae as in *Elophila s. str.*, but more numerous than in *Elophila s. str.*; inner surface evenly sclerotized with many setae; distal margin with many long setae. Phallus short, thick; perivesical area evenly sclerotized; vesica with a pair of cornuti, each one consisting of many spines.

Juxta almost triangle, but variable in shape; proximal margin connecting with saccus by plate or membrane. In addition, 8th sternum almost U-shapedly sclerotized, without any special projection at posterior margin.

Female genitalia: Ductus bursae weakly sclerotized. Corpus bursae rather long, evenly membranous; signa usually representing as a group of spines. Cervix bursae well developed, about 1/2 as long as corpus bursae. Spermatheca with utricus moderate in length, without lagena. Apophysis anterioris slender. Papilla analis small and oblique. In addition, 7th sternum very shorter than the tergum.

Remarks: The genus *Munroessa* Lange was established based on the North American 4 species by having the different male genitalia from those of the genus *Elophila*. In *Munroessa*, the uncus is well developed, the gnathos is slender and the valva is blade-shaped, while in *Elophila* the uncus is short and flat, the gnathos is widened at apex and the valva is long and parallel-sided. But after the close examination of the Japanese species possibly including in the genus *Munroessa* and the specimens of *Munroessa serralinealis* (Bernes and Benjamin), I have come to the conclusion that *Munroessa* is better to treat as a subgenus of the genus *Elophila* followed after Speidel (1984). Because the wing venation and marking of *Munroessa* are almost the same as those of *Elophila*, and the male genitalia of the former show the slight variation of those of the latter. In addition, the male genitalia with the special setae on ampulla and the scale-like tuft on anellifer in the valva and the female genitalia with well developed cervix bursae are characteristic to the genus *Elophila*.

The subgenus *Munroessa* contains 4 species described from Nearctic Region and 6 species occurred in the East Palearctic Region. The subgenus is thought relatively a primative one in the genus *Elophila*.

Key to the Species of *Elophila* (*Munroessa*) based on Adults

1. Wings with lines distinct and white areas broad; male genitalia with setae on valval ampulla short; female genitalia with ductus seminalis partly swollen ……*E.* (*M.*) *miurai* sp. nov.
— Wings with lines slender and white areas narrow; male genitalia with several setae on valval ampulla long; female genitalia with ductus seminalis lacking swollen portion…… 2
2. Forewing with PML evenly curved; male genitalia with setae on valval ampulla constricted to base of valva; female genitalia with corpus bursae having a pair of signa …*E.* (*M.*) *fengwhanalis* (Pryer)
— Forewing with PML excurved; male genitalia with setae on valval ampulla sparsely present along costa; female genitalia with corpus bursae having scattered spinules of signa…… 3
3. Wings with ground components evenly pale orange; hindleg with each inner spur 1.5 times as long as outer one; male genitalia with juxta having a projection at apex, and with gnathos widened and strongly depressed laterally at apex; female genitalia with cervix bursae almost as long as corpus bursae …… *E.* (*M.*) *orientalis* (Filipjev)
— Wings with ground components fuscous, partly suffused with yellowish; hindleg with each inner spur twice as long as outer one; male genitalia with juxta lacking of a projection at apex, and with gnathos narrowing to apex; female genitalia with cervix bursae shorter than corpus bursae……
…… *E.* (*M.*) *sinicalis* (Hampson)

Key to the Species of *Elophila* (*Munroessa*) based on Larvae and Pupae

1. Larval head and prothoracic shield with spotted with blackish pigmentations; pupa with forelegs on

both sides attached each other at mid-ventral line ·····*E.* (*M.*) *fengwhanalis* (Pryer)

— Larval head and prothoracic shield with broad blackish bands; pupa with forelegs on both sides not attached at mid-ventral line ····· 2

2. Larval head with adfrons dark brown; pupa with spiracle on 2nd abdominal segment much smaller than those on 3rd and 4th ones·····*E.* (*M.*) *orientalis* (Filipjev)

— Larval head with adfrons brown; pupa with spiracle on 2nd segment a little smaller than those on 3rd and 4th ones ·····*E.* (*M.*) *sinicalis* (Hampson)

Elophila (*Munroessa*) *miurai* sp. nov.

Nymphula separatalis: Inoue, 1982. I:370, II: 242, pl. 44, fig. 30 (♂).

External characters: Head with frons white. Vertex with somewhat elevated scales, white, scattered with fuscous scales. Labial palpus with basal 2 segments dark brown on outer surface; the 3rd white. Maxillary palpus small, dark fuscous at base, white at apex. Antenna in male thick, 1/2 as long as forewing length, in female slender and 1/3 as long as forewing length; bases in both sexes fuscous on outer surface. Thorax above whitish with broad dark brown band, beneath whitish. Abdomen above fulvous to whitish, with fuscous ring at anterior margin of each segment. Legs whitish; foreleg with anterior surface of coxa to tibia fuscous; midleg with anterior surface of femur and dorsal surface of tibia fuscous, inner spur about twice as long as the outer one; hindleg evenly whitish except for fuscous tips of femur and tibia, both inner spurs 1.5 times as long as outer ones.

Wing shape and venation: Forewing with apex rounded, with termen evenly curved. Vein Sc ending costa near end of cell; R_2 connated with R_{3+4} basally; R_5 from just behind anterior angle of cell; M_2 and M_3 rather separated; CuP absent.

Hindwing with apex rounded, and termen as in forewing. Vein $Sc+R_1$ fused with Rs for about

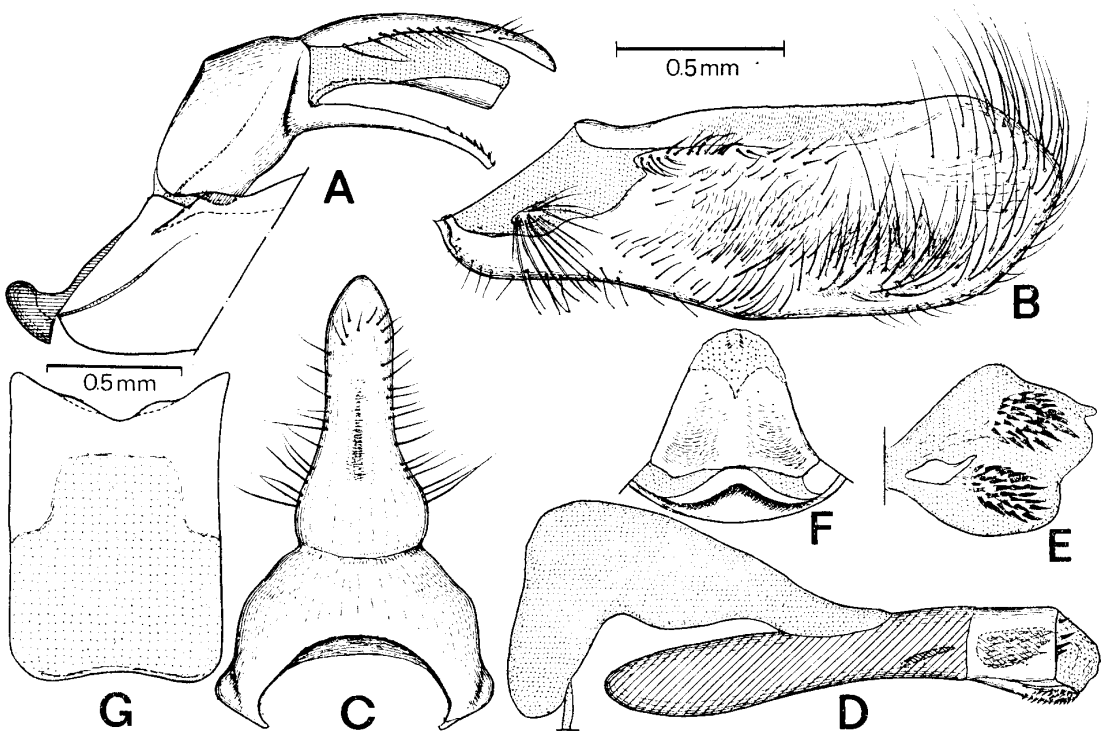

Fig. 18. *Elophila* (*M.*) *miurai* sp. nov., male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, cornuti; F, juxta; G, 8th sternum.

5/8 the length of $Sc+R_1$ beyond cell; bases of M_2 and M_3 as in forewing.

Wing marking: Similar to *E. separatalis* (Leech, 1889), but differs from the latter as follows: Forewing with margins of white area more straight, especially SMW with anterior margin almost straight, whereas in *separatalis* undulate, and with posterior portion of ML evenly oblique inwards, thence WC triangle in shape; hindwing with SMW as in forewing.

Male genitalia: Tegumen shorter than long. T-v plate rather expanded laterally. Uncus flat and rather long, with several setae laterally. Gnathos slender, curved downwards, with some distinct dentations at apex. Valva long; costa flat and wide medially; ampulla with several short but distinct setae; apical portion with long, curved setae; sacculus narrow, convex ventrally. Phallus short, almost straight; perivesical area with a group of spines on ventral surface; vesica with a pair of cornuti, each consists of about 30 spines and with a weak plate anteriorly.

In addition, 8th sternum leaving U-shaped sclerite.

Female genitalia: Ductus bursae wide, moderate in length, about as long as 7th sternum. Corpus bursae relatively short, almost as long as 7th sternum, its base weakly sclerotized and medially furnished with many spinules, of which lateral ones are distinct and star-shaped at bases. Cervix bursae well developed, rounded, with base wide and scleorotized and furnished with lined spinules. Eighth tergum 0.47 as long as 7th tergum, evenly scleorotized, with posterior setae present on a line; apophysis anterioris 0.80 as long as 7th tergum, with triangular plate a little beyond base. Aphophysis posterioris 1.21 times as long as anterioris.

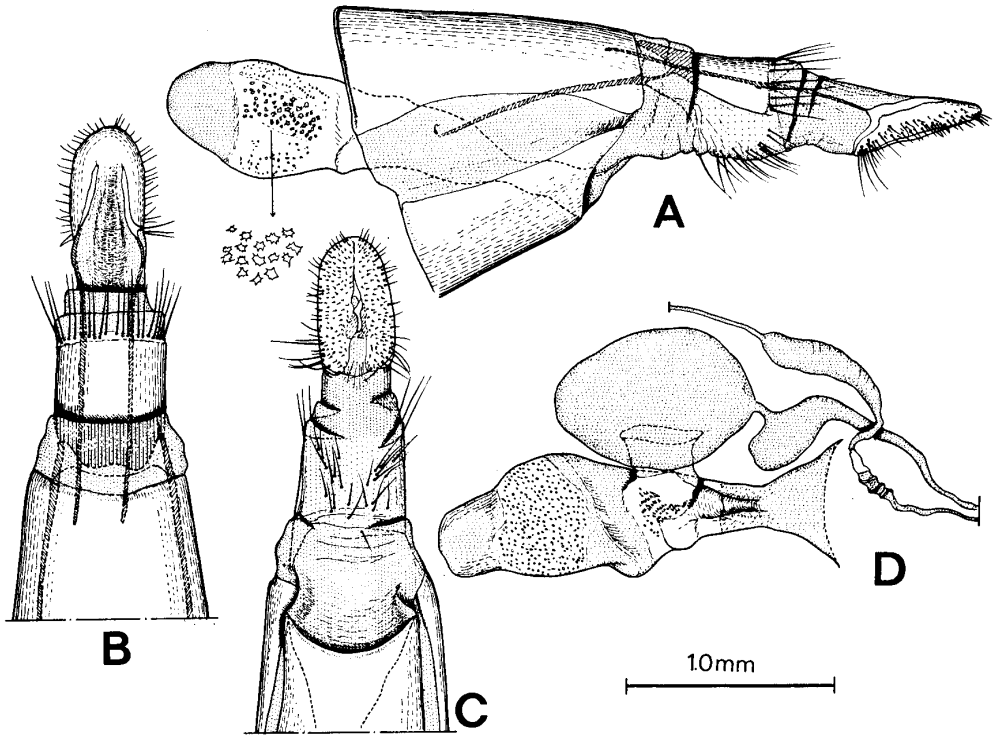

Fig. 19. *Elophila* (*M.*) *miurai* sp. nov., female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, dorsal view.

Size of forewing: Male, 10.1 mm; female 10.7−11.3 mm.

Holotype: Female, Okazaki, Aichi Pref., 6. ix. 1976 (S. Miura) (KU). Paratypes: 1♂, Kooridono, Ojiya, Niigata Pref. 15. vi. 1975 (K. Yamagishi) 15. vi. 1975 (KPU); 2♀, data as holotype (KPU); 1♀, Ojino, Gifu Pref., 16. vi.1976 (H. Endo) (KPU); 3♀, Kasamatsu, Gifu Pref., 17. v. 1980, 10. vi. 1981,

13. vi.1982 (S. Funakoshi) (KPU).

Immature stages: Unknown.

Distribution: Japan (Honshu).

Remarks: The present new species is very close to *E. separatalis* in the wing marking and the both male and female genitalia, but differs from the latter as follows: SMW of both wings with anterior margins more straight; male genitalia with uncus broader, and with many terminal setae on valva; female genitalia with shorter cervix bursae.

On the other hand, this new species is similar to *E.* (*E.*) *interruptalis* in the wing marking, but is separable from the latter by the presence of the broader and more rounded PML.

Speidel (1984) added *E. separatalis* to the Japanese fauna based on Wileman's paper (1911). In this paper the decision on this record is retained because of no examination of the specimen and of the difficulty of the identification of these allied *E. separatalis* group, including *E. nigrolinealis* (Pryer) and *E. roesleri* (Speidel).

***Elophila* (*Munroessa*) *fengwhanalis* (Pryer)**

Lepyrodes fengwhanalis Pryer, 1877: 235, pl. 4., fig. 11 (type-locality: Fengwhan-shan, China).

Nymphula fengwhanalis: Hampson, 1897: 140; Leech, 1901: 432; Shibuya, 1929: 124, 126; Matsumura, 1931: 1045; Caradja, 1932: 147; Inoue, 1954: 154; Mutuura, 1957: 118; Inoue, 1982, I: 370, II: 242, pl. 44, fig. 31 (♂) & pl. 228, fig. 41 (♀).

Elophila fengwhanalis: Speidel, 1984: 65.

External characters: Head with frons whitish and medianly fulvous; vertex fulvous mixed with fuscous scales. Labial palpus upturned, basal 2 segments scaled thickly, brown; the 3rd narrow, whitish Proboscis short, almost as long as eye width, base with whitish scaling. Ocellus rather small, black. Antenna of male thick, with raised fulvous scales dorsally; that of female shorter than in male, about 2/5 the length of forewing, with flat fulvous scales dorsally. Foreleg with anterior surface of coxa to tibia ochreous to fuscous, otherwise whitish. Midleg evenly whitish, with short spurs of which inner one is as long as outer one. Hindleg also evenly whitish, each inner spur about twice as long as outer one. Thorax above fulvous to pale orange, mixed with some whitish scales, beneath whitish. Abdomen above pale orange, with whitish ring at posterior margin of each segment, beneath paler.

Wing shape and venation: Forewing with apex broadly rounded. Vein Sc ending at proximal 3/5 of costa near distal end of cell; R_1 short; R_2 of basal 1/2 closely connated with base of R_{3+4}; R_5 emitting just behind base of R_{3+4}; bases of M_2, M_3 and CuA_1 not so approximated; starting point of CuA_2 more proximal than that of R_1; CuP weakly present at distal 1/2; discocellulars erect. Hindwing with apex rounded; termen behind apex a little excurved. Vein $Sc+R_1$ fused with Rs for about 4/7 the length of $Sc+R_1$ beyond discoidal cell; bases of M_2, M_3 and CuA_1 as in forewing.

Wing marking: Ground components pale orange. BL and SBL represented by evenly pale orange. AMG with anterior 1/2 expanded distally to touch ML, with posterior portion narrowly edged by fuscous at distal margin. WD indistinct. ML starting at 1/2 of costa, indistinct, blackish brown anteriorly and pale orange posteriorly. WA separated into 2 portions, one near costa, the other in discoidal cell. WC reduced to narrow and obscure area. PML recognized by narrow PMW, pale orange and edged by fuscous at distal margin, excurved from vein R to CuA_2 and retracted to posterior margin of discoidal cell, then zigzagged to posterior margin. WB separated into 2 small, obscure areas. SML narrow, interrupted into 7 fuscous bars by veins. SMW also interrupted accompanying with that

of SML. SMG evenly pale orange. ML absent. Cilia fuscous with darker line at proxiaml 1/3.

Hindwing with BL and SBL absent. AMG broad, edged by fuscous at distal margin. ML oblique in discoidal cell, then broadly touched with PML and curved to near tornus, thence WA not formed and being separated from triangular WC. DB2 continued with posterior portion of PML, fuscous. PML stouter than in forewing, and retracted at vein M_3 to posterior angle of discoidal cell, then almost straightly ended to posterior margin, pale fuscous. PMG with both margin suffused with fuscous. SML as in forewing, and SMW a little broader than in forewing. Cilia as in forewing.

Male genitalia: Tegumen short, rounded, with broad internal ridge at anterior margin. Vinculum slightly shorter than height of tegumen. Saccus small, flat and slightly produced at anterior portion. Uncus long, as long as height of ring, with lateral setae from base to subapex. Gnathos long, with apical portion a little broadened, and depressed laterally, with single series of distinct dorsal spines at apex. Valva long, slightly narrowing to apex; costa rather flat, expanding dorsally in medial portion, without seta; ampulla with a group of long setae which are curved; apical margin with many long setae. Phallus narrow, short; coecum penis about 0.6 as long as whole length of phallus; vesica with cornuti consisting of many minute spinules, and with a rectangular plate on which some spinules are emitted anteriorly. Juxta triangular in shape, apical portion narrowly excurved. In addition, 8th tergum membranous medially, with posterior margin produced; 8th sternum membranous at mid-vental portion.

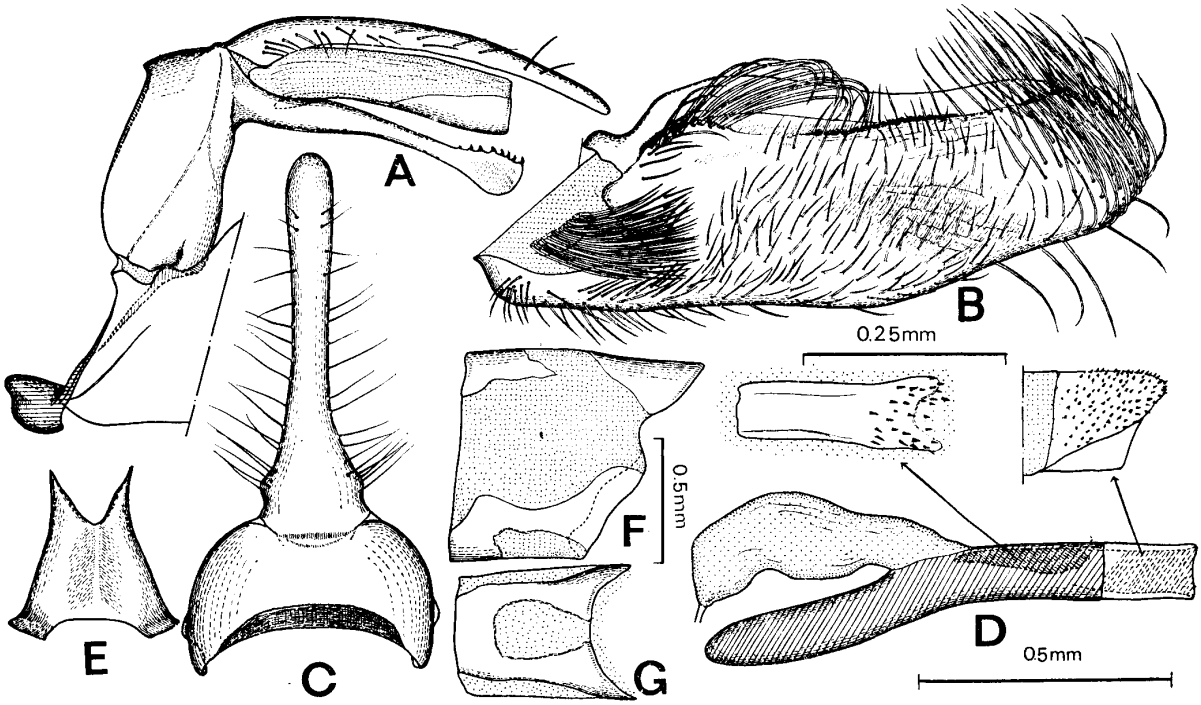

Fig. 20. *Elophila* (*M.*) *fengwhanalis* (Pryer), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, junxta; F, 8th abdominal segment, lateral view; G, 8th sternum, ventral view.

Female genitalia: Ostium bursae wide. Ductus bursae rather long, narrowing to bursal ring, with many minute spinules. Bursal ring narrow and rather long, simple in shape. Corpus bursae moderate in length, base with minute but distinct spines which are encircle bursa; apical portion stout, elliptic in shape, with a characteristic pair of signa of which each consists of many triangular distinct spines. Cervix bursae rounded, ductus seminalis emitting from its anterior portion. Spermatheca with spiral, sclerotized ring much long. Eighth tergum evenly sclerotized, 0.45 as long as 7th tergum, with long

setae at posterior margin on a straight line. Papilla analis rather wide; apophysis posterioris 1.43 times as long as anterioris.

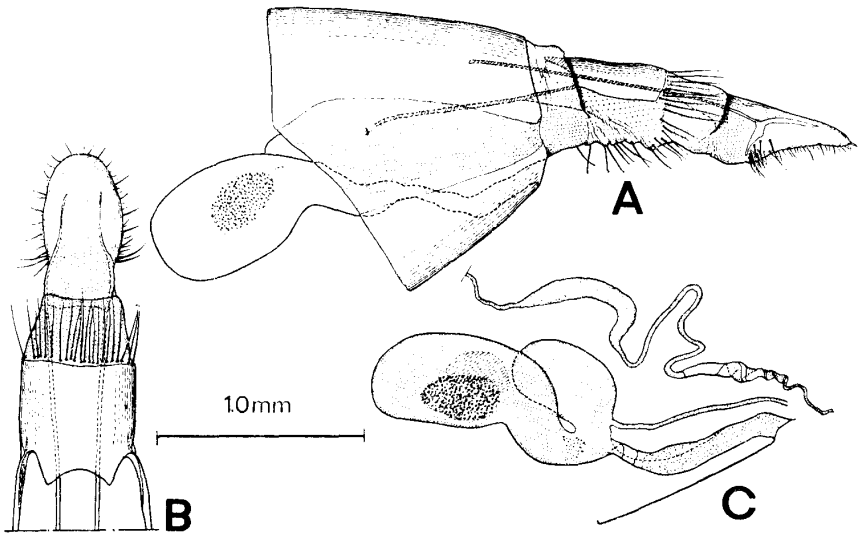

Fig. 21. *Elophila (M.) fengwhanalis* (Pryer), female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, bursa and spermatheca, lateral view.

Size of forewing: Male, 6.6-7.6 mm; female, 6.9-9.1 mm.

Mature larva (5th instar): Head width 1.3 mm, body length 15-23 mm.

Head: Wider than long, pale brown with many darker spots on cranium which spots are continuous and forming 6 indistinct bands transversely. Each setal base marked by darker ring. Seta AF1 longer than AF2; puncture AFa anterior to AF1; P1 long, nearly lateral to AF2; L1 short, lateral to P1; A2 short, posterior to A1, not situated on a combining line between A1 and A3; O1 short; O2 longest, near to O1; O3 shifted a little anteriorly, thence situated laterally to an extension line between O1 and O2; SO1, SO2 and O3 situated on a line. Labrum pale brown with medial anterior plate on inner surface wide; seta M3 shorter than M1. Mandible light brown, with 5 teeth; inner teeth well developed; posterior seta from postero-ventral margin about 1/3 as long as anterior one.

Thorax: Milky white suffused with pale brown. Prothorax with prothoracic shield pale brown with spotted marking as in head; legs with coxae on both sides attached at mid-ventral line; setal base with darker ring; seta D2 long, a little posterior to a combining line between D1 and SD2; L2 short, just anterior to long L1; SV1 long. Meso- and metathorax with coxae of legs on both sides separated; setae D1 and D2 vertically arranged; SD2 long, antero-ventral to SD1; L3 minute, ventral to L1; SV1 long.

Abdomen: Broader than thorax, especially expanded dorsally at anterior portion of 8th segment; yellowish white. Prolegs with crochets short, semicircle, biordinal, about 65 in number. In 1st to 8th segments, seta D1 very short; D2 postero-ventral to D1; L2 minute, anterior or antero-ventral to L1; number of SV setae, 1 on 7th and 8th, 2 on 1st and 3 on 2nd to 6th segments. Ninth segment with seta D1 short, nearer to slender SD1 than to D2; D2, SD1 and L1 long, almost same in length; L2 short, ventral to L1. Tenth segment with anal shield represented by a darker area where no seta is included; setae D2 and SD1 same in lenght, about 1/2 lenght of the segment and D2 shifted laterally; SD2 short, lateral to D1; anal proleg with crochets uniserial, biordinal, 15-19 in number.

Pupa: Body length 8.3-10.0 mm, width 2.4-2.9 mm.

Body stout, evenly pale brown. Head with frons medially concave, seta F1 relatively distinct; vertex without seta V1; pilifer not clearly marked; maxilla extending to 3/5 the length of wings; antenna in

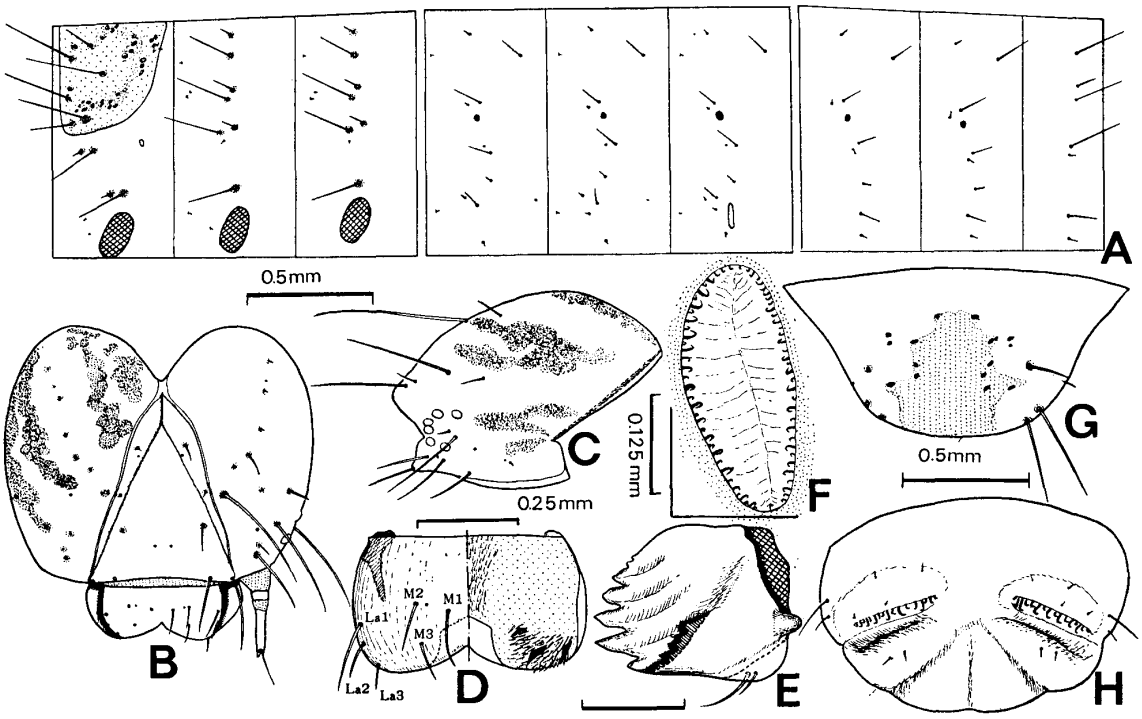

Fig. 22. *Elophila* (*M.*) *fengwhanalis* (Pryer), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, crochets of proleg; G, 10th abdominal segment, dorsal view; H, ditto, ventral view.

male reaching to apex of wings, that in female short, almost reaching to apex of maxilla. Thorax with foreleg in male a little beyond wing apex, that in female short, ending at 2/3 of wings; apical portions of both forelegs attached at mid-ventral line each other. Midleg in male long, far beyond wing apex, that in female almost reaching to wing apex. Hindleg distinctly longer than midleg. Abdomen with spiracles of 2nd to 4th segments well developed except that one of the 2nd is a little smaller. Apex of 10th abdominal segment rounded, with short but distinct 3 pairs of setae which are almost equal in size.

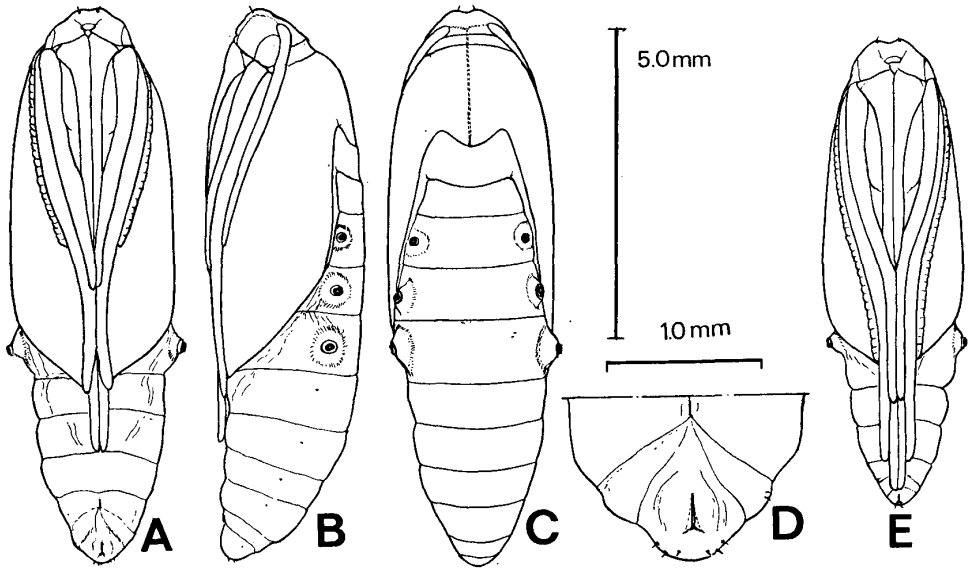

Fig. 23. *Elophila* (*M.*) *fengwhanalis* (Pryer), pupae. A, Female, ventral view; B, ditto, lateral view; C, ditto, dorsal view; D, ditto, apical segments, ventral view; E, male, ventral view.

Specimens examined: 21♂, 36♀ from Honshu (Iwate, Akita, Niigata, Kanagawa, Aich, Mie, Shiga, Kyoto, Osaka, Prefectures). Shikoku, 1♀, 12. vii.1972, 1♀, 13. viii. 1972, Ino, Kochi Pref. (Y. Suzuki) (KPU). Kyushu (Fukuoka, Oita, Kagoshima Prefectures), Tokara Is. (2♀, Takara-jima Is, 26. iii. 1975 (K. Kanmiya) (KPU)) (KU, KPU, UOP, IC, MC).

Distribution: Japan (Hokkaido, Honshu, Shikoku*, Kyushu, Tokara Iss.)*, China, Korea.

Biological notes: The female lay the eggs in mass as in the species of *Elophila s. str.* The just hatched larvae immediately make the small cases by two fragments of the host-leaves, and feed on the surfaces of the leaves. After the 2nd instar larvae, the life history is almost the same as in the *Elophila s. str.* But the cases of the mature larvae are more finely made than those of *Elophila s. str.* and they seems to prefer the submerged plants.

According to Kuwayama (1950), the larvae feed on the rice plant in Hokkaido. Unfortunately I could not confirmed the host.

Remarks: The species is allied to *E. (M.) orientalis*, but differ from the latter by the some points as will be discussed in the description of *E. (M.) orientalis*.

***Elophila (Munroessa) orientalis* (Filipjev)**

Nymphula orientalis Filipjev, 1934: 15, figs. 3-5. (type-locality: Ussuri); Inoue, 1982, I: 371, II: 243, pl. 44, fig. 38 & pl. 228, fig. 42.

Elophila orientalis: Speidel, 1984: 64.

External characters: Almost resembles *Elophila (M.) fengwhanalis* (Pryer). Head with frons and vertex as in *fengwhanalis*. Labial palpus with scales longer and more sparse. Maxillary palpus upturned longer, with base brown and apex whitish. Proboscis well developed. Antenna longer than in *fengwhanalis*, that of female about 1/2 as long as forewing length, fulvous dorsally. Legs as in *fengwhanalis* except that each tarsal tip in *orientalis* fuscous, while in *fengwhanalis* evenly fulvous. Thorax and abdomen as in *fengwhanalis*.

Wing shape and venation: Separable from *fengwhanalis* as follows: Forewing with apex more produced bases of veins M_2, M_3 and CuA_1 more approximated each other. Hindwing with vein $Sc+R_1$ anastomosed with Rs for longer distance; bases of vein M_2, M_3 and CuA_1 as in forewing.

Wing marking: Ground components pale orange. Forewing with SBL pale fuscous. AML clearly recognized, undulate, fuscous. AMG rather narrow, expanded distally in discoidal cell, evenly pale fuscous. WD darkened except for round whitish distal portion. ML broad in costa, and narrowing to discoidal cell, then diminished there, and restarting from posterior portion of discoidal cell to posterior margin, pale fuscous with some blackish scales. DB1 unrecognized. PML absent on costa, and appeared from vein R and retracted proximally along the vein, then excurved to vein M_2 where the line connected with DB2, Posterior portion of PML from posterior angle of discoidal cell expanded in cell CuA_2 and obliquely ended to posterior margin. PMG moderate in width, pale fuscous; proximal margin in cell M_3 extended proximally to touch discocellular lunule. SMW more obscure than in *fengwhanalis* SMG evenly pale fuscous. Cilia with interrupted fuscous line at proximal 1/4, while the line in *fengwhanalis* continuous.

Hindwing with AML dark brown, innerly oblique, straight, whereas in *fengwhanalis* more or less undulate. PML from costa extending outwards to vein $Sc+R_1$, then angled and more strongly excurved to vein M_3 than in *fengwhanalis*; lower portion of the line almost parallel with ML to posterior margin. Otherwise as in forewing.

*An asterick on local distributisn indicates new record for the area.

Male genitalia: Tegumen short, anterior margin U-shaped, with transverse ridge dorsally. Vinculum shorter than in *fengwhanalis*. Saccus small and flat. Uncus long, evenly curved downwards to apex, with lateral setae; apical 2/3 parallel-sided and apex narrowly rounded. Gnathos straight, evenly narrowing to apex, which is suppressed laterally as in *fengwhanalis* and has small dorsal spines. Valva with costa flattened and obscure at ventral margin; ampulla with a group of special setae extending at proximal 2/3 of valva and parallel with costa; inner surface with many long setae together with more or less stout setae on apical margin. Phallus short; coecum penis straight, and its anterior portion narrowing, about 0.44 as long as whole length of phallus; vesica with cornuti consisting of 2 groups of many distinct spines. Juxta triangular, apical portion narrow and produced to form characteristic projection extending ventrally.

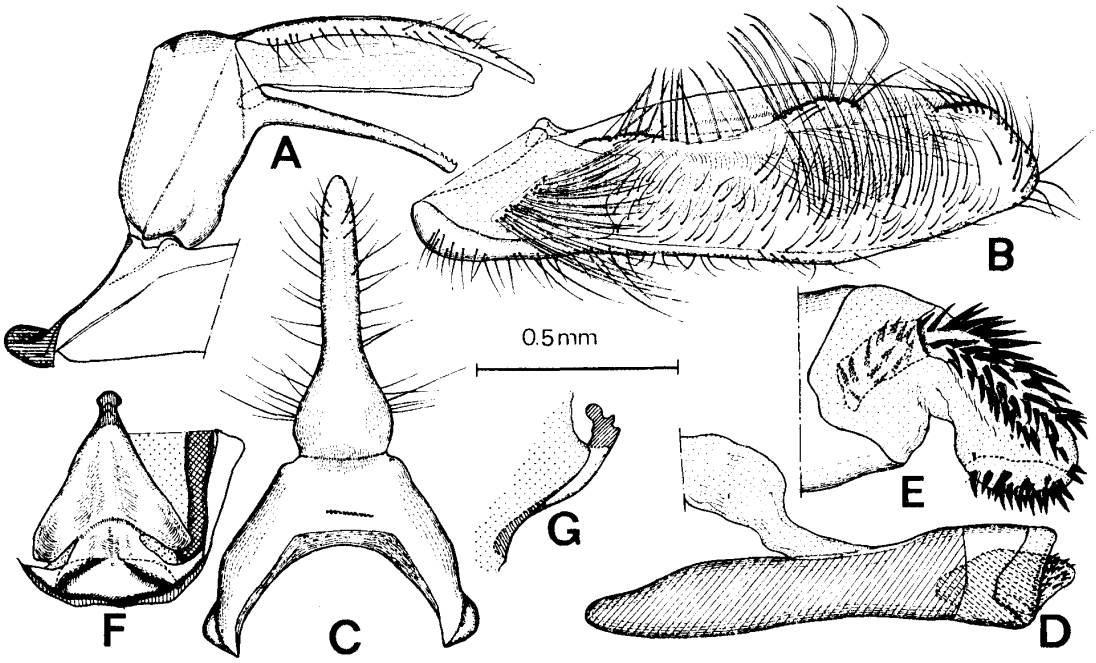

Fig. 24. *Elophila* (*M.*) *orientalis* (Filipjev), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, cornuti; F, juxta with is base: G, ditto. lateral. view.

Female genitalia: Ostium bursae moderate in width. Ductus bursae membranous, with minute spinules anteriorly. Corpus bursae short, 7/8 as long as 7th tergum, basal 1/3 sclerotized, with more or less lined, distinct wrinkles; median 1/3 sclerotized, with many triangular spinules which are larger to lateral portion; apical 1/3 narrow, evenly membranous. Cervix bursae almost as large as corpus bursae expanded roundly. Spermatheca with utricus long, equal to corpus bursae in length. Eighth tergum 0.51 as long as 7th tergum, with anterior portion weakly sclerotized; apophysis anterioris 0.83 as long as 7th tergum, with base a little widened. Papilla analis flattened and narrower than in *fengwhanalis*; apophysis posterioris 1.2 times as long as anterioris.

Size of forewing: Male, 7.7-8.5 mm, female, 7.9-10.8 mm.

Mature larva (*5th instar*): Head width 1.3 mm, body length 15-18 mm,

Almost similar to *Elophila* (*M.*) *fengwhanalis*, but differs from the latter as follows: Head with darker marking broader, continuous and forming 4 transverse bands; frons and adfrons darker; seta P2 longer; A2 just situated on a combining line between A1 and A3. Prothoracic shield also with darker marking broader and more distinct, X-shaped in dorsal view. Ninth abdominal segment with seta D1 equidistant from D2 and SD1. Tenth segment with anal shield broader, including setae D1, D2 and SD1.

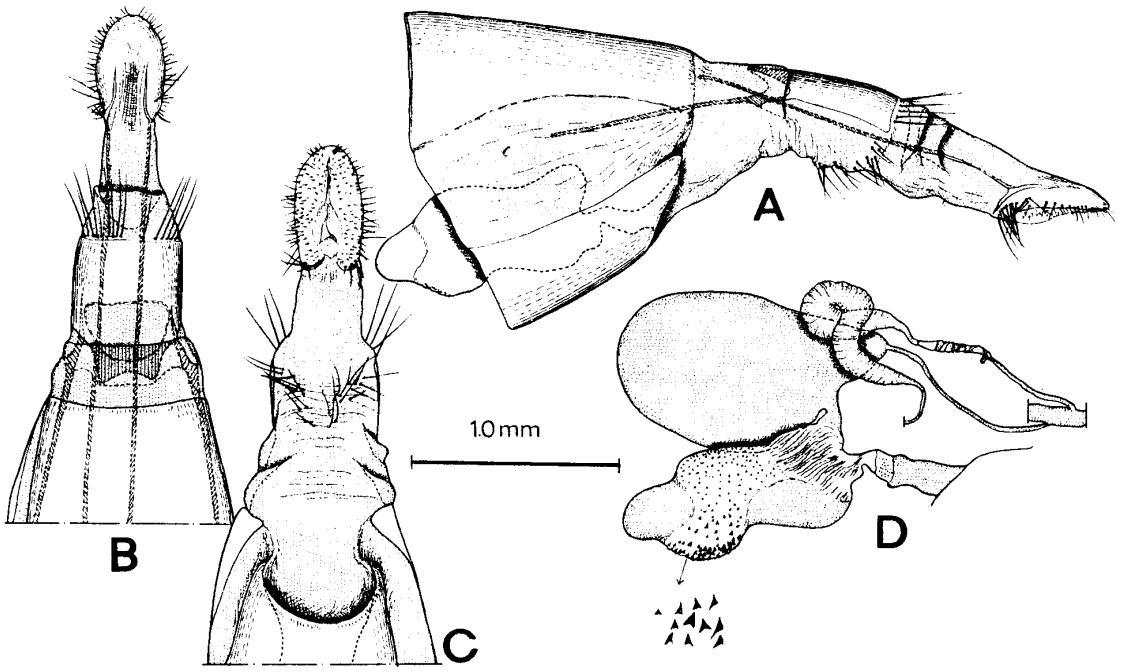

Fig. 25. *Elophila* (*M.*) *orientalis* (Filipjev), female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, lateral view.

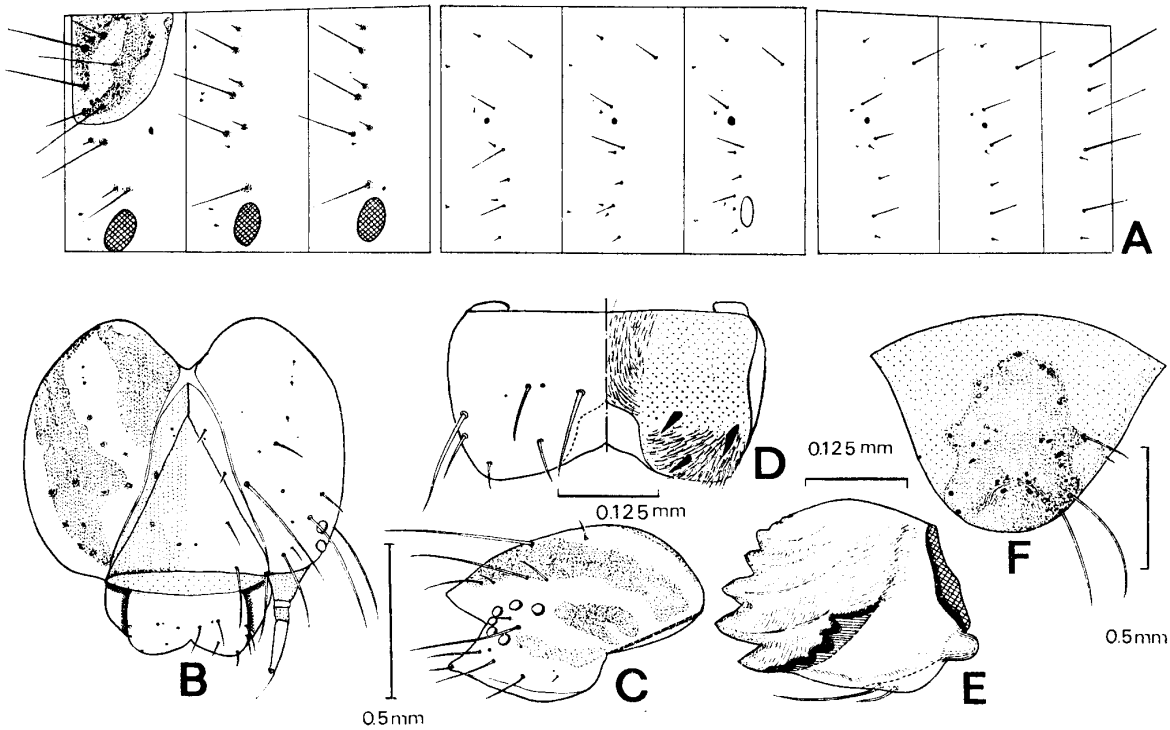

Fig. 26. *Elophila* (*M.*) *orientalis* (Filipjev), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, 10th abdominal segment, dorsal view.

Pupa: Body length 8.5–11.5 mm, width 2.5–3.1 mm.

Resembles *Elophila* (*M.*) *fengwhanalis*, but separable from the latter in the following points: Head with pilifer weakly recognized; maxilla longer, its apex reaching to near wing apex in both sexes; antenna in female longer, extending to 3/4 the length of wings. Forelegs of both sexes longer and

those of both sides not attached at midventral line. Mid- and hindlegs also longer. Abdomen with spiracle of 2nd segment distinctly smaller than those of 3rd and 4th, without protruded base. Tenth segment with setae on posterior margin longer in a inner-most one and shorter in 2 lateral pairs.

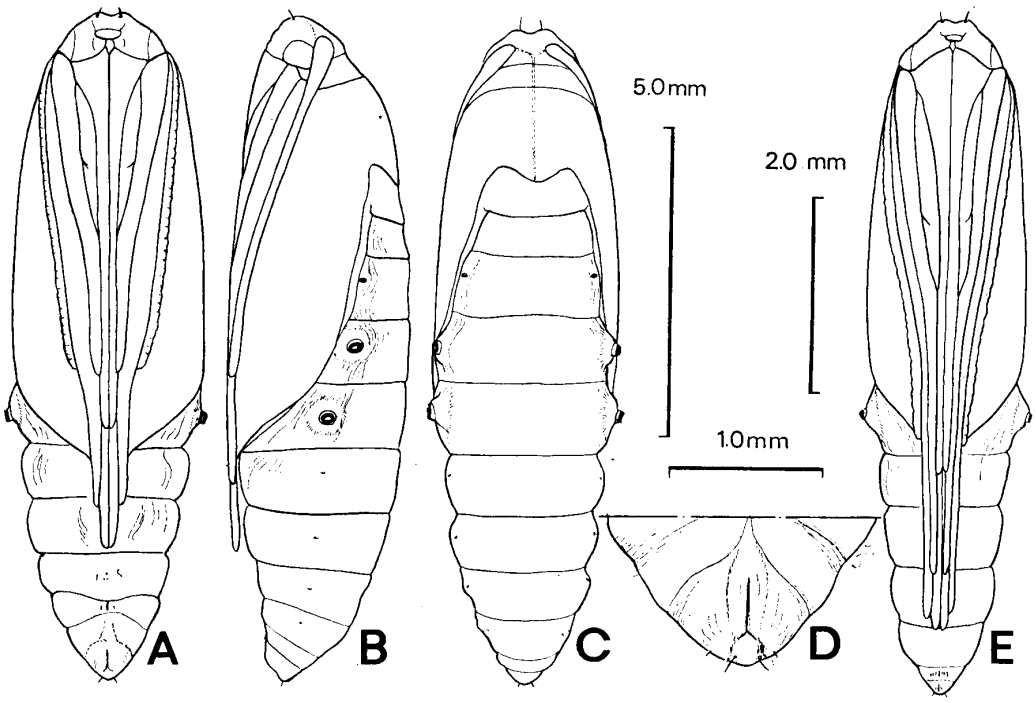

Fig. 27. *Elophila* (*M.*) *orientalis* (Filipjev), pupae. A, Female, ventral view; B, ditto, lateral view; C, ditto, dorsal view; ditto, apical segments, ventral view; E, male, ventral view.

Specimens examined: Hokkaido:-2♂, Hiraki-numa Pond, near Tomakomai, 8.vii.1980 (Y. Yoshiyasu) (KPU); Honshu:-1♀, Otomonuma Pond, Noshiro-shi, Akita Pref., 13. viii. 1979 (M. Kudo) (IC); 1♂, Kodo, Niigata-shi, Niigata Pref., 9.vi. 1963 (F. Fujita) (KPU); 1♂, Kodo, Niigata-shi, Niigata Pref., 8. vi. 1963 (R. Sato) (KPU); 1♀, Kodo, Niigata-shi, Niigata Pref., ix. 1963 (F. Fujita) (KPU); 1♀, Kooridono, Ojiya-shi, Niigata Pref., 1.viii.1973 (K. Yamagishi); 1♂, Sakurabushi, Shinishiro, Aichi Pref., 17-18. v. 1958 (H. Inoue) (IC); 1♀, Chiharazawa, Aichi Pref., 13. viii. 1979 (S. Miura) (MI); 8♀, Shimagahara, near Ueno-shi, Mie Pref., 8.i x. 1982 (Y. Yoshiyasu) (KPU); 1♀, Kii-Oshima Is., Wakayama Pref., 16. vii. 1979 (S. Hashimoto) (KPU); 2♀, Shirahama, Wakayama Pref., 25. vii. 1980 (S. Hashimoto) (KPU).

Distribution: Japan (Hokkaido, Honshu), Ussuri.

Biological notes: The immature stages of this species are little known. I discovered the larvae in the pond of Niigata Prefecture in 1979. They made the portable cases by two pieces of *Phragmites* sp. In that time I could not determine the host plants, although suggesting that they might feed on the submerged plants.

In 1982, I fortunately collected 8 females at Shimagahara, Mie Prefecture, and got the eggs from the adults. The eggs were laid in a mass on the underside of the leaves of *Potamogeton* sp. The egg was elliptical in shape, 0.62-0.75 mm in length and 0.48-0.50 mm in width, milky white. The lst instar larvae feed on surface of the host leaves, and almost all larvae made the oblong, portable cases by cutting two pieces from the hosts. The 2nd to the last (6th) instar larvae made the cases by the same way. The last instar larvae

attached the cases to the host plants and pupated. The life cycle of this species in the field is uncertain.

Remarks: The species is closely allied to *E.* (*M.*) *fengwhanalis*, but distinguished from the latter as follows: Antenna longer; forewing with apex more produced; wings marking with PML more strongly excurved at anterior portion; male genitalia with apical portion of juxta having a characteristinc projection ventrally; female genitalia with cervix bursae more developed.

***Elophila* (*Munroessa*) *sinicalis* (Hampson) comb. nov.**

Nymphula sinicalis Hampson, 1897: 141 (type-locality: Chekiang, China); Leech, 1901: 432; Inoue, 1982 I: 370, II: 243, pl. 228, fig. 38.

External characters: Almost as in *E.* (*M.*) *orientalis*, but different from the latter as follows: Head with frons purely white, with medial brown streak darker. Maxillary palpus with apex acutely upturned while in *orientalis* evenly upturned. Midlegs in both sexes almost fulvous. Hindleg with both inner spurs 1.5 times as long as outer ones. Thorax and abdomen above dark brown, mixed with whitish scales, with posterior white ring on each abdominal segment broader; beneath whitish.

Wing shape and venation: As in *orientalis*.

Wing marking: Rather dimorphic in color. Male paler than in female. Forewing with BL and SBL fuscous. AMG wide, pale yellow, mixed with fuscous. Discal ring narrow, rectangular in shape. DB1 wedge-shaped, fuscous, almost fused with narrow DB2. WA broad. PML as in *orientalis*. WC rounded. PMG broadly suffused with fuscous. PMW narrow, represented by costal wedged-shaped portion and 2 posterior portions distal to WB and WC. SML narrow, usually separated into 5 slender bars by veins, blackish. SMG ochreous to fulvous. SMW usually separated by veins, of which one on cell M_2 is larger than the others and triangular. Cilia whitish, partly mixed with fuscous scales, with darker line at proximal 1/3 except in end of vein CuP evenly white.

Hindwing with base to AMG evenly pale yellow. AML narrow, undulate inwardly, fuscous. DB1 broad, fuscous, continued with broad posterior portion of ML. WA rectangular. ML with anterior portion excurved, continued with anterior portion at cell M_2, fuscous. PML as in forewing. WB broader and WC narrower than in forewing. Discocellular lunule broad, pale yellow. PMW with anterior portion obscure. PMG fuscous at anterior portion, and broadly pale yellow at posterior portion, leaving fuscous area at distal margin. SMW usually interrupted into anterior and posterior portions, dentate at proximal margin. Otherwise as in forewing.

Male genitalia: Tegumen very wide and short, with well-developed ridge along anterior margin. T-v plate as broad as tegumen, expanded laterally. Vinculum a little shorter than tegumen, with fold undeveloped. Saccus short, rounded laterally. Uncus long, narrower than in *orientalis* at base, tapering and curved downwards to apex, with some setae along lateral side. Gnathos almost straight, about 0.62 as long as uncus, narrow and tapering to apex, which has some distinct dorsal spines. Valva long, almost parallel-sided; apical margin slightly widened and rounded; costa narrow at base and wide at middle, suppressed laterally; anellifer with a tuft of scalelike setae parallel with costa; inner surface without any special setae, with apical portion furnished with several long setae. Phallus short, thick, straight; apex of aedeagus with some vertical wrinkles; coecum penis 0.38 as long as whole length of phallus; vesica with 2 groups of cornuti, which are consisting of several spines, equal in length, on sclerotized plate. Juxta almost trapezoidal in shape. In addition, 8th sternum partly membranous, leaving U-shaped sclerite posteriorly.

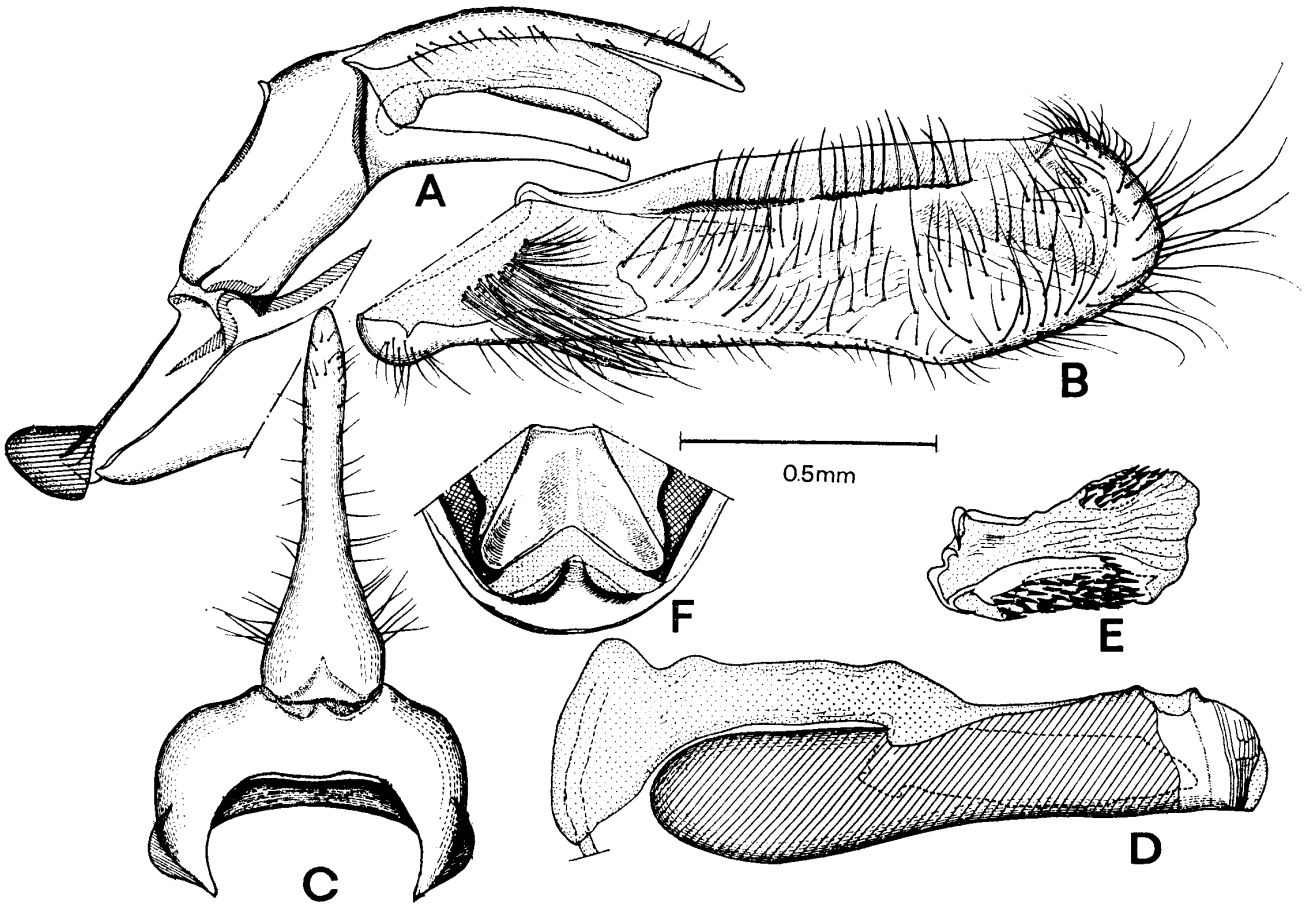

Fig. 28. *Elophila* (*M.*) *sinicalis* (Hampson), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, cornuti; F, juxta with its base.

Female genitalia: Ductus bursae long, longer than 7th sternum, with many minute spinules as in *orientalis*. Corpus bursae large, weakly sclerotized at basal 3/4 on which dorso-distal portion is furnished with long spinules; apical portion rounded, with small spinules in circle thicker on ventral ones. Spermatheca with utricus as in *orientalis*. Eighth tergum evenly sclerotized, 0.53 as long as 7th tergum, with anterior margin weakly concave dorsally; posterior portion with several long setae; apophysis anterioris 0.86 as long as 7th tergum. Papilla analis as in *orientalis*; apophysis posterioris about 1.5 times as long as anterioris.

Size of forewing: Male, 7.3-8.3 mm; female, 7.5-8.7 mm.

Mature larva (*5th instar*): Head width, 1.2 mm, body length 12-16 mm.

The larva is closely allied to that of *orientalis*, but slightly differs from the latter as follows: Head with dark bands slightly narrower; seta AF1 anterior to P1; A2 just situated on a combining line between A1 and A3; O3 also situated on a extension line between O1 and O2; thorax with seta SD1 longer than SD2, while in *Munroessa s. str.* SD1 shorter than SD2; 9th abdominal segment with seta D1 equidistant from D2 and SD1.

Male pupa: Body length, 8.5 mm, width, 2.5 mm.

Much closely allied to *orientalis*, but different from the latter as follows: Abdomen with spiracles of 2nd segment a little smaller than those of 3rd and 4th segments as in *fengwhanalis*. and 4th segment with base of spiracle more protruded.

Specimens examined: Honshu: 5♀, Akasai-keikoku, Hyogo Pref., 6. ix. 1983 (N. Nishida) (KPU); 1♂, 6♀, Masuda-shi, Shimane Pref., 23. vii. 1976 (K. Yano) (KPU). Goto Iss.: 1♀, Tomie-Tao-Ohara, Fukue-

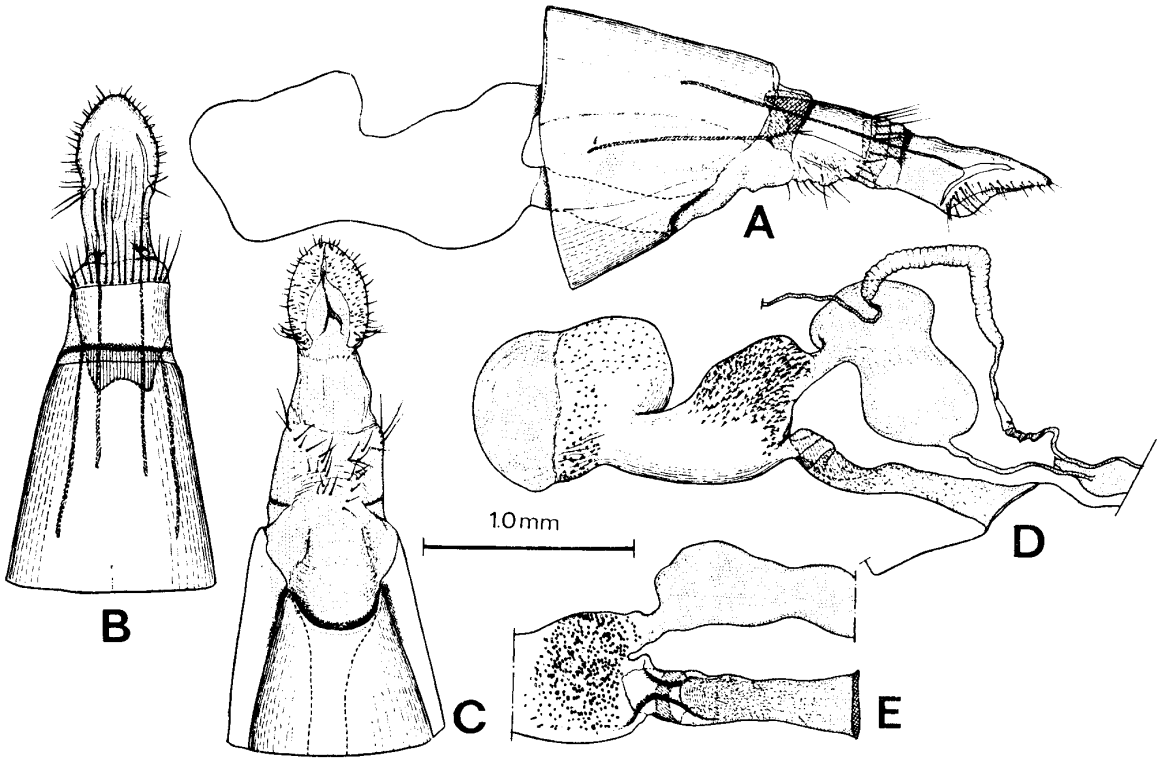

Fig. 29. *Elophila* (*M.*) *sinicalis* (Hampson), female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, lateral view; E, base of corpus bursae, dorsal view.

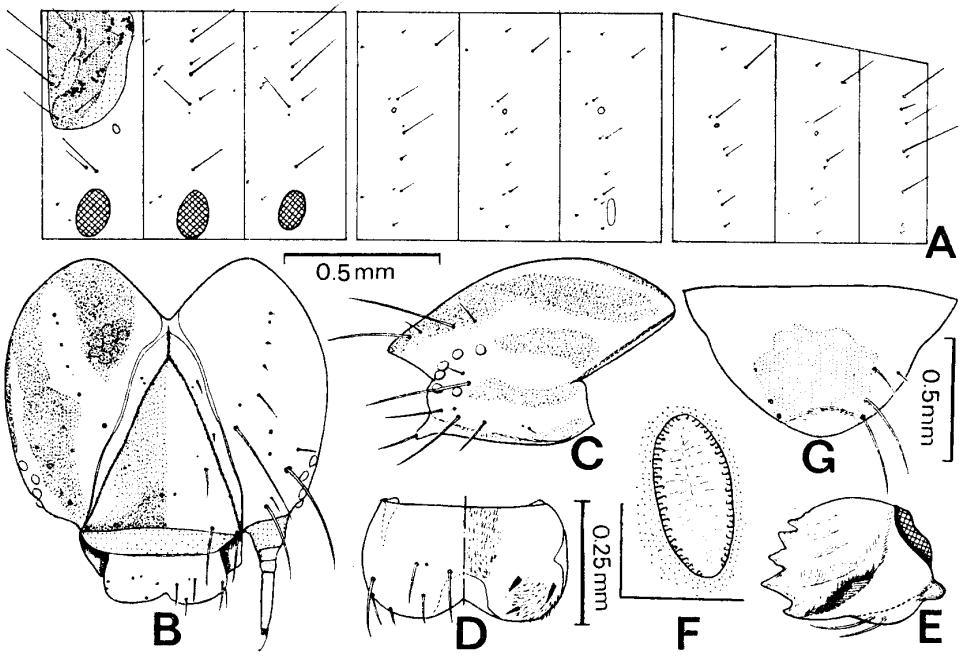

Fig. 30. *Elophila* (*M.*) *sinicalis* (Hampson), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, crochets of proleg; G, 10th abdominal segment, dorsal view.

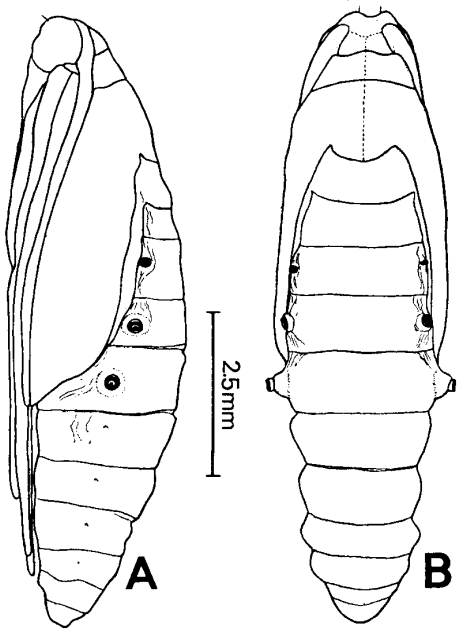

Fig. 31. *Elophila* (*M.*) *sinicalis* (Hampson), pupa. A. Male, lateral view; B, ditto, dorsal view.

jima I., 19. v. 1935 (H. Hori) (KU); 1♀, Meshima of Danjo Is., 20. v. 1935 (H. Hori) (KU); 2♀, Arakawa, Fukue-jima Is., 7.ix.1974 (Y. Yoshiyasu) (KPU); 2♂, 5♀, Arakawa, Fukue-jima Is., emerg. 20-26.x.1974 (Y. Yoshiyasu) (KPU).

Distribution: Japan (Honshu, Kyushu, Goto Iss.) China, Korea.

Remarks: This species appears to be much different from the other species in the subgenus in having the dark ochreous wing ground components as mentioned above, but the line components are almost similar to those of *orientalis*. The species also differs from the latter species by having the simple juxta in the male genitalia, in addition to the darker wing marking.

This species is rare in Japan, and collected only in some places as mentioned above, in addition to Miyazaki Pref., Kyushu (Asahi, 1981).

Genus *Nymphula* Schrank

Nymphula Schrank, 1802: 162.
Hydrocampa Stephens, 1829: 163.
Pseudoparapoynx Patočka, 1950: 59.

Type-species: *Phalaena Pyralis Potamogalis* Hübner, 1793 (=*Phalaena stagnata* Donovan, 1806)

External characters: Head rather small, with frons evenly rounded; vertex not elevated. Labial palpus long, upturned to reach to hight of vertex, poorely scaled. Maxillary palpus well developed, with apex dilating by scales. Proboscis long, with basal scaling. Antenna moderate in length, that in male longer and thicker than in female. Ocellus distinct. Chaetosemata well developed. Legs long and slender, with well-developed spurs.

Wing shape and venation: Forewing with apex a little produced; termen evenly curved; tornus broadly rounded. Vein Sc ending at costa a little beyond end of discoidal cell; R_{3+4} stalked with R_2 at base; bases of M_2 and M_3 relatively apart from each other; CuA_2 from discoidal cell rather proximal than that of R_1.

Hindwing with apex rounded and termen not incised behind apex. Vein $Sc+R_1$ anastomosed with Rs for long distance (more than 1/2 the length of $Sc+R_1$ beyond discoidal cell); M_1 arising from anterior angle of cell, straight; bases of M_2, M_3 and CuA_1 as in forewing; CuP indistinct at its proximal 1/2.

