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The Saturniidae (Lepidoptera) of the Philippines

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Abstract: 23 species of Saturniidae are reported for the Philippine Islands (a checklist is provided on p. 231). 2 new species and 4 new subspecies are described: *Antheraea (Antheraeopsis)* ***paniki*** n. sp. (widespread endemic on the Philippines), *Antheraea (Antheraeopsis) paniki* ***sahi*** n. ssp. (endemic on Palawan), *Antheraea (Antheraea) rosieri* ***imeldae*** n. ssp. (endemic on Palawan), *Antheraea (Antheraea) semperi* ***noeli*** n. ssp. (endemic on Mindoro), *Antheraea (Antheraea)* ***gulata*** n. sp. (endemic in the Palawan region), *Antheraea (Antheraea) gschwandneri* ***zwicki*** n. ssp. (endemic on Palawan). The holotypes are deposited in the TREADAWAY collection which is assigned to Senckenberg-Museum, or in the NÄSSIG collection in Senckenberg-Museum, Frankfurt am Main. The lectotype of *Antheraea semperi* C. & R. FELDER, 1861 is designated (in BMNH, London). *Antheraea (Antheraeopsis) youngi* WATSON, 1915 is interpreted as a separate Sundaland species (stat. rev.). All species are described and discussed. 13 colour plates are included which illustrate each species with examples of some of the possible variation; further 6 colour plates illustrate preimaginal instars. Maps illustrating the distribution of the taxa on the Philippines are provided, as well as illustrations of the genitalia. Tables have been added to show the degree of endemicity as well as the total number of species per island and per zoogeographical region. Mindanao (14) and Luzon (12) are the islands from which the largest number of autochthonous Saturniidae species is known, followed by Palawan and Leyte (10), Negros and Mindoro (9).

Die Saturniidae der Philippinen (Lepidoptera)

Zusammenfassung: 23 Saturniidenarten werden von den Philippinen nachgewiesen (Artenverzeichnis siehe S. 231), darunter 2 neue Arten und 4 neue Unterarten: *Antheraea (Antheraeopsis)* ***paniki*** n. sp. (weitverbreitete endemische Art der Philippinen), *Antheraea (Antheraeopsis) paniki* ***sahi*** n. ssp. (endemisch auf Palawan), *Antheraea (Antheraea) rosieri* ***imeldae*** n. ssp. (endemisch auf Palawan), *Antheraea (Antheraea) semperi* ***noeli*** n. ssp. (endemisch auf Mindoro), *Antheraea (Antheraea)* ***gulata*** n. sp. (endemisch in der Palawan-Region), *Antheraea (Antheraea) gschwandneri* ***zwicki*** n. ssp. (endemisch auf Palawan). Die Holotypen befinden sich in der Sammlung TREADAWAY, die in das Senckenberg-Museum, Frankfurt am Main, gelangen wird, oder sind mit der Sammlung NÄSSIG bereits dort. Der Lectotypus von *Antheraea semperi* C. & R. FELDER, 1861 wird designiert (im BMNH, London). *Antheraea (Antheraeopsis) youngi* WATSON, 1915 wird als separate sundaländische Art interpretiert (stat. rev.). Alle Arten werden beschrieben und diskutiert. Auf 13 Farbtafeln werden die Arten abgebildet mit einem Querschnitt der Variationsbreite; weitere 6 Farbtafeln zeigen Präimaginalstadien. Die Verbreitungsmuster der Taxa auf den Philippinen werden auf Verbreitungskarten

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[1] 49th Contribution to the knowledge of the Saturniidae.

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vorgestellt; die Genitalmorphologie wird abgebildet. In Tabellen werden Endemiegrad sowie Gesamtartenzahl pro Insel und pro zoogeografischer Region angegeben. Die meisten Nachweise autochthoner Arten sind von Mindanao (14) und Luzon (12) bekannt, gefolgt von Palawan, Leyte (je 10), Negros und Mindoro (je 9).

Introduction

Recent studies resulted in several national or regional faunal treatments of the Saturniidae of South-East Asia: Peninsular Malaysia (Lampe 1984, 1985), Borneo (Allen 1981, Holloway 1987), Thailand (Pinratana & Lampe 1990), Sulawesi (Naumann 1995), Sumatra (Nässig et al. 1996), Vietnam (Nässig 1994 d, Brechlin in preparation); further parts of Indonesia are in preparation (Paukstadt et al.). The present publication deals with the Saturniidae of the Philippine Islands.

The Philippine Islands form an archipelago in South-East Asia of over 7000 islands (Baltazar 1991, Gaulke 1993, Treadaway 1998, in this issue). The zoogeographical relationships to other areas of SE Asia are manifold and complicated (e.g., Vane-Wright 1990, de Jong & Treadaway 1993) and must be studied for every taxon separately. The climate on the Philippines tends to be seasonal, with rainy and drier seasons, although rain may fall at any time (see Treadaway 1998, in this issue). Seasons are usually more clearly expressed on the Philippines than in northern Borneo, West Malaysia or northern Sumatra (Nässig et al. 1996: 14)[2]

Anthropogenic destruction of primary biotopes in the tropics (and elsewhere) has accelerated to such a rate that it appears likely that many of the species known today, and most likely even more species which we do not yet know (and possibly will never know because their habitats will become cut down before anyone will ever study such fauna), will be lost within the next few decades. Not all species are able to survive within the secondary, agricultural, urbanized or otherwise transformed landscapes which are the result of man's impact on nature. Saturniid species may possibly survive at a higher rate than the average, because several of them are polyphagous and appear to be already pre-adapted to agricultural areas of the "non-industrialized" type.

Today, most Philippine specimens of Saturniidae in private collections (and probably even in most museums) originate from commercial traders. Usually they were collected or reared by local people on several islands, stored in the house of a Filipino (or Filipina) trader, imported to Europe by a European

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Long-lasting droughts like in 1997/98, caused by the Pacific "El Niño" effect, where even the usually perhumid forests of N-Sumatra become so dry that unextinguishable anthropogenic fires can devastate huge areas, are exceptions, but may appear. Similarly, Balabac in 1997 had an unusual 6 months dry period.

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trader and then sold to the customers. In this way, most of the stations did not pay much attention to the exact origin as well as correct and complete label data for the specimens. Therefore, the vast majority of traders' specimens tend to be unlabelled, mislabelled or carry only the name of an island (which often will be the place where the trader lives, not the true collecting place) but no exact locality data. Only in recent years, some traders began (on request) to be more careful with the data of their material. To avoid inexact or wrong locality data in distribution maps etc., we have concentrated our work on specimens which were collected during (official or private) scientific collecting expeditions or by local collectors who were especially trained to label their specimens correctly. Even if the label data appears to be reliable, it is still often incomplete, e.g., lacking the elevation data or other relevant information. We have discussed the accuracy of all locality data under the species in the systematic part and tried to eliminate unreliable data by checking the zoogeographical plausibility of the localities on the labels. The more than 40 years of collecting experience in the Philippines of one author (C.G.T.) were another main "plausibility filter" for the compilation of distribution data. Supplementary data was included until the last possible day (except in most tables); we hope that the consistency of the text did not suffer too much from this.

