The Phaneropterinae were divided into several groups by Brunner (1878) and these may be regarded as tribes in present day taxonomy (e.g. Bei-Bienko 1965). The tribe Elimaeeini Yakobson, 1905 (group Elimaeae Brunner, 1878) consists so far of only three genera, 

Elimaea Stål, 1874, Hemielimaea Brunner, 1878, and Ectadia Brunner, 1878, all occurring in the Oriental region. It is thought to be most closely related with the African and Mediterranean Acrometopini and the Oriental Mirolliini (Brunner 1878).

The genus most rich in species, Elimaea Stål, 1874, contains a few widespread and numerous local species (Brunner 1878, 1891, Kirby 1906, Hebard 1922a, Karny 1926a-c, 1931, Tinkham 1943, Bei-Bienko 1951, 1962, 1965, Ingrisch 1990a, Jin & Xia 1994). It was divided into three subgenera by Karny (1926a):

Orthelimaea, Rhaebelimaea, and Elimaea s. str. While the anterior femur is straight in Orthelimaea, it is curved in Elimaea and Rhaebelimaea. The latter subgenera differ in the radius sector branching before or about in the middle of the tegmen. Hemielimaea differs from Elimaea by the tibial tympanum which is open on external and covered by a conchate fold on internal side, while in Elimaea it is covered by a conchate fold of the integument on both sides. Hemielimaea species are so far only known from China and Indochina, while the distribution of Elimaea s. lat. reaches from India to the Sunda Islands and the Philippines (map 1).

The species of the Elimaeeini belong to the com-
mon Phaneropterinae in South East Asia. They can be found in primary forests as well as in secondary vegetation. They live in the lower vegetation as shrubs and grasses and are thus amongst the first katydids to be met when looking for Orthoptera in tropical Asia. Their activity is largely nocturnal. During day time they are often found sitting along the central vein of a leaf with the fore legs and antennae stretched anteriorly. In doing so, the head fits in the phasmid-like curvature of the anterior femora which is found in some of the taxa. The middle and the hind legs are pressed together and spread in an acute angle from the body (figs. 152-153, 155).

The great species diversity of Elimaea in South East Asia was noted by Hebard (1922a) and Karny (1926a). Despite this, many species are not well described, and it is difficult to identify Elimaea species without re-examining the types or specimens from the type localities. This is especially true for the species of the subgenus Elimaea s. str. which cannot be identified with certainty on the basis of the previously used characters. Thus it became necessary to find new differentiating characters. The characters that were most commonly used to identify Elimaea species are the tegminal venation (i.e. the branching of the radius sector), male and female subgenital plates, male cerci, and coloration. Coloration can, however, be greatly variable within species. The subgenital plates also show some individual variation (compare e.g. figs. 57 and 58) and, unfortunately, its shape in museum specimens may have changed due to desiccation after death (compare e.g. figs. 59 and 60).

Examination of material from the museums in Bologna (Italy), Leiden (The Netherlands) and Genoa (Italy) and my collection from Thailand, Sumatra and Java revealed two facts: (1) The number of species and the regional diversity is even greater than previously thought; and (2) there are additional distinctive characters that allow - together with those previously described - a clear distinction between the species in both sexes. Those characters are, in males: (1) the stridulatory file on the underside of the left tegmen, and (2) sclerotised structures of the phallus which consist of a pair of conchate (mussel-shaped) sclerites with serrate margin and sometimes with an additional unpaired sclerotised projection. Those sclerotised structures are characteristic for the species of Rhaebelimaea and Hemieliimaea. In females, the gonangulum (a lateral sclerite at the base of the ovipositor) can be provided with an appendage of variable shape at the ventral margin. In some cases the corresponding area of the ventral ovipositor valves is also modified.

The purpose of the present paper is to show the distinctiveness of the new and previously recognised characters. This may be the basis for a future revision of the genus. The results are presented in form of a tabular key to the species from Java, Sumatra, Mentawei Islands, Malay Peninsula and Thailand. The restriction to that area is for practical reasons, as no new material from other areas has been available to me. Especially the species from Vietnam and China cannot be revised without extensive new material as several of the types are lost (see checklist below). The present paper includes most of the species previously assigned to Rhaebelimaea, except those from Borneo and the Philippines, and it includes a redescription of the types of the “classical” species of Elimaea s. str. which were most difficult to differentiate and often wrongly identified.

The consideration of the new diagnostic characters makes it necessary to discuss the relations between the genera and subgenera anew on a phylogenetic basis. A checklist of the taxa of the Elimaeini is provided. Descriptions of species are restricted to new or insufficiently known species.

**Depositories**

Material examined for this study is deposited in the following collections:

- **CI** Private collection of S. Ingrisch, Bad Karls-hafen, Germany, will later be deposited in a museum
- **DAB** Department of Agriculture, Entomology and Zoology Division, Chatuchak, Bangkok, Thailand
- **MCN** Museo Civico di Storia Naturale, Genoa, Italy
- **MZH** Museo Zoologicum Bogoriense, Bogor, Indonesia
- **NHMW** Naturhistorisches Museum, Vienna, Austria
- **MNHN** Museum National d’Histoire naturelle, Paris, France
- **RMNH** Nationaal Natuurhistorisch Museum, Leiden, The Netherlands
- **NRS** Naturhistoriska Riksmuseet, Stockholm, Sweden
- **SMF** Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt/M, Germany
- **ZSI** Zoological Survey of India, Calcutta, India.

**Methods for recording stridulation**

Stridulation of one species each of Ectadia, Hemieliimaea and Rhaebelimaea and that of three morphologically similar species of Elimaea s. str. were so far recorded. Recording of the song of E. chloris was done in the field, that of the other species in wooden cages with gauze walls in the laboratory. In Phaneropterinae, there is usually a male-female response stridulation (Heller 1990). With one exception, only the male songs which are more distinctive were studied. All recordings were
made during the night in darkness. For recording in the field, a portable cassette recorder (Sony \textsuperscript{\textregistered} \textsuperscript{\textcopyright} \textcopyright) with a stereo microphone (Sennheiser \textsuperscript{\textregistered} \textsuperscript{\textcopyright}) and CrO\textsubscript{2}-tape cassettes were used (frequency range 0.05 - 15 kHz), in the laboratory a cassette recorder (Kenwood \textsuperscript{\textregistered} \textsuperscript{\textcopyright} \textcopyright) with a mono microphone (AKG D202 or Sennheiser black fire 541) and metal tape cassettes (frequency range 0.05 - 20 kHz). Analysis of stridulation was done using the programme Soundscope on a Macintosh \textsuperscript{\textregistered} (Quadra 840) with a MacAdios II/16 board as A/D converter which was connected via a MacAdios ABO box to the cassette recorder. The sound was filtered before analysis (zola-filter \textsuperscript{\textcopyright} \textcopyright). The oscillograms were copied into a graphic program for arrangement and final presentation.

### Phylogeny

Within the Elimaeini, \textit{Ectadia} is rather remote from the other genera and shows some similarities with the Acrometopini and the Mirollini. The similarities of \textit{Ectadia} with \textit{Acrometopa} concern e.g. the rather stout and somewhat breakable antennae (but not as extreme as in \textit{Acrometopa}) and the wing dimorphism of male and female (the wings of \textit{Ectadia} females are however less reduced than those of \textit{Acrometopa} females). The tegminal venation with an irregular course of the media and a wide network of oblique transverse veins resembles the situation in \textit{Mirollia}. In the other Elimaeini, the antennae are thin and flexible, the tegmina of both sexes are of equal size, and the principle veins of the tegmen are straight, subparallel and rather equally spaced from each other with the transverse veins running vertical to the principle veins. The relations of \textit{Ectadia} have to be re-evaluated in a suprageneric revision of the Phaneropterinae, which is beyond the scope of the present paper. Brunner (1891) assigned also the African genus \textit{Pantolepta} Karsch, 1889 to the Elimaeini, because it has the fore and mid femora compressed and spined on ventral margins. It was said to be close to both \textit{Acrometopa} and \textit{Ectadia} Brunner (1891). The stout, breakable antennae and the reduced hind wings of the female, which do not surpass the tegmina, makes it more likely that \textit{Pantolepta} belongs to the Acrometopini, but its position should also be re-evaluated in a suprageneric revision. The remaining taxa of the Elimaeini are certainly closely related to each other, and these should be considered, if the formal, present day division into genera and subgenera is correct, from a phylogenetic point of view.

A phylogenetic tree based on the presently recog-
nised division is presented in fig. 1a. The armature of the tibial tympana is obviously a character that is readily modified in the Phaneropterinae. It is conchate on both sides in the Acrometopini, in Ectadia and in Elimaeina, and it is conchate on internal and open on external side in Hemielimaeina and in the Mirollini. As such there is not a very strong argument for a separation of Hemielimaeina and Elimaeina. Moreover, if we agree with the traditional arrangement of the genera, we have to suppose that the occurrence of a pair of conchate sclerites on the phallus has evolved twice independently in this closely related group of taxa (in Hemielimaeina and in Rhaebelimaeina). The phallus of the majority of Phaneropterinae is basically simply membranous. Sclerotised structures exist in several genera but they are not well known. Their structures probably evolved independently in different genera or genus groups. However, those of Hemielimaeina and Rhaebelimaeina species are very similar in shape and position and may thus be regarded as homologous structures of both taxa. In Orthelimaeina, the phallus is membranous, but in some species the dorsal lobes are provided with a stiffened longitudinal ridge covered with spines. A situation which is regarded more primitive than the possession of distinct sclerites as in Hemielimaeina and Rhaebelimaeina. Sclerotised structures are also found on the phallus of the Mirollini, but these are quite different from those of the Elimaeini. They will be dealt with in a later paper.

If however, we regard Hemielimaeina and Rhaebelimaeina as sister groups on the base of the phallic sclerites as a synapomorphic character (fig. 1b), we have to suppose that the phasmid-like curvature of the anterior femora evolved twice independently in a closely related group of taxa (Rhaebelimaeina and Elimaeina). Curved anterior femora are unique in the Phaneropterinae and may thus be regarded as a synapomorphic character of Rhaebelimaeina and Elimaeina.

A solution would be a sister group relationship as presented in the third phylogenetic tree (fig. 1c). In this tree, both characters, phallus sclerites and curved anterior femora, are considered to be apomorphic and evolved only once within Elimaeini. But in contrast to the first tree (fig. 1a), it is supposed that the phallic sclerites are secondarily reduced in Elimaeina s. str. The third tree is the most parsimonious, as we do not have to suppose that any obviously homologous characters evolved twice independently.

If we accept the phylogenetic tree in fig. 1c to be correct, the division of the Elimaeini into genera and subgenera has to be changed. There are two alternatives: (1) At least Orthelimaeina has to be removed from Elimaeina and raised to full generic rank, as it is more remote from Elimaeina and Rhaebelimaeina than is Hemielimaeina. Rhaebelimaeina might also be raised from a subgenus under Elimaeina to full generic rank as it shows close relations to both, Hemielimaeina (conchate phallus sclerites) and Elimaeina (curved anterior femora). (2) Hemielimaeina should become a subgenus of Elimaeina. As this is not a complete revision of the tribe, the second alternative is preferred.

The species previously included in the subgenus Elimaeina can be divided into two distinct morphological groups, as already recognised by Karny (1926a): (1) species with moderately narrow tegmina which are distinctly wider than the pronotum length, and (2) species with very elongate tegmina which are in the male narrower than the pronotum length and in the female of subequal width. To the former belongs the type species (Phaneroptera subcarinata Stål, 1861) of Elimaeina and they are thus the Elimaeina s. str. The latter are listed here as the E. poaefolia–group within the subgenus Elimaeina. As both are sister groups with many shared characters, they can remain in the same subgenus. If the males, which are unknown for several species of the E. poaefolia–group, show constant differences to Elimaeina s. str., it might later be useful to erect a separate subgenus for this group.

Systematic part

Checklist of the species of Elimaeini

With information on types, type localities and depositories. Abbreviations: H holotype, S Syntypes, F female, M male; synonyms marked by =.

**Ectadia**

*fulva* Brunner, 1878

**Hemielimaea**

*sulcata* Xia & Liu, 1990

**Orthelimaea**

*annulata* Brunner, 1878

= *annulata* Brunner, 1893

**Rhaebelimaea**

*flavolineata* Brunner, 1878

= *flavolineata* Brunner, 1893

**Elimaeina (Orthelimaeina)** Karny, 1926

*flavolineata* Brunner, 1878

**Hemielimaea**

*annulata* Brunner, 1878

= *annulata* Brunner, 1893

**Orthelimaea**

*flavolineata* Brunner, 1878

= *flavolineata* Brunner, 1893

**Rhaebelimaea**

*Sulawesi* (Warsaw? formerly coll. Dohrn, Stettin)
**Elimaeinae** (Hemielimaeinae) Brunner, 1893

- **chinesis** (Brunner, 1878) (Hemielimaeinae)
  - SFM: China (Budapest, lost?; Vienna)
  - HC: Thailand: Kanchanaburi prov., Erawan falls (Frankfurt/M)

- **formosana** (Shiraki, 1930) (Hemielimaeinae)

- **mannhardti** Krausze, 1903a
  - HC: Tonkin: Than-Moi (lost), combined with *Hemielima* by Dohrn 1906
  - SFM: Malaysia: Selangor, Kanching (Kuala Lumpur)

- **procera** (Ingrisch, 1990a) (Hemielimaeinae)
  - HC: Thailand: Chanthaburi prov., Khao Soi Dao (Frankfurt/M)

- **tonkinensis** (Dohrn, 1906) (Hemielimaeinae)
  - SFM: Thailand: Chanthaburi prov., Khao Soi Dao (Bangkok)

- **Elimaeinae** (Rhaebelimaeinae) Karny, 1926

  - **adpersa** Dohrn, 1906 (*Elimaea signata* var. *adpersa*)
    - SFM: Sumatra: not further specified, but Dohrn collected in North Sumatra (Warsaw? formerly Stettin)

  - **apicata** sp. n.
    - HM: Thailand: Surat Thani province, Khao Sok (Bangkok)

  - **bakeri** Hebard, 1922a
    - HM: Mindanao: Davao (Philadelphia)

  - **bidentata** Brunner, 1878
    - HF: Malabar (Berlin)

  - **brunneri** Dohrn, 1906
    - HF: Philippines (Vienna), replacement name for *E. parumpunctata* Brunner, 1878 nec Serville, 1839

  - **caricifolia** (De Haan, 1842) (*Phaneroptera*)
    - HM: Borneo: Loetontoe (Leiden)

  - **femorata** Brunner, 1878
    - HF: Borneo (Vienna), synonymy by Dohrn (1906) and Karny (1923)

  - **curvicercata** Brunner, 1891
    - SFM: Java orientalis (Vienna)

  - **filicata** Hebard, 1922a
    - HM: Luzon: Laguna, Los Banos (Philadelphia)

  - **hebardi** Karny, 1926b
    - SFM: South Sumatra: Lampongs, Wai Lima (Bogor; Leiden)

  - **krauszei** Karny, 1926a
    - SFM: West Java, Cibodas, 1400m (Bogor; Leiden)

  - **lamlilipt** Hebard, 1922a
    - HF: Sabah: Labuan (Philadelphia)

  - **longicercata** Brunner, 1891
    - SFM: Borneo (Vienna)

  - **malayica** Karny, 1920
    - SFM: Borneo (Vienna), replacement name for *E. paeofolia* Brunner, 1878 nec De Haan, 1842

  - **maninjuensis** sp. n.
    - HM: West Sumatra: Maninjau (Bogor)

  - **mentawei** sp. n.
    - HM: Mentawei Islands (Bogor)

  - **modigliani** sp. n.
    - HM: Sumatra: Si-Rambe (Genoa)

  - **monilomii** Karny, 1923
    - HF: Sarawak: Baram river (Singapore?)