Wing marking: Resembles *Elophila* fundamentally, but ground components narrower and white areas broader than in *Elophila*. Forewing with anterior portion of PML making a right angle with costa, whereas in *Elophila* PML parallel with termen; ML represented by 7 darker spots in cells along termen. Hindwing with AML absent, in *Elophila* present; discocellular lunule reduced, and in *corculina* completely absent.

Male genitalia: Tegumen shorter than wide. T-v plate weakly produced, not visible in dorsal view. Fenestrulae rather narrow, separated into lateral 2 and dorsal 1 portions. Vinculum connected with tegumen by membrane, longer than height of tegumen, with posterodorsal portion wide and not fused with costa of valva. Saccus small and straight. Uncus long and narrow, slightly extending downwards. Gnathos almost straight, with dorso-apical portion furnished with spines. Valva long, almost parallel-sided; anellifer with a tuft of scale-like setae. Phallus moderate; vesica without cornuti. Juxta almost rectangular in shape. In addition, 8th sternum sclerotized in U-shape; 8th tergum membranous at posterior portion.

Female genitalia: Ostium bursae not so wide. Ductus bursae short, membranous. Corpus bursae long, with a compact group of signa on swollen apical portion. Cervix bursae undeveloped. Spermatheca with a pouch of lagena. Eighth tergum short, with posterior margin having short setae; 8th sternum membranous, without setae. Papilla analis long and narrow, with short ventral setae which are almost equal in length. Apophysis posterioris nearly as long as anterioris. In addition, 7th sternum shorter than the tergum, membranous posteriorly.

Remarks: The genus *Nymphula* apparently resembles *Elophila* in the wing marking and the larval habitat and the morphology. But the former differs from the latter in having the longer corpus bursae and the lagena in the female genitalia and lacking of sickle-like setae on valva in the male genitalia.

Speidel (1984) considered *Nymphula* was much allied to *Parapoynx* in having the long "ductus bursae", synapomorphic for the above two genera. According to my observation, however, *Nymphula* is seemed to be more closely allied to *Neoschoenobia* Hampson and *Kasania* Krulikovsky, shared with the next features: (1) the vesica on male phallus is broadly sclerotized apically, (2) the apical portion of pupal abdomen is produced rectangularly (uncertain in *Kasania*), (3) the eggs are laid lineously on undersurface of the hosts (uncertain in *Kasania*). The "ductus bursae" (=a part of corpus bursae in my sense) of *Nymphula* is longer than that of *Elophila*, but not so long as in *Parapoynx*.

The genus consists of only two species redescribed in the following line from the Palearctic region.

Key to the species of *Nymphula*

1. Hindwing with anterior portion of ML and lacking of silvery scales on SML; larva with SV setae of 1st and 2nd abdominal segments 1 and 2 in number, respectively ..... *N. stagnata* (Donovan)
— Hindwing without anterior portion of ML and having silvery scales on SML; larva with SV setae of 1st and 2nd abdominal segments 2 and 3, respectively ..... *N. corculina* (Butler)

Nymphula corculina (Butler)

Oligostigma corculina Butler, 1879: 75, pl. 59, fig. 7 (type-locality: Yokohama, Japan).

Nymphula corculina: Shibuya, 1929: 125, pl. 5, fig. 3; Inoue, 1954: 154; Inoue, 1982, I: 370, II: 243, pl. 44, fig. 35.

Aulacodes nawalis Wileman, 1911: 373 (type-locality: Gifu, Japan),

Nymphula nawalis: Speidel, 1984: 96.

Nymphula stagnata: Spidel, 1984: 97 (Part).

External characters: Head with frons whitish, becoming fuscous to ventral portion. Vertex whitish, faintly suffused fuscous medially. Labial palpus with dorsal portion fuscous with ventral portion whitish; 3rd segment long and narrow, fuscous. Maxillary palpus fuscous. Proboscis with basal scales whitish. Antenna in male 3/5 as long as and that in female 2/5 as long as forewing length; both dorsally with whitish scaling. Foreleg with anterior surfaces of coxa to tibia fuscous, the others whitish. Midleg with dorsal surfaces of femur and tibia slightly suffused with fuscous, otherwise whitish; inner spur twice as long as outer one. Hindleg evenly whitish; each inner spur twice as long as outer one. Thorax above with anterior portions of meso- and metanota suffused with fuscous, the others whitish; thorax beneath whitish. Abdomen above with 1st segment fuscous at anterior margin, with 2nd one ochreous, the others whitish; abdomen beneath evenly whitish.

Wing shape and venation: As described for the genus.

Wing marking: Wings with line components dark brown. Forewing with BL and SBL fused, inwardly oblique. ML with posterior portion broadly excurvate, with posterior portion touched with posterior portion of PML to form a large and rounded WC. PMG pale orange, suffused with dark brown distally. PML with anterior portion outwardly running to vein M_2, then retracted to postrior angle of discoidal cell and diminished there. PML with posterior portion emitting from cell CuA_2, then broadly inwardly curved to posterior margin. SMW broad, almost same width from costa to near tornus, parallel with termen. SMG pale orange. ML reduced to small blackish specles in cells along termen. Cilia whitish, with basal portion slightly darker.

Hindwing with base evenly pure white. DB1 continuous with posterior portion of ML and forming a more or less oblique line (=AML). PML from costa to vein M_2 oblique outwardly, then angled there, and extending to vein CuA_2, and curving to tornus. Area between AML and PML broadly white. SMW with anterior portion narrow, fuscous, separated by cells $Sc+R_1$, Rs, M_1 and M_2 and suffused with silvery grey. SMW with posterior portion as in forewing. Otherwise as in forewing.

Male genitalia: Tegumen short, with indistinct ridge along anterior margin. T-v plate clearly separated from tegumen. Fenestrula rather narrow. Vinculum about 1.2 times as long as height of tegumen. Uncus long and narrow, slightly curved to apex, with sparse setae laterally; apical 1/4 abruptly narrowed and pointed at apex. Gnathos slightly shorter than uncus, with 4 dorsal spines apically. Valva long; ampulla with comparatively stout setae compared with those of inner surface; apical portion with long setae curved anteriorly. Phallus moderate in length, narrowed medially and thickened posteriorly; vesica without cornuti; coecum penis slightly extending downwards, about 0.36 as long as whole length of phallus. Juxta almost rectangular.

Female genitalia: Ductus bursae short, membranous. Corpus bursae long, almost extending to anterioir margin of 3rd abdominal segment; proximal portion slender; apical portion swollen, with a band of signa which are consisted of many minute spinules. Base of ductus seminalis thick. Eighth tergum short; apophysis anterioris slightly shorter than 7th tergum. Apophysis posterioris almost same in length of anterioris.

Size of forewing: Male, 7.4 mm; female, 8.2 mm.

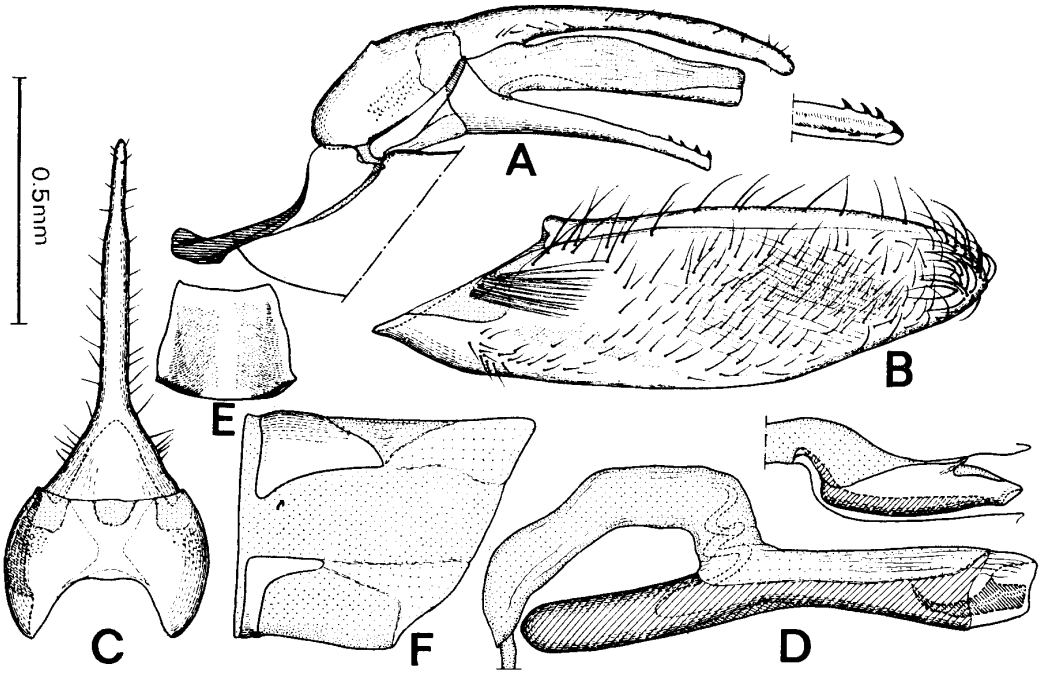

Fig. 32. *Nymphula corculina* (Butler), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta; F, 8th abdominal segment, lateral view.

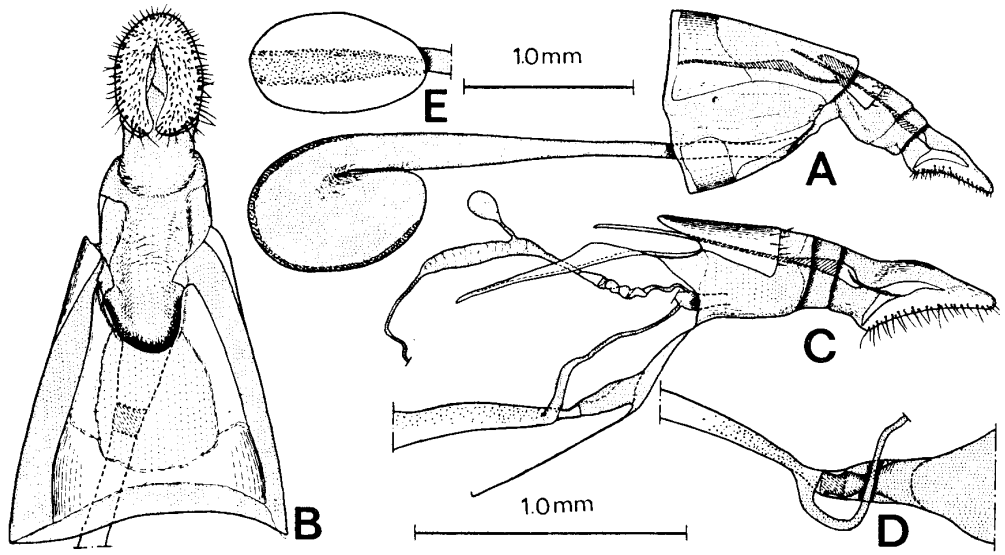

Fig. 33. *Nymphula corculina* (Butler), female genitalia. A, Lateral view; B, 7th to 10th segments, ventral view; C, spermatheca; D, base of corpus bursae, dorsal view; E, signa on apical portion of corpus bursae.

Mature larva (5th or 6th instar): Head width 1.2 mm, body length 13-18 mm.

Head: A little wider than long, evenly pale brown. Seta AF1 and AF2 very short, almost equal in length; puncture AFa posterior to AF2; P1 short, almost as long as AF setae, lateral to AF2; P1 longest; A2 short, situated just on a combining line between A1 and A3; O1 short; O3 shifted anteriorly and not being on a extension line between O1 and O2. Labrum pale brown with seta M3 almost as long as LA1, lateral to M1; puncture Ma just posterior to M3; M2 anterior to M3. Mandible rectangular, with 5 teeth; inner teeth weakly developed; posteroventral portion edged triangularly and posterior seta

from its margin very short.

Thorax: Prothorax with prothoracic shield flat, pale brown with some dark maculations. Seta D1 short, just posterior to XD1; D2 shifted posteriorly; SD2 short, changed in position to anterior margin of prothoracic shield; L2 lateral to L1. Chaetotaxy of meso- and metathorax as in *Elnphila* species except all setae are shorter than those of *Elophila*.

Abdomen: Prolegs with crochets transversely arranged, bi- or triordinal, anterior ones more numerous than posterior ones, about 50 in total number. All setae very short except ones on the caudal segments. In 1st to 8th segments, seta D1 short, almost anterior to longer D2 in 1st and 2nd, but slightly ventral to D2 in 3rd to 8th segments; L setae short; number of SV setae, 1 on 8th, 2 on lst and 7th and 3 on 2nd to 6th segments, respectively. Ninth segment with seta D1 moderately thick; L2 just ventral to long L2; SV1 long. Tenth segment with anal shield weakly present; seta D2 most posteriorly shifted; SD2 just posterior to D1, as long as length of the segment. Anal prolegs with crochets biordinal, 16-20 in number.

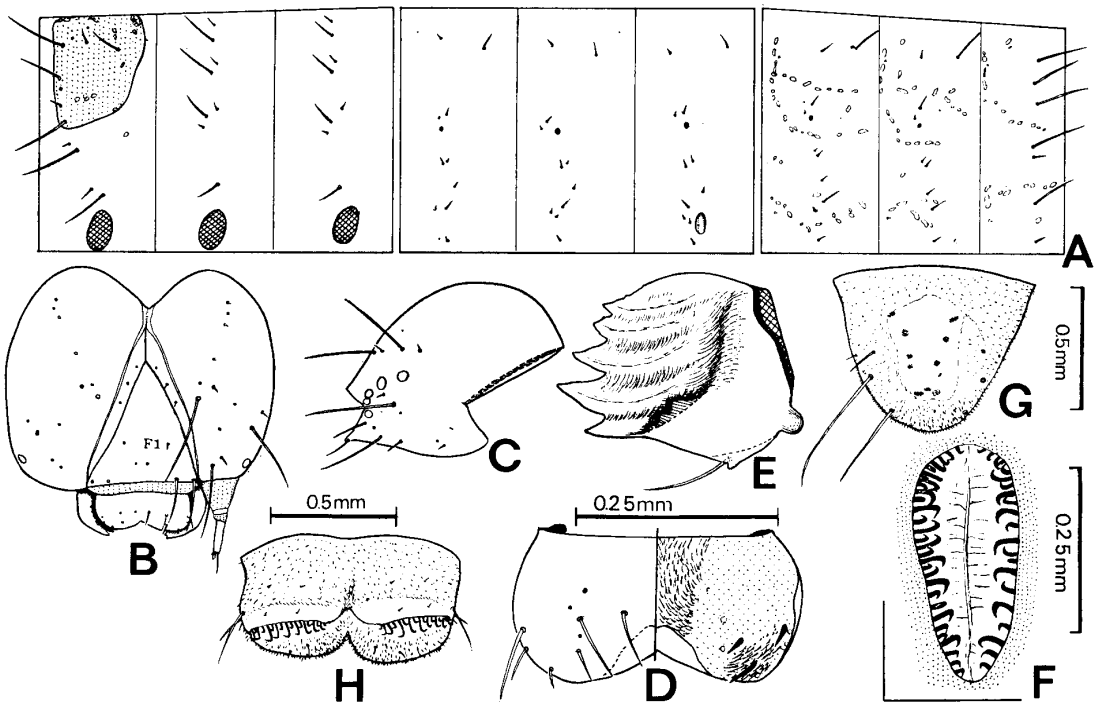

Fig. 34. *Nymphula corculina* (Butler), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, crochets of proleg; G, 10th abdominal segment, dorsal view.

Pupa: Body length 8.3 mm, width 2.4 mm.

Head with frons flat in dorsal view, with short seta F1; vertex without seta; pilifer clearly recognized; maxilla extending to proximal 2/3 of wings; antenna reaching to wing apex. Thorax with wings reaching to 1/2 of 5th abdominal segment; foreleg longer than apex of maxilla which is attached to that of another side at mid-ventral line; midleg longer than wing apex, apices of both sides separated; hindleg longer than midleg. Abdomen with spiracles of 2nd to 4th segments well developed, but its bases not so protruded laterally as in the other nymphuline genera. Tenth segment rounded at apex, with wide and flat projection at apical margin, which is acutely projected in lateral view.

Specimens examined: 17♂, 25♀ from Hokkaido, Honshu (Akita, Iwate, Niigata, Tokyo, Kanagawa, Aichi, Gifu, Fukui, Shiga, Kyoto, Osaka, Mie and Hyogo Prefectures). (HU, KU, KPU, IC, UOP and MC).

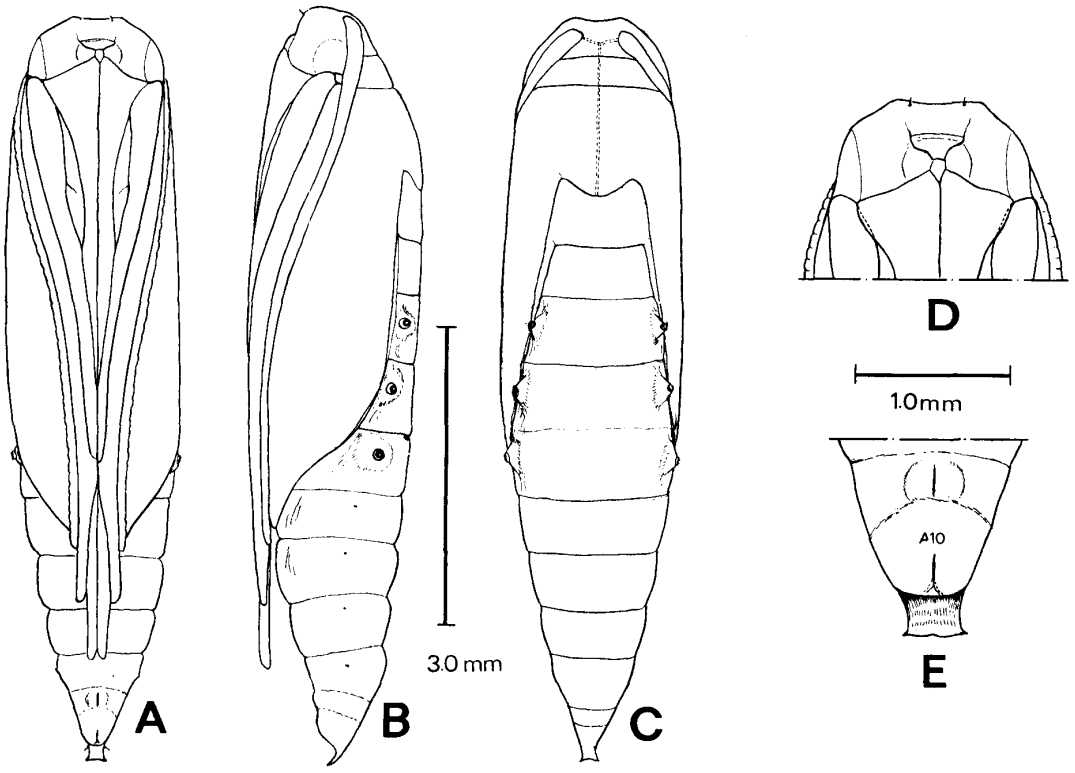

Fig. 35. *Nymphula corculina* (Butler), pupa. A, Male, ventral view; B, ditto, lateral view; C, ditto, dorsal view; D, head, ventral view; E, apical segments, ventral view.

Distribution: Japan (Hokkaido, Honshu), Sakhalin, the Kuriles.

Biological notes: The female lays eggs in 2-4 rows on the underside of the host plant, *Potamogeton* sp. The number of eggs per mass in the field is 41.2 in mean (n=30). The first instar larvae mine the leaves from the undersides, then feed inside. After developing to the mid-instar larvae, they cut the leaves into the pieces and make the portable cases which is elongate in shape and slenderer than those of *Elophila* species. The pupation takes place in the last instar larval case, tightly attached one side of the case to the leaves or stems of the host plants under the water level. The emergence of the adult in the field is probably once a year, from late June to August.

Remarks: This species is rather common in Northern part of Japan. The species is closely related to *Nymphula stagnata* (Donovan), and Speidel (1984) treated *corculina* as a synonym of *stagnata*. The auther, however, admit that *corculina* is distinct from *stagnata* as already shown in the key.

The larvae of this species lives in the pond as in *Elophila* species. The early stages of *N. corculina* are easily distinguished from those of *Elophila* species, because the eggs are laid as a mass with 2-4 rows, while those of the latter are deposited in a fan-shaped or circular mass, and the larval seta SD2 on prothorax is shifted on the anterior margin of prothoracic shield in *Nymphula* as in European *Acentria ephemerella* (Fig. 36) whereas the seta is situated more posteriorly in *Elophila*. And the larval body and the pupa of *Nymphula corculina* are slenderer than those of *Elophila* species.

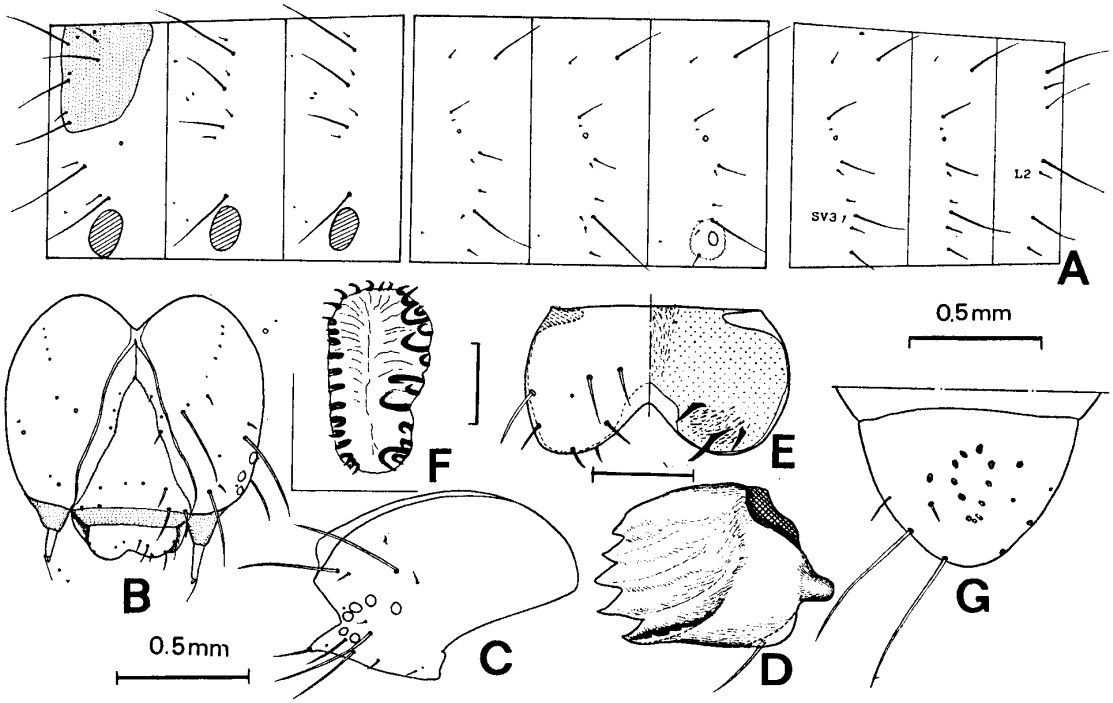

Fig. 36. *Acentria ephemerella* (Dennis & Schiffermüller), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, right mandible, inner view; E, labrum; F, crochets of proleg; G, 10th abdominal segment, dorsal view.

Nymphula stagnata (Donovan)

Phalaena stagnata Donovan, 1806: 10, pl. 363, fig. 3 (type-locality: England).

Hydrocampa stagnata: Stanton, 1859: 145.

Parapoynx stagnata: Snellen, 1882: 75.

Nymphula stagnata: Meyrick, 1890: 466; Hampson, 1897: 139; Shibuya, 1929, 121, 124; Inoue, 1954: 154; Inoue, 1982, I: 371, II: 243, Pl. 44, figs. 46, 47 (European specimens).

Hydrocampa stagnalis Guenée, 1854: 276.

Nymphula nymphaealis Treitschke, 1829: 141.

This species is seemed to be most rare in Japan. Only one female specimen preserved in Hokkaido University is available for the description, which has no abdomen. Therefore, I could not examine both male and female genitalia in this time.

External characters, wing shape and venation: As in *corculina*.

Wing marking: Similar to *corculina*, but different from the latter as follows: Forewing with line components narrower and more undulate; WA, WB and WC broader; SML shifted more distally, thence SMW wider. Hindwing with distinct discocellular lunule, whereas in *corculina* the lunule absent; SML with anterior portion lacking of silvery grey spots.

Larva: Hasenfuss (1960) described the larva of this species based on the German specimens. It is almost same as in *corculina*, and having characteristic SD2 seta in prothorax. But SV setae on the abdominal segments are different from those of *corculina* in number.

Specimens examined: 1♀, from Hokkaido, without data of place, day and collector (HU). Germany:- 1♂, 1♀ (KU).

Distribution: Japan (Hokkaido), North, West to East Europe, Turkey, Armenia, Ural, Siberia, Amur, China.

Biological notes: The biology of this species has not known in Japan. According to Buckler (1897) and Beirn (1952), the larvae in Europe feed on *Nymphaea* spp., *Potamogenton* spp., *Nuphar leteuma*, *Sparganium ramosum* and *S. simplex*. The young to mid-instar larvae mine the leaves and the stems of the host plants. After that, the mature larvae make portable cases of the fragments of leaves. The overwintering stage is the mid-instar larva. The habit resembles *N. corculina*.

Genus *Neoschoenobia* Hampson

Neoschoenobia Hampson, 1900: 308.

Type-species: *Neoshoenobia testacealis* Hampson, 1900.

The genus was first described under the Subfamily Siginae (=Schoenobiinae) by Hampson, with type-species *Neoschoenobis testacealis* Hampson. Since then only one species, *N. decoloralis* Hampson, has been recorded under the genus from North China in 1919. This species was also discoverd in Japan by Shibuya in 1931. The genus was belonging to Schoenobiinae, it has some characters shared with Schoenobiinae species: Adult proboscis short, in forewing vein CuA_2 present on distal half, and having unicolor wing marking. The proboscis sometimes is short or reduced in Nymphuline species, *i.e.*, *Elophila* (*Cyrtogramme*), and CuA_2 also present in some North American Argyractini Lange. *Parapoynx* species sometimes have no distinct strial components and represent unicolor appearance. On the view point of genitalic character, though constricted to *N. decoloralis*, the genus *Neoschoenobia* has well-developed gnathos which is the same to the other Nymphuline genera. In addition to these, Nagasaki (1981) found the larvae of *N. decoloralis* were aquatic and fed on *Nuphar* species. The examination of the larval morphology revealed that the setal characters were shared with those of *Nymphula* species.

In her revision of the Old World species of *Scirpophaga*, Lewvanich (1981) transferred the genus *Neoschoenobia* from the Schoenobiinae to the Nymphulinae.

External characters: Relatively small in size, with long and narrow legs; both sexes almost same except in size. Head with frons rounded evenly, and smooth scaling. Vertex not high. Labial palpus upturned, reaching to height of vertex; 1st and 2nd segments with tuft of scales, extending anteriorly; the 3rd narrow, slightly dilated at apex. Maxillary palpus curved, relatively long, dilating at apex. Proboscis short almost as long as maxillary palpus. Ocellus absent. Chaetosemata present. Antenna short, about 1/2 as long as forewing, in female slenderer; dorsally with narrow scaling, and in female, scale area wider ventrally pilose densely.

Wing shape and venation: Wings relatively long. Forewing narrow costal margin straight; apex and tornus rounded; termen curved evenly. Vein Sc extended to proximal 2/3 of costal margin; R_2 free; R_3 stalked with R_4 along its proximal 1/2; R_5 free, emitted from just behind R_{3+4}, and curved to termen M_1 almost straight; bases of M_2, M_3, and CuA_1 not approximated; CuP present, weak but distinct at apical 1/3. Discoidal cell about 2/3 length of wing. Discocellulars curved from vein R_5 to M_2, not excised behind apex. Vein $Sc+R_1$ anastomosed with Rs for short distance beyond discoical cell; base of M_1 not touching to common stem of $Sc+R_1$ and Rs; bases of M_2, M_3 and CuA_1 as in forewing; CuP weak but distinct; A1 and A2 present. Discoidal cell about 1/2 length of wing. Discocellulars not closed.

Male genitalia: Tegumen narrow, continued with uncus dorsally. T-v plate well developed. Fenestrulae well developed laterally. Vinculum higher than tegumen, postero-dorsal portion prolonged.

Saccus moderate in size, rounded laterlly. Uncus very long, about as long as height of tegumen, curved ventrally and with several setae laterally. Gnathos as long as uncus, curved downwards with, distinct 4 pairs of dorsal spines. Valva long, parallel-sided, apical margin rounded; inner surface without any special setae. Phallus long; coecum penis long, anerior portion downwards; vesicaltip with a bifurcated characteristic sclerite; vesica with many spinules. Juxta with base wide, parallel-sided and bifid distally.

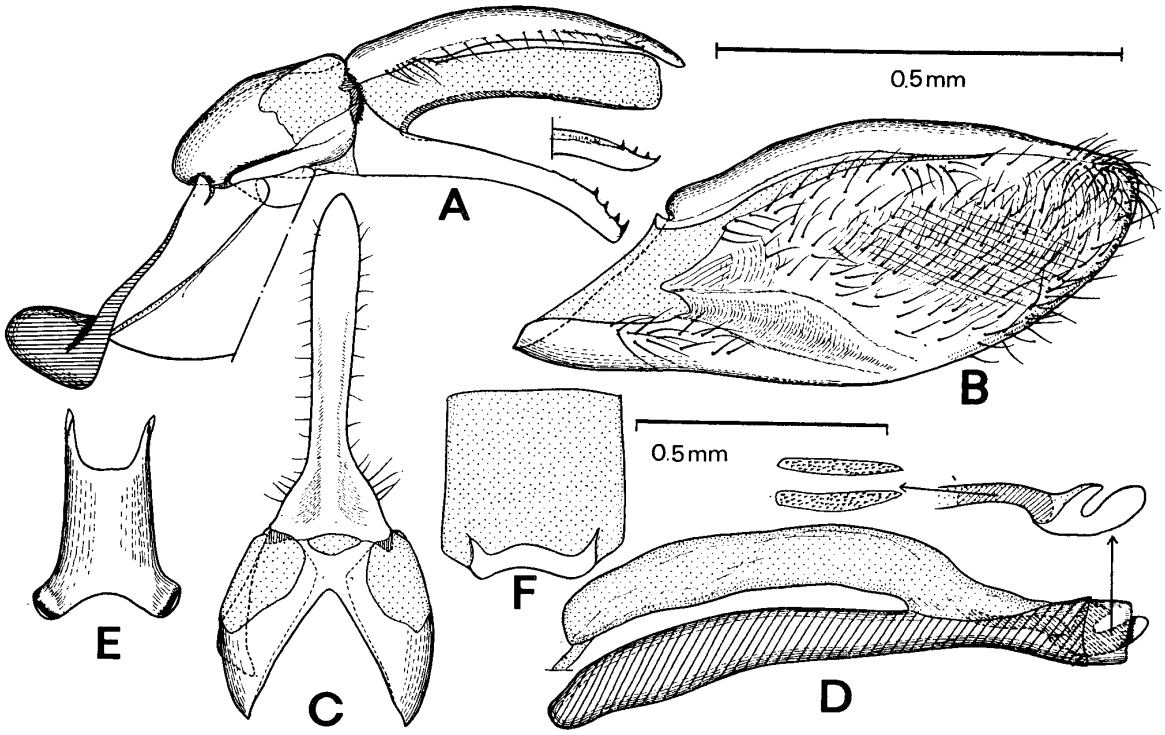

Fig. 37. *Neoshoenobia decoloralis* Hampson, male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta; F, 8th sternum.

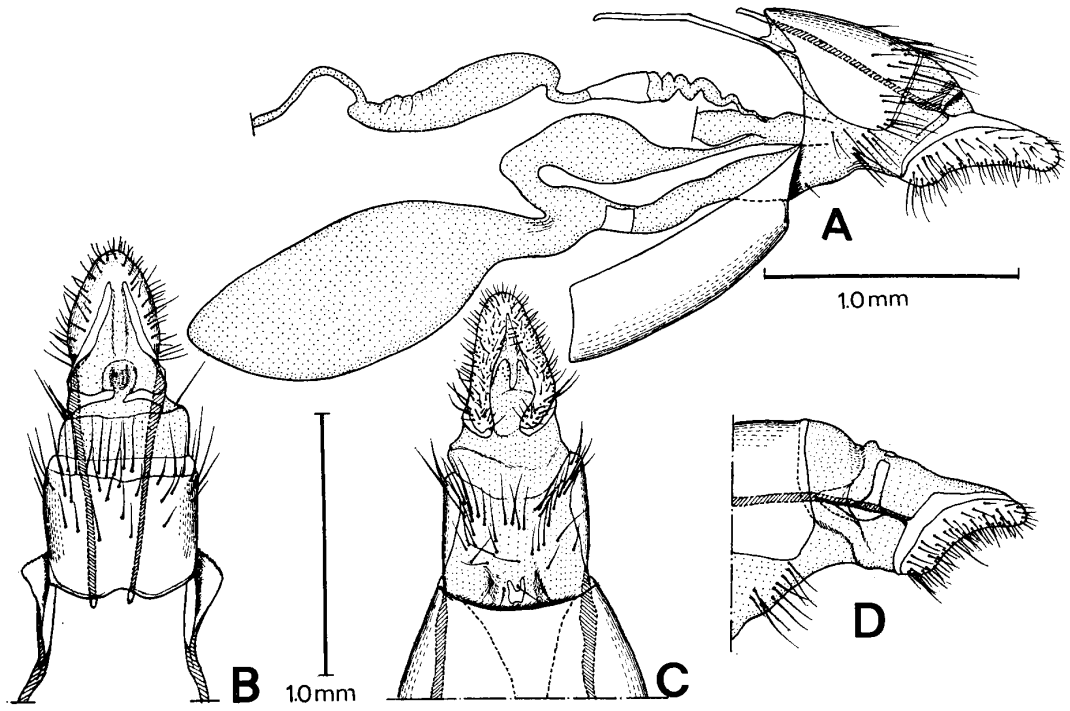

Fig. 38. *Neoshoenobia decoloralis* Hampson, female genitalia. A, Lateral view with spermatheca; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, ditto, lateral view.

Female genitalia: Ostium bursae rather wide, dorsal wall with a small sclerite. Ductus bursae rather broad, membranous. Corpus bursae oblong, evenly membranous without signum. Ductus seminalis thick. Spermatheca large; lagena undeveloped. Eighth tergum wide, with several long and short setae posteriorly; apophysis anterioris a little shorter than 7th tergum. Eighth sternum also with long setae. Papilla analis flat; apophysis posterioris with base prolonged dorsally, nearly as to touch the one of the other side.

Remarks: The characteristic pupal structures and the wing venation and marking are considerably different from the other genera of the Nymphulinae. And also the habit of the larvae of *Neoschoenobia decoloralis* Hampson is peculiar as will be mentioned below.

Neoschoenobia decoloralis Hampson

Neoschoenobia decoloralis Hampson, 1919: 309; Shibuya, 1931: 371; Inoue, 1982, I: 374, II: 244, pl. 36, figs. 32, 33.

External characters: Head with frons fuscous except presence of whitish scales along eyes; vertex fuscous. Labial palpus fuscous in outer surface, but ventrally whitish; the 3rd segment small, blackish outerly. Maxillary palpus fuscous, enlarged at apex by fulvous scales. Thorax above fuscous, beneath white. Legs long, whitish. Foreleg with anterior to dorsal surfaces of femur and tibia blackish, and each taresomere faintly darkened at apex. Mid- and hindlegs whitish except for faintly fuscous tarsal tips; spurs moderate in length, each inner spur twice as long as the outer one. Abdomen above fulvous with faint whitish marking at each posterior margin, beneath whitish.

Wing shape and venation: As described for the genus.

Wing marking: Ground components ochreous to brownish fuscous. Forewing with proximal 2/3 of costa blackish in female, paler in male. BL indistinct. SBL weakly present at posterior portion of discoidal cell. DBI from proximal 1/4 of costa, oblique outwardly to posterior margin of discoidal cell and continued with posterior portion of ML. ML obscure, running to vein CuA_1, then retracted strongly and started at proximal 1/2 of posterior margin of discoidal cell, and running to proximal 1/3 of posterior margin. Discocellular lunule representing by fuscous dot. PML emitted from proximal 1/4 of costa, rather dentated, curved to vein CuA_1, then recurved and ended at 2/3 of posterior margin. Area PML to termen evenly fuscous. MGL represent as fuscous flecks between veins. Cillia concolorous with wing.

Hindwing paler than forewing and no distinct line formed. ML and PML faintly present. Cilia as in forewing.

Male and female genitalia: As described for the genus.

Size of forewing: Male 6.8–8.5 mm, female 8.2–9.2 mm.

Mature larva (7th instar): Head width 1.5 mm, body length 16–23 mm.

Head: Wider than long, thick, evenly brown to pale orange. All setae shorter than in *Elophila* species. Seta AF2 shorter than AF1; puncture AFa ventral to AF2; P1 short; posterolateral to AF1; P2 as long as AF2; A2 short, almost equidistant from A1 and A3, and a combining line between the latter 2 setae; O1 short; O2 relatively wide-seperated from O1; O3 anteriorly shifted and not on the extension line between O1 and O2. Labrum pale brown, with all setae short; puncture Ma posterior to seta M3; Lal longest and most posteriorly shifted among the other setae. Mandible almost as long as wide; inner teeth developed, extending ventrally; posterior setae from postero-ventral margin absent.

Thorax: Rather slender, variable in color, pale brownish white dirty brownish white. Prothorax with prothoracic shield pale brown; seta XD shorter than SD1; D1 short, just posterior to XD1; D2 ventral to D1; SD2 very short, anterior to extention line between D1 and D2; L2 short, dorsal to L1; proleg with both sides a little separated. Meso- and metathorax with coxae of legs on both sides widely

separated; seta D2 just ventral to D1; L3 minute, ventral to L1.

Abdomen: Concolorous with thorax, and not stout seen in genus *Elophila*. Prolegs with crochets transversely arranged, biordinal, anterior ones short and numerous, posterior ones longer and fewer, about 35 in total number. In lst to 8th segments, seta D1 short; D2 almost twice as long as D1, almost just posterior to D1 except that in 1st segment the seta is a little ventral to D1; L setae all very short; SV1 longer than L setae; number of SV setae 1 on 8th, 2 on and 7th and 3 on 2nd to 6th segments, respectively. Ninth segment with seta D1 almost equidistant from D2 and slender SD1; L2 minute, ventral to longer L1; SV1 characteristically shifted ventrally and near to V1. Tenth segment with anal shield weakly recognized; seta D1 absent; D2 longest, about twice as long as the segment; SD1 short and slender, postero-dorsal to D2; anal proleg with crochets uniserial, biordinal, about 15 in number.

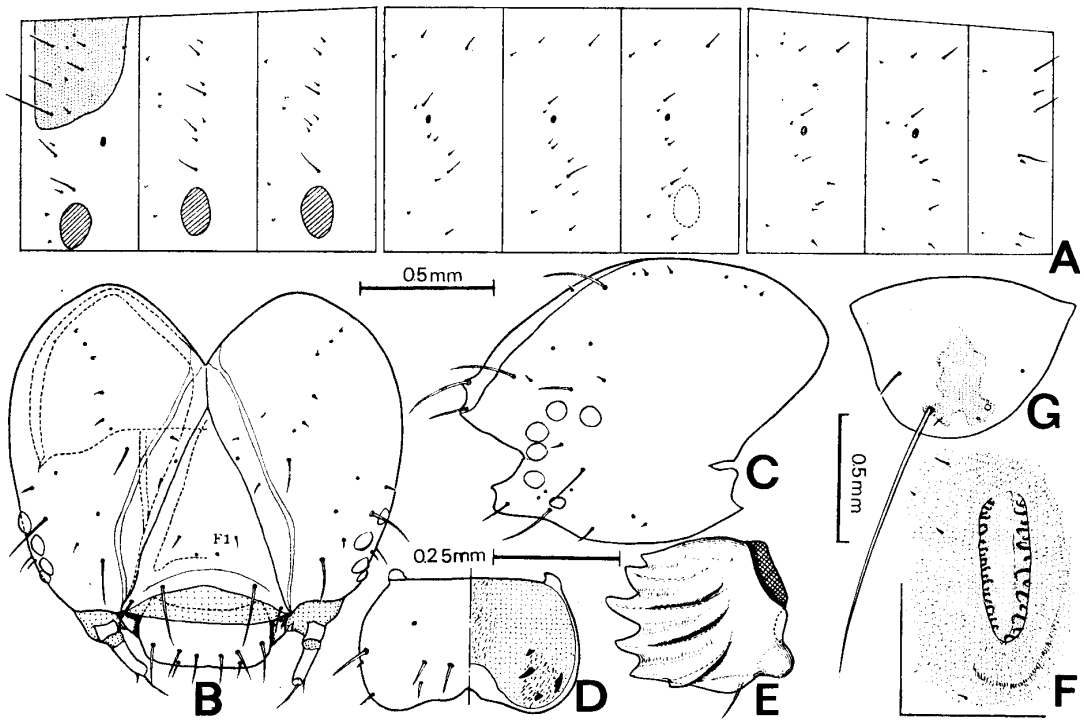

Fig. 39. *Neoschoenobia decoloralis* Hampson, larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, crochets of proleg; G, 10th abdominal segment, dorsal view.

Pupa: Body length 12.5 mm, width 2.8 mm.

Very different from the other nymphuline genera. Rather slender and pale brown. Head small and narrow; frons produced, rounded without F1 seta; vertex also narrow, without seta V1; pilifer clearly marked; maxilla very short, about 1/3 of wing length; antenna in male extending at 3/4 the length of wings, in female shorter, extending to near apex of maxilla. Thorax rather slender, parallelsided; wings extended to middle of 4th abdominal segment; foreleg short, clearly recognized coxa, femur and tibia, while in the other nymphuline genera these portions completely concealed; midleg with tip reaching to wings apices; hindleg extending far beyond wings apices. Abdomen almost same as thorax in width; spiracles of 2nd to 4th segments well developed as in the other Nymphulinae; 10th segment with developed cremaster posteriorly, flattened, acute at apex laterally.

Specimens examined: 1♀, 25. vi. 1979, 2♂, 4♀, 13. vii. 1979, 1♂, 3♀, 4. ix. 1980, 3♂, 5♀, 28. vii. 1982, all these collected at Midoro-ike Pond, Kyoto-shi, Kyoto Pref. (Y. Yoshiyasu) (KPU); 1♂, 2♀,

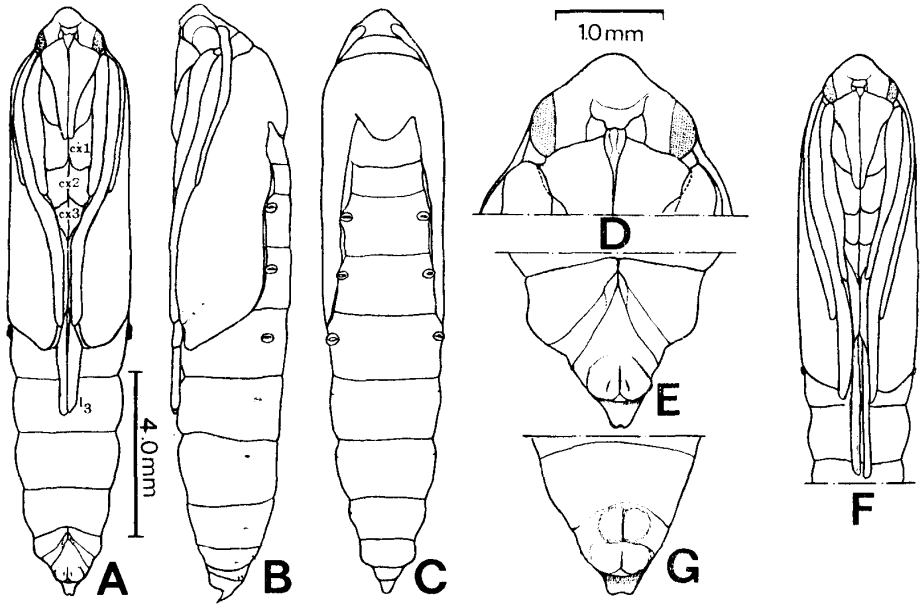

Fig. 40. *Neoshoenobia decoloralis* Hampson, pupae. A, Female, ventral view; B, ditto. lateral view; C, ditto, dorsal view; D, head, ventral view; E, apical segments, ventral view; F, male, ventral view; G, apical segments, ventral view.

Noshiro, Akita Pref., 5. vii. 1981 (Y. Yoshiyasu) (KPU);

Distribution: Japan (Honshu, Hokkaido, Shikoku, Kyushu), China, Korea.

Biological notes: The female lays the eggs in mass as one row along the under surface of the leaf margin of *Nuphar* spp. The just hatched larvae enter the tissue from the underside, and feed on the leaf-tissue, leaving the linear markings like the other leaf-mining lepidopterous larvae. The larvae develop up to the 5th instar by this habit. Then, the 5th or 6th instar larvae enter the petioles from the top of the leaves or the middle portion of the petiole (plate 2) by proceeding downwards in the water. Seventh instar larvae make cocoons in the petioles for pupation with 4 or 5 thin silken filters above the cocoons, and the emergence holes for the adults. The number of the pupa per petiole is usually one in Midoro-ike Pond, Kyoto. Thus the pupation takes place in the petiole under the water. The adults appear twice a year, late June and late August to early September in Kyoto.

Remarks: The species was first recorded from Japan by Shibuya (1931) on the specimen collected in Hokkaido and Kyushu. The species had been placed under the Schoenobiinae untill Inoue (1982) treated it as a nymphuline species.

The immature stages are much different from those of the other nymphuline genera. The larvae do not make the cases in all larval stadia, and feed only on the inner tissues of the host plants. And the pupation is taken place in the petiole in the unique way. The morphology of the pupa is much peculiar in the pyralid species as mentioned above.

Genus *Parapoynx* Hübner

Parapoynx Hübner, 1825: 362.

Eustales Clemens, 1860: 216 (type-species: *Eustales tedyusconglis* Clemens. Monotypy. Synonymized with

Parapoynx seminealis (Walker, 1859) by Munroe (1972)).

Nymphaeela Grote, 1880: 97 (type-species: *Nymphaeela dispar* Grote, 1880. Monotypy. Synonymized with *Parapoynx maculalis* (Clemens, 1860) by Munroe (1972)).

Type-species: *Phalaena Pyralis stratiotalis* (Denis & Schiffermüller), 1775 (=*Phalaena Geometra stratiotata* L., 1758).

This genus is widely distributed in the world from the tropical to the northern areas, and consisted of about one hundred species. In Japan, 6 species of the genus has been known. In this study, *Oligostigma bilinealis* Snellen is transferred to this genus and a new species *P. rectilinealis* will be described from Japan.

External characters: Moderate to small in size, with long and narrow wings and slender legs. Frons rounded to rather flat. Vertex not elevated or a little elevated. Labial palpus strongly upturned, with basal 2 segments thickly scaled; the 3rd narrow and acuminate at apex. Maxillary palpus prominent, dilated by scales. Proboscis usually well developed. Ocellus present or not. Antenna somewhat thickened in male, slender in female, strongly annulated, at least in proximal portion of flagellum. Praecinctorium long, ended in a rounded tuft of scales.

Wing shape and venation: Forewing long and narrow, especially in female. Discoidal cell about 2/3 as long as the wing. Vein R_1 arising fairly near end of discoidal cell; R_2 free or stalked with R_{3+4}; R_3 long stalked with R_4 beyond discoidal cell; R_5 emitted at or a little behind anterior angle of discoidal cell; M_1 arising somewhat behind R_5, both veins straight and not approximated to each other basally; M_2, M_3 and CuA_1 arising close together at or near posterior angle of discoidal cell, which are not curved or approximated to one another basally; CuA_2 emitting well outt on discoidal cell; CuP lacking; 1A+2A well developed; 3A weakly present of absent; discocellulars with posterior portion angled or curved to a varying degree behind its midpoint.

Hindwing also long and narrow. Discoidal cell about 1/2 as long as the wing or somewhat longer. Vein $Sc+R_1$ and Rs anastomosed for long distance, often near to wing apex; M_1 free, straight; M_2, M_3 and CuA_1 emitted close together at or near posterior angle of discoidal cell, which are not curved and approximated to one another basally; CuA_2 arisng somewhat proximal to posterior angle; discocellulars moderately or strongly curved.

Male genitalia: Tegumen as long as or longer than width, with anterior margin incised rather strongly with ridge along its margin, and in addition to the ridge usually with transverse ridge(s) in mid-dorsal line; posterior portion fused or articulated with uncus. T-v plate distinct from tegumen, usually hidden by tegumen in dorsal view. Fenestrulae broad, separated into 2 lateral portions. Vinculum long, almost as long as height of tegumen. Saccus well developed. Uncus finger-like in shape, with apex rounded dorsally. Gnathos shorter than uncus, usually L-shaped laterally, narrowing to apex; base concealed by tegumen. Valva long; costa not flattened; apical margin with long, curved setae; sacculus wide, usually with one or more papilate projection(s) on which setae are arisen. Phallus short and rather slender; dorsal portion of subzonal sheath sometimes weakly sclerotized; coecum penis short; vesica without and special cornuti. Juxta long, trapezoid in shape.

Female genitalia: Ostium bursae narrow and membranous. Ductus bursae membranous, very short, following to flat bursal ring. Corpus bursae considerably long, sometimes weakly sclerotized basally; apex swollen, in many species with a pair of signa which are consisted of minute spinules. Spermatheca with developed lagena. Eighth tergum long, evenly sclerotized; anophysis apterioris slender, shorter than 7th tergum. Papilla analis small and narrow, with dense setae; apophysis posterioris as long as or a little longer than anterioris, widened at near base.

Remarks: This genus is characteristic, as designated by Lange (1956), in the long and narrow wings, the male genitalia with broad fenestrulae and blade-like valva and the female genitalia with very long corpus bursae. In addition to the adult characters, the known larvae of this genus have the branched tracheal gills along the body.

According to Lange (1956), this genus is closely allied to Australian genera *Hydreuretis* Meyrick and *Hygraula* Meyrick.

Key to the species of the genus *Parapoynx*

1. Wing marking with line components represented as spots; male genitalia without papilate process at valval base; female genitalia with base of apophysis posterioris rounded 2
— Wing marking with line components rather continuous; male genitalia with papilate projection(s) at valval base; female genitalia with base of apophysis posterioris rectangular 2
2. Wings purely white; male genitalia with fenestrula moderate in width, separated into 3 portions; female genitalia without signa .....*P. stagnalis* (Zeller)
— Wings dark fulvous; male genitalia with fenestrula broad, separated into 2 portions; female genitalia with signa .....*P. crisonalis* (Walker)
3. Forewing with PML oblique outwardly 4
— Forewing with PML parallel with termen 5
4. Forewing with PMG broad .....*P. rectilinealis* sp. nov.
— Forewing with PMG narrow .....*P. bilinealis* (Snellen)
5. Wings with ground components broad and SMW very narrow; male genitalia with costa bifurcated at apex .....*P. ussuriensis* (Rebel)
— Wings with ground components narrow and SMW moderate in width; male genitalia with costa not bifurcated 6
6. Wings rather broad, with apex rounded; male genitalia with large papilate projection at valval base .....*P. vittalis* (Bremer)
— Wings narrow, with apex pointed; male genitalia without papilate projection at valval base 7
7. Wing marking linear in appearance..... *P. fluctuosalis* (Zeller)
— Wing marking with lines curved .....*P. diminutalis* Snellen

Key to the species of the genus *Parapoynx* based on larvae

1. First to 6 th abdominal segments with 2 dorsal groups of tracheal gills 2
— First to 6 th abdominal segments with 1 dorsal group of tracheal gills 3
2. Tracheal gills longer than segments' length; each gill apically 5-branched (maximum); thorax without dorsal gill group.....*P. crisonalis* (Hampson)
— Tracheal gills shorter than segments' length; each gill apically 7-branched (maximum); thorax with dorsal gill group .....*P. stagnalis* (Zeller)
3. Head without blackish maculations; meso- and metathorax with 3 groups of dorsal gills.....
.....*P. ussuriensis* (Rebel)
— Head with remarkable blackish maculations; meso- and metathorax with 2 groups of dorsal gills
..... 4
4. Eighth abdominal segment without dorsal gills .....*P. diminutalis* Snellen
— Eighth abdominal segment with dorsal gills 5
5. Thoracic segments with 1 group of lateral gills.....*P. vittalis* (Bremer)
— Thoracic segments with 2 groups of lateral gills .....*P. fluctuosalis* (Zeller)

Parapoynx vittalis (Bremer)

Oligostigma vittalis Bremer, 1864: 66, pl. 6, fig. 3 (type-locality: Amur); Pryer, 1885: 61.
Nymphula vittalis: Meyrick, 1890: 466; Hampson, 1897: 142; Leech, 1911: 371; Shibuya, 1929: 124, 126; Matsumura, 1931: 1044; Inoue, 1954: 155.
Parapoynx vittalis: Inoue, 1982, I: 371, II: 243, Pl. 44, fig. 40; Speidel, 1984: 86, pl. 2, figs. 62, 63.
Oligostigma regularis Pryer, 1877: 234 (type-locality: Japan). Designated by Shibuya (1929).

External characters: Head with frons rather flat, evenly whitish; vertex whitish with faint fuscous band medially. Labial palpus with basal 2 segments with fulvous scaling; the 3rd fulvous. Maxillary palpus with basal 3 segments fuscous; the 4th slender, whitish. Proboscis with base fulvous. Antenna long, 3/4-4/5 as long as forewing length, thick in male and filiform in female, with dorsal surface evenly fulvous. Ocellus distinct. Legs long, whitish. Foreleg with anterior surfaces of femur and tibia dark brown, otherwise fulvous. Mid- and hindlegs whitish; each inner spur about twice as long as outer one. Thorax above whitish tinged with dark brown, beneath whitish. Abdomen above whitish, with posterior margin of each segment edged by dark brown, beneath whitish.

Wing shape and venation: Forewing with apex slightly produced and rounded; termen almost straight to tornus. Vein reaching at costa beyond end of discoidal coll; R_1 emitted from near anterior angle of discoidal cell; R_2 stalked with R_{3+4} for its 1/2 length; R_5 rather apart from base of R_{3+4} at base; M_2 and M_3 with bases approximated each other; CuA_2 arising from proximal 3/4 of discoidal cell; 1A+2A curved; 3A absent; discocellulars weakly curved.

Hindwing with costa curved; apex rounded; termen slightly incised behind apex. Vein $Sc+R_1$ long stalked with Rs almost to near apex; M_2 to CuA_1 with bases as in forewing; CuA_2 emitted from discoidal cell more proximal than in forewing; CuP to 3A distinct; discocellulars with anterior 1/2 erect, and with posterior 1/2 strongly oblique.

Wing marking: Forewing with base fulvous to whitish. AML present behind discoidal cell as an oblique fuscous shadow. Discoidal cell with dark brown band horizontally. DB2 represented by 2 small dark spots in cells R_5 and M_1. PML running straightly from proximal 3/4 of costa to vein CuA_2, then obtusely angled inwardly and ended to near proximal extreme of posterior margin. PMG wide, almost parallel with termen, pale orange but both margins suffused with dark brown, and with its proximal margin ended at 1/2 of posterior margin. SMW parallel with termen, with its portion in cell CuA_2 curved proximally and being metallic grey. SML slender, somewhat dentate, dark brown. SMG evenly pale orange. ML absent. Cilia whitish scattered with some darker scales, with distinct darker spots at proximal 1/3 beyond each cell.

Hindwing with basal 1/3 whitish except for a darker faint spot of ML behind discoidal cell. DB1 and DB2 absent. PML from proximal 2/3 of costa oblique inwardly to 1/2 of posterior margin, fuscous. PMG well developed, running from proximal 3/4 of costa to near tornus obliquely, pale orange, with proximal margin broadly edged by dark brown. SMW almost parallel with termen from costa to vein 1A, and lacking of grey scales seen in forewing. SMG entirely pale orange. Cilia as in forewing except darker proximal 1/3.

Male genitalia: Tegumen as long as wide, with anterior margin U-shaped, and with Y-shaped ridge dorsally; posterior portion united with uncus dorsally. Fenestrulae narrow, separated into 2 lateral portions. Vinculum as long as height of tegumen. Saccus moderate, slightly produced anteriorly. Uncus spatulate in dorsal view, almost 1.2 times as long as height of tegumen, with apical portion swollen, broad at apical extreme. Gnathos 0.83 as long as uncus, flat, dorsally with indistinct denticles at apex. Valva long and narrow; costa long; anellifer with some strong setae near base of costa; inner surface with many setae, with its apical margin furnished with long setae curved inwards;

sacculus wide, suppressed at middle, with a papilate process near base on which 3 stout setae are arising. Phallus short and slender; coecum penis extending downwards, 0.2 as long as whole length of phallus; vesica without cornuti. Juxta trapezoidal in shape, posterior margin strongly incised.

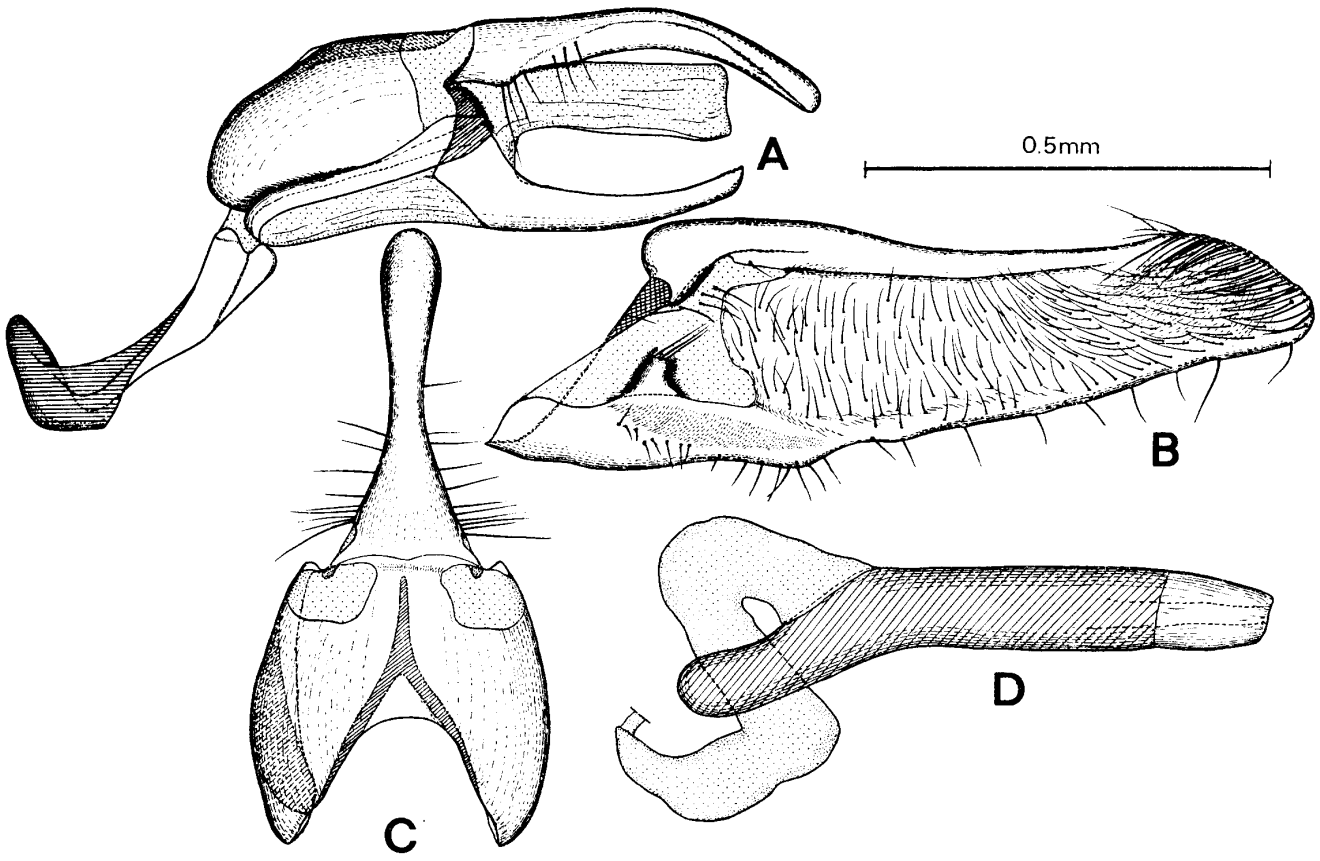

Fig. 41. *Parapoynx vittalis* (Bremer), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus.

Female genitalia: Ostium bursae narrow and membranous. Ductus bursae narrow, long, extending to lst abdominal segment. Corpus bursae membranous, almost twice as long as 7th tergum, with basal 3/4 slender, with apical 1/4 stout and oblong in shape. Signa represented by a pair of plates where many minute spinules are arising. Ductus seminalis slender at base. Spermatheca with lagena large. Eighth tergum 0.5 as long as 7th tergum, with long setae posteriorly; the sternum membranous, with some short setae; apophysis anterioris 0.7 as long as 7th tergum. Papilla analis small and narrow, posteriorly with setae of which ventral ones are longer; apophysis posterioris longer than anterioris, with rectangular dorsal expansion at base.

Size of forewing: Male, 6.7 mm (n=17); female, 7.2 mm (n=31).

Mature larva (*6th instar*) : Head width 1.2 mm, body length 13-16 mm.

Head: Whitish brown, with many dark maculations in some regions. Setae long, with basal darker ring. Seta AF1 relatively long, twice as long as AF1; puncture AFa ventral to AF2 ; P1 very long, situated between AF1 and P2; A2 relatively long, about 3/4 as long as A1; A3 longest; D2 long, shifted posteriorly, then O1, O2 and O3 not on a same straight line; SO2 postero-ventral to SO1. Labrum with seta M3 longest, most posteriorly situated; puncture Ma postero-dorsal to M3. Mandible longer than wide, brown, with 5 inner teeth; inner teeth moderately developed; posterior seta from postero-ventral angle very short.

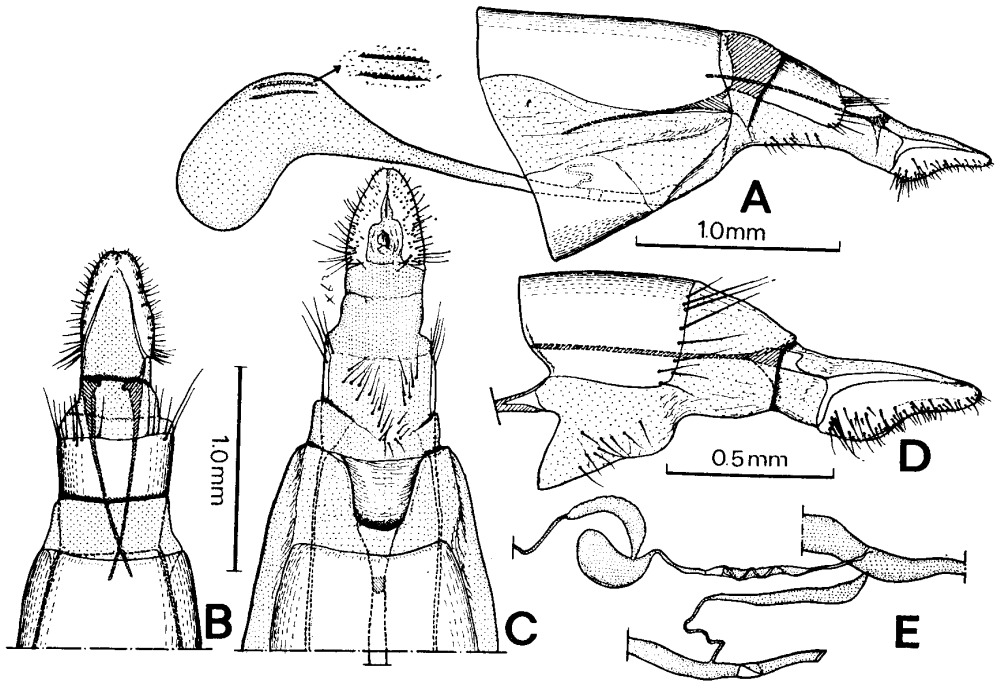

Fig. 42. *Parapoynx vittalis* (Bremer), female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, ditto, lateral view; E. base of corpus bursae and spermatheca, lateral view.

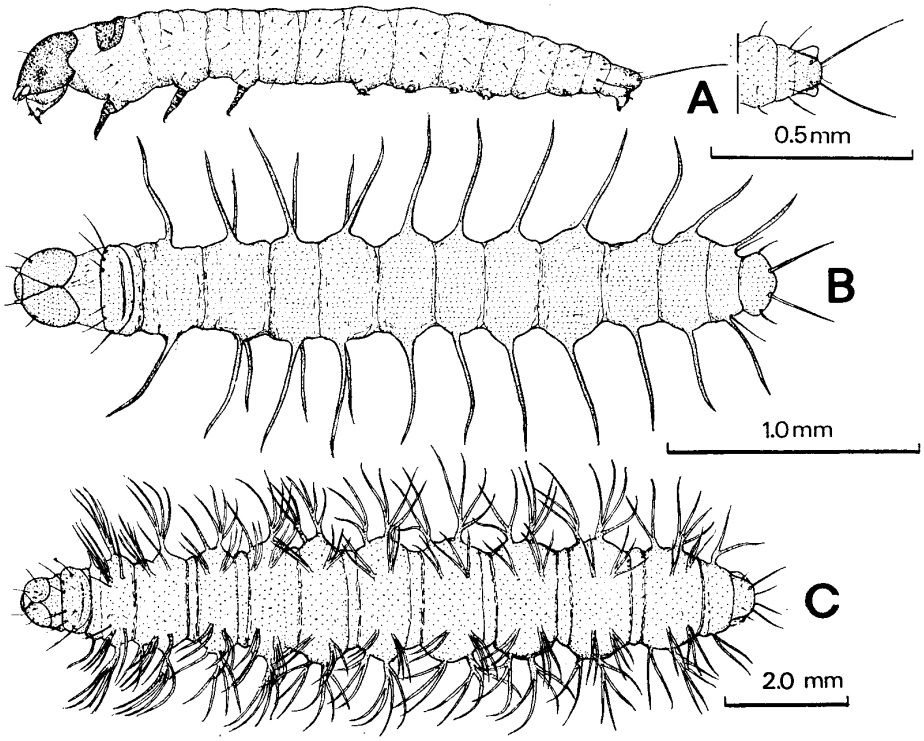

Fig. 43. *Parapoynx vittalis* (Bremer), larvae. A, First instar larva; B, 2nd instar larva; C, 5th instar larva.

Thorax: Slender and whitish. Prothorax with prothoracic shield swollen at posterior 1/3, evenly pale brown; setae XD1, XD2 long; D1 short, just posterior to XD1; D2 more posteriorly shifted than that of *Elophila* species; SD1 longest; L2 ventral to L1. Prothoracic legs on both sides attached the bases at mid-ventral line. Meso- and metathorax with coxae of legs on both sides a little separated with

each other; setae D2 and SV1 long; L setae arranged obliquely.

Abdomen: Almost same width and color as in thorax. Prolegs well developed, with crochets completely circle, triordinal, about 60 in number. In 1st to 8th segments, setae D2 postero-ventral to D1; L2 just ventral to L1; SV1 longest; SV2 on 3rd to 6th segments antero-ventral to SV3; number of SV setae, 1 on 8th, 2 on 1st and 7th, 3 on 2nd to 6th segments, respectively. Ninth segment with seta D1 nearer to D2 than to slender SD1; L2 antero-dorsal to long L1. Tenth segment without distinct anal shield; seta SD1 longer than D1, slender; SD2 very long, about 1.5 times as long as segment's length.