Our distribution maps (see general legend of the maps) are, therefore, mainly based on material collected by Thomas Achilles, Ronald Brechlin, Karel Černý, Roland A. Müller, Alexander Schintlmeister, Peter Schütz, Josef Settele, Victor Sinjaev, Colin G. Treadaway, Andreas Zwick and the Danish Noona Dan Expedition. Other reliably labelled specimens came, e.g., from Peter and Pancrasio Arimas, Prof. Josue de los Reyes†, Prof. Julian Jumalon, Manuel Medicielo, Noel, Dave and Domingo Mohagan, Justin Nuyda, Jan Petersen, Roy Rodriguez, Father Heinrich Schoenig†, and Ben Villan. The labels of Semper's material in SMFL (see below) are often not very detailed and sometimes do not give more information than an island name. Other, less reliable data are marked as such in the maps, in case they are not left out.

Zoogeography, geology and present-day distribution patterns

The present-day distribution patterns of species are the result of millions of years of evolution and changes, both of the species concerned and of the surface of our planet, including all other life. Therefore, not only the present-day patterns of land and sea, but also the past changes in these patterns must be considered when analyzing the evolution and distribution of a species (e.g.,

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Knight & Holloway 1990, especially Humphries 1990, or Holloway 1982, [1998]). In general, the influence of more recent changes in the surface of the earth is – not surprisingly – easier to trace than that of older events. Nevertheless, even the different break-ups of the Gondwanian land mass in the Cretaceous (and maybe earlier), more than 65 Ma[3] ago, evidently have left their traces: the distribution of many higher taxa (in the Saturniidae, mainly on the level of subfamilies, tribes and even genera) can most easily be explained when associated with isolation events of this period. In rare cases, there are hints that even a single present-day species may be the result of such Cretaceous isolation processes (Nässig & Oberprieler 1994). However, geological or paleogeographical literature (e.g., with focus on SE Asia: Hamilton 1979, Hayes 1980, Haq & van Eysinga 1987, Hutchinson 1989, Hall & Blundell 1996; with special focus on the Philippines: Hayes 1983; see also de Jong & Treadaway 1993: 81 ff.) is presently not able to explain in detail all the changes of the surface of our planet. The accuracy of models and scenarios becomes less reliable, the further back the changes have taken place. Additionally, the history of the big plates of earth's crust can be traced with more accuracy than that of smaller terranes (or microcontinents[4]). Not surprisingly, this can (and often does) lead to – at least partially – contradictory statements in geological literature (examples see in Katili 1989 [review] or in Hall & Blundell 1996; or compare earlier theories like those in, e.g., Whitmore 1981 with the more recent ones). Further, geological literature tends to describe the tectonic history of the drifting plates, but often does not add information whether this took place beneath the ocean or (at which elevation?) above sea level (Holloway 1982, Monk et al. 1997: 45–49). It is, therefore, often not possible for the biologist working on terrestrial organisms to find out whether and when a given movement in plate tectonics did or did not allow more or less "sessile" plant and animal species to utilize it (in the form of a land bridge, a series of "stepping stones" or a "drifting raft") for colonization of new areas.

Nevertheless, when analyzing the evolutionary history of present-day Lepidoptera species, it is necessary to consider not only present patterns of land and sea, but also the changes which have taken place earlier: the repeated changes of the sea levels during the Pleistocenic glaciation period (i.e., ca. the last 2 Ma) as well as the overlapping influence of plate tectonics during the past ca. 60–100 (or more) Ma. A general picture of the pa-

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[3] Ma = million years ("Mega-anni"; from "mega", million, and "annus", year); b.p. = before present.

[4] Even the present-day continental core of the Sundaland area (for the definition of this term, see the "explanatory note" below, following the abbreviations) was agglomerated during the Jurassic and early Cretaceous from such continental fragments, see Metcalfe (1990).

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leogeography of the Philippines according to actual hypotheses was published by DE JONG & TREADAWAY (1993: 83–88).

Another important aspect is the paleoclimate: for example, the more or less steady cooling of earth through the Tertiary, culminating in the Pleistocenic glaciations of the temperate zones. As Lepidoptera are herbivores, it is also necessary to know the evolution and biogeography of their foodplants and other paleoecological background data.

The Philippines were influenced during the past ca. 5–10 Ma especially by the drift of the SW-Mindoro/N-Palawan complex (the "Calamian block" of FULLER et al. 1983), the "docking" of N-Palawan onto the Sunda shelf in the NE of Borneo (and possibly thereby the uplifting of S-Palawan as part of the Sundanian shelf?) and the repeated oscillations of the sea level during the ice-ages. Further back in the past, the changes are more dramatic and surely less accurately interpreted (see TREADAWAY 1998, in this issue; for more details consult, e.g., DE JONG & TREADAWAY 1993, HALL 1996). The present-day knowledge about the zoogeography of the Philippines was summarized by VANE-WRIGHT (1990; his map of the 6 zoogeographical regions of the Philippines is reprinted in TREADAWAY 1998, in this issue) and DE JONG & TREADAWAY (1993).

Systematic part

The family Saturniidae comprises worldwide about 1200–1500 (LEMAIRE 1978, 1980, 1988, 1996, HEPPNER 1991, SCOBLE 1992, NÄSSIG unpubl.) species, with a centre of diversity in the Neotropics (LEMAIRE 1978). In South East Asia from the Malayan Peninsula to New Guinea probably around 100 species can be found. Only a few of the genera found in the area have been rigorously revised (with examining the primary types and using phylogenetic methods), and several taxonomic and systematic problems are still unsolved.

Faunistic observations on the Saturniidae of the Philippines are comparatively scarce in earlier literature. Besides the general publications of PAGENSTECHER (1890) and SEMPER (1896), there are only a few, mostly taxonomic publications (descriptions of new taxa) which are cited under the species. PAGENSTECHER (1890) described the "Heterocera" of Palawan, mainly based on a collection made by K. K. PLATEN and later sold by STAUDINGER and BANG-HAAS to their customers; most of this material seems today to be lost (HORN et al. 1990), only some part of it (e.g., one of the paratypes of *Samia treadawayi* NAUMANN, 1998, see NAUMANN 1998 a, in this issue) may have

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found its way into the STAUDINGER collection in ZMHU in Berlin. PAGENSTECHER counted 3 saturniid species, 2 of them misidentified. SEMPER (1896) listed 7 species of Saturniidae (including PAGENSTECHER's species) for the Philippines as a whole, 4 of which were misidentified (see systematic part). This collection is still preserved in the Senckenberg-Museum, although significantly reduced in numbers; evidently there was some trade and exchange with the specimens before they were deposited in Senckenberg.