  - **neglecta** Karny, 1926c
    - HF: Malaysia: Selangor, Kanching (Kuala Lumpur)

  - **parumpunctata** (Serville, 1839) (*Phaneroptera*)
    - HF: Java (Paris)

  - **pentaspina** sp. n.
    - HF: Thailand: Chanthaburi prov., Khao Soi Dao (Bangkok)

  - **pseudochloris** sp. n.
    - HM: Thailand: Trang prov., Khao Chong (Bangkok)

  - **puncticostata** Bolivar, 1914
    - HF: ? Philippines or Himalaya (lost), occurs in the Philippines according to Karny (1926b)

  - **roseoalata** Brunner, 1891

  - **siamensis** Karny, 1926c (*Elimaea signata* *siamensis*)
    - HF: South Thailand: Nakhon Sri Tamarat (Kuala Lumpur)

  - **signata** Brunner, 1878
    - SFM: Singapore: Bukit (Vienna)

- **siunita** sp. n.
  - HM: Mentawei Islands: Sipora (Bogor)

  - **spiniger** Brunner, 1878
    - SFM: Singapore: Bukit (Vienna)

  - **sumatranana** Karny, 1926a
    - HM: West Sumatra: Padangische Bovenland, Batu Sangkar (Philadelphia), replacement name for *E. parumpunctata* Hebard, 1922a nec Serville, 1839

  - **transversa** Ingrisch, 1990a
    - HF: Thailand: Chanthaburi prov., Khao Soi Dao (Frankfurt/M)

  - **willemsei** Karny, 1926b
    - HM: South Sumatra: Lampongs, Wai Lima (Leiden)

The subgeneric position of the following species was not considered before. Judging from the descriptions, they might belong to *Rhaebelimaeinae*.

- **melanocantha** (Walker, 1869) (*Phaneroptera*)
  - HM: Sri Lanka (London)

- **= carinata** Brunner, 1878
  - HF: Sri Lanka (Berlin), synonymy by Uvarov (1927)

  - **nigrosignata** Bolivar, 1900
    - SFMM: South India: Madure, Kodaikanal (Madrid, Paris)

  - **verrucosa** Brunner, 1878
    - SFM: ? (Geneva)

**Elimaeinae** (*Elimaea*) Stål, 1874

- **annamensis** Hebard, 1922a
  - HM: Annam: Phuc-Son (Philadelphia)

- **bereozoki** Bei-Bienko, 1951
  - HM: Sichuan: Lunnu-Kuochikow (St. Petersburg)

- **chloris** (De Haan, 1842) (*Phaneroptera*)
  - SFMM: Java: Thihanjavar (Leiden)

- **filax** Bei-Bienko, 1951
  - HF: Southern Maritime Territory of USSR (St. Petersburg)

- **hoozanensis** Karny, 1915
  - SFM: Taiwan: Hoozan (DEI Berlin-Dahlem)

- **nautica** sp. n.
  - HF: Thailand: Chanthaburi prov., Khao Soi Dao (Bangkok)


**Elimaea punctifera** (Walker, 1869) (*Phaneroptera*)

- **HM**: Bangladesh: Silhet (London)

**= diversa** (Walker, 1869) (*Phaneroptera*)

- **HF**: Bangladesh: Silhet (London) synonymy by Uvarov (1927)

**schmidtii Krausze, 1903a**

- **HM**: Annam: Phuc-Son (lost)

**semicirculara** Kang & Yang, 1992

- **HM**: Fujiang, Dehua (Beijing)

**setifera** Bei-Bienko, 1962

- **HM**: Yunnan (St. Petersburg)

**subcaurina** (Stål, 1861) (*Phaneroptera*)

- **SMF**: Hongkong (Stockholm)

**= appendiculata** Brunner, 1878

- **HM**: Indochina (Vienna) synonymy in this paper

**= rubicunda** Krausze, 1903a

- **HM**: Tonkin: Than-Moi (lost) synonymy by Dohrn (1906) as synonym of *E. appendiculata*

**thaii sp. n.**

- **HM**: Thailand, Tak prov.: Mae Salid, Monkrating, 700m (Bangkok)

**tympanalis** (Matsumura & Shiraki, 1908) (*Phaneroptera*)

- **SMF**: Taiwan (Matsumura’s coll.)

The subgeneric position of the following species was not stated with the description nor later revised. Most of them probably belong to *Elimaea* s. str., but some might belong to other subgenera:

- **atrata** Carl, 1914

- **cheni** Kang & Yang, 1992

- **lii** Kang & Yang, 1992

- **obtusifolia** Kang & Yang, 1992

- **schenklingi** Karny, 1915

- **sri lanka** (De Haan, 1842) (*Phaneroptera*)

- **= rufonotata** Walker, 1869 nec Serville, 1839 (*Phaneroptera*), synonymy by Kirby (1906) as a synonym of *E. appendiculata*

**telnica** (De Haan, 1842) (*Phaneroptera*)

- **HF**: Borneo: Kahayan (Leiden), listed under *Elimaea* in Brunner (1878) and Kirby (1906); according to Karny (1926a) this is not an *Elimaea* species but might belong to *Habra*

**Species with uncertain status:**

- **aliena** (Walker, 1869) (*Phaneroptera*)

- **HF**: Bangladesh: Silhet (London), treated in Kirby (1906) as a synonym of *E. paramunctata*; this is certainly wrong; if it belongs in *Elimaea*, it might belong to the *poeafolia*-group

**theopoldi Krausze, 1903b**

- **HF**: Tonkin (lost), cited in Karny (1926a) as “species dubia”.

**tritisciifolia** (De Haan, 1842) (*Phaneroptera*)

- **HF**: Borneo: Kahayan (Leiden), listed under *Elimaea* in Brunner (1878) and Kirby (1906); according to Karny (1926a) this is not an *Elimaea* species but might belong to *Habra*

**Tentative key**

This key is meant for the species of *Elimaeini* occurring in Java, Sumatra, Mentawei Islands, Malay Peninsula, Singapore and Thailand.

Although the key is largely based on material studied by myself, not all species have been seen by me. Some illustrations were taken from Hebard (1922a) or Karny (1926a-c) and adapted in size to the original drawings.

1. Anterior tibia with internal (= anterior) tympanum covered by a conchate fold, external (= posterior) tympanum free. *Hemielimaea*.................................2

   – Anterior tibia with internal and external tympanum covered by a conchate fold.................................3

2. Tegmen long and narrow (in ♀ 6.7×, ♂ 6.2-7.1× longer than wide). Stridulatory file with a strong step-like declination slightly behind middle of length (figs. 14-15). Conchate sclerites of phallus forming a quarter of a circle (fig. 95). Female subgenital plate with apex in middle slightly concave (fig. 118). Eastern Central Thailand ..................................................*E. (H.) procer*

   – Tegmen relatively broader (in ♀ 5.7-6.2×, ♂ 5.8-6.0× longer than wide). Stridulatory file with a weaker step-like declination slightly behind middle of length (figs. 16). Conchate sclerites of phallus forming almost a semicircle (fig. 96). Female subgenital plate with apex in middle subtruncate to slightly convex (fig. 117). Central Thailand ..................................................*E. (H.) cucullata*

3. Tegmen: radius subsector fused with media; media with zigzag course and sending several oblique, subparallel branches to posterior margin of tegmen. Male: tenth abdominal tergite prolonged behind with apex subtruncate. Female: wings shorter than in male but hind wings still slightly surpassing tegmina. Burma, North Thailand, South China ..................*Ectadia fulva*

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**Elimaea poeafolia-group**

- **jacobsonii** Karny, 1926a

- **HM**: West Sumatra: Bukittinggi, Fort Kock (Leiden)

**poeafolia** (De Haan, 1842)

- **SMF**: Java (Leiden)

**rosea** Brunner, 1878

- **SMF**: Borneo (Vienna; Dresden)

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**70**
- Tegmen: radius sector separate; media straight, running about in middle between radius (respectively radius sector) and cubitus; between radius and cubitus with vertical, rather regularly spaced, transverse veinlets. Male: tenth abdominal tergite either not prolonged or if prolonged, apex divided into 2 or 3 lobes. Female: wings of same size as in male.............................................................4

4. Anterior femur not compressed, straight (fig. 151). Orthelimaeæ ..............................................5
- Anterior femur in basal area compressed and phasmid-like curved (figs. 153, 162).................6

5. Male cerci sickle-shaped, bent in basal third, afterwards flattened (fig. 52). Male subgenital plate split for less than half of its length (fig. 78). Stridulatory file with circa 30 teeth (fig. 2). Female subgenital plate triangular. Ovipositor sabre-shaped, margins with large teeth (fig. 119). Thailand.............................................E. (O.) leeuwenii
- Male cerci gradually curved, slightly widened before apical cone (fig. 51). Male subgenital plate split for more than half of its length (fig. 79). Stridulatory file with circa 70 teeth (fig. 3). Female unknown. Eastern and Central Java.............................................E. (O.) minor

6. Phallus with a pair of conchate sclerites (figs. 85-94). Tegmen with radius sector branching about in or behind middle of tegmen (figs. 152-155, 159, 162), rarely (E. pseudochloris) before middle (fig. 161). Pronotum often, but not in all species, slightly constricted in circa middle of length. ......7
- Phallus membranous without sclerites. Tegmen with radius sector branching distinctly before middle of tegmen (figs. 156-158, 160, 164). Pronotum not constricted in middle. Elimaeæ..............................................................37

7. Tegmen slightly widening towards apex (width in middle 6 mm, at apex 7 mm). Pronotum with lateral margins of disc angularly rounded. Sumatra (only known from the female type). Sumatra..............................................................E. (?) marmorata
- Tegmen narrowing towards apex or of subequal width throughout. Pronotum with lateral margins of disc rounded. Rhaebelimææ........................................8

8. Tegmen with radius sector branching before middle of tegmen (fig. 161). Male subgenital plate step-like constricted behind base, thereafter narrow, parallel-sided (fig. 73). Stridulatory file with large, spaced teeth throughout (fig. 9). Phallus sclerites as in fig. 93. South Thailand.........................................................E. (R.) pseudochloris
- Tegmen with radius sector branching in or behind middle of tegmen (figs. 152-155, 159, 162). Male genitalia of different shape .........................................................9

9. Pronotum and single cells of tegmen densely suffused with black dots, giving the impression of the tegmen being marbled with somewhat irregular, quadrangular, black spots. Male cerci surpassing subgenital plate, round, before apex slightly widened. Male subgenital plate apically prolonged into a long, very narrow projection with bulging lateral margins, split in circa apical quarter with lobes not deviating. Sumatra......................E. (R.) adspersa
- Pronotum and tegmen less densely covered with black dots. Male external genitalia of different shape............................10

10. ♂ ♂ .............................................................................11
- ♀ ♀ .......................................................................25

11. Tenth abdominal tergite largely prolonged behind and apex divided into 2 or 3 lobes. ..........12
- Tenth abdominal tergite not prolonged behind, apex entire (subtruncate, slightly concave or convex)..........................................................14

12. Tenth abdominal tergite with apical projections long and narrow, forming a three-spined apex. Malaysia, Singapore............................E. (R.) spinigera
- Tenth abdominal tergite with apical projections bilobate, rounded........................................13

13. Subgenital plate split for about apical half into 2 narrow lobes. Borneo, Sumatra? [only known from a male and a female syntype which are possibly not conspecific]..........................E. (R.) malaica
- Subgenital plate with apical half entire, only at very apex faintly excised (fig. 74). South Thailand..........................................................E. (R.) apicata

14. Subgenital plate bowl-shaped with a conical, narrow, apical part; almost split to base (fig. 71) ..15
- Subgenital plate of different shape, split in apical quarter or at apex only.................................16

15. Cerci with black apical cone long and narrow (fig. 29). South Sumatra...........E. (R.) willemsei
- Cerci with black apical cone shorter and stout (fig. 30). Phallus with an unpaired ventral sclerite in addition to the paired conchate sclerites (fig. 90). Stridulatory file sinuate with teeth spaced in circa basal half and dense in circa apical half (fig. 5). Mentawei Islands ........................................E. (R.) sinuita

16. Cerci long, surpassing or embracing subgenital plate (figs. 38-41).................................17
- Cerci short, usually shorter than subgenital plate (figs. 31-35).....................................................20

17. Cerci regularly curved in middle; apical area straight, apical cone long and narrow; apex acute (fig. 38). Singapore, Riouw, Pulau Ubin.........................E. (R.) signata
- Cerci re-curved at apex or apical cone short and stout (figs. 39-41).............................................18

18. Cerci only in apical area distinctly curved (fig. 41). Subgenital plate with apex of apical lobes transversely truncate (fig. 75). South-East Sumatra......E. (R.) behardi
19. Subgenital plate split in apical third; base broad (fig. 77). Cerci at apex re-curved with margins gradually tapering (fig. 40). Stridulatory file with teeth spaced in basal area (fig. 7). Conchate sclerites of phallus as in figs. 85-86. Mentawei Islands ..............................................E. (R.) mentaweii

Subgenital plate split only at apex; base narrow (fig. 76). Cerci before apex slightly widened and then suddenly constricted to apical cone (fig. 94). Stridulatory file with teeth rather dense from base (fig. 8). Conchate sclerites of phallus as in fig. 94.