The position and number of branching of gills are as follows:

Segment	T2			T3			A1		A2		A3		A4		A5		A6		A7		A8		A9
Region	A	M	P	A	M	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	P
D	—	5	3	—	5	4	3	5	5	5	5	5	5	5	5	5	4	4	2	3	2	2	—
SD	1	—	—	2	—	—	—		—		—		—		—		—		—		—		—
L	—	—	5	—	—	5	3	5	4	5	5	5	5	5	5	5	2	5	2	5	1	2	1
SV	—	—	5	—	—	5	—	5	—	5	—	5	—	5	—	5	—	5	—	5	—	1	—

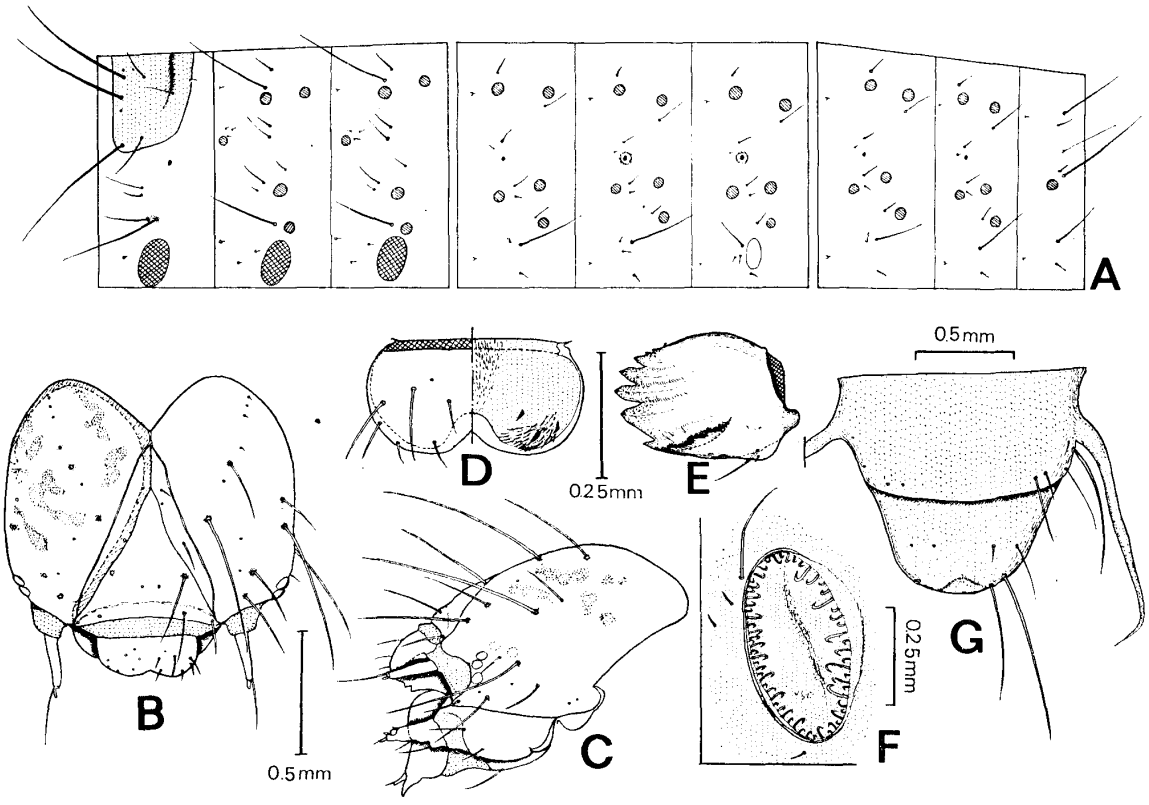

Fig. 44. *Parapoynx vittalis* (Bremer), 6th instar larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, crochets of proleg; G, 9th to 10th abdominal segments.

Pupa: Head with frons and vertex concave medially, with seta F 1 stout; antenna in male extending far beyond apices of wings, that in female just ending to wings apices. Thorax moderate in width; forelegs on both sides not attached at mid-ventral line, ending at proximal 4/5 (♂) or 3/5 (♀) the length of wings; midleg ending a little before antennal tip; hindleg very long, reaching far beyond

wings' apices. Abdomen of 2nd to 4th segments with equally large spiracles; 10th segment with some short, transverse ridges ventrally, with apical margin narrowly rounded and without special hooks.

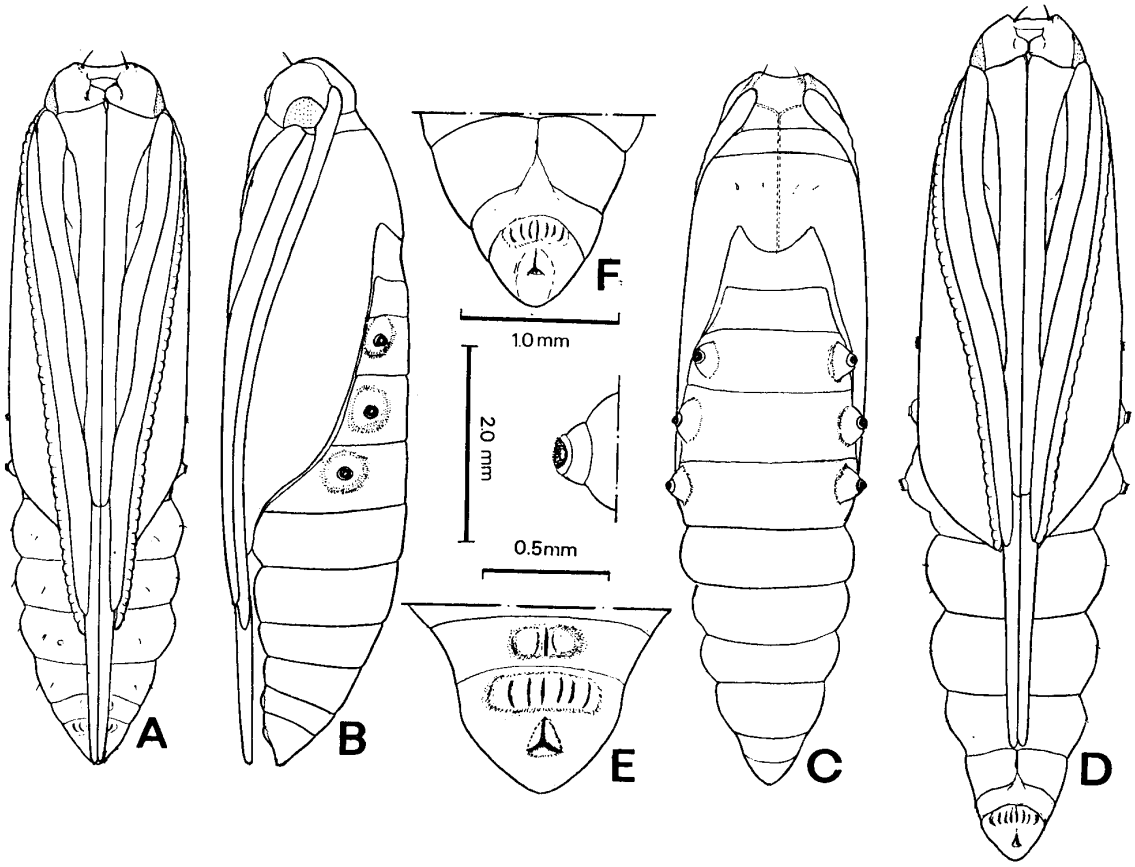

Fig. 45. *Parapoynx vittalis* (Bremer), pupae. A, Male, ventral view; B, ditto, lateral view; C, ditto, dorsal view; D, female, ventral view; E, male, apical segments, ventral view; F, female, apical segments, ventral view.

Specimens examined: 17♂, 31♀ from Honshu (Iwate, Niigata, Kanagawa, Aichi, Gifu, Kyoto, Osaka Prefectures), Shikoku (Kagawa, Kochi Prefectures), Kyushu (Fukuoka, Saga, Kumamoto, Oita, Kagoshima Prefectures) (KU, KPU, UOP, IC, MC).

Distribution: Japan (Honshu, Shikoku, Kyushu), China, Amur, Korea.

***Parapoynx fluctuosalis* (Zeller)**

Nymphula fluctuosalis Zeller, 1852: 27 (type-locality: Natal, South Africa); Meyrick, 1894: 11; Hampson, 1896: 193; Matsumura, 1900: 381; Hering, 1903: 61; Wileman, 1911: 371; Strand, 1919: 102; Shibuya, 1928: 141, 144; Marumo, 1942: 16; Inoue, 1954: 154.

Parapoynx fluctuosalis: Hampson, 1891: 40; Zimmerman, 1958; 267; Inoue, 1982, I: 371, II: 247, pl. 44, fig. 39 (♀); Speidel, 1984: 84, pl. 2, fig. 31 (♀).

Parapoynx linealis Guenée, 1854: 271 (type-locality: East India). Designated by Hampson (1896).

Oligostigma chrysippusalis Walker, 1859: 432 (type-locality: China). Designated by Hampson (1896).

Oligostigma obitalis Walker, 1859: 432 (type-locality: Ceylon). Designated by Hampson (1896).

Oligostigma curta Butler, 1879: 270 (type-locality: Hawaii). Designated by Hampson (1896).

External characters: Head with frons whitish; vertex elevated, whitish but medially blackish. Labial palpus with basal 2 segments thickly scaled, brownish; the 3rd acute at apex, fulvous. Maxillary

palpus rather long, with basal 3 segments thickened by brownish scales; the 4th narrow, fulvous. Proboscis and antenna as in *P. vittalis*. Legs almost as in *vittalis* except that each inner spur twice as long as outer one. Thorax above white mixed with fuscous scales, beneath whitish. Abdomen long, about twice as long as hindwing width; above with first 2 segments white, posteriorly edged by dark brown, the other segments white on anterior 1/2 and fuscous on posterior 1/2; beneath whitish.

Wing shape and venation: Wings long and narrow. Forewing with costa straight; apex narrowly rounded; termen slightly curved; tornus rather pointed. Vein Sc reached at costa near end of discoidal cell; R_1 short; R_2 free, emitted from anterior angle of discoidal cell; R_{3+4} curved basally and approximated R_2 at base; R_5 arising from just behind base of R_{3+4}; M_2 and M_3 closely approximated at bases; CuA_1 with base a little apart from M_3; discocellulars as in *vittalis*.

Hindwing with costa incised at middle; apex rounded; termen weakly undulate to tornus. Vein $Sc+R_1$ long anastomosed with Rs to near apex; bases of M_2 and M_3 as in forewing; CuP with proximal 1/2 indistinct; discocellulars strongly oblique.

Wing marking: Forewing with base oblique inwardly, fuscous mixed with fulvous. AML also oblique arising from 1/3 of costa to almost proximal extream of posterior margin, fuscous. DB2 represented by blackish spot. ML with anterior portion short and obscure, then WB wide, and with anterior portion oblique, running from posterior angle of discoidal cell to proximal 1/3 of posterior margin. PML curved, semicircular in shape to posterior angle of discoidal cell, then oblique running to 1/2 of posterior margin, ochreous, but edged by blackish. PMG narrower than in *vittalis*, almost parallel with termen, ochreous, with both margins blackish. SML narrow and fuscous. MGL slightly interrupted by veins, ochreous. Cilia as in *vittalis*.

Hindwing with base white. ML with posterior portion oblique inwardly, narrow, blackish. DB2 faintly dark fuscous. PML narrower and more oblique than in forewing, slightly retracted proximally to posterior angle of discoidal cell, fuscous. PMG broader than in forewing. Otherwise as in forewing.

Male genitalia: Tegumen longer than wide, with anterior margin incised in V-shape except for slight expansion at mid-dorsal portion, with ridge along the margin; mid-dorsal portion without ridge. T-v plate as in *vittalis*. Fenestrulae broad, separated into 2 lateral portions. Vinculum long, as long as height of tegumen, almost the same width throughout its length. Saccus relatively large, triangular view, with apex extending upwards. Uncus moderate in size, 1.3 times as long as height of tegumen, curved downwards, aristate in dorsal view; base rather wide with some long setae laterally; apical 3/4 parallel-sided, with apex broadly rounded. Gnathos L-shaped in lateral view; flat and short, about 3/4 as long as uncus, with some dorsal denticles around apex. Valva long lonvoidal in shape, large, with apex narrowly pointed; costa not flattened, rather slender, with base curved; anellifer with some stout setae at near base of costa and with 2 spines on small sclerotized process medially; inner surface with many setae, with apical margin with several long setae oriented upwards or inwards; sacculus wide, a little suppressed at medial portion, without papilate projection. Phallus short, weakly sclerotized at anterior portion of base of bulbus ejaculatorius; coecum penis poorely developed, 0.24 as long as whole length of phallus; vesica with minute spinules. Juxta long, trapezoid, with proximal margin broadly rounded.

Female genitalia: Ostium bursae narrow, membranous. Ductus bursae narrow, very short as in *P. diminutalis*. Corpus bursae considerably long, about 4 times as long as 7th tergum, narrow, becoming swollen to apex which has a pair of signa consisted of some small spinules. Ductus seminalis moderate in width, a little separated from bursal ring. Spermatheca with lagena well developed and arising from base of utricus. Eighth tergum long, 1/2 as long as 7th tergum, with posterior margin furnished with some setae shorter than in the other species of *Parapoynx*; apophysis anterioris slender, about 0.6 as long as 7th tergum; 8th sternum membranous, with several setae which are almost as long as ones on

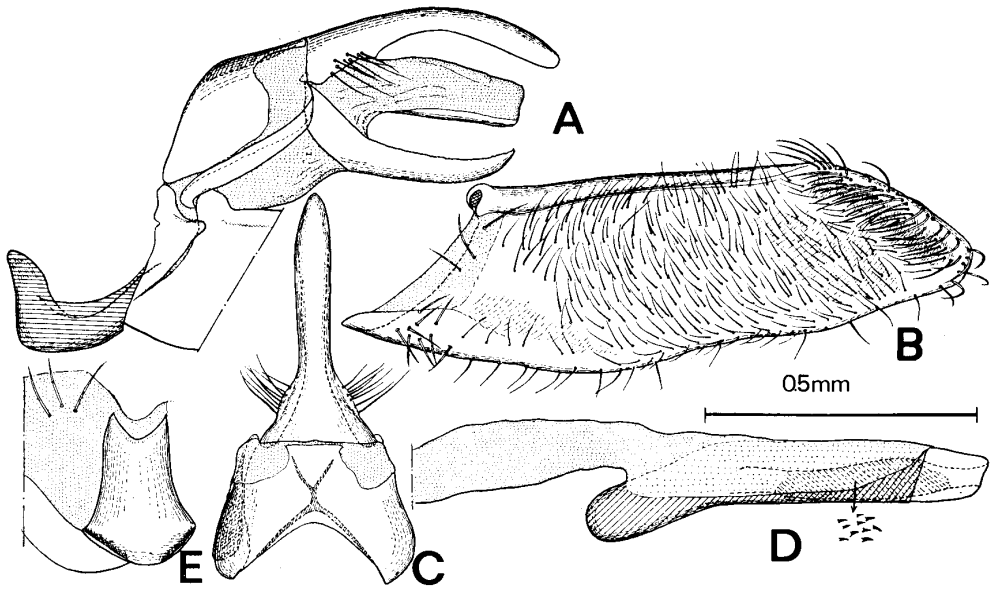

Fig. 46. *Parapoynx fluctuosalis* (Zeller), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta.

the tergum. Papilla analis long, narrow, with short setae of which ventral ones are slightly longer than dorsal ones; apophysis posterioris somewhat longer than anterioris, with trapezoidal expansion at near base.

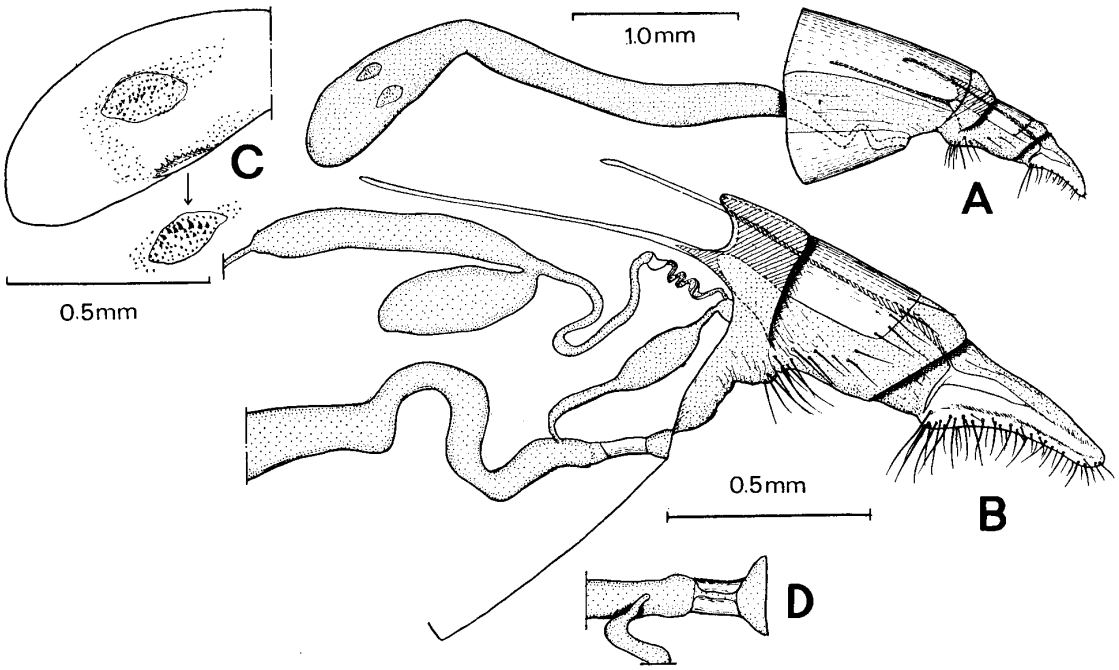

Fig. 47. *Parapoynx fluctuosalis* (Zeller), female genitalia. A, Lateral view; B, base of corpus bursae and spermatheca, lateral view; C, apical portion of corpus bursae; D, base of corpus bursae, dorsal view.

Size of forewing: Male, 6.9 mm (n=8); female, 7.8 mm (n=21).

Larva and pupa: Unavailable in this study.

Specimens examined: Honshu: 2 ♀. Shizuoka-shi, Shizuoka Pref., 10. x. 1956 (H. Inoue) (IC). Kyushu: 2♂, Tororo-Shimotsufukae, Amakusa Is., Kumamoto Pref., 12. ix. 1931 (H. Hori) (KU); 1♀,

Shindenbaru, Oita Pref., 4. x. 1931 (I. Tateishi) (KU); 1♀, Mt. Hikosan, Fukuoka Pref., 18. viii. 1953 (H. Kuroko) (KU). Tokara Iss.: 1♀, Nakanoshima Is., 28. vii. 1964 (K. Kanmiya) (KPU). Amami Iss.: 1♀, Yakkachi, Sumiyo-mura, Amami-Oshima Is., 18. vii. 1933 (Esaki & Yasumatsu) (KU); 1♀, Shinmura, Amami-Oshima Is., 22. vii. 1954 (S. H. S. U. & T. E.) (KU); 1♂, Taken, 21 viii. 1973. (Y. Yoshiyasu) (KPU); 1♀, Hatsuno, 11-13. viii. 1977 (R. Sato) and 2♂ (A. Seino), same data (KPU).

Distribution: Japan (Honshu, Shikoku, Kyushu, Yakushima Is., Tokara Iss.*, Amami Iss., the Ryukyus), tropical and subtropical countries.

Biological notes: According to Tsuda (1936), the larvae of this species feed on the rice plants in Japan. The larvae have the tracheal gills and make the portable cases by cutting off the pieces from the host plants. I have no chance to investigate the life history untill now. The species is also known as a pest of water lilies (Nymphaeaceae) in Hawaii, as well as the wild grasses (Williams, 1944; Zimmerman, 1956).

Remarks: The species is closely allied to *P. votalis* (Walker, 1854) from the Oriental Region, but differs from the latter as already described by Yoshiyasu (1983). In Japanese fauna, the species resembles *vittalis* by having the rather straight line components in the wings. The former is different from the latter as follows: Head with vertex more elevated; vein R_2 free from R_{3+4}, while in *vittalis* R_2 anastomosed with R_{3+4} at base; male genitalia without papilate projection on sacculus; female genitalia with corpus bursae narrower than in *vittalis* at apical portion.

This species is relatively rare in Japan, although the distribution is world-wide in the tropical areas and many materials are collected in the regions.

***Parapoynx rectilinelis* sp. nov.**

Male external characters: Head with frons purely white. Vertex white, with V-shaped fuscous band. Labial palpus with basal 2 segments thickly with fuscous scales; the 3rd acuminate at apex, white. Maxillary palpus with base fuscous scales, and with apical portion dilating by white scales. Proboscis whitish at base. Antenna 2/5 as long as forewing length, a little suppressed laterally, with dorsal surface with a group of raised, fulvous scales on each flagellar segment. Ocellus distinct, near to eye. Legs whitish. Foreleg with antero-dorsal surfaces of coxa to tibia fuscous. Mid- and hindlegs almost whitish, with each inner spur about 1.5 times as long as outer one. Thorax above whitish except for fuscous mesoscutellum, beneath whitish. Abdomen above pale fulvous, with darker ring on each segment posteriorly; beneath whitish.

Male wing shape and venation: Allied to *P. vittalis*, but different from the latter as follows: Wings narrower. Forewing with apex more angulate; vein R_2 with base separated from that of R_{3+4}, while in *vittalis* R_2 anastomosed with R_{3+4} for short distnce; vein 3A completely absent.

Hindwing with apex more angulate, and with termen clearly incised behind apex, whereas in *vittalis* termen weakly curved to tornus; vein $Sc+R_1$ anastomosed with Rs for longer distance, for about 8/9 the length of it beyond discoidal cell, and with stalked portion indistinct; vein M_3 more curved, thence approximated to M_2 at base; discocellulars more strongly divergent distally.

Male wing marking: Similar to *vittalis*, but different from the latter as follows: DB1 fuscous, oplique inwards in discoidal cell, with anterior portion touched with DB2, and with posterior portion connected with ML to form a single, oblique line; PML emitted from 2/3 of costa to cell CuA_1, making a right angle with costa, and touched there with PMG, then extending inwards, and ended to proximal 1/4 of posterior margin, while in *vittalis* PML almost parallel with termen to cell CuA_1, then strongly

retracted proximally and ended to proximal 2/3 of posterior margin; MG absent as in *vittalis*; cilia whitish except for proximal 1/3 darker. Hindwing with SMW narrower, separated into 2 portions, of which anterior one is metallic grey and posterior one starts from vein Rs and ends to tornus, whereas in *vittalis* SMW continuous from costa to tornus; ML undulate, continuous, while in *vittalis* represented by separate spots on each vein; cilia with proximal 1/3 darker, especially on distal portion of veins Rs, M_1 and M_2.

Male genitalia: Tegumen short and wide in dorsal view, with anterior margin incised but mid-dorsal expansion anteriorly, with dorsal surface furnished with complex ridges, and with posterior margin not fused with uncus. Fenestrulae represented as 3 membranous portions, 2 lateral and 1 dorsal. T-v plate expanded laterally, and recognized clearly in dorsal view. Vinculum moderate in shape. Saccus short. Uncus much longer than in *vittalis*, about twice as long as height of tegumen, strongly, with apical 1/2 furnished with sparse setae. Gnathos almost straight, narrowing to apex which is indistinctly dentate dorsally. Valva shorter than those of the other species of *Parapoynx*; costa with dorsal margin undulate and with long setae at apical 2/3; sacculus with some stout setae on a papilate projection; inner surface with many setae; apical margin with long setae. Phallus short; coecum penis 0.16 as long as whole length of phallus; bulbus ejaculatorius with 3 coils; vesica with minute spinules throughout the middle portion. Juxta oblong, trapezoidal, with apical margin incised in U-shape.

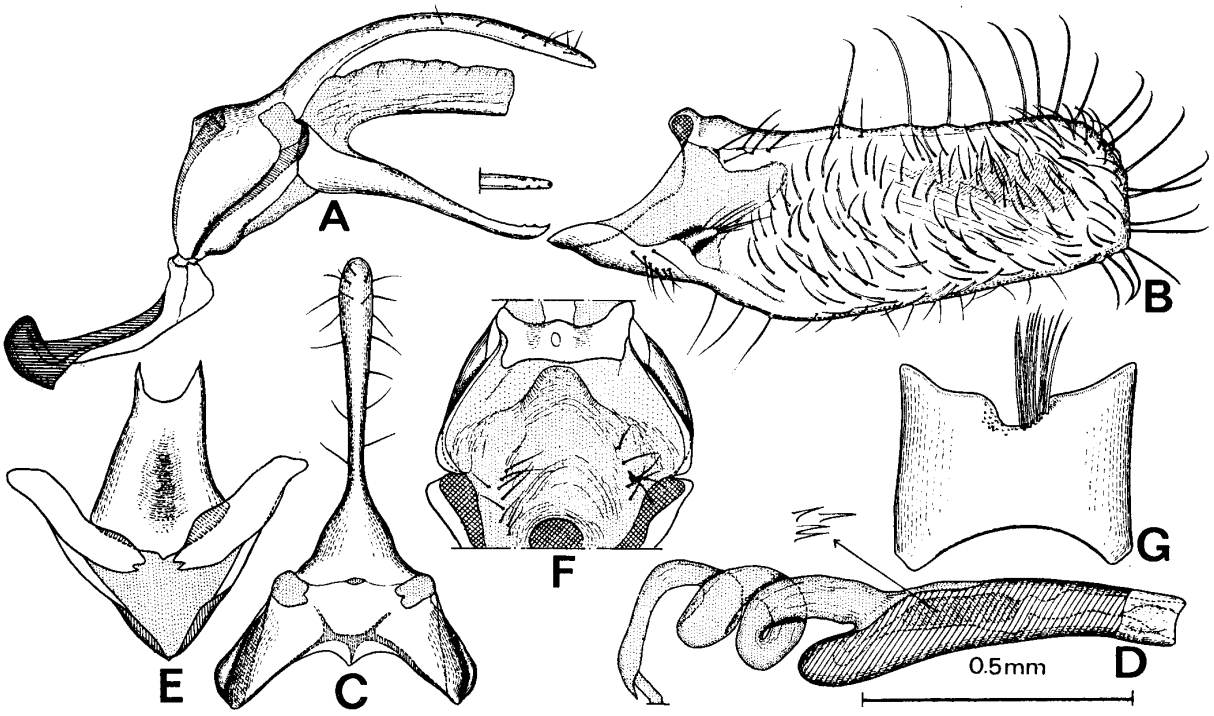

Fig. 48. *Parapoynx rectilinealis* sp. nov., male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta with its base; F, anellus, ventral view; G, 8th sternum.

Size of forewing: Male, 5.7 mm.

Immature stages: Unknown.

Holotype: Male, Midoroike pond, Kyoto-shi, Kyoto Pref., 13. viii. 1979 (Y. Yoshiyasu) (KU).

Remarks: This new species resembles *Parapoynx vittalis* (Bremer, 1864) in appearance, but differs from the latter in the oblique PML in the forewing, the separated SML in the hindwing and the shorter tegumen and longer uncus in the male genitalia and so on.

The present new species is described for only a male type specimen, so the female characters are not described in this study.

Parapoynx bilinealis (Snellen) comb. nov.

Oligostigma bilinealis Snellen, 1876: 196 (type-locoality: India); Inoue, 1982, I: 372, II: 243, pl. 44, fig. 48 (♂).

This species is closely related to *P. rectilinealis* sp. nov. in the same wing shape and venation, and similar wing marking, but differs from the latter in the following characters.

Wing marking: Forewing with PMG narrower, and shifted more distally. Hindwing with PMG also narrower, and with MGL more obscure.

Male genitalia: Tegumen narrower, with broader fenestrulae. Uncus shorter and more straight. Valva with apical portion broader.

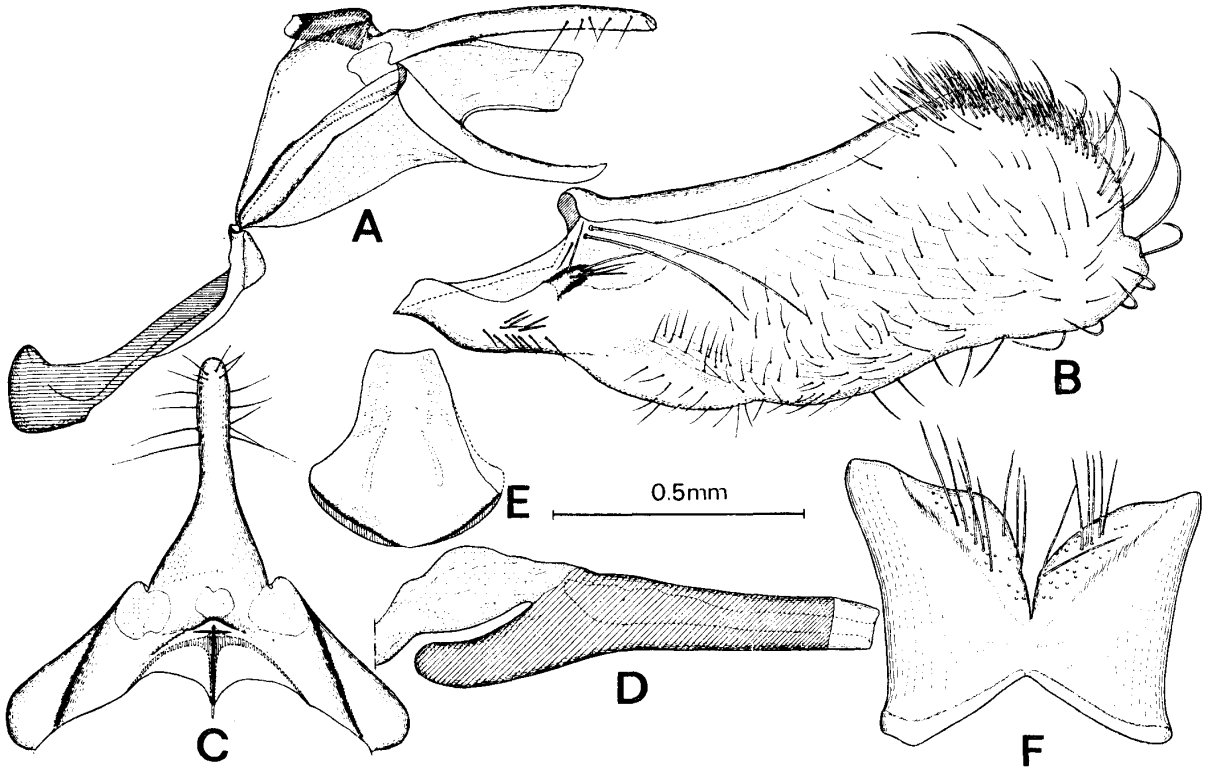

Fig. 49. *Parapoynx bilinealis* (Snellen), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta; F, 8th sternum.

Female genitalia: Differs from *P. vittalis* as follows: Ductus bursae longer; apical portion of corpus bursae stouter; with a pair of shorter signa; base of apophysis posterioris not so broad as in *vittalis*.

Size of forewing: Male, 6.5 mm; female, 6.3 - 6.5 mm.

Immature stages: Unknown.

Specimens examined: 1♂, Shirahama, Iriomote-jima, Is., the Ryukyus, 8. xi. 1963 (Samelson) (IC); 2♀, Mt. Banna-dake, Ishigaki-jima Is., 1-6. viii. 1981 (M. Owada) (KPU).

Distribution: Japan (the Ryukyus), India.

Remarks: This species was transferred from *Oligostigma* Guenée, 1854 to *Parapoynx* in having the hindwing with vein $Sc+R_1$ long-anastomosed with Rs, the male genitalia with

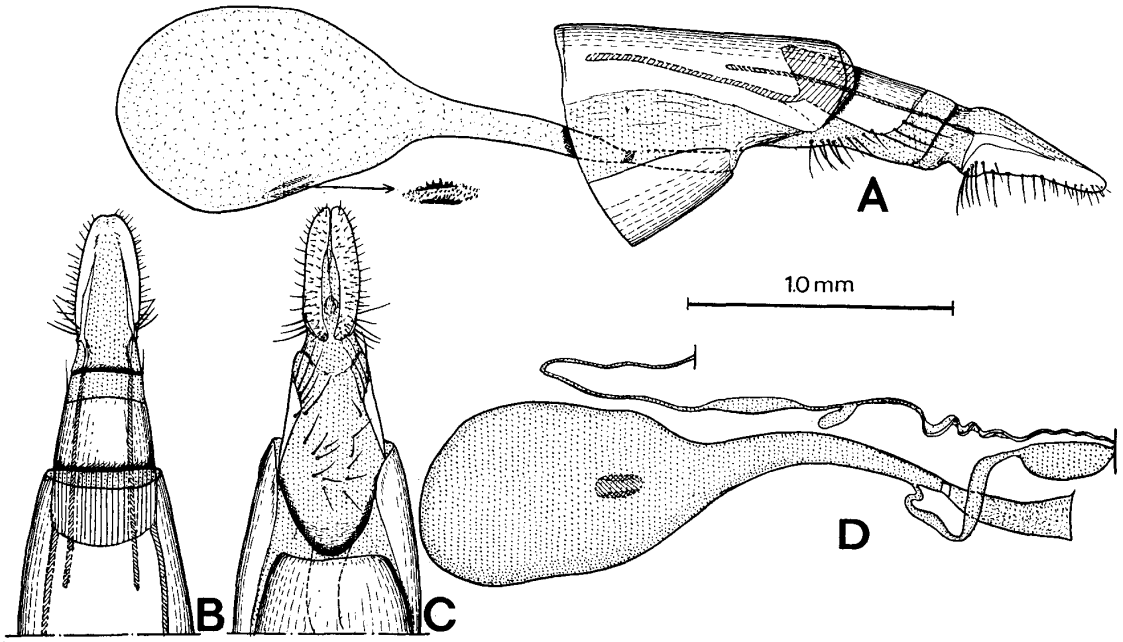

Fig. 50. *Parapoynx bilinealis* (Snellen), female genitalia. A, Laterel view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, dorsal view.

broad fenestrulae and with a papilate projection on valva, and the female genitalia with long corpus bursae having a pair of signa and with lagena in spermatheca.

Parapoynx crisonalis **(Walker)**

Hydrocampa crisonalis Walker, 1859: 961 (type-locality: Sri Lanka).
Parapoynx crisonalis: Hampson, 1893: 176, pl. 174, fig. 8; Yoshiyasu, 1983: 123, fig. 4; Speidel, 1984: 83.
Nymphula takamukui Shibuya, 1929: 124, 127, pl. 5, fig. 10 (type-locality: Kyushu, Japan); Marumo, 1942: 16; Inoue, 1982, I: 371, II: 243, pl. 44, fig. 41. Designated by Yoshiyasu (1983).

External characters: Head with frons rounded, whitish, with marginal area near eye suffused with fuscous. Vertex whitish, mixed with fuscous. Labial palpus fuscous, with 3rd segment obtuse at apex. Maxillary palpus lengthened by whitish scales. Proboscis short, almost as long as width of eye, with base whitish. Antenna 1/2 as long as forewing length, in male dorsally with flat fulvous scales and fan-shaped fuscous scales on each flagellar segment alternately; in female evenly fulvous dorsally. Ocellus distinct. Legs whitish except for anterior surfaces of fore-femur and -tibia and dorsal surface of hind 1st to 3rd tarsomeres fuscous; each inner spur 2.5 times as long as outer one. Thorax and abdomen above whitish with dark brown rings on mesonotum and 2nd abdominal segment; beneath whitish.

Wing shape and venation: Resembles *vittalis*, but differs from the latter as follows: Wing narrower, with apex more pointed; forewing with vein R_1 nearer to anterior angle of discoidal cell at base, hindwing with vein $Sc+R_1$ anastomosed with Rs for longer distance.

Wing marking: Both wings with line components obscure. Forewing with base to AMG pale fuscous AMG narrow, oblique inwards, fuscous. DB1 represented by a fuscous spot in discoidal cell. Discocellular lunule fuscous. PMG separated into 3 portions of which costal one is fuscous, middle one is curved situated area posterior to discoidal cell and posterior one is oblique inwards. SMG yellowish fuscous, with proximal margin retracted at vein R_5 and curved to posterior margin. SML parallel with termen, narrow, interrupted by veins, fuscous. Cilia whitish yellow, with fuscous spots on distal portion of each cell.

Hindwing with base to AMG whitish. AMG started from posterior angle of discoidal cell to posterior margin, oblique. Discocellular lunule marked clearly, fuscous. PMG parallel with termen, yellowish fuscous. SML as in forewing, but rather clearly marked. Cilia as in forewing.

Male genitalia: Tegumen short and wide, with middorsal portion extending triangularly anteriorly and furnished with a large ridge transversely; posterior margin fused with uncus dorsally. Fenestrulae broad. T-v plate strongly expanded in dorsal view. Vinculum moderate in width, a little longer than height of tegumen. Saccus rounded. Uncus a little longer than height of tegumen, slightly curved downwardly, with several setae laterally. Gnathos shorter than uncus, with dorso-apical spines indistinct Valva broad, with apex broadened and curved upwards; costa slender; sacculus wide with a papilate projection on which 3 stout setae are emitted; apical portion furnished with many long setae. Phallus short; coecum penis 0.19 as long as whole length of phallus; vesica without cornuti; bulbus ejaculatorius about 1.2 times as long as whole length of phallus. Juxta almost trapezoid in shape. In addition, 8th sternum with posterior margin incised in V-shape.

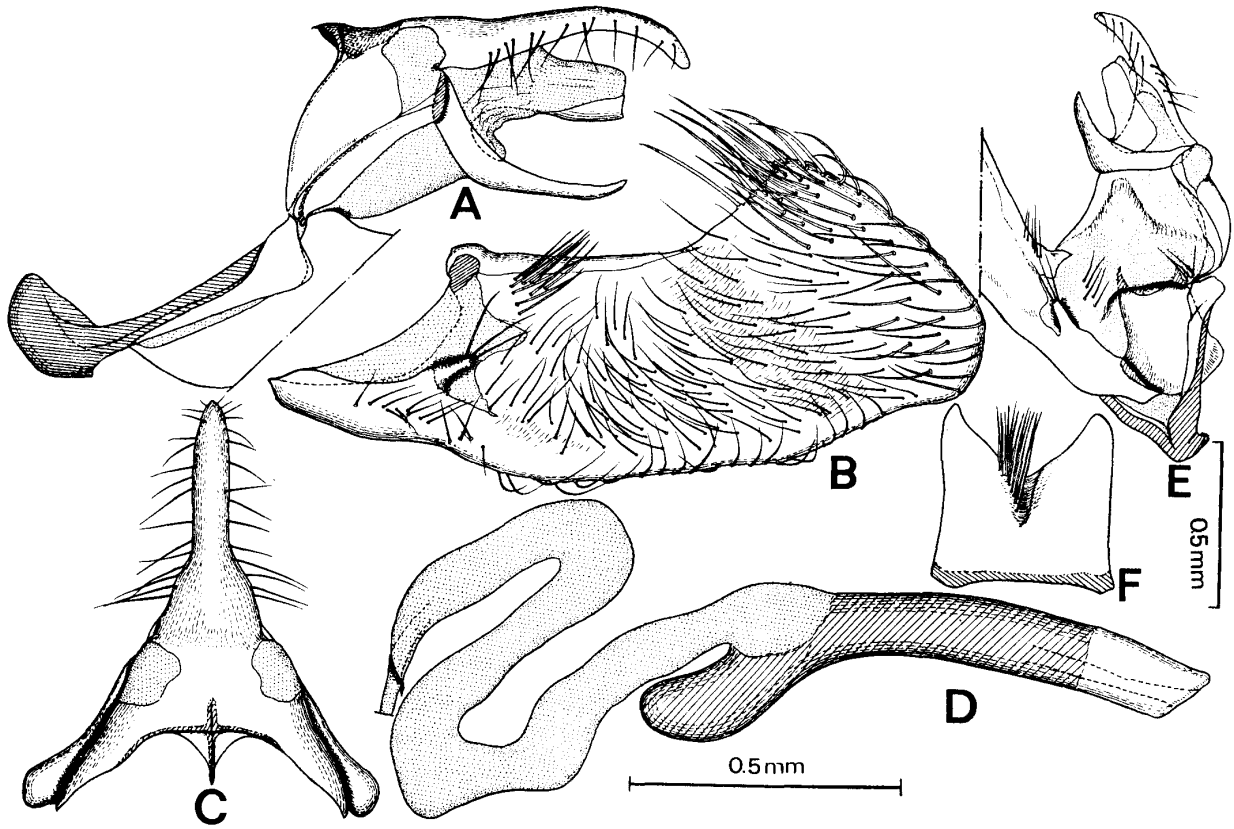

Fig. 51. *Parapoynx crisonalis* (Walker), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, postero-ventral view, right valva removed; F, 8th sternum.

Female genitalia: Ostium bursae narrow; ductus bursae moderate in length, evenly membranous. Bursal ring short. Ductus seminalis a little separated from bursal ring. Base of corpus bursae long and narrow, about twice as long as 7th tergum; apical portion swollen, with a pair of signa. Spermatheca with lagena large. Eighth tergum 0.5 as long as 7th tergum, with posterior margin a little incised at mid-dorsal line; apophysis anterioris with base wide as the other species of *Parapoynx*. Apophysis posterioris about 1.2 times as long as anterioris.

Size of forewing: Male, 6.5 - 9.1 mm; female, 7.3 - 9.8 mm.

Mature larva(6th instar): Head width, 1.2 mm, body length 14 - 19 mm.

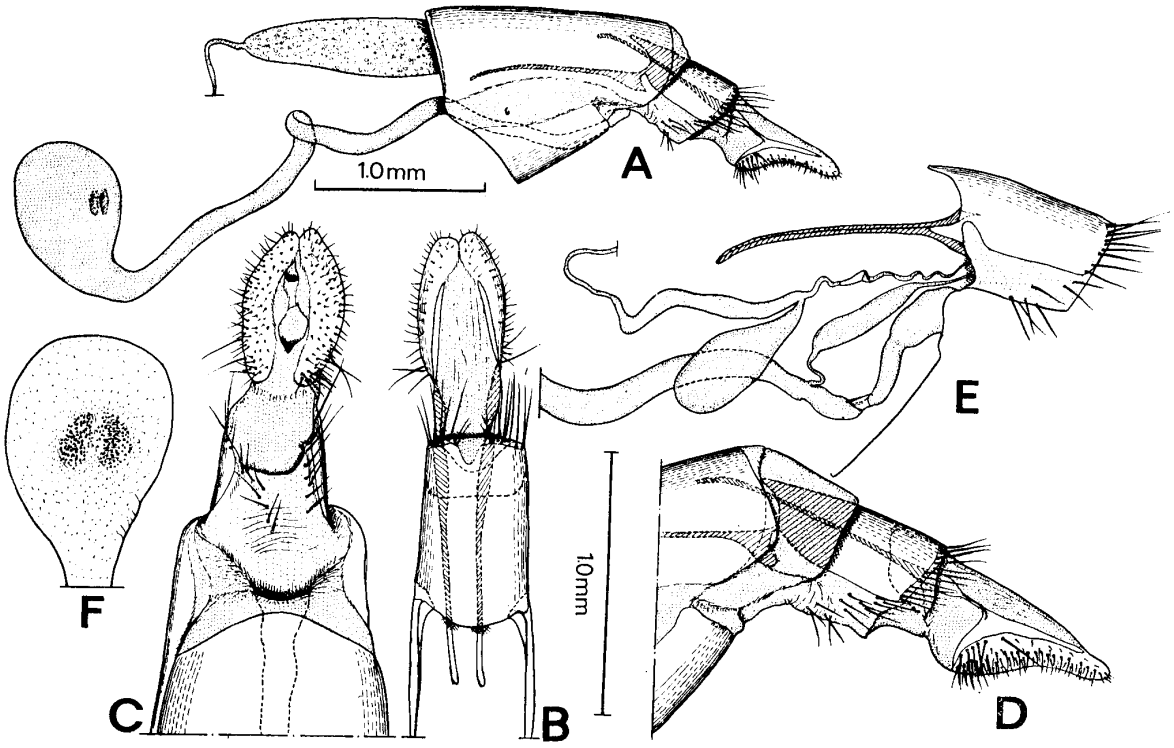

Fig. 52. *Parapoynx crisonalis* (Walker), female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, ditto, lateral view; E, base of corpus bursae and spermatheca, lateral view; F, apical portion of corpus bursae.

Head: Wider than the other species of *Parapoynx*, pale brown without distinct dark maculations; with 6 ocelli; setae long, with darker ring at bases. Seta AF1 much long, longer than AF2; A2 about 1/2 the length of A1, equidistinct from A1 and A3, almost on a line between A1 and A3; O2 relatively shorter than in *vittalis*; O3 just situated on a extension line combined O1 with O2. Labrum relatively wide; seta M3 situated most posteriorly, as long as M1. Mandible longer than wide, with 5 teeth; inner teeth with most ventral one larger than the others; posterior 2 setae emitting from postero-ventral margin short.

Thorax: Thoracic legs as in *vittalis*. Prothorax with seta D2 short; L2 postero-ventral to L1. Meso- and metathorax with chaetotaxy nearly same as *vittalis* except that L3 just ventral to L1; tracheal gills longest among *Parapoynx* species, longer than segment's length.

Abdomen: Almost as wide as thorax, whitish. Prolegs with crochets completely circle, bi- or triordinal, about 55 in number. In 1st to 8th segments, seta D2 postero-ventral to short D1; L1 short, a little longer than ventral L2; number of SV setae as in the other species of *Parapoynx*. Ninth segment with setae D2, SD1 and L1 long; D1 nearer to D2 than to SD1; L2 dorsal to L1. Tenth segment with anal shield weakly developed; seta SD1 slender, and longer than and just lateral to D1; SD2 about 1.5 times as long as segment's length. Position and branching number of gills on each segment as follows:

Segment	T2			T3			A1		A2		A3		A4		A5		A6		A7		A8		A9
Region	A	M	P	A	M	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	P
D	—	4	3	—	4	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	—
SD	4	—	—	4	—	—	—		—		—		—		—		—		—		—		—
L		—	5		—	5	3	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	5
SV		—	5		—	5	4	5	4	5	3	4	3	4	3	4	3	4	3	4	3	4	—

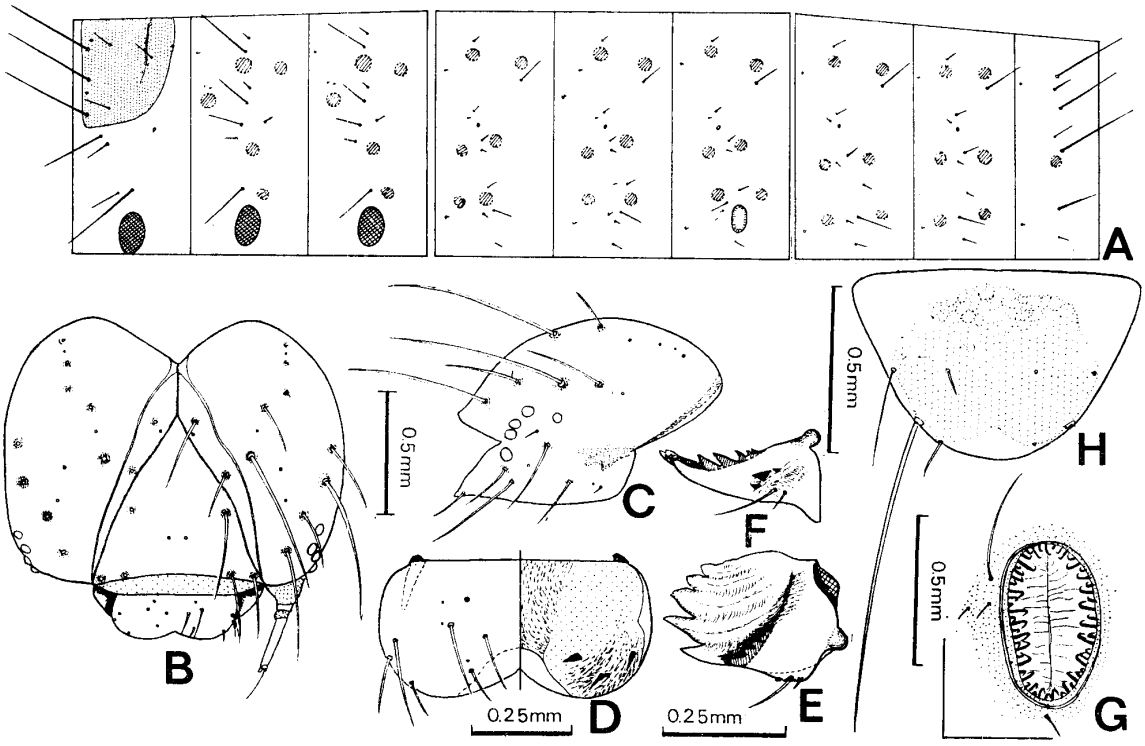

Fig. 53. *Parapoynx crisonalis* (Walker), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner riew; F, ditto, lateral view; G, crochets of proleg; H, 10th abdominal segment, dorsal view.

Male pupa: Body length, 8.3 - 9.7 mm, width, 2.5 - 2.8 mm.

Body evenly pale brown. Head with frons flat in dorsal view, with seta F1 remarkably stout; pilifer not clearly marked; maxilla rather long, reaching to apex of 4th abdominal segment; antenna ending to

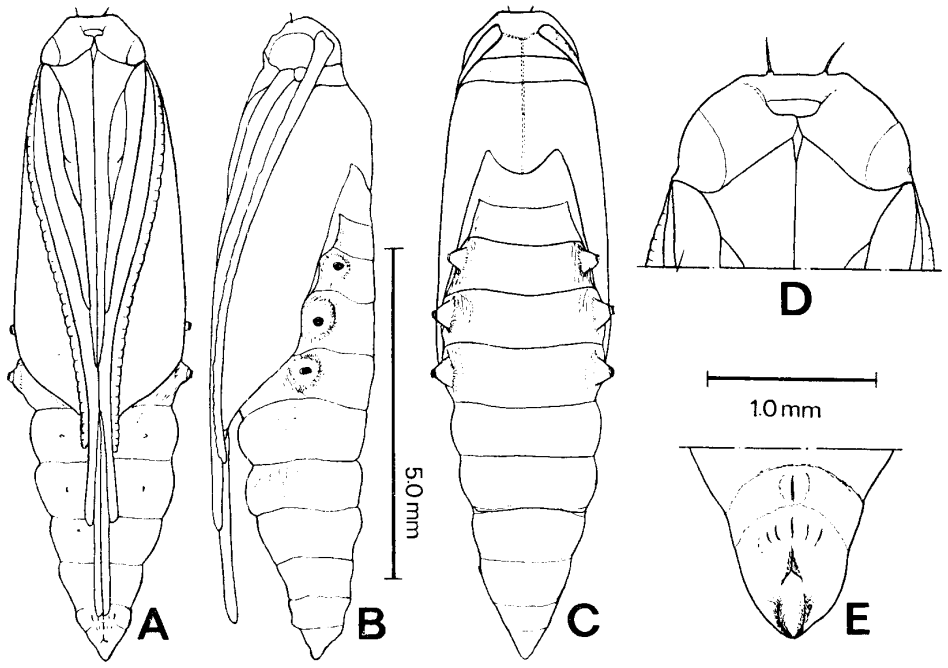

Fig. 54. *Parapoynx crisonalis* (Walker), pupa. A, Male, ventral view; B, ditto, lateral view; C, ditto, dorsal view; D, head, ventral view; E, apical segments, ventral view.

near wing apices. Thorax with foreleg shorter than maxilla; midleg long, far beyond apeces of wings, with apical portions of both sides attached other at mid-ventral line around wings apeces, then becoming separated at apices; hindleg very long, appearing behind midleg. Abdomen slender, without any projection; 2nd to 4th segments with spiracles well developed, each one equal in size; 9th to 10th segments narrowing, with caudal margin narrowly rounded without any hooks.

Specimens emamined: Kyushu: 1 ♂, Fukuoka, 28. x. 1923 (H. Hori) (KU); 1 ♂, 1 ♀, 8. vii. 1972, 2 ♂, 3 ♀, 11, vii. 1972, Ibusuki, Kagoshima Pref. (Y. Yoshiyasu) (KPU). The Ryukyus: 1 ♀, Komi, Iriomotejima Is., 24-26. x. 1973 (M. Owada); 1 ♀, Sonai, Iriomote-jima Is., 1-2. I. 1980 (Fujimaki & Kanazawa) (KPU).

Distribution: Japan (Kyushu, Amami Iss., the Ryukyus), India, Sri Lanka, Burma Thailand, Indonesia, Taiwan, Australia.

Biological notes: The larvae of this species live in the stagnant water, feeding on *Euryale ferox* Salisb. (Nymphaeaceae) at Kagoshima., Kyushu. The eggs are laid by masses (less than 10 in number per mass) under the surfaces of the floating host leaves. The first instar larvae enter the leaf-tissue like in *Elophila* and *Nymphula* species. In the preceeding stadia they cut the fragments of leaves and attached them to upper or under surfaces of leaves to make the cases. They sometimes live inside two leaves attached together with silk. Up to the last instar, they do not make the portable cases seen in the other *Parapoynx* species. The pupation takes place as in *Elophila interrutalis* (Pryer). The life cycle is not known in Japan. Accoring to Takahashi (1930), the larvae feed on *Lomnanthemum indicum* L., *Trapa natans* L., *Jussiaea repens* L. and *Euryale ferox* Salisb. among which the former two hosts are preferred. In Thailand, they are known as a feeder *Nymphaea* spp. (Yoshiyasu, 1983).

Remarks: The species is separable from *P. vittalis* and the allied species in having the rather spotted, fuscous wing marking, the male genitalia with shorter and apically broader valva, and the female genitalia with longer and narrower base of corpus bursae.

The species is very rare in Japan, although it is common in South-East Asia. I found the species at Ibusuki, (botanical garden), Kagoshima Pref., Kyushu, but the population at that place is diminished since then. By this fact, I think the species would be introduced from South East Asia on occasion, at least in Kyushu.

***Parapoynx stagnalis* (Zeller)**

Nymphula stagnalis Zeller, 1852: 26 (*nec. stagnalis* Guenée, 1854) (type-locality: Natal, South Africa).
Parapoynx stagnalis: Lederer, 1863: 452; Hampson, 1891: 40; Inoue, 1982, I: 374, II: 243, pl. 43, figs 46, 47; Speidel, 1984: 88.
Hydrocampa stagnalis: Kaye, 1900: 18.
Hydrocampa depunctalis Guenée, 1854: 274; Walker, 1859: 461; Lederer, 1863: 451; Swinhoe, 1885: 869.
Nymphula depunctalis: Moore, 1886: 305; Meyrick, 1894: 11; Hampson, 1896: 175; Hering, 1903: 64; Strand, 1919; 102; Shibuya, 1928: 142, 145; Matsumura, 1931: 1043; Klima, 1937: 81.
Zobronia ? *decussalis* Walker, 1859: 481.
Parapoynx decussalis: Meyrick, 1885: 432.
Cataclysta vestigialis Snellen, 1880: 78; Moschler, 1890: 318.
Parapoynx dianalis Schaus, 1905: 1377.

External characters: Head with frons evenly silver white. Vertex not erected, silver white. Labial

palpus curved upwards, with basal 2 segments suffused with brown outerly, and the 3rd ascending upwards, parallel with labial palpus, white. Proboscis moderate in length, basally with whitish scaling. Antenna with base just lateral to eye, ciliate, dorsally with white scales. Ocellus present. Thorax above whitish, in some specimens tinged with pale brown, beneath white. Abdomen almost whitish.

Legs white. Foreleg with anterior portion of femur and tibia suffused with brown. Midleg with inner tibial spur 1.5 times as long as the outer one. Hindleg with mid inner spur 1.5 times and distal inner spur twice as long as each outer one.

Wing shape and venation: Wings narrow and elongate. Forewing with costa weakly concave at middle, apex narrowly rounded. Vein R_1 with base near to anterior angle of discoidal cell; R_5 and M_1 almost straight; bases of M_2, M_3 and CuA_1 not curved and a little separated; 1A+2A almost straight; 3A vestigile; discocellulars erect.

Hindwing with costa curved; apex rounded; termen weakly incised behind apex. Vein $Sc+R_1$ long anastomosed with Rs; discoidal cell about 2/5 of whole wing length; bases of M_2, M_3 and CuA_1 as in forewing; CuP with base vestigile; 1A+2A, 3A distinct; discocellulars retracted distally in posterior portion.

Wing marking: Forewing with proximal 1/2 almost whitish. Discocellular lunule representing by 2 black spots at each angle of discoidal cell. ML leaving as a black dot behind discoidal cell at proximal 1/3 of wing. PML emitted from near end of vein Sc, curving to vein CuA_2 and retracting proximally, then straight to 1/2 of posterior margin. PMG emitted from costa near end of vein R_2, then straight to vein M_3 and diminishing there, and reappearing behind vein CuA_2, fuscous. SML parallel with termen, representing as 7 fragmented, triangular spots on veins, fuscous. MGL weakly present between veins. Cilia whitish.

Hindwing with discocellular lunule spot small, fuscous, sometimes obscure. PML separated into 3 bars, fuscous. PMG to MGL as in forewing, but SML spots larger, thence continuous with MGL bars at posterior portion. Cilia white but darker at 1/3 of ends of the veins.

Male genitalia: Tegumen wider than length, without tranverse ridge dorsally. Fenestrulae separated into 3 circular membranous portions, one in dorsal, 2 in lateral side. T-v plate strongly expanded laterally, especially on antero-ventral portion. Saccus extending upwards, triangular in lateral view. Uncus spatulate dorsally, a little downwards, with 1 basal and several long setae laterally at posterior 1/2. Gnathos narrow, without apical denticles, dorsally. Valva elongate, almost parallel-sided but apically upwards; costa flat and narrow; sacculus wide at base extending to 1/2 of valva, with a papillate projection having 2 setae on tip and with long setae dorso-apical portion; inner surface with many scale-like setae; apical margin with long, curved setae. Phallus short, subzonal sheath membranous dorsally; coecum penis downwards, about 0.21 as long as whole length of phallus; vesica with many minute spinules throughout its length. Juxta lonvoidal, weakly swollen mid-ventrally.

Female genitalia: Ostium bursae rather narrow. Ductus bursae moderate in length, membranous. Corpus bursae evenly membranous, becoming larger to apex; apical portion slightly swollen without signa. Spermatheca with lagena smaller than the other *Parapoynx* species. Eighth tergum 0.58 as long as 7th tergum, with posterior long setae which are not on a line, apophysis anterioris 1.16 times as long as 7th tergum, with base extending triangularly; 8th sternum with several long setae. Apophysis posterioris almost as long as anterioris, with base slightly wide.

Size of forewing: Male, 6.5 - 7.5 mm; female, 7.1 - 8.2 mm.

Specimens examined: Tokara Iss.: 1 ♀, Nakanoshima Is., 24. vii. 1964 (K. Kanmiya) (KPU). Amami Iss.: 1 ♀, Nishinakama, Amami-Oshima Is., 15. vii. 1933 (Esaki & Yasumatsu) (KU). The Ryukyus: 2 ♀, Ishigaki-shi, Ishigaki Is., 15. viii. 1975 (Y. Yoshiyasu); 2 ♂ 2 ♀, Ishigakishi, Ishigaki Is., em. 2-4. viii. 1975 (Y. Yoshiyasu) (KPU).

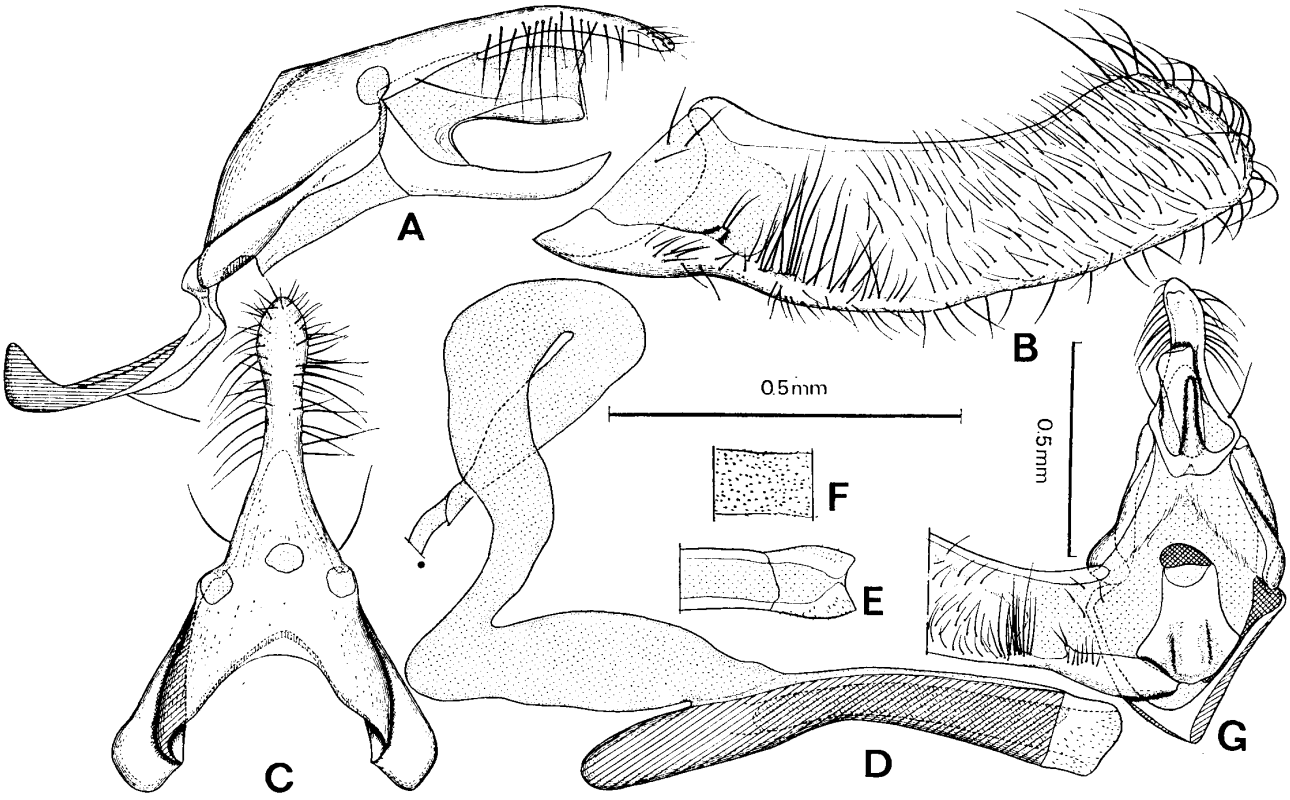

Fig. 55. *Parapoynx stagnalis* (Zeller), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, apical portion, dorsal view; F, cornuti; G, postero-ventral view, right valva removed.

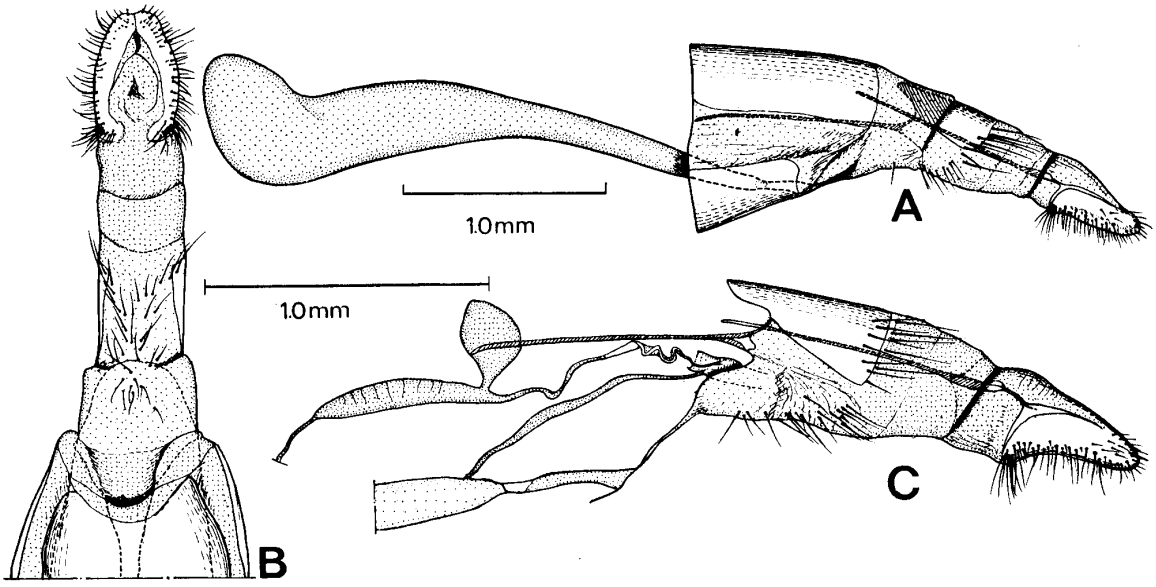

Fig. 56. *Parapoynx stagnalis* (Zeller), female genitalia. A, Lateral view; B, 8th to 10th segments, ventral view; C, base of corpus bursae and spermatheca, lateral view.

Mature larva (*6th instr*): Head width, 1.0 mm, body length, 11 - 14 mm.

Head: Wider than long, pale brown with distinct maculation. Seta AF1 almost as long as AF2; A2 shorter than 1/2 the length of A1, present on a line between A1 and long A3; O2 longer than A1, just situated on a line between O1 and O3. Mandible, labrum and ocelli as in *P. crisonalis*.

Thorax: White, a little translucent. Prothorax with seta SD2 shifted at anterior margin of prothoracic shield, just dorsal to SD1. Meso- and metathorax with D1, SD1 and L1 stout; SD1 almost as long as SD2; L1 postero-ventral to L3; L2 very short; tracheal gills short, almost as long as segment's length and that of SD region absent.