Publications in the first half of the 20th century containing information about Philippine Saturniidae are few; SCHULTZE (1925) and SCHÜSSLER (1933) are rare exceptions. SCHULTZE listed only one species, *Actias philippinica*, which was misidentified as *A. maenas* by him, but nevertheless was a new record for the archipelago. SEITZ (1926/28) is not very informative with respect to the Philippines. Thus, 8 species of the family were known for the archipelago before the new period of work began in the 1980ies.

The complex geological and biogeographical history of the Philippine Islands resulted in complex distribution patterns of the species within the archipelago as well as in complicated relationships between Philippine species and their extralimital close relatives. It is thus not surprising that, when more detailed studies were conducted on the saturniid species of the Philippines during the last decades and during the preparation of the present publication, it became necessary to describe several new taxa (see PEIGLER 1985, NÄSSIG 1989 b, NÄSSIG & TREADAWAY 1988, 1997 a, 1997 b, NÄSSIG & LAMPE 1989, PAUKSTADT & BROSCH 1996, TREADAWAY & NÄSSIG 1997, LAMPE et al. 1997, NAUMANN 1998 a; finally, the present publication). The Philippines show a high degree of endemism in Saturniidae (see below), a fact which is different in some other lepidopteran families.

No truly migratory species are known in saturniid moths; usually the imagines do not possess a functional proboscis and do not take up water and nutrients (HOLLOWAY et al. 1987, SCOBLE 1992; but see also TAYLOR 1957 for an exception). Because of this, their imaginal lifespan is usually short (on average 1-5 d, rarely up to ca. 10 d for ♂♂ as well as ♀♀ when unmated, often shorter when mated; JANZEN 1984 a, NÄSSIG unpubl.). While ♂♂ are usually strong fliers (and can fly considerable distances within their short lifespan), ♀♀ tend to fly slower and probably also over shorter distances (JANZEN 1984 a). The females are so heavy-bodied, caused by the fact that most of their ova are fully developed and ready for oviposition when the imago hatches, that they usually do not fly longer distances (often not at all) before pairing and subsequent begin of oviposition. Only after laying most of their eggs are the

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♀♀ able to fly better and longer; but then their reproductive potential is often already almost exhausted. Although several species occur over a wide range (e.g., *Attacus atlas*, see below, or *Aglia tau* (Linnaeus, 1758), which is known nearly all across the Palearctic region from Western Europe to Eastern Siberia[5]), they are on average poor long-distance colonizers. This can be seen from the fact that there tend to be fewer species of Saturniidae on islands, when these islands are farther away from the continent[6]. It can be expected that – as a rule – the long-distance dispersal in saturniid moths will take place mainly across more or less homogeneous areas, covered by a vegetation and habitat structure suitable for the species concerned. Crossing of barriers will be unlikely and usually take place only over short distances, especially in ♀♀. Panmictic relationships within the range of a species are supported only by the strongly flying ♂♂; but even these will, on average, rather prefer to stay within their habitat than easily cross wide barriers. All these restrictions of the species' mobility do, of course, not rule out that sometimes even fairly remote islands may be inhabited by a saturniid species. But the present-day distribution patterns of Saturniidae will probably give better clues for the analysis of their distribution history as well as the geological and paleoclimatical history than those of highly mobile species like, e.g., most Sphingidae.

These presumed factors would well explain the distribution and specific differentiation patterns of Saturniidae observed: Most species are found on the big continents (like Asia, Africa, North and South America), while fewer species are found on islands. And usually fewer species are found on smaller than on larger islands, as well as on remote oceanic islands compared with islands close to a continent. Further, insular populations are often species separate from their relatives on the neighbouring islands or the closest continent, at least as long as there was no recent (pleistocenic) land bridge.

Abbreviations and conventions

Abbreviations of collections:

AMNH	American Museum of Natural History, New York, USA
BMNH	The Natural History Museum (formerly British Museum (Natural History)), London, UK

And is replaced on Sakhalin and the Japanese Islands by the closely related *A. japonica* Leech, 1889.

[6] Examples for continental faunas: Vietnam ca. 40 species (Nässig 1994 d, additional species: Nässig 1996 and unpubl., Brechlin 1997 and pers. comm.), Thailand 28 species (Pinratana & Lampe 1990), Peninsular Malaysia 23 species (Lampe 1984, 1985, addition see Nässig et al. 1996); for insular faunas: Sundaland: 23 species on Borneo and Sumatra each (but with several differences in the faunal composition: Holloway 1987, Nässig et al. 1996), larger islands of the Philippines 10–14 species (see below), Sulawesi 15 species (Naumann 1995). (U. Paukstadt et al. 1997 a described a 16th species from Sulawesi: *Antheraea kageri*. In our opinion, however, its status as a separate species was not yet demonstrated beyond doubt and requires some more research; it may possibly be just an infrasubspecific variety of the variable *A. paukstadtorum*.)

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CAZS	Collection Andreas ZWICK, Schlitz, Germany
CCGT	Collection Colin G. TREADAWAY, Limbach-Wagenschwend, Germany, assigned to SMFL
CMBH	Collection Martin BEEKE, Hille, Germany
CMWM	Collection Museum Thomas WITT, München (Munich; assigned to Zoologische Staatssammlung München, ZSM, Munich), Germany
CPSA	Collection Richard S. PEIGLER, San Antonio, Texas, U.S.A.
CPSS	Collection Peter SCHÜTZ, Stuttgart, Germany
CRBP	Collection Ronald BRECHLIN, Pasewalk, Germany
CRLN	Collection Rudolf E. J. LAMPE, Nürnberg, Germany
CRMG	Collection Roland A. MÜLLER, St. Gallen, Switzerland
CSKN	Collection Stefan KAGER, Nürnberg, Germany
CSNB	Collection Stefan NAUMANN, Berlin, Germany
CUBH	Collection Ulrich BROSCH, Hille, Germany
CUPW	Collection Ulrich and Laela H. PAUKSTADT, Wilhelmshaven, Germany
CWAN	Collection Wolfgang A. NÄSSIG, now in SMFL
MNHN	Muséum national d'Histoire naturelle, Paris, France
NHMW	Naturhistorisches Museum, Wien (Vienna), Austria
SMFL	Lepidoptera collection in the Senckenberg-Museum, Frankfurt am Main (with the number of the Lepidoptera type catalogue of the Senckenberg-Museum), Germany
ZMHU	Zoological Museum of the Humboldt University, Berlin, Germany
ZMUC	Zoological Museum of the University of Copenhagen, Danmark

Other abbreviations and conventions:

A1–A10	abdominal segments 1–10 (of the preimaginal instars)
D	Distibution by islands (within the political borders of the Philippines, see distribution maps)
DM	Distribution map(s)
ED	Extralimital distribution (records of the taxon from outside the Philippines)
fw.	forewing(s)
GP no.	Dissection/genitalia slide no. (Genitalpräparatenummer), ex CWAN, now in SMFL, if not stated otherwise
HT	holotype
hw.	hindwing(s)
lfw.	length of the forewing, measured in a straight line from the base of the wing to the most distant point of the apex, without the width of the thorax and without the tegulae
l.t.	locus typicus
LT	lectotype
NT	neotype
PLT	paralectotype(s)
PT	paratype(s)
ST	syntype(s)
T1–T3	pro-, meso- and metathorax
TS	type species

Abbreviations of the islands of the Philippines see in TREADAWAY (1998, in this volume).