West Sumatra ..................E. (R.) kasmirii

20. Subgenital plate with apical lobes step-like constricted and apex spiniform (fig. 70). North-East Sumatra ........................................E. (R.) curvicercata

Subgenital plate with apex of different shape...21

21. Tegmen with dorsal field considerably widened and on right tegmen with subparallel transverse veins (fig. 17). Stridulatory file very long, teeth gradually changing from spaced teeth at base to dense teeth at apex; at apex with a few spaced teeth (fig. 10). Conchate sclerites of phallus as in fig. 92. Cerci acute-angularly curved with a long, narrow, apical part (fig. 34). West Java (mountainous) .... ........................................E. (R.) kraussi

Tegmen with dorsal field not considerably widened and on right tegmen without subparallel transverse veins. Cerci less strongly curved (figs. 31-33, 35) ............22

22. Subgenital plate with apical part narrowly divided; apex of lobes transversely truncate (figs. 66, 68). Java .........................................23

Subgenital plate with apical part broader, roundly excised (figs. 69, 72). Sumatra ..................24

23. Cerci with apical cone longer and more slender (fig. 32). Stridulatory file with circa 100 teeth; teeth larger and more spaced (fig. 6). Conchate sclerites of phallus higher (fig. 87). West Java .... ........................................E. (R.) parumpunctata

Cerci with apical cone shorter and stouter (fig. 33). Stridulatory file with circa 80 teeth; teeth in central area more dense (fig. 11). Conchate sclerites of phallus very narrow (fig. 88). East Java.... ........................................E. (R.) curvicercata

24. Subgenital plate with apical lobes longer and more widely spaced (fig. 69). Cerci more strongly curved (fig. 35). West Sumatra .................E. (R.) sumatrana

Subgenital plate with apical lobes shorter and closer approached to each other (fig. 72). Cerci less strongly curved (fig. 31). Stridulatory file step-like declined before middle (fig. 12-13). Conchate sclerites of phallus as in fig. 89. North-West Sumatra .................E. (R.) modiglianii


Subgenital plate with apico-lateral projections only. Gonangulum of ovipositor with ventro-apical projection pointing ventrad (figs. 132-133, 135-136; gonangulum not described for all species!) ..................................................26

26. Subgenital plate constricted before apical lobes which are pointing laterally (figs. 103-104) ....27

Subgenital plate not constricted or apical lobes pointing apically (figs. 97-100, 102, 105-108)...28

27. Subgenital plate at apex more narrowly excised, apical lobes shorter (fig. 104). South-East Sumatra .................................................E. (R.) hebardi

Subgenital plate at apex widely excised, apical lobes very long (fig. 103). North-East Sumatra ... ........................................E. (R.) parumpunctata

28. Subgenital plate distinctly narrowed towards apex; apex roundly excised between apico-lateral lobes (figs. 105-106, 108) .................29

Subgenital plate not narrowed towards apex; if slightly narrowed widely truncate between apico-lateral lobes (figs. 97-100, 102, 107) ...............31

29. Subgenital plate with apex rather deeply excised, apical lobes spiniform (fig. 106). Malaysia: Selangor .......................E. (R.) neglecta

Subgenital plate with apex slightly excised (figs. 105, 108) ..................30

30. Subgenital plate with apico-lateral lobes acute (fig. 108). Singapore, Riouw, Pulau Ubin ........E. (R.) signata

Subgenital plate with apico-lateral lobes circa rectangular (fig. 105). West Java (mountainous) .... .................E. (R.) kraussi

31. Subgenital plate with apex almost trilobate, similar to fig. 97, but medial lobe triangular and emarginate. East Java ............E. (R.) curvicercata

Subgenital plate of different shape; if apex almost trilobate then medial lobe obtuse, not emarginate (fig. 97) ........................................32

32. Ventral valves of ovipositor at base (between subgenital plate and gonangulum) with a tongue-shaped projection (figs. 121, 136). Subgenital plate as in fig. 97. West Java ..................E. (R.) parumpunctata

33. Subgenital plate largely widening apicad; apex broad-roundly excised (fig. 107). South Thailand .....................E. (R.) siamensis

Subgenital plate not or only slightly widening apicad; apex more or less truncate between apical lobes or triangularly excised (figs. 98, 102) ........34
34. Subgenital plate with apico-lateral lobes large (figs. 99-100). Cerci sinuate, apex subacute (figs. 143-144) ...........................................E. (R.) punctifera

- Subgenital plate with apico-lateral lobes small (figs. 98, 102). Cerci simply curved, apex obtuse (figs. 140-141) ...........................................E. (R.) modiglianii

35. Subgenital plate with apico-lateral lobes pointing apico-laterally, apex transversely truncate in between (fig. 99). West Sumatra ...........................................E. (E.) rosea

- Subgenital plate with apico-lateral lobes pointing apically; apex triangularly excised in between (fig. 100). Mentawei Islands ..........E. (R.) mentavei

36. Subgenital plate with apex truncate between apico-lateral lobes but slightly excised in middle (fig. 98). Eastern Central Thailand ........E. (R.) transversa

- Subgenital plate with apex convexly truncate between apico-lateral lobes (fig. 102). North-West Sumatra ........E. (R.) jacobsonii

37. Tegmen long and narrow, its width in middle shorter than length of pronotum (Δ) or of about equal length (Φ); tegmen parallel-sided or in some males slightly narrowed in middle and widening towards apex (about 1 mm). Pronotum with lateral lobes distinctly longer than high. Elimaea poaefolia-group ..........................................................38

- Tegmen not so narrow; its width in middle distinctly longer than length of pronotum; costal area usually widened in about basal half (figs. 158, 160, 164). Pronotum with lateral lobes only little longer than high. Elimaea s. str. ..............41

38. δ δ ........................................................................41


- Cerci of subequal length with subgenital plate. Subgenital plate more gradually narrowed.............40

40. Java ..........................................................E. (E.) poaefolia

- Borneo; also in Malaysia? ..........E. (E.) rosea

41. Subgenital plate with lateral margins converging in circa apical half; apex rounded excised and with apico-lateral angles acute. Java ..........E. (E.) poaefolia

- Subgenital plate with apex not rounded excised ... ........................................................................42

42. Fastigium verticis not furrowed. Subgenital plate short, apex obtuse, at each side provided with a narrow, acute lobe. Borneo; also in Malaysia? ......

- Fastigium verticis furrowed. Subgenital plate without a narrow acute lobe at each side. Thailand ........................................................................43

43. Subgenital plate with apex transversely truncate and slightly excised in middle; at each apico-lateral angle with 2 short obtuse lobes (fig. 115). Gonangulum of ovipositor longer, pointing more or less apicad (fig. 138). Northern Thailand ..............

- Subgenital plate with apex obtuse-triangular with somewhat irregular margin, at each side with a short conical projection (fig. 114). Gonangulum of ovipositor shorter, pointing more or less ventrad (fig. 137). Western Thailand ..........E. (E.) sp. 2

44. Male: Subgenital plate split in circa apical half or more (figs. 55-56). Cerci rather strongly bulging before apex (figs. 49-50). Stridulatory file with circa 28-29 rather large and spaced teeth (figs. 27-28). Female: Cerci with apex rather broad, obtuse (fig. 145). Eastern Central Thailand, Hawaii Islands ....E. (E.) nautica

- Male: Subgenital plate split in less than apical half, usually split in apical third only (figs. 59-65); if split for almost apical half (figs. 57-58) then stridulatory file with 34-42 teeth (figs. 24-25). Cerci only slightly widened before apex (figs. 42-48). Female: Cerci with apex narrow, subacute (figs. 146-150) ..............45

45. Male: Stridulatory file with less than 20 large and widely spaced teeth in basal and central area and a variable number of minute teeth in apical area (figs. 18-23). Female: Gonangulum of ovipositor with a large ventro-apical appendage (figs. 127-128). Apex of subgenital plate only faintly excised or apical lobes approached to each other (figs. 111-113) .........46

- Male: Stridulatory file with more numerous and less widely spaced teeth which are gradually decreasing in size from central area to apex (figs. 24-26). Female: Gonangulum of ovipositor with a small ventro-apical appendage (figs. 129-130). Apex of subgenital plate with two widely spaced, obtuse, apical lobes (fig. 110). [Female of E. punctifera unknown] ..............47

46. Male: Stridulatory file with circa 32-35 (14-16 large) teeth. Female: Apex of subgenital plate only faintly excised in middle (fig. 111). Cerci less strongly curved (fig. 148). Central Thailand to Java ..........E. (E.) chloris

- Male: Stridulatory file with circa 9-17 (6-9 large) teeth. Female: Apex of subgenital plate terminating into 2 subacute to subobtuse lobes which are only narrowly separated from each other (figs. 112-113). Cerci more strongly curved (fig. 146). Hongkong to North East India.................E. (E.) subcarinata

47. Male: Stridulatory file with circa 53 teeth (fig. 26). Cerci with apical cone long and robust (fig. 44). Subgenital plate split in circa apical quarter to apical third (figs. 61-62). Female unknown. Bangladesh ..........E. (E.) punctifera

- Male: Stridulatory file with circa 34-42 teeth (figs. 24-25). Cerci with apical cone short and
slender (fig. 48). Subgenital plate split for somewhat less than apical half (figs. 57-58). Female: Apex of subgenital plate with 2 short obtuse lobes and broadly truncate in between (fig. 110). Thailand..............................E. (E.) thailand

Elimaeini Yakobson, 1905: 324, 373

Diagnosis. – Antennae elastic (less so in Ectadia). Fastigium verticis forming a right angle with fastigium frontis. Pronotum with a distinct humeral sinus. Anterior coxa without spine but in some species with a minute spine. Anterior femur on ventral side furrowed and provided with small spines. Anterior tibia dorsally furrowed and provided with (small) dorso-apical spurs. Tibial tympana covered by a conchate fold with wide anterior slit on both sides or on internal (= anterior) side only. Subgenital plate without styli. Ovipositor usually forked, rarely sabre-shaped, little longer than pronotum.

Ectadia Brunner, 1878

Ectadia Brunner, 1878: 103. Type species: Ectadia pilosa Brunner, 1878; by monotypy.

Diagnosis. – Elimaeini with modified tegminal venation and sexual wing dimorphism. Radius sector fused with media; media with a zigzag course and sending several oblique, subparallel branches to posterior margin of tegmen. Tegmen of male with dorsal area widened. In the female, both pairs of wings slightly shortened but hind wings surpassing tegmina in both sexes. Male subgenital plate without styli. Ovipositor usually forked, rarely sabre-shaped, little longer than pronotum.

Ectadia fulva Brunner


Material examined. – Thailand: 1 ♂, Chiang Mai prov., Doi Suthep-Pui, 1100-1200m, 22.x.1990; 1 ♂, 1 ♀, same data but 13.iv.1995; 23 ♂, 21 ♀, same data but ex ovo; 1 ♂, 1 ♀, Mae Hong Son prov., mountains between Samoeng - Pa Pae, 30.iv.1988; 1 ♂, Nan prov., Doi Phukha, 1500m, 5.x.1991, all ct.

Remarks. – The species is sufficiently described and figured in Brunner (1893). The female of this species was described under the name Ectadia abbreviata Brunner, 1893 as already recognised by Bei-Bienko (1962).

The tegminal venation, especially the irregular course of the media and the network of strong transverse veinlets resembles the situation in Mirollia Stål, 1873 but in a less extreme form. The rather stout and breakable antennae and the sexual wing dimorphism resemble the condition in the Acrometopini. However in contrast to the latter, the antennae are somewhat more flexible and in the female, the hind wings still surpass the tegmina although both pairs of wings are slightly shortened. The male cerci are curved and strongly compressed except for a short conical part at base. They are similar to that of O. leeuwenii. E. fulva shows a green brown colour dimorphism.

Development. – Oviposition was in parenchyma of leaves of wheat, between the layers of absorbent paper and in polystyrene. The eggs are of typical Phaneropterae shape, compressed kidney-shaped. Egg development required 37-94 (mean 52) days at 20-23°C. There were 6 larval instars. The first larval instar is pale reddish brown with 3 longitudinal white stripes (fig. 168). Legs and antennae are almost colourless. Body and legs are dotted with black. Larval development (from hatching to adult) required 52-68 days at 20-23°C. In captivity, larvae and adults readily fed the following European plants: leaves of Triticum and Rumex as well as flowers of Rumex, Achillea, Chrysanthemum, and Bellis, and less readily leaves of Rubus and Taraxacum.

Stridulation (fig. 169). – The song of one male from Doi Suthep (Chiang Mai province, Thailand) was recorded at 20.5°C. Stridulation consists of a sequence of about six schemes, the first scheme slightly quieter than the following. Each scheme consists in the first half of crescendoing pulses which are separated by rather large pauses from each other. The second half of an scheme is quieter, the repetition of the decrescendoing pulses becomes increasingly faster, such that in the last quarter of an scheme single pulses can not be recognised, even with a high time resolution. At the end of an scheme the song intensity becomes loud again. The schemes lasted between 1640 and 1890 ms, the interval time varied between 4900 and 6050 ms. The main frequency of the song was about 6-14 kHz. The sound of an scheme can be circumscribed as “trrrr ziìip”, with the second part of the sound quieter than the first. Stridulation of Ectadia fulva with an extreme acceleration of the stridulatory elements (syllables or pulses) within one scheme is rather curious.

Elimaea Stål

Elimaea Stål, 1874: 27. Type species: Phaneroptera subcarinata Stål, 1861; by monotypy.

Diagnosis. – Elimaeini with posterior margin of tegmen straight; radius, radius sector, media and cu-
Elimaea (Orthelimaea) Karny

Orthelimaea Karny, 1926a: 23. Type species: Elimaea (Orthelimaea) leeuwenii Karny, 1926a; by original designation.

Diagnosis. – Elimaeini with straight anterior femora. Tibial tympana covered by a conchate fold on both sides. Greatest width of tegmen wider than length of pronotum; radius sector branching about in middle of tegmen. Male cerci either compressed or subcylindrical with an apical conus. Phallos membranous, but dorsal lobes in some species provided with a longitudinal rim covered with spinules. Ovipositor short sabre-shaped with basal area substraight and apical area with stout teeth or falcate with margins in apical area finely serrulate; gonangulum with ventral margin projecting, but sometimes not very distinct.

Remarks. – Orthelimaea is heterogeneous with regard to the male cerci, the phallus and the female ovipositor. It is thus possible that this subgenus is a heterogeneous assemblage of species and must be further subdivided. However, as most species referred to Orthelimaea are known from the Indian subcontinent, we have to wait until those species are carefully revised.

Distribution. – The subgenus has its greatest species diversity on the Indian subcontinent but spreads into Central China and Thailand; a single species is known from each, Java and Sulawesi (map 1).

Elimaea (Orthelimaea) leeuwenii Karny
(figs. 2, 52, 78, 116, 119, map 3)

Elimaea (Orthelimaea) leeuwenii Karny, 1926a: 24, fig. 90. Synotypes, 2♂, Thailand, Bangkok, 5.xi.1920, Docters van Leeuwen: 1♂ (without type label) in MZB [examined]. 1♂ (labelled holotype) in RMNH. – Ingrisch 1990a: 91, figs. 1-2.


Remarks. – The male of this species is already sufficiently described in Karny (1926a), the female in Ingrisch (1990a). The diagnostic characters are outlined in the key. The stridulatory file bears circa 31 teeth which are gradually decreasing in size towards apex but remain rather large throughout.