Abdomen: Concolorous with thorax. Prolegs with crochets arranged biordinally or partly triordinally, about 70 in number. Chaetotaxy as in *crisonalis* except in 1st to 8th segments L1 antero-ventral to L2 and in 10th segment seta D1 situated posteriorly near long SD1. The position and number of branching of tracheal gills are shown with those of thorax in the next table:

Segment	T2			T3			A1		A2		A3		A4		A5		A6		A7		A8		A9
Region	A	M	P	A	M	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	P
D	—	3	3	—	3	3	3	3	3	3	3	3	2	3	2	3	2	3	2	3	2	2	—
SD	—	—		—	—	—	—		—		—		—		—		—		—		—		—
L	—	—	3	—	—	4	3	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	3
SV	—	—	4	—	—	4	3	5	3	5	3	5	3	5	3	4	2	4	2	3	2	2	—

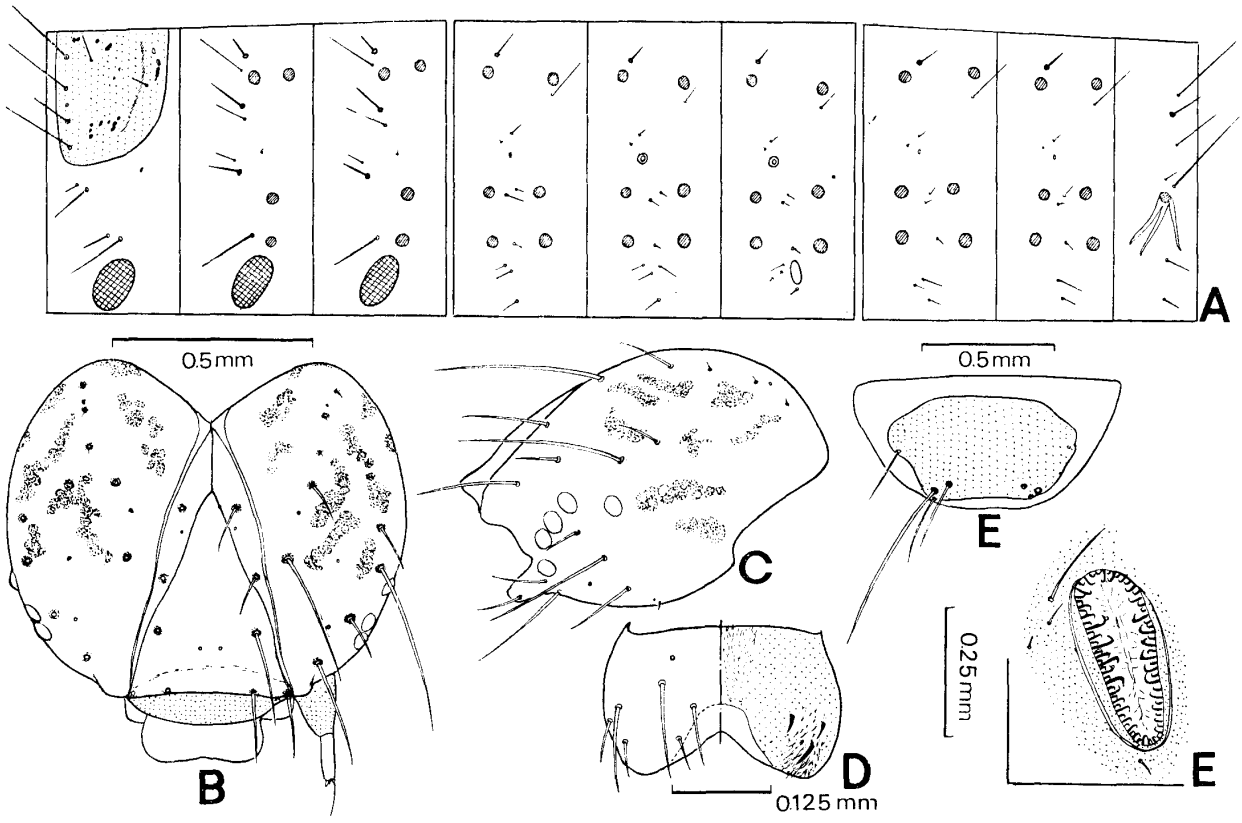

Fig. 57. *Parapoynx stagnalis* (Zeller), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, crochets of proleg; F, 10th abdominal segment, dorsal view.

Pupa: Body length 7.5 mm, width 1.8 mm. Body evenly pale brown. Head with frons flat in dorsal view, seta F1 stout as in *crisonalis*: eyes rather expanded laterally; labial palpus narrower than the other species of *Parapoynx*; maxilla extending to 3/4 length of wings; antenna reaching to near apex of wings. Thorax with foreleg slightly shorter than apex of maxilla and tips of both sides not attached at mid-ventral line; mid- and hindlegs as in *P. crisonalis*. Abdomen rather slender with spiracles of 2nd

and 4th segments well developed, each protruded base larger than *P. crisonalis* and equal in size; apex of 10th segment narrowly rounded.

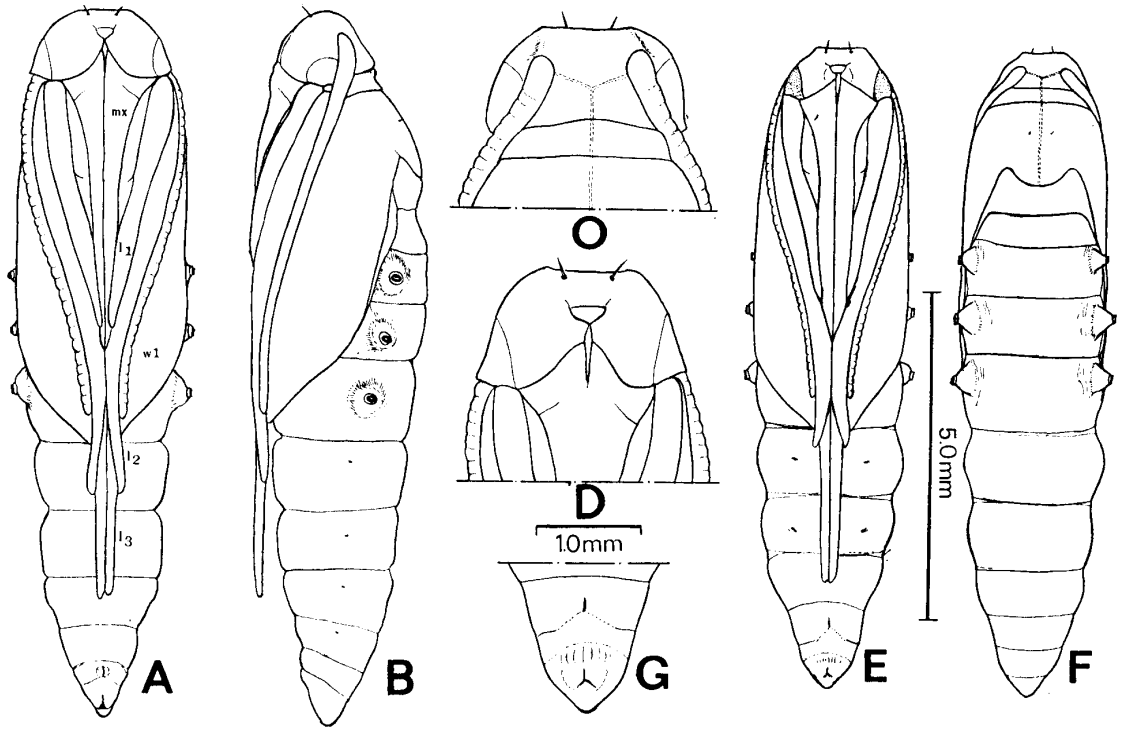

Fig. 58. *Parapoynx stagnalis* (Zeller), pupae. A, Male, ventral view; B, ditto, lateral view; C, head, dorsal view; D, ditto, ventral view; E, Female, ventral view; F, ditto, dorsal view; G. apical segments, ventral view.

Distribution: Japan (Kyushu, the Ryukyus), Morroko, India, Sri Lanka, Burma, Thailand, Vietnam, Sumatra, Java, Borneo, Sulawesi, Philippines, Taiwan, China, Australia, East to South Africa, South America (Brazil), West Indies (Puerto Rico).

Biological notes: The larvae feed on the rice plants, and the habit is almost as in *vittalis*.

Remarks: The species is allied to *P. crisonalis*, but differs from the latter by having the broad white area and the spotted ground and line components in the wings, and the tegumen without transverse ridge in the male genitalia and the smaller lagena in the female genitalia.

Parapoynx diminutalis Snellen

Parapoynx diminutalis: Snellen, 1880 23: 242 (type-locality: Sulawesi); Agassiz, 1978: 123; Inoue, 1982 I: 372, II: 243, pl. 44, figs. 42, 43; Speidal, 1984: 78.

Nymphula diminutalis: Meyrick, 1894: 470; Hampson, 1896: 193; Hering, 1903: 62; Shibuya, 1928: 142..

External characters: Head with frons rounded, whitish but medially scattered with fuscous scales. Vertex rather prominent whitish, with transverse fuscous band. Labial palpus upturned; basal 2 segments fuscous outerly; the 3rd narrower, whitish, not acuminate at apex. Maxillarly palpus rather long, basally fuscous or ochreous. Proboscis relatively shorter than the other species of *Parapoynx*, about 2.5 times as long as length of eye. Antenna in male thick, annulate, slightly shorter than forewing length, each flagellar segment with rosette like, fuscous scales on dorsal surface; in female filiform, shorter

than in male, about 2/3 as long forewing length. Ocellus rather separated from eye, especially in female. Thorax above whitish, mixed with fuscous, beneath whitish. Abdomen above ochreous to dark brown with whitish ring posteriorly, beneath evenly whitish.

Legs long, whitish. Foreleg with anterior surface of coxa and dorsal surfaces of femur to tarsus dictinctly dark brown. Mid- and hindlegs with each inner spur about twice as long outer one.

Wing shape and venation: Forewing with costa slightly swollen at middle; apex rounded; termen almost straight to tornus. Vein R_1 rather short, reaching at 1/2 of costa, before end of discoidal cell; R_2 also short, incompletely anastomosed with R_{3+4} at base; R_5 and M_1 almost straight; bases of M_2 and M_3 approximated at each other, and M_3 curved at base; CuA_1 separated from base of M_3; 1A+2A straight to termen; 3A indistinct; discocellulars erected but converging posteriorly.

Hindwing with $Sc+R_1$ long-stalked with Rs; M_2 and M_3 as in forewing; CuP unclear in basal half; 1A+2A and 3A distinct; discocellulars oblique outwards.

Wing marking: Forewing with costa suffused with dark brown at proximal 2/3; BL and SBL representing as one indistinct oblique, fuscous shade. AML rather broad, oblique, extending to proximal portion of posterior margin, ochreous mixed with dark brown. DB1 representing as an ochreous spot in discoidal cell. DB2 suffused with dark brown, obscure in shape. ML with anterior portion distinctly, representing as a black dot, sometimes as transverse two bars. ML connected with DB1, running obliquely to 1/4 of posterior margin, purely fuscous in male, ochreous in female. PML broad, extending as to encircle ML, then retracting to posterior angle of cell, and ending at 1/2 of posterior margin; in male fuscous but in female ochreous with darker edges. PMG almost parallel with PML, broad; fuscous in male, ochreous in female. SML narrow, parallel with termen, interrupted posteriorly, fuscous. SMG ochreous. Cilia pale ochreous except base white, and with blackish dots at each end of veins.

Hindwing with posterior portion of ML faintly marked. Discocellular lunule fuscous. PML narrow, running as in forewing, fuscous. PMG broad, extending distally to touch with submarginal line at vein

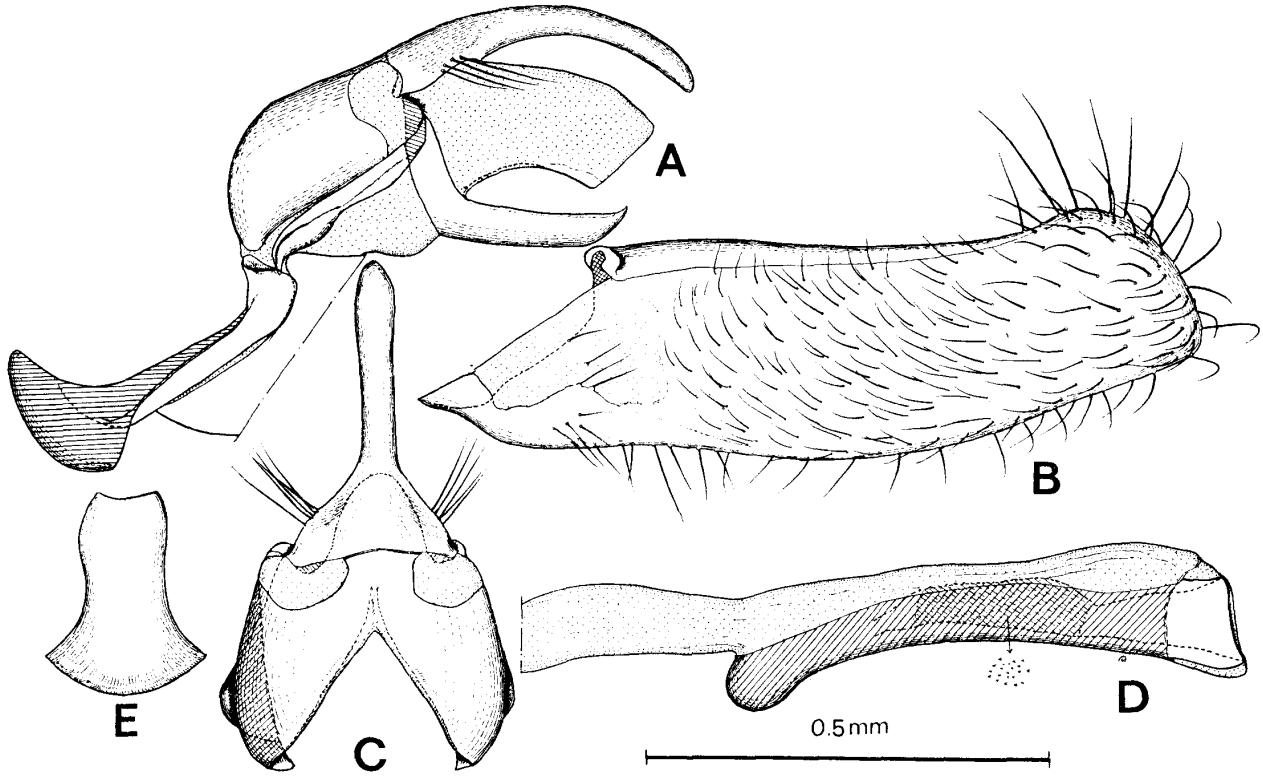

Fig. 59. *Parapoynx diminutalis* Snellen, male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus; D, phallus; E, juxta.

M_3, fuscous in male, ochreous in female. SML interrupted to form crescent fuscous bars in each cell. SMG parallel with termen, extending to vein 1A+2A, ochreous. Cilia as in forewing.

Male genitalia: Tegumen shorter than width; anterior margin V-shaped incurvate, with transverse ridge dorsally; posterior margin separated from base of uncus. Fenestrulae broad and separated into two lateral portions. T-v plate rather distant from tegumen and not so expanded laterally in dorsal view. Vinculum connected with tegumen by membrane, moderate in width. Saccus relatively large, upwards and triangular in lateral view. Uncus broad, with base furnished with some long, lateral setae; apical 2/3 narrow, parallel-sided, without setae, rather strongly curved downwards. Gnathos L-shaped in lateral view, with base broadly concealed by t-v plate; apical portion flat, without dorsal denticles. Valva almost parallel-sided, slightly upwards apically; costa moderate, rounded, narrowing to apex; sacculus broad basally, without papilate projection seen in other *Parapoynx* species, but 2 stout setae on corresponding place with its projection; inner surface with many setae; apical margin with long setae as in the others of *Parapoynx*. Phallus short, suprazonal sheath membranous dorsally; coecum penis very short, about 0.07 as long as whole length of phallus; vesica with minute spinules. Juxta elongate, with lateral side concave.

Female genitalia: Ductus bursae very short. Corpus bursae with base partly sclerotized, narrow, being broad to apical rounded portion which has a pair of signa on plates. Ductus seminalis with base rather separated from bursal ring. Spermatheca with large lagena. Eighth tergum 0.54 as long as 7th tergum, with posterior long setae, not situated on a line; apophysis anterioris 0.80 as long as 7th tergum, with base triangularly sclerotized; 8th sternum with long setae. Apophysis posterioris longer than anterioris, with trapezoidal expansion dorsally at base.

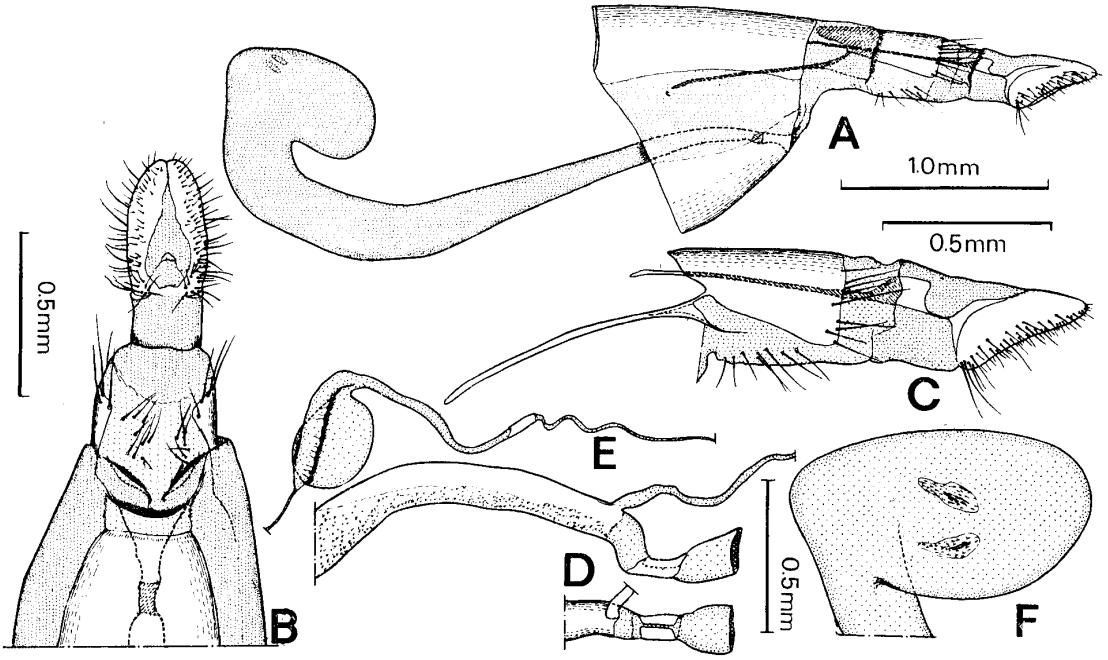

Fig. 60. *Parapoynx diminutalis* Snellen, female genitalia. A, Lateral view; B, 8th to 10th segments, ventral view; C, ditto, lateral view; base of corpus bursae, lateral view; E, spermatheca.

Size of forewing: Male, 5.8 - 6.7 mm; female, 6.1 - 8.2 mm.

Specimens examined: Kyushu: 1♀, Mt. Wakasugiyama Fukuoka Pref., 27. viii. 1967 (Y. Yoshiyasu) (KPU); 1 ♀, Hakozaki, Fukuoka-shi, Fukuoka Pref., 28. ix. 1971, 1 ♂, 13. ix. 1976 (Y. Yoshiyasu), 1 ♂, 20. ix. 1976 (M. Yamamoto), 1 ♀, 21. ix. 1976 (Y. Yoshiyasu), 1 ♀, 29. ix. 1976 (Y. Yoshiyasu),

1 ♂, 13. x. 1976 (K. Ôhara), 1 ♀, 13. x. 1976 (Y. Suzuki) (all same locality) (KPU); 1 ♀, Omuta-shi, Fukuoka Pref., 6. ix. 1977 (T. Sata) (KPU). The Ryukyus: 1 ♂, Tabarugawa, Yonakuni-jima Is., 29. vii. 1962 (M. Sato & Y. Arita) (EU); 1 ♀, Sonai, Yonaguni-jima Is., 25. v. 1975 (S. Azuma) (IC); 3 ♀, Ishigaki-jima Is, 9-13. viii. 1965 (K. Kanmiya) (KPU).

Distribution: Japan (Kyushu, the Ryukyus), India, Nepal, Sri Lanka, Thailand, Singapore, Sumatra, Java, Lombok, Celebes, Borneo, Vietnam, Philippines, China, Taiwan, Panama.

4th instar larva: Head pale brown, a little wider than long, lacking dark maculation except darker setal bases. Seta AF1 shorter than AF2; A2 very short, close to A1; A3 long, almost as long as P1, and situated more posteriorly than the other *Parapoxnx* species. Labrum, mandible and ocelli as in the other *Parapoynx* species.

Thorax whitish, semilucent. Chaetotaxy almost as in *vittalis* and *crisonalis* except D2 of prothoracic shield very long. Meso- and metathorax lacking SD and V group of gills.

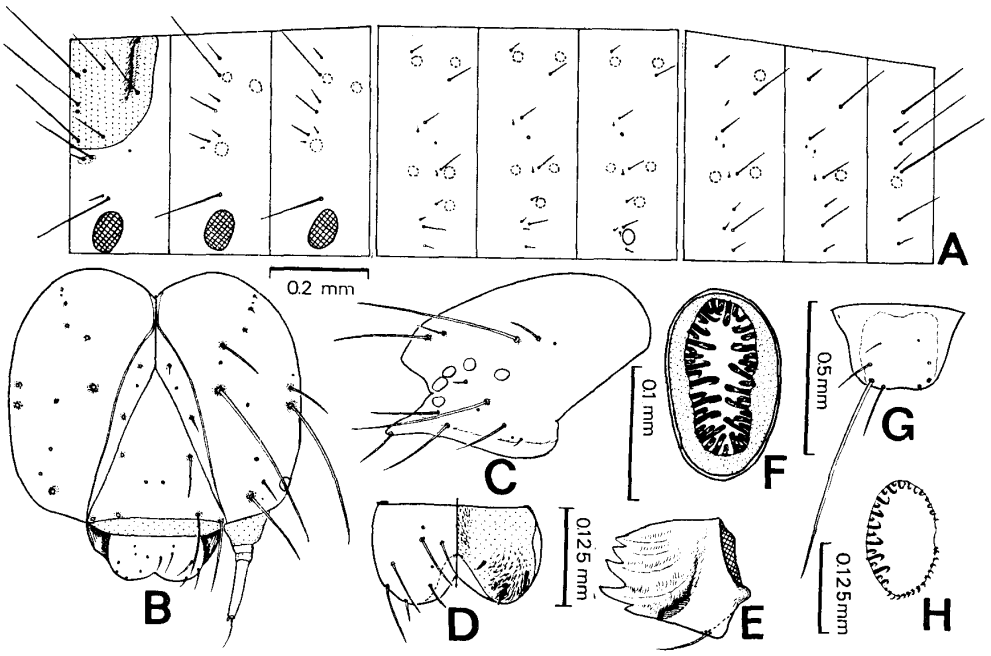

Fig. 61. *Parapoynx diminutalis* Snellen, larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; labrum; E, right mandible, inner view; F, crochets of proleg; G, 10th abdominal segment, dorsal view; H, crochets of anal prolegs.

Abdomen: Prolegs with crochets biordinally or partlyt triordinally arranged, about 45 in number. Chaetotaxy as in *crisonalis* except on anal shield with D1 longer than D2 and shifted posteriorly, just anterior to SD1.

Remarks: The species is rather close to *P. fluctuosalis*, but differs from the latter in the wing with more sinuous line and ground components, in the male genitalia without papilate projection on the valva and the female genitalia with the shorter ductus bursae.

The species is wide in distribution and recently is introduced to Central America with the host plants (Buckingham, 1982).

***Parapoynx ussuriensis* (Rebel)**

Nymphula ussuriensis Rebel, 1910: 6, pl, 1, fig. 7 (type-locality: Ussuri); Caradja, 1917: 21; Shibuya, 1929: 124, 127; Matsumura, 1931: 1044; Inoue, 1954: 155.

Parapoynx ussuriensis: Inoue, 1982, I: 372, II: 243, pl. 44, figs. 44, 45; Speidel, 1984: 92.
Nymphula munakatae Matsumura, 1917: 548. Designated by Shibuya (1929).

External characters: Head with frons rounded, fuscous. Vertex fulvous with dark brown scales. Labial with basal 2 segments roughly scaled, fulvous; the 3rd blunt at apex, fulvous. Maxillary palpus curved upwards, fulvous but apical portion dark brown. Proboscis short, about 1.5 times as long as width of eye. Antenna long, about 7/9 as long as forewing length, a little pectinate; in male fuscous dorsally, in female paler. Ocellus absent. Legs long, foreleg with anterior surfaces of coxa to tarsus fuscous, especially darker in tibia, others fulvous. Midleg evenly fulvous except for femoral tip; inner spur twice as long as outer one. Hindleg also evenly fulvous, both inner spurs about 3/4 as long as outer ones. Thorax and abdomen above fuscous, beneath whitish.

Wing shape and venation: Forewing with costa straight; apex rounded; termen a little excurved behind apex and evenly rounded to tornus; tornus broadly rounded. Vein Sc reaching to costa a little beyond end of discoidal cell; R_2 free, emitting from anterior angle of discoidal cell; R_3 anastomosed with R_4 for long distance, about 2/3 of its length beyond discoidal cell; R_5 in male arising just behind bases of R_{3+4}, that in female shortly anastomosed with R_{3+4} at base; base of M_2 curved, approximated to that of M_3; CuA_1 emitted from discoidal cell a little apart from base of M_3; CuP absent.

Hindwing long and tornal area well developed so that it is almost lonvoidal in shape; apex rounded; termen weakly excurved behind apex and posterior portion to vein CuA_1 almost parallel with costal margin. Vein $Sc+R_1$ long anastomosed with Rs beyond discoidal cell; bases of M_2 and M_3 as in forewing; base of CuA_1 a little apart from that of M_3; CuA_2 emitted from 2/3 of discoidal cell. Discollulars interrupted at middle.

Wing marking: Ground components fulvous to pale fuscous. Forewing with basal 2/3 dark fulvous to fuscous, mixed with several dark brown scales. Discocellular lunule narrow but distinct, blackish brown. PML weak, running from costa near end of vein R_2 and continued to posterior margin, parallel with termen, light brown. SML wide, parallel with termen, fuscous edged by blackish. ML narrow, blackish. Cilia fulvous except fuscous scales at proximal 1/3 of each end of veins.

Hindwing with base fulvous. ML appeared only behind discoidal cell, oblique inwards, dark brown. SML wide, parallel with termen, fuscous but becoming darker at posterior portion. ML balckish. Cilia as in forewing.

Male genitalia: Tegumen short and wide dorsally, rounded laterally; anterior margin weakly incised, with transverse and longitudinal ridges dorsally as in the other *Parapoynx* species. T-v plate long, expanded laterally. Fenestrula well developed, but narrower than in the other *Parapoynx* species. Vinculum longer than height of tegumen, continued with tegumen by concave plate. Saccus upturned, membranous dorsally. Uncus with base separated from tegumen, long, spatulate in dorsal view, with short setae laterally; apex widened and broadly rounded. Gnathos long, a little shorter than uncus, almost straight and narrowing and slightly upwards to apex which has no distinct spines dorsally. Valva moderate in length, relatively wide at base, and more widened in middle and narrowing to apex, dorso-apical portion produced roundly; costa cylindrical, apical 1/2 separated from medial portion of valva, curved inwardly, with apex furnished with many scale-like setae; sacculus relatively narrow and short; anellifer extended posteriorly at its dorsal portion; inner surface with sparse setae, basal area near acculus with 3 stout setae on produced bases. Phallus short, dorsal surface of subzonal sheath weakly sclerotized; coecum penis short, about 0.33 as long as whole length of phallus; vesica without cornuti. Juxta small, almost rectangular in shape, slightly incised at posterior margin. In addition, 8th tergum almost representing by triangular plate, with longitudinal ridge mid-dorsally.

Female genitalia: Ostium bursae narrow. Ductus bursae short, membranous. Corpus bursae long and slender, coiled four times medially, and ended to rounded portion which has a pair of linear signa.

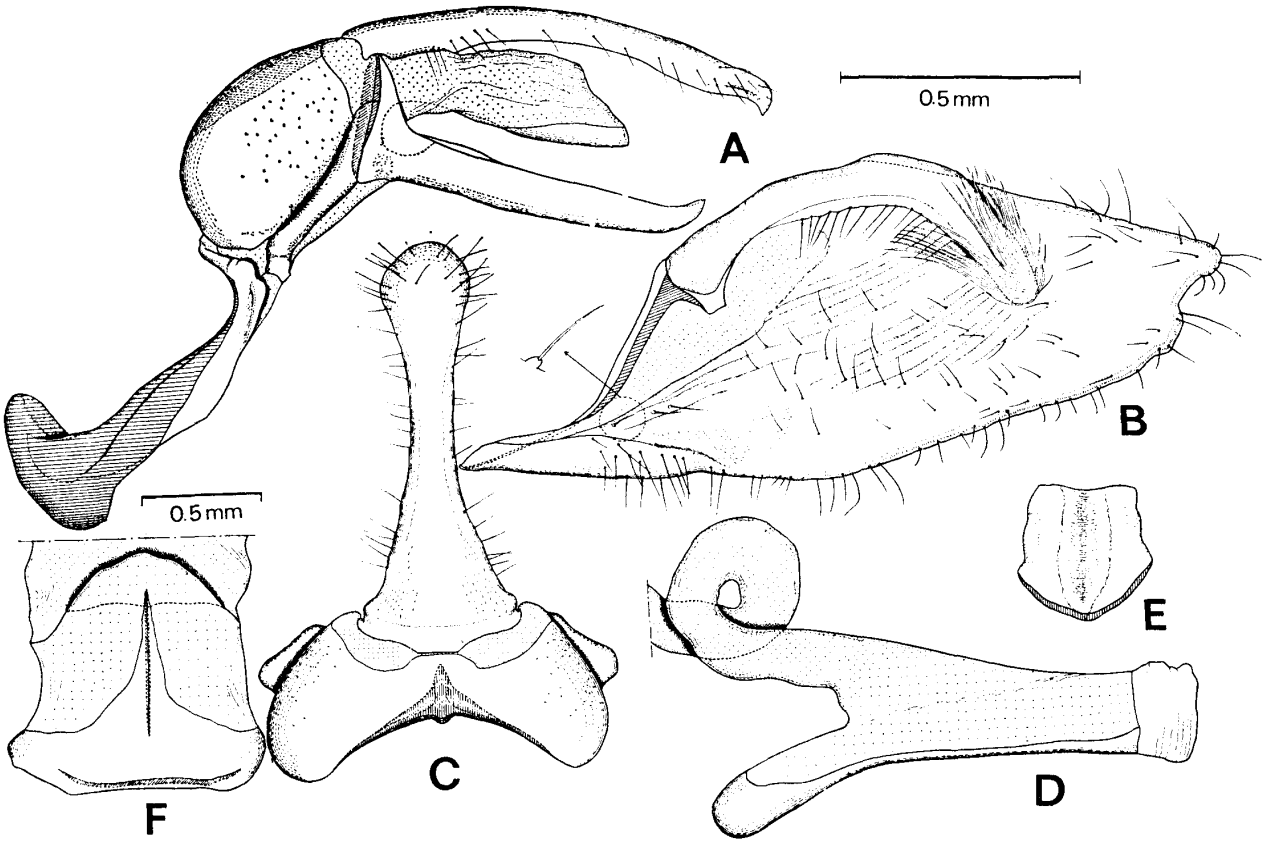

Fig. 62. *Parapoynx ussuriensis* (Bremer), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta; F, 8th sternum.

Cervix bursae undeveloped. Eighth tergum long, 0.38 as long as 7th tergum, with long setae posteriorly; apophysis anterioris long, slender, slightly shorter than 7th tergum; 8th sternum membranous, with several short setae. Papilla analis small, with many short setae posteriorly; apophysis posterioris a little shorter than anterioris, with characteristic lonvoidal plate near base. In addition, 7th sternum relatively longer than those of the other species of *Parapoynx*.

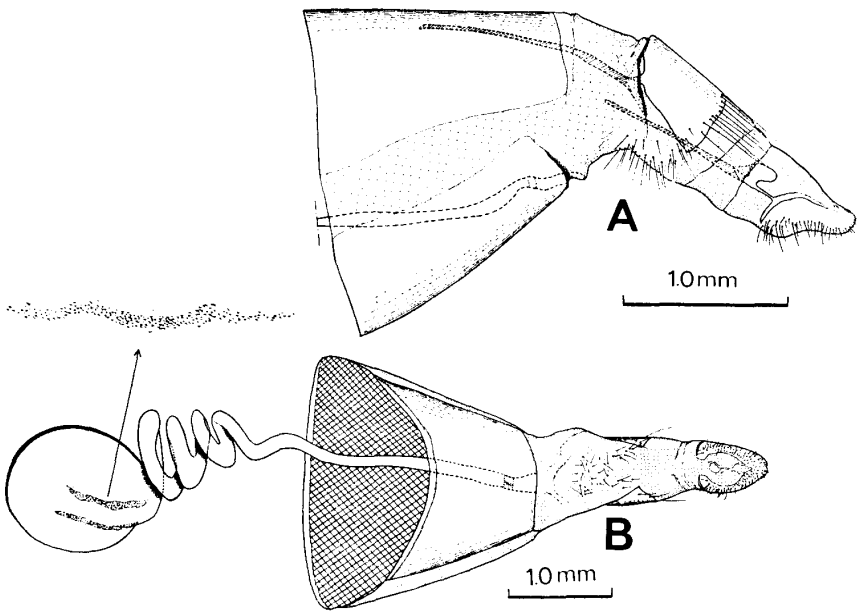

Fig. 63. *Parapoynx ussuriensis* (Rebel), female genitalia. A, lateral view; B, ventral view with corpus bursae.

Size of forewing: Male, 9.0 - 9.3 mm; female, 9.2 - 9.9 mm.

Mature larva (6th instar?): Head width 1.2 - 1.3 mm, body length 8.5 - 14.5 mm.

Chaetotaxy as in the other species of *Parapoynx*. The other characters are as follows: Head wider than long, thick, whitish pale brown with many dark maculations on cranium. Mandible rectangular, blackish, with 5 teeth. Thorax milky white, with prothoracic shield pale brown. Meso- and metathorax with branched tracheal gills. Abdomen almost as wide as thorax, concolorous with thorax but somewhat translucent, with 1st to 9th segments furnished with developed gills. Prolegs well developed, with crochets completely circle, triordinal, about 50 in number. Position and branching number of gills on each segment as follows:

Segment	T2			T3			A1		A2		A3		A4		A5		A6		A7		A8		A9
Region	A	M	P	A	M	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	P
D	3	5	3	4	5	4	5	5	5	5	5	5	5	5	5	5	5	4	—		—		—
SD	3	—	—	3	—	—	—		—		—		—		—		—		—		—		—
L	5		5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	4	4	3	2	1
SV		—			5			5		5		5		5		5		—		—		—	—

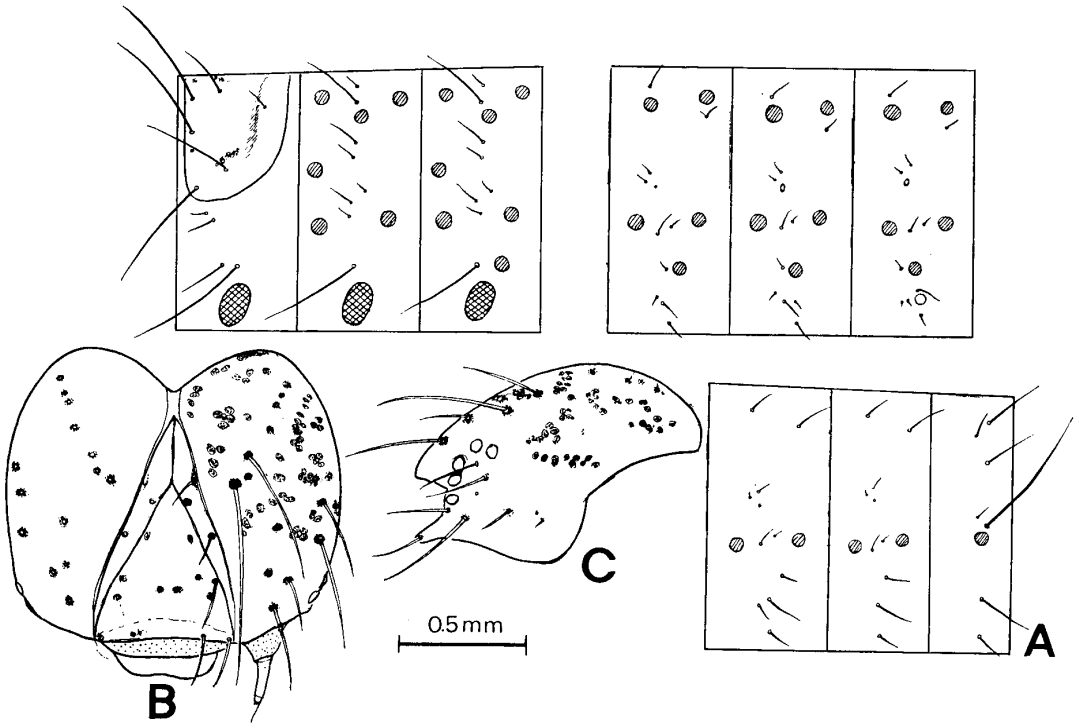

Fig. 64. *Parapoynx ussuriensis* (Rebel), larva. A, Chaetotaxy, B, head, frontal view; C, ditto, lateral view.

Pupa: Unknown.

Specimens examined: Hokkaido: 2 ♂ & 1 ♀, Tairaginuma Pond, near Tomakomai, 7-8. viii. 1980 (Y. Yoshiyasu) (KPU). Honshu: 3 ♂ & 2 ♀, 8. vi. 1963, 1 ♀, 22. vi. 1963, 2 ♂, 2 ♀, 6. ix. 1963, 1 ♀, 2 ♂, 15. ix. 1965, Kodo, Niigata-shi, Niigata Pref. (R. Sato) (KPU). Exotic specimen: — Korea, 1 ♀, Suigen, Keiki-do, 6.1 x. 1931 (C. Takeya) (KU).

Distribution: Japan (Hokkaido, Honshu), Ussuri, Korea.

Biological notes: The life history of this species is not fully known, although the larvae

are known as a pest of the rice plant. By my examination of this species in Tairagi-numa Pond, Hokkaido, the larvae feed on *Urtricularia japonica* Makino (Lentibulariaceae) and undetermined grasses of Gramineae at the pond-shore. The larval case is 27 mm in length, 4 mm in width in mean and made of some pieces (usually 3) of the host plants (Gramineae). The shape is almost as in those of *Parapoynx vittalis* and *P. stagnalis*, both are the rice insect pests. Dr. T. Ito collected one larva of this species from about 1 m depth in this pond (pers. commun.). Then this species seems to live in wide range from the pond-shore to deep place in the water. The overwintering is probably done in the larval stage. The species is bivoltine by the collected specimens of the adults in Japan, the first from June to July and the second early September.

Remarks: This species is rare and unique in *Parapoynx* species of Japan. It is signigicantly different from other *Parapoynx* species by having the long lonvoidal hindwing, the free process of costa in the male genitalia and the coiled corpus bursae in the female genitalia.

Genus *Parthenodes* Guenée

Parthenodes Guenée, 1854: 252; Hampson, 1896: 216; Hampson, 1897: 134; Inoue, 1982, I: 372, II: 243.

Gethosyne Warren, 1896: 221 (type-species: *G. aepuivocalis* Warren, 1896). Designated by Hampson (1896).

Stenicula Snellen, 1901: 284 (type-species: *S. flavicaput* Snellen, 1901). Designated by Shibuya (1928).

Type-species: *Parthenodes hydrocampalis* Guenée, 1854

External characters: Head moderate in size; frons prominent roundly; vertex not elevated. Labial palpus porrect or extending upwards, in both cases straight; basal 2 segments thickly scaled; the 3rd short, almost hidden by scales on 2nd segment. Maxillary palpus long, triangularly dilated at apex. Proboscis well developed, basally with scales Antenna in male rather thick, a little suppressed laterally; in famale ciliate. Ocellus small. Legs long, slender; male mid-tibia without any special tuft of scales; male hindleg with coxa furnished with a tuft of scales dilating ventrally; each inner spur almost 1.5 times as long as outer one.

Wing shape and venation: Wings moderate in width. Forewing with costa straight; apex rounded; termen evenly curved. Vein R_2 stalked or connated with R_{3+4}; R_{3+4} emitted from anterior angle of discoidal cell; R_5 with base separated from base of R_{3+4}; M_1 straight; M_2 to CuA_1 more or less approximated each other at bases; 3A weak or absent. Discocellulars erect.

Hindwing with costa almost straight; apex rounded; termen slightly sinuous to tornus. Vein $Sc+R_1$ anastomosed with Rs for short distance (almost 2/5 the length of $Sc+R_1$ beyond discoidal cell); M_1 straight; M_2 to CuA_1 as in forewing; CuA_2, 1A+2A and 3A complete.

Wing marking: Ground components ochreous to light brown. Forewing with basal 1/3 evenly fuscous, thence BL and SBL unclear in those margins. WA not formed. ML with anterior portion weak or absent, posterior portion distinct, oblique inwards. PML almost parallel with termen to vein CuA_1, and retracted to posterior angle of discoidal cell, then oblique outwards to posterior margin. WC represented by a characteristic white area. SML parallel with termen.

Hindwing with BL and SBL as in forewing, fuscous. Discocellular lunule connected with posterior protion of ML, then both form a distinct straight line. ML with anterior portion absent. PML running almost parallel with termen to near posterior margin. WB and WC continuous, and forming broad white area at middle of wing. Otherwise as in forewing.

Male genitalia: Slender and oblique in general shape. Tegumen rather short, flat, with anterior margin incised in U-shape, with mid-dorsal portion having distinct transverse ridge. T-v plate expanded laterally. Fenestrulae developed, separated into 2 lateral portions at uncal base. Vinculum a little longer than height of tegumen, continuous with tegumen by weak sclerotized plate. Saccus moderate in length, membranous anteromedially. Uncus long, about twice as long as height of tegumen, flat, with several lateral setae. Gnathos long and narrow, with apical portion extending downwards and having distinct spines on dorsal surface. Valva long, almost parallel-sided; costa rounded, not flat; inner surface with dense, short setae, with dorso-apical portion furnished with 2 long and curved setae which bases are rather protruded, and with apical margin having many scale-like setae curved inwards; sacculus moderate in width. Phallus rather short; bulbus ejaculatorius moderate in length; suprazonal sheath long; coecum penis long, extending downwards; vesica with a pair of sclerotized plates, each of them with some short spines. Juxta broad. In addition, 8th sternum weakly sclerotized in mid-ventral portion, with posterior margin W-shaped.

Female genitalia: Ostium bursae narrow. Ductus bursae long, membranous with minute spinules, some of them continuous at bases. Corpus bursae long and stout, membranous or weakly sclerotized, without a compact group of signa. Spermatheca without lagena or if present much small. Eighth tergum membranous or weakly sclerotized at postero-dorsal portion; posterior setae very short. Eighth sternum membranous, without setae except in *niger*. Papilla analis small and short, dorso-apical portion rather pointed, with setae on lateral to dorsal surfaces. In addition, 7th sternum slightly shorter than the tergum.

Remarks: The genus is allied to *Paracymoriza* Warren in the rather straight labial palpus, the wing marking with posterior portion of PML oblique outwards, the male genitalia with long and curved setae on valval apex and the female genitalia without lagena on spermatheca. *Parthenodes* differs from *Paracymoriza* as follows: Male genitalia with valva not so broad, with saccus smaller, and female genitalia more elongate in corpus bursae, apophyses and papilla analis.

Nymphula bifurcalis (Wileman) and *Nymphula nigra* Warren are newly combined with this genus. And a new species *Parthenodes fuscalis* is described from Japan. *Parthenods vagalis* Walker is transferred to *Paracymoriza* Warren. As a result, 4 species are included in this genus.

Key to the species of *Parthenodes* in Japan

1. Antenna short, 1/2 as long as forewing length; forewing narrow, without distinct line components, with vein R_2 connated with R_{3+4} at base; male genitalia with 3 plates in vesica of phallus; female genitalia with base of corpus bursae wide and sclerotized ..... *Parthenodes niger* (Warren) comb. nov.
— Antenna long, 2/3 as long as forewing length; forewing broad, with distinct line components, with vein R_2 anastomosed with R_{3+4} at base; male genitalia with base of corpus bursae narrow and membranous 2
2. Forewing with WB fuscous; hindwing with discocellulars emitted from vein M_1; male genitalia with apical specialized setae on valva longer than 1/2 the length of valva; female genitalia with lagena in spermatheca ..... *Parthenodes fuscalis* sp. nov.
— Forewing with WB white; hindwing with discocellulars emitted from far proximal portion of vein M_1; male genitalia with apical specialized setae on valva shorter than 1/2 the length of valva;

female genitalia without lagena 3

3. Forewing with WA suffused with fuscous; male genitalia with tegumen having X-shaped ridge dorsally ..... *Parthenodes prodigalis* (Leech)

— Forewing with WA clearly white; male genitalia with tegumen having a transverse ridge mid-dorsally ..... *Parthenodes bifurcalis* Wilemann

***Parthenodes bifurcalis* Wilemann**

Parthenodes bifucalis Wilemann, 1911: 373, pl. 31, fig. 23 (type-locality: "Iyo" (Ehime Pref., Shikoku, Japan)).

Nymphula bifurcalis Shibuya, 1929: 124, 125; Matsumura, 1931: 1043; Marumo, 1942: 10; Inoue, 1954: 156; Inoue, 1982, I: 371, II: 243, pl. 44, fig. 36.

Nymphula prodigalis: Speidel, 1984: 94 (part).

Nymphula yuennanensis: Speidel, 1984: 96 (part).

External characters: Head with frons pale fulvous, in female becoming fuscous medially. Vertex evenly fulvous. Labial palpus with basal 1/2 whitish, and apical 1/2 fuscous; apex of 3rd segment narrow, whitish. Maxillary palpus fuscous. Antenna almost 2/3 as long as forewing length in both sexes; scape and pedicel fuscous in dorsal surface; flagellum with dorsal surface scaled fulvous. Foreleg with tarsus especially long, almost as in those of mid- and hindlegs; anterodorsal surface of cosa, femur and tibia fuscous, especially apical 1/2 of tibia broadly suffused with fuscous; otherwise fulvous. Mid- and hindlegs evenly fulvous; spurs long, each inner spur about 1.5 times as long as outer one. Thorax above fulvous mixed with fuscous and whitish scales; thorax beneath whitish. Abdomen above fulvous except for fuscous apex of 7th segment, with posterior portion of each segment ringed with whitish; abdomen beneath whitish.

Wing shape and venation: Wings rather broad, with apex rounded; termen weakly curved to rounded tornus. Forewing with vein Sc reaching at costa beyond of discoidal cell; R_1 emitted from near anterior angle of discoidal cell, rather short; R_2 stalked with R_{3+4} at base, but its proximal extreme slightly separated; R_5 arising from just behind base of R_{3+4}; M_1 with base weakly curved; M_2, M_3 and CuA_1 equidistant from each other at bases; CuA_2 emitted from proximal 2/3 of posterior margin of discoidal cell; CuP absent; 3A running obliquely; discocellulars almost erect, with posterior portion weakly curved.

Hindwing with costa curved; apex rounded; termen weakly sinuous to rounded tornus. Vein $Sc+R_1$ stalked with Rs for its 1/2 length beyond discoidal cell, with distal portion curved along costa; M_1 straight; M_2 to CuA_2 as in forewing; CuP with base faintly present; discocellulars oblique.

Wing marking: Ground components usually ochreous and line components fuscous. Forewing with BL and SBL oblique inwardly. AMG also oblique. AML straight, oblique. Discocellular lunule distinct fulvous. PML almost prarllel with termen to vein CuA_1, and curved upwards to vein M_2, then touched with DB2 at there, and restarted from posterior angle of discoidal cell, then distally expanded at cell CuA_2 and ended at proximal 1/2 of posterior margin inwardly. WA, WB and WC clearly white. PMG ochreous to fuscous. SML narrow, parallel with termen. SMW continuous from vein R_{3+4} to cell CuA_2, and triangularly expanded proximally. SMG evenly pale orange. Cilia fuscous, with a darker line at proximal 1/3 along termen.

Hindwing with SML pale fuscous. AMG oblique inwardly, fuscous. DB2 being along discocellulars, and continued with ML. This complex component (=AML) representing by a oblique, straight fuscous line. WA, WB and WC broader than in forewing, oblong. PML parallel with termen. PMG almost same width to posterior margin, paler than in forewing. Otherwise almost as in forewing.

Male genitalia: Tegumen a little wider than long, with anterior margin excurved in U-shape and furnished with ridge along the margin; dorsal portion with a longitudinal ridge along mid-dorsal line. T-v plate distinct, well expanded laterally. Vinculum relatively narrow, 1.1 times as long as height of tegumen, with dorso-lateral portion wide. Saccus moderate in size, more or less rounded laterally, with apex projecting anteriorly. Uncus wide and flat, 1.9 times as long as height of tegumen, with setae laterally becoming shorter to apex; apical 2/3 slightly curved downwards, with apex narrowly rounded. Gnathos long, narrow in lateral view, with base not concealed by tegumen, with apical portion set with 4 pairs and 1 (at apical extreme) denticles dorsally. Valva long, almost parallel-sided; costa moderate in width, rounded; sacculus narrow; ampulla without any special setae; inner surface with dorso-apical portion with 2 considerably long setae which are about 1/2 as long as length of valva and extending anteriorly, with ventro-apical portion with long setae extending inwards. Phallus moderate in length; suprazonal sheath long, 0.24 as long as whole length of phallus; coecum penis acutely dilating downwards, 0.41 as long as whole length of phallus; vesica with 2 groups of cornuti of which each has some distinct spinules on a weakly sclerotized plate in addition to minute spinules around the plate. Juxta almost rectangular, both margins curved. In addition, 8th tergum weakly sclerotized posteriorly; 8th sternum also membranous ventro-medially, leaving a long U-shaped sclerite.

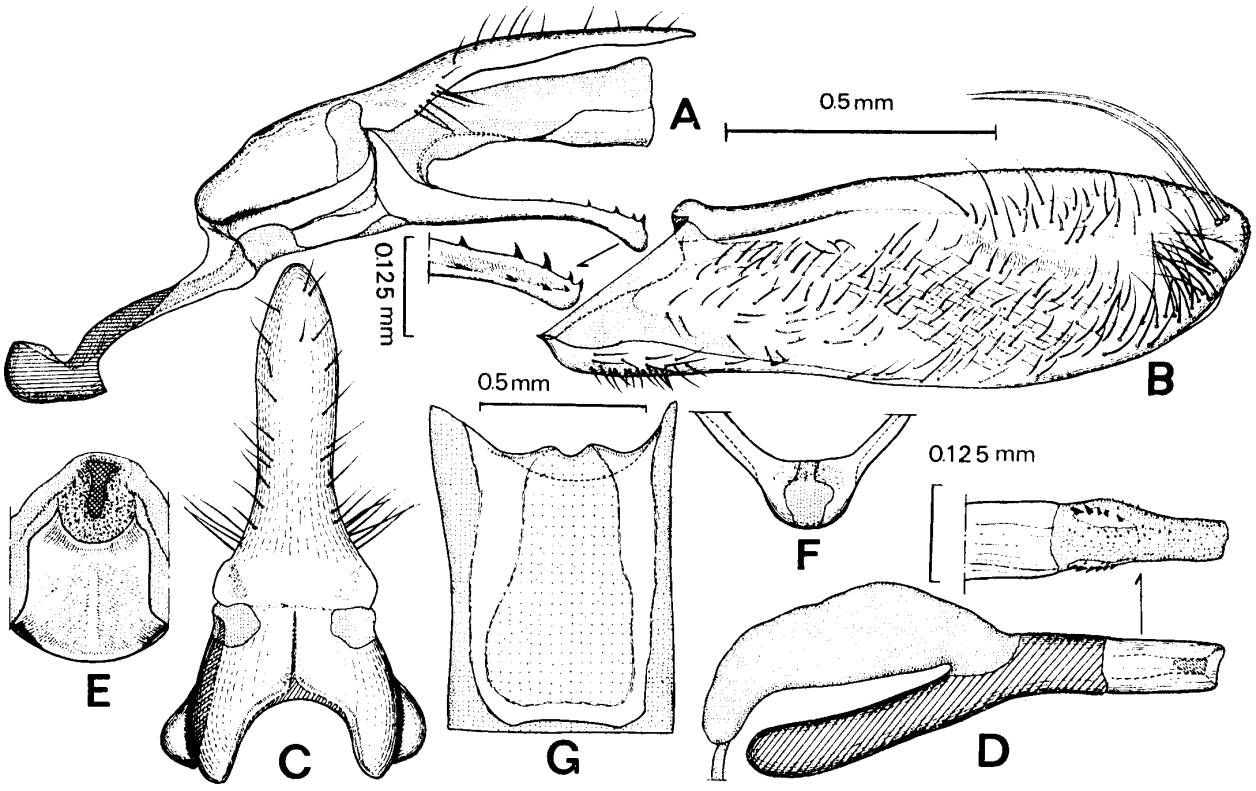

Fig. 65. *Parthenodes bifurcalis* (Pryer), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; E, juxta; F, saccus, antero-dorsal view; G, 8th sternum.

Female genitalia: Ostium bursae narrow, forming special chamber in the entrance. Ductus bursae long, medially with minute spinules and ended to completely circled bursal ring. Corpus bursae elliptic in shape, about 1.5 times as long as 7th tergum, evenly membranous without signa. Cervix bursae well developed, broad. Spermatheca without lagena. Eighth tergum 0.47 as long as 7th tergum, sclerotized in U-shape by presence of postero-medial membranous portion, with posterior 1/2 furnishing with setae sparsely; apophysis anterioris almost as long as 7th tergum, slender; 8th sternum membranous with short

setae as in the tergum. Papilla analis short and narrow, rather acute at apex, with several setae latero-posteriorly, some of them are long; ovipositor sac well developed to produce ventrally; apophysis posterioris 1.1 times as long as anterioris, with base narrow and indistinct at ventral portion.

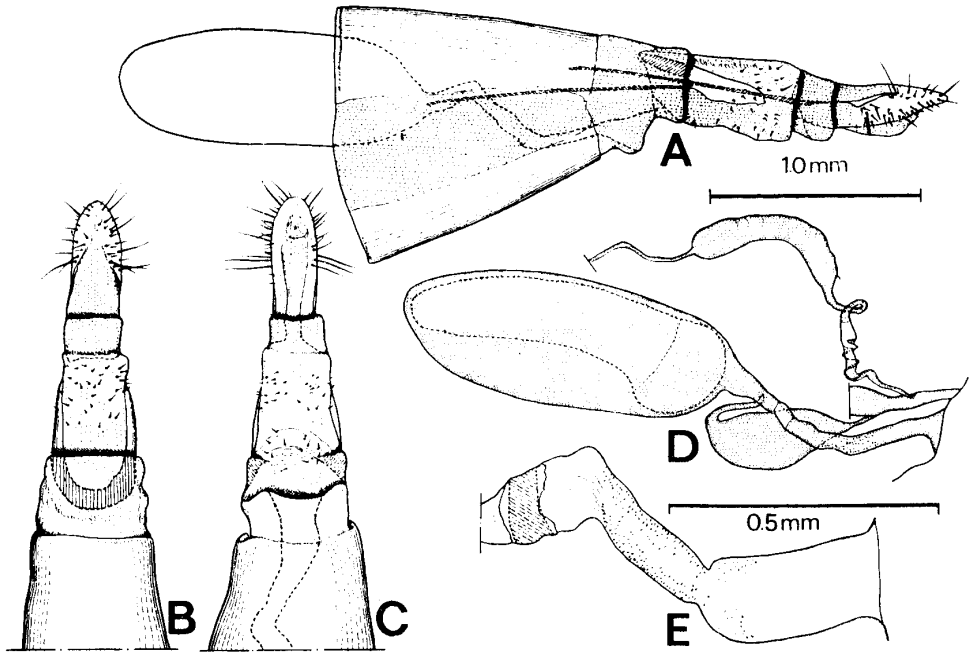

Fig. 66. *Parthenodes bifurcalis* (Wileman), female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, lateral view; E, base of ductus bursae, ventral view.

Size of forewing: Male, 6.8 - 7.8 mm (7.5 mm in mean, n=16); female, 7.7 - 9.4 mm (8.4 mm in mean, n=27).

Immature stages: Unknown.

Specimens examined: 16 ♀, 29 ♂ from Honshu (Niigata, Gumma, Kanagawa, Aichi, Gifu, Kanazawa, Shiga, Kyoto, Osaka, Wakayama Prefectures), Shikoku (Ehime Prefecture), Kyushu (Fukuoka, Oita, Kumamoto, Miyazaki Prefectures) and Amami-Oshima Is. (1 ♂, Hatsuno, 11-13. viii. 1977, 1 ♂, Mt. Yuwandake, 15-17 viii. 1977 (A. Seino) (KPU)).

Distribution: Japan (Honshu, Shikoku, Kyushu, Amami Iss.*), Korea.

Remarks: This species was originally described under the genus *Parthenodes* Guenée, 1854. But it has been included in the genus *Nymphula* since Hampson's work (1896), and in the recent study on Japanese moths by Inoue (1982) the species is treated as a species of *Nymphula*. The close examination of the species of Japan reveals that the species is better to include in *Parthenodes* by having the following characters: Labial palpus rather porrect, while in *Nymphula* evenly upturned; forewing with vein R_2 shortly connated with R_{3+4} at base, while in *Nymphula* they are completely fused at base; with apical specialized setae on valva; female genitalia with slenderer papilla analis and with 8th tergum sclerotized U-shapedly.

The species is usually collected in the mountainous area in Japan. The emergence of the adults is constricted to mid summer (14th July - 21st August by collecting data). From this data the species is seemed to be univoltine in Japan.

Parthenodes prodigalis **(Leech)**

Cataclysta prodigalis Leech, 1889: 70, pl. 4, fig. 16 (type-locality: Taiwan).

Parthenodes prodigalis: Hampson, 1897: 183; Caradja, 1927: 405; Shibuya, 1928: 153, pl. 4, fig. 32; Marumo, 1942: 19; Inoue, 1954: 157; Inoue, 1982 I: 372, II: 243, pl. 44, fig. 49.

Nymphula prodigalis: Speidel, 1984: 94.

External characters: Almost as in *bifurcalis*, but paler in color than in *bifurcalis*.

Wing shape and venation: Similar to *bifurcalis*, but differs from the latter as follows: Forewing with apex more produced; vein R_2 completely anastomosed with R_{3+4} at base. Hindwing with stalked point of veins $Sc+R_1$ and Rs more proximal; M_2 with base more separated from posterior angle of discoidal cell.

Wing marking: Almost as in *bifurcalis*, but separable from the latter as follows: Forewing with BL to AMG evenly fuscous. DB2 indistinct and WA not represent as white area. WC in cell 1A+2A suffused with fuscous. WB broadly suffused with dark ochreous, leaving narrow transverse white lines in cells. PG pale orange, weakly edged by fuscous scales on both margins. MG faintly present, fuscous. Cilia with proximal darker line blackish. Hindwing with SBL fuscous. PMG broader.

Male genitalia: Tegumen as long as wide, with dorsal portion furnished with inner ridge X in shape. Vinculum wide at dorso-lateral portion as in *bifurcalis*. and narrowing to ventral portion. Uncus long and wide, 2.2 times as long as height of tegumen, with apical 3/4 straight and furnished with lateral setae more numerous than the other species of *Parthenodes*. Gnathos 0.8 as long as uncus; apical portion extended ventrally; with base a little concealed by t-v plate. Valva with costa rather wide; apical

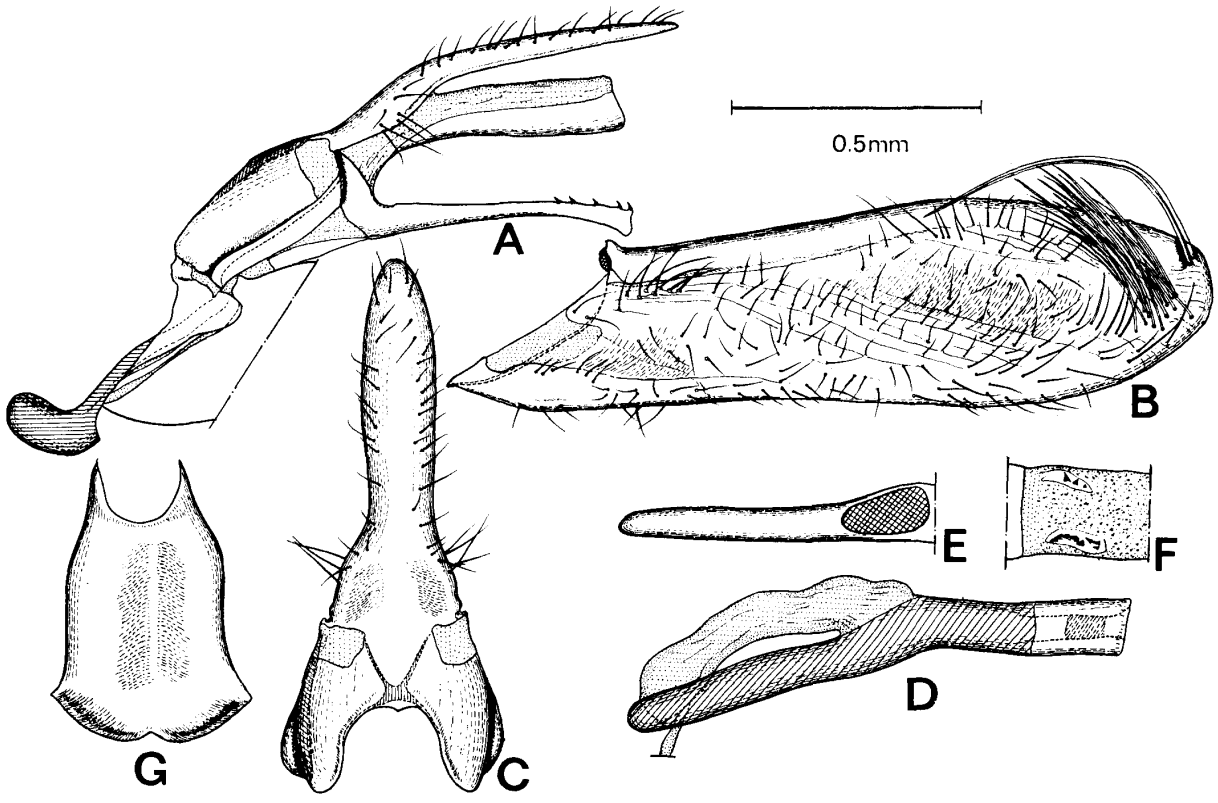

Fig. 67. *Parthenodes prodigalis* (Leech), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, coecum penis; F, ditto, cornuti; G, juxta.

special setae as in *bifurcalis*. Phallus with coecum penis slender, 0.4 as long as whole length of phallus; vesica with 2 groups of cornuti. Juxta broad and longer than in *bifurcalis*.

Female genitalia: Differs from *bifurcalis* as follows: Corpus bursae broader, 1.9 times as long as 7th tergum. Spermatheca with a very small lagena. Ductus seminalis with base narrower.

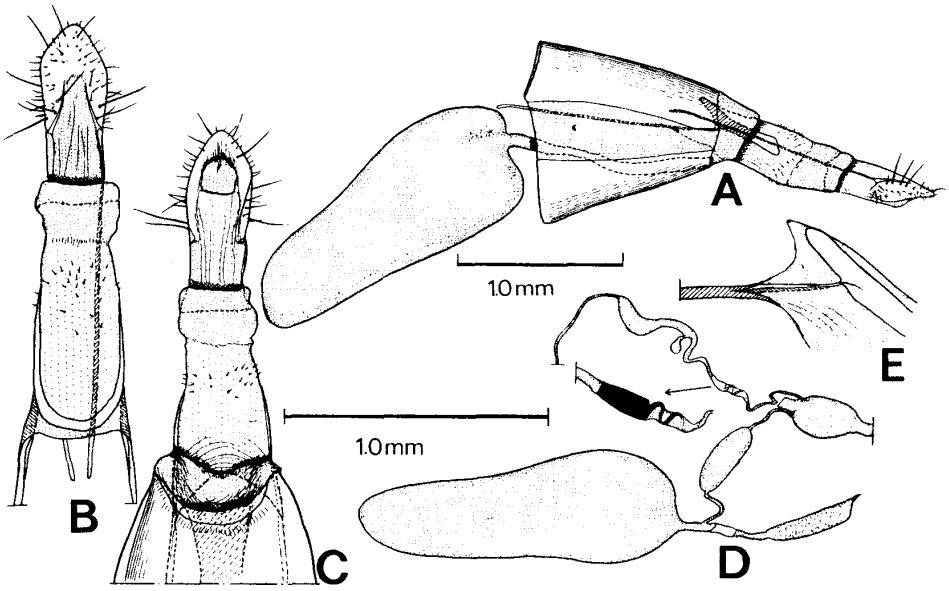

Fig. 68. *Parthenodes prodigalis* (Leech), female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, lateral view; E, base of apophysis anterioris, lateral view.

Size of forewing: Male, 7.5 - 9.5 mm; female, 8.4 - 10.3 mm.

Immature stages: Unknown.

Specimens examined: No Japanese specimens is available. 10♀, 16 ♂ from various places of Taiwan. (KU, KPU, IC).

Distribution: Japan (Honshu), China, Taiwan, Korea.

Remarks: This species was first recorded from Japan by Leech (1889) based on the specimens collected at "Tsuruga" (Fukui Prefecture). But I could not examine any specimens of this species collected since then and could not collected by myself. It will become clear the possibility after the examination of Japanese form of *prodigalis sensu* Leech. In this time the species *prodigalis* is tentatively included in the Japanese fauna.

In addition, Inoue (1982) recognized the specimens from Tokunoshima Is. and Amami-Oshima Is (Amami Iss.) as *prodigalis sensu* Leech. The examination of these specimens revealed that they were conspecific with *Parthenodes fuscalis* sp. nov. which will be described after. Then Amami Iss. were excluded from the distribution of this species.

As mentioned above, the species is closely allied to *P. bifurcalis*, but differs from the latter in the wing marking with WB suffused with dark ochreous, in the male genitalia with X-shaped ridge on dorsal portion of tegumen, and the female genitalia with broader corpus bursae and with a small lagena.

***Parthenodes fuscalis* sp. nov.**

External characters: Resembles *bifurcalis* and *prodigalis*, but differs from them as follows: Antenna with

dorsal surface darker. Thorax above fuscous, tinged with fulvous. Abdomen above with anterior segments fuscous mixed with fulvous scales except for whitish ring on posterior portion of each segment.

Wing shape and venation: Forewing with termen slightly sinuous to tornus. Vein R_1 ended at proximal 3/5 of costa; R_2 completely anastomosed with R_{3+4} at base; M_2, M_3 and CuA_1 with bases more approximated each other than in *bifurcalis*; 3A absent; discocellulars erect.

Hindwing with vein $Sc+R_1$ anastomosed with Rs for its 2/5 length beyond discoidal cell; CuP distinct at base; discocellulars started at proximal portion of vein M_1.

Wing marking: Almost as in *bifurcalis* and *prodigalis*, but separable from the latters as follows: Ground components darker. Forewing with BL and AMG continuous, evenly dark ochreous. WA, WB and WC changing to fuscous area but WC represented by a small white spot.

Hindwing with SBL weakly present, fuscous. DB1 a little larger and somewhat separated from AML. PML shifted more proximaly, then WA, WB and WC narrower.

Male genitalia: Tegumen rather wide, 1.2 times as long as its length, with dorsal ridge X-shaped as in *prodigalis*. Vinculum as in the other *Parthenodes* species. Uncus comparatively short, about 1.8 times as long as height of tegumen, straight, with base wide and expanded laterally; lateral setae more sparse and longer than in the other *Parthenodes*. Gnathos short, with base not concealed by t-v plate. Valva comparatively short; apical special setae on inner surface shorter than 1/2 the length of valva. Phallus as in the other species of *Parthenodes*; coecum penis 0.35 as long as whole length of phallus.