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Explanatory note: The terrestrial zoogeographical term ***Sundaland,*** as applied here, was defined by JOHNSON (1964) as a replacement for the term "Malaya" and derivatives, when the modern state of Malaysia was founded, and is today used by most modern authors working on SE Asia (e.g., BARLOW 1982, HOLLOWAY [see references], KNIGHT & HOLLOWAY 1990, ELIOT 1992, etc.). It covers the zoogeographical unit of the lands on the Sunda shelf, that is: the Malayan Peninsula south of the Isthmus of Krah (or south of the 7th–10th degree of northern latitude, depending on authors) plus the islands of Sumatra, Borneo, Palawan, Java, Bali and smaller islands in between and around these larger islands. The lands east of WALLACE's line (mainly Wallacea, see KNIGHT & HOLLOWAY 1990, and the Australian Region), i.e., the Lesser Sunda Islands from Lombok to the East and Sulawesi and the Moluccas as well as the Philippines proper (except Palawan and the extreme western islands of the Sulu Archipelago), do not belong to Sundaland, because they are not situated on the Sunda shelf (see JOHNSON 1964, VANE-WRIGHT 1990). The islands along the SW coast of Sumatra (Simeuluë, Nias, Pulau Pulau Batu, Kepulauan Mentawai, Enggano, etc.) show some degree of endemicity, but in general should best be included into Sundaland. This small area constitutes a subregion called ***Paramalaya*** (TOXOPEUS 1926). TOXOPEUS also included the Nicobar – but not the Andaman – Islands into Paramalaya, which may be questionable; we do not have any information about the saturniid fauna of the Nicobar Islands to comment further upon this question, but, for example, RIPLEY & BEEHLER (1989) grouped the Nicobar and Andaman Islands together in a separate subregion closely associated to Burma with respect to their ornithofauna. Another subdivision of Sundaland is ***Neomalaya;*** this term was already introduced by MOULTON (1915 a, 1915 b) and comprises the northern corelands of Sundaland, which have the closest faunistic relationships: Sumatra, West Malaysia, and Borneo only, excluding Java, Bali and Palawan as well as Paramalaya. During most of the glaciation periods, Sundaland was above the sea and formed one more or less united land mass, while in warmer times large areas were submerged. Species inhabiting swampy lowland forests and mangroves were principally able to disperse from one present-day land to the next during these times of lower sea level, while species inhabiting mountain biotopes most likely were not, except the mobile species. On the other hand, at times even the isthmus was submerged (ELIOT 1992: 19–23). Today the natural northern borderline of the zoogeographical unit Sundaland on the Asian continent for many species is the climate divide between the perhumid equatorial tropical climate and the monsoonal (seasonal tropical to subtropical) climate in the northern part of West Malaysia and in South Thailand. Many species were able to cross that borderline, and we think there are still dispersal processes going on along the Malayan Peninsula in both directions. One example may be *Antheraea larissa*, which appears to slowly invade the Indochinese Peninsula north of the narrow Malayan Peninsula today. – Although there was no narrow isthmus as today during the glaciations (even Cambodia and the southern parts of Vietnam were at some times directly connected with Malaya and North Borneo: TJIA 1980, WHITTEN et al. 1987), probably there have been other barriers (e.g., big rivers – see TJIA 1980: 415 – or drastic climatical borderlines, see MACKINNON et al. 1997: 20) in the northeastern part of the Sunda shelf, because today there appear to be more differences in the faunal composition between Vietnam and Sundaland than between Thailand/Burma and Sundaland.

Checklist of the Saturniidae of the Philippines

Superfamily Bombycoidea LATREILLE, 1802

Family Saturniidae BOISDUVAL, [1837]

Subfamily Saturniinae BOISDUVAL, [1837]

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Tribus Attacini Blanchard, 1840

Genus *Attacus* Linnaeus, 1767

- *Attacus atlas* (Linnaeus, 1758)
- *Attacus caesar* Maassen, 1873
- *Attacus lorquinii* C. & R. Felder, 1861
- *Attacus lemairei* Peigler, 1985

Genus *Samia* Hübner, [1819]

- *Samia luzonica* (Watson, 1914)
- *Samia treadawayi* Naumann, 1998

Tribus Saturniini Boisduval, [1837]

Genus *Actias* Leach, 1815

- *Actias philippinica* Nässig & Treadaway, 1997
  - *Actias philippinica philippinica* Nässig & Treadaway, 1997
  - *Actias philippinica bulbosa* Nässig & Treadaway, 1997
- *Actias selene* (Hübner, 1806)
  - *Actias selene brevijuxta* Nässig & Treadaway, 1997

Genus *Cricula* Walker, 1855

- *Cricula trifenestrata* (Helfer, 1837)
  - *Cricula trifenestrata treadawayi* Nässig, 1989
- *Cricula luzonica* Jordan, 1909
  - *Cricula luzonica luzonica* Jordan, 1909
  - *Cricula luzonica leyteana* Nässig & Treadaway, 1997
  - *Cricula luzonica kareli* Nässig & Treadaway, 1997
- *Cricula mindanaensis* Nässig & Treadaway, 1997

Genus *Antheraea* Hübner, [1819]

Subgenus *Antheraeopsis* Wood-Mason, 1886[7]

- *Antheraea (Antheraeopsis)* ***paniki*** Nässig & Treadaway, **n. sp.**
  - *Antheraea (Antheraeopsis) paniki paniki* Nässig & Treadaway, 1998
  - *Antheraea (Antheraeopsis) paniki* ***sahi*** Nässig & Treadaway, **n. ssp.**

Subgenus *Antheraea* Hübner, [1819]

- *Antheraea (Antheraea) halconensis* Paukstadt & Brosch, 1996
- *Antheraea (Antheraea) rosieri* (Toxopeus, 1940)
  - *Antheraea (Antheraea) rosieri* ***imeldae*** Nässig & Treadaway, **n. ssp.**

In earlier publications (e.g., Nässig 1991 a, Nässig et al. 1996), the publication date of the generic name *Antheraeopsis* by Wood-Mason was repeatedly incorrectly stated as "1866". This was due to a typing error, which was then copied into subsequent manuscripts. The correct publication year is 1886. Thanks to U. Brosch & U. Paukstadt for drawing our attention on that error.