The species is widespread in Central and Northern Thailand and was so far collected from the Chiang Mai province in the north to the Prachup Khiri Khan province in the south (map 3).

Development. – In contrast to all other Elimaea species, E. leeuwenii has a sabre-shaped instead of a sickle-shaped ovipositor. Oviposition of one female in laboratory was in the soil; but the eggs were obviously not fertilised as no hatching occurred.

Elimaea (Orthelimaea) minor (Brunner) comb. n.
(figs. 3, 51, 79, 151)

Elimaea minor Brunner, 1891: 48. Syntypes [not seen], 3 males: 2♂, Indonesia, Java, Tengger mountains, H. Fruhstorfer (18.190; NHMW); 1♂, Java, Dr. Dohrn (18.435; NHMW).

Elimaea (Rhaebelimaea) minor Karny, 1926a: 20.

Material examined. – Indonesia: 1♂, East Java, Tretes, Gunung Arjuna, 1300m, mixed forest, 26.iii.1995; 1♂, Central Java, Gunung Lawu, Tawangmangu - Sarangan, 1400m, mountain forest, 29.iii.1993, both ct.

Description. – Small species with parallel-sided tegmen (fig. 151).

Male: Stridulatory file with circa 70 teeth which are gradually decreasing in size towards apex (fig. 3). Cerci regularly curved, slightly constricted in middle and widened again before apex, apical cone subacute (fig. 51). Subgenital plate slightly constricted behind basal area, split into 2 lobes for more than apical half (fig. 79); internal surface of resulting lobes densely covered with minute spinules.

Female unknown.

Coloration: Green; posterior margin of pronotum and dorsal field of tegmen (including stridulatory area) brown. Tegmen with brown dots in cells between media and cubitus and a row of single larger dots between radius (respectively radius sector) and media. Variation: In the male from Gunung Lawu which was collected as a freshly moulted specimen, the dark pattern is largely absent.

Measurements of male (length in mm): Body 17; pronotum 3.5; tegmen 21.0-23.0; tegmen width 4.0-4.5; anterior femur 5.7-6.0; mesofemur 7.5-8.0; post-femur 17.0-18.0.

Remarks. – In the original description (Brunner 1891) and later in Karny (1926a) it is said that this species has the anterior femora curved in a phasmd-like fashion. Accordingly, the species was combined with Rhaebelimaea by Karny (1926a). This information is based on an error. In the specimens at hand as well as in the original type series (3♂ syntypes, “coll.” and “det. Brunner v. Wattenwyl” without type labels in NHMW, information by Dr. A. Kaltenbach 19.xii.1996), the anterior tibiae are straight, without the phasmd-like modification. The species must thus be grouped with Orthelimaea.
Elimaea (Hemielimaea) Brunner stat. n.

Hemielimaea Brunner, 1878: 103. Type species: Hemielimaea chinensis Brunner, 1878; by monotypy.

Diagnosis. – Elimaeini with straight anterior femora. Tibial tympana covered by a conchate fold on internal, open on external side. Greatest width of tegmen wider than length of pronotum; radius sector branching about in middle of tegmen. Phallus with a pair of conchate sclerites. Ovipositor falcate; gonangulum with ventral margin projecting; dorsal margin of ventral valves laterally projecting at base and curved around projection of gonangulum.

Distribution. – The area of this subgenus stretches from Eastern and Central China to Central Thailand (map 1). There are probably more, superficially similar, Hemielimaea species in Thailand than the following two. But the few additional specimens in DAB (3♂, 3♀♀) and CT (1♂) do not allow to be certain about the individual variation. The stridulatory songs of individuals from different localities should also be studied to determine whether small morphological differences are due to individual variation or are species specific.

Elimaea (Hemielimaea) procera (Ingrisch) comb. n. (figs. 14-15, 53, 81, 95, 118, map 3)


Material examined. – Thailand: 3♀♀, Chanthaburi prov., Khao Soi Dao, 12.vi.1988, Ct.

Description. – Fastigium verticis narrow, dorsal margin sinuate, furrowed; step-like declined to fastigium frontis. Pronotum with disc nearly flat, lateral margins rounded; transverse sulcus broad V- or short Y-shaped; paranota about as high as long; ventral and posterior margins rounded together; humeral sinus distinct. Tegmen sub-parallel-sided, in male about 6.7 times, in female 6.2-7.1 times longer than wide; radius sector branching in about middle. Anterior femur with spines on both ventral margins. Meso- and postfemur with spines on ventro-external margin only. Knee lobes of all femora bipinose. Anterior tibia with external and internal, dorsal and ventral apical spurs.

Male: Stridulatory file with a distinct step slightly behind middle of length, with circa 100 teeth (figs. 14-15). Tenth abdominal tergite with apex subtruncate. Epiproct tongue-shaped. Cerci slightly curved, slightly widening behind base, widest in circa middle, apex subacute. Subgenital plate semicircular in general outline, apex subtruncate in middle; lateral areas faintly grooved and with fine transverse furrows; central area faintly and broadly furrowed (fig. 118); at each side of subgenital plate intersegmental membrane with an awl-shaped appendage. Ovipositor falcate, stout; dorsal margin serrate in circa apical half, ventral margin in apical area; gonangulum slightly projecting ventrad, projection sticking in a curved fold of the dorsal margin of the ventral ovipositor valves; dorsal margin of the ventral ovipositor valves widened at base and acute-angularly excised at end of widening.

Coloration: Green. Antenna black with spaced light rings, but scapus and pedicellus with anterior surface light, posterior (= dorsal) surface dark. Vertex with a pair of longitudinal black bands. Pronotum with complete or incomplete black lateral bands (distinct at anterior and posterior margins, often dissolved into dots or absent in middle). Tegmen with dorsal area black with light veinlets, otherwise green with dark dots in the cells between radius and cubitus and between subcosta and anterior margin.

Measurements (length in mm): Body ♂ 21, ♀ 23-26; pronotum ♂ 4.5, ♀ 4.5-4.9; tegmen ♂ 37.0, ♀ 39.0-40.5; tegmen width ♂ 5.5, ♀ 5.5-6.0; anterior femur ♂ 7.5, ♀ 8.5-9.0; mesofemur ♂, ♀ 11.5-13.0; postfemur ♂ 26.0, ♀ 27.0-29.5; ovipositor 8.5-9.0.

Elimaea (Hemielimaea) cucullata (Ingrisch) comb. n. (figs. 16, 54, 80, 96, 117, map 3)


Description. – Fastigium verticis narrow, deeply furrowed and dorsal margin sinuate; step-like declined to fastigium frontis. Pronotum with disc nearly flat and lateral angles broadly rounded; anterior margin concave, posterior margin convex; transverse sulcus Y-shaped; paranota in male circa 1.1x longer than high, in female as high as long, ventral and posterior margins rounded together; humeral sinus distinct. Tegmen in male 5.7-6.2 times, in female 5.8-6.0; mesofemur ♂, ♀ 11.5-13.0; postfemur ♂ 26.0, ♀ 27.0-29.5; ovipositor 8.5-9.0.
Male: Stridulatory file with a rather weak step in circa middle of length, with about 90-109 teeth (fig. 16). Tenth abdominal tergite with a Y-shaped sulcus; apical margin slightly sinuate. Epiproct long-triangular with apex broadly rounded. Cerci curved, slightly widening behind base, widest in basal half; apex with a strong, acute cone (fig. 54). Subgenital plate with lateral margins sloping and approaching each other in circa basal half, narrow and with subparallel lateral margins in apical half; split in circa apical third, apical lobes setose and on internal side of apical lobes with strong spinules (fig. 80). Phallices with a pair of conchate sclerites with serrate apical margin (fig. 96).

Female: Epiproct triangular, apex rounded. Cerci slightly curved, widest in circa middle, apex obtuse. Subgenital plate short-rectangular, apex rounded (fig. 117); at each side of subgenital plate intersegmental membrane with an awl-shaped appendage. Ovipositor falcate, stout; dorsal margin serrate in circa apical half, ventral margin in apical area; gonangulum slightly projecting ventrad, projection sticking in a curved fold of the dorsal margin of the ventral ovipositor valves; dorsal margin of the ventral ovipositor valves widened at base and acute-angularly excised at end of widening.

Coloration: Green. Antenna black with spaced light rings, but scapus and pedicellus with anterior surface light, posterior (= dorsal) surface dark. Vertex with a pair of longitudinal black bands. Pronotum with incomplete black lateral bands (distinct at anterior and posterior margins, dissolved into dots or absent in middle). Tegmen with dorsal area black with light veins, otherwise green with indistinct dark dots in the cells between radius and media and eventually between media and cubitus.

Measurements (length in mm): Body ♂ 20.22, ♀ 20.23; pronotum ♂ 4.2-4.5, ♀ 4.0-4.5; tegmen ♂ 31.5-34.5, ♀ 36.0-38.0; tegmen width ♂ 5.5, ♀ 6.0-6.5; anterior femur ♂ 7.0-8.0, ♀ 7.5; mesofemur ♂ 10.5-11.5, ♀ 11.0; postfemur ♂ 22.0-24.5, ♀ 25.0; ovipositor 8.0-8.5.

Stridulation (fig. 170). – The song of one male from Erawan waterfall (Kanchanaburi province, Thailand) was recorded at 21.5°C. Stridulation consists of an echeme with crescendoing syllables and, separated by a short pause from the syllables, a loud final zip-sound. The resulting sound can be circumscribed as “trrrrrr zip”, with the zip-sound louder than the first part of the echeme. The echemes were often grouped in loose sequences with 2-5 echemes which were repeated with an interval of 8-17 s. Between those sequences the male was quiet for several minutes.

The echemes lasted 1281-1443 ms. There were 16-17 syllables per echeme. The syllables were repeated with an interval of 55-84 ms, while the final zip-sound followed 330-340 ms after the beginning of the preceding syllable. Syllable duration varied between 21-73 ms. The main frequency of the song was about 13-24 kHz, that of the final zip-sound 9-24 kHz.

Stridulation of Hemielimaea cucullata resembles the songs of the Mediterranean Acrometopa species (compare Heller 1988). This might be a hint for a relationship between the Elimaeini and the Acrometopini as proposed by Brunner (1878), if the more complex male stridulation of Hemielimaea compared with Elimaea is the more primitive one. It is however also possible that the similar time pattern in both genera (Hemielimaea and Acrometopa) resulted from convergent evolution.

Elimaea (Rhaebelimaeæ) Karny

Rhaebelimaeæ Karny, 1926a: 26. Type species: Phaneroptera parumpunctata Serville, 1839; here designated.

Diagnosis. – Elimaeini with anterior femora curved as in phasmins. Tibial tympana covered by a conchate fold on both sides. Greatest width of tegmen wider than length of pronotum; radius sector usually branching about in middle of tegmen, rarely distinctly before middle. Phallices with a pair of conchate sclerites. Ovipositor falcate, dorsal margin in apical half, ventral margin only at apex finely serrulate; gonangulum with ventro-apical angle projecting.

Remarks. – Several cases of misidentification of species are summarised in Karny (1926a).

Distribution. – The species of this subgenus live in a rather restricted area from Sumatra in the west to the Philippines in the east and from Java in the south to central Thailand in the north (map 2). A few species from South India and Sri Lanka might also belong here, but without re-examining the specimens, it is not possible to be certain about their subgeneric status. Rhaebelimaeæ species usually live in forests and have very restricted ranges, many of them have so far been recorded from a single locality.

Elimaea (Rhaebelimaeæ) parumpunctata (Serville) (figs. 6, 32, 68, 87, 97, 121, 136, 152, 167)

Phaneroptera parumpunctata Serville, 1839: 418. Holotype, ♀, Indonesia, Java, MNHN? [not seen].

Elimaea (Rhaebelimaeæ) parumpunctata Karny 1926a: 34, fig. 95.

Material examined. – Indonesia: 1 ♀, West Java, Gunung Salak, above Ciapus, Sukamandri, 850-950m, mountain forest, 27.II.1995; 4♂, same data but ex ovo; 1 ♀, West Java, Gibodas, Botanical Gardens, 1400m, 24.III.1993 ex larva; 1 ♀, same data but 1.iv.1995, all ct.

Description. – Male: Stridulatory file with circa 104 teeth which are gradually decreasing in size towards apex (fig. 6). Cerci shorter than subgenital plate, strongly curved, widened before apex, apical cone slender, subacute (fig. 32). Subgenital plate strongly narrowing...
from base to circa middle of length, apical area narrow; apex split into 2 slightly diverging lobes with obliquely truncate apex (fig. 68). Phallos with a pair of semi-void, conchate sclerites (fig. 87).

Female: Subgenital plate transverse, subordinated in middle, apex with slightly diverging cones at lateral angles, sinuate in between (fig. 97). Ventral ovipositor valves with a tongue-shaped appendage at base between gonangulum and subgenital plate (figs. 121, 136); gonangulum with a weak, broadly rounded ventral projection (fig. 136).

Coloration: Green. Pronotum with incomplete black lateral bands and with black dots. Tegmen in male with dorsal field black with orange veinlets, in female green with black dots; aggregations of black dots in cells between media and cubitus and rows of single larger dots between radius (respectively radius sector) and media. Variation: In the female the dark pattern is hardly expressed; instead, in the live specimen, pronotum with white lateral bands and tegmen with white posterior margin (fig. 152).

Measurements (length in mm): Body $\delta$ 21-22, $\varphi$ 20-21; pronotum $\delta$ 3.8-4.2, $\varphi$ 3.5-3.8; tegmen $\delta$ 31.0-32.0, $\varphi$ 31.0-33.0; tegmen width 5.0, $\varphi$ 5.0-5.5; anterior femur $\delta$ 7.0, $\varphi$ 7.5-8.0; mesofemur $\delta$ 9.5-10.0, $\varphi$ 9.0-10.0; postfemur $\delta$ 20.5-22.0, $\varphi$ 21.0-22.0.

Development. – Oviposition was in parenchyma of leaves. The eggs are compressed kidney-shaped. Egg development required 41-43 days at 25-28°C. There were 6 larval instars. The first instar larvae is green with 3 longitudinal rows of white dots and the abdominal apex white (fig. 167). The legs are olivaceous to yellowish brown and densely covered with black dots. The antennae are blackish brown with white annulation. Larval development (from hatching to adult) required about 63-75 days (temperature not controlled, but always above 20°C). In captivity, the species fed on *Mentha, Rumex*, wheat, seedlings of sunflower, as well as on dry rolled oats.