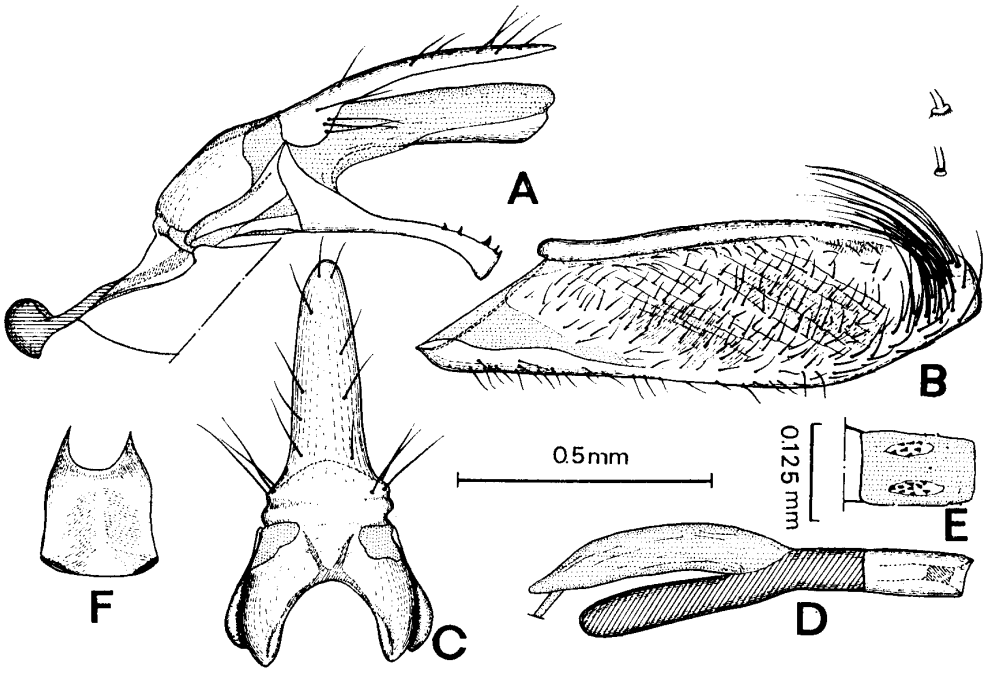

Fig. 69. *Parthenodes fuscalis* sp. nov., male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, cornuti; F, juxta.

Female genitalia: Ductus bursae longer than in *bifurcalis*. Corpus bursae membranous, without any spinules. Base of ductus seminalis rather broad. Spermatheca with a small pouch of lagena. Eighth tergum sclerotized in U-shape, with posterior portion furnished with short setae; 8th sternum evenly membranous, without setae. Papilla analis as in *bifurcalis* and *prodigalis*.

Size of forewing: Male, 5.9 - 6.2 mm; female, 6.3 - 7.3 mm (6.9 mm in mean, n=4).

Immature stages: Unknown.

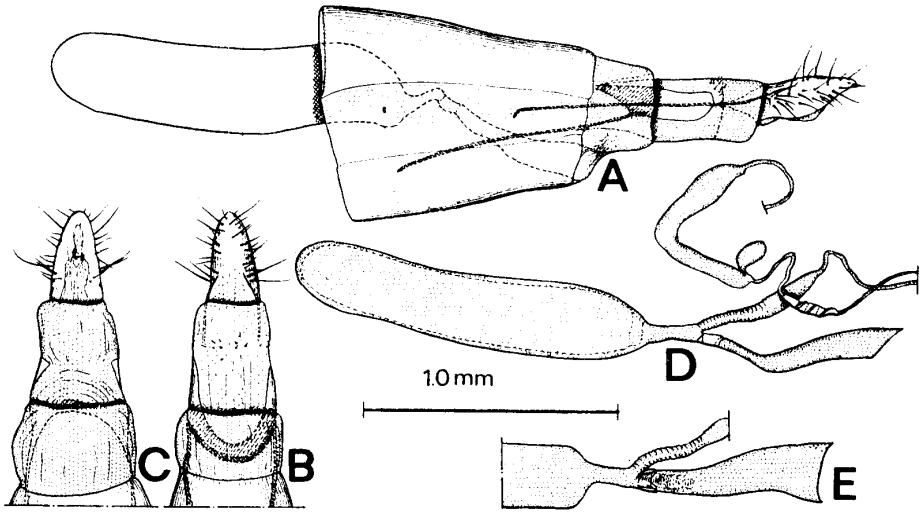

Fig. 70. *Parthenodes fuscalis* sp. nov., female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, lateral view; E, base of corpus bursae, dorsal view.

Holotype: Female, Mt. Yuwan-dake, Amami-Oshima Is., 15. viii. 1977 (K. Nakano et A. Seino) (KU). Allotype: male, same data as holotype. Paratypes: 1 ♀, 4 ♀, same data as holotype (KPU); 1 ♀, Shinmura, Amami-Oshima Is., 19. v. 1977 (Y. Yoshiyasu) (KPU); 1 ♂, Mikyo, Tokunoshima Is., Amami Iss., 24-25. viii. 1963 (H. Inoue) (IC).

Distribution: Japan (Amami Iss.).

Remarks: The present new species is easily distinguished from the allied 2 species, *bifurcalis* and *prodigalis*, by having the darker wing marking in appearance, the hindwing venation with discocellulars started from base of vein M_1, the male genitalia with shorter apical setae on the valva and the female genitalia with rather distinct lagena on spermatheca.

***Parthenodes niger* (Warren) comb. nov.**

Nymphula nigra Warren, 1896: 220 (type-locality: Khasias, India); Hampson, 1897: 140; Shibuya, 1928: 142; Inoue, 1974: 137; Inoue, 1982, I: 371, II: 243, pl. 44, fig. 37.

External characters: Head with frons evenly fuscous; vertex a little elevated, fuscous. Labial palpus slender; basal 2 segments slightly ascending, fuscous; 3rd segment narrow and dilating anteriorly, fuscous. Maxillary palpus evenly fuscous. Proboscis with base fuscous. Antenna short, about 1/2 as long as forewing length in both sexes, dorsally with fuscous scales. Ocellus apart from eye. Foreleg with anterior surface of coxa to 4th tarsomere fuscous, otherwise fulvous. Mid- and hindlegs almost fulvous; each inner spurs about 4 times as long as short outer one.

Wing shape and venation: Wings narrow, resembles phycitine species together with wing marking. Forewing with costa stright; apex broadly rounded; termen weakly curved to tornus. Vein Sc reached at 1/2 of costa, almost end of discoidal cell; R_2 incompletely anastomosed with R_{3+4} at base; bases of R- and M_1 curved; M_2 to 3A as in the other species of *Parthenodes*; discocellulars erect.

Hindwing with costa weakly curved; apex rather produced; termen behind apex slightly excurved. Vein $Sc+R_1$ rather shortly anastomosed with Rs than in the other species of *Parthenodes*; CuP complete; discocellulars strongly curved.

Wing marking: Forewing with line and ground components blackish and those margins unclear.

Next white areas, although being obscure, indicated. AMW emitted from proximal 2/5 of costa and oblique inwards to posterior margin. PMW arising from proximal 4/5 of costa, and retracting proximally to vein R, then broadly outwards to vein CuA_1 as in the other species of *Parthenodes*, diminishing there, and restarted from near posterior angle of discoidal cell, extending downwards to vein 1A+2A, angled there and ending to 1/2 of posterior margin. SMW representing by 1 or some white scales row, parallel with termen.

Hindwing evenly pale fuscous without any line component except darker line along termen (=ML?). Cilia almost concolorous with ground components.

Male genitalia: Tegumen wider than long, with anterior margin excurved in U shape; dorsal portion with a pair of ridges. Fenestrulae broad. Vinculum longer than the other species of *Parthenodes*. Saccus wide and large, rounded in lateral view, with anterior portion membranous. Uncus long, about 2.2 times as long as height of tegumen, curved downwards in lateral view; apical 3/4 slender and narrowest in *Parthenodes* species. Gnathos long, with base slightly concealed by t-v plate, narrowing to apex which has 4 pairs and 1 of dorsal denticles as in the other species of *Parthenodes* but slightly

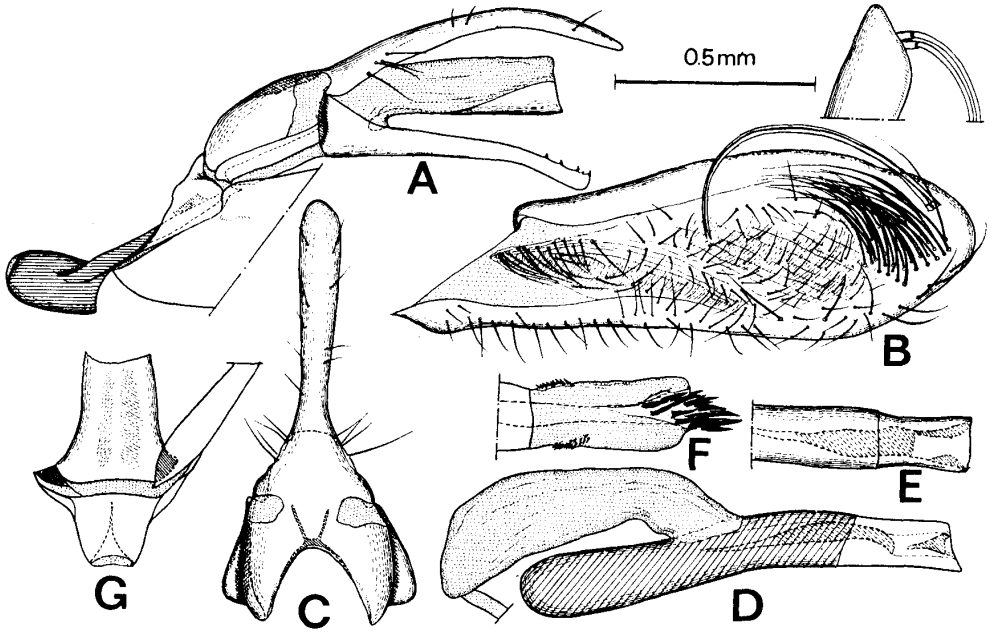

Fig. 71. *Parthenodes niger* (Warren), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, apical portion: F, ditto, cornuti: G, juxta.

smaller. Valva long, a little swollen at middle; costa with base narrow; sacculus moderate in width, with several setae; inner surface with apical portion furnished with long, curved setae and 2 specialized setae which are longer than 1/2 the length of valva; apical margin rounded. Phallus long, stout; coecum penis 0.34 as long as whole length of phallus; vesica with cornuti which are consisted of several spinules on 3 separated plates. Juxta trapezoidal in shape, longer than in the other species of *Parthenodes*.

Female genitalia: Ostium bursae narrow, membranous. Corpus bursae with base wide and sclerotized; apical portion membranous, stout, elliptic in shape, with minute spinules throughout on its portion. Ductus seminalis with base apart from bursal ring, and swollen at middle. Spermatheca without lagena. Eighth tergum 0.48 as long as 7th tergum, with posterior portion broadly membranous and with several short setae on it; apophysis anterioris 0.72 as long as 7th tergum, without basal expansion; 8th sternum membranous with short setae. Apophysis posterioris 1.2 times as long as anterioris.

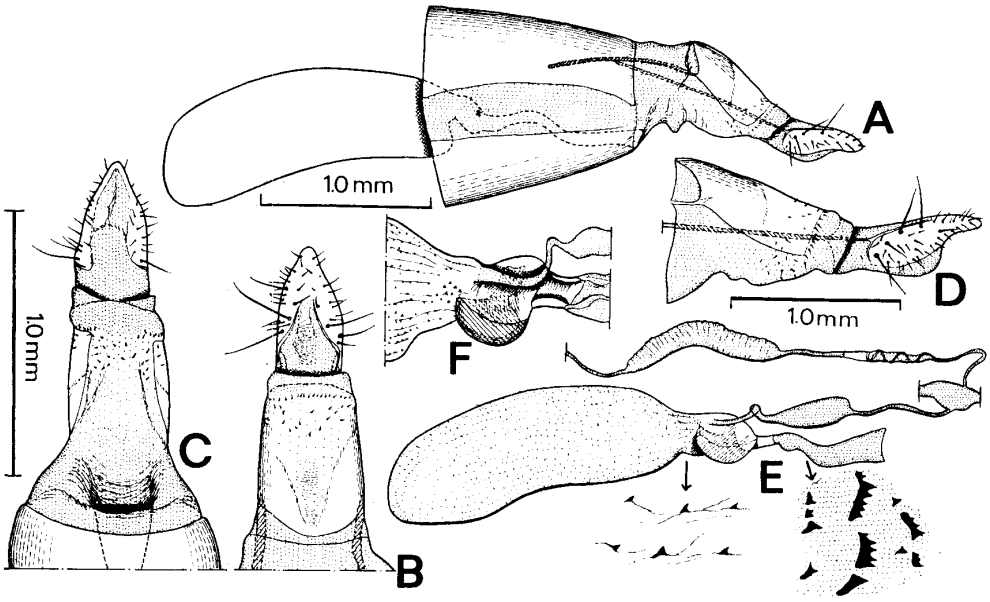

Fig. 72. *Prathenodes niger* (Warren), female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, ditto, lateral view; E, bursa and spermatheca, dorsal view; F, base of corpus bursae, dorsal view.

Size of forewing: Male, 6.8 - 8.5 mm; female, 7.5 - 9.1 mm.

Specimens examined: 23 ♀, 26 ♀, from Honshu (Kyoto Pref.), Kyushu (Fukuoka Pref.: 1 ♂, Shiibaru, Fukuoka-shi 21. vii. 1975 (Y. Yoshiyasu) (KPU). Kumamoto Pref.: 3 ♀, 1 ♂, Itsuki, 4. viii. 1975 (T. Saigusa); 10 ♀, 12 ♂, Naidaijin, 30. vii.—1. viii. 1976 (Y. Yoshiyasu); 5 ♀, 6 ♀, Naidaijin, 18. viii. 1976 (Y. Yoshiyasu) (KPU). Kagoshima Pref.: 1 ♀, Neshime, 12. x. 1971 (Y. Yoshiyasu)2 ♀, Neshime, 12. x. 1971 (K. Ueda & M. Takagi) (KPU) Yakushima Is.

Immature stages: Unknown.

Distribution: Japan (Honshu, Kyushu*, Yakushima Is., the Ryukyus), India, Taiwan.

Biological notes: The immature stages is unknown. The adults are collected in the mountanous area near the streams in Kyushu. They rest under surfaces of rocks or bridges, raising the anterior portion of the body by extending the long forelegs.

Remarks: This species has long been included in *Nymphula* Shrank. Having examined the specimens of *Nymphula nigra*, I have come to the conclusion that this species is belonging to the genus *Parthenodes* by the following characters: Vein R_2 a little separated from R_{3+4} at proximal extreme; male genitalia with valva furnished with 2 specialized setae at dorso-apical portion of inner surface, and with vesica of phallus set with cornuti on separated plates on which several spinules are emitting; female genitalia with 8th tergum membranous posteriorly and U in shape, with papilla analis very slender and so on. On the other hand, the wing marking are much different from the other species of *Parthenodes* in appearance. The wing marking of this species is characterized by the enlargement of the ground components from the moderate width in the other *Parthenodes*. However, the shape of PMW of the forewing resembles the other species of *Parthenodes*.

Genus *Paracymoriza* Warren

Paracymoriza Warren, 1890: 479; Speidel, 1984: 41.

Type-species: *Oligostigma vagalis* Walker, [1866].

External characters: Head with frons rounded, not so protruded as in *Parthenodes*. Vertex flat. Labial palpus almost as in *Parthenodes*, but the 3rd segment smaller and more thickly covered with scales. Maxillary palpus upturned, with apical segment widely extending by scales. Proboscis long with basal scaling. Antenna as in *Parthenodes*. Ocellus distinct, with blackish ring. Legs long. Midleg with tibia thick, in male with a tuft of hair-like scales (= hair pencil), in female with series of short scales along dorsal and ventral surface (it is uncertain to use them for swimming or not). Hindleg long, in male coxa with a tuft of scales dilating posteriorly, in female slender; medial inner spurs long, almost twice as long as preapical ones.

Wing shape and venation: Wings moderate in width. Forewing with costa almost straight in both sexes; apex a little angulate; termen weakly sinouous. Vein Sc reaching at costa a little beyond discoidal cell; R_1 arising from near anterior angle of discoidal cell; R_2 incompletely anastomosed with R_{3+4}; M_2 and M_3 approximated to one another at bases; otherwide as in *Parthenodes*.

Hindwing with apex more angulate than in *Parthenodes*; termen sinuous to tornus. Vein $Sc+R_1$ rather shortly anastomosed with Rs (shorter than 1/2 of its length beyond discoidal cell); M_2 to CuA_2 as in forewing; CuP distinct; discocellulars emitted from starting point of M_1 and erect.

Wing marking: Allied to *Parthenodes*, but different from it by the following points. Ground components ochreous or pale orange to fuscous. Forewing with AML shifted more proximad; PML strongly angulated at veins R_{3+4} and 1A+2A. Hindwing with AML narrower and more proximally shifted; PML also narrower and angulated at vein CuA_1; SML more distally situated.

Male genitalia: Tegumen wider than long, flattened, not fused with uncus posteriorly. Fenestrulae developed, separated into 3 portions, lateral 2 and dorsal 1. T-v plate laterally expanded. Vinculum long, continuous with tegumen by weak plate. Saccus large, evenly sclerotized. Uncus long and large, with several setae latero-basally, and many scale-like setae dorso-apically. Gnathos rather narrow; base partly concealed by t-v plate; apical portion suppressed laterally and with a series of spines dorsally. Valva long and broad; costa articulated with vinculum; apical portion with some long, specialized setae. Phallus long; bulbus ejaculatorius moderate in length; coecum penis well developed, extending downwards; vesica with distinct cornuti. Juxta almost as long as width, hexagonal in shape. In addition, 8th sternum membranous medially, with posterior margin with a pair of processes.

Female genitalia: Ostium bursae not wide, evenly membranous. Ductus bursae short, narrow, membranous, with minute spinules throughout it. Bursal ring developed moderately. Corpus bursae long and large; base weakly sclerotized; apical portion broad, evenly membranous, without signa. Spermatheca with lagena. Ductus seminalis with base narrow. Eighth tergum short, evenly sclerotized, triangular in lateral view; posterior portion with short setae sparsely. Eighth sternum membranous, also with scattered short setae. Papilla analis short and wide, not elongate dorsally, with setae on dorsal and posterior portions. Apophyses moderate in length.

Remarks: Hampson (1896) treated *Paracymoriza* Warren, 1890, as a section (=subgenus) of *Parthenodes* and some other species allied to *vagalis* are included in this section. He divided *Paracymoriza* species from *Parthenodes s. str.* by having the next characters; Midtibia of male dilated, with a fold containing a fringe of hairs (=hair pencil in my sense); with hair tufts from base of hindcoxa; wings with outer margin (= termen) somewhat excurved at middle. But adding to these, some important differences are found between *Paracymoriza s. str.* and *Parthenodes s. str.* in this time, *i. e.*, in *Paracymoriza*, wing marking with PML of both wings more angulate; male genitalia with tegumen not fused with uncus postero-dorsally, fenestrulae separated into 3 portions, apical spines of valva specialized at apex,

phallus with well-developed cornuti; female genitalia broad, with 8th tergum evenly sclerotized, and with papilla analis wide. By these reasons, I admitted *Paracymoriza* as a distinct genus from *Parthenodes*.

Rose and Rajni (1977) offered the revalidation of the genus *Paracymoriza* and transferred it to the subfamly Endotrichinae because of having the chaetosemata in the head and the stalked condition of veins R_5 and R_{3+4} in the forewing. These are characteristic features of Endotrichinae by them. I can not agree with their treatment. Because the presence of chaetosemata is not only shared with Endotrichinae, but also with Nymphulinae. In addition, the character is usually seen in the other pyralid subfamilies. And vein R_5 of forewing in Japanese specimens and Hampson's description (1896) based on Indian specimens of *Paracymoriza vagalis* is free from vein R_{3+4}. Or even if the vein R_2 stalking with R_{3+4} is admitted in the form of North West India, the venation possibly vary in individual and specific level, then not stable in the subfamilial level. As mentioned above, I treat *Paracymoriza* as a distinct genus in the Nymphulinae.

Speidel (1984) treated *Paracymoriza* as a distinct genus, and moreover, he transferred some species belonging to *Parthenodes* to *Paracymoriza*.

Paracymoriza vagalis **(Walker)**

Oligostigma vagalis Walker, 1865: 1530 (type-locality: India).

Parthenodes vagalis: Hampon, 1896: 219, fig. 124; Inoue, 1974: 138, pl. 3, fig. 40; Yoshiyasu, 1979: 14; Inoue, 1982, I: 372, II: 243, pl. 44, fig. 50.

Paracymoriza vagalis: Warren, 1890: 479; Speidel, 1984: 45.

External characters: Head with frons whitish, with fuscous scales medially. Vertex fulvous, with fuscous scales transversely. Labial palpus long, ventrally whitish, and dorsally fuscous; the 3rd segment short, completely concealed by fuscous scales. Maxillary palpus fuscous; apex widely extending by fuscous scales. Antenna rather long, about 2/3 as long as forewing length; scape and pedicel fuscous on dorsal surface; in male dorsally with fulvous scales; in female dorsally with fulvous and brown scales, alternately.

Legs whitish. Male:— Foreleg with anterior surface of coxa fulvous; anterior surface of femur fuscous; tibia dark fuscous, especially with distal 1/2 darker. Midleg with coxa with a group of fulvous scales on anterior surface of distal portion; femur with a group of long, fulvous, hair-like scales (hair pencil) from proximal portion; tibial spurs much short, with inner one 1.7 times as long outer one. Hindleg with coxa furnished with thick and fulvous scales on anterior surface, and with longer fuscous scales on distal portion; femur with short, thick scales along ventral surface; mid inner spur long, about twice as long as outer one; distal spur as in midleg. Female:— Foreleg evenly whitish; midleg with femur lacking a hair-like scales tuft, with short series of fulvous scales on dorsal and ventral surfaces, hindleg as in male, but coxa without a tuft of scales on posterior surface of distal portion.

Thorax above fuscous mixed with fulvous; beneath whitish. Abdomen above fuscous, with posterior portion of each segment paler; beneath whitish.

Wing shape and venation: Wing shape as described for the genus. Forewing with vein Sc reaching at proximal 3/5 of costa; R_2 incompletely anastomosed with R_{3+4} for its 2/5 length beyond discoidal cell; M_1 emitted from just behind base of R_{3+4}, with base weakly curved; M_2 and M_3 with bases curved and approximated to one another; CuA_2 arising from proximal 3/4 of posteior margin of discoidal cell; 3A distinct.

Hindwing with $Sc+R_1$ anastomosed with Rs shortly, about 2/5 of its length beyond discoidal cell; M_1 almost straight; M_2 to CuA_2 as in forewing; CuP distinct.

Wing marking: Ground components olive brown to fuscous. Forewing with BL fuscous. SBL brown to fuscous. AMG broad, brown at anterior portion, darker posteriorly. ML starting from proximal 2/5 of costa and continuing to DB1 in discoidal cell, then forming a narrow, fuscous line (= AML) parallel with termen. WA and WC continuous, represented as a wide straight white area. ML with distal to discocellulars small, blackish. PML narrow, blackish, emitting from 5/7 of costa and acutely extending to posterior portion of vein R_{3+4}, and retracted and curved to vein CuA_1, then proximally curved to near posterior angle of discoidal cell and diminished there, and restarting from posterior margin of discoidal cell and oblique outwardly to proximal 2/3 of vein 1A+2A, then retracting along the vein to 1/2 of the vein, ended straight to posterior margin. WB dark ochreous at anterior portion and blackish at posterior portion. PMG dark ochreous, somewhat darker edged on both margins. SML narrow, extending promimally along cells M_1 and M_2. SMG as in PMG in color. MCL absent. Cilia fulvous, with proximal 1/3 fuscous, especially darker at distal portion of each vein and distal portion of wing apex.

Hindwing with SBL faintly fuscous at posterior portion of discoidal cell. AMG wide, narrowed at vein CuP, fuscous. AML narrow, almost straight, fuscous. ML in distal portion of discocellulars faintly marked, in some specimens completely absent. PML emitted from stalking point of $Sc+R_1$ and Rs, weakly curved to vein CuA_1, then retracted proximally and straight to near tornus. PMG wide at anterior portion, and narrowing posteriorly, dark ochreous but darker in proximal side. SML continuous, but narrowed at vein M_3. Cilia almost as in forewing except evenly fuscous at proximal 1/3 along termen.

Male genitalia: Tegumen wider than long, flattened and short, with anterior margin excised in

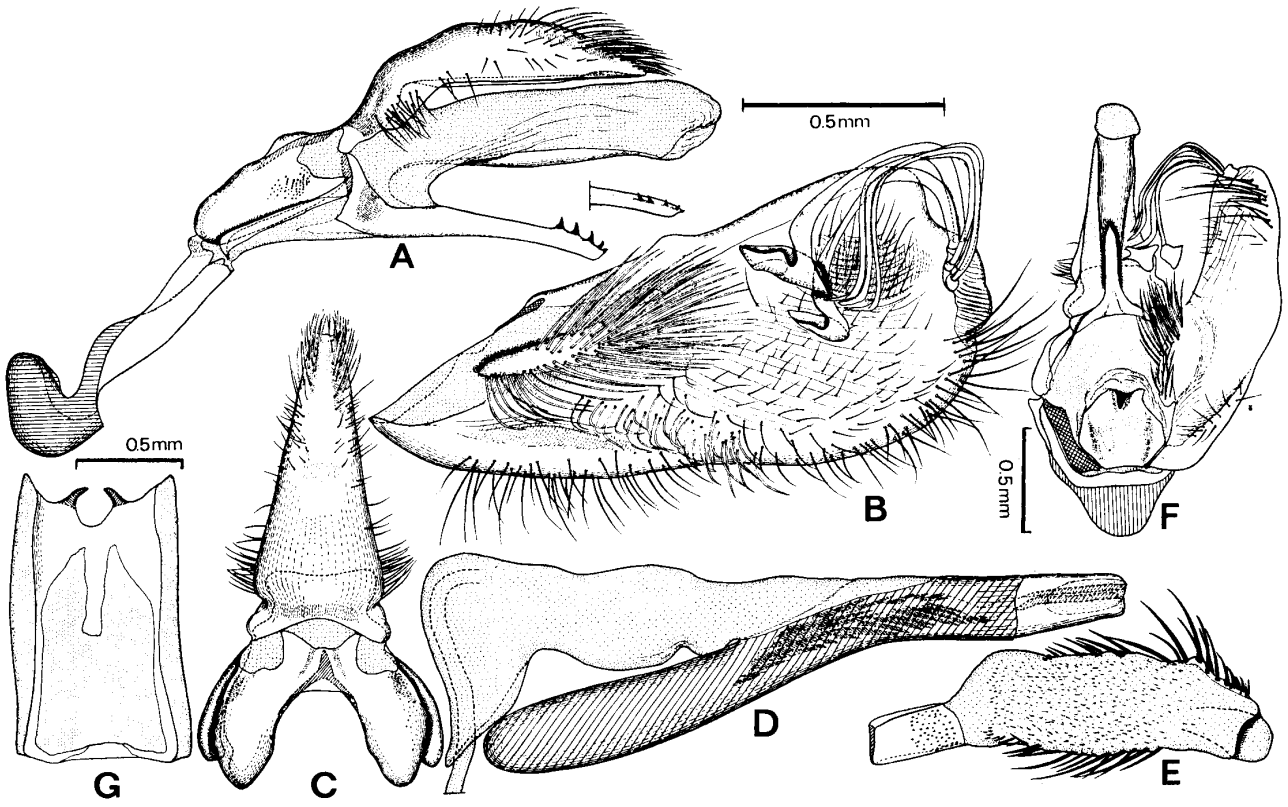

Fig. 73. *Paracymoriza vagalis* (Walker), male genitalia. A, Lateral view; B, valva, inner view; tegumen and uncus, dorsal view; D, phallus; E, ditto, cornuti; F, postero-ventral view, left valva removed; G, 8th sternum.

U-shaped and with Y-shaped ridged dorsally. Fenestrulae moderate in width. Vinculum long and stout, about 1.2 times as long as height of tegumen. Saccus large, extending upwards. Uncus long and large, about 1.7 times as long as height of tegumen; base wide and with several setae; medial portion elevated roundly in dorsal portion; apical portion with many scale-like setae dorsally. Gnathos a little shorter than uncus, with apical 2/3 rather suppressed laterally; apical portion with 5 distinct spines dorsally. Valva broad, widened apically; base of costa narrow, but protruded at proximal 1/3 triangularly; cuculus with a large expansion which has many long, scale-like setae; apical portion with 5 specialized setae on protruded base, of which dorsal 2 setae broadened at apex; inner surface with scale-like setae ventrally and with short setae dorsally; sacculus rather narrow, reaching at 1/2 of valva, with long setae posteriorly. Phallus long; coecum penis extending slightly downwards, 0.42 as long as whole length of phallus; vesica with 2 groups of cornuti which are consisted of about 20 long spines.

Female genitalia: Corpus bursae large, about 1.5 times as long as 7th tergum, with basal 1/3 sclerotized with many short processes around base, and with apical 2/3 stout, almost elliptical in shape. Eighth tergum 0.32 as long as 7th tergum, with posterior portion furnished with sparse, short setae, which are not arranged in a straight line; appophysis anterioris with base a little widened, 0.67 as long as 7th tergum. Papilla analis with posterior setae long at ventral portion; apophysis posterioris almost as anterioris.

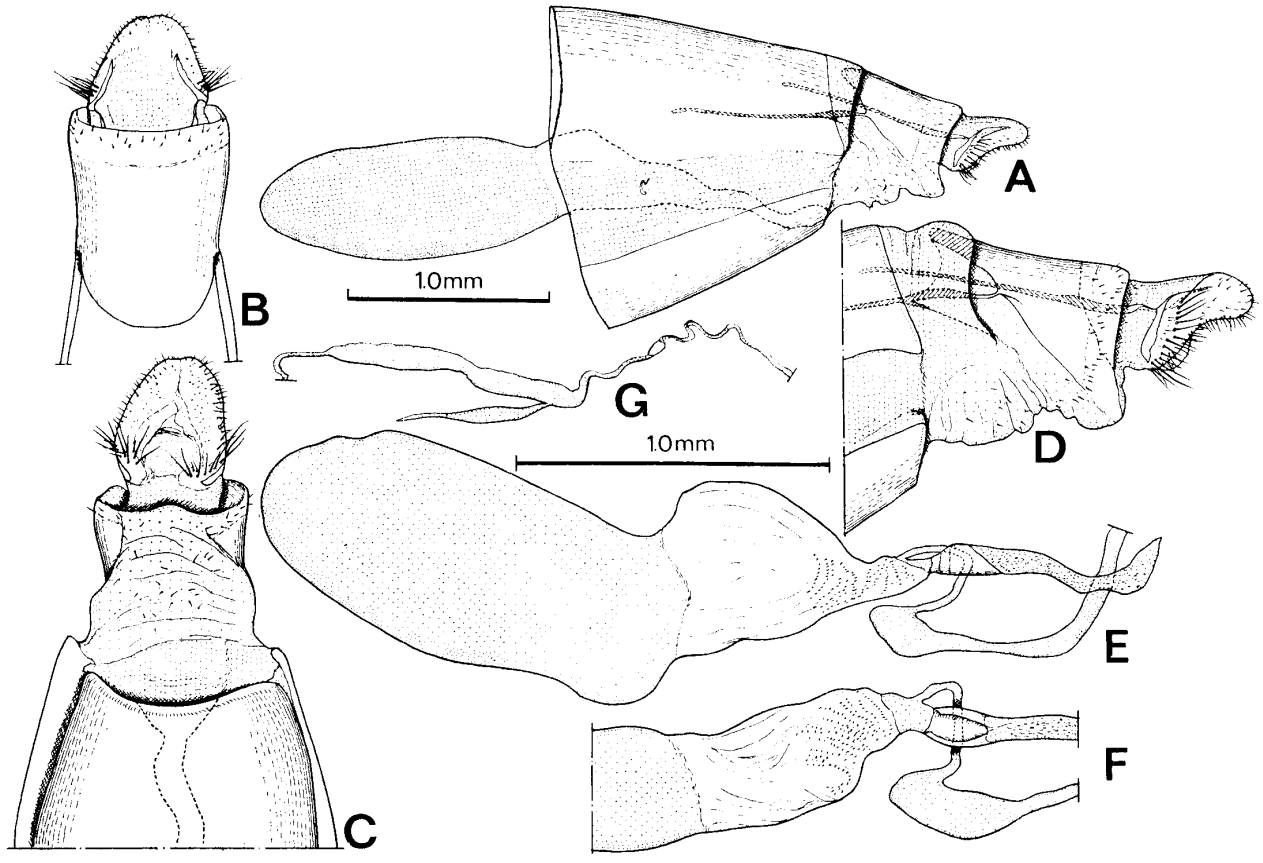

Fig. 74. *Paracymoriza vagalis* (Walker), female genitalia, A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, ditto, lateral view; E, bursa, lateral view; F, base of corpus bursae, dorsal view; G, spermatheca.

Size of forewing: Male, 9.2 - 10.5 mm; female, 10.4 - 12.6 mm.

Mature larva: Head width 2.1 mm, Body length. 25 - 32 mm.

Head: Almost as long as wide, pale brown with many dark pigmentations. Setae curved and short.

Setae AF short; F1 short; P1 almost twice as long as P2; A2 minute, just lateral to long A1; L1 short. Labrum dark, with seta M2 flat, broadened at apex. Mandible rectangular, with 5 teeth.

Thorax: Dark greenish white. Prothorax with prothoracic shield pale; seta D1 shifted posteriorly; D2 ventral to D1. Meso- and metathorax with 5 and 6 groups of tracheal gills which are emitted independently and 5 - 30 in number; chaetotaxy almost as in *Nymphula* species.

Abdomen: Concolorous with thorax. Prolegs well developed, with crochets arranged in circular, biordinal, and about 60 in number. Number of gill groups 7 (1st to 6th segments), 6 (7th), 4 (8th) and 2 (9th), respectively. Setae short except long D2 and L1 on 9th segment. Number of SV setae 1 (1st, 8th and 9th segments), 2 (2nd and 7th) and 3 (3rd to 6th), respectively. Tenth segment with setae D and SD very long, almost equal in length; proleg with crochets semicircular, biordinal, about 50 in number.

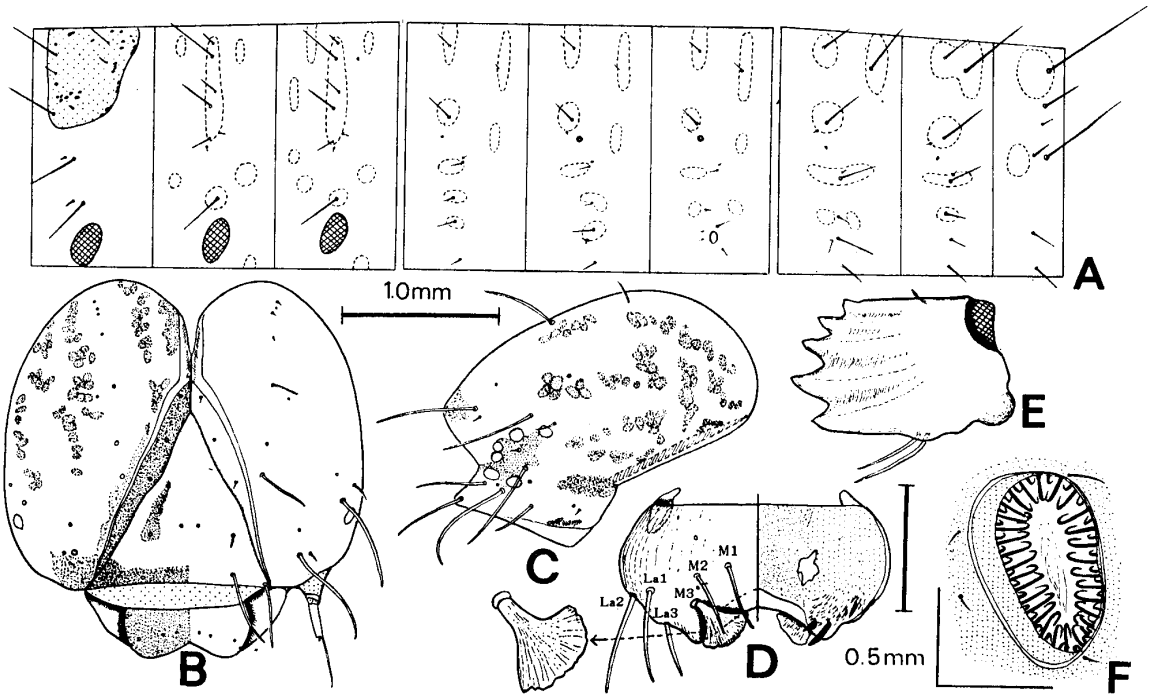

Fig. 75. *Paracymoriza vagalis* (Walker), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum; E, right mandible, inner view; F, crochets of proleg.

Male pupa: Body length 9.2 mm, width 2.8 mm.

Body pale brown with darker broad band from apex of head to abdomen dorsally. Head rather short; frons broadly rounded with seta F1 slender; pilifer weakly recognized; maxilla very long, extending to near apex of long hindleg; antenna also long, reaching far beyond apices of wings.

Thorax with foreleg long, almost extending to apices of wings; midleg slightly shorter than maxilla; hindleg almost concealed by maxilla and its tip faintly recognized at lateral side of maxilla tip.

Abdomen relatively stouter than in thorax; spiracles of 2nd to 4th segments well developed and clearly marked by darker basal rings, equal in size; 9th segment with setae distinctly developed, of which bases are a little produced; 10th segment with apex wide and rectangular, arising 4 pairs of stout setae along caudal end.

Specimens examined: 12 ♂, 12 ♀ from Kyushu (Kagoshima Prefecture): Mt. Takakuma-yama (S. Takemura), Miyanojo (Y. Yoshiyasu), Negime (Y. Yoshiyasu) (KPU). Taiwan: 1 ♀, Juisui, Hualien Hsien (K. Kanmiya) (KPU).

Distribution: Japan (South Kyushu, Yakushima Is.), India, Java, China, Taiwan.

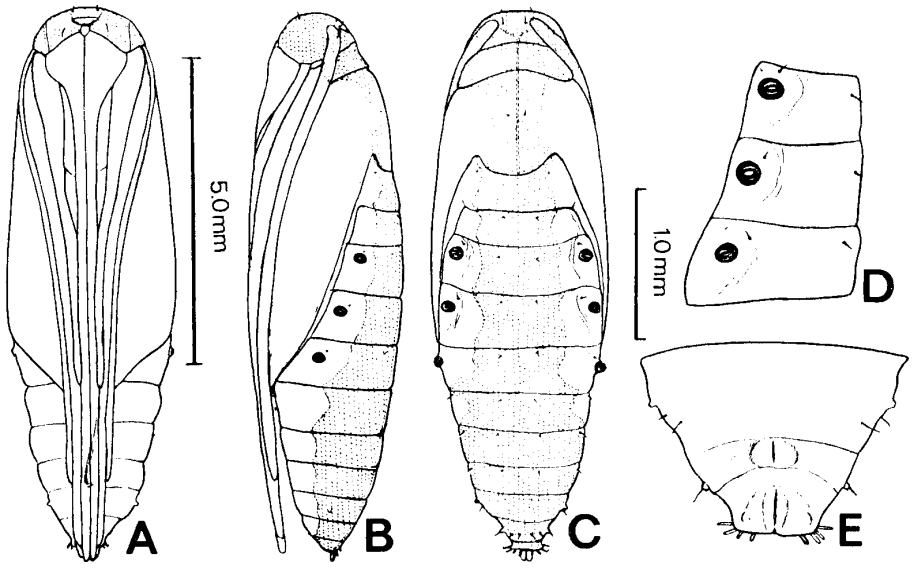

Fig. 76. *Paracymoriza vagalis* (Walker), pupa. A, Male, ventral view; B, ditto, lateral view; C, ditto, dorsal view; D, 2nd to 4th abdominal segments, lateral view; E, apical segments, ventral view.

Biological notes: The larva of this species was first discovered by Iwata (1929), with its peculiar host plant. According to him, the larvae live on the rocks in the rapid stream where the host plants, Podostemaceae spp., are developed. They make the fixed cases on the rocks by webbing the host plants, and feed on them outside of their cases. When I went to the Sendaigawa River, at Miyanojo, Kagoshima Pref., in 1973 - 1974, I could collect some larvae in 30 - 50 cm depth of the river and some adults around the river. At one times, I fortunately collected a male pupa which had not been known yet. The pupal case was made by the many particles of sands. It resembles the larval or pupal cases of some Trichoptera.

Remarks: There is no congeneric species in Japan. But several species are known from the Oriental Region. And some undescribed species of the genus are found in Thailand (Yoshiyasu, unpublished).

The tips of valval specialized setae in the male genitalia in the Japanese form are different from those in Chinese form shown by Speidel (1984), *viz.*, the setae are broadened in Japanese form, while those are slender in Chinese form. In this paper I treated both forms are conspecific.

The species is multivoltine, because the adults fly in any time from August to November at Miyanojo, Kagoshima Prefecture.

Genus *Potamomusa* nov.

(potamos ποταμός (=river) +musa μούσα (=muse) (feminine))

Type-species: *Cataclysta midas* Butler, 1881.

A nymphuline species *midas* Butler has been placed under the genus *Cataclysta* since 1881, when the original description was made. Speidel (1981) treated it as a species of the

genus *Margarosticha* Lederer, 1863, and in 1984 he transferred it to *Neocataclysta* Lange, 1956. Having compared *Cataclysta midas* Butler with the original descriptions of the genera *Margarosticha* and *Neocataclysta* and the species described under the genera, it has been revealed that *Cataclysta midas* was not congeneric with above two genera by the different wing marking and venation and the genitalic characters. *Potamomusa* gen. nov. is, therefore, proposed for *midas* and a new species belonging to this new genus is described from Japan.

External characters: Rather large in size, with legs slender and long. Head with frons rounded; vertex not elevated. Labial palpus ascending, long, reaching at level of vertex; basal 2 segments roughly scaled below; the 3rd slender, acute at apex. Maxillary palpus moderate in length. Proboscis long, scaled basally. Antenna in male ciliate, without thick scale tuft; that in female slenderer than in male. Ocellus present.

Wing shape and venation: Wings rather broad. Forewing with costal margin almost straight in both sexes; apex rounded; termen slightly curved to tornus; tornus not angulate. Vein Sc ending at proximal 1/3 of costa; R_1 stalked with R_{2-4}; R_2 stalked with R_{3+4}; R_5 emitted from anterior angle of discoidal cell; M_1 straight; M_2, M_3 and CuA_1 slightly separated from each other at bases; CuP absent; discocellulars strongly oblique outwardly.

Hindwing with apex rounded; termen evenly curved but slight excurvation behind apex. Vein $Sc+R_1$ stalked with Rs in moderate length; M_1 arising from anterior angle of discoidal cell; bases of M_2, M_3 and CuA_1 as in forewing; discocellulars weakly oblique outwards.

Wing marking: Forewing without BL and SBL. Discocellular lunule formed distinctly, circular. PML oblique outwardly, sometimes interrupted. SMW broad. SML continuous to cell CuA_2, parallel with termen, while in *Margarosticha* SMW and SML interrupted to form "tornal marking" *sensu* Yoshiyasu, 1980a. ML represented as a series of small spots at each cell.

Hindwing with base to AMG purely white. Discocellular lunule as in forewing. PML indistinct. PMG suffused with smoky grey at middle by having dark brown scales on white ground. SML obscure. ML represented by a series of spots along termen in cells.

Mele genitalia: Tegumen relatively narrow, fused with uncus posteriorly, with anterior margin incised deeply. Fenestrulae present. Vinculum longer than height of tegumen, with narrow fold. Saccus large and wide. Uncus short, attenuate near base. Gnathos almost straight, a little shorter than uncus, with some spines at dorso-apical portion. Valva broad; costa long; inner surface with dorso-apical portion with long, specialized setae. Phallus thick, with a large horn-like cornutus besides some smaller cornuti. Juxta large, rectangular.

Female genitalia: Ostium bursae rather narrow. Ductus bursae short. Corpus bursae long and large, with a unseparable pair of long signa on apical 2/3. Ductus seminalis slender. Spematheca without lagena. Eighth tergum short, with some short setae at posterior margin; apophysis anterioris short. Papilla analis short and small; apophysis posterioris slightly shorter than anterioris.

Remarks: *Potamomusa* gen. nov. is allied to *Margarosticha*, which contains 13 proposed species, distributed in the Oriental and Australian Regions. But the former genus is distinguished from the latter as follows: Wings broader, with apex more rounded; forewing with SMW and SML continuous, and with vein R_1; hindwing with vein $Sc+R_1$; male genitalia with phallus thicker and furnished with a larger cornutus; female genitalia with corpus bursae larger and weakly sclerotized at basal 1/2.

On the other hand, these 2 genera also have some resemblances to *Eoophyla* Swinhoe in

the wing and genitalic characters, *i.e.*, discocellulars oblique outwardly, especially in forewing; hindwing with ML represented by a series of blackish spots along termen; male genitalia with tegumen relatively short, with anterior margin rather deeply incised, and with valva broad and large furnished with specialized setae at dorso-apical portion on inner surface; female genitalia with corpus bursae long, and with 8th tergum short. But *Potamomusa* gen. nov. and *Margarosticha* differ from *Eoophyla* by the presence of the marginal black spots without metallic scales on each spot and the absence of strongly incised termen in the hindwing. In addition to these adult characters, it is known that the larvae of *Potamomusa* inhabit on the surface of submarged rocks in the rapid streams as well as the larvae of *Eoophyla*. But the larvae of *Margarosticha* has not known up to the present. The larvae of *Potamomusa*, however, are different from those of *Eoophyla* in having the cylindrical body, not flattened head, almost rectangular mandible and 2 L setae on 9th abdominal segment.

The new genus resembles *Neocataclysta* in having the similar wing marking and the long, apical setae on valva in the male genitalia, but easily distinguished from the latter as follows: Both wings with discocellulars more strongly oblique; forewing with R_1 stalked with R_{2-4}, while in *Neocataclysta* R_1 free; male genitalia with a large cornutus on phallus, whereas in *Neocataclysta* cornuti consisted of a group of smaller spines and with tegumen shorter than vinculum; female genitalia with length of signa much longer than that of *Neocataclysta*.

Key to the Species of *Potamomusa*

1. Forewing with WB and WC continuous to form a broad white area; hindwing with upper-most fragment of ML much reduced; female genitalia with 8th tergum partly membranous at mid-dorsal line on posterior portion ..... *P. aquilonia* sp. nov.
— Forewing with WB and WC separated; hindwing with upper-most fragment of ML about 1/2 as large as the 2nd; female genitalia with 8th tergum evenly sclerotized ..... *P. midas* (Butler)

Potamomusa midas (Butler) comb. nov.

Cataclysta midas Butler, 1881: 585; Hampson, 1897: 152; Leech, 1901: 435; Shibuya, 1929: 128; Marumo 1942: 18; Inoue, 1982, I; 372, II: 243, pl. 44, fig. 51.
Margarosticha midas: Speidel, 1981: 126.
Neocataclysta midas: Speidel, 1984: 40.

External characters: Head with frons silvery white; vertex concolorous with frons. Labial palpus with basal 2 segments ochreous dorsally and whitish ventrally; the 3rd whitish. Maxillary palpus slender, ochreous proximally and whitish distally. Proboscis with base pale ochreous. Antenna 3/5 as long as forewing length, dorsally with whitish to pale ochreous scales. Legs long and slender. Foreleg with anterior surfaces of coxa to tibia dark brown, otherwise whitish. Mid- and hindlegs almost whitish; male mid- and hindcoxae (medial portion) and hindtibia with a special tuft of scales extending posteriorly, female coxae lacking of special tuft of scales; each inner spur 1.5 times as long as outer one. Thorax above whitish, mixed with pale ochreous scales, beneath evenly whitish. Abdomen above whitish with pale ochreous ring at each anterior 1/3 of segment, beneath whitish.

Wing shape and venation: As described for the genus.

Wing marking: Forewing with AMG faintly marked, oblique inwards, yellowish. ML with posterior portion narrow, ended at proximal 3/5 of posterior margin, fuscous. PML emitted from costa, running to vein CuA_1 obliquely outwardly, interrupted at there, and restarting from posterior angle of discoidal cell, then outwarly expanded, and ended proximal 2/3 of posterior margin. WB represented as a wedge-shaped one, making an obtuse angle with costal margin. SMW parallel with termen to vein 1A, with posterior portion becoming narrow and suffused with malallic grey. ML represented by 7 narrow, blackish bars, interrupted by veins. Cilia evenly whitish.

Hindwing with base to ML evenly whitish. ML with posterior portion curved inwardly, fuscous. Discocellular lunule distinct, pale orange. PML obscure, undulate, blackish. PMG broadly suffused with grey by scattering fuscous scales on white ground. WB and WC continued. SMW only appeared at near apex and tornus, metallic grey. ML represented by 5 blackish spots in cells of M_1 to CuA_2, of which upper-most one smaller than the others, about 1/2 as large as the 2nd. SMG pale orange. Cilia whitish, with proximal 1/3 darker.

Male genitalia: Tegumen with anterior margin broadly incised in U-shape. Fenestrulae rather narrow. Vinculum about 1.3 times as long as height of tegumen, narrowing to ventral portion. Saccus rounded laterally. Uncus about 1.5 times as long as tegumen, finger-shaped, almost straight, with apex narrowly rounded. Gnathos 0.8 as long as uncus, narrowing to apex, which is suppressed laterally. Valva broadened apically; inner surface with dorso-apical specialized setae 3 in number, broadened at apices. Phallus with coecum penis 0.27 as long as whole length of phallus; vesica with a large cornutus 0.4 as long as whole length of phallus.

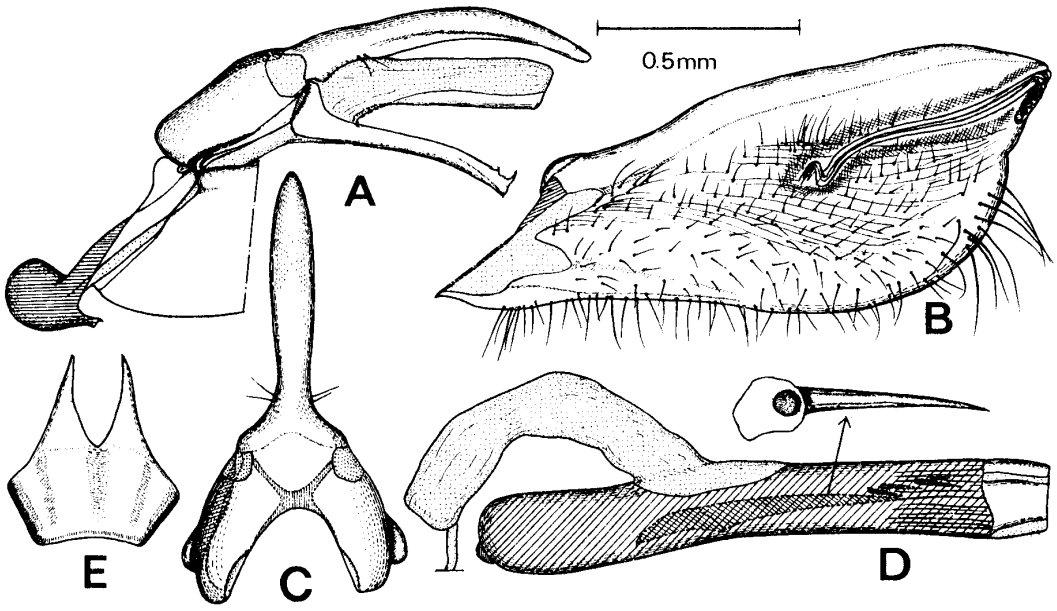

Fig. 77. *Potamomusa midas* (Butler), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta.

Female genitalia; Corpus bursae about twice as long as 7th tergum, with basal sclerotized portion furnished with a dorsal, flat projection extending posteriorly. Eighth tergum short, 0.2 as long as 7th tergum; posterior portion with some short setae along its margin, evenly sclerotized; apophysis anterioris 0.6 as long as long as 7th tergum. Apophysis posterioris slightly shorter than anterioris.

Size of forewing: Male, 8.2-9.7 mm; female, 9.1-14.0 mm.

Mature larva: Head width, 1.7 mm, body length, 20-34 mm.

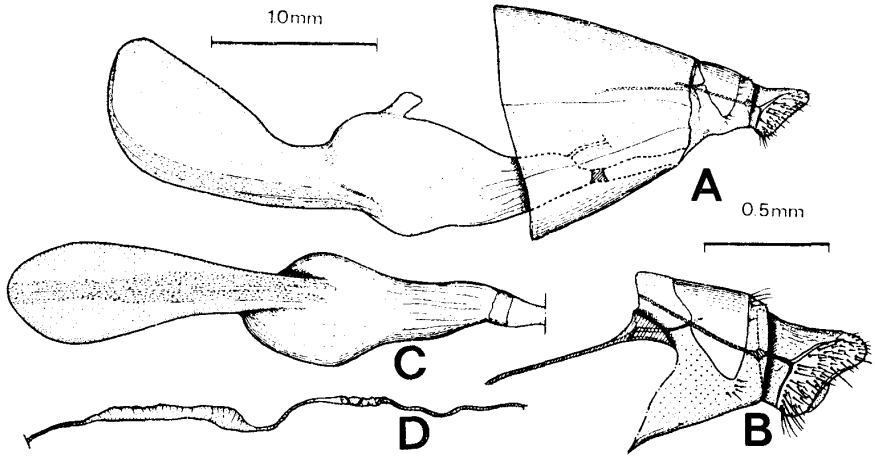

Fig. 78. *Potamomusa midas* (Butler), female genitalia. A, Lateral view; B, 8th segment, lateral view; C, corpus bursae, ventral view; D, spermatheca.

Head: Rounded, wider than long; cranium undulate laterally, blackish with several pale spots. Seta AF1 short; puncture AFa ventral to minute AF2; P1 and P2 long; A2 short, just lateral to A1, thence not situated on a line between A1 and A3; L1 short; O2 long; O3 shifted on a extension line between O1 and O2; labrum moderate in size, with M2 changed to flat and broad seta as in *Paracymoriza vagalis*. Mandible a little longer than wide, with 5 teeth; inner teeth undeveloped; postero-ventral margin rounded, with posterior seta from its margin much longer than anterior one.

Thorax: Well developed, whitish. Prothorax with prothoracic shield evenly blackish; seta XD1 long, XD2 short, 1/3 as long as XD1; D2 just ventral to and as long as D1; SD1 as long as XD1; SD2 short, postero-dorsal to SD1 and situated anteriorly from a combining line of D1 and D2; L2 short, anterior to long L1; SV1 long; tracheal gills present on posterior portion of SV setae (2 in number).

Meso- and metathorax with D1, D2, SD1 and SD2 situated almost in a same vertical line, and D2 and SD1 long; all L setae short; L1 and L2 arranged in a oblique line; gills emitting from the area around D and SD setae (8-10), anterior to SD and L (1) and L (1) except on mesothorax, dorsal to L (3-7), between to L and SV (5) and dorsal to coxae of legs (5-6).

Abdomen: Concolorous with thorax. Prolegs well developed with crochets completely circle, biordinal, about 50 in number. In 1st to 8th segments with D1 moderate in length, about 1/2 as long as postero-ventral D2; SD1 long, SD2 minute; L1 longer than the other L setae; SV1 short except on 2nd; number of SV setae, 1 on 1st and 8th, 2 on 2nd and 7th, and 3 on 3rd to 6th segments, respecitively. Tracheal gills on 1st and 2nd segments appeared in 6 groups around each setae group except V seta, those on 3rd to 7th in 5 groups except around SV and V, and those on 8th in 4 groups and on 9th in 2 groups except around SD, SV and V setae groups; each group consisted of 4 to 15 no-branching gills. In 9th segment, D1 short, equidistant from D2 and slender SD1; L1 longest; L2 ventral to L1; SV1 as long as D2. Tenth segment with anal shield undeveloped; anal proleg with crochets transversely arranged, biordinal, 20 in number.

Pupa: Unavailabe in this time.

Specimens examined: Honshu: Aomori Pref.: 1♀, Shimokita, 27. vii. 1957 (T. Saigusa) (KPU). Niigata Pref.: 1♀, Miomote, 31. vii. 1963 (R. Sato) (KPU). Toyama Pref.: 1♀, Kamidaki, 13. viii. 1954 (H. Yamanaka) (IC); 1♀, Matsukura, Nakaniikawa-gun, 21. vii. 1980 (M. Tao) (KPU). Gifu Pref.: 1♂, Ozino, Mugegawa-cho, 14. vi. 1975 (H. Kasai) (KPU); 1♀, Fukutomi, 12. vii. 1977 & 1♀, Shonou, Hachiman-cho, 25. vi. 1979 (S. Funakoshi) (KPU); Shiga Pref.: 1♀, Katata, Otsu-shi, 10. ix. 1981 (Y. Yoshiyasu) (KPU); Kyoto Pref.: 1♀, Kyoto, 29. v. 1951 & 1♀, Kyoto, 15. vi. 1956 (Y. Takeuchi) (UOP). Shikoku: Ehime

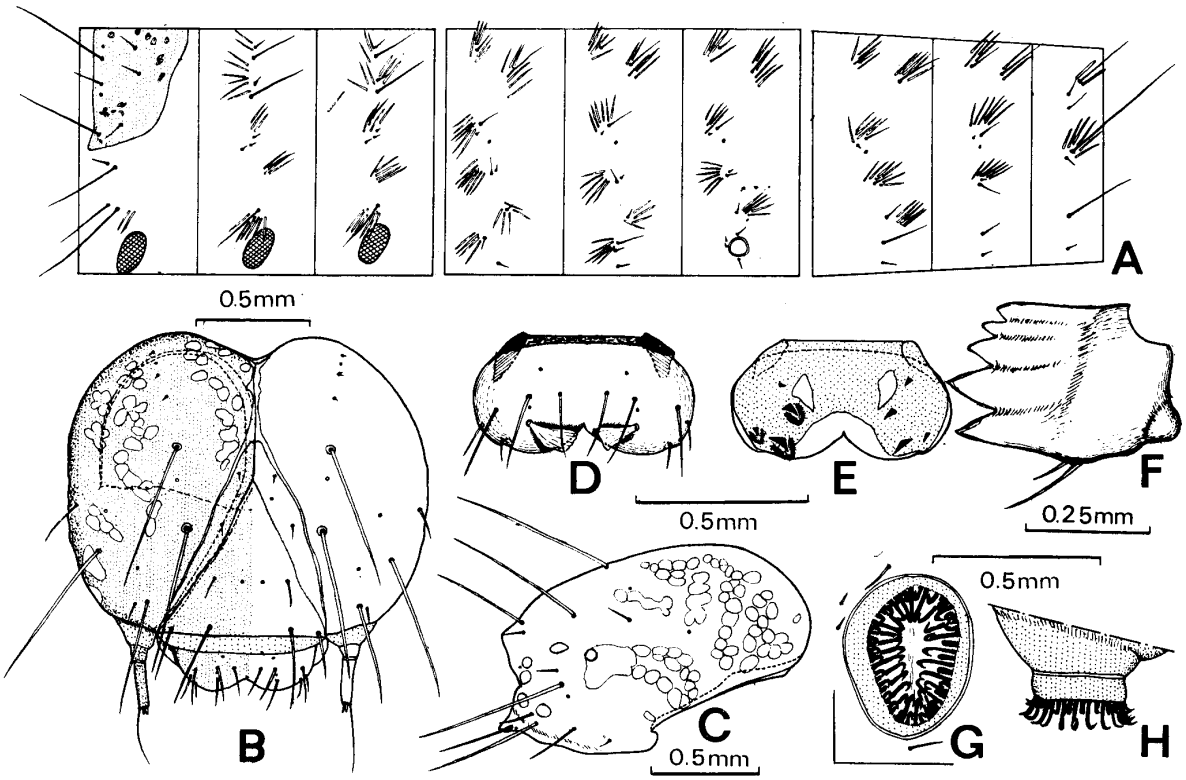

Fig. 79. *Potamomusa midas* (Butler), larva. A, Chaetotaxy; B, head, frontal view; C, ditto, lateral view; D, labrum, frontal view; E, ditto, ventral view; F, right mandible, inner view; G, crochets of proleg; H, ditto, lateral view.

Pref.: 1♀, Omogokei, 28. vii. 1952 (T. I. et T. E.) (KU). Kochi Pref.: 1♀, Oudaba Kuroson, Hata-gun, 17. vii. 1953 (S. Hisamatsu et T. Edashige) (EU). Kyushu: Fukuoka Pref.: 1♀, Shiibaru, Fukuoka-shi, 21. vii. 1975 & 1♀, Mt. Inunaki-yama, 28. vii. 1975 & 1♂, Shiibaru, Fukuoka-shi, 4. viii. 1975 (Y. Yoshiyasu) (KPU). Oita Pref.: 1♀, Mt. Sobo-san, 29. vi. 1932 & 1♀, Mt, Sobosan, 1. vii. 1932 (Hori, Fujino & Cho) (KU); 1♀, Hobashira, 2. ix. 1957 (H. Kuroko) (HBL, KU); 1♂, 2♀, Ukenokuchi, Kuju, & 15. viii. 1975 & 2♂, 1♀, Ukenokuchi, Kuju, 16. viii. 1975 & 2♂, 6♀, Ukenokuchi, Kuju, 18. viii. 1976 (Y. Yoshiyasu) (KPU). Miyazaki Pref.: 1♀, Takachiho-cho, 30. vi. 1976 (M. Yamamoto) (KPU). Kagoshima Pref.: 1♂, Hamada, Kanoya-shi, 4. vii. 1964 (K. Kanmiya) (KPU); 1♂, Miyanojo, 9. x. 1972 & 1♀, Miyanojo, 12. x. 1972 (Y. Yoshiyasu) (KPU); 1♀, Miike, Kirishima, 27. v. 1977 (K. Ohara *et al.*) (KPU). Exotic specimen: Korea: 1♀, Mt. Sudosan, Kyongsangpuk-do, 15-16. vii. 1971 (K. Yamagishi) (KPU).

Distribution: Japan (Honshu, Shikoku, Kyushu, Yakushima Is.), China, Amur, Ussuri, Korea.

Biological notes: The biology was studied by Tsuda (1936) with hosts. However, the detail information of this species is not available now.

***Potamomusa aquilonia* sp. nov.**

This species is closely allied to *P. midas* (Butler), but can be separated from the latter by the wing marking and the female genitalia as follows:

Female wing marking: Wings with white areas WA, WB and WC broader, thence completely continuous each other, and in relation to this the ground components narrower. Hindwing with upper-most spot of MGL smaller.

Female genitalia: Corpus bursae with ligamentous process in dorso-medial portion extending ante

riorly, whereas in *midas* extending posteriorly. Ductus seminalis with base broader. Eighth tergum membranous partly at mid-dorsal portion posteriorly.

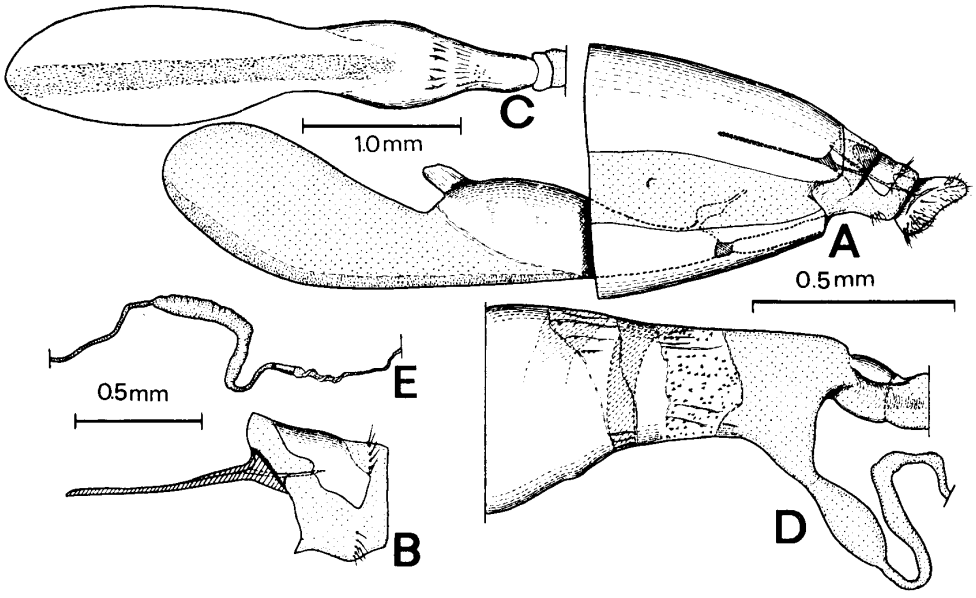

Fig. 80. *Potamomusa aquilonia* sp. nov., female genitalia. A, Lateral view; B, 8th segment, lateral view; C, corpus bursae, ventral view; D, base of corpus bursae, dorsal view; E, spermatheca.

Immature stages: Unknown.

Holotype: Female, Ishikari, Hokkaido, 23.vi.1953 (T. Shirôzu) (KU).

Distribution: Japan (Hokkaido).

Remarks: The present new species is separable from the allied species *midas* by the reason as mentioned above. The male specimen is not available in this time.

Genus *Eoophyla* Swinhoe

Eoophyla Swinhoe, 1900: 442.

Theila Swinhoe, 1900: 443 (type-species: *Oligostigma gibbosalis* Guenée, 1854.). Designated by Klima (1937).

Type-species: *Cataclysta peribocalis* Guenée, 1859

External characters: Head with frons flat. Vertex not elevated. Labial palpus upturned, sparsely scaled; the 3rd segment rather short and narrow, acutely extending upwards. Maxillary palpus more or less short. Proboscis long. Antenna in male with a process laterally on scape, with flagellum a little suppressed laterally; that in female slender. Ocellus absent. Legs long; hindleg with a long scale tuft on ventral portion of femur.

Wing shape and venation: Forewing in male with costa convex at its 1/2 roundly, that in female costa straight; apex narrowly rounded. Vein R_1 short and anastomosed with R_2 and R_{3+4} at base; R_2 anastomosed with R_{3+4} for long distance; R_5 emitted from anterior angle of discoidal cell; M_1 with base a little apart from base of R_5 and straight; M_2 and M_3 with bases closely approximated to one another, emitting from posterior angle of discoidal cell; CuA_1 with base a little apart from base of M_3; CuA_2 arising rather proximal to posterior angle of discoidal cell; CuP absent; 1A+2A with distal portion

curved; 3A short, stright; Discocellulars oblique outwards.

Hindwing long and narrow; costa waving weakly; apex rounded; termen strongly incised behind apex, then slightly curved to rounded tornus. Vein $Sc+R_1$ shortly or moderately anastomosed with Rs; M_1 with base touched with those of $Sc+R_1$ and Rs near anterior angle of discoidal cell; M_2 to CuA_2 as in forewing; CuP, 1A+2A and 3A completely present.