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Antheraea (Antheraea) larissa (WESTWOOD, 1847)
    Antheraea (Antheraea) larissa larissa (WESTWOOD, 1847)
    Antheraea (Antheraea) larissa mindoroensis BROSCH & PAUKSTADT, 1996
    Antheraea (Antheraea) larissa philippirissa TREADAWAY & NÄSSIG, 1997

Antheraea (Antheraea) semperi C. & R. FELDER, 1861
    Antheraea (Antheraea) semperi semperi C. & R. FELDER, 1861
    Antheraea (Antheraea) semperi ***noeli*** NÄSSIG & TREADAWAY, **n. ssp.**

Antheraea (Antheraea) ***gulata*** NÄSSIG & TREADAWAY, **n. sp.**

Antheraea (Antheraea) platessa ROTHSCHILD, 1903

Antheraea (Antheraea) gschwandneri NIEPELT, 1918
    Antheraea (Antheraea) gschwandneri ***zwicki*** NÄSSIG & TREADAWAY, **n. ssp.**

Genus *Loepa* MOORE, [1860]
    Loepa nigropupillata NÄSSIG & TREADAWAY, 1988
    Loepa mindanaensis SCHÜSSLER, 1933
    Loepa palawana NÄSSIG & TREADAWAY, 1997
    Loepa sp.?[8]

Genus *Lemaireia* NÄSSIG & HOLLOWAY, 1987
    Lemaireia schintlmeisteri NÄSSIG & LAMPE, 1989

Descriptions of and comments on the species

Introductory note. In many, probably most cases for insects, especially in the tropics, the concepts of biological species (biospecies; MAYR 1967, AX 1984) or evolutionary species (WILEY 1978, AX 1984) cannot be reasonably applied because the data available to characterize a taxon is so scarce. Instead, species are provisionally defined by morphological discontinuities (morphospecies concept, MAYR 1967). Most of the taxa dealt with here are species (or subspecies) on the morphospecies level. (In fact, even the approach using DNA analyses or other molecular methods today still is some kind of morphospecies concept on the "lowest possible level".) Such morphospecies can be characterized by the terms cladospecies and paraspecies, following ACKERY & VANE-WRIGHT (1984: 21): A ***cladospecies*** is defined by characters which are reliably apomorphic (autapomorphic, if it is a monotypic species, synapomorphic, if it is a polytypic species). A ***paraspecies*** lacks such apomorphic characters; it may, for example, either be a monotypic morphospecies defined by only some weak characters (the status of which as being apomorphic or plesiomorphic is unknown) within a bulk of similar, usually allopatric "species" often of the same qualification. Alternatively, it may be a widespread, generally polytypic morphospecies which is defined only by the *absence* of apomorphic characters (which were used to exclude other taxa from the group); this is an example of a "paraphyletic residue" (ACKERY & VANE-WRIGHT 1984; "paraphyletische Restgruppe": AX 1984, NÄSSIG 1995 b) on the species level. Species identity questions are commonly occuring problems in the study of tropical insects, see, e.g., the paragraphs on *Antheraea* below.

Altitudinal data and other information on collecting sites was, where possible, supplemented by one of the authors (C.G.T.) from personal knowledge of the collecting localities.

[8] Excluded from the count of species and endemics inhabiting the Philippines, see text.

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Saturniidae: Saturniinae
Tribe Attacini BLANCHARD, 1840

This tribe is characterized by several synapomorphies and forms a well-defined monophyletic group (MICHENER 1952, LEMAIRE 1978, PEIGLER 1989, NÄSSIG et al. 1996). It contains approximately 80–100 species nearly world-wide, with a natural distribution from the tropical to the warm-temperate zones of all continents except Europe and Antarctica. Its sister-group is possibly the genus *Rhodinia* STAUDINGER, 1892 (OBERPRIELER & NÄSSIG 1994)[9] See PEIGLER (1989) and NÄSSIG et al. (1996) for further details.

The genus *Archaeoattacus* WATSON, 1914, known with two species from Sundaland and the SE Asiatic continent, has thus far not been found on the Philippines. However, it may be possible that *Arch. staudingeri* (ROTHSCHILD, 1895) has made its way from Borneo to Balabac, Palawan or the Sulu Archipelago and still awaits discovery. It is a naturally rare species of primary forest biotopes in Sundaland from lowlands to ca. 1800 m (see NÄSSIG et al. 1996).

Genus *Attacus* LINNAEUS, 1767

Attacus LINAEUS, 1767 (Systema naturae, 12th edition, **1** (2): 808). TS: *Phalaena Bombyx Atlas* LINNAEUS, 1758, by fixation in OPINION 450 (1957, Opin. Decl. int. Commn. zool. Nomencl. **15**: 255).

The genus *Attacus* was revised some years ago and found to consist of 14 species (PEIGLER 1983, 1989). With regard to the number of species of the genus inhabiting the area within the political borders, the Philippines are second only to Indonesia, which is a much larger archipelago stretching from the Asian Paleotropic Region in the West to the Australian Region in the East. Four species of *Attacus* are known from the Philippines, 3 of them[10] are endemics to parts of the area. Although there is some evidence that the three endemic species are not forming a monophyletic subunit within the genus, their distribution areas are obviously allopatric, with any actual overlap most likely due to human interference.

[9] FRIEDLANDER et al. (1998), however, grouped *Rhodinia* outside the Attacini; they placed it as a basal outgroup of some Saturniini samples used as outgroup comparison for their Attacini analysis.

[10] PEIGLER (1989) placed these three species within the same species-group of the genus *Attacus* (the *lorquinii*-group), based mainly on imaginal morphology. But two of these species are most divergent in larval morphology (within those 10 of the 14 species where the larval morphology is at least partially known): *A. lorquinii* is without any larval defensive spraying glands (evidently just as *A. aurantiacus*), while *A. caesar* exhibits the most apomorphic conditions of the genus known today, with the dorsal scoli of the first abdominal segment being also transformed into spraying domes (NÄSSIG 1983, 1989 a, U. & L. H. PAUKSTADT 1986, 1992, 1993 b, DEML & DETTNER 1994, NÄSSIG et al. 1996, NÄSSIG & TASCHNER 1996, PEIGLER & WANG 1996, L. H. & U. PAUKSTADT 1997 b). This suggests that the *lorquinii*-group sensu PEIGLER may possibly be a paraphyletic conglomerate. The preimaginal morphology of *A. lemairei* is still unknown. The Sulawesian *Attacus erebus* FRUHSTORFER, 1904, also included into the *lorquinii*-group by PEIGLER, is – like *A. atlas* – somewhat intermediate between *lorquinii* and *caesar* with respect to the spraying domes, but has some obviously independent autapomorphies in larval morphology (see L. H. PAUKSTADT et al. 1996 b) and may perhaps, in fact, be more closely related to *A. crameri* and other eastern species.