Stridulation (fig. 171). – Stridulation of two males bred from the egg from Gunung Salak (West Java, Indonesia) was recorded at 24.5° and 27°C. Two different song types were produced by the same male, a short song consisting of a single syllable and a long song consisting of a sequence of 4-8 syllables. The time pattern of the syllables was the same in both song types. The syllables lasted 29-73 ms in the long songs at 27°C and 54-61 ms in the short songs at 24.5°C. The long songs lasted 1210-2500 ms, depending on the number of syllables, with a syllable repetition rate of 282-312 ms. The mean frequency of both song types was 12-24 kHz. The sound of a syllable can be circumscribed as “zip”, the long songs are a repetition of this sound.

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**Elimaea (Rhaebelimaea) curvicercata** Brunner stat. rev. (figs. 11, 33, 66, 88, 155)

**Elimaea curvicercata** Brunner, 1891: 50. Syntypes, $\delta$, $\varphi$, Java orientalis, NHMW [not seen].

**Elimaea (Rhaebelimaea) parumpunctata** partim Karny 1926a: 34.

Material examined. – Indonesia: 1 $\delta$, East Java, Trete, Gunung Arjuna, 1000m, mixed forest, 26.iii.1995, ct.

Description. – Male: Stridulatory file with circa 79 teeth, gradually decreasing in size towards apex (fig. 11). Ceri strongly and angularly curved, distinctly constricted and then widening again before apex, apical cone long, apex subacute (fig. 33). Subgenital plate narrowing from base to circa middle of length, apical area narrow, apex split into 2 lobes with bulging internal margin, apex of lobes obliquely truncate (fig. 66). Phallos with a pair of very slender, conchate sclerites (fig. 88).

Female: According to the description in Brunner (1891), the subgenital plate is similar to that of *R. parumpunctata*, but the medial lobe emarginate in middle.

Coloration (male): Green. Pronotum with black lateral bands which are obsolete in metazona and with black dots. Tegmen with dorsal field black with orange veinlets, stridulatory vein green; aggregations of black dots in cells between media and cubitus and rows of single larger dots between radius (respectively radius sector) and media. Mesofemur with a ventral black spot at base and a row of black dots on external surface. In the live specimen, central part of vertex, disc of pronotum and anterior part of stridulatory area of tegmen before stridulatory vein white.

Measurements (length in mm): Body 19; pronotum 3.8; tegmen width 6.0; anterior femur 6.0; mesofemur 9.0; postfemur 20.0.

Remarks. – The species was previously regarded to be a synonym of *E. parumpunctata* (Serville, 1839) (Karny 1926a). It shows however distinct differences in the stridulatory file as well as in external and internal male genitalia. It is regarded here as a distinct species. The differences between both taxa are outlined in the key.

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**Elimaea (Rhaebelimaea) kraussi** Karny (figs. 10, 17, 34, 67, 92, 105)

**Elimaea (Rhaebelimaea) kraussi** Karny, 1926a: 31, fig. 92. Syntypes, $4\delta$, $1\varphi$, West Java, Cibodas, 1400m, xi./xii.1921, H.H. Karny, $3\delta$ in mzb [examined], $1\delta$, $1\varphi$ in RMNH.

Material examined. – Indonesia: 2 $\delta$, West Java, Gunung Pangrango, Botanical Garden to Cibeureum waterfall, 1400-1700m, primary mountain forest, 25.iii.1993, ct.

Description. – Male: Stridulatory file with circa
102 teeth which are distinctly spaced in circa basal half (circa 35 teeth), very narrow and dense in apical half; at apex there are a few small and widely spaced teeth (fig. 10). The dorsal field of the right tegmen (covered by the left tegmen when at rest) carries a series of rather regularly spaced transverse veinlets which are raised and forming transverse ridges (fig. 17). Cerci short, sub-parallel at base and then curved in a more than 90°-angle before the very long and slender apical cone (fig. 34). Subgenital plate with apical area narrow, apex shortly divided into 2 lobes with faintly bulging internal margins, apex of lobes obliquely truncate (fig. 67). Phallus with a pair of circa semi-ovoid conchate sclerites (fig. 92).

Remarks. – The species was already extensively described by Karny (1926a). Some additional notes on stridulatory file and male genitalia are added.

Elimaea (Rhaebelimaea) mentaweii sp. n. (figs. 7, 40, 77, 84-86, 100, 123, 135, 144, 159)

Holotype ♂: Indonesia, Mentawei exp., H.H. Karny, R.M. 17.x.1924, mzb. – Paratypes: Indonesia, Mentawei exp., H.H. Karny, all mzb: 1 ♂, no. 95, Siberut, 23.ix.1924; 1 ♂, no. 112, Siberut, 25.ix.1924; 1 ♂, no. 163, Sipora, 9.x.1924; 2 ♂, no. 170, Sipora, 10.x.1924; 1 ♂, no. 173, Sipora, 11.x.1924; 2 ♂, no. 174, Sipora, 12.x.1924; 1 ♂, no. 183, Sipora, 15.x.1924; 1 ♂, no. 187, 17.x.1924; 2 ♂, no. 188, 17.x.1924; 1 ♂, no. 227, Sipora, 31.x.1924; 2 ♂, R.M. 17.x.1924; 1 ♂, R.M. 18.x.1924; 1 ♂, R.M. 21.x.1924; 1 ♂ (allotype), R.M. 22.x.1924; 1 ♂, Mentawei, Sipora, Sereina, v.-vi.1894, Modigliani, mcsn; 3 ♂, 1 ♀, Mentawei, Si Oban, iv.-viii.1894, Modigliani, mcsn.

Description. – Fastigium verticis with dorsal surface roundedly declined; dorsal surface shallowly furrowed. Pronotum with disc slightly rounded to nearly flat, but in posterior area slightly concave, lateral margins rounded into paranota; anterior margin concave in middle, posterior margin rounded; transverse sulcus circa triangular, in or slightly behind middle of pronotum length; paranota about as long as high or faintly longer, anterior angle angularly rounded, posterior angle broadly rounded, humeral sinus weak but distinct. Tegmen surpassing hind knees; with subparallel transverse veinlets in circa basal half of tegmen; radius sector branching somewhat before or behind middle of tegmen or even distinctly behind, this character somewhat variable even on left and right tegmen of the same specimen. Anterior femur with dorsal margins angular. Anterior femur with spines on ventro-internal margin or on both ventral margins (varying between individuals), mesofemur with spines on ventro-external margin, postfemur without spines or with a few spines on ventro-external margin. Knee lobes of all femora bispinose or individual lobes unispinose.

Male: Stridulatory file with circa 82 teeth which are distinctly spaced in basal half, dense but regularly spaced in apical half (fig. 7). Tenth abdominal tergite with apical margin subtruncate. Epiproct long tongue-shaped, slightly curved from base to apex, shallowly depressed in basal area (fig. 84a). Cerci long, curved ventrad near base and mediad near apex, at the turning point between ventral and medial curvature cercus slightly narrowed; apex forming a curved, tri-edged cone (fig. 40). Subgenital plate elongate, basal area with sloping lateral margins, central area prolonged behind and narrow, apex split to a variable degree with apices of lobes obtuse (fig. 77). Phallus with a pair of muscled-shaped, large, hyaline sclerites, with concave internal and convex external surface; external surface in basal area covered by membrane; dorso-apical margin finely serrulate (figs. 85-86).

Female: Tenth abdominal tergite with apical margin subinute. Epiproct long, triangular with apex rounded; dorsal surface slightly curved from base to apex. Cerci curved, widest near middle of length; apex pointed (fig. 144). Subgenital plate transverse, divided in midline but both halves connected by strong membrane, apico-lateral angles acute-angularly projecting behind (fig. 100). Gonangulum of ovipositor with a short, obtuse, ventral projection that inserts into a fold of the ventral ovipositor valves (figs. 123, 135).

Coloration: Green when alive. Pronotum: disc margined with dark brown lateral bands and dark spots on both sides of the bands (more distinct in ♀ than in ♂). Tegmen: area behind media with dark cells and pale veinlets; area between radius and media usually with one or behind branching of radius sector with 2 rows of dark spots; towards apex with or without small dark dots; dorsal field brown in male only.

Measurements (length in mm): Body ♀ 18.23, ♂ 17.23; pronotum ♀ 4.0-5.0, ♂ 4.5-4.7; tegmen ♀ 35.0-40.0, ♂ 37.0-41.0; tegmen width ♀ 6.0, ♂ 6.0-6.5; postfemur ♀ 24.0-29.0, ♂ 27.0-29.0; ovipositor 8.0-8.5.

Etymology. – The name of the new species is chosen from the type locality, the Mentawei Islands west of Sumatra.

Elimaea (Rhaebelimaea) maninjauensis sp. n. (figs. 8, 39, 76, 94, 99, 122, 143, 153)

Holotype ♂: Indonesia, West Sumatra, Maninjau, 500-700m, 16.iii.1995 ex larva, S. Ingrisch, mzb. – Allotype: 1 ♀, Indonesia, West Sumatra, Maninjau, 14.iii.1993, ci.

Description. – Fastigium verticis narrow, sulcate, apex obtuse and step-like declined to fastigium frontis. Pronotum with disc nearly flat, especially in post-
terior area, lateral angles rounded, apical area shouldered; anterior margin faintly concave in middle, posterior margin rounded; transverse sulcus Y-shaped; paranota almost as high as long; ventral margin round-ed, humeral sinus present. Tegmen surpassing hind knees; anterior margin convex, posterior margin sub-straight; radius sector branching slightly before or in middle of tegmen. Anterior femur with dorsal margins angular. Anterior femur with spines on ventro-internal margin, mesofemur with spines on ventro-external margin, postfemur without spines or with one spine on ventro-external margin. Knee lobes of anterior femur bispinose on external, unispinose on internal side, of mesofemur unispinose on external, bispinose on internal side, of postfemur bispinose on both sides. Anterior tibia with dorsal and ventral, external and internal, apical spurs.

Male: Stridulatory file curved behind base, otherwise substraight with about 126 teeth which become regularly narrower from base to apex (fig. 8). Tenth abdominal tergite distorted in specimen at hand. Epi-proct long tongue-shaped, apex rounded, with a broad medial furrow in basal area. Cerci strongly curved near base, afterwards moderately curved; apex terminating into a stout, triangular, acute tooth (fig. 39). Subgenital plate narrow even at base, basal area with sloping lateral margins, central area prolonged behind into a long, narrow, medial process with subparallel margins behind middle and with a weak and broad medial furrow, apex shortly divided into two obtuse lobes (fig. 76). Phallus with a pair of mussel-shaped, large, hyaline sclerites, with serrulate margin (fig. 94).

Female: Tenth abdominal tergite with apical margin subtruncated. Epiproct triangular, apex rounded; dorsal surface slightly curved from base to apex. Cerci very thin-cylindrical, moderately curved, apex spinose (fig. 143). Subgenital plate transverse, in midline with a membranous fold, apical margin subtruncated or slightly concave and on each apical angle prolonged into a long spineous projection (fig. 99). Gonangulum of ovipositor with a short obtuse ventro-apical projection pointing ventrad.

Coloration: Green. Pronotum with narrow, dark, lateral bands accompanied by dark dots. Tegmen with black dots and with two rows of spaced larger dots in radial areas. In male, tegmen with dorsal area brown. Anterior femur with black spots around spines on ventral edges.

Measurements (length in mm): Body ♂ 17, ♀ 27; pronotum ♂ 4.5, ♀ 4.5; tegmen ♂ 35.0 (broken), ♀ 39.0; tegmen width ♂ 6.0, ♀ 7.0; postfemur ♂ 23.0, ♀ 25.0; ovipositor 7.5.

Etymology. – The name of the new species is chosen from the type locality, Lake Maninjau in West Sumatra.

Elimaea (Rhaebelimaea) modiglianii sp. n. (figs. 12-13, 31, 72, 89, 102, 132, 140)

Holotype ♂: Indonesia, Sumatra, Si - Rambe, xii.1890 - iii.1891, E. Modigliani, mcSN. – Paratypes: Indonesia: 2 ♀, Sumatra, Si - Rambe, xii.1890 - iii.1891, E. Modigliani, mcSN; 1 ♀, Balighe, x.1890 - iii.1891, E. Modigliani, mcSN.

Description. – Fastigium verticis narrow, sulcate, apex obtuse, step-like declined to fastigium frontis. Pronotum with disc narrow, subparallel-sided, surface nearly flat, in anterior area rounded; lateral angles rounded into paranota, apical area shouldered; transverse sulcus V- or Y-shaped; paranota slightly longer than in male or about as long as high in female; ventral margin rounded, humeral sinus present. Tegmen surpassing hind knees; anterior margin convex, posterior margin substraight; radius sector branching slightly behind middle of tegmen. Anterior femur with dorsal margins angular, with spines on both ventral margins, those on internal side sitting on dark brown spots; meso- and postfemora with spines on ventro-external margin only (in the female with a single spine also on ventro-internal margin of postfemur). Knee lobes of all femora bispinose, but the ventral spine often smaller and occasionally absent (especially on external side of postfemur). Anterior tibia with dor-sal and ventral, external and internal, apical spurs; dor-so-interal spur smaller and occasionally absent.

Male: Stridulatory vein widened and greatly bulging on dorsal side. Stridulatory file step-like declined before middle (after about 22 teeth), teeth large and wide before the step; the step includes about 7 teeth; behind the step with about 62 - 67 teeth which are becoming smaller and denser towards apex (figs. 12-13). Tenth abdominal tergite transverse with apex subtruncate. Epiproct long tongue-shaped, apex triangularly-rounded, with a broad and shallow furrow in basal area. Cerci rather regularly curved; apical area narrow-spatulate, apex acute (fig. 31). Subgenital plate strongly curved dorsad behind middle of length; with a weak medial carina; apical area roundly excised, with lobes narrowly spaced and subparallel, apex of lobes transversely truncate (fig. 72); divided apical area provided with long hair on dorsal, internal and lateral surfaces. Phallus with two elongate conchathe sclerites (fig. 89).

Female: Tenth abdominal tergite with apical margin subtruncated. Epiproct tongue-shaped, apex broadly subtruncate. Cerci rather stout, regularly curved and narrowed to apex, apex subobtuse (fig. 140). Subgenital plate short, much wider than long, with a weak median keel; apico-lateral angles acute-triangulaly projecting; central part of apical margin subsinuate (fig. 102). Gonangulum of ovipositor with a short, obtuse, ventral projection (fig. 132).
Elimaea (Rhaebelimaea) transversa Ingrisch

Rhabelimaea (sic) transversa Ingrisch, 1990a: 91, fig. 3-6.

Holotype ♀: Thailand, Chanthaburi prov., Khao Soi Dao, 15.x.1985, smr [examined].

Material examined. – 1 ♀, Thailand, Chanthaburi prov., Khao Soi Dao, 12.vi.1988 (ci); 1 ♀, Chanthaburi prov., Pong Nam Lorn, 30.iv.1959, Pai San (dab, Lot 2506).

Measurements of female (length in mm): Body 22-23; pronotum 4.0-4.8; tegmen 34.0-35.0; tegmen width 7.0-7.5; postfemur 23.5-24.0; ovipositor 7.0-7.5.