Wing marking: Forewing with components in discoidal cell obscure. WA unclear. WB wedge-shaped, oblique outwards. WC constricted at posterior portion of vein 1A+2A, oblong. SMW retracted proximally along cell CuA_2. SML and MGL parallel with termen.

Hindwing with PML more situated proximally than in forewing, oblique at middle of wing. ML changing into some black spots along termen with silvery center.

Male genitalia: Tegumen long and flat, with anterior margin strongly incised with ridge; posterior portion fused with uncus dorsally. T-v plate distinct from tegumen, not so expanded laterally. Fenestrulae narrow, present on both lateral sides of tegumen at uncal base. Vinculum relatively long, not fused with costa of valva. Saccus large, rounded, with dorsal surface membranous. Uncus long and flat, straight, almost subtriangular dorsally. Gnathos large, with distinct spines at apex dorsally. Valva large and wide; costa not suppressed laterally; apex with a few specialized setae extending inwards and anteriorly. Phallus long and stout; coecum penis moderately developed; vesica with many spinules. Juxta rectangular, with ventral margin not curved. In addition, 8th sternum evenly sclerotized.

Female genitalia: Ostium bursae broad, evenly membranous. Ductus bursae moderate in length, membranous. Bursal ring developed, circular. Corpus bursae long, stout, with a pair of signa. Spermatheca with lagena. Eighth tergum rather short, with short setae posteriorly; apophysis anterioris short, broad at base. Papilla analis small and erect; apophysis posterioris almost as long as anterioris. In addition, 7th sternum, evenly sclerotized, almost as long as the tergum.

Key to the species of *Eoophyla* in Japan

1. Forewing with WC reached to termen; underside of hindwing with marginal spots 3 in number; male genitalia with gnathos shorter than uncus, valva about 2.7 times as long as wide; female genitalia with spinules of signa dull at apex ·····*E. inouei* Yoshiyasu
— Forewing with WC not reached to termen; underside of hindwing with marginal spots 4 in number; male genitalia with gnathos almost as long as uncus, valva about 2.2 times as long as wide; female genitalia with spinules of signa acute at apex·····*E. conjunctalis* (Wileman et South)

Eoophyla conjunctalis (Wileman et South)

Aulacodes conjunctalis Wileman et South, 1917: 176 (type-locality: Taiwan).
Eoophyla conjunctalis: Shibuya, 1928: 152, pl. 6, fig. 4. (♀).

External characters: Head with frons fulvous to pale orange. Vertex entirely fulvous. Labial palpus extending far beyond vertex; with lst segment dilated anteriorly with fulvous triangular scales; the 2nd acutely curved upwards, fulvous; the 3rd conical, fulvous. Maxillary palpus rather small, fulvous. Proboscis with base fulvous to brown. Antenna 2/3 as long as forewing length; in male with a fuscous process on scape posteriorly, flagellum thick and fulvous dorsally; in female ciliate, fulvous. Legs long, with claws well developed in female, moderate in male, pale fulvous to whitish except anterior surfaces of femur and tibia blackish brown. Mid- and hindlegs with each inner spur 1.5 times as long as outer one.

Wing marking: Ground components pale orange, more dull in female. Forewing with basal 1/2 broadly pale fuscous. White spots present beyond discoidal cell. DB1 an DB2 indistinct. ML present

from proximal 2/3 of costa to vein CuA_2, oblique outwards. PML started from near apex, then weakly excurved to vein CuA_2, at there touched with anterior portion of ML. An area between above 2 lines, wedge-shaped, pure white. PMG rather broad, pale orange. SML narrow, parallel with termen, fuscous. SMW parallel with termen to vein CuA_2, then proximally retracted and running along the cell to proximal extreme of wing. MGL very narrow, dark brown to cell CuA_2. WC long, semicircular posterior to vein 1A+2A. Cilia fulvous.

Hindwing with basal 1/3 fulvous with some brownish scales. ML absent. PML from proximal 2/3 of costa curved to vein CuP, then retracted to 1A+2A, and returned to tornus. PMG with distal margin expanded distally as to touch with SML, where it is suffused with fuscous. SML narrow and fuscous, but indistinct from vein M_1 to CuA_1. MGL enlarged in cells M_1 to CuA_1, each rectangular and black, and illuminated with small silver scales. Cilia as in forewing.

Male genitalia (based on Taiwanese specimens): Tegumen long, flat, with anterior margin incised in U-shape. Vinculum wide at dorsal portion, narrowing to ventral portion. Saccus large. Unucus with base wide, becoming narrow to rounded apex, with a seta at subbasal side. Gnathos as long as uncus, with 3 pairs of spines dorso-apically. Valva very large, about 2.2 times as long as wide; costa extending to apex of valva, rather pointed at its extream; inner surface with dorso-apical portion furnished with 3 specialized setae of which ventral-most one is enlarged at apex; sacculus with base wide, medially with several long setae. Phallus long and stout; coecum penis about 0.4 as long as whole length of phallus; vesica with cornuti consisting of many minute spinules. Juxta with posterior margin strongly concave medially.

Female genitalia: Ostium bursae wide. Ductus bursae 1/2 as long as 7th sternum. Corpus bursae about twice as long as 7th tergum, with base slender and with apical portion broadly swollen in elliptic. Signa representing by a pair of groups of spinules which are arranged obliquely and acute at apices. Eighth tergum short, with short setae posteriorly; apophysis anterioris about 0.4 as long as 7th tergum, with base broadened; 8th sternum weakly sclerotized, with some short setae. Papilla analis with short setae; apophysis posterioris almost as long as anterioris.

Size of forewing: Male (Taiwanese specimens) 11.5 mm (n=7); female (1 Japanese and 15 Taiwanese specimens), 13.2 mm (n=16).

Immature stages: Unknown.

Specimens examined: 1 ♀, Ogimi, Okinawa-Honto Is., the Ryukyus, 30. v. 1959 (S. Azuma) (IC) (previously misidentified as *E. inouei* Yoshiyasu by Yoshiyasu (1979)); 1 ♀, Yona, Okinawa-Honto Is., the Ryukyus,16.iv.1981 (Y. Yoshiyasu) (KPU). Taiwan: 7 ♂, 15 ♀, from various places of Taiwan (KU, KPU).

Distribution: Japan (Okinawa-Honto Is., the Ryukyus), Taiwan. New to Japan.

Remarks: The male genitalia and forewing length are described based on Taiwanese specimens because of the lacking of male specimens from Japan.

The species is allied to *Eoophyla peribocalis* (Walker, 1859) from South-East Asia and China, but differs from the latter in the wing marking with paler ground color, the more proximal PML and the narrower SMW in the hindwing.

Iwata (1930) recorded the larvae of *Aulacodes* sp. from Taiwan. Judging from the description of the larvae, they seems to be identical to *Eoophyla conjunctalis* (Wileman & South).

***Eoophyla inouei* Yoshiyasu**

Eoophyla inouei Yoshiyasu, 1979: 1 (type-locality: Ishigaki-jima Is., the Ryukyus); Inoue, 1982, I: 373, II: 243, pl. 44, figs. 52, 53.

The close description of this species was given by Yoshiyasu (1979). The additional specimens are as follows:

Specimens examined: 5♂, Kanpira, Iriomote-jima Is., the Ryukyus, 26. III. 1979 (S. Hashimoto). 3♂, 4♀, Ohara, Iriomote-jima Is., the Ryukyus, 18. vii. 1981 (N. Koda) (KPU).

Distribution: Japan (Ishigaki-jima Is. and Iriomote-jima Is., the Ryukyus).

Remarks: This species is very close to *E. conjunctalis* (Wileman & South). *E. inouei*, however, differs from the latter in the wings with more fuscous ground color on both wings and the smaller marginal dots on the hindwing, and in the slight different genitalia given in the key.

Dr. K. Tanida, University of Osaka Prefecture, kindly noticed me that the larvae of *Eoophyla* sp. were found in Okino-erabu-jima Is., between the Ryukyus and Amami Iss. (pers. commun.). I could not confirm the specific name because I have no chance to examine the specimens until now.

Okinawa-Honto Is., previously considered as one of the locality of this species by Yoshiyasu (1979), is excluded from the distribution of this species by the reason mentioned at description of *E. conjunctalis*.

Genus *Nymphicula* Snellen

Nymphicula Snellen, 1880: 78; Yoshiyasu, 1980: 2; Inoue, 1982, I: 243, II: 381; Speidel, 1984: 20.

Type-species: *Cataclysta blandialis* Walker, 1859 (=*Nymphicula stipalis* Snellen, 1880).

This genus was redescribed by Yoshiyasu (1980a) in detail. The terminology of the wing marking in this study is different from the previous one, then I will describe the wing marking again.

Wing marking: Forewing with ground components pale orange. BL and SBL obscure, running obliquely, fuscous with some pale orange scales. AMG broad, also oblique inwards. AMG to PML trapezoid in shape, broadly grey by scattering fuscous scales on white scales. PMW emitting from 3/4 of costa to cell M_3, then interrupted there, and reappearing at posterior angle of discoidal cell, and running outwards to near tornus, with proximal portion unclear at its margin. PML narrow, edged by proximal margin of PMW. SMW parallel with termen to near vein CuA_1, metallic grey posteriorly; posterior portion (=tornal marking *sensu* Yoshiyasu, 1980a) oblique outwards or curved to tornus, evenly metallic grey. SML narrow, fuscous, edged by distal margin of SMW. ML absent or representing by a narrow, fuscous marking at apex. Cilia long, fulvous.

Hindwing with BL and SBL faintly fuscous or absent. Discocelluar lunule weakly representing by fuscous area. ML to PML broadly grey as in forewing. SML narrow, rather undulate, fuscous. MGL represented by 4 or 5 blackish spots (=terminal dots *sensu* Yoshiyasu, 1980a), with metallic blue scales on or between spots. Cilia near tornus fuscous, otherwise fulvous.

Remarks: As already mentioned by me (Yoshiyasu, 1980a), the genus is closely allied to Nearctic *Chrysendeton* Grote, 1881, but differs from the latter by the absence of ocellus and the presence of preapical spurs in hindtibia. It is thought that there are many species of this genus undescribed from South-East Asia. In Japan the next 4 species have been known.

Key to the species of *Nymphicula* (after Yoshiyasu, 1980a, slightly modified)

1. Upperside of hindwing with base to AMG tinged with fuscous; underside of hindwing with metallic blue scales on spots of MGL; male foreleg widened laterally by thick scales on 1st to 3rd tarsomeres 2
— Upperside of hindwing with base to AMG white; underside of hindwing without metallic blue scales on spots of MGL; male foreleg without lateral thick scales on 1st to 3rd tarsomeres; forwing length 5.2–6.2 mm ..... *N. albibasalis* Yoshiyasu
2. Upperside of forewing with posterior portion of SMW not curved; anastomotic portion of vein R_{3+4} with R_5 shorter than 1/4 length of R_5; hair pencil in male fulvous; saccus elliptic laterally, valva without long setae on inner surface 3
— Upperside of forewing with posterior portion of SMW strongly curved; anastomotic portion of vein R_{3+4} with R_5 about 1/4 as long as length of R_5; hair pencil in male blackish; saccus almost rectangular laterally, valva with long, posteriorly directed setae on inner surface; forewing length 4.9–5.6 mm ..... *N. minuta* Yoshiyasu
3. Upperside of hindwing with 4 spots of MGL; upperside of forewing with MGL representing at apex, fuscous; male foreleg with lateral thick scales on tarsomeres partly blackish; tegumen long, with a distinct dorsal ridge longitudinally, phallus without cornutus; forewing length 6.3 mm ..... *N. saigusai* Yoshiyasu
— Upperside of hindwing with 5 spots of MGL; upperside of forewing without MGL; male foreleg with lateral thick scales evenly fulvous; tegumen relatively short, without dorsal longitudinal ridge, phallus with cornuti; forewing length 6.9 mm ..... *N. junctalis* (Hampson)

Nymphicula saigusai Yoshiyasu

Nymphicula saigusai Yoshiyasu, 1980: 6, figs. 1-4, 14A, 15A (type-locality: Fukuoka-shi, Fukuoka Pref., Kyushu).

Cataclysta blandialis: Hampson, 1897: 197; Shibuya, 1929: 128; Marumo, 1942: 17; Inoue, 1955: 158; Mutuura, 1957: 119.

Nymphicula blandialis: Mutuura, 1971: 119.

A detail descriptions of the adult including the immature stages of this species were already shown by Yoshiyasu (1980a). The additional specimens examined are given.

Specimens examined: 8♂, 11♀ from Honshu (Ibaragi Pref.: Mt. Tsukubasan, Niigata Pref.: Mt. Kashibasan, Awa I.; Sakasamaki; Awabii, Sagashima I., Aichi Pref.: Mt. Sanageyama, Toyota-shi. Mie Pref.: Kirihata, Miegun. Shiga Pref.: Katata, Otsu-shi. Kyoto Pref.: Iwakura, Kyoto-shi) and Kyushu (Fukuoka Pref.: Ozasa, Fukuoka-shi).

Distribution: Japan (Honshu, Awa I.*, Sadogashima I.*, Shikoku, Kyushu), Korea.

Remarks: This species is easily separable from the other Japanese species in appearance by having 4 marginal dots in the hindwing, whereas the dots in the other species are rather small and 5 in number. But this character is not used for the exotic *Nymphicula* species.

Nymphicula junctalis (Hampson)

Cataclysta junctalis Hampson, 1891: 140, pl. 155, fig. 24 (type-locality: India).

Nymphicula junctalis: Yoshiyasu, 1980: 18.
Nymphicula patnalis: Speidel, 1984: 30.

The description of the species is referred to Yoshiyasu (1980a). This species is newly known from Taiwan in this time.

Additional specimens examined: Amami-Oshima Is.: 6 ♂, 8 ♀, Taken. Exotic specimens: Taiwan: 2 ♂ 3 ♀, Tiuyuehtan, Nantou Hsien, 29. v. 1973 (Y. Yoshiyasu).

Distribution: Japan (Amami Iss.), India, Taiwan. New to Taiwan.

Nymphicula minuta **Yoshiyasu**

Nymphicula minuta Yoshiyasu, 1980:22. figs. 12 & 13, 14D, 15D (type-locality: Taken, Amami-Oshima Is.).
Nymphicula mesorphna: Speidel, 1984: 32.

This species was described for a rather small number of materials. In this time I could examine more specimens, including one female from Honshu (new record). Adding to this, the larvae of this species are suggested to be terrestrial.

Additional specimens examined: Honshu: 1♀, 22. vi. 1981, Katata, Otsu-shi, Shiga Pref., Y. Yoshiyasu (KPU); 12♂, 16♀, from Yakushima I., Amami-Oshima, Okinawa-Honto I., Ishigaki-jima I. and Iriomote-jima I. by A. Seino, H. Makihara, S. Hashimoto and Y. Yoshiyasu (KPU).

Distribution: Japan (Honshu*, Shikoku, Kyushu, Tanegashima I., Yakushima I., Amami Is., the Ryukyus).

Biological notes: One female collected on 9th April, 1981, Ishigaki-jima I., laid some eggs on a paper tissue unnaturally. The just hatched larvae mede small cases by fine soil particles like those of *N. saigusai*. Unfortunately, the larvae could not be well reared after that. According to these, the larvae of this species are suggested to be terrestrial.

Nymphicula albibasalis **Yoshiyasu**

Nymphicula albibasalis Yoshiyasu, 1980: 18, figs. 10 & 11, 14C, 15C (type-locality: Naidaijin, Kumamoto Pref., Kyushu); Speidel, 1984: 31.

The description of this species is referred to Yoshiyasu (1980a).

Additional specimen examined: Honshu:-1♀, Kizu, Soraku-gun, Kyoto Pref., 18. vii. 1985 (Y. Yoshiyasu) (KPU).

Distribution: Japan (Honshu*, Shikoku, Kyushu), China.

Remarks: According to Spiedel (1984), this species is allied to *Nymphicula manilensis* Sauber from the Philippines.

5.6 The biology and host plants

1. The habitat and larval types

As already stated, the larvae of most nymphuline species are aquatic. It is said that their life modes are secondarily acquired by changing of the terrestrial life (Lange, 1956) and this is probably correct judging from the systematic position of the Pyralidae. But the mode of adaption to the aquatic habitat is variable in different groups, so their lives can be

classified into some types. For aquatic species, Lange (1956) first divided their life modes into two types considering the larval habit and morphology. The grouping is based on the North American species as follows:

(1) Plant feeding type (= tribe Nymphulini *sensu* Lange) These larvae live in the pond or rather stagnant water, and feed on water plants, often making tubes or cases by the leaves in which they live. The mandibles are small and the bodies have the tracheal gills or not.

(2) Rock dweller type (= tribe Argyractini *sensu* Lange) The larvae live in fast-flowing streams or lakes or springs, feeding on the algae and diatoms at the surface of the rocks under silken webs. The known larvae have the tracheal gills and their mandibles are large and flattened.

For Japanese species (including some exotic species), the following classification is proposed, although it is conventional and each type does not always reflect the phylogenetic relationship.

(1) Aquatic types

a. Nymphula type (*Nymphula, Elophila, Neoschoenobia, Cataclysta**, *Neocataclysta**, *Synclita**, *Nymphuliella**).

World-wide in distribution. The larvae live in the ponds or stagnant water, often feeding on the floating leaves of many kinds of plants or sometimes on the submerged plants (*i.e.*, Trapaceae, Nymphaeaceae, Polygonaceae, Sparganiaceae, Potamogetonaceae, Hydrocharitaceae, Lemnaceae and so on). They are most polyphagous and making the portable cases except *Neoschoenobia* which is the leaf-miner and stem-borer. The larval body is cylindrical, without the tracheal gills, but is furnished with water-resistant structure (Reichholf, 1970 etc.; Yoshiyasu, 1980b).

b. Parapoynx type (*Parapoynx, Hydreuretis**)

World-wide in distribution. The larvae are living in the stagnant water as in the Nymphula type, but can live rather deep in the water where their hosts exist. The larvae are often polyphagous and make the cases. The larval body is cylindrical with branched tracheal gills from the 2nd instar larva for the respiration. The larvae of this type are well known as the pests of the rice plants.

c. Potamomusa type (*Potamomusa, Paracymoriza*)

East Palaearctic to Oriental Regions. The larvae live in the rapid streams, and feed on the algae and Podostemaceae species on the surface of the rocks in the water. The larval body is cyclindrical and provided with the gills which are not branched. They make the stable cases or nests by roughly spinning the host plants. Probably they are monophagous or oligophagous.

d. Eoophyla type (= rock dweller type, *sensu* Lange) (*Eoophyla, Parargyractis**)

Oriental and Nearctic Regions. The larvae live on the surface of the rocks in the rapid rivers as in the above type, but they are also discovered in the shallow streams. They make sheet-like flat nests by spinning the silk. The larval head and body are flat and with many plumose gills on protuded base of lateral side of thoracic and abdominal segments.

* Exotic genera

Table 1. The host plants of the Japanese Nymphulinae

Species	Host plants[1]
1. *Elophila (E.) interruptalis interruptalis*	*Nymphaea* spp. *Hydrocharis dubia* (Blume) Backer *Brasenia* sp. (undet.) *Trapa japonica* L. **Potamogeton* sp. (undet.)
*2. *Elophila (E.) interruptalis ezoensis*	**Polygonium amphibium* L. **Trapa japonica* L. **Potamogeton* sp. (undet.)
3. *Elophila (C.) turbata*	*Spirodela polyrhiza* (L.) Schleiden *Hydrocharis dubia* (Blume) Backer *Trapa japonica* L. *Nymphaea* spp., **Azolla imbricata* Nakai
4. *Elophila (C.) nigralbalis*	**Azolla imbricata* Nakai **Marsilea quadrifolia* L. **Salvinia natans* Allioni
5. *Elophila (M.) fengwhanalis*	*Hydrocharis dubia* (Blume) Backer **Potamogeton* sp. (undet.) *Oryza sativa* L. (?)
6. *Elophila (M.) orientalis*	**Potamogeton* sp. (undet.)
7. *Elophila (M.) sinicalis*	*Spirodela polyrhiza* (L.) Schleiden *Hydrocharis dubia* (Blume) Backer
8. *Nymphula corculina*	*Potamogeton* sp. (undet.)
9. *Nymphula stagnata*[2]	*Nuphar* spp. *Potamogeton* spp. *Sparganium* spp. *Nymphaea* spp.
10. *Neoschoenobia decoloralis*	*Nuphar* spp. *Trapa japonica* L.
11. *Parapoynx diminutalis*	**Hydrocharis dubia* (Blume) Backer **Egeria nuttallii* (Planch.) St. John
12. *Parapoynx stagnalis*	*Oryza sativa* L.
13. *Parapoynx crisonalis*	*Euryale ferox* Salisbury *Nymphaea* spp.[3]
14. *Parapoynx fluctuosalis*	*Oryza sativa* L. *Nymphaea* spp.
15. *Parapoynx vittalis*	*Oriza sativa* L. *Potamogeton maakianus* A. Benn *Potamogeton crispus* L. *Calomba caroliniana* A. Gray **Polygonium* sp.
16. *Parapoynx ussuriensis*	*Oryza sativa* L. **Utricularia* sp. (undet.)
17. *Paracymoriza vagalis*	*Lawiella kiusiana* Koidzumi
18. *Potamomusa midas*	*Chiloscyphus polyanthus* Corda var. *rivularis* Nees *Isopterygium* sp.
19. *Eoophyla inouei*	Algae (undet.)
20. *Nymphicula saigusai*	*Jungermannia truncata* Nees Musci (undet.)
21. *Nymphicula junctalis*	*Jungermannia* sp. (undet.)

* new subspecies or new host records.

1) Plant scientific names are after Ooi (1956).

2) Record of the hosts are based on European populations.

3) Recorded from Taiwan.

They feed on attached algae and diatoms on the rocks by using the large and elongate mandibles.

(2) Terrestrial type

a. Nymphicula type (*Nymphicula*, (*Crysendeton**))

Oriental, East Palaearctic and Nearctic Regions. The larvae of this type are found on the vertical band of the path in the mountainous area. They make the cylindrical cases by the soil particles and feed on Jungermaniacea and some kinds of Musci. As stated in my paper (Yoshiyasu, 1980a), *Nymphicula* is closely allied to Nearctic *Crysendeton*. Although the larvae of *Crytendeton* have not been known, they are probably included in this type.

2. The host plants

The host plants of the larvae of Japanese nymphuline species are listed in Table 1.

6. Subfamily Musotiminae Meyrick

Musotimidae Meyrick, 1890: 468.
Musotiminae: Speidel, 1981: 124.
Ambiini Munroe, 1972: 74

Type-genus: *Musotima* Meyrick, 1884.

The designation of this subfamily was made by Speidel (1981).

The Musotiminae are world-wide in distribution, and there are many species in the tropical regions. This subfamily is at least composed of *Musotima* Meyrick, *Ambia* Walker, 1859, *Undulambia* Lange, 1956, and *Cymoryza* Guenée, 1854. Here I will describe 2 additional new genera from Japan, with 4 new species of which 2 species were already known from Japan.

The larvae, known to the present, are peculiar to feed on the ferns.

6.1 Historical review of Japanese species

Up to the present, 3 species of *Ambia* have been known from Japan. *A. acclaralis* (=*Musotima dryopterisivora* sp. nov.) was first recorded from Yakushima Is. as *Musotima acclaralis* Walker in Marumo (1923). And *A. colonalis* (=*Musotima colonalis* (Bremer)) was recorded from Hokkaido by Inoue (1974). Recently Inoue (1982) discovered the another *Ambia* sp., although the description was not made.

6.2 Morphology and terminology

A. External characters

Head

Frons: It is usually moderate in width, rounded, sometimes flat.

Vertex: This portion is rather elevated, with the chaetosemata and with or without ocellus laterally.

Antenna: The antenna is rather short, 1/2 to 2/3 as long as the forewing length. The male antenna is a little suppressed laterally, and the female one is filiform.

Labial palpus: This is 3-segmented, and acutely upturned, with the narrow 3rd segment

almost as long as the 2nd except for shorter *Neomusotima* gen. nov.

Maxillary palpus: The palpus is 4-segmented without exception, and rather short.

Proboscis: This is long, having basal scales as in the other Pyralidae.

Legs

The legs of the Musotiminae are shorter than those of the other *Pyralidae*, especially in the foreleg. The spurs are much long, and the distal outer spur of the hindleg is almost as long as the inner one.

Wing venation

Forewing: Vein R_1 is shortly present or absent, in Nearctic *Undulambia* the vein is touched with Sc at the apex. R_2 is stalked with R_{3+4}. R_5 is emitted from the anterior angle of discoidal cell. M_1 is approximated with or rather separated from R_5. M_2 to CuA_1 are usually approximated with one another. CuA_2 is rather close to the posterior angle of discoidal cell. CuP is present or not. 1A+2A and 3A are present.

Hindwing: Vein $Sc+R_1$ is shortly anastomosed with Rs, but in *Melanochroa* completely fused with Rs to the wing margin. M_2 to CuA_1 are as in the forewing. CuA_2 separates from the posterior angle of discoidal cell than in the forewing. CuP is present or not. 1A+2A and 3A are present.

B. Wing marking

The terminology of the wing marking used here is the same as in the Nymphulinae. The Musotiminae is characteristic by having the parallel line components with the termen in both wings.

C. Male genitalia

The terminology of the male genitalia is also as that of the Nymphulinae.

Eighth tergum and 8th sternum: No modification is recognized in this subfamily. Both plates are evenly sclerotized and almost same in length. *Tegumen*: It is simple in shape, and short, with posterior margin usually fused with uncus dorsally. The fenestrula is distincly present. *T-v plate*: This plate is unknown in the Musotiminae. *Vinculum*: This is moderate in width, and its dorso-lateral portion is fused with the costa of valva as in the *Elophila* of the Nymphulinae. *Saccus*: It is variable in shape, usually membranous in dorsal surface. *Uncus*: This is well developed and setose. The apex is narrow and acute, extending downwards. *Gnathos*: This is well developed and slender. The basal portion extends anteriorly, and in some cases the plate is articulated with the costa of valva. *Phallus*: It is rather stout and short. The suprazonal sheath is very long, and usually membranous on the dorsal surface. The coecum penis is poorely developed. The burbus ejacultorius is moderate in length. *Anellus*: The anellus is evenly membranous. The manica has many minute spinules as in the Nymphulinae. *Juxta*: It is much longer than the width. In *Musotima*, the apical portion is produced ventrally to form a special projection. *Valva*: This is simple in the inner surface, without any special setae. The transtilla is present, but not so developed as to form a bridge above the phallus. The apical portion of sacculus is sometimes extended ventrally and produce a free process, which is also seen in some

Scopariinae species.

D. Female genitalia

Seventh sternum: The *Musotiminae* have the sternum almost as long as the tergum. *Eighth tergum*: It is rather narrow, sometimes leaved in U-shaped sclerite in dorsal view, and has several short setae posteriorly. *Apophysis anterioris*: It is rather short. *Lamella postvaginalis*: This is a sclerite near ostium bursae, corresponding to 8th sternum and sometimes extends to ductus bursae. It is not appeared in the Nymphulinae. *Ostium bursae*: This is membranous, or sometimes sclerotized dorsally by the extension of the lamella postvaginalis. *Ductus bursae*: It is short, membranous, in some cases weakly sclerotized dorsally. *Bursal ring*: It is normal in shape. *Corpus bursae*: This is rather stout, with compact groups of, or scattered signa. *Cervix bursae*: This is undeveloped in the Musotiminae. *Ductus seminalis*: The duct is variable in shape, sometimes apart from the bursal ring in the base. *Spermatheca*: The utricus is large and lacking of the lagena. *Papilla analis*: The portion is rather large, with the posterior setae same in the length. *Apophysis posterioris*: In the Musotiminae, the apophysis is shorter than the anterioris.

6.3 Key to the Genera of Musotiminae

1. Wings with apices produced and pointed; forewing with vein R_2 stalked with R_{3+4}; hindwing with vein $Sc+R_1$ long stalked with Rs; male genitalia with vinculum fused with costa of valva; female genitalia with signa absent, if present represented by a compact group 2
— Wings with apices broadly rounded; forewing with vein R_2 completely fused with R_{3+4}; hindwing with vein $Sc+R_1$ fused with Rs; male genitalia with vinculum articulated with costa of valva; female genitalia with scattered signa ..... *Melanochroa* gen. nov.
2. Forewing with termen incised at cell CuA_2; labial palpus with 3rd segment 1/2 as long as the 2nd; male genitalia with suprazonal sheath long; female genitalia with lagena in spermatheca ..... *Neomusotima* gen. nov.
— Forewing with termen not incised at cell CuA_2; labial palpus with 3rd segment almost as long as the 2nd; male genitalia with suprazonal sheath short; female genitalia without lagena in spermatheca ..... *Musotima* Meyrick

6.4 Description

Genus Musotima Meyrick

Musotima Meyrick, 1884: 123 (type-locality: New Zealand).

Type-species: *Diathrausta aduncalis* Felder et Rogenhofer, 1874.

External characters: Moderate to small in size, with broad wings and short legs. Head with frons rounded; vertex prominent. Labial palpus upturned; the 3rd segment slender and acute at apex. Maxillary palpus relatively short. Proboscis long, with basal scaling. Antenna short, about 1/2 as long as forewing length, thick in male and filiform in female. Ocellus present as in the other Japanese genera. Chaetosemata present.

Wing shape and venation: Forewing broad; apex protruded and rather pointed; termen strongly incised behind apex; tornus broadly rounded. Vein Sc short, reaching at costa before 1/2 of forewing length; R_1 short, not touched with Sc at apex; R_2 stalked with R_{3+4} for long distance; R_5 a little separated from

R_2 at base, curved; M_1 straight; M_2 emitting at anterior portion of posterior angle of discoidal cell; CuA_1 approximated with M_2 at base; CuA_2 arising from near posterior angle of discoidal cell; CuP being rudimentary at base; 1A curved to termen; 3A rudimentary and oblique; discocellulars curved.

Hindwing with costa curved; apex pointed; termen incised behind apex and undulate to tornus by expanding distal end of each vein. Vein $Sc+R_1$ anastomosed with Rs for short distance, shorter than 1/2 length of its vein beyond discoidal cell; M_1 straight; M_2 to CuA_1 approximated to one another basally; CuA_2 a little separated from base of CuA_1; CuP rudimentary at basal 1/2; 1A+2A straight; 3A present; discocellulars curved.

Wing marking: The marking of wing characterrized as follows: (1) Hindwing components almost similar to those of forewing, (2) each component running parallel with termen, (3) DB1 and DB2 absent, and WA, WB and WC not formed, (4) PML with posterior portion retracted proximally, especially in forewing.

Male genitalia: Tegumen short, without any ridge dorsally, fused or articulated with uncus. T-v plate absent. Vinculum rather short, dorsally fused with costa of valva. Saccus large and flat, membranous on dorsal surface. Uncus long and curved, with apical portion slender, furnished with setae. Gnathos long, slender, basally extending behind tegumen. Valva almost broad, simple, with short transtilla; sacculus with base broad triangularly, and with apical portion usually furnished with rather pointed process. Phallus rather thick; coecum penis undeveloped; suprazonal sheath very long, sometimes partly membranous. Juxta long.

Female genitalia: Lamela postvaginalis well developed near ostium brusae. Ostium bursae membranous. Ductus bursae short, membranous. Bursal ring circular. Corpus busae membranous, usually with signa on a circular. Spermatheca without lagena. Eighth tergum short, separated at mid-dorsal line; apophysis anterioris very short. Papilla analis large, erected; apophysis posterioris short.

Remarks: *Ambia* Walker contains about one hundred species in the world, and especially flourish in Oriental and Nearctic Regions. The genus is very close to *Musotima* Meyrick, 1884. *Musotima* is established for the species *Diathrausta aduncalis* Felder et Rogenhofer, 1874, occurred in New Zealand. The genus is composed of 17 nominal species from East Palearctic, Oriental and Australian Regions. Having compared the species of *Ambia sensu* Inoue, 1982 of Japan with the specimens of *Musotima aduncalis* from New Zealand, I have not found any significant difference between them. And the characters shared with these species are as follows: Male antenna thick, suppressed laterally; spur of hindleg long and each inner spur almost as long as outer one; ocellus present; wings broad, with each termen incised behind apex; vein M_2 in forewing rather separated from posterior angle of discoidal cell at base; discocellulars of hindwing emitted from vein M_1; male genitalia with tegumen short, and with vinculum fused with costa of valva. By these characters, it will be better to treat the species of *Ambia* in Japan as *Musotima*. As a result, in Japan, there are 3 species of the genus. *Musotima dryopterisivora* sp. nov. has been known as *Musotima acclaralis* Walker, 1854. And *M. tanzawensis* sp. nov. also has been known as *Ambia* sp.

Key to the Species of *Musotima*

1. Forewing with anterior portion of PML weakly curved outwards; male genitalia with cuticula exterior formed a dorsal projection on phallus; female genitalia with signa of corpus bursae consisting of rather stout spines……*M. colonalis* (Bremer)
— Forewing with anterior portion of PML excurved; male genitalia without a dorsal projection of

cuticula exterior on phallus; female genitalia with signa consisting of minute spinules·····2

2. Forewing with discocellular lunule indistinct; male genitalia with a large process from sacculus of valva; female genitalia with lamella postvaginalis large, and with 8th tergum separated at mid-dorsal line····· *M. tanzawensis* sp. nov.

— Forewing with discocellular lunule distinct, 8-shaped; male genitalia with a process from sacculus of valva; female genitalia with lamella postvaginalis slender, and with 8th tergum not separated at mid-dorsal line····· *M. dryopterisivora* sp. nov.

Musotima colonalis **(Bremer)**

Hydrocampa colonalis Bremer, 1864: 67, pl. 6, fig. 4 (type-locality: Amur).

Musotima colonalis: Meyrick, 1890: 469.

Ambia colonalis: Hampson, 1896: 204; Shibuya, 1929: 150; Inoue, 1974: 137; Inoue, 1982, I: 373, II: 243, pl. 44, fig. 37.

Oligostigma locuples Butler, 1889: 97. Disignated by Klima, 1937.

Oligostigam dives Butler, 1889: 97. Designated by Klima, 1937.

External characters: Head with frons whitish; vertex also covered with whitish scales. Labial palpus with basal 2 segments weakly curved upwards, fuscous; the 3rd acutely upturned, whitish. Maxillary palpus ringed with fuscous. Antenna about 1/2 as long as forewing length, dorsally with fulvous scales. Ocellus small but distinct.

Legs whitish. Foreleg with apical portion of each segment darkened. Midleg with apical portion of each segment as in foreleg, but paler; inner spur about 1.5 times as long as outer one. Hindleg as in midleg in color; mid-inner spur 1.5 times as long as outer one; distal-inner spur twice as long as outer one.

Thorax above with ochreous to fuscous horizontal bands, otherwise whitish; beneath white.

Male genitalia: Tegumen narrow and wide, with anterior margin incised in V-shape, and with

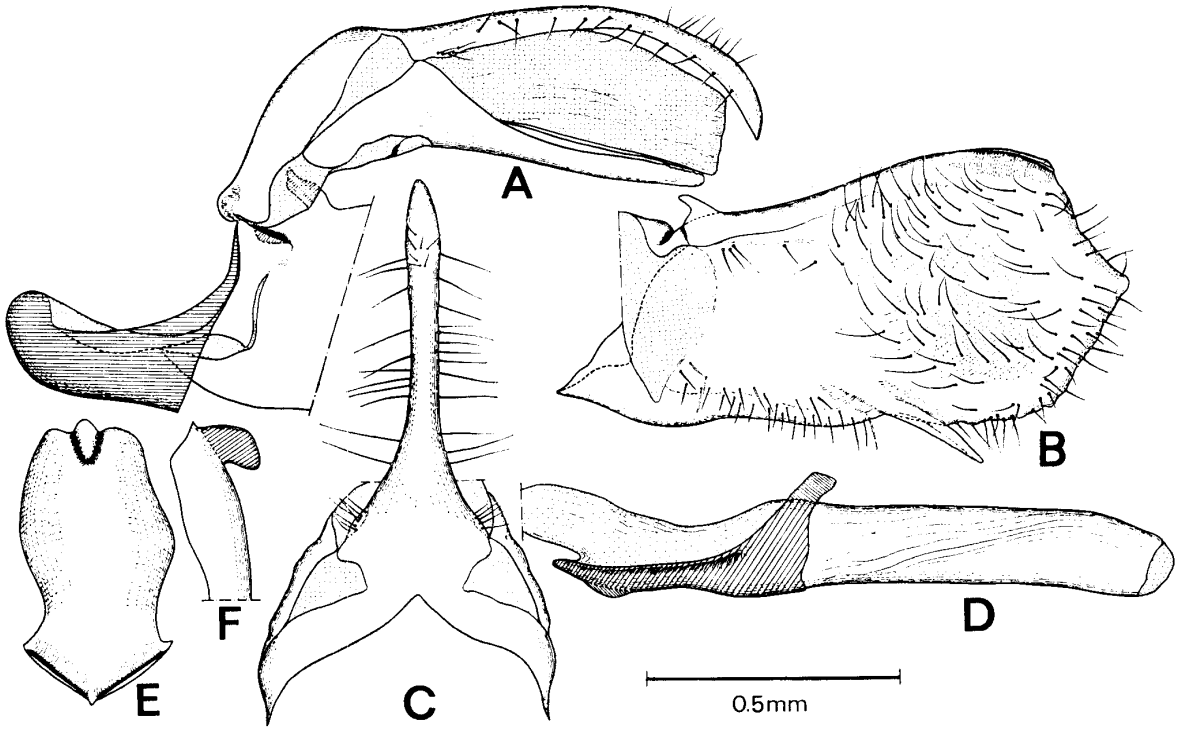

Fig. 81. *Musotima colonalis* (Bremer), male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta; F, ditto, lateral view.

posterior portion fused with uncus dorsally. Fenestrulae broadly present. Vinculum 0.7 as long as height of tegumen, becoming narrow to ventral portion, with a broad membranous area between sacculus of valva and vinculum. Saccus large and long. Uncus long, pencil-like, with apex pointed and curved downwards, and a small group of setae basally and long setae laterally. Gnathos almost straight, a little shorter than uncus, with base extended anteriorly below tegumen. Valva broad, with costa moderate and having short transtilla at proximal extreme; inner surface with dorso-apical portion flattened and curved inwards; sacculus wide at base, becoming narrow to apex which has a large, slender process extending posteriorly. Phallus long; suprazonal sheath well developed, about 0.56 as long as whole length of phallus; coecum penis undeveloped; cuticle exterior with a rectangular process dorsally near base of bulbus ejaculatorius; vesica without cornuti. Juxta oblong, with apex furnished with a rounded process in mid-ventral line.

Female genitalia: Lamella postvaginalis representing as a pair of long sclerites. Ductus bursae rather long. Bursal ring indistinct. Corpus busae large and rounded, membranous, basal 1/2 with spinules throughout; signa consisting of short spines on a distinct area of array-shaped plate. Eighth tergum short, 0.1 as long as 7th tergum, without any setae posteriorly; apophysis anterioris short, about 0.5 as long as 7th tergum; the sternum membranous, without setae. Papilla analis large and erected, with long setae same in length; apophysis posterioris a little shorter than anterioris.

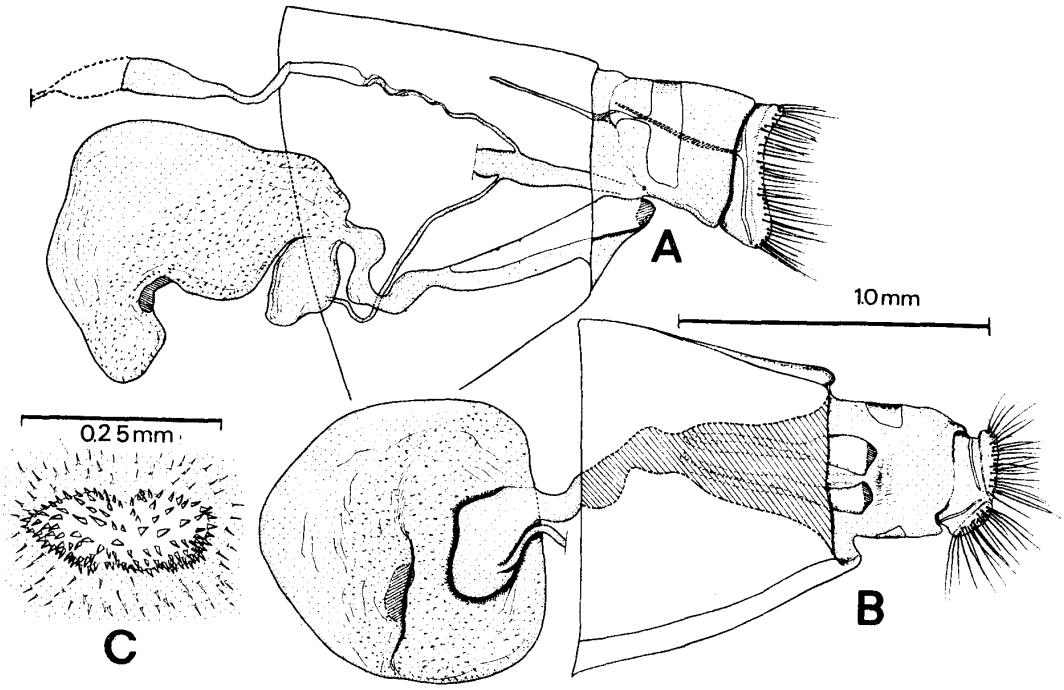

Fig. 82. *Musotima colonalis* (Bremer), female genitalia. A, Lateral view; B, ventral view; C, signa.

Size of forewing: Male, 6.5 mm; female 7.6 mm.

Immature stages: Unknown.

Specimens examined: 1 ♂, 1 ♀, Sibecha, Kushiro, Hokkaido, 13. viii. 1978 (R. Sato) (KPU).

Distribution: Japan (Hokkaido), Nepal, China, Taiwan, Amur.

Remarks: According to Inoue (1974), the record of this species from Taiwan is questionable.

The species is closely allied to the another *Musotima* species by having the similar wing marking and genital structures, but differs from the latters by the reason as will discussed

in the following description.

The species is very rare and the distribution is restricted to the Eastern part of Hokkaido in Japan.

Musotima tanzawensis sp. nov.

External characters: Head with fron whitish, tinged with brown; vertex covered with long, white scales. Labial palpus with basal 2 segments extending anteriorly and stout, fuscous; the 3rd abruptly dilating upwards, long and slender, acuminate at apex. Maxillary palpus short, fuscous, with 4th segment not so dilated. Proboscis with base white. Antenna about 1/2 as long as forewing length, with dorsal surface furnished with dense, fulvous scales except for fuscous apical portion of each segment. Ocellus distinct.

Legs white. Foreleg with femoral tip fuscous; tibia widened laterally with distal 1/2 dark brown on dorsal surface; tarsomeres ochreous at apices. Midleg with femoral tip as in foreleg in color; tibia with weak fuscous dots at middle and tip dorsally; tarsomeres suffused with ochreous at middle; inner spur in male about 1.5 times as long as outer one. Hindleg almost as in midleg; mid-inner spur 1.5 times as long as outer one; distal-inner spur in male 1.5 times and in female almost as long as outer one.

Thorax above fuscous mixed with white scales, beneath purely white. Abdomen above white mixed with dark brown and fulvous scales, beneath whitish.

Wing shape and venation: Wings rather broad. Forewing with costa weakly curved; apex produced triangularly; termen strongly incised behind apex and broadly curved to rounded tornus. Vein Sc short, reaching to costa beyond end of discoidal cell; R_2 anastomosed with R_{3+4} for 2/3 the length of R_2 beyond discoidal cell; R_4 curved and extending along produced apex; M_2 separated from posterior angle of discoidal cell at base; CuA_2 curved, emitted from near posterior angle of discoidal cell.

Hindwing with termen incised behind apex, undulate. Vein $Sc+R_1$ short-stalked with Rs for 2/5 of its length beyond discoidal cell; M_1 straight; M_2, M_3 and CuA_1 with bases approximated to one another; CuA_2 emitted from proximal 3/4 of posterior margin of discoidal cell; CuP weak in basal 1/2.

Wing marking: Forewing with line components fuscous, ground components ochreous to fuscous. BL and SBL broad, oblique inwardly. AMG fuscous at anterior to discoidal cell and fulvous posterior to it. ML running to posterior margin of discoidal cell outwardly, then straight to posterior margin, with proximal margin clearly edged by white area. Discocellular lunule being a small white spot. PML arising at 2/5 of costa, slightly curved outwardly to vein M_2, then diminished there, and retracting proximally and reappearing near posterior angle of discoidal cell, then ended at 1/2 of posterior margin. Area between ML and PML broadly fuscous posteriorly. PMG ochreous but becoming suffused with dark ochreous at anterior portion. SML narrow, parallel with termen to cell CuA_2. SMG evenly ochreous. Cilia fulvous except darker apex and medial portion, and with dark brown line at proximal 1/3.

Hindwing with BL and AML pale fuscous. ML as in forewing, but lacking of anterior portion. Discocellular lunule representing as a blackish bar. PML with anterior portion retracted proximally, parallel with termen. PMG ochreous, but suffused with fuscous at proximal margin. SML slightly sinuous to vein 1A+2A. SMG and cilia as in forewing.

Male genitalia: Different from *colonalis* as follows: Tegumen with anterior margin more roundly excurved, with posterior margin not fused with uncus. Vinculum shorter, about 2/3 as long as height of tegumen. Uncus shorter, without setae at base. Valva with costa more rounded; apical margin not so acute; sacculus with a free process slightly extending upwards, whereas in *colonalis* extending downwards. Phallus shorter; suprazonal sheath with left side membranous; cuticule exterior without dorsal process appearing in *colonalis*. Juxta with postero-ventral projection broadly swollen, while in *colonalis* with rectangular process.

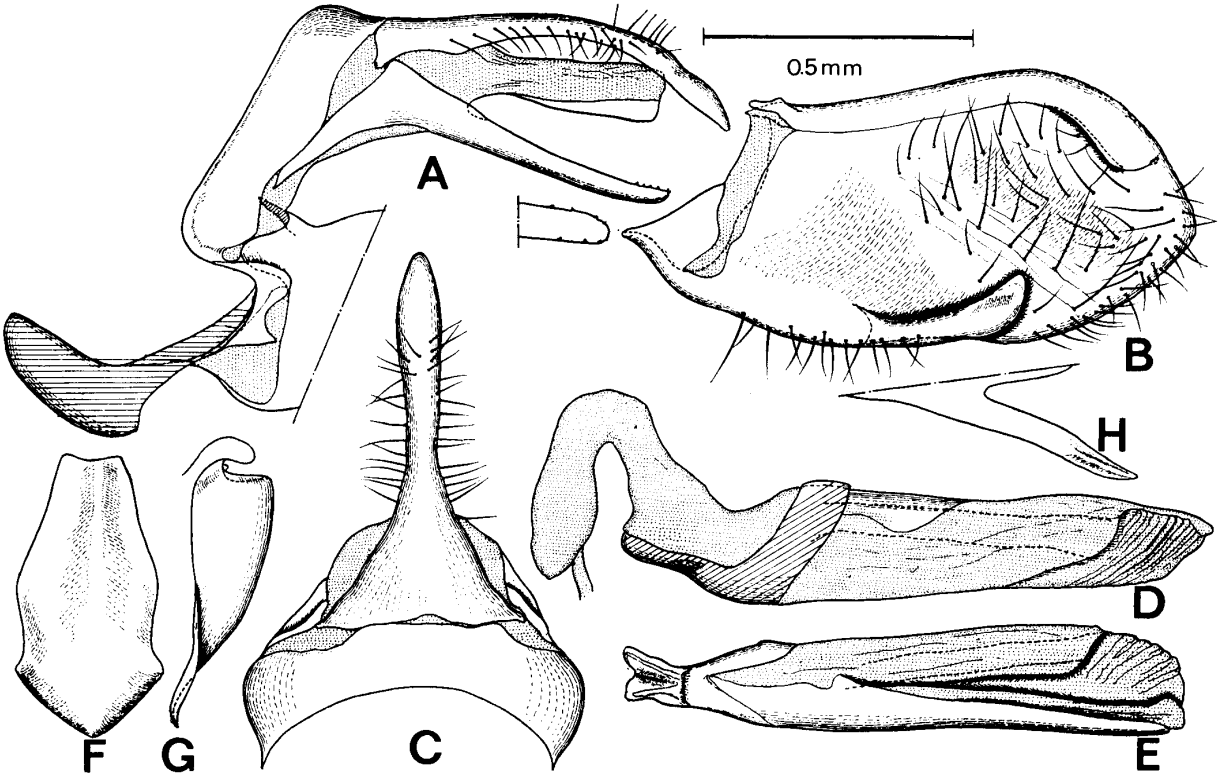

Fig. 83. *Musotima tanzawensis* sp. nov., male genitalia. A, lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, ventral view; F, juxta; G, ditto, lateral view.

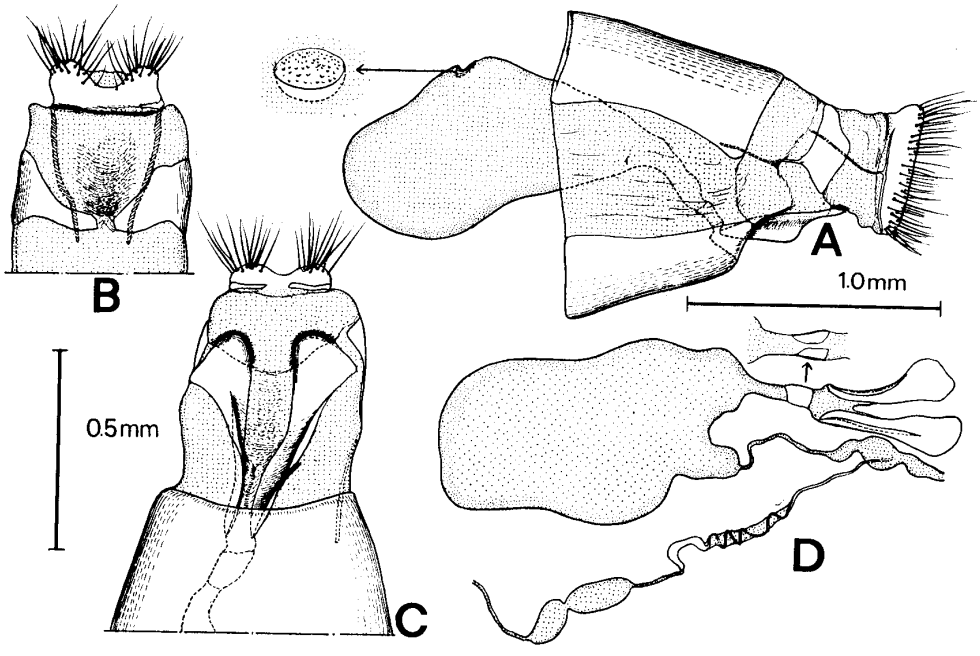

Fig. 84. *Musotima tanzawensis* sp. nov., female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, ventral view.

Female genitalia: Also resembles *colonalis*, but separated from it as follows: Bursal ring semicircular; corpus bursae evenly membranous, without spinules seen in *colonalis*; signa present on a circular plate; cervix bursae smaller; 8th tergum almost lonvoidal in shape in lateral view, while in *colonalis* triangular.

Size of forewing: Male, 6.3 - 8.6 mm; female, 7.4 - 7.6 mm.

Immature stages: Unknown.

Holotype: Male, Iyo-dani, Tokushima Pref., 10. x. 1980 (S. Hashimoto) (KU). Paratypes: 2 ♂, 2 ♀. — 1 ♂, Bodai, Tanzawa, Kanagawa Pref., 23. vii. 1974 (H. Iwamoto) (IC); 1 ♂, 2 ♀, Mt. Koya-san, Wakayama Pref., 5. vi. 1980 (S. Hashimoto) (KPU).

Distribution: Japan (Honshu, Shikoku).

Remarks: The species was first treated as *Ambia* sp. by Inoue (1982). The species is allied to *Musotima colonalis* (Bremer, 1864) by having the similar wing venation and shape, and the male genitalia with a process of sacculus, and so on. But *tanzawensis* is distinguished from the latter in the darker wing grounds, the male genitalia with tegumen fused with uncus and the female genitalia without spinules on corpus bursae.

The specimens of this species are collected at rather mountainous areas, but the biology is unknown.

***Musotima dryopterisivora* sp. nov.**

Musotima acclaralis: Marumo, 1923: 187; Shibuya, 1928: 135; Inoue, 1954: 162.
Ambia acclaralis: Inoue, 1984, I: 373, II: 243, pl. 44, figs. 55, 56.

External characters: Head with frons and vertex whitish. Labial palpus with basal 2 segments short-scaled, fuscous except whitish portion partly; the 3rd slightly narrowed at base, whitish with some brown scales. Maxillary palpus with basal 1/3 fuscous, and with apex truncate and fuscous. Proboscis with whitish scaling at base. Antenna about 2/3 as long as forewing length. Ocellus distinct, touched with eye.

Foreleg whitish to fulvous; coxa with a tuft of scales ventrally as in *acclaralis*, fulvous; femoral apex, tibia and proximal 3 tarsomeres fuscous on dorsal surfaces; otherwise whitish. Midleg with apices of femur, tibia and medial portions of proximal 3 tarsomeres suffused with fuscous on dorsal surfaces; spurs as in the other species of *Musotima*. Hindleg almost as in midleg except that all spurs long and equal in length.

Wing shape and venation: Forewing with costa slightly concave at middle; apex a little produced; termen as in the other species of *Musotima*; tornus weakly angulate. Vein Sc ended at 3/5 of costa, with apex indistinct; R_1 anastomosed with R_2 + R_{3+4} at base, while in *acclaralis* both veins separated; R_2 anastomosed with R_{3+4} for its 1/2 length beyond discoidal cell; R_5 emitted from anterior angle of discoidal cell, with apical portion curved; M_1 straight; M_2 with base separated from posterior angle of discoidal cell; M_3 and CuA_1 arising from posterior angle of discoidal cell; CuA_2 curved, emitted from near posterior angle of discoidal cell as in *tanzawensis*; CuP obscure at base; 3A indistinct; discocellulars erect.

Hindwing with costa weakly curved; apex rounded; termen strongly incised behind apex, thence expanded roundly between vein M_2 and CuA_2. Vein Sc+R_1 anastomosed with Rs for its 1/3 length beyond discoidal cell; M_1 straight; M_2 straight, rather separated from posterior angle of discoidal cell; M_3 and CuA_1 approximated as in forewing; CuA_2 emitting from proximal 2/3 of posterior margin of discoidal cell; CuP, 1A+2A and 3A distinct; discocellular erected, arising from proximal 2/5 of vein M_1.

Male wing marking: Forewing with BL and SBL fuscous. AMG rather wide, fuscous except for whitish semihyaline portion in discoidal cell. AMW continued to posterior margin in same width, while in *acclaralis* AMW expanded distally at posterior portion of discoidal cell to form a special white spot at there. Discocellular lunule kidney in shape, distinct. PML from proximal 3/4 of costa curved to vein CuA_2, then running to 1/2 of posterior margin as in the other *Musotima* species. Area between ML and PML evenly fulvous. PMW rather broad at costa and narrowing to vein M_3, diminished there and

reappeared at posterior portion to vein CuA_2. PMG and SMG fulvous. SML almost parallel with termen, fuscous. ML absent. Cilia evenly fulvous.

Hindwing almost as in forewing, but different from the latter as follows: BL absent; SBL weakly appeared behind discoidal cell; AMG dark ochreous, with distal margin more indented; PMG darker; cilia of posterior margin longer and white.

Female wing marking: Different from male by having both wings ground components evenly fuscous to dark ochreous, thence 3 white areas, AMW, PMW and SMW significantly marked.

Male genitalia: Tegumen short, rounded, fused with uncus posteriorly, with antero-ventral portion extended roundly. Vinculum narrower than the other species of *Musotima*, almost as long as height of tegumen. Saccus long, rounded in lateral view. Uncus aristate in dorsal view, setose laterally, with apex curved downwards. Gnathos almost as long as uncus; base extending to costa of valva; apical portion slender with distinct spines dorsally. Valva broad, with transtilla; costa with a free process at apex; apical portion triangularly produced; inner surface with apical 1/2 furnished with many setae; sacculus wide at base, without projection at apex. Phallus with coecum penis undeveloped; subzonal sheath with left side membranous; vesica with many minute spinules. Juxta with proximal margin triangular, and with apex with mid-ventral process as in *colonalis*.

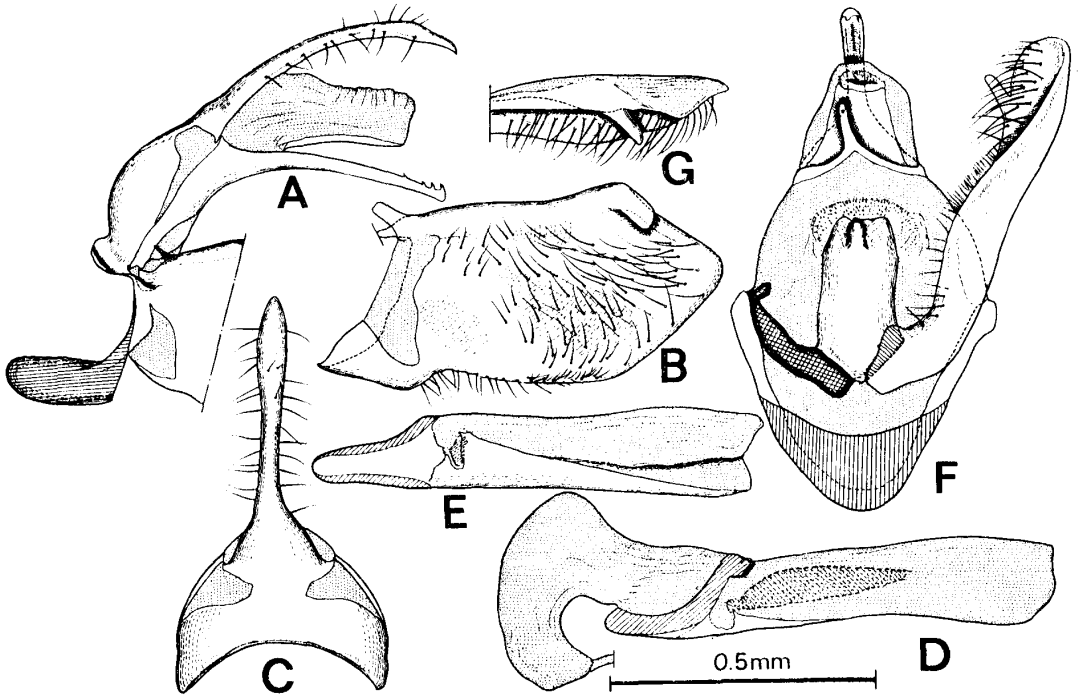

Fig. 85. *Musotima dryopterisivora* sp. nov., male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, ditto, ventral view; F, postero-ventral view, left valva removed; G, apical portion of valva, dorsal view.

Female genitalia: Lamella postvaginalis well developed, exteding to ductus bursae. Ostium bursae wide. Corpus bursae stout, membranous, attenuate at middle; apical portion with signa which are consisted of many minute spinules on circular area. Ductus seminalis with base far from bursal ring, swollen at middle. Spermatheca long, without lagena. Eighth tergum recognized as a narrow U-shaped sclerite in dorsal view; apophysis anterioris longer than those of the other *Musotima*, about 3/4 as long as 7th tergum. Papilla analis small with setae, of which anterior ones longer than posterior ones; apophysis posterioris 3/4 as long anterioris.

Size of forewing: Male, 5.8 - 6.6 mm; female, 6.0 - 6.3 mm.

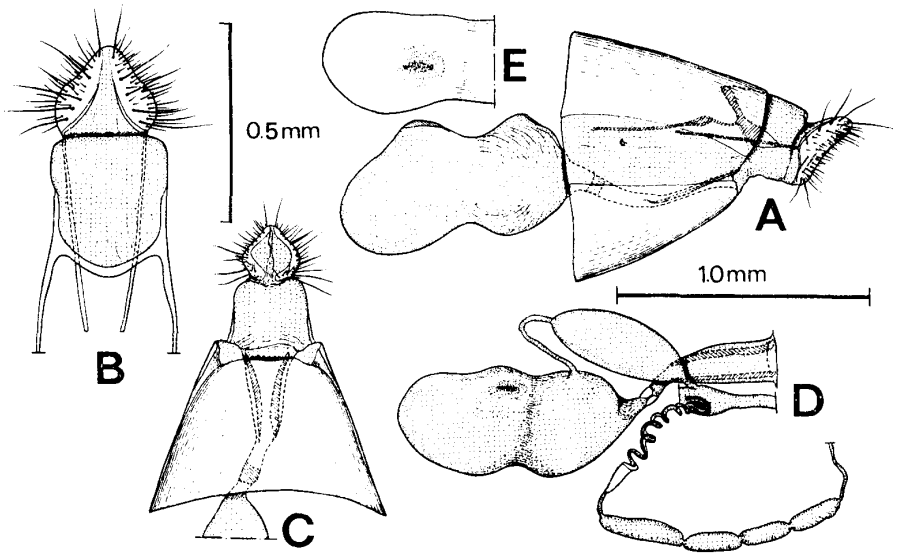

Fig. 86. *Musotima dryopterisivora* sp. nov., female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, dorsal view.

Immature stages: Unavailable in this time.

Holotype: Male, Miyanoura, Yakushima Is., 28. x. 1959 (H. Kuroko) (HBL, KU). Paratypes: 3 ♂, 2 ♀. — 2 ♂, Minoo, Osaka Pref., 4. x. 1974, 13. vii. 1976 (T. Saito) (KPU); 1 ♂, Mt. Takakuma-yama, Kagoshima Pref., 15. vii. 1960 (T. Kumata) (HK); 1 ♀, data as in holotype (HBL, KU); 1 ♀, Miyanoura, Yakushima Is., 14. x. 1972 (T. Watanabe) (IC).

Distribution: Japan (Honshu, Kyushu, Yakushima Is.).

Biological notes: A fern, *Dryopteris* sp. (undet.), has been known as the host (Nakamura, 1977), however, its close biology is unknown.

Remarks: This species is closely allied to *M. acclaralis* (Walker, 1859), and has been treated as a Japanese form of the latter species up to now. Having compared the Japanese form with the original description, Hampson's redescription and the photo of the type specimen of *M. acclaralis* (pl. 12-6), I have come to the conclusion that the Japanese form is a distinct new species from *M. acclaralis* by having the much smaller wings, the forewing venation with R_1 anastomosed with $R_2 + R_{3+4}$ and wing marking without a distinct white spot behind discoidal cell seen in *acclaralis*.

The present new species is easily distinguishable from the other *Musotima* species in the forewing venation as mentioned above, the male genitalia with a free process from apex of costa on valva and female genitalia with U-shaped 8th tergum.

The larval and pupal morphology is referred to Nakamura (1977).

Genus *Neomusotima* nov.

(feminine)

Type-species: *Neomusotima fuscolinealis* sp. nov. by monotypy.

External characters: Head with frons rather flat, not produced; vertex elevated. Labial palpus upturned, with 3rd segmnet short, about 1/2 as long as the 2nd, conical. Maxillary palpus moderately developed, apically dilated by scales. Proboscis long with basal scaling. Antenna short, in male thick and a little suppressed laterally, in female ciliate. Ocellus small. Legs short; spurs of mid- and

hindlegs long.

Wing shape and venation: Almost as in *Musotima* but different from the latter in the following points. Forewing with termen incised at cell CuA_2; vein Sc reaching to 1/2 of costa; R_2 stalked with R_{3+4} for shorter distance; R_5 emitting just behind base of R_{3+4}, whereas in *Musotima* a little separated; CuP absent; discocellulars rather straight.

Hindwing with vein M_2 more separated from M_3 at base.

Wing marking: Similar to *Musotima* but different from the latter as follow: All line components more obscure except PML and SML; PML with posterior portion not so retracted as in *Musotima* and ending

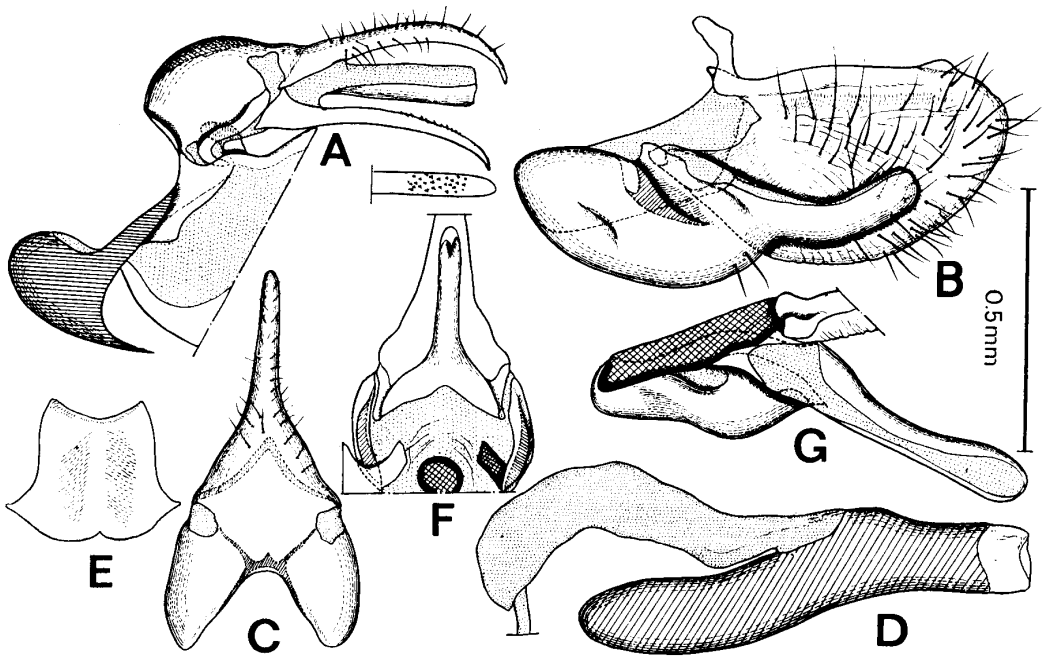

Fig. 87. *Neomusotima fuscolinealis* sp. nov., male genitalia. A, Lateral view; B, valva, inner view; C, tegumen and uncus, dorsal view; D, phallus; E, juxta; F, gnathos, postero-ventral view; G, sacculus, dorsal view.