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Unlabelled specimens or specimens with incomplete, dubious or plainly wrong locality data as well as evidently artificially introduced populations occur especially often in the genus *Attacus* (examples see in Peigler 1989 and possibly also in U. & L. H. Paukstadt 1990 a, b), because these huge species are very popular with amateur entomologists and traders, easy to rear (and regularly reared in big numbers), traded in large numbers (but not at all endangered thereby), polyphagous and usually capable to survive in secondary and agricultural landscape of the non-industrial type, and obviously will thrive well under tropical and subtropical climate nearly everywhere in the wild in SE Asia. This, consequently, may well have resulted in several populations being set free in the wild at the "wrong" places, often in or near cities. Such distribution data would seem best to be considered as information of minimal value with respect to "natural" zoogeography. In addition, due to the repeated use of misidentifications and synonyms as traders' names (e.g., *"atlas"*, *imperator*, *"crameri"*, etc.) and to the history of subordination of most taxa as "forms" of *Attacus atlas*, both traders and amateurs were (and frequently still are) often unaware of the correct name and identity of the different species, of the differences between them and of their original distribution patterns. This lack of knowledge, perhaps combined with "wishful thinking" on both sides, has most probably been responsible for most of the mistakes. We have, therefore, as a rule interpreted trader's material, especially of *Attacus*, as being of dubious origin. We accepted only data from scientifically organized, reliable expeditions to remnants of primary biotopes or reliable trader's material zoogeographically in accordance with the above concept.

Evidently, the species (especially *A. caesar* and *A. lorquinii*, perhaps also *A. atlas* [imported from Sundaland or Taiwan or just misidentified?] and, maybe, even *A. lemairei*) have repeatedly been reared and hybridized by traders (intentional or not) who rear their own stock – at least there have been specimens being traded which are labelled as hybrids. However, not all of these specimens look like real hybrids, while other traded specimens not labelled as hybrids occasionally do resemble such (and thus may be unnoticed and unintentional hybrids obtained during mass rearings?).

Attacus atlas (Linnaeus, 1758)

Phalaena Bombyx Atlas Linnaeus, 1758 (Systema Naturae, ed. 10, p. 495). NT (designated by Peigler 1989) in AMNH, not examined (but illustrated by Peigler); l.t.: Indonesia, Java, Bogor. – Full synonymy see Peigler (1989).

D: Only known from some of the northernmost islets of the Philippines: Batanes group: Itbayat (1 ♂ in CCGT) and Babuyan Island (Peigler 1989: 39, 1 ♂, 1 ♀ in CUPW). DM 1.

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ED: *A. atlas* is the most widely distributed species of *Attacus*, ranging from NW India to the southern parts of China, to Okinawa and to Sundaland (Bali), with some doubtful stray records (mislabelled or introduced specimens? See discussion) from eastern Indonesia (see map in Peigler 1989: 148). Reliable records of the species closest to the Philippines are Taiwan to the North and Borneo to the Southwest. No records of (Sundanian) *Attacus atlas* are known thus far from the small Philippine islets close to Borneo like, e.g., the Tawitawi group or Balabac, or from Palawan.

Material studied: 1 ♂, Batanes group: Itbayat, xii. 1983 (CCGT). 1 ♂, 1 ♀, Babuyan isl., 4. iv. 1973 (♂), 25. iii. 1973 (♀), CUPW (an additional ♀ with same data ex CUPW in CSKN).

Figured: Imago in Col. pl. 1: 2. Genitalia in B&W pl. 1: 2 (♂).

Attacus atlas is an example of a (cryptic polytypic?) paraspecies. Peigler (1983, 1989) distinguished this species from its closest relatives (*A. taprobanis* Moore, 1882/83 and *A. mcmulleni*[11] Watson [in Packard], 1914) by several weak wing pattern and genitalia and, in case of *A. mcmulleni*, larval morphology characters (Veenakumari et al. 1995), which were not analyzed in more detail with respect to their apomorphic quality. The larval morphology[12] and, most likely, the distribution pattern suggests that the species belongs to the more advanced species. The species is widely distributed and shows a wide range of individual and geographic variability, even in genitalia morphology.[13]

We have studied one Philippine ♂ of *A. atlas* only (that from Itbayat in CCGT, GP 1137/97; Col. pl. 1, Fig. 2). The specimen is relatively small (lfw. 98 mm). In colouration it is quite close to *A. atlas* from Taiwan, except that the black margins of the fw. fenestrae are much narrower than on average in the Taiwan population. The ♂ genitalia (B&W plate 1, Fig. 2) show only minor differences when compared with Taiwanese specimens (B&W plate 1, Fig. 1): The cornutus of the vesica is big, but less sclerotized than in Taiwan specimens, and the distal part of the valve is slightly more slender. But the differences between Taiwan and Itbayat specimens are clearly smaller than those between Itbayat and Java specimens. According to preliminary studies on small numbers of specimens, there appears to be a certain individual variability in *A. atlas* genitalia, maybe also in other species of the genus.

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[11] Sometimes misspelled (unintentionally in case of Nässig et al. 1996: 117) as "*macmulleni*"; Recommendation D (21.) (a) of ICZN (1985) does not apply here (R. S. Peigler, in litt.).

[12] In contrast to many imaginal characters, where the evolutive direction of the character development is unknown, the larval defensive glands offer a clear direction of the evolution: from normal "horns" of Attacini larvae (sensu Nässig 1989 a) over reduced "horns" to spraying glands on A8–10 and T1–3 and, eventually, to spraying glands on A8–10, T1–3 and A1. A secondary reduction of such glands, although not impossible, is much less likely; a secondary return to "horns" is most improbable.

[13] We agree with Peigler that it appears not to be necessary to split the species into several subspecies, because on average individual variability seems to dominate over geographical variability. Consequently, we have some doubt whether the Japanese population of *A. atlas* on the Ryukyu Islands necessarily deserved a subspecific name, as described by Inoue (1992). There is indeed some geographical variability in *atlas*, but before splitting it up more detailed research would be necessary.

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It seems likely that these northernmost islets of the Philippines were reached from the North (perhaps more likely by passive migrants blown by wind, as *Attacus* specimens – like other saturniids – on average are poor colonizers, see above) from Taiwan[14] The maximum distance from island to island in that area is less than 200 km (the average distances are usually less than 50 km), and this will have been even much less during times of lower sea level of the glaciation periods, thus making these islands a series of potential stepping stones. This distribution pattern of *A. atlas* resembles that of *Papilio polytes* LINNAEUS, 1758 (see DE JONG & TREADAWAY 1993: 97).

Preimaginal stages: Unknown from the Philippines, but well-known from Taiwan, Sundaland, and the Asiatic continent. The Taiwanese larvae were illustrated and described by HEPPNER et al. (1989), WANG (1988, [1994]), and PEIGLER & WANG (1996); further references see in HOLLOWAY (1987), PEIGLER (1989) and NÄSSIG et al. (1996). It can be expected that the larvae of the Philippine *atlas* will not differ significantly from the Taiwanese ones. The larvae are polyphagous on a broad variety of plant families (HOLLOWAY 1987 lists alone 33 plant genera out of 25 families compiled from different references), usually trees or shrubs; even monocots like Zingiberaceae may be foodplants (SUHARDJONO & ADISOEMARTO 1986).

Attacus caesar MAASSEN, 1873

Attacus Caesar MAASSEN, 1873 (*in* MAASSEN, J. P., Beiträge zur Schmetterlingskunde 2: col. pls. 22, 23). ST (1 ♂, 1 ♀ as illustrated) lost (see PEIGLER 1989). l.t. Bohol or Mindanao.