Remarks. – The species is already sufficiently described in Ingrisch (1990a). It was previously only known from the holotype. New material available includes two females; thus the male is still unknown. The diagnostic characters are outlined in the key.

Elimaea (Rhaebelimaea) pseudochloris sp. n.

(figs. 9, 36, 73, 93, 161)


Description. – Fastigium verticis narrow, sulcate, apex obtuse, step-like declined to fastigium frontis. Pronotum with disc nearly flat and with a distinct medial carina which is subobsolete in posterior area; paranota longer than high, ventral margin subincurved and angles rounded, humeral sinus distinct. Anterior femur with spines on both ventral margins, meso- and postfemur with spines on ventro-external margin. Knee lobes of all legs uni- or bispinose (irregular). Anterior tibia with dorsal and ventral, internal and external, apical spurs. Tegmen surpassing hind knees, anterior margin distinctly convex, posterior margin faintly concave, substraight; radius sector branching in basal half, distinctly before middle of tegmen.

Male. Stridulatory file with circa 32 teeth which are rather large and almost equally sized and equally spaced throughout (fig. 9). Tenth abdominal tergite with apical margin subtruncate (faintly concave). Epiproct long tongue-shaped. Cerci narrow-cylindrical, strongly curved but substraight at base; apex terminating in a long twisted cone with acute apex (fig. 36). Subgenital plate with a short bowl-shaped basal part and a long, curved, apical part which is parallel-sided and split from apex for slightly less than half of its length (fig. 73); resulting lobes armed with numerous spinules on medial surfaces. Phallos with large semi-cylindrical projections which are terminating in numerous spinules with apical margin finely serrulate (fig. 93).

Female unknown.

Coloration: Green; pronotum, legs and body with black dots. Pronotum with a yellow medio-longitudinal band; abdominal tergites red in middle.

Measurements of male (length in mm): Body 20; pronotum 4.0; tegmen 29.5; tegmen width 5.5; postfemur 21.5.

Etymology. – The name of this species is given for its superficial similarity with E. chloris.
compressed and terminating in a long-triangular, acute cone (fig. 37). Subgenital plate with quickly approaching lateral margins in basal area, central area attenuate and prolonged, gently curved and sub-parallel-sided, only at apex very faintly excised; basal part with a medial carina that runs to about half of the attenuate central projection (fig. 74). Phallos with a pair of elongate, sclerotised, conchate projections with serrate dorsal margin (fig. 91).

Female unknown.

Coloration: Green. Body and legs with black and red dots. Antenna brown on dorsal, light on ventral side, in posterior area blackish-brown with largely spaced white rings. Pronotum with lateral carinulae whitish, bordered on both sides by a band of black dots. Tegmen green, dorsal field black but with stridulatory vein, a large spot at end of stridulatory area and veinlets light brown; lateral area with 2 rows of large black dots (between subcosta and anterior margin and between radius and media) and with aggregations of small black dots in cells between radius and anal margin.

Measurements of male (length in mm): Body 22; pronotum 3.8; tegmen 31.5; tegmen width 4.8; anterior femur 7.5; mesofemur 11.5; postfemur 22.5.

Etymology. – The name of this species refers to the prolongation of the last abdominal tergite.

Elimaea (Rhaebelimaea) sinuata sp. n. (figs. 5, 30, 71, 90, 162)


Description. – Fastigium verticis narrow, furrowed above; step-like declined to fastigium frontis. Pronotum with disc nearly flat especially in posterior area, angles rounded, anterior margin concave, posterior margin rounded, transverse sulcus V-shaped; paranota circa as long as high, humeral sinus present. Tegmen surpassing hind knees, sub-parallel-sided but faintly curved throughout, apex rounded; radius sector branching slightly before middle; transverse veinlets rather regular, especially in anterior area and between radius and radius sector. Anterior coxa with a minute spinule. Anterior femur with one spinule on both ventral margins, meso- and postfemur with several spinules on ventro-external margins. Knee lobes of all femora bispinose. Tympana conchate on both sides, but leaving the anterior part of the tymanum uncovered. Anterior tibia with dorsal and ventral, external and internal, apical spurs. Posttibia with one dorsal and two ventral apical spurs on both sides.

Male: Stridulatory file sinuate, with about 10 large, widely spaced teeth in circa basal half and narrow, dense teeth in apical half; together about 52 teeth (fig. 5). Cerci long-cylindrical, rather moderately curved, apex slightly bulbous and with a large, compressed, curved, subacute cone (fig. 30). Subgenital plate bowl-shaped, regularly curved throughout, split until base, apex terminating in two narrow, parallel, subacute, stylete projections (fig. 71). Phallus with a pair of wedge-shaped sclerites with slightly rounded apical margin curved ventrad and serrulate; and ventral of sclerites with an unpaired stylete projection which is slightly curved and has angular margins, dorsal angles armed with spines (fig. 90).

Female unknown.

Coloration: Yellowish brown, probably green when alive. Pronotum with interrupted bands of spots and dots along lateral angles. Tegmen with a row of dark spots in radial area.

Measurements of male (length in mm): Body 19; pronotum 4.8; tegmen 35.0; tegmen width 5.5; postfemur 26.0.

Etymology. – The name of this species refers to the sinuate course of the stridulatory file.

Elimaea (Rhaebelimaea) pentaspina sp. n. (figs. 101, 124, 134, 142)

Holotype ♀: Thailand, Chanthaburi prov., Khao Soi Dao, 19.xii.1974, A.Lewvanich, DAB (Lot 3697).

Paratype: 1 ♀, Thailand, Chanthaburi prov., Khao Soi Dao, 12.vi.1988, ci.

Description. – Fastigium verticis narrow, sulcate, apex obtuse and step-like declined to fastigium frontis. Pronotum with disc broadly rounded but posterior area nearly flat and shouldered, lateral angles rounded; anterior margin concave in middle, posterior margin rounded; transverse sulcus Y-shaped, behind middle of pronotum; paranota longer than high, ventral margin rounded, humeral sinus weak. Tegmen surpassing hind knees; radius sector branching slightly before middle of tegmen. Anterior femur phasmid-like curved but curvature weak, almost straight. Anterior femur with spines on both ventral margins, meso- and postfemur with spines on ventro-external margin. Knee lobes of all femora bispinose. Anterior tibia with dorsal and ventral, external and internal, apical spurs.

Male unknown.

Female: Tenth abdominal tergite with apical margin subtruncate. Epiproct long tongue-shaped. Cerci long-conical, curved, apex obtuse (fig. 142). Subgenital plate with a compressed lateral projection at each side; apical margin with a long spinose projection at each angle and area in between short, obtuse-angularly projecting (fig. 101). Gonangulum of ovipositor with a long, conical, ventro-apical projection; ventral ovipositor valves with a triangular projection with obtuse apex just below projection of gonangulum (figs. 124, 134).

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Coloration: Green; abdomen with red dots. Pronotum with black dots especially around lateral angles. Tegmen with a longitudinal band of black dots in medial area and some dots in other fields.

Measurements of female (length in mm): Body 21-23; pronotum 4.0-4.8; tegmen 34.0-34.5; tegmen width 6.0; postfurca 24.0-25.0; ovipositor 6.5-6.8.

Etymology. – The name of this species refers to the subgenital plate with its 5 (2 lateral and 3 apical) projections.

Elimaea (Elimaea) Stål

Elimaea Stål, 1874: 27. Type species: Phaneroptera subcarinata Stål, 1861; by monotypy.

Diagnosis. – Elimaeini with anterior femora curved as in phasmids. Tibial tympana covered by a conchate fold on both sides. Greatest width of tegmen wider than length of pronotum; radius sector branching distinctly before middle of tegmen. Phallus membranous. Ovipositor falcate, dorsal margin serrulate in apical half, ventral margin in apical area; gonangulum with ventro-apical angle projecting.

Distribution. – The typical subgenus Elimaea has its greatest species diversity in China and Indochina, while from the Malay Peninsula to western Indonesia there is only a single species (except for the potefolia-group). The known range spreads from the Southern Maritime Territory of Russia in the north to Java in the south, and from Taiwan in the east to North-East India (West Bengal) in the west (map 1). There are records of a few species with doubtful subgeneric affinity from Bombay and Sri Lanka. Thus the range of the subgenus might also cover the Indian subcontinent. Species of the nominate subgenus are often found in secondary vegetation, although they can intrude into forests along roads and clearings.

Elimaea (Elimaea) subcarinata (Stål) stat. rev. (figs. 20-23, 45-47, 59-60, 65, 146-147, 158, 163, 164-165, map 3)

Phaneroptera subcarinata Stål, 1861: 319. Syntypes 1 ♂ , 1 ♀ : China, Hongkong, nrs [examined].

Elimaea chloris (nec De Haan, 1842) Brunner 1878: 100 (partim); Karny 1926a: 36 (partim).


Elimaea punctifera (nec Walker, 1869) Kirby 1906 (partim): 396; Uvarov 1927: 95 (partim).

Material examined. – Thailand: 1 ♂ , 1 ♀ , Chiang Mai prov., Phrao district, Phrao - Ban Pradu, 26.-29.ix.1985; 1 ♂ , 1 ♀ , Lampang prov., Doi Khun Tan, 900m, 16/17.ix.1993 at night; 26 ♂ , 24 ♀ , same data but ex ovo; 1 ♂ , Tak prov., Mac Salid, Monkrating, 700m, 18./19.v.1988; 1 ♂ , Nakhon Ratchasima prov., Khao Yai, 1./2.x.1985, all ct. – India: 1 ♂ , West Bengal, Jalpaiguri, 18.xii.1986, R.S. Barman; 1 ♂ , 1 ♀ , Mizoram, Teirei, Aizaul, 13.xi.1995, M.S. Shishodia, all zst.

Description. – Fastigium verticis narrow, apex subacute, dorsal surface furrowed. Pronotum with disc flattened, especially in posterior area, lateral angles rounded; transverse sulcus Y-shaped, slightly behind middle; anterior margin concave, posterior margin rounded; paranota longer than high (51:40 and 55:49 in syntypes of E. subcarinata, 56:48 in type of E. appendiculata); ventral and posterior margins rounded; humeral sinus distinct. Tegmen surpassing hind knees; radius sector branching circa 8-10 mm from base. Anterior femur with spines on both ventral margins (on external side smaller). Meso- and postfemora with spines on ventro-external margin. Genicular lobes of all legs bispinose. Anterior tibia with external and internal, dorsal and ventral apical spurs (dorso-internal spine lacking on one fore leg of both syntypes of E. subcarinata).

Male (syntype of E. subcarinata): Stridulatory file (damaged) with 8 large to medium sized teeth and a few indistinct minute teeth (fig. 20). Tenth abdominal tergite with apex broadly rounded; central area setose and with a small puncture in middle. Epiproct tongue-shaped, apex obtuse. Cerci strongly curved; apical area compressed, sinuate and external side convex, internal concave, with narrowing margins and apex subacute on dorso-cranial side (fig. 45). Subgenital plate moderately curved dorsad (almost straight behind basal area); split into two obtuse lobes in circa apical third (fig. 65).

Male (type of E. appendiculata): Stridulatory file with 8 large and 3 minute teeth (fig. 21). Tenth abdominal tergite entire (shrunck due to previous storage in alcohol), central area setose. Epiproct tongue-shaped with a weak medial carina. Cerci strongly curved; apical area compressed, sinuate and external side convex, internal concave, with narrowing margins and apex acute on dorso-cranial side (fig. 46). Subgenital plate damaged.

Male (specimens from Thailand): Stridulatory file with 6-8 large and 2-11 minute teeth (fig. 22-23). Tenth abdominal tergite with apex broadly rounded; central area setose and with a small puncture in middle. Epiproct tongue-shaped, apex obtuse. Cerci strongly curved; apical area compressed and twisted, with narrowing margins; apex varying from acute (on dorso-cranial end) to subobtuse (fig. 47). Subgenital plate moderately curved dorsad; split into two obtuse lobes in circa apical third (figs. 59-60).

Female: Tenth abdominal tergite with apex subtruncated. Epiproct triangular, apex obtuse. Subgenital plate acute-triangular, apex angularly excised and with 2 short triangular lobes (figs. 112-113). Cerci regularly and rather strongly curved; apex subacute to subobtuse (fig. 146, 147). Gonangulum of ovipositor with a large,
bulbous, ventro-apical appendage which in situ lies in a cleft between dorsal and ventral valves (fig. 128).

Coloration: Syntypes of *E. subcarinata*: Discolored, but probably green when alive. Antenna with scapus and pedicellus concolorous, flagellum blackish brown on dorso-lateral side (with antenna directed posteriorly), ventro-internal side light brown. Disc of pronotum in male with a brown medial band which is split by a white line, in female green with the white line only. Tegmen in cells between radius and anal margin with aggregations of black dots, less distinct between radius and media.

Type of *E. appendiculata*: Discolored, but probably green when alive. Antenna with scapus and pedicellus concolorous, flagellum dark brown especially on dorso-lateral side (with antenna directed posteriorly). Tegmen in cells between media and anal margin, in apical half also in cells between radius and media with aggregations of black dots.

Variation of specimens from Thailand:

1. Green. Compound eyes brown. Scapus and pedicellus reddish brown, flagellum black in basal area, with or without annulation, otherwise with spaced light rings. Vertex and disc of pronotum with a brown medial band. Tegmen green, anterior margin orange or red, anal margin darkened (cells black, veinlets green). Abdominal tergites red in middle; anterior and medial legs orange brown.

2. as before but general colour yellowish brown (this colour variant appeared while breeding the species in laboratory). Antenna as described under (1) or light brown with spaced dark rings.

3. as (1) but dorsal area of tegmen distinctly darkened.

4. as (3) but anterior area of tegmen with a red pattern; hind legs brownish.

5. almost uniformly green (or yellowish brown); flagellum of antenna only slightly infumate at base especially on dorsal side (with antenna directed posteriorly); vertex and pronotum without dark medial band; tegmen green with the dark dots little conspicuous.

Measurements of syntypes of *E. subcarinata* (length in mm): Body ♂ 16, ♀ 22; pronotum ♂ 4.2, ♀ 4.9; tegmen ♂ 29.0, ♀ 32.0; tegmen width ♂ 4.7, ♀ 5.8; anterior femur ♂ 7.5, ♀ 9.0; mesofemur ♂ 10.0, ♀ 10.0; postfemur ♂ 22.0, ♀ 25.0; ovipositor 6.8.

Measurements of male type of *E. appendiculata* (length in mm): Body 21; pronotum 4.5; tegmen 37.0; tegmen width 6.0; anterior femur 9.5; mesofemur 12.0; postfemur 26.0.