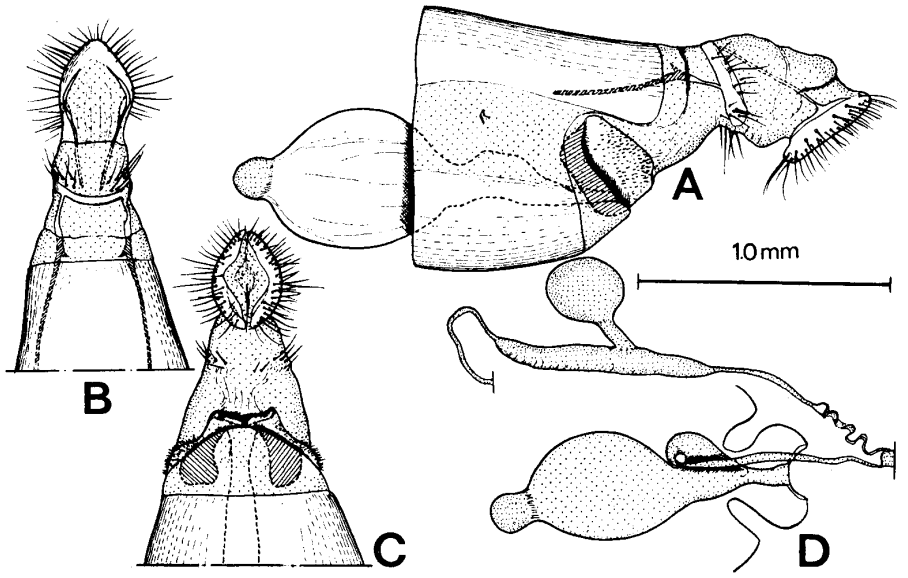

Fig. 88. *Neomusotima fuscolinealis* sp. nov., female genitalia. A, Lateral view; B, 8th to 10th segments, dorsal view; C, ditto, ventral view; D, bursa and spermatheca, dorsal view.

at proximal 3/5 of posterior margin; white areas between the lines absent except for SMW.

Male genitalia: Significantly different from *Musotima*. Tegumen longer than in *Musotima*, with X-shaped ridge dorsally, and fused with uncus posteriorly. Vinculum longer than height of tegumen. Saccus large and rounded laterally. Uncus rather long, curved with several short setae. Gnathos as long as uncus, ventrally curved to apical portion. Valva with sacculus well developed to produce a large projection posteriorly. Phallus short, with transtilla; coecum penis developed; suprazonal sheath moderate in length. Juxta long as in *Musotima*, but apical portion without mid-ventral projection.

Female genitalia: Lamella postvaginalis represented by a broad plate near ostium bursae and with minute spinules throughout the plate. Ductus bursae membranous. Bursal ring transformed to a narrow sclerite near lamella postvaginalis. Corpus bursae evenly membranous without signa; apical portion with a small apendix sac. Eighth tergum short, with several setae on it. Apophyses longer than in *Musotima*. Papilla analis wide and erected.

Remarks: The genus resembles *Musotima* Meyrick in the wing venation and marking, but differs from the latter in the labial palpus with shorter 3rd segment, the wing with incised termen at cell CuA_2, the male genitalia with coecum penis more developed and without apical projection on juxta and the female genitalia without signa.

In Japan, the genus is composed of a single type-species, new species, distributed in South Honshu to the Ryukyus. The biology is unknown up to now.

***Neomusotima fuscolinealis* sp. nov.**

External characters: Head with frons fuscous to fulvous; vertex fulvous. Labial palpus with basal segment whitish, with apical 2 segments tinged with fuscous. Maxillary palpus fuscous. Proboscis with whitish scaling at base. Antenna of male 2/5 the length of forewing, with a group of fan-shaped, fulvous scales at each flagellar segment dorsally; that of female a little longer and slenderer, with fulvous scales dorsally. Foreleg with antero-dorsal surfacess of coxa to tibia fuscous, otherwise whitish. Midleg almost whitish except slightly fulvous anterior surface of femur and tibia; inner spur 1.5 times as long as outer one which is blackish ventrally. Hindleg whitish; all spurs long, almost the same in length. Thorax and abdomen above fuscous, beneath paler.

Wing shape and venation: As described for the geus.

Wing marking: Forewing with ground components dark brown and line components blackish fulcous. Base to ML as in *Musotima* species. Discocellular lunule represented by a short fuscous bar, not forming white area. PML narrow, parallel with termen, and ending at proximal 3/5 of posterior margin. PMW not formed. White patch formed at costal margin just proximal to PML. SMW parallel with termen, almost continued to vein 1A, and broader at cell CuA_2. Cilia whitish except basal fuscous portion at proximal 1/3.

Hindwing with base to AMG evenly dark brown. ML narrow, parallel with termen. Discocellular lunule recognized as a small fuscous spot. PML narrow, more undulate than in forewing. PMW absent. SML represented by series of small spots on each vein. Cilia as in forewing.

Male genitalia: Tegumen rounded at lateral view, with ventral extension to near costa of valva. Vinculum 1.4 times as long as height of tegumen, rather wide dorsally and narrowing to ventral portion. Saccus large and rounded, dorsally membranous. Uncus curved to flat apex, 1.5 times as long as height of tegumen. Gnathos slender; base not extending anteriorly; apex curved as in uncus, dorsally with several minute spinules. Valva rather short, with apical margin rounded; costa with apex a little produced dorsally; inner surface with several setae; sacculus large, with characteristic apical projection, which is membranous dorsally. Phallus with coecum penis extending downwards; vesica with some short

cornuti.

Female genitalia: Lamella postvaginalis partly fold in intermembrane between 7th and 8th sterna. Corpus bursae short, almost as long as 7th tergum, egg-shaped; apendix sac emitted from apical portion of corpus bursae, small, rounded. Apophysis anterioris a little curved, about 3/5 as long as 7th tergum. Ductus seminalis slender. Spermatheca with lagena cubic in shape, emitting from middle of utricus. Eighth sternum with some setae. Apophysis posterioris slender, a little shorter than anterioris.

In addition, 7th sternum 2/3 as long as 7th tergum.

Size of forewing: Male, 4.7 - 5.7 mm; female, 5.4 - 6.0 mm.

Holotype: Male, Yuwan, Amami-Oshima Is., Amami Iss., 28 - 30. vi. 1974 (H. Makihara) (KU). Paratypes: 3 ♂, 3 ♀. — 1 ♂, Yugawara, Kanagawa Pref., 23. ix. 1979 (H. Iwamoto) (IC); 1 ♀, Kyoto, Kyoto Pref., 25. x. 1955 (Y. Takeuchi) (UOP); 1 ♂, Yatsushiro, Kumamoto Pref., 8. viii. 1977 (A. Seino) (KPU); 1 ♀, Kaseda, Kagoshima Pref., 23. vii. 1977 (Y. Yoshiyasu) (KPU); 1 ♂, Kurio, Yakushima Is., 26. x. 1959 (H. Kuroko) (HBL, KU); 1 ♀, Chinen, Okinawa-Honto Is., the Ryukyus, 24. iii. 1980 (K. Yasuda) (KPU).

Distribution: Japan (Honshu, Kyushu, Yakushima Is., the Ryukyus).

Genus *Melanochroa* nov.

(melanos μελανός (=black) + chroa χροιά (=color) (feminine))

Type-species: *Melanochroa yasudai* sp. nov. by monotypy.

The new genus is allied to *Musotima* Meyrick, 1884, but easily separable from the latter in the following characters.

External characters: Head with frons more expanded. Labial palpus shorter, with 3rd segment almost as long as the 2nd as in *Musotima*. Maxillary palpus more dilated by long scales. Antenna and legs as in *Musotima*. Ocellus larger.

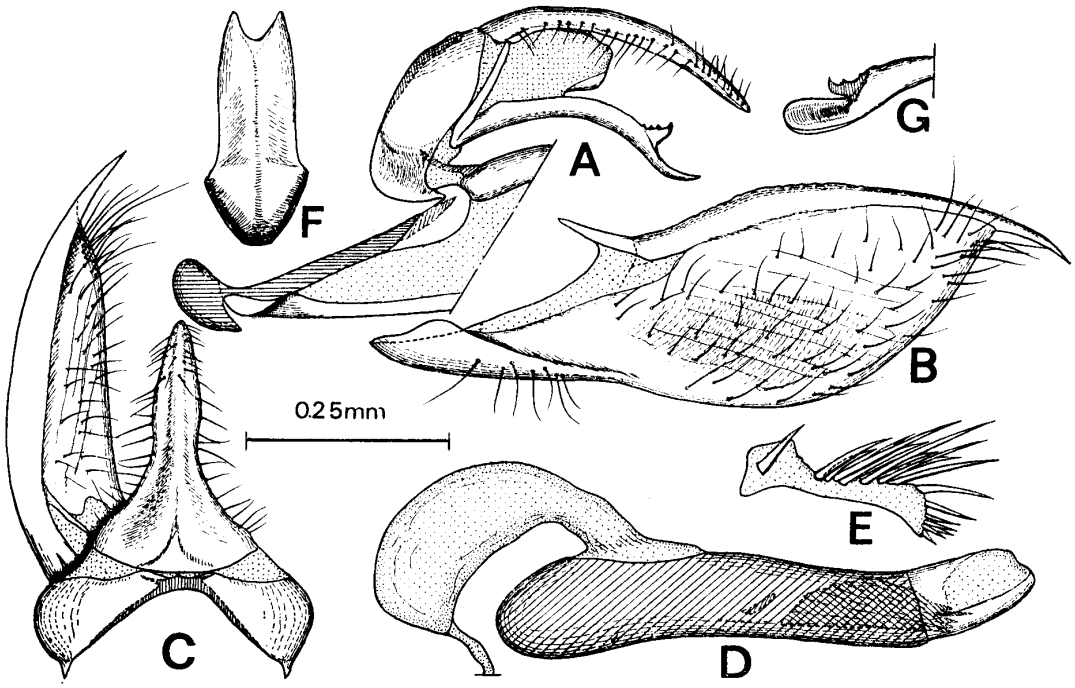

Fig. 89. *Melanochroa yasudai* sp. nov., male genitalia. A, Lateral view; B, valva, inner view; C, tegumen, uncus and valva, dorsal view; D, phallus; E, ditto, cornuti; F, juxta; G, apical portion of gnathos.

Wing shape and venation: Wings narrower. Forewing with apex rounded, while in *Musotima* produced; termen more weakly incised; tornus more rounded. Vein Sc shorter, reaching to proximal 3/5 of costa; R_1 absent; R_3 completely fused with R_4, in *Musotima* both veins stalked; M_2 with base rather separated from that of M_3 than in *Musotima*.

Hindwing with apex and termen as in forewing. Vein $Sc+R_1$ completely fused with Rs to wing margin; M_3 stalked with CuA_1 at base, while in *Musotima* M_3 emitted from discoidal cell; discoidal cell much shorter, about 1/4 the length of wing.

Wing marking: Line components indistinct at margins. Ground components dark brown to blackish in both sexes. Forewing with base to AMG lacking of distinct lines, whereas in *Musotima* having distinct BL and SBL. PMW more undulated and ended more distally. SMW obscure and interrupted, while in *Musotima* continuous. Hindwing with discocellular lunule narrower. PMW and SMW as in forewing.

Male genitalia: Tegumen shorter and wider, with posterior margin separated from base of uncus. Vinculum narrower and more obliquely developed. Uncus more strongly curved ventrally, with lateral setae. Gnathos longer, with base angle to appear in L-shape in lateral view. Valva longer with transtilla developed as in the other Musotiminae; costa with apex extending far beyond valval body. Phallus longer, with more distinct several spinules of cornuti; coecum penis short as in *Musotima*.

Female genitalia: Ductus bursae longer, with dorsal wall narrowly sclerotized. Bursal ring smaller. Corpus bursae longer and larger, with much more spinules of signa. Spermatheca longer, without lagena.

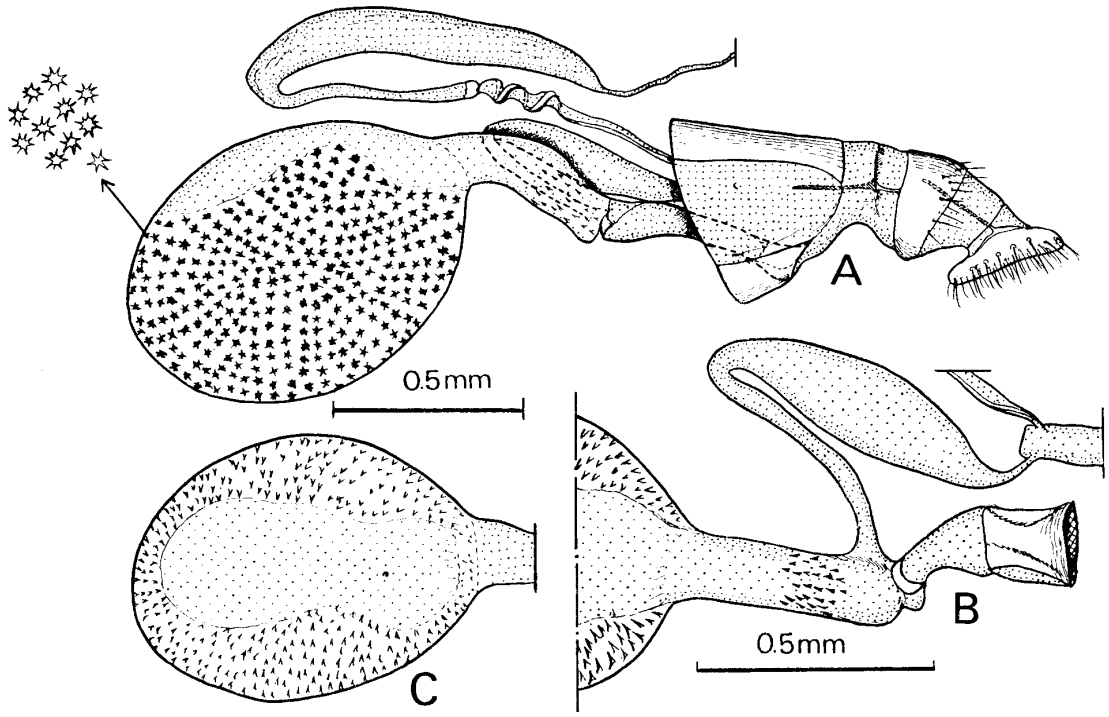

Fig. 90. *Melanochroa yasudai* sp. nov., female genitalia. A, Lateral view; B, base of corpus bursae, dorsal view; C, apical portion of corpus bursae, dorsal view.

Remarks: The new genus is allied to *Musotima* Meyrick, but differs from the latter by the forewing with vein R_1 absent, the hindwing with vein $Sc+R_1$ completely fused with Rs, the male genitalia with tegumen separated from base of uncus and the female genitalia with longer corpus bursae.

The genus is established by a single type-species of *Melanochroa yasudai* sp. nov., which is known from the Ryuskyus, Japan.

Melanochroa yasudai sp. nov.

External characters: Head with frons fuscous with metallic scales, and with vertex fuscous. Labial palpus evenly upturned, fulvous; 3rd segment a little flattened. Maxillary palpus fulvous. Proboscis with fulvous scaling at base. Antenna 2/3 as long as forewing length, fuscous dorsally.

Foreleg with dorsal surface of tibia and tarsus fuscous, otherwise whitish. Midleg with dorsal surfaces of tibia and tarsus fuscous, the others fulvous; inner spur twice as long as outer one. Hindleg fulvous except dorsal surfaces of tibia and tarsus faintly suffused with fuscous; spurs as in *Musotima* spp.

Wing shape and venation: As described for the genus.

Wing marking: Wings scattered with metallic scales, especially on white areas. Forewing with base to AMG evenly blackish. AMW inwardly curved behind discoidal cell. Discocellular lunule purely white, reniform. PMW represented by double curved lines to posterior margin. SML distinct at anterior portion obliquely inwards, otherwise faintly marked. Cilia fuscous except for purely white portion between cells M_1 and M_2, and CuA_1 and CuA_2, with proximal 1/3 having darker line.

Hindwing almost as in forewing, but discocellular lunule indistinct, AMW almost parallel with termen and anterior oblique portion of SMW absent.

Male genitalia: Tegumen with inner ridge along anterior margin. Vinculum a little longer than height of tegumen. Uncus with base wide, with many setae at apical 1/2 dorsally. Gnathos almost as long as uncus, with a horn-like process mid-dorsally. Valva elongate, with inner surface almost flat and furnished with setae; costa with apical process extending posteriorly. Phallus almost straight; coecum penis about 1/5 as long as whole length of phallus; cornuti consisting of some 20 spinules. Juxta about 3 times as long as width.

Female genitalia: Ductus bursae longer than 7th tergum, membranous except partly sclerotized distal portion of dorsal wall. Corpus bursae reaching to 1st abdominal segment, with base rather narrow and furnished with some rows of slender spinules; apical swollen portion with many distinct spinules of signa except in dorsal portion. Base of each spinule star-marked. Eighth tergum with short setae postero-dorsally; apophysis anterioris 2/3 as long as 7th tergum. Apophysis posterioris a little longer than anterioris.

Size of forewing: Male, 3.9 - 4.6 mm; female, 4.2 mm.

Immature stages: Unknown.

Holotype: Male, Mt. Inadake, Okinawa-Honto Is., the Ryukyus, 27. iii. 1980 (K. Yasuda) (KU). Paratypes: 2 ♂, 1 ♀, same data as holotype (KPU).

Distribution: Japan (the Ryukyus).

Remarks: The present new species is collected at Okinawa-Honto Is., and no allied species is known up to now. The biology is unknown.

The new species is named in honor of Mr. K. Yasuda, Okinawa Pref., who collected and kindly offered me the invaluable specimens.

7. Systematic position of the Nymphulinae and the Musotiminae

Concerning the systematic position of the Nymphulinae, including the Musotiminae by the previous authors, Lange (1956) stated that the Nymphulinae might be a monophyletic group and derived from the "*Scoparia*-like Pyraustinae". Munroe (1972) mentioned the Nymphulinae are a relatively primitive group among the Crambiform subfamilies by having the short praecinctorium. But they did not indicate the detailed position of the Nymphulinae in the Pyralidae.

Recently the phylogeny of the Pyralidae was discussed by Roesler (1973) and Kuzunezov and Stekolnikov (1979a) as mentioned below.

Roesler (1973) showed the phylogenetic scheme of the Pyralidae based on the Hennig's cladistic method. In his scheme, the Nymphulinae have a sister group relationship with the collective group including Evergestinae, Pyraustinae and Scopariinae (see Fig. 101). All these subfamilies have a common ancester with the Crambinae, formerly with Schoenobiinae. The Acentropinae (*Acentria* of the Schoenobiinae *sensu* Munroe, 1972) were treated as an independent family Acentropidae.

On the other hand, Kuzunezov & Stekolnikov (1979a) offered their view on the phylogeny of the Pyralidae on the basis of the male genitalia with the musculatures and functions. According to them, the Nymphulinae have a sister group relationship with the group consisting of the Pyraustinae, Evergestinae, Glaphiriinae and Odontiinae. And the Schoenobiinae might be close to the group. The Scopariinae have a common ancester with all subfamilies mentioned above, which are treated as the Pyraustidae collectively. The Crambinae were admitted as the distinct family Crambidae (Fig. 101).

I think the opinion of Roesler is not always accepted because the characters used for the consideration of the phylogeny are not appropriate in some points. For example, he thought the 3-segmented maxillary palpus was assumed to be an autapomorphic condition shared with the species of the Crambinae. But it is always 4-segmented in the Japanese species. And a synapomorphic condition shared with the Nymphulinae is thought to be aquatic in life. But some other aquatic species are known in other subfamilies.

Kuzunezov & Stekolnikov (1979b) described the male genitalia of one or more species per each subfamily or family. However, they sometimes showed the different musculature in comparison. For example, they stated that, in the musculature of *Elophila nymphaeata* (L.), a muscle m3 was arisen from the tegumen and ended to valva, while I found that in *E. interruptalis* (Pryer) of Japan., related *E. nymphaeata*, the muscle was inserted from the tegumen to the t-v plate. They also wrongly admitted another muscle combined the tegumen with the t-v plate and named it as m12. It is very probable that they examined so restricted species as to compare the male genital structures in the pyralid subfamilies.

In this study the systematic position of the Nymphulinae and Musotiminae are discussed based on many important characters.

Head: The maxillary palpus is 4-segmented without exception, differing from the view by Roesler. The proboscis is reduced and short in the Schoenobiinae and some species of Nymphulinae and others. The labial palpus is always 3-segmented except *Acentria ephemerella* (only the exotic species examined in the study as a representative of *Acentria*) with 2-segmented palpus, which is assumed to be synapomorphic for *Acentria*.

Wing venation: The rooped condition of the vein 3A in the Pyraustinae is characteristic aut to this subfamily and assumed to be autapomorphic condition. The presence of the vein CuP is rather important in the Schoenobiinae, but it is shared with some species of the Nympulinae and others.

Praecinctorium: It is developed in all Crambiform subfamilies, especially in the Pyraustinae the lobe is long and divided at the apex as mentioned by Munroe (1972). The

other tympanal organ is similar throughout the subfamilies.

Male genitalia: The t-v plate is developed in the Nymphulinae, Schoenobiinae and *Acentria*, although the plate in the Schoenobiinae is called "subteguminal process". And it might be assumed to be an autapomorphic condition for these subfamilies. The sclerite has a muscle (m3) from the tegumen, and it also has another muscle from the vinculum ventrally (m4). That condition is also unique in the pyralid species. The cochlear of the gnathos is undeveloped in the Pyraustinae and Glaphyriinae. And the base of the cochlear is extended anteriorly along the ventral side of the tegumen in the Musotiminae and Scopariinae. The coremata is seen in the Pyraustinae *s. lat.* at the antero-lateral portion of the tegumen and in the Schoenobiinae at the valval base. The each condition is assumed to be autapomorphic condition for each subfamily.

The characters of the male genitalia are summarized as follows (Table 2).

Table 2. The character states of the male genitalia based on Japanese Pyralidae

Subfamily	Transtilla	Cochlear of gnathos	Subscaphium	Musculature	
				m3	m4
Anchylolomiinae	+	+	+	Tg-Cs	Vn-Cs
Crambinae	+	+	+	Tg-Cs (Tr)	Vn-Cs
Schoenobiinae	−	+	+	Tg-Tv	Vn-Tv
Nymphulinae	−	+	+	Tg-Tv	Vn-Tv
Musotiminae	+	+	+	?	?
Scopariinae	+	+	+	Tg-An	Vn-Cs
Evergestinae	++	+	+	Tg-Cs	Vn-Tr
Glaphyriinae	++	−	+	?	?
Pyraustinae	++	−	+	Tg-Tr (Cs)	Vn-Cs
Galleriinae	++	−	+	?	?
Phycitinae	++	+	+	Tg-Tr	Vn-Cs
Epipaschiinae	++	+	−	Tg-Cs	Vn-Cs
Pyralinae	++	+	−	Tg-Cs	Vn-Cs

Transtilla (Tr): ++, well developed, +, developed, −, undeveloped.
Cochlear of gnathos and Subscaphium: +, developed, −, undeveloped.
Tg=Tegumen, Cs=Costa, Tv=T-v plate, Vn=Vinculum.

Female genitalia: The Scoparinae have the appendix bursae and the Hawaiian species also have the organ (Zimmerman, 1958). This feature is considered to be autapomorphic to this subfamily. And the lamella postvaginalis is seen only in Scopariinae and Musotiminae. The Crambinae also have the special plate near the ostium bursae to some extent. The sclerite is corresponding to the lamella postvaginalis in other subfamilies and also another families of the Lepidoptera. But it is interesting that the development is corelated with the lacking of the bursal ring which is usually seen in other subfamilies. So the sclerite near the ostium bursae appeared in the Crambinae may be different in the origin from those of other groups.

Larval chaetotaxy: The Nymphulinae have the setae O1, O2 and O3 of the head situated in a line and the condition is shared with *Acentria* species as already mentioned by Hasenfuss (1960). He included *Acentria* in the Nymphulinae in this reason. The seta V1 of the

thoracic segments is lost in the Nymphulinae, Schoenobiinae and *Acentria* as far as I know. This condition may be autapomorphic for these groups. The L setae on the 9th abdominal segment are 2 in number in the Nymphulinae and *Acentria*, while in the other Crambiform subfamilies and in the Pyraliform subfamilies 1 or 3 in number, respectively. In regard to the setal map, the chaetotaxy of the Acentropinae is similar to that of *Nymphula* of the Nymphulinae by having the SD2 seta on the prothorax situated at the anterior margin.

Pupa: Speidel (1981) considered the enlargement of the spiracles on the 2nd to 4th abdominal segments is an autapomophic condition for the Acentropinae of his sense. My judgement will be retained, because the pupae of *Acentria* were not available and a species of aquatic Crambinae of Japan has much produced spiracles (A2-A4) (Funakoshi, pers. commun.).

As a result of my observations mentioned above, I propose a preliminary intra-relationship in the Crambiform subfamilies. The scheme is shown in Fig. 102. The results are summarized as follows:

1. The Pyraustinae *s. lat.* in Japan should be composed of 3 subfamiles, Pyraustinae, Glaphiriinae and Evergestinae. These subfamilies may be closely related each other than to the other Crambiforms.

2. The Musotiminae may be more allied to the Scopariinae than to the Nymphulinae.

3. The Nymphulinae are probably close to the Schoenobiinae as well as to *Acentria* on the basis of the male genitalia.

4. It is not advisable to raise the Crambinae and the Acentropinae to the familial rank. Especially the latter subfamily is suggested to be close to the Nymphulinae.

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9. References

(Asterisks indicate indirect references)

1) Agassiz, R. D., 1978. Five introduced species, including one new Science, of China Mark Moths (Lepidoptera: Pyralidae) new to Britain. *Entomologist' Gaz.*, **29**: 117-127.

2) ————, 1980. Further introduced China Mark Moths (Lepidoptera: Pyralidae) new to Britain. *ibid.*, **32**: 21-26.

3) Aoyama, T., 1939. The life historical study of *Nymphula vittalis* Bremer in Korea. *Nihon Gakujutsu kyokai Hokoku* (Report of Academic Society of Japan), **14** (2): 320-323 (In Japanese.)

4) Asahi, N., 1981. The remarkable moths from northern part of Miyazaki Prefecture. (1). *Yugato*, (84): 87-88. (In Japanese.)

5) Beirne, B. P., 1952. British pyralid and plume moths. 208 pp. F. Warne, London.

6) Berg, C. O., 1950. Biology of certain aquatic caterpillars (Pyralididae: *Nymphula* spp.) which feed on *Potamogeton*. *Trans. Amer. microscopical Soc.*, **69** (3): 254-266.

7) Berg, K., 1942. Contribution to the biology of the aquatic moth *Acentropus niveus* (Oliv.). *Vidensk. Medd. fra. Dansk naturh. Foren*, **105**: 59-139.

8) Buckler, W. M., 1875. On the larva and habits of *Paraponyx stratiotalis*. *Ent. month. Mag.*, **12**: 160-163.

9) ————, 1876. On the larva of *Hydrocampa nymphaealis* and its habits. *ibid.*, **13**: 210-215.

10) ————, 1877. Natural history of *Hydrocampa stagnalis*. *ibid.*, **14**: 97-103.

11) ————, 1881. Further notes on the early stages of *Hydrocampa nymphaealis*. *ibid.*, 249-254.

12) Callahan, P. S. and J. B. Chapin, 1960. Morphology of the reproductive sys tems and mating in two representative members of the family Noctuidae, *Pseudaletia unipuncta* and *Peridroma magaritosa*, with comparison to *Heliothis zea*. *Ann. ent. Soc. Amer.*, **53**: 763-782.

13) *Duponchel, M. P. A. J., 1844. Cataloque méthodique des Lépidoptères d' Europe. xxx+524 pp. (Pyralides p. 194-214.) Mequognon-Marvis fils, Paris.

14) Dyar, H. G., 1906. The North American Nymphulinae and Scopariinae. *J. New York ent. Soc.* **14**: 77-107.

15) ————, 1917. Notes on North American Nymphulinae. *Insedutor Inscitinae Menstruus*, **5**: 75-79.

16) Filipjev, N. N., 1927. Zur Kenntnis der Heterocera (Lepidoptera) von Sutchan (Ussuri Gebiet). *Ezheg. zool. Muz.*, **28**: 219-264, pls. 12-16.

17) Fletcher, D. S. and I. W. B. Nye, 1984. The Generic Names of Moths of the World, Vol. 5. 185 pp., London.

18) Forbes, W. T. M., 1923. The Lepidoptera of New York and neighboring states. New York (Nymphulinae, p. 574-581). Cornell Agricultural Experiment Station, Memoir 68, 729 pp.

19) Guenée, M. A., 1854. *In* Boisduval and Guenée Histoire naturelle des insectes. Species Générale des Lépidoptéres, Deltoides et Pyralites, Vol. 8. 488 pp. Paris.

20) Hampson, G. F., 1896. The Fauna of British India. Moths, Vol. 4. xxviii+594 pp., London.

21) ————, 1897. On the classification of two subfamilies of moths of the family Pyralidae: The Hydrocampinae and Scopariinae. *Trans. ent. Soc.* London, **1897**: 127-240.

22) ————, 1906. Descriptions of new Pyralidae of the subfamilies Hydrocampinae and Scopariinae. *Ann. Mag. nat. Hist.*, (7) **18**: 373-393.

23) Hasenfuss, I., 1960. Die Larvalsystematik der Zünsler. Abhandlungen zur Larvalsystematik der Insekten, Vol. 5. 263 pp., Akademie-Verlag, Berlin.

25) Hinton, 1946. On the homology and nomenculature of the setae of lepidopterous larvae and some notes on the phylogeny of the Lepidoptera. *Trans. ent. Soc. London*, **97**: 1-37.

26)*Hübner, J., 1796. Sammlung europaischer Schmetteringe. *Horde Zunsler. Augsburg*, **6**: 18, fig. 104.

27) Inoue, H., 1955. Nymphulinae. The check list of Lepidoptera of Japan, Vol. 2. pp. 154-157.

28) ———, 1974. Descriptions and records of some Pyralidae (Lepidoptera) from Japan. *Bull. Fac. domestic Sci., Otsuma Woman's Univ.*, (10): 131-154.

29) ——— *et. al.*, 1982. The Moths of Japan. Vol. 1: 1-968, Vol. 2: 1-556, pls. 1-392, Tokyo.

30) Iwata, M., 1929. The larva of aquqtic pyralids on Podostemonaceae. *Kontyû*, 3 (2): 89-96. 1 pl. (In Japanese.)

31) ———, 1930. The larval and pupal stages of *Aulacodes* sp. (Hydrocampinae, Lepidoptera) from Formosa. *Annot. zool. Jap.*, **12**: 409-412, 1 pl.

32) Jeffrey, R. W., 1877. *Hydrocampa stagnalis* Bred. *Ent. month. Mag.*, **14**: 116.

33) Karvonen, J., A. Alto and E. Laasonen, 1980. Two introduced species new Finland (Lepidoptera, Pyralidae). *Not. Ent.*, **60**: 101-102.

34) Klima, A., 1937. Pyralidae: Subfam. Scopariinae, Nymphulinae. Lepidopterorum Catalogus, 84. 226 pp. Gravenhage, W. Junk.

35) Kuwayama, S., 1967. Insect Fauna of the Southern Kurile Islands. 225 pp., 5 pls. Hokuno-kai, Sapporo.

36) Kuzunezov, V. I. and A. A. Stekolnikov, 1979a. Classification and phylogenetic relationships of the families and subfamilies of the Pyraloidea (Lepidoptera) of the Palaearctic fauna with regard of functional morphology of the male genitalia. *Acad. Sci. USSR, Proc. zool. Inst.*, **82**: 43-74.

37) ———, 1979b. Functional morphology of the male genitalia of the Pyraloidea (Lepidoptera) of the Palaearctic fauna. *ibid.*, **83**: 46-96.

38) Lange, W. H. JR., 1956. A generic revision of the aquatic moths of North America (Lepidoptera: Pyralidae, Nymphulinae). *Wasmann J. Biol.*, **14**: 59-144.

39) Larvey, M. A. and R. R. Costa, 1976. Life history of *Parargyractis canadensis* Munroe (Lepidoptera: Pyralidae). *Amer. Midland Naturalist*, **96** (2): 407-417.

40) Lederer, V. J., 1863a. Beitrag zur Kenntniss der Pyralidinen. *Wiener Ent. Monats.*, **7** (8): 243-280.

41) ———, 1863b. *ibid.*, **7** (10):331-426.

42) ———, 1863c. *ibid.*, **7** (12): 427-506, pls. 2-19.

43) Leech, H. J., 1886. British Pyralides, including the Pterophoridae. viii + 121 pp., 18 pls., London.

44) ———, 1889. New species of Deltoids and Pyrales from Corea, North China, and Japan. *Entomologist*, **22**: 62-71, pls. 2-4.

45) ———, 1901. Lepidoptera Heterocera from China, Japan and Corea. Part V. With description of new species by Richard South. *Trans. ent. Soc. London*,. **1901**: 385-514, pls. 14-15.

46) Lewvanich, A., 1981. A revision of the Old World species of *Scirpophaga* (Lepidoptera: Pyralidae). *Bull. Brit. Mus. (Nat. Hist.)*, **42** (4): 185-298.

47) Lloyd, J. T., 1914. Lepidopterous larvae from rapid streams. *J. New York ent. Soc.*, **22**: 145-152, 2 pls.

48) Lübben, H., 1907. Ueber die Lebensgewohnheiten von *Cataclysta lemnata* L. und enige biologische beziehungen zwischen Pyraliden und Chiloniden. *Zeits. fur wissenschaft. Insektenbilogie*, **3**: 174-179.

49) Luh Chin-jen and Chih-hu, Kuan, 1953. Recorded Species of Pyralididae from China; A Supplement to Wu's Catalogus Insectorum Sinensium. Part II. Subfamilies Nymphulinae, Scopariinae and Pyraustinae. *Ent. Sinica*, **3**: 203-210.

50) Marion, H., 1952. Ebauche d' une classification nouvelle des Pyraustidae. *Revue francaise de Lepidopterogie*, **13**: 260-270.

51) ———, 1953. Ebauche d'une classification nouvelle des Pyraustidae. *ibid.*, **14**: 53-59.

52) Martin, P., 1949. Ethologie d'un Lépidoptère aquatique *Nymphula nymphaeata* L. (Pyralidae).

Mitt. Schweiz. ent. Ges., **22** (4): 111-121.

53) Marumo, N., 1923. List of Lepidoptera of the islands Tanegashima and Yakushima. *J. Coll. Agr. Tokyo Imp. Univ.*, **8**: 187.

54) ———, 1942. Classification of Nymphuline moths (Subfamily Agroterinae) in Japan. Studies on rice borers, 7., *Nozi-Kairyo-Siryo*, **162**: 1-47, 6 pls. (In Japanese.)

55) Matsumura, S., 1931. 6000 illustrated Insects of the Japan-Empire. 191 pp., 10 pls., Tokyo.

56) McGaha, Y. J., 1954. Contribution to the biology of some Lepidoptera which feed on certain aquatic flowering plants. *Trans. Amer. microscopical Soc.*, **71** (4): 355-381.

57) Meyrick, E., 1885. On the classification of the Australian Pyralidina. *Trans. ent. Soc. London*, **1885**: 421-456.

58) ———, 1887. On the Pyralidina from Australia and the South Pacific. *ibid.*, **1887**: 185-268.

59) ———, 1890. On the classification of the Pyralidina of the Europe fauna. *ibid.*, **1890**: 429-492.

60) Muir, F. and J. C. Kershaw, 1909. Notes on the life history of *Aulacodes simplicialis*, Snell. *Proc. ent. Soc. London*, **1909**: 40-41.

61) Müller, G. W., 1892. Beobachtungen an im Wasserlebenden Schmetterlingsraupen. *Zool. Jahrb. Abt. Syst. Geograph. und Biol. Tiere*, **6**: 617-630.

62) Müller, W., 1884. Uber einige im Wasserlebende Schmetterlingsraupen Brasiliens. *Arch. Naturgesch.*, **50**: 194-211.

63) Munroe, E. G., 1972. Pyraloidea: Pyralidae (Part). The Moths of America North of Mexico. 13. 1 A. 134 pp. Classey, London.

64) ———, 1973. *ibid.*, 13. 1 C. 253-304, 13 pls. Classey, London.

65) Mutuura, A., 1971. *In* Esaki *et al.*, Icones Heterocerorum Japonicolum in Coloribus Naturalibus. (rev. ed.) (2). xix+318 pp., 64 pls., Hoikusha, Osaka.

66) Nakamura, M., 1977. Notes on the immature stage of *Musotima acclaralis* Walker (Lep.: Pyralidae). *Kita-Kyushu no Konchu*, **23**: 33-36, 1 pl. (In Japanese.)

67) Nagasaki, O., 1981. Life histories and distributions of two nymphuline species at Midoroike pond in Kyoto. *Midoroike-Gakujusu-Chosa-hokokusho*, 219-223. (In Japanese.)

68) Nigmann, M., 1908. Anatomie und Biologie von *Acentropus niveus* Oliv. *Zool. Jahrb. Abt. Syst.*, **26**: 489-560.

69) Patočka, 1950. Prispevek k morfologii a systemu Pyralidid. *Ent. Listy.* **13**: 107-109.

70) Peterson, A., 1948. Larvae of Insects. (1) Lepidoptera and Hymenoptera. 315 pp. Edwards Brothers, Inc., Ann Arbor.

71) Pierce, F. N. and J. W. Metcalf, 1938. The genitalia of the British pyrales with the deltoids and plumes. xiii+69 pp, 29 pls. England. (Hydrocampidae p. 33-34).

72) *Portier, P., 1949. La biologie des Lépidoptères. (Aquatic Lepidoptera, p. 201-222) 643 pp. Paul Lechevalier, Paris.

73) Poulton, E. B., 1909. Notes on the life-history of *Aulacodes simplicalis* Snell. *Trans. ent. Soc. London*, **1909**: 50-54.

74) Pruthi, H. S., 1928. Observations on the biology and morphology of the immature stages of *Aulacodes peribocalis* Wlk. (Hydrocampinae. Lepidoptera). *Records of Ind. Mus.*, **30**: 353-356, 1 pl.

75) Reichholf, J., 1970. Untersuchungen zur Biologie des Wasserschmetterlings *Nymphula nymphaeata* L. *Int. Rev. ges. Hydrobiol.*, **55**: 687-728.

76) ———, 1973a. Zur Verbreitung und Okologie des Wasserschmetterlings *Acentropus niveus* (Oliv.) (Lep., Pyralidae) in Bayern. *Nachrbl. Bayer. Entomologen*, **22**: 60-64.

77) ———, 1973b. Larval stages of water moths (Lepid., Pyralidae, Nymphulinae) from torrents of Ceylon and some south-pacific islands. *Bull. Fish. Res. Stn., Sri Lanka*, **24**: 75-81.

78) ———, 1978. Zur Nischenwahl mitteleuropäischen Wasserschmetterlings. *Nachrbl. Bayer. Entomolgen*, **27**: 116-126.

79) ———, 1979. Ein Massenanflug des Wasserschmetterlings *Acentropus niveus* (Oliv.) im Juli 1973 am unteren Inn. *Nachrbl. Bayer. Ento-*

mologen, **28**: 85-100.

80) Roesler, R, U. 1973. Trifine Acrobasiina. I. Teiband der Phycitinae. Microlepidoptera Palaearctica. Vol. 4. xvi+752 pp. Wien.

81) Schaus, W., 1940. Insects of Porto Rico and the Virgin Islands-moths of the families Geometridae and Pyralidiae. (Nymphulinae, pp. 379-387) *New York Acad. Sci.*, **12**: 291-471.

82) ————, 1924. New species of Pyralidae of the subfamily Nymphulinae from tropical America. (Lepid.) *Proc. ent. Soc. Wash.*, **26**: 93-130.

83) Shibuya, J., 1928. The Japanese Crambinae and Pyralidinae. *J. Fac. Agr. Hokkaido Imp. Univ.*, **21**: 121-176.

84) ————, 1928. The Systematic study on the Formosan Pyralidae. *ibid.*, **22**: 1-300, 9 pls.

85) ————, 1929. On the Japanese Hydrocampinae. *Ins. matsum.*, **3**: 120-136.

86) ————, 1931. On the Schoenobiinae of Japan. *Konchu Sekai* (Insect World), **35**: 365-372. (In Japanese.)

87) Shirôzu, T., 1960. Butterflies of Formosa in colour. 481 pp., (Terminology, 1-10 pp.), Hoikusha, Osaka.

88) Snellen, P. C. T., 1876. Over *Oligostigma* Guenée, een genus der Pyraliden. *Tijd. v. Ent.*, **19**: 186-209.

89) ————, 1880a. Midden-Sumatra. *Natuurlijeke Historie*, **4** (8): 1-92, 5 pls.

90) ————, 1880b. Nieuwe Pyraliden op het Eiland Celebes gevonden door Mr. M. C. Piepers. *Tijds. v. Ent.*, **23**: 198-250.

91) ————, 1901. Aanteekeningen over Pyraliden. *ibid.*, **43**: 265-309.

92) South, F. W., 1926. Annual report of the chief field officer. *Malayan Agr. J.*, **14** (6):146-159.

93) Speidel, W., 1981. Die Abgrenzung der Unterfamilie Acentropinae (Lepidoptera, Pyraloidea). *Atalanta*, **12**: 117-128.

94) ————, 1984. Revision der Acentropinae des palaearktischen Faunengebietes (Lepidoptera, Crambidae). *Neue ent. Nachrichten*, **12**: 1-157.

95) Spuler, A., 1910. Die Schmetterlige Europas. Band. II. 523 pp., Stuttgart.

96) Sylven, E., 1947. Systemetic studies of the Swedish species of Pyralinae, Nymphulinae and Pyraustinae (Pyr., Lep.). *Arkiv. Zool.*, **38** (3): 1-37.

97) Takahashi, R., 1930. A general consideration on the insects of Jitsugetsutan (Lake Candidius). *Trans. nat. Hist. Sci. Formosa*, **20**: 145-156. (In Japanese.)

98) Thorpe, W. H., 1950. Plastron respiration in aquatic insects. *Biol. Rev.*, **25**: 344-390.

99) Tsuda, M., 1936. Untersuhungen über die japanischen Wasserinsekten. III. Einige Wasserschmetterlinge. *Annot. zool. Jap.*, **15**: 525-533.

100) ————, 1939. On the host of *Nymphula vittalis* (Bremer). *Akitu*, **2** (1): 32-33. (In Japanese.)

101) ————, 1962. Aquatic Entomolgy. v+269 pp. (Pyralidae, 149-152 pp.), Hokuryukan, Tokyo. (In Japanese.)

102) Tuskes, P. M., 1977. Observations on the biology of *Parargyractis confusalis*, an aquatic pyralid. (Lep., Pyralidae). *Can. Ent.*, **109**: 695-699.

103) Walker, F., 1854-1856. List of specimens of lepidopterous insects in the collection of the British Museum, 35 parts. London (Nymphulinae in part 17, 1859; part 29, 1864; part 34, 1865; and part 35, 1866.)

104) Wang, P., 1980. Economic Insect Fauna of China., 21 (Lep., Pyralidae). xii+229 pp. Science Press, Beijing.

105) Welch, P. S., 1924. Observations on the early larval activities of *Nymphula maculalis* Clemens (Lep.). *Ann. ent. Soc. America*, **17**: 395-402.

106) Wileman, A. E., 1911. New and unrecorded species of Lepidoptera Heterocera from Japan. *Trans. ent. Soc. London*, **1911**: 189-407, pls. 30-31.

107) Williams, F. X., 1944. Biological studies in Hawaiian water-loving insects. Part 4. Lepidoptera or moths and butterflies. *Proc. Hawaiian ent. Soc.* **12**: 180-185. pls. 11-12.

108) Yoshiyasu, Y., 1979. A new species of Nymphulinae from Japan, with description of the immature stages (Lepidoptera: Pyralidae). *Akitu*, (n. ser.), (22): 1-14.

109) ————, 1979. Notes on the Nymphulinae of

Japan. I. Historical review and larval stage. *Yugato*, (76): 39-54. (In Japanese.)
110)————, 1980a. A Systematic Study of the Genus *Nymphicula* Snellen from Japan (Lepidoptera: pyralidae). *Tyô to Ga*, **31**:1-28.
111)————, 1980b. Aquatic Lepidoptera. *Kontyu to Sizen* (Insect and Nature), **15** (8): 18-23. (In Japanese.)
112)————, 1983. A study of Thailand Nymphulinae (Lepidoptera: Pyralidae). (2) Notes on genera *Nymphula* and *Parapoynx*, with description of a new species. *Tinea*, (11):117-124.
113)————, 1985. Lepidoptera. Kawai, T., ed, An Illustrated Book of Aquatic Insects of Japan. Viii+409 pp. (Pyralidae, 217-226 pp.). Tokai University Press, Tokyo. (In Japanese.)
114)Zimmerman, E. C., 1958. Insects of Hawaii. Vol. 8. Lepidoptera: Pyraloidea. ix+456 pp. University of Hawaii Press, Honolulu.

日本産ミズメイガ亜科及びシダメイガ亜科（鱗翅目：メイガ科）の分類学的研究

吉　安　　裕

要旨：メイガ科ミズメイガ亜科は鱗翅目の中では特異な群で，大部分の幼虫が水生生活を行う。また，水田生態系では農業害虫または益虫として注目される種を含んでいる。世界から約700種が知られ，おもに熱帯から亜熱帯にかけて種類が多い。我が国では井上（1982）によってミズメイガ亜科（広義）9属29種が報告されている。

本論文は，日本各地の研究機関所蔵の標本や，筆者が収集した国内・国外の標本にもとづき，日本産ミズメイガ亜科（広義）の分類学的再検討を行った結果をとりまとめたものである。その結果，我が国からミズメイガ亜科9属32種1亜種，シダメイガ亜科3属5種をみとめた。本論文ではこれらの学名を明らかにするとともに，両亜科及び各亜科内の属や種の定義及び記載を行った。

ミズメイガ亜科では1属6種を新たに記録した。そのうち1属は新属，4種は新種，2種は日本未記録種である。また，1新亜属を記載するとともに，5種について属名と種名の新結合を明らかにした。

一方，シダメイガ亜科では，2新属4新種を明らかにした。

これらの2亜科の属，亜属，種の識別をするために，検索表を作成した。また，ミズメイガ亜科に関しては幼虫と蛹の検索表を付し，応用昆虫学の観点から，食草の判明したものについては，そのリストを作成した。

日本産の種については，できる限り雌雄交尾器，幼虫，蛹の形態を図示した。一部外国産の種についても同様な図示を行った。成虫の斑紋については，従来用いられてきた名称を統一し，新しい定義を行ったほか，雄交尾器については新形態用語を提案した。

ミズメイガ亜科とシダメイガ亜科との系統的な関連性について，Roesler (1973)，Kuzunezov と Stekolnikov (1979)，Speidel (1981) などを参照して考察を行った。その結果，ミズメイガ亜科はオオメイガ亜科と，シダメイガ亜科はヤマメイガ亜科と近縁であることが推定された。

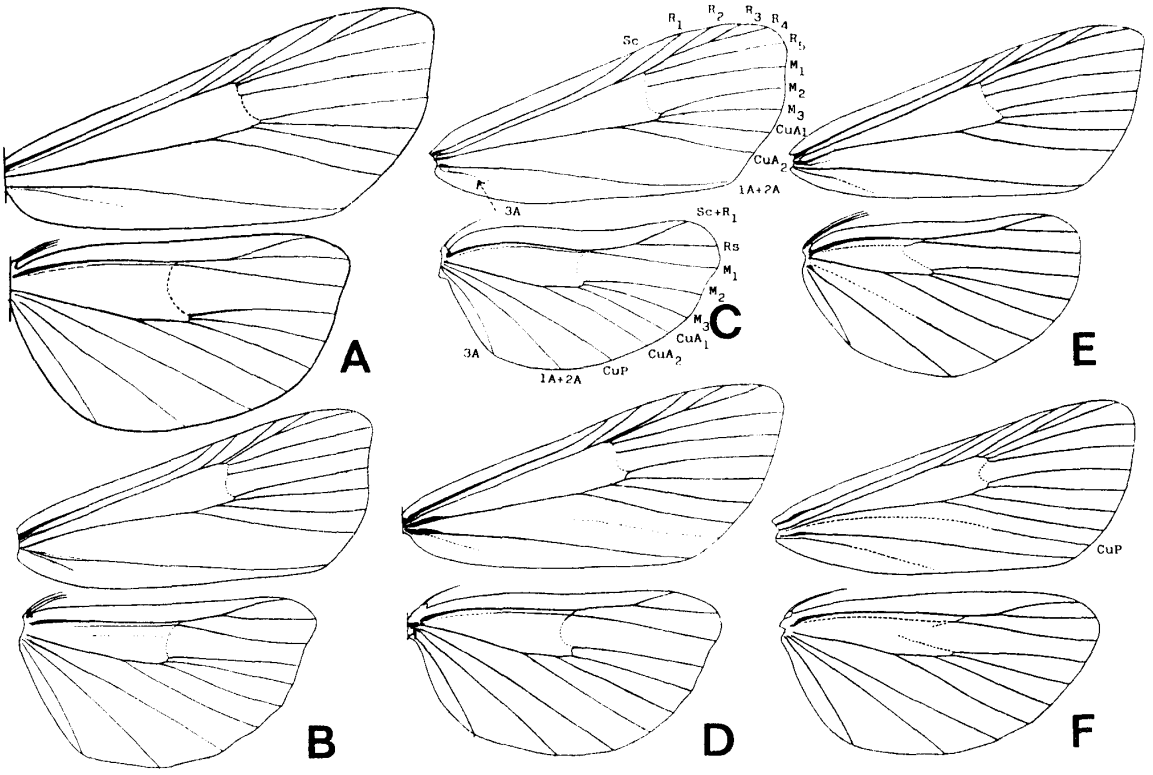

Fig. 91. Wing venation of the Nymphulinae (1). A, *Elophila* (*E.*) *interruptalis* (Pryer); B, *Elophila* (*C.*) *turbata* (Butler); C, *Elophila* (*C.*) *melagynalis* (Agassiz); D, *Elophila* (*M.*) *fengwangnalis*; E, *Nymphula corculina* (Butler); F, *Neoschoenobia decoloralis* Hampson.

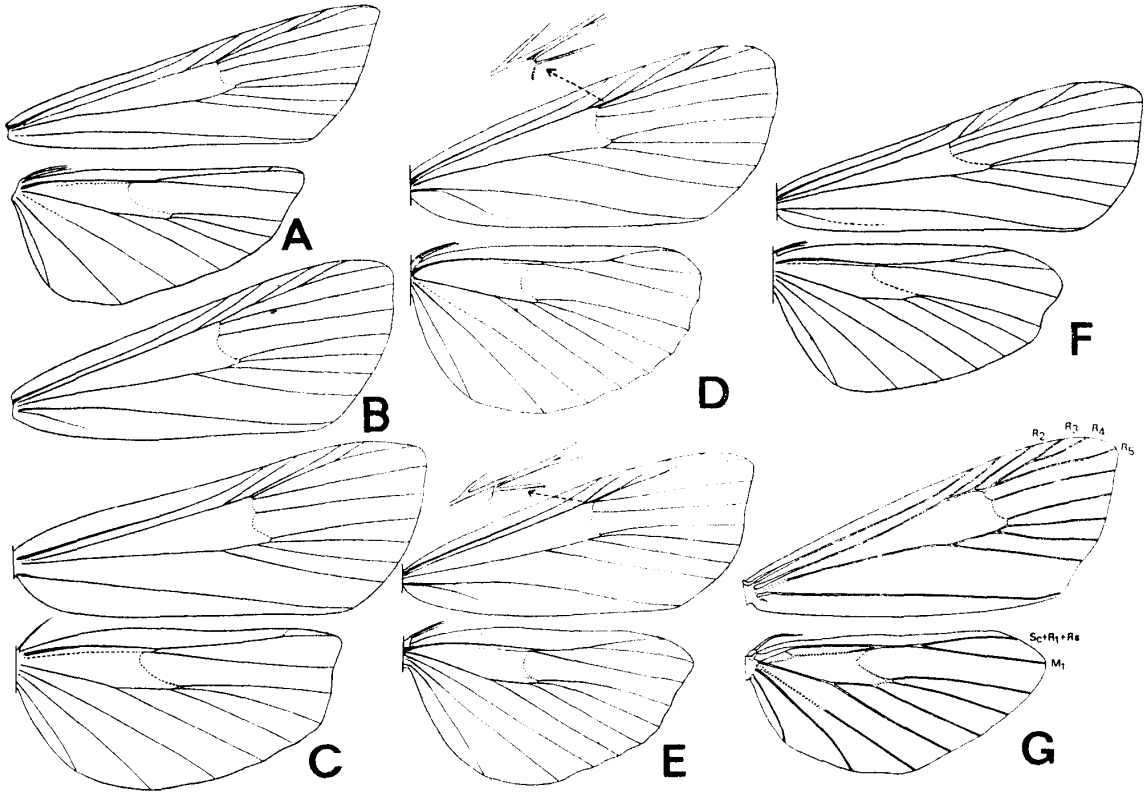

Fig. 92. Wing venation of the Nymphulinae (2). A, *Parapoynx fluctuosalis* (Zeller); B, *Parapoynx vittalis* (Bremer), forewing; C, *Parapoynx rectilinealis* sp. nov.; D, *Parthenodes bifurcalis* (Wileman); E, *Paracymoriza vagalis* (Walker); F. *Eoophyla conjunctalis* (Wileman & South); G, *Nymphicula junctalis* (Hampson).

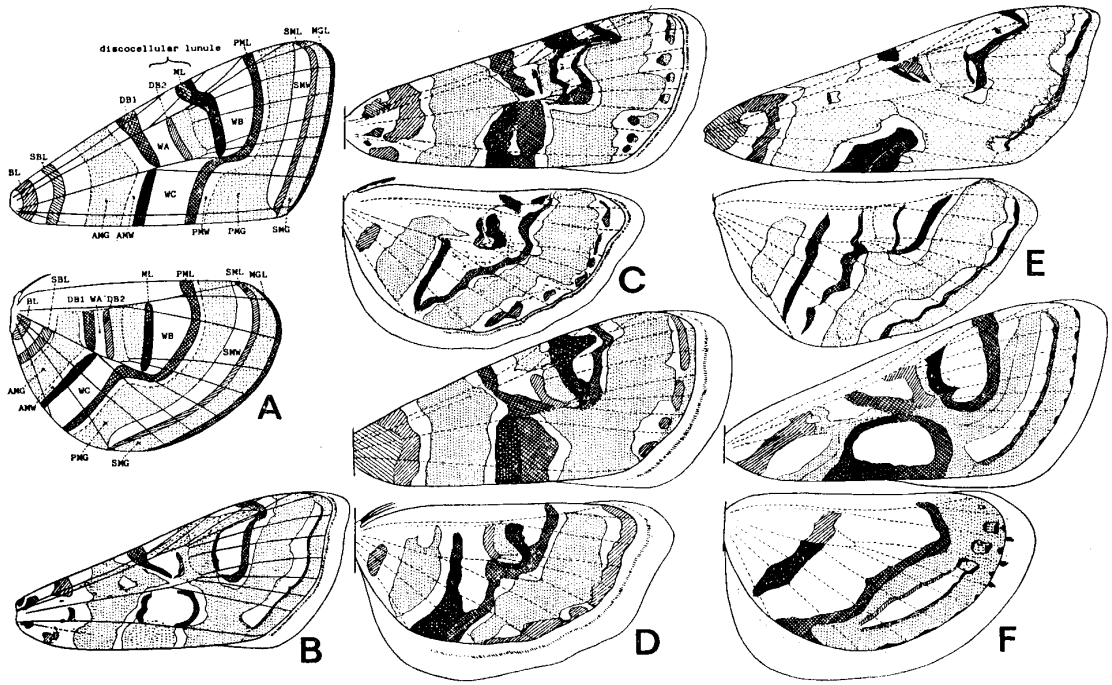

Fig. 93. Wing markings of the Nymphulinae (1). A, Typical wing marking pattern of the Nymphulinae and terminology; B, *Elophila* (*E.*) *interruptalis* (Pryer), forewing; B, *Elophila* (*C.*) *nigralbalis* (Caradja); C, *Elophila* (*C.*) *melagynalis* (Agassiz); E, *Elophila* (*M.*) *orientalis* (Filipjev); F, *Nymphula corculina* (Butler).

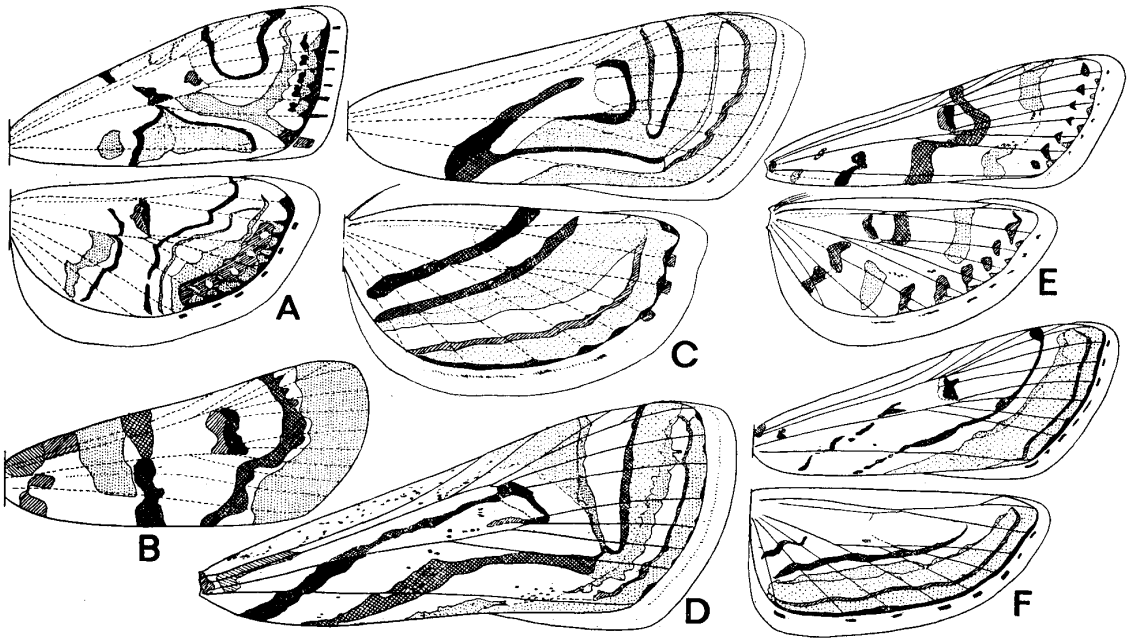

Fig. 94. Wing markings of the Nymphulinae (2). A, *Cataclysta lemnata* (*L.*) (note "marginal dots" are formed by submarginal line); B, *Neoschoenobia decoloralis* Hampson, forewing; C, *Parapoynx rectilinealis* sp. nov.; D, *Parapoynx bilinealis* (Snellen), forewing; E, *Parapoynx stagnalis* (Zeller); F, *Parapoynx ussuriensis* (Rebel).

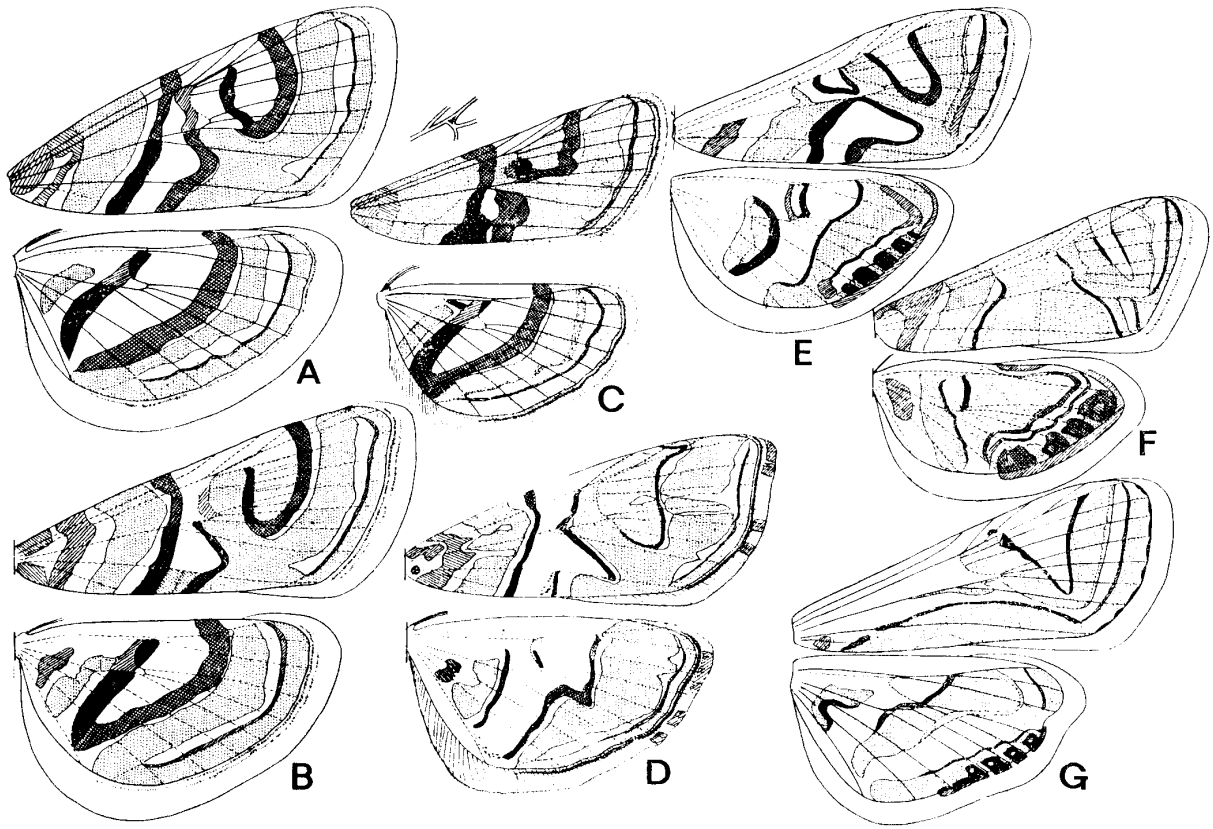

Fig. 95. Wing markings of the Nymphulinae (3). A, *Parthenodes bifurcalis* (Wileman); B, *Parthenodes prodigalis* (Leech) C, *Parthenodes fuscalis* sp. nov.; D, *Paracymoriza vagalis* (Walker); E, *Potamomusa midas* (Butler); F, *Nymphicula saigusai* Yoshiyasu; G, *Eoophyla inouei* Yoshiyasu.

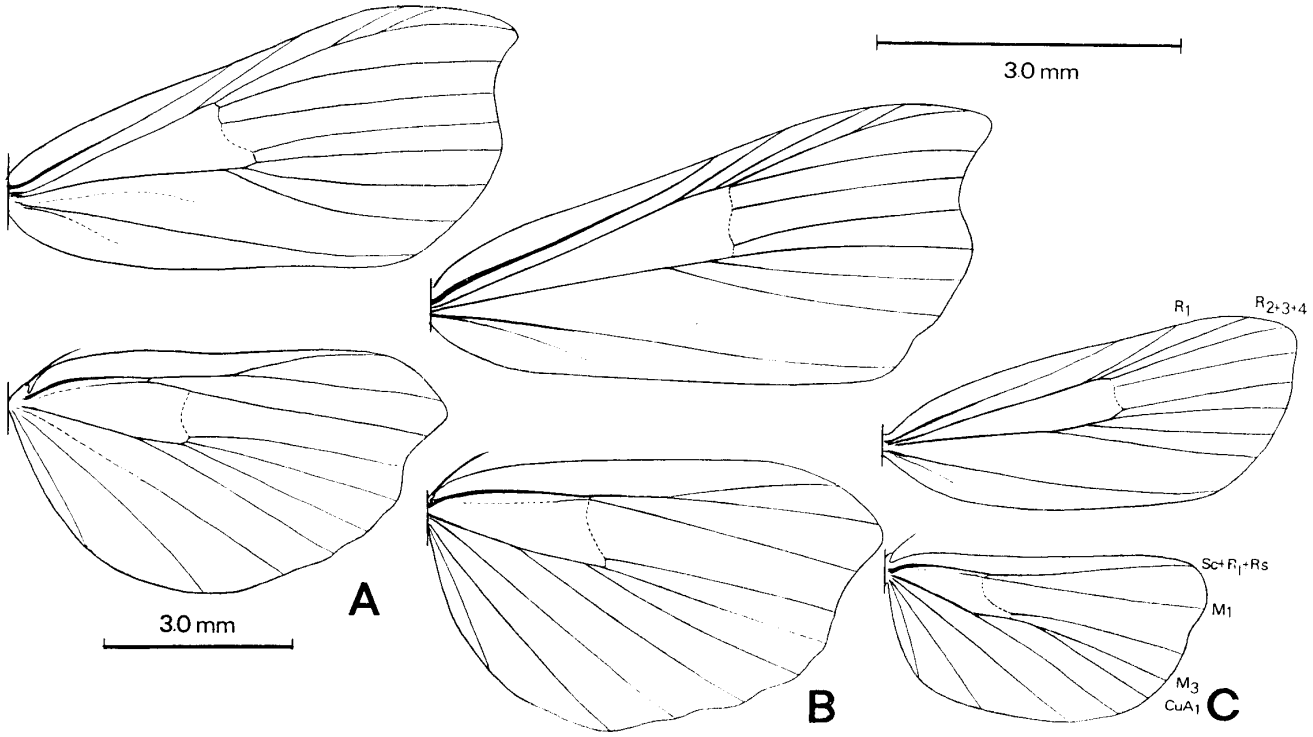

Fig. 96. Wing venations of the Musotiminae A, *Musotima tanzawensis* sp. nov.; B, *Neomusotima fuscolinealis* sp. nov.; C, *Melanochroa yasudai* sp. nov.

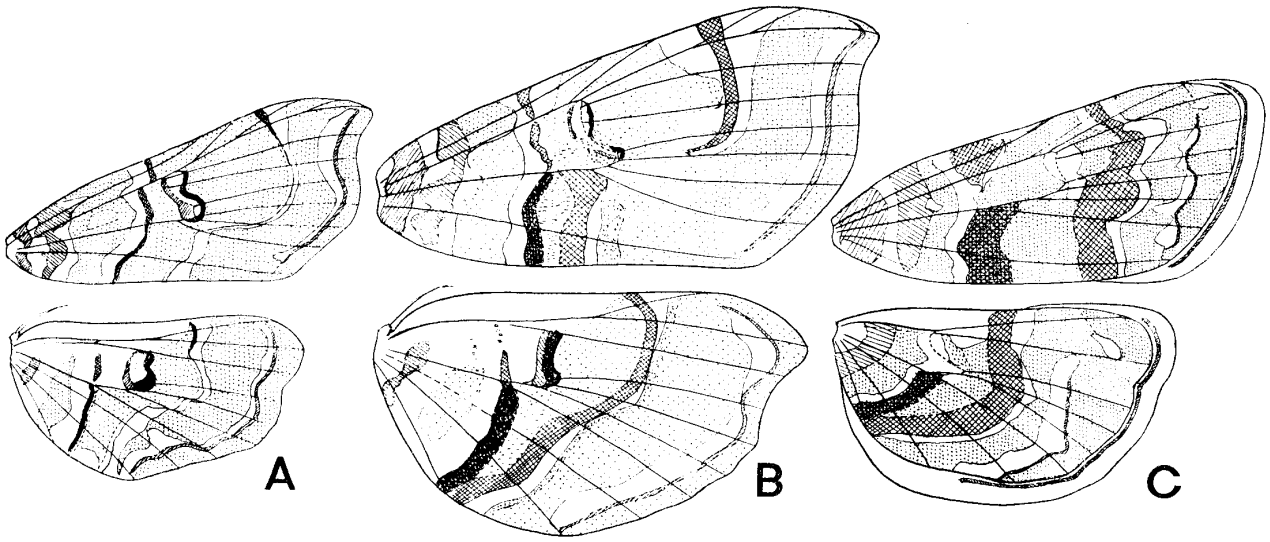

Fig. 97. Wing markings of the Musotiminae. A, *Musotima dryopterisivora* sp. nov.; B, *Musotima tanzawensis* sp. nov. C, *Melanochroa yasudai* sp. nov.