= *Attacus imperator* KIRBY, 1892 (A synonymic catalogue of the Lepidoptera Heterocera (moths). **1.** Sphinges and Bombyces, London, p. 746; and [both publications in 1892]: Entomologist **4:** 187); see PEIGLER (1989). – Further synonymy see PEIGLER (1989).

Attacus caesar: SEMPER (1896: 384; he had 7 specimens from Bohol and Mindanao before him).

D: Southern Philippines: Jolo, Basilan, Mindanao, Bohol, Leyte, Samar (CCGT, CRLN, CWAN, PEIGLER 1989). Additional doubtful (probably not autochthonous) records (see discussion) from Balabac, Palawan, Cebu, Marinduque, Luzon. DM 2.

Therefore, we think that the *Attacus atlas* populations in eastern Indonesia reported by PEIGLER (1989), if they are really established there and not just based on mislabelled specimens, are probably not naturally occurring there, but have been introduced by man, either inadvertently or deliberately. If *A. atlas* had managed to colonize this area on its own (possibly in a more humid time during the glaciation age, with, additionally, lower sea levels reducing the distances between islands), then there should be some remnant populations in between. *A. atlas* is quite well adapted to temporarily dry monsoonal climate, surviving the drought in the pupal stage. Natural disjunctions of that type are quite unlikely, considering the low flight abilities and short natural lifespan of the species as well as the type of area and the distances involved in the case. In addition, as far as we are informed none of the recent serious and reliable collecting expeditions in eastern Indonesia has resulted in a specimen of *A. atlas* being collected there in the wild.

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ED: None except the doubtful stray record of a ♂ from Papua Niugini (introduced or mislabelled?) cited by PEIGLER (1989).

Material studied (only ± reliable and detailed locality data listed): **Sulu Archipelago, Jolo** (in total 4 ♂♂, 2 ♀♀): 1 ♂, Maimbung, 21. XI. 1994; 3 ♂♂, 2 ♀♀, Patikul, 25. I. 1995, 1. XII. 1995, 25. XII. 1995, 10. II. 1996 (♀), 12. II. 1996 (♀), all CCGT; **Basilan:** 1 ♂, Limdok, 30 m, 9. IV. 1991, leg. C.G.T., CCGT. **Mindanao** (in total 23 ♂♂, 11 ♀♀): 1 ♀, Misamis occ., Jiminez, Mt. Malindang, 1000 m, 12. II. 1982. 1 ♂, Davao, Davao City, 23. II. 1981. 1 ♂, Bukidnon, Mt. Kitanglad, 16. V. 1995. 1 ♂, 1 ♀, Bukidnon, Mt. Kitanglad, Intavas, 4000 ft., 1. II. 1990 (♀), 25. VII. 1990. 1 ♀, Cotabato, Mt. Apo, 6. II. 1981. 1 ♂, S. Cotabato, Mt. Matutum, 6. II. 1996. 2 ♂, 1 ♀, S. Cotabato, Tboli, Siman, 14. XII. 1983 (♂♀), 1. III. 1988. 1 ♂, 2 ♀♀, Zamboanga City, Talisayan, 2./3./9. III. 1981. 1 ♂, Zamboanga, Mutya, 6. VI. 1987 All in CCGT. 2 ♂♂, 1 ♀, "E. Mindanao" or "Davao", coll. SEMPER in SMFL. 1 ♂, N Mindanao, Iligan City, VIII. 1978, SMFL. 3 ♂♂, Bukidnon, 40 km NNW Maramag, Dalongdong, 800 m, Talakag, 1.–3. X. 1988. 2 ♂♂, dto., 31. XII. 1991–2. I. 1992, all in CWAN. 1 ♂, Surigao del Sur, XI. 1976. 1 ♂, 1 ♀, Bukidnon, Bayabason, Maramag, 800–900 m, 3. IV. 1994. 4 ♂♂, 2 ♀♀, "Mindanao", e. o./ e. p. 1977, 1979, 1992, all in CRLN. 1 ♂, 2 ♀, "Mindanao", XII. 1989, CSNB. **Bohol** (in total 25 ♂♂, 17 ♀♀): 12 ♂♂, 5 ♀♀, Bilar, 4. II. 1953, 22. II. 1956 (♀), 6./11. IX. 1984 (2 ♀♀), 7. IX. 1984, 13. IX. 1984, 4. III. 1987, XI. 1987, 1. XI. 1987 (1 ♂, 2 ♀), 16.–21. XI. 1987 (5 ♂♂), 3. XI. 1988, CCGT. 1 ♂, Inabanga, 24. II. 1956, CCGT. 1 ♂, 1 ♀, Bilar, IX. 1984, CWAN. 5 ♂♂, 2 ♀♀ with only "Bohol" in SMFL (SEMPER coll., 1 ♂) and CWAN (ex pupa: 1 ♂, 2 ♀♀, II. 1982; ex ovo: 2 ♂♂ V. 1982; 1 ♂ 29. VI. 1984). 2 ♂♂, 2 ♀♀, "Visayas, Bohol", e.o. X. 1981, CRLN. 4 ♂♂, 5 ♀♀, "Bohol", III. 1993, III. 1997, CSNB. **Leyte** (in total 11 ♂♂, 6 ♀♀): 2 ♂♂, 3 ♀♀, C. Leyte, Mahaplag, Hilusig, Mt. Balocaue, 700 m, 3. I. 1986, 13. II. 1990, 15. II. 1990 (♀♀), 16. II. 1990 (♀), CCGT; 2 ♂♂, dto., 600 m, 7. IX. 1988, 12. IX. 1987, CCGT; 2 ♂♂, C. Leyte, VISCA, 5 km N Baybay, 100 m, 8. VII. 1985, CWAN. 3 ♂♂, S. Leyte, St. Bernard, Catmon, 155 m (530 ft.), 6. III. 1979, 5. IX. 1976, 6. IX. 1986, CCGT. 1 ♀, S. Leyte, St. Bernard, 2. VI. 1982, CCGT. 1 ♂, 1 ♀, S. Leyte, St. Bernard, reared, 1981, CRLN. 1 ♂, 1 ♀, same data, CWAN. **Samar** (in total 4 ♂♂, 2 ♀): 1 ♀, E. Samar, nr. Gen. MacArthur, VIII./IX. 1976, SMFL. 1 ♂, 1 ♀, N. Samar, Paco, nr. Catubig, 20. X. 1988 (♀), 13. XI. 1988. 2 ♂♂, C. Samar, Bagacay, ca. 350 m (1000 ft.), 10. IV. 1980, 12. IV. 1985. 1 ♂, C. Samar, 11,5 km WSW Bagacay, Arizona, 27. III. 1996; all CCGT.

Further specimens from "Luzon", "Cebu" and "Palawan" in CRLN, CSNB, CWAN etc. which would seem to be artificially introduced (Luzon) or most likely mislabelled (Cebu, Palawan), see discussion.

Figured: Imagines in Col. pls. 1: 1, 3, 4; 2: 6, 10. Preimaginal instars in Col. pls. 14 & 15. Genitalia in B&W pl. 1: 3 (♂).