Measurements of specimens from Thailand (length in mm). – Body ♂ 21-28, ♀ 22-27; pronotum ♂ 4.0-4.5, ♀ 4.2-4.8; tegmen ♂ 35.0-40.0, ♀ 35.0-38.0; tegmen width ♂ 5.5-6.0, ♀ 5.5-6.0; anterior femur ♂ 9.0-10.0, ♀ 9.5-10.0; mesofemur ♂ 11.0-12.5, ♀ 11.0-13.0; postfemur ♂ 23.0-27.5, ♀ 23.5-27.5; ovipositor 6.5-7.0.

Remarks. – Males of *E. subcarinata* are easily recognizable by the low number of large and widely spaced stridulatory teeth on the underside of the left tegmen. The additional minute teeth at the apex which vary in number and which are sometimes absent are certainly not used for stridulation and as such do not underlie a selective pressure. The differences of the stridulatory files show with certainty that *E. subcarinata* is not a synonym of *E. chloris* as supposed by Brunner (1878), and *E. appendiculata* not a synonym of *E. punctifera* as supposed by Kirby (1906). The male syntype of *E. subcarinata* is rather small compared with the series of specimens from Thailand and with the type of *E. appendiculata*. Small differences in the male cerci might be attributed to this fact. The stridulatory file does not show any significant differences between the specimens of different origin. Thus there is no doubt that they are conspecific, and *E. appendiculata* is a synonym of *E. subcarinata*.

Development. – Oviposition was in parenchyma of leaves (*Rubus*), but also between the layers of absorbent paper and in polystyrene. The eggs are compressed kidney-shaped as typical for Phaneropterinae. Egg development required 28-42 (mean 35) days at 25°C and 39-105 (mean 64) days at 20-23°C. There are 6 larval instars. The first instar larvae are green with 3 white longitudinal stripes which are very conspicuous (fig. 165). The femora are olivaceous at base, otherwise legs and antennae are yellowish brown. Larval development (from hatching to adult) required 45-49 days at 25°C and 71-86 days at 20-23°C. The spermatophore is very large (fig. 164). In captivity, the species fed readily on European plants as *Rumex*, *Plantago*, and seedlings of sunflower, and less readily on wheat, *Rubus*, and *Cirsium*.

Stridulation (fig. 173). – The songs of two males bred from the egg from Doi Khun Tan (Lampang province, Thailand) was recorded at 24°C and 26°C. Stridulation consists of loose groups of 1-3 syllables. The groups are repeated at irregular intervals. Syllable duration varied between 18-35 ms at 24°C or 15-26 ms at 26°C. It was thus similar to the syllable duration in *E. chloris*. However the syllables consisted of only 4-6 pulses which were longer than in *E. chloris* and not well separated from each other. Stridulation was loudest at about 12-18 kHz. The sound of a syllable can be circumscribed as “zip”.

Elimaea (*Elimaea*) chloris (De Haan) (figs. 18-19, 42-43, 63-64, 83, 111, 120, 127, 148, 157, map 3)

Locusta (*Phaneroptera*) chloris De Haan, 1842: 192. Synonymes (2 ♂, 1 ♀): Java, RMNH [examined]. – *Elimaea chloris* Brunner 1878: 100 (partim); Karny 1926a: 36, fig. 96 (partim); Karny 1926b: 265, fig. 185.

Description. – Fastigium verticis narrow, dorsally furrowed; step-like declined to fastigium frontis. Pronotum with disk flattened, especially in posterior area, lateral angles rounded into paranota; transverse sulcus V-shaped; with a faint indication of a medial carinula; paranota longer than high (54:45), ventral and posterior margins together broadly rounded; humeral sinus distinct. Tegmen with radius sector branching between 5.5 and 11.5 mm from base of tegmen. Anterior femur with spines on both ventral margins, on external side sometimes absent or only one spine; meso- and post femora with spines on ventro-external margin; genicular lobes of all legs bispinose. Anterior tibia with dorsal and ventral, external and internal apical spurs.

Male: Stridulatory file with circa 32-35 teeth which are large and very widely spaced in circa basal half, gradually decreasing in size in third quarter and terminating in a series of minute teeth in apical quarter (figs. 18-19). About 14-16 teeth may be regarded as large and useful for sound production; the minute teeth at apex are probably without function. Tenth abdominal tergite slightly prolonged behind, apex truncate; central area setose and with a distinct puncture in middle. Epiproct long tongue-shaped; apex subtruncate. Cerci curved, widest in basal area, slightly narrowing in middle and slightly widening again towards apex; apical area compressed and twisted-triangular, very apex acute and curved cephalad (figs. 42-43). Subgenital plate narrow, only slightly curved, angular, very apex acute and curved cephalad (figs. 18-19). About 14-16 teeth may be regarded as large and useful for sound production; the minute teeth at apex are probably without function. Tenth abdominal tergite slightly prolonged behind, apex truncate; central area setose and with a distinct puncture in middle. Epiproct long tongue-shaped; apex subtruncate. Cerci curved, widest in basal area, slightly narrowing in middle and slightly widening again towards apex; apical area compressed and twisted-triangular, very apex acute and curved cephalad (figs. 42-43). Subgenital plate narrow, only slightly curved, split into two parallel lobes in apical quarter to apical third (37:93 - 20:82) (figs. 63-64, 83).


Coloration: Green with or without a brown longitudinal band on vertex, disc of pronotum and dorsal area of tegmen (or part of these organs); compound eyes brown; antenna concolorous or dorsal side of flagellum infumate (antenna directed anteriorly), scapus and pedicellus with or without some reddish pattern.

Tegmen with more or less distinct aggregations of dark dots in the cells mainly in apical half of tegmen and between radius and cubitus. Abdominal tergites often reddish brown in middle and with or without some reddish dots in lateral areas.

Measurements (length in mm): Body △ 22-23, □ 20-25; pronotum △ 4.2-4.5, □ 3.8-4.5; tegmen △ 33.0-35.0, □ 30.5-37.0; tegmen width △ 5.5 - 6.2, □ 5.5-6.0; anterior femur △ 7.5-8.0, □ 7.5-8.0; mesofemur △ 9.5-10.5, □ 9.0-10.5; postfemur △ 21.0-23.0, □ 20.0-22.5; ovipositor 6.0-7.0.

Remarks. – The species was previously thought to be widespread in the Oriental Region (Brunner 1878, Karny 1926a, Jin & Xia 1994). However of the material at hand, only specimens from Central and Southern Thailand, Malay Peninsula, Sumatra and Java can be attributed to this species. The occurrence in other regions has to be verified.

Stridulation (fig. 172). – The song of one male from Lard Phrao (Bangkok, Thailand) was recorded in the field during the night (temperature not measured but supposed to be about 25-28°C). Stridulation consists of echemes of 2-3 crescendoing syllables. The echemes can be rather regularly repeated for several minutes. Syllable duration varied between 15-29 ms, scheme duration between 381-393 ms in the two-syllabic and 1012-1318 in the three-syllabic echemes. About ten single pulses can be recognised in the syllables at a high time resolution. The song was loudest at 10-15 kHz but higher frequencies were not recorded with the field equipment. The sound of an echeme can be circumscribed as “zip zip zip”.

Elimaea (Elimaea) punctifera (Walker)
(figs. 26, 44, 61-62, 82, 160)

Redescription of holotype. – Fastigium verticis narrow, acute-angular in dorsal view with apex subacute, dorsal surface furrowed. Pronotum with disc flattened in posterior area, lateral margins rounded; transverse sulcus slightly behind middle, V-shaped; paranota longer than high (4:3); ventral and posterior margins rounded together; humeral sinus distinct. Tegmen surpassing hind knees; radius sector branching circa 8 mm from base. Legs I and II absent. Postfemur with spines on ventro-external margin. Hind knees bispinose.

Male: Stridulatory file with about 53 teeth which are large and spaced in basal half and gradually becoming narrower and denser towards apex (fig. 26). Tenth abdominal tergite slightly prolonged and apex subtruncate. Epiproct long tongue-shaped. Cerci rather strongly curved, centre of curvature slightly before middle; apical area spatulate, rather long and
step-like constricted against rest of cercus, with convex external and conclave internal surface, very apex curved ventral and subacute (fig. 44). Subgenital plate narrow, rather strongly curved dorsad (artifact?), with a weak medial carina, apex split in circa apical quarter (figs. 61-62, 82).

Coloration: Rather uniformly green. Tegmen in cells between media and cubitus and in apical half of tegmen also in cells between radius and media with aggregations of black dots; internal margin of tegmen brownish.

Measurements of male (length in mm). Body 21; pronotum 4.5; tegmen 36.0; tegmen width 6.0; postfemur 27.0.

Remarks. – *E. punctifera* is a rather uniformly green coloured species without striking characters. The dark colour pattern caused by the black dots in the cells of the tegmina are not as striking as described in the key in Karny (1926a). Moreover, the subgenital plate is not so strongly divided at the apex as supposed by previous authors (Tinkham 1943, Bei-Bienko 1955). Thus both authors probably misidentified other species as *E. punctifera*. Only the apical quarter of the subgenital plate is divided which is the same value as in *E. chloris*. The subgenital plate as well as coloration which were previously thought to differ between both taxa, are thus not distinctive. Both species are very similar. They differ however strikingly in the number of striudulatory teeth on the underside of the left tegmen and less strikingly in the length of the cerci and the shape of the apical area of the cerci.

*E. punctifera* was previously thought to be widespread in the Oriental Region (Kirby 1906, Yin & Xia 1994) and adventive to the Hawaiian fauna (Hedberg 1922b). However the material that I have seen from Indochna and Hawaii is not conspecific with the holotype. Thus the species is with certainty only known from the type locality Silhet in Bangladesh. Its' distribution is probably restricted to the Indian subcontinent or to an even smaller range. The occurrence in other regions has to be verified.

Elimaea (*Elimaea*) thaili sp. n. (figs. 24-25, 48, 57-58, 110, 129-130, 149-150, 156, 166, map 3)


Description. – Fastigium verticis narrow, dorsally furrowed, apex subacute. Pronotum with disc flattened in posterior area, lateral angles rounded; transverse sulcus short Y-shaped, slightly behind middle; paranota about 1.1-1.2x longer than high; ventral and posterior margin rounded together; humeral sinus distinct. Tegmen surpassing hind knees; radius sector branching circa 7.5-12 mm from base.

Male: Stridulatory file with circa 34-42 teeth which are large and somewhat spaced from each other in basal half and gradually becoming narrower and denser towards apex (figs. 24-25). Tenth abdominal tergite with apical margin broadly rounded; central area setose and with a distinct puncture in middle. Epiproct long tongue-shaped. Cerci rather short, strongly curved; apical area short, compressed and twisted, slightly curved, apex acute (fig. 48). Subgenital plate narrow, split for slightly less than apical half (apical four to five tenth) (figs. 57-58). Dorso-central surface of medial phallus valves covered with warts.

Female: Tenth abdominal tergite with apex subtruncate or slightly concave; with a distinct puncture in the middle. Epiproct long- triangular, apex subobtuse (figs. 149-150). Cerci moderately curved, slender; apex varying from subacute to obtuse. Subgenital plate long-triangular in general outline with a medial furrow bordered by a carina at each side; apex subtruncate between two slightly projecting lateral angles (fig. 110). Gonangulum of ovipositor with ventro-apical appendage smaller than in *E. subcarinata* and *E. chloris* (figs. 129-130).

Coloration: Male green; compound eyes brown; antenna (stretched anteriorly) light brown on dorsal, dark brown to black on ventral surface, with spaced annulation; disc of pronotum with dark dots and with a narrow brown medial band which is interrupted in middle by a fine white line. Tegmen with aggregations of black dots in cells between media and anal margin and in apical half of tegmen also between radius and media. Abdominal tergites red in middle.

Variation: The brown band on pronotum sometimes indistinct or absent and leaving only the white line and eventually a pair of irregular white lateral lines present. The dark brown band may also extend to the vertex and the dorsal area of the tegmen. In
darker individuals, the anterior and medial legs are often brownish or pale reddish brown and the anterior margin of the tegmen reddish. The pronotum can be with or without red dots and the anterior area of the stridulatory field can be red.

Female varying from uniformly green (rarely brown when alive) to very colourful. Head, antenna and pronotum as in male. Pronotum with or without dark brown or red dots; with or without a brown medial band that is split by a fine white line (may be extended to vertex or not); with or without irregular white lateral lines. Tegmen green with aggregations of black dots in cells between radius and anal margin varying from hardly expressed to very distinct, may also be replaced by red dots; or cells between radius sector and cubitus almost completely red and only the veins green; or almost all of tegmen, body, and legs suffused with red. Abdominal tergites usually red in middle. Legs as in male; genicular region of anterior leg (femur and tibia) often, but not always darkened.

Measurements (length in mm): Body: \( \xi \) 16-25, \( \eta \) 20-25; pronotum: \( \xi \) 3.5-4.2, \( \eta \) 3.5-4.2; tegmen: \( \xi \) 32.0-36.5, \( \eta \) 31.5-37.0; tegmen width: \( \xi \) 5.0-6.0, \( \eta \) 5.0-6.0; anterior femur: \( \xi \) 7.5-9.0, \( \eta \) 7.5-9.0; mesofemur: \( \xi \) 9.5-12.0, \( \eta \) 9.5-11.0; postfemur: \( \xi \) 21.0-25.0, \( \eta \) 20.0-24.5; ovipositor: 6.0-6.5.

Remarks. – Part of the material of this species was previously misinterpreted as belonging to E. punctifera by Ingrisch (1990a). The stridulatory file and the male cerci show however distinct differences to the male holotype of E. punctifera. A large number of specimens in the dab from numerous localities in Thailand which were partly identified as E. chloris by the late Dr. H.H. Karny probably also belong to this species or to E. subcarinata; the stridulatory file was, however, not checked.

The male subgenital plate of E. thailand is also similar to that of E. berezovskii Bei-Bienko, 1951, described from the Sichuan province in China. Both species differ in the width of the tegmen which is 5.1-5.3 times longer than wide in E. berezovskii (Bei-Bienko 1965), but 6-7 times longer than wide in E. thailand. Other diagnostic characters are not well described for E. berezovskii, especially the stridulatory file is unknown.

E. thailand is common in western and northern Thailand, where it can occur in the same habitat together with E. subcarinata (map 3).

Etymology. – The name of this species refers to its distribution.

Development. – Oviposition was in parenchyma of leaves (Rubus). Egg development required about 42-64 days at 18-25°C. There are six larval instars. The first instar larvae are green; the longitudinal white stripes are less conspicuous than in the young larvae of E. subcarinata. Legs and antennae are yellowish brown. When at rest, they sit as the adults with the antennae and anterior legs stretched forwards and the posterior legs spread in an acute angle from the body (fig. 166). Several larvae became brown in subsequent moultings, but almost all of them changed back to green with the final ecdysis. Food plants were the same as in E. subcarinata.