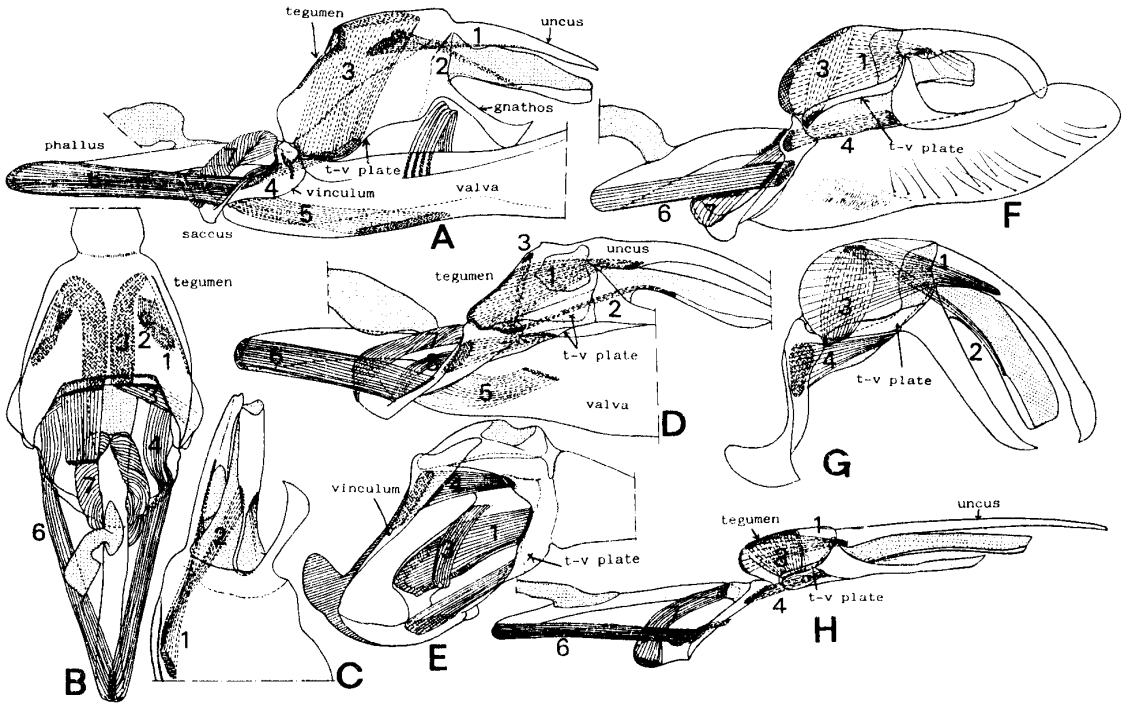

Fig. 98. Musculature of male genitalia of the Nymphulinae. A, *Elophila* (*E.*) *interruptalis* (Pryer), lateral view; B, ditto, dorsal view; C, ditto, latero-ventral view; D, *Neoshoenobia decoloralis* Hampson, lateral view; E, ditto, latero-ventral view; F, *Parapoynx vittalis* (Bremer), lateral view; G, *Parapoynx ussuriensis* (Rebel), lateral view; H, *Nymphicula saigusai* Yoshiyasu, lateral view.

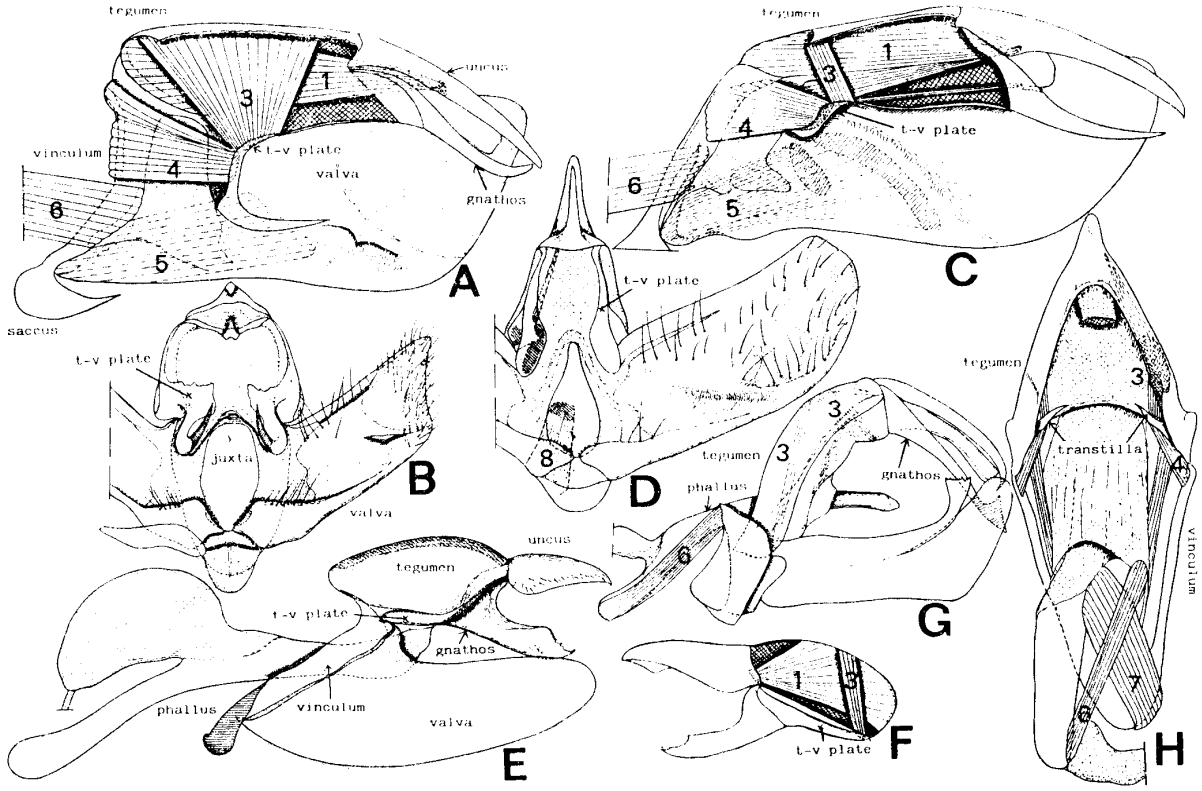

Fig. 99. Musculature of male genitalia of the Schoenobiinae and the Crambinae. A, *Scirpophaga excerptalis* (Walker), lateral view; B, ditto, postero-ventral view; C, *Schoenobius sasakii* Inoue, lateral view; D, ditto, ventral view; E, *Acentria ephemerella* (Denis and Schiffermüller), lateral view; F, ditto, musculature inside tegumen; G, *Catoptria montivaga* (Inoue), lateral view; H, *Chilo suppressalis* (Walker), dorsal view.

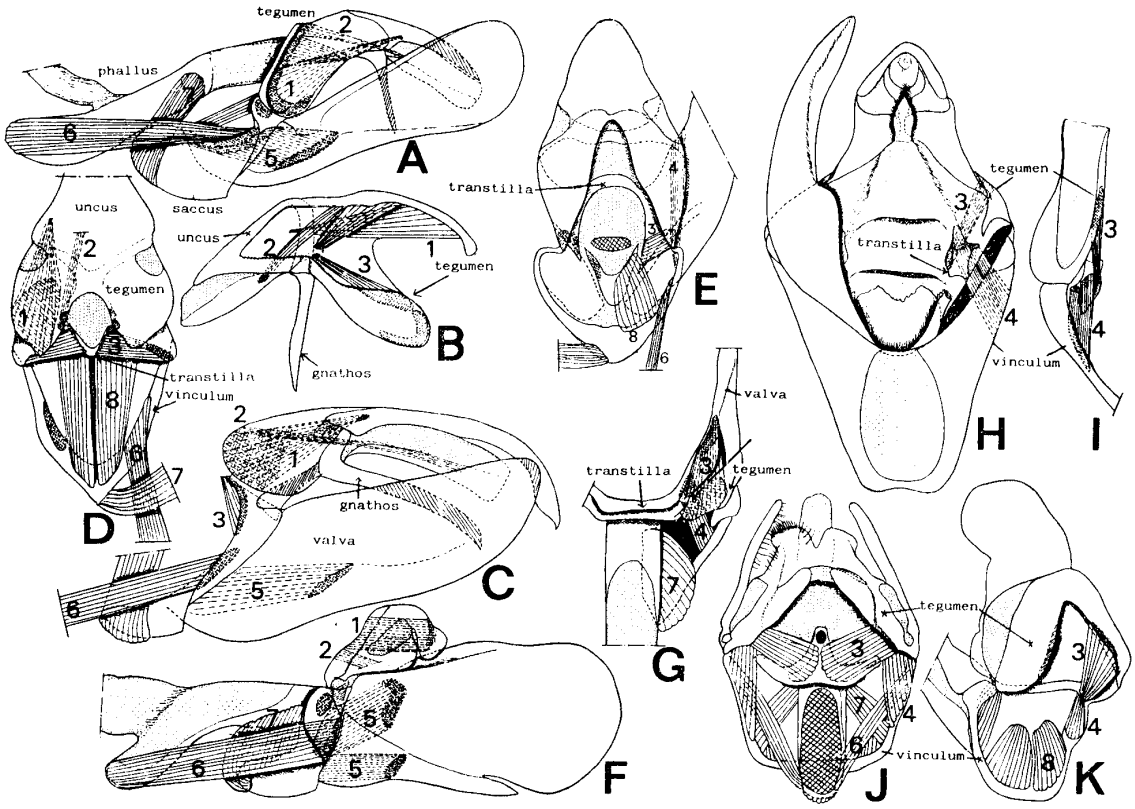

Fig. 100. Musculature of male genitalia of the Scopariinae, Evergestinae, Pyraustinae, Pyralinae, Epipashiinae and Phycitinae. A, *Scoparia* sp, lateral view; B, ditto, musculature inside tegumen; C, *Evergestis forficalis* (*L.*), lateral view; E, ditto, dorsal view; E, *Notarcha derogata* (Fabricius), dorsal view; F, *Endotricha portialis* Walker, lateral view; G, ditto, dorsal view; H. *Nephopterix mikadella* (Ragonot), ventral view; I, ditto, musculature near transtilla; J, *Cryptoblabes aphidivora* Yoshiyasu & Ôhara, dorsal view; K, *Craneophora ficki* Christoph, dorso-lateral view.

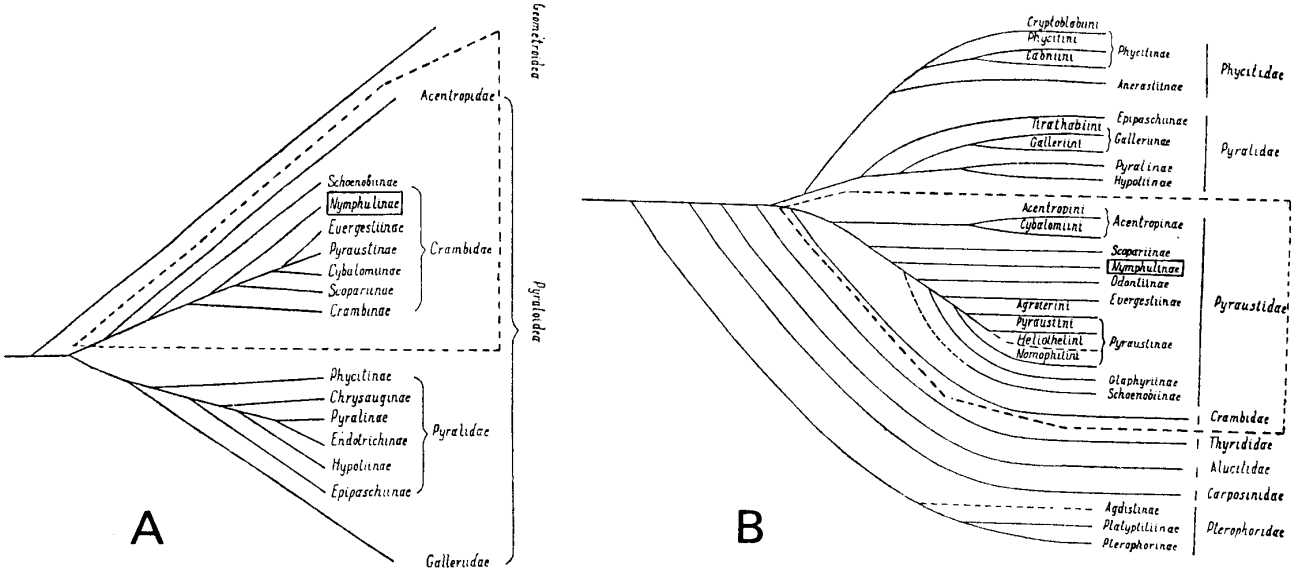

Fig. 101. Inter-relationship of the pyralid subfamilies. A, After Roesler, 1973; B, after Kuzunezov & Stekolnikov, 1979.

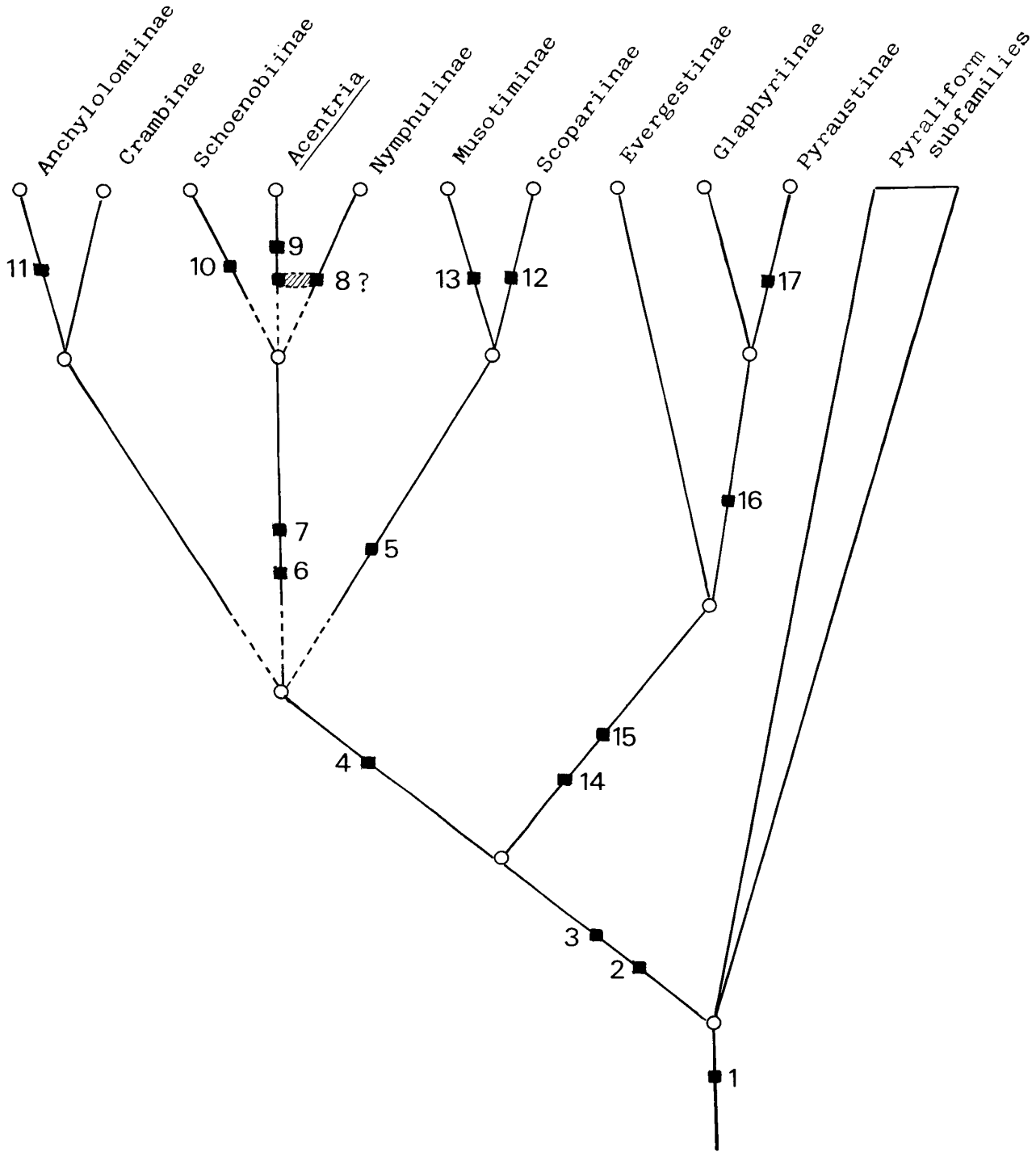

Fig. 102. Preliminary inter-relationship of the Japanese Crambiform subfamilies with exotic genus *Acentria*. Character states are as follows: 1. tympanal organ developed; 2. tympanal bullae fused midventrally; 3. larva with 1 or 2 L setae on 9th abdorminal segment; 4. male genitalia with transtilla shortened or reduced; 5. female genitalia with ductus bursae sclerotized dorsally (lamella postvaginalis); 6. male genitalia with t-v plate having muscle(s) 3 and/or 4; 7. larva without seta V1 on thoracic segments; 8. pupa with produced spiracles on 2nd (or 3rd) to 4th abdominal segments; 9. labial palpus 2-segmented; 10. male genitalia with coremata; 11. hindwing with M_1 emitting from far behind anterior angle of cell; 12. female genitalia with appendix bursae; 13. male genitalia with base of gnathos extended anteriorly; 14. chaetosemata reduced; 15. tympanal bullae bifurcated at apex; 16. male genitalia without cochlear of gnathos; 17. forewing with vein 3A rooped.

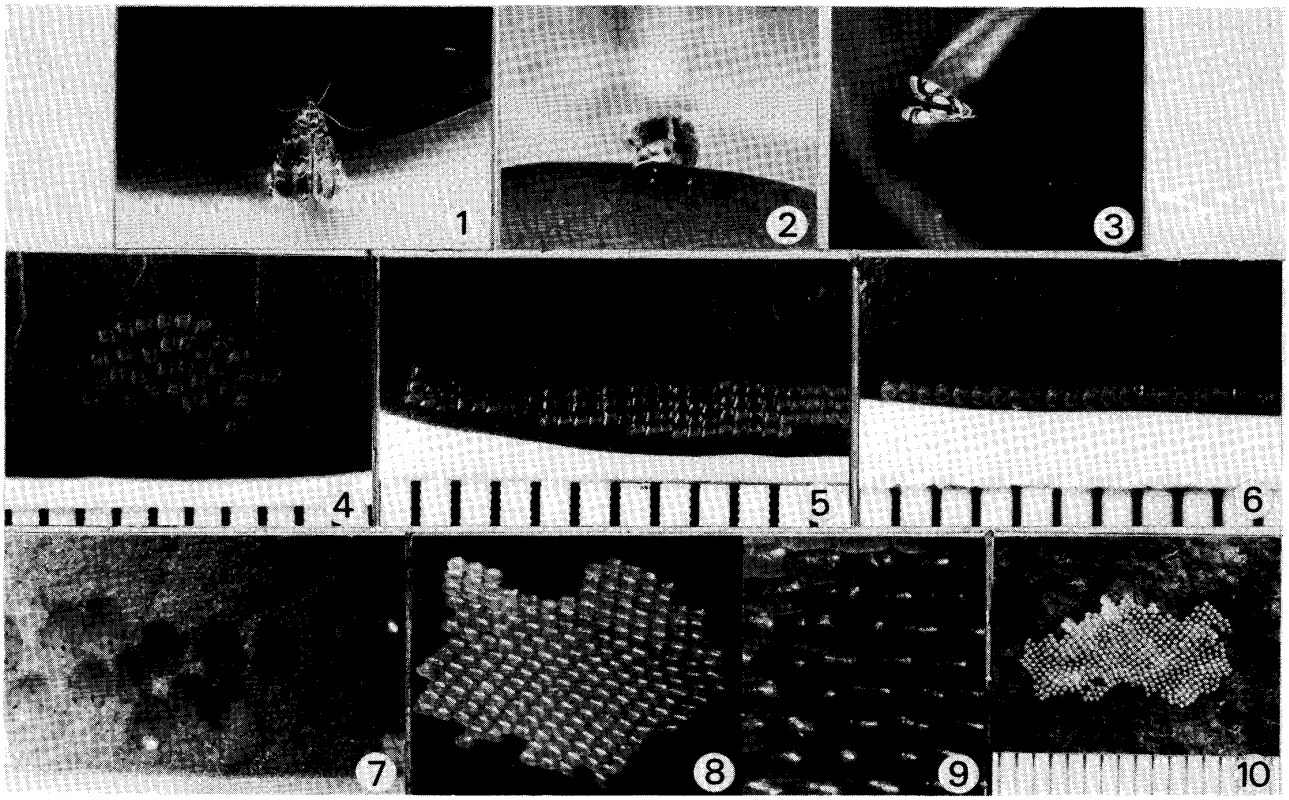

Plate 1. 1-3, Egg-laying posture of nymphuline species, 1, *Elophila* (*Cirtogramme*) *turbata* (Butler), dorsal view; 2, ditto, ventral view; 3, *Nymphula corculina* (Butler), dorsal view. 4-10, Egg masses, 4, *Elophila* (*E.*) *interruptalis* (Pryer); 5, *Nymphula corculina* (Butler); 6, *Neoschoenobia decoloralis* Hampson; 7, *Parapoynx vittalis* (Bremer); 8, *Potamomusa midas* (Butler); 9, ditto; 10, *Eoophyla conjunctalis* (Wileman & South). (4-6 & 10, Yoshiyasu, 1985).

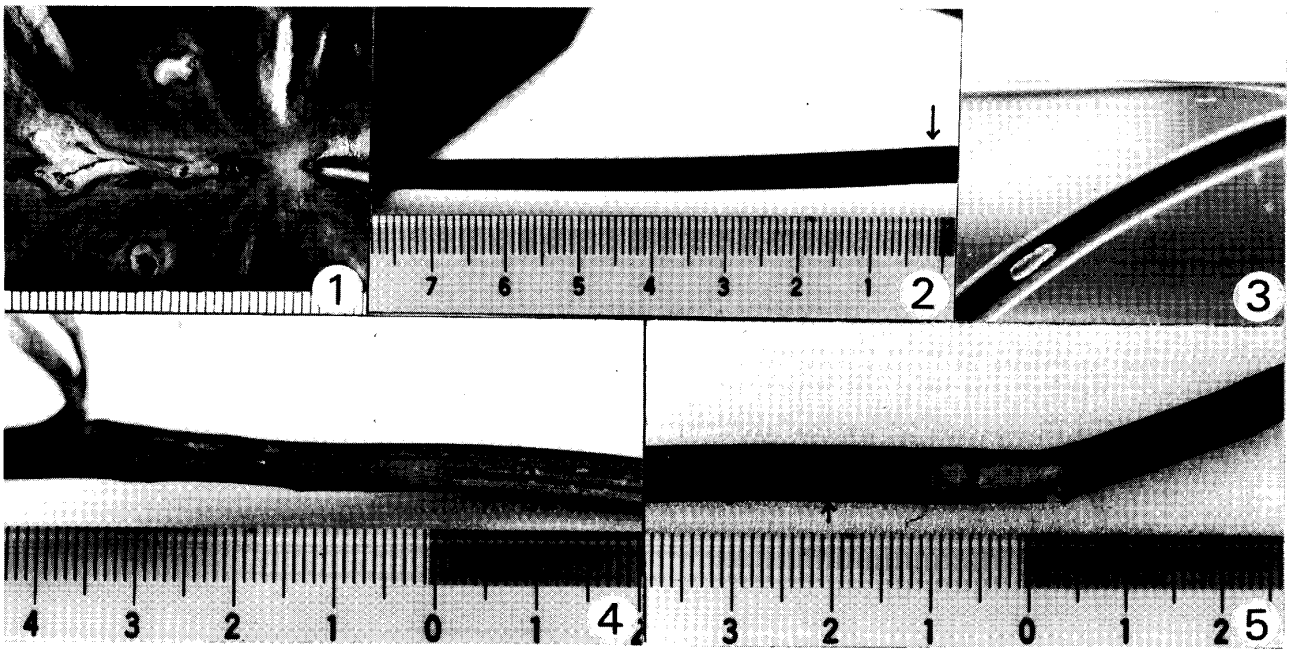

Plate 2. Larva and pupa of *Neoschoenobia decoloralis* Hampson on *Nuphar* sp., 1, Leaf mining; 2, boring entrance of stem (indicated by an arrow); 3, larva entering stem under the water; 4, larva inside stem; 5, pupa inside stem (adult exit hole indicated by an arrow).

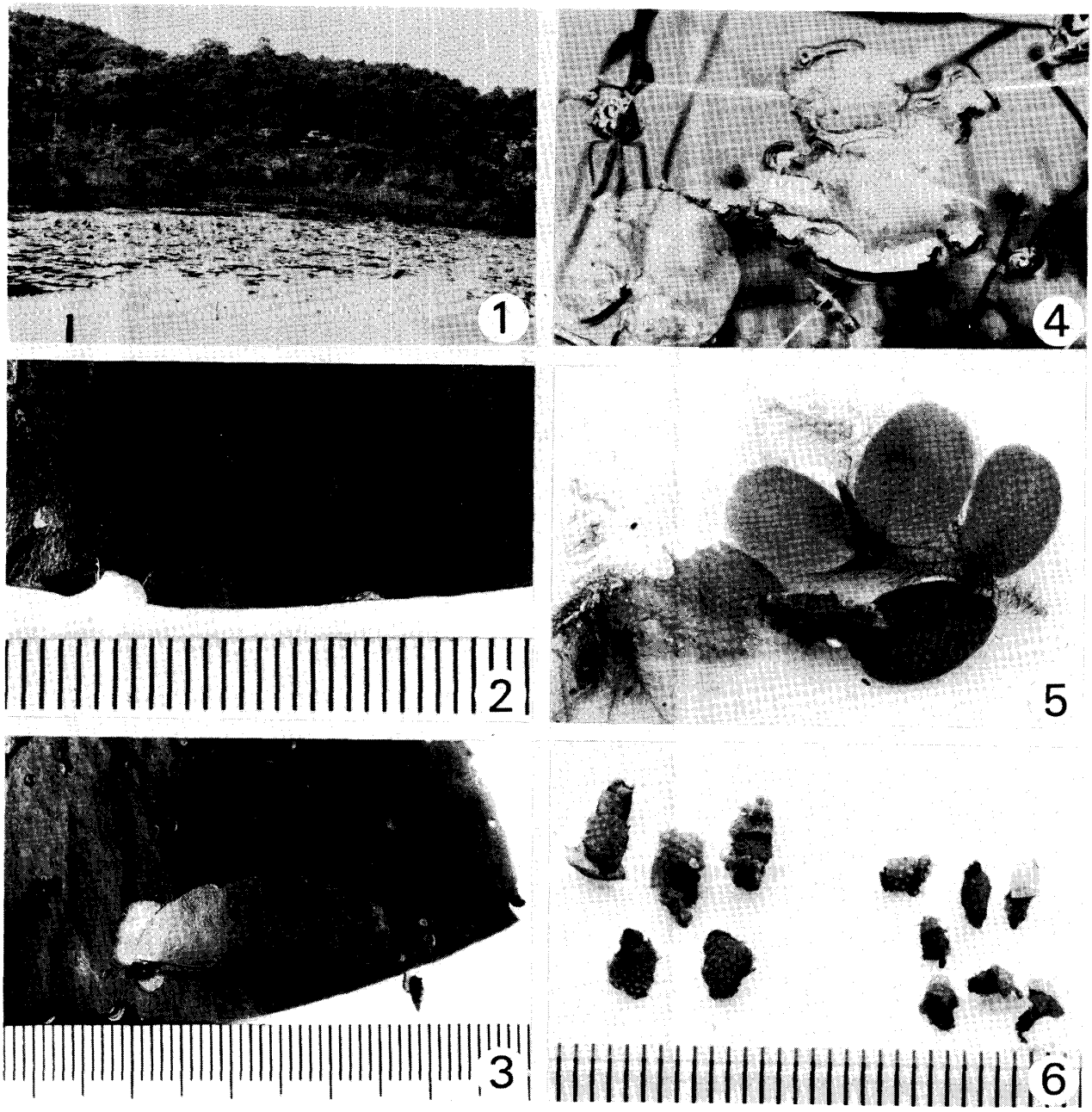

Plate 3. Habitats and larval cases of nymphuline species. 1, Habitat of *Elophila* (*E.*) *interruptalis* (Pryer) and *Neoschoenobia decoloralis* Hampson; 2, *Elophila* (*E.*) *interruptalis* (Pryer), lst instar larvae and their cases; 3, ditto, mature larval case; 4, ditto, feeding habit in the field; 5, *Elophila* (*C.*) *nigralbalis* (Caradja), feeding habit; 6, ditto, 3rd (right) and 4th (left) instar larval cases.

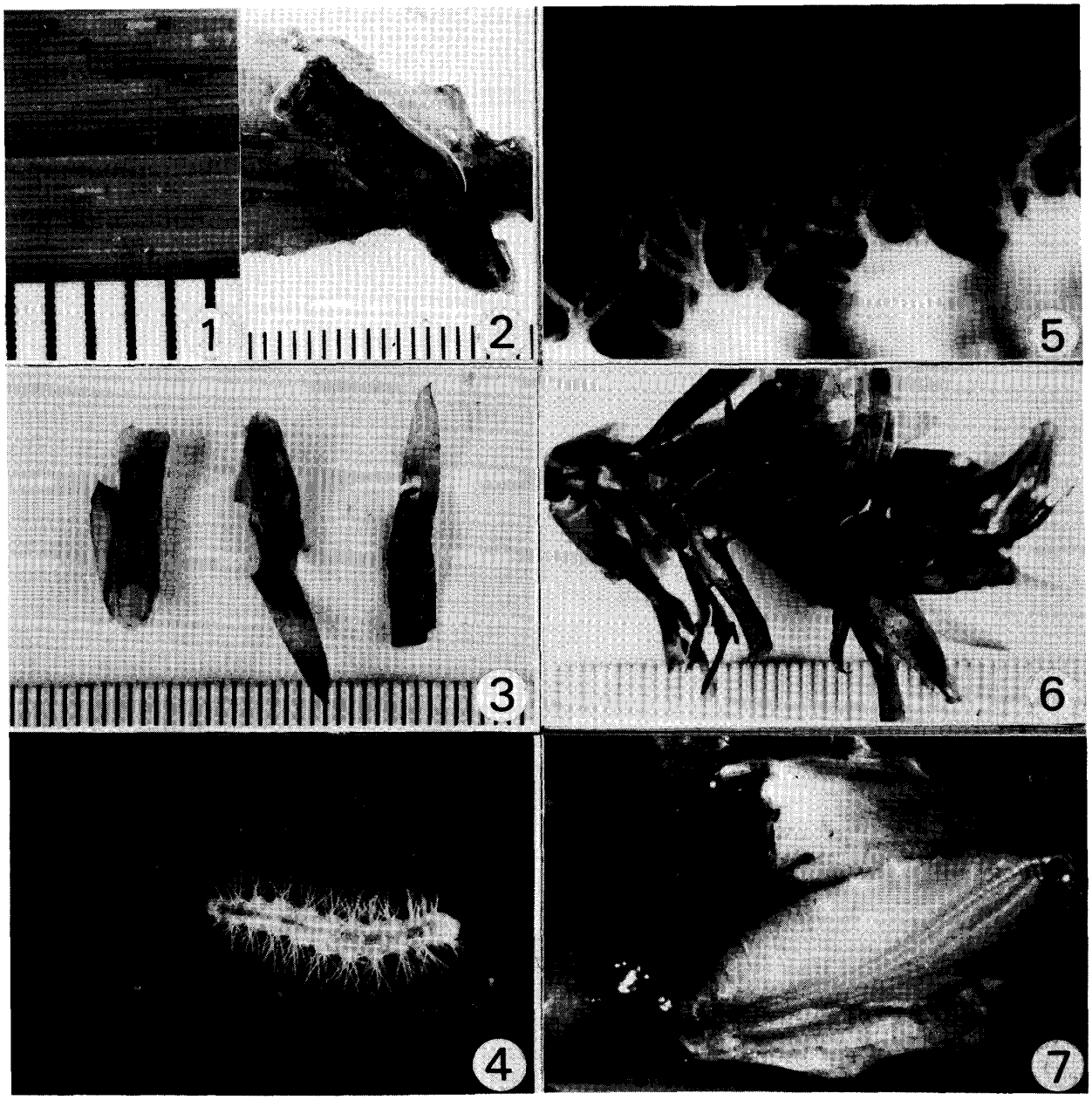

Plate 4. Immatue stages of nymphuline species. 1, *Nymphula corculina* (Butler), 1st inster larva inside leaf; 2, ditto, pupal case; 3, *Parapoynx vittalis* (Bremer), mature larval cases; 4, ditto, mature larva inside case; 5, ditto, tracheal gills; 6, ditto, pupal case attached on host; 7, ditto, pupa inside cocoon (note thick and air-containing cocoon around spiracles).

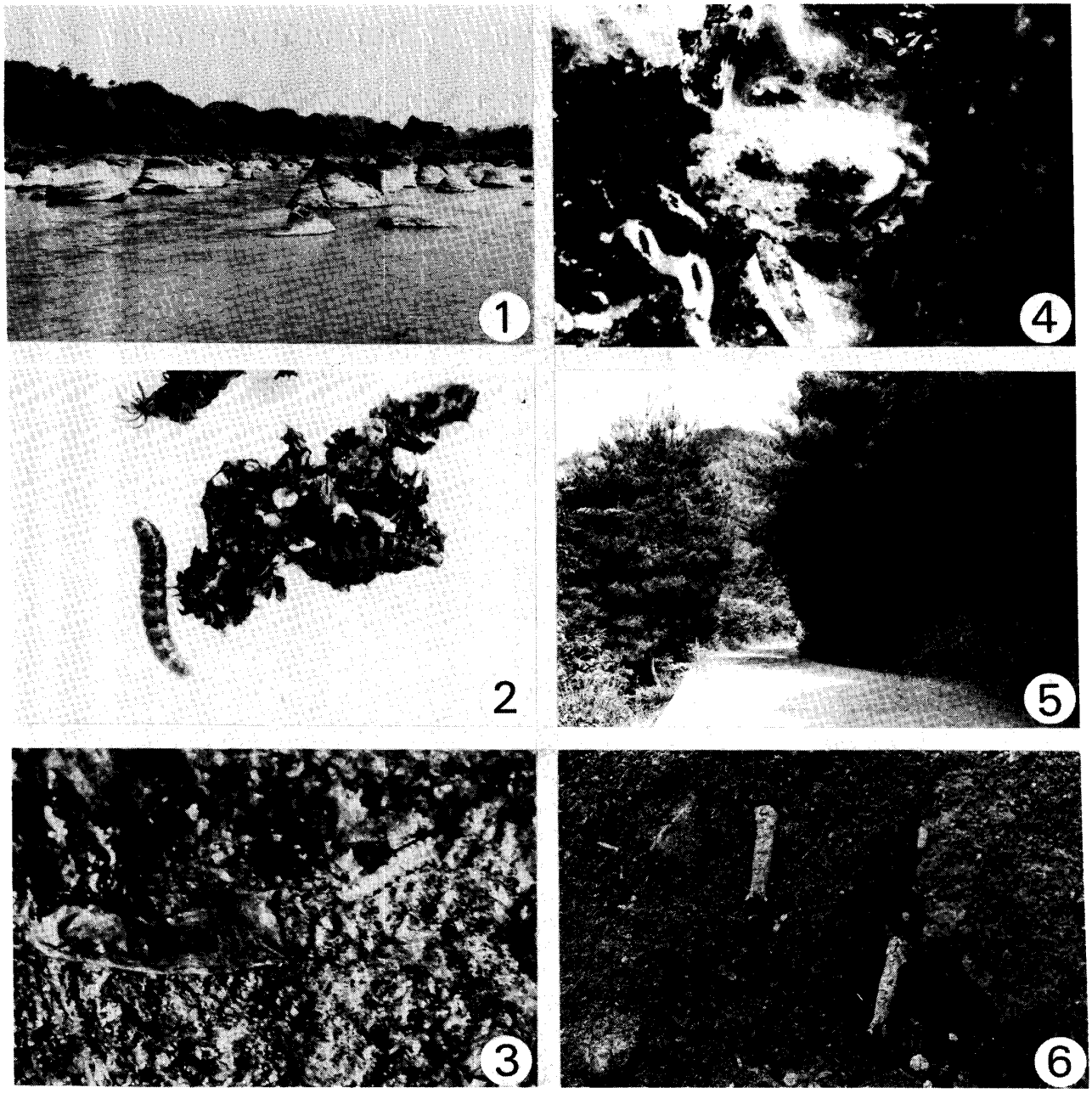

Plate 5. Habitats, larvae and pupa of nymphuline species. 1, Habitat of *Paracymoriza vagalis* (Walker), Sendai river, Kagoshima Pref.; 2, *Paracymoriza vagalis* (Walker) larvae with host; 3, *Eoophyla inouei* Yoshiyasu, larval case sheet and larva; 4, ditto, pupal case on rock; 5, habitat of *Nymphicula saigusai* Yoshiyasu; 6, ditto, larval cases. (5 & 6, Yoshiyasu, 1980).

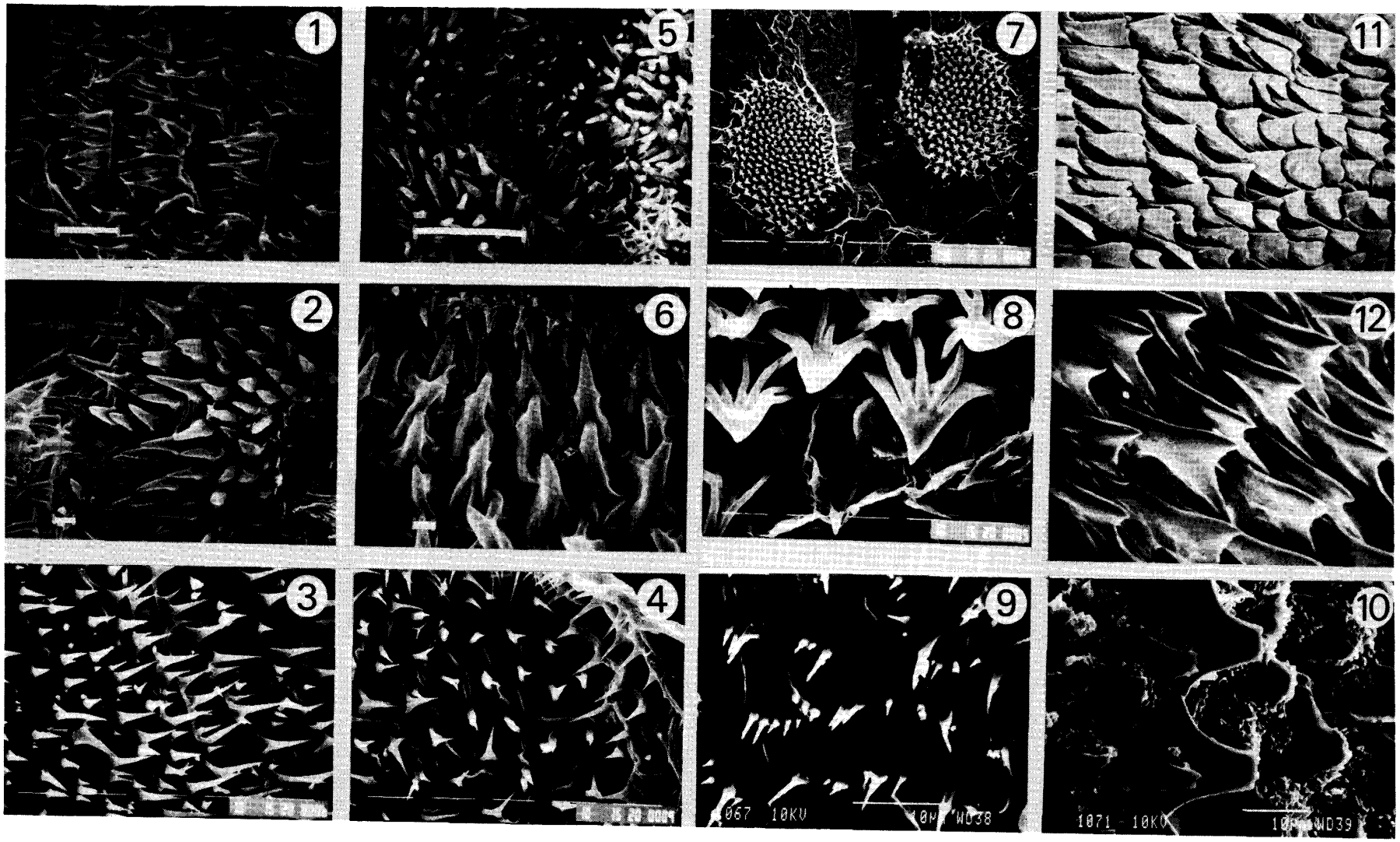

Plate 6. Signa and spinules on female bursa in the nymphulinae. 1, *Elophila* (*E.*) *interruptalis* (Pryer), spinules on ductus bursae; 2, ditto, spinules on corpus bursae; 3, *Elophila* (*C.*) *melagynalis* (Agassiz), spinules on ductus bursae; 4, ditto, spinules on corpus bursae; 5, *Elophila* (*M.*) *sinicalis* (Hampson), spinules on corpus bursae near ductus seminalis; 6, ditto, spinules on corpus bursae; 7, *Elophila* (*M.*) *fengwhanalis* (Pryer), signa; 8, ditto, spinules on signa; 9, *Parapoynx vittalis* (Bremer), spinuleson ductus bursae; 10, ditto, spinules on signa; 11, *Eoophyla inouei* Yoshiyasu, spinuleson signa; 12, *Eoophyla conjunctalis* (Wileman & South), spinules on signa. (11 & 12, Yoshiyasu, 1979) (Scale: one white bar indicates 10 μm except 100 μm in 7)

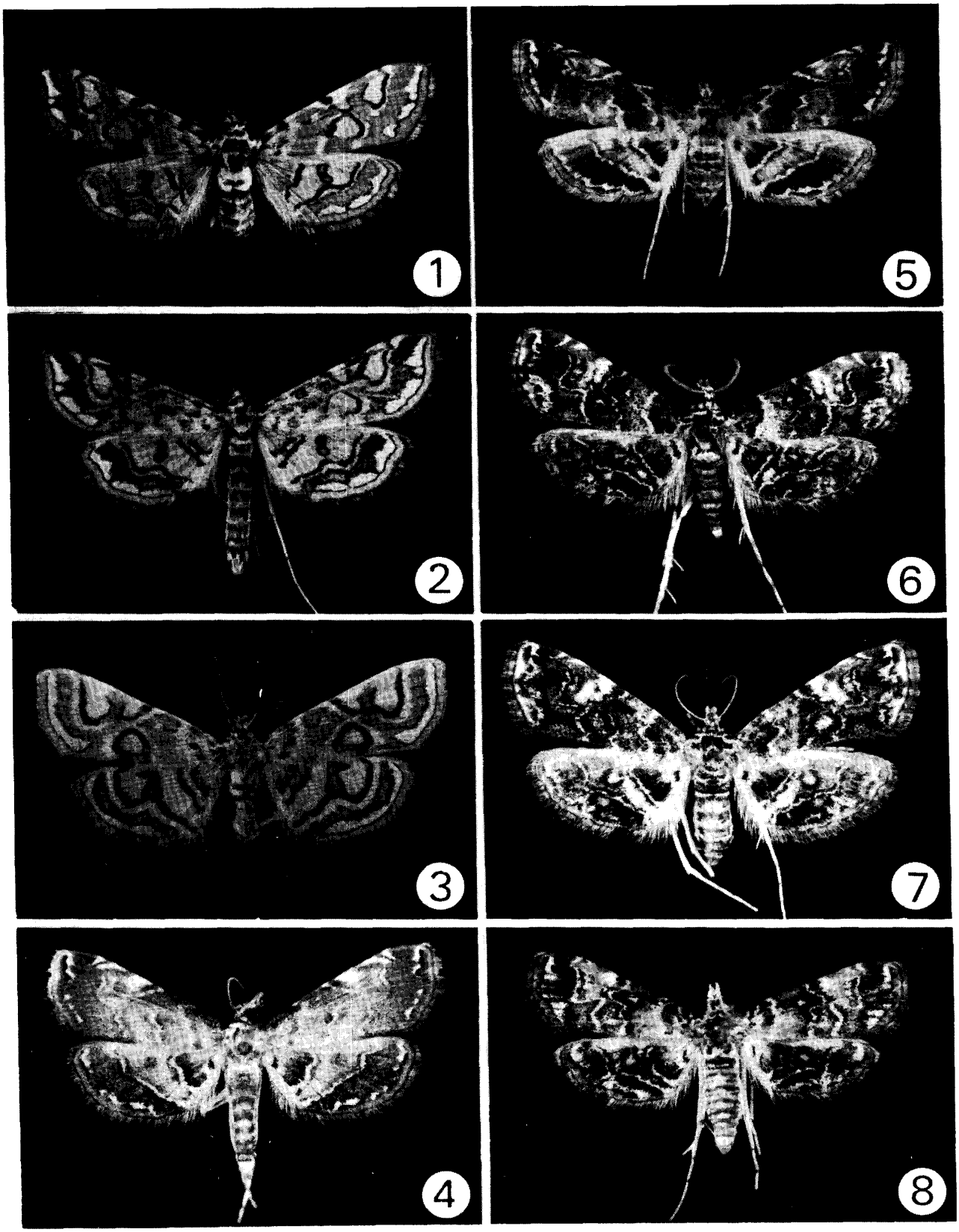

Plate 7. 1, *Elophila* (*E.*) *interruptalis* (Pryer) (♀); 2, *Elophila* (*E.*) *interruptalis ezoensis* ssp. nov. (♂); 3, *Elophila* (*M.*) *miurai* sp. nov. (♀); 4, *Elophila* (*C.*) *turbata* (Butler) (♂); 5, ditto, (♀); 6, *Elophila* (*C.*) *nigralbalis* (Caradja) (♂); 7, ditto, (♀); 8, *Elophila* (*C.*) *enixalis* (Swinhoe) (♂), Thailand.

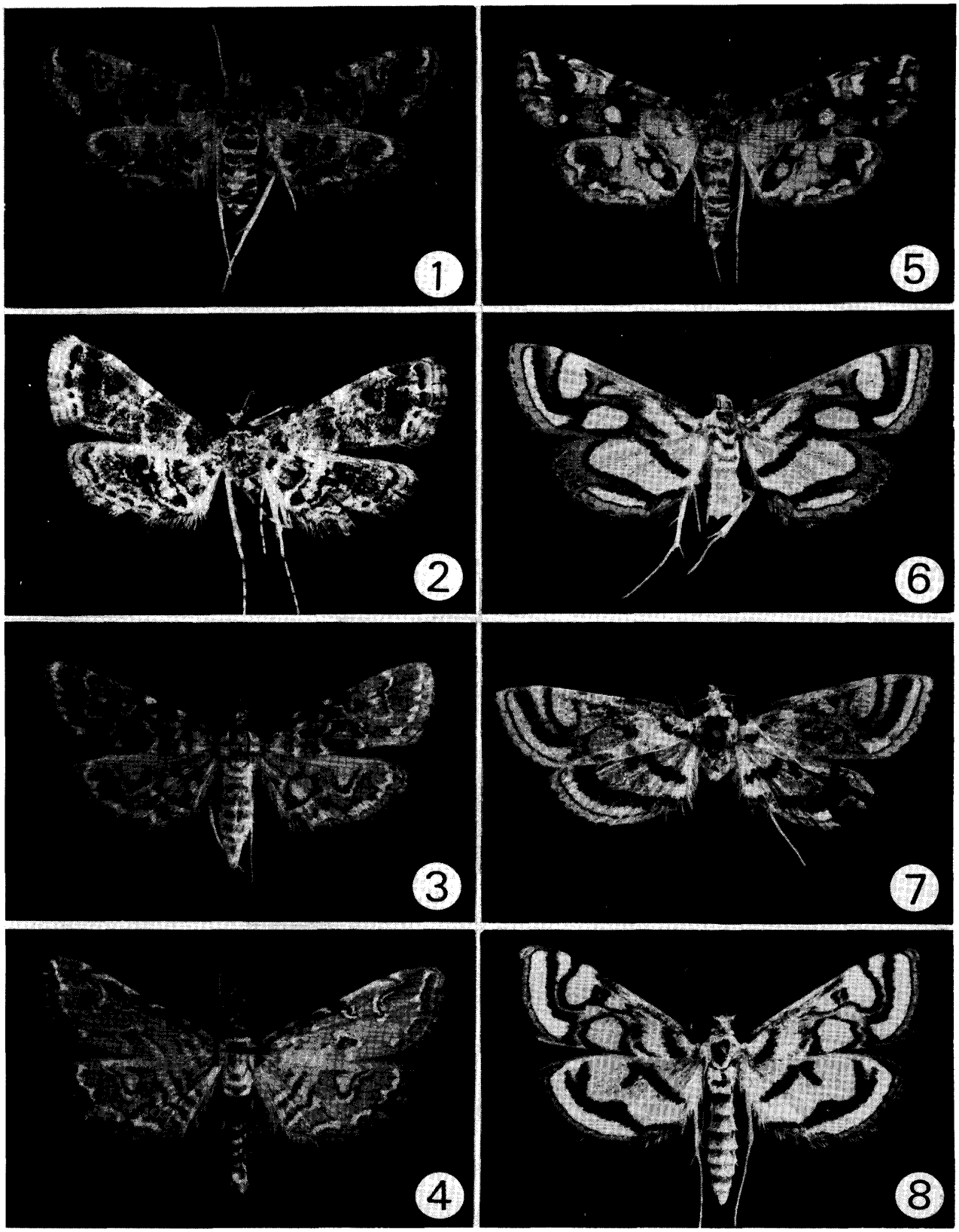

Plate 8. 1, *Elophila enixalis* (Swinhoe) (♀), Thailand; 2, *Elophila* (*C.*) *melagynalis* (Agassiz) (♀); 3, *Elophila* (*M.*) *fengwhanalis* (Pryer) (♀); 4, *Elophila* (*M.*) *orientalis* (Filipjev) (♂); 5, *Elophila* (*M.*) *sinicalis* (Hampson) (♀); 6, *Nymphula corculina* (Butler) (♀); 7, *Nymphula stagnata* (Donovan) (♀), Japan; 8, ditto, (♂), West Germany.

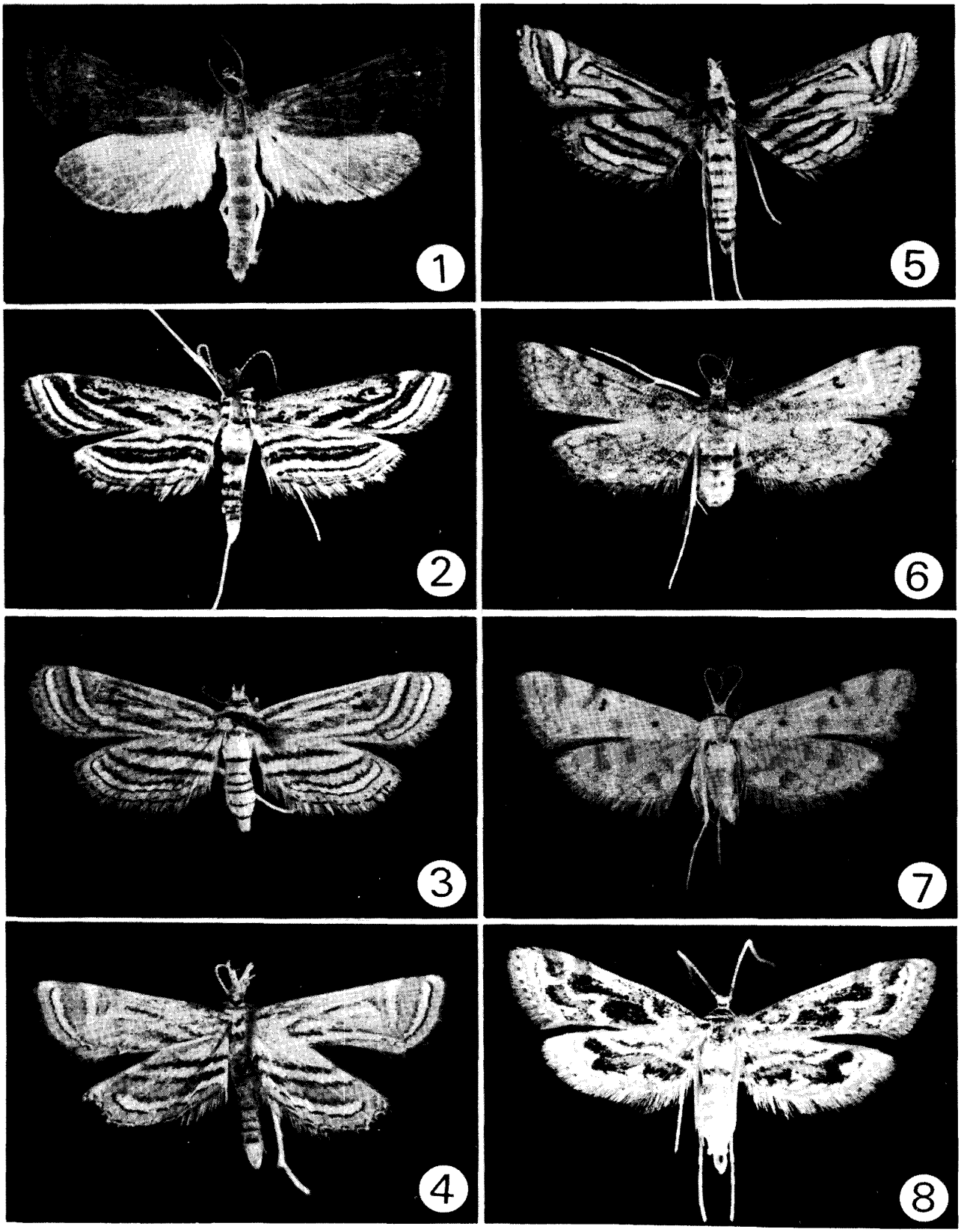

Plate 9. 1, *Neoschoenobia decoloralis* Hampson (♀); 2, *Parapoynx fluctuosalis* (Zeller) (♂); 3, *Parapoynx vittalis* (Bremer) (♀); 4, *Parapoynx rectilinealis* sp. nov. (♂); 5, *Parapoynx bilinealis* (Snellen) (♂); 6, *Parapoynx crisonalis* (Hampson) (♀); 7, *Parapoynx stagnalis* (Zeller) (♀); 8, *Parapoynx diminutalis* Snellen (♂).

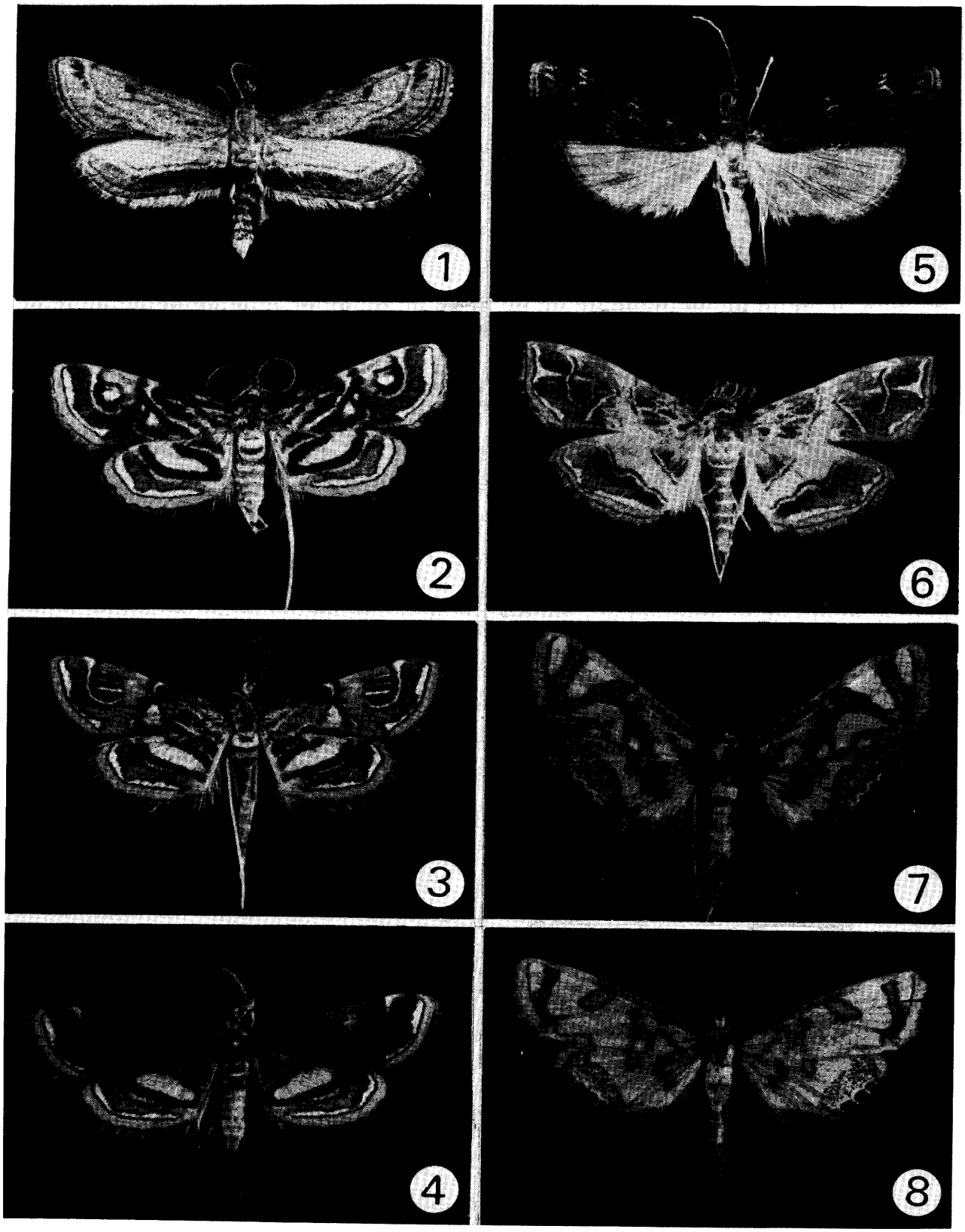

Plate 10. 1, *Parapoynx ussuriensis* (Rebel) (♂); 2, *Parthenodes bifurcalis* (Butler) (♀); 3, *Parthenodes prodigalis* Leech (♀), Taiwan; 4, *Parthenodes fuscalis* sp. nov. (♀); 5, *Parthenodes niger* (Warren) (♀); 6, *Paracymoriza vagalis* (Walker) (♂); 7, *Potamomusa midas* (Butler) (♀); 8, *Potamomusa aquilonia* sp. nov. (♀).

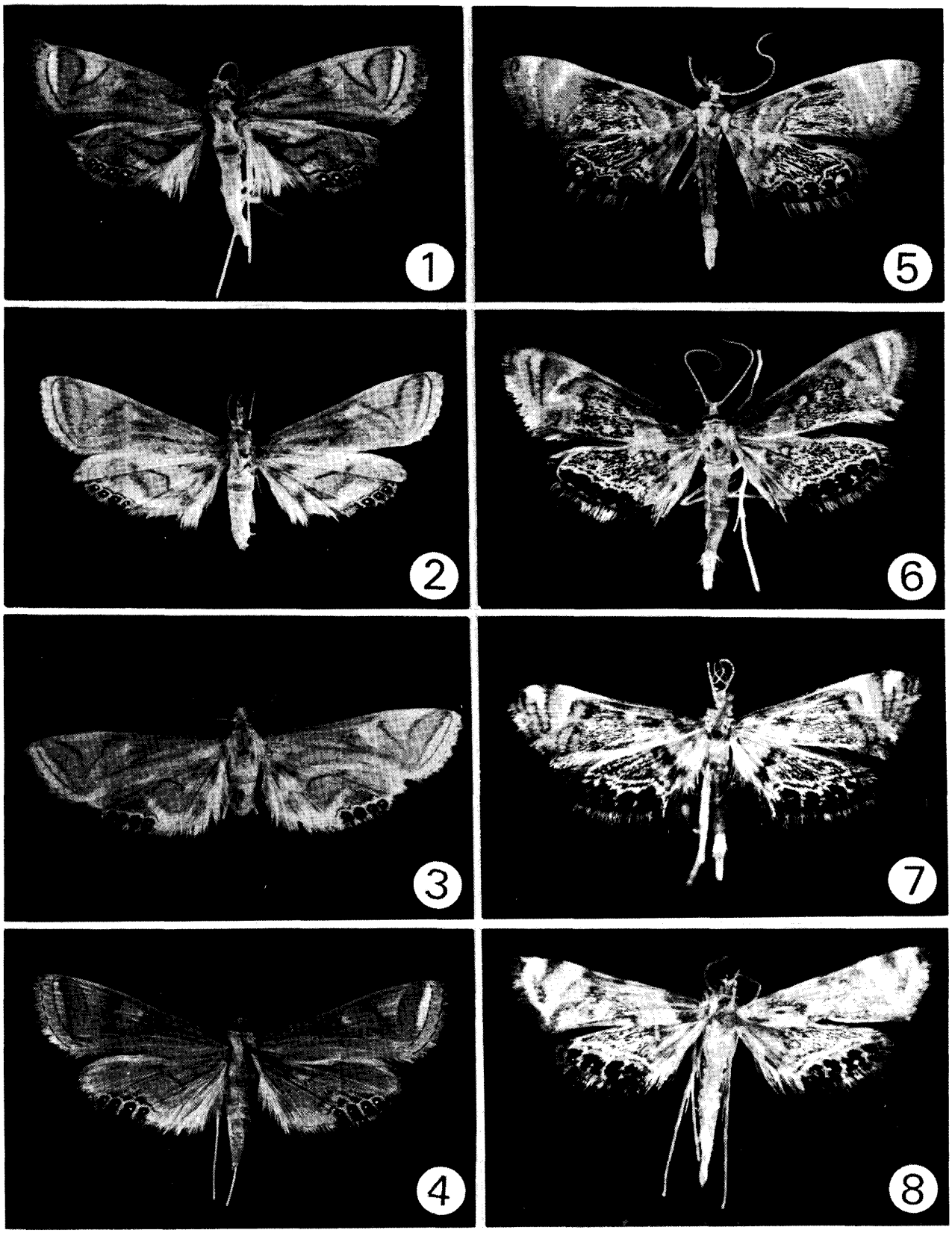

Plate 11. 1, *Eoophyla inouei* Yoshiyasu (♂); 2, ditto, (♀); 3, *Eoophyla conjunctalis* (Wileman & South) (♀), Japan; 4, ditto, (♀), Taiwan; 5, *Nymphicula saigusai* Yoshiyasu (♂); 6, *Nymphicula junctalis* (Hampson) (♂); 7, *Nymphicula albibasalis* Yoshiyasu (♂); 8, *Nymphicula minuta* Yoshiyasu (♀).

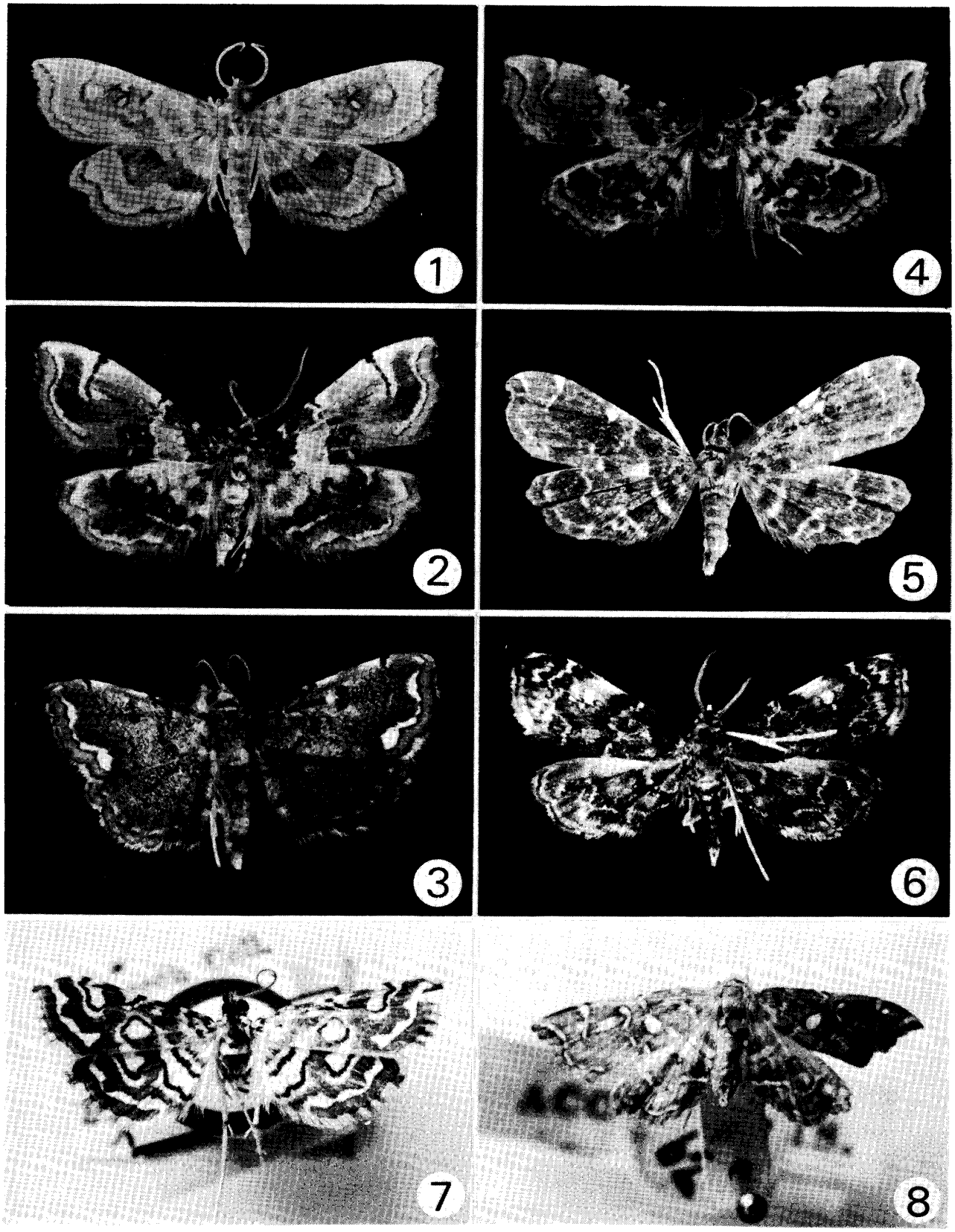

Plate 12. 1, *Musotima colonalis* (Walker) (♂); 2, *Musotima tanzawensis* sp. nov. (♀); 3, *Neomusotima fuscolinealis* sp. nov. (♂); 4, *Musotima dryopterisivora* sp. nov. (♂); 5, ditto, (♀); 6, *Melanochroa yasudai* sp. nov. (♂); 7, Type specimen of *Elophila* (*M.*) *separatalis* (Leech), China; 8, Type specimen of *Musotima acclaralis* (Walker), Sri Lanka.