Stridulation (fig. 174). – Stridulation of one male from Samoeng (Chiang Mai province, Thailand) was recorded at 22.5°C. The male was kept with a female larva and later with an adult female in the same cage. On the latter occasion, the male female response stridulation was also recorded.

Stridulation of the male kept together with the larva consisted of single syllables which were repeated in long and irregular intervals. In a 45 min continuous recording, the male produced only 5 syllables. According to the higher number of stridulatory teeth, syllable duration (122-213 ms) was much longer than in both other Elimaea s. str. species.

On a later occasion, when a female answered the males’ syllable with a short and quiet click sound, the male produced a second syllable. The female response was 3042-3760 ms after the males’ first syllable, while the males’ second syllable followed 6400-6915 ms after the females’ answer.

The main frequency of the male stridulation was at 8-18 kHz and thus rather loud for the human ear. The sound of a syllable is the same as in the preceding two species, but longer.

Discussion. – Male stridulation of the Elimaea and Rhaebelimaea species so far studied is rather simple and is composed of only a few short syllables. The differences in stridulation of the three Elimaea species however give evidence that despite of the great morphological similarity they are three distinct species. Moreover, the time pattern of the syllables they produce corresponds with the number of teeth on the stridulatory file. This gives evidence that the stridulatory file is one of the most useful characters in Elimaeini (especially in Elimaea s. str.) and it should be used for taxonomic purpose.

Elimaea (s. str.) nautica sp. n.
(figs. 27-28, 49-50, 55-56, 109, 145, map 3)

Holotype: \( \xi \), Thailand: Chanthaburi prov., Kho Soi Dao, 29.-31.v.1990, A. Lewvanich, V. Koonpeng, S. Wangsuk, DAB (Lot 4166). – Paratypes: 1 \( \xi \), 1 \( \eta \), Thailand, Chanthaburi prov., Kho Soi Dao, 15.x.1985, ci. – USA: 1 \( \xi \), 1 \( \eta \), Hawaii, Big Island, near Kaumana Cave, 7.viii.1993, ci.

Description. – Fastigium verticis narrow, dorsal surface sulcate, in lateral view sinuate; step-like declined to fastigium frontis. Pronotum with disc flattened but lateral angles rounded; transverse sulcus V-
or short Y-shaped; with a short and weak medial carina before apex; anterior margin concave, posterior margin rounded; paranota 1.1x longer than high, ventro-posterior angle rounded; humeral sinus distinct. Anterior femur with spines on both ventral margins (on internal side more than on external); meso- and postfemur with spines on ventro-external margin. Tibial tymbra concha on both sides. Anterior tibia with dorsal and ventral, external and internal apical spurs; dorsal surface sulcate.

Male: Stridulatory file with circa 28-29 teeth which are large and widely spaced from each other (figs. 27-28). Tenth abdominal tergite with apical margin widely rounded; central area setose and provided with a puncture in centre. Epiroct tongue-shaped, apex broadly rounded. Cerci strongly curved, rather short; apical area compressed and excavated on cranial side; tapering towards acute apex (figs. 49-50). Subgenital plate long and narrow, with a medial carinal in basal half; split into 2 subparallel lobes in circa apical half or more (apical five to six tenth); apical lobes setose (figs. 55-56).

Female: Epiroct tongue-shaped. Cerci short, slightly curved, stout in basal area, narrowing in about middle, but then cylindrical and of subequal width to apex; apex obtuse (fig. 145). Subgenital plate long-triangular, apex rather broadly excised in middle, subtruncate between two short obtuse lateral projections (fig. 109).

Coloration: Green. Vertex and disc of pronotum with a faint brown medial band split in middle by a whitish line and with scattered brown dots, lateral angles with a little distinct white line. Tegmen green, anterior margin reddish or anterior area indistinctly infumate, with aggregations of black dots mainly between radius and anal margin.

Variation. In the female at hand, paranota and abdomen with red dots; medial band on disc of pronotum reddish, not split in middle.

Measurements (length in mm): Body 21-22, 21; pronotum 4.2-4.5, 4.8; tegmen 36.5-37.5, 40.0; tegmen width 5.5-6.3, 6.0; anterior femur 9.0, 10.0; mesofemur 11.5-12.0, 12.0; postfemur 23.0-24.0, 24.0; ovipositor 8.0.

Remarks. – This species agrees with the description of E. punctifera by Bei-Bienko (1955), not Walker (1869). A re-investigation of Walkers’ type shows however that both species are quite different.

Material of E. nautica at hand was collected in south-eastern central Thailand (map 3). It is possible that its range spread from there to Cambodia and South Vietnam. E. nautica is also adventive to the Hawaiian fauna. Whether other Elimaea species, e.g. E. punctifera as recorded by Hebard (1922b), also occur on the Hawaiian Islands was not investigated.

Etymology. – The name of this species is derived from Latin “nauticus” = seaman. It refers to its ability to cross the ocean and become an adventive species in Hawaii.

Elimaea poaefolia–group

Type species: Locusta (Phaneroptera) poaefolia De Haan, 1842; here designated.

Diagnosis. – Elimaeini with anterior femora curved as in phasmands. Tibial tymbra covered by a concha fold on both sides. Width of tegmen in middle slightly narrower than length of pronotum in male or width subequal to length of pronotum in female; in male tegmen often widening towards apex (for about 1 mm); radius sector branching distinctly before middle of tegmen. Phallus membranous. Ovipositor elongo-falcate, margins serrulate near apex; gonangulum with ventro-apical angle projecting.

Remarks. – There are two females from northern Thailand at hand that cannot be assigned to any described species and that obviously represent two different species. As the corresponding males are not known, I hesitate to name the new taxa, but an informal description of the two females is given below.

Distribution. – The poaefolia–group was previously known with one species each from Java, Sumatra, Borneo and Malaysia. The material at hand proves that the range of the group extends at least to the mountains of northern Thailand (maps 1, 3).

Elimaea (Elimaea) sp. 1
(figs. 115, 125, 138, map 3)

Material studied. – Thailand: 1 ♂, Chiang Mai prov., Chiang Dao, iv.1958, Phon, DAB (Lot 2409).

Description. – Female: Fastigium verticis narrow, sulcate, apex obtuse and step-like declined to fastigium frontis. Pronotum with disc nearly flat and with a low medial carina which is replaced by a furrow behind transverse sulcus and distinct again before apex; transverse sulcus arcuate; paranota circa 1.5 times longer than high with a longitudinal carina below middle of height, ventral margin slightly convex, anterior and posterior angles rounded, humeral sinus distinct. Tegmen narrow, subparallel-sided, apex rounded; radius sector branching distinctly before middle. Anterior femur with spines on ventro-internal margin. Mesofemur with spines on ventro-external margin; postfemora lacking. Knee lobes of pron- and mesofemur bispinose. Anterior tibia with dorsal and ventral, external and internal apical spurs. Anterior and medial legs very thin.

Male unknown.

Female: Tenth abdominal tergite with apical mar-
gin subsinuate. Epiproct long-triangular with apex obtuse; basal half bulging and with a medial furrow, apical half flattened. Cerci long-conical, moderately curved, apex subacute. Subgenital plate transverse, with a medio-longitudinal fold (artifact?); apical margin transversely truncate but slightly excised in middle; apico-lateral angles with two faint, obtuse, bulging swellings (fig. 115). Gonangulum of ovipositor with a strong projection pointing (ventro-)apicad (figs. 125, 138).

Coloration: Uniformly yellowish brown (discoloured?). Pronotum with dark dots on disc and lateral angles. Tegmen with light veins and veinlets and dark cells, less expressed in anterior-apical area.

Measurements of female (length in mm): Body 23; pronotum 4.5; tegmen 36.0; tegmen width 4.5; mesofemur 13.5; ovipositor 8.3.

Remarks. – This species is close to the following, it differs by the transverse subgenital plate, the stouter process of the gonangulum which is pointing apicad not ventrad and the lateral lobes of pronotum with the ventral margin broadly rounded not truncate.

**Elimaea** (*Elimaea*) sp. 2
(figs. 114, 126, 137, 139, map 3)

Material studied. – Thailand: 1♀, Tak prov., Mae Salid, Monkrating, 700m, 1.viii.1992, at night, ct.

Description. – Fastigium verticis narrow, sulcate, apex obtuse and step-like declined to fastigium frontis. Pronotum with disc nearly flat and with a medial carina which becomes subobsolete in metazona, lateral angles rounded; transverse sulcus broad-Y-shaped; anterior margin concave, posterior margin rounded; paranota circa 1.5 times longer than high with a longitudinal carina in about middle of height, ventral margin straight, anterior and posterior angles rounded, humeral sinus present. Tegmen surpassing hind knees, narrow, parallel-sided, apex rounded; radius sector branching distinctly before middle of tegmen. Anterior femur with spines on ventro-internal margin, meso- and postfemur with spines on ventro-external margin. Knees of all femora bispinose. Anterior tibia with dorsal and ventral, external and internal, apical spurs.

Male unknown.

Female: Tenth abdominal tergite with apical margin subsinuate. Epiproct subparallel-sided in circa basal half, with a medial furrow and lateral bulges, flat and long-triangular in apical half. Cerci long-conical, moderately curved, apex subobtuse (fig. 139). Subgenital plate with disc circa pentagonal in general outline and with a medial furrow in apical half; lateral area sloping and prolonged into spinose projections pointing apicad (fig. 114). Gonangulum of ovipositor with a short, conical, obtuse projection pointing ven- trad (figs. 126, 137).

Coloration: Green; pronotum and tergites with black dots. Tegmen with black dots forming three indistinct bands in radial and medial areas; costal area with red spots.

Measurements of female (length in mm): Body 22; pronotum 4.0; tegmen 34.0; tegmen width 4.0; post-femur 24.5; ovipositor 8.0.

Acknowledgements

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References


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Brunner von Wattenwyl, C., 1891. Additamenta zur Mono-
Abbreviations for species names in figs. 2-150:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Species Name</th>
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<tr>
<td>api</td>
<td>E. (R.) apicata sp. n.</td>
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<tr>
<td>app</td>
<td>E. (E.) appendiculata Brunner, 1878</td>
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<td>chl</td>
<td>E. (E.) chloris (De Haan, 1842)</td>
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<td>cuc</td>
<td>E. (H.) cucullata Ingrisch, 1990</td>
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<td>cur</td>
<td>E. (R.) curvicercata (Brunner, 1891)</td>
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<td>E. (R.) hebardi Karny, 1926</td>
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<td>kra</td>
<td>E. (R.) kraussi Karny, 1926</td>
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<tr>
<td>lee</td>
<td>E. (O.) leeuwenii Karny, 1926</td>
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<td>E. (O.) minor (Brunner, 1891)</td>
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<td>mod</td>
<td>E. (R.) modiglianii sp. n.</td>
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<td>nau</td>
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<td>nec</td>
<td>E. (R.) neglecta Karny, 1926</td>
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<td>par</td>
<td>E. (R.) parumpunctata (Serville, 1839)</td>
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<td>pen</td>
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<td>pse</td>
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<td>wil</td>
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<tr>
<td>H</td>
<td>specimen from Hawaii</td>
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<tr>
<td>T</td>
<td>specimen from Thailand</td>
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Figs. 18-28. Stridulatory files of Elimaea species. – 18-19, E. (E.) chloris (18, Java, syntype; 19, Bangkok, Thailand); 20-23, E. (E.) subcarinata (20, Hongkong, syntype; 21, Indochina, type of E. (E.) appendiculata; 22-23, Doi Khun Tan, Thailand); 24-25, E. (E.) thalii (24, Monkrating, Thailand; 25, Doi Musoe, Thailand); 26, E. (E.) punctifera, Silhet, Bangladesh, type; 27-28, E. (E.) nautica (27, Khao Soi Dao, Thailand; 28, Caumana Cave, Big Island, Hawaii).
Figs. 157-163. Habitus of Elimaea and Rhaebelimaea species. – 157, E. (E.) chloris, syntype male (RMNH); 158, E. (E.) subcarinata, syntype male (nrs); 159, E. (R.) mentaweii, holotype male (MZH); 160, E. (E.) punctifera, holotype male (RMNH); 161, E. (R.) pseudochloris, holotype male (DAR); 162, E. (R.) sinuata, holotype male (MZH); 163, E. (E.) appendiculata, holotype male (NHMW).

170) *Elimaea (Hemielimaea) cucullata*: Erawan

171) *Elimaea (Rhaebeelimaea) parumpunctata*: Gunung Salak

*Ectadia fulva;* Doi Suthep

- 20.5°C

*Elimaea (Hemielimaea) cucullata;* Erawan

- 21.5°C

*Elimaea (Rhaebeelimaea) parumpunctata;* Gunung Salak

- 24.5°C, short song
- 27°C, long song

- 24.5°C, short song
- 27°C, long song

Figs. 169-171. Oscillograms of stridulation. – 169, *Ectadia fulva*: upper row, sequence of echemes; lower row, echeme on expanded time scale; 170, *Elimaea (H.) cucullata*: upper row: series of three echemes; middle row: echeme on expanded time scale; lower row, last three syllables of an echeme; 171, *Elimaea (R.) parumpunctata*: upper row left, one-syllabic song; upper row right, multi-syllabic song; middle row, syllable of short song on expanded time scale; lower row, multi-syllabic song on expanded time scale.
Figs. 172-174. Oscillograms of stridulation. – 172, Elimaea (E.) chloris; Bangkok, Lard I’harma

173) Elimaea (Elimaea) subcarinata; Doi Khun Tan

26°C

174) Elimaea (Elimaea) thalii; Samoeng

22.5°C

Figs. 172-174. Oscillograms of stridulation. – 172, Elimaea (E.) chloris: upper row, series of echemes; lower row, syllable on expanded time scale; 173, Elimaea (E.) subcarinata: upper row, series of three syllables; lower row, syllable on expanded time scale; 174, Elimaea (E.) thalii: upper row, one-syllabic song; middle row, syllable on expanded time scale; lower row, male-female response song.
Map 1. Known areas of the genera and subgenera of Elimaeini, without subgenus *Rhaebelimaea*. 
Map 2. Distribution of *Elimaea* (Rhaebelimaea) species in South East Asia. Species without precise locality data are tentatively placed but not encircled. 1 parumpunctata, 2 kraussi, 3 curvicercata, 4 hebardi, 5 willemsei, 6 mentawei, 7 sinuata, 8 maninjauensis, 9 sumatrana, 10 modigliani, 11 rosealata, 12 adspersa, 13 signata, 14 spinigera, 15 neglecta, 16 siamenis, 17 pseudochloris, 18 apicata, 19 transversa, 20 pentaspina, 21 malayica, 22 caricifolia, 23 moultonii, 24 lamellipes, 25 longicercata, 26 puncticosta, 27 bakeri, 28 filicauda.
Map 3. Distribution of the species of *Elimaea* and *Ectadia* in Thailand; without subgenus *Rhaebelimaeae*.