Attacus caesar is probably one of the best defined cladospecies within the genus, because it offers a broad array of autapomorphic characters both in larval and imaginal morphology (larval defensive glands also present on A1, imaginal wing pattern and the distinctive greenish ground colour described below, etc.). There is some insular variability (see below), but as no subspecies are accepted presently it can still be termed a monotypic cladospecies.

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Description and diagnosis. (See Col. pl. 1, Figs. 1, 3, 4; Col. pl. 2, Figs. 6, 10.) Lfw. see Tab. 1. *Attacus caesar* can be readily separated from *A. lorquinii*, *A. lemairei* and *A. atlas* in the ♂ by the considerably smaller and often divided main fenestrae of the fw. For both the ♂ and the ♀ the extended red line in the subapical area of the fw. for *lorquinii*, *lemairei* and *atlas* is not present in most cases and, if present, is only a short vague reddish line. ♂ genitalia see in B&W plate 1, Fig. 3; the valves are much more pointed to the apex than in the other three species.

Table 1: Forewing length of *Attacus caesar*. Material of colls. SMFL, CCGT, CRLN, CWAN. Specimens with doubtful locality data or two damaged forewings excluded.

Attacus caesar Island	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Jolo, Basilan	♂♂ ♀♀	120.6 125.5	3.78 2.12	5 2	117 124	125 127
Mindanao	♂♂ ♀♀	117.5 123.1	4.72 5.95	22 9	103 116	125 134
Bohol	♂♂ ♀♀	115.5 126.6	4.88 7.15	20 11	108 112	125 139
Samar, Leyte	♂♂ ♀♀	118.7 128.0	5.62 3.02	14 8	110 125	126 132
All islands together	♂♂ ♀♀	**117.4** **126.0**	**5.07** **5.84**	**61** **30**	**103** **112**	**126** **139**

Insular and individual variability. *A. caesar* is a very variable species. Differences comprise both individual (probably in part weather- or climate-dependent? See JANZEN 1984 b, U. & L. H. PAUKSTADT 1990 a) and geographical variability, although the geographical variability seems to play a minimal rôle only.

The ♂♂ are known in basically three types:

1. both wings upperside nearly totally an olive greenish ground colour (which, in fact, consist of a combination of long, yellowish or bright brownish scales overlying shorter, black, dark brown or dark reddish scales, and, depending on the distribution and colour of the scales, the overall colour ranges from a dark to a light olive green ground colour);
2. forewing upperside greenish (again consisting of long yellowish and short dark brown scales), hindwing upperside a reddish colour; and
3. both wings upperside a red (or maybe orange) colour. In all cases the fasciae are inconspicious, and the basal, median, and marginal zones of the wings are more or less uniformly coloured.

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The ♀♀ show a similar range of ground colour variation, but the fasciae (usually broadly whitish, bordered with red and with a stripe of black, blue, and white scales mixed) and the marginal area (often red) are more prominent than in ♂♂. Specimens from Bohol often tend to be of a lighter (e.g., the red appearing orange) overall colour for each of the colour forms mentioned above which (besides the sexual dimorphism) probably caused Kirby to create the separate species name *imperator* for the Bohol *caesar*. Interestingly, both red and olive green forms have been collected on Bohol in which the postdiscal narrow curved band of black, white, and red has the white stripe enlarged for the fw. to 7–10 mm at the costa, to 3–6 mm at the inner margin (see Col. pl. 2, Fig. 6).

These longer, usually yellow scales which produce the distinctive greenish appearance of *caesar* are also known from other *Attacus* species, usually mostly in the marginal zone of the wing. But in no other species do they dominate so strongly within the median and (in ♂♂) basal parts of the forewings. The colour variability of "red versus green" in *caesar* can therefore be reduced to the usual dimorphism of reddish versus blackish brown scales (possibly influenced by external factors) known from many other Attacini species (see *lorquinii;* see Janzen 1984 b), in *caesar* in both cases overlaid by yellowish to — sometimes — reddish scales.

Phenology. The collecting dates (Tab. 2) show peaks in February, March, September, and November. These dates probably correlate mainly with events like the preferred times of European expeditions (November to March) etc. rather than with actual rainfall data (see Treadaway 1998, in this issue).

Altitudinal distribution. The known locality data range from sea level to about 1400 m elevation; but there is only rarely any altitudinal data on the labels. At least, *A. caesar* is evidently not a "high mountain species"; no specimen was found above ca. 1500 m thus far.

Table 2: Phenology data (collecting dates) of *Attacus caesar* from Mindanao (n = 26) alone, Bohol (n = 29) alone and for the entire material available (n = 80, including Mindanao and Bohol). Geographical or climatical effects not separated, reared specimens excluded.

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Mindanao	2	5	4	2	1	1	1	1	0	3	1	5
Bohol	0	3	10	0	0	0	0	0	6	0	10	0
All islands	4	14	16	5	1	2	3	1	11	4	12	7

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Preimaginal stages: The first publication describing and illustrating in colour the larval instars of *A. caesar* was that of Nässig (1983), also describing the defensive spraying glands. See Col. pls. 14 & 15. The larva is also illustrated by Peigler (1983, 1989) and Peigler & Wang (1996). The differences between larvae of *A. caesar* and *A. lorquinii* see under the latter.

Discussion. The distribution data especially of this and the next species (but also of some other Saturniidae species) are obscured by man-made extralimital introductions or plain mistakes. *A. caesar* is reported from 5 islands of the Philippines for which we strongly believe that they do ***not*** belong to the natural range of the species:

- **Luzon.** The known records come: (a) from hotel gardens in Manila (e.g., in CWAN). These specimens were truely collected there as larvae or pupae. But it is very clear that this is not within the natural range of the species; it can be assumed that someone (a tourist or a local Philippine rearer?) could well have deliberately or accidentially set the species free there. (b) from Baguio (Peigler 1989: 52), see discussion by him. These specimens were most likely included in mixed lots from a dealer and were carelessly labelled. (c) from Isabela (U. & L. H. Paukstadt 1990 a, sold under the name "*A. atlas*"); these were most likely as well either from introduced lifestock or just mislabelled.
- **Marinduque.** Again data compiled by Peigler (1989), see his discussion.
- **Cebu.** In CSNB and same case as before, Peigler (1989) has already stated that this is unlikely.
- **Palawan** and **Balabac.** These records originate from Peigler (1989) after specimens in museum collections and from traders' material in private collections (e.g., CRLN) and are, admittedly, relatively numerous. Nevertheless, they appear to be quite improbable, because intensive long-term collecting by Rodriguez, Petersen and Zwick on Palawan as well as collecting expeditions by these and other reliable entomologists (including Father Schoenig†, J. Settele and C.G.T.) to Palawan and Balabac during the recent decades to our information never resulted in any specimen of *A. caesar* collected in the wild at light within a primary (or well-preserved secondary) biotope. Further, there are several insect dealers on Palawan which collect their lots on different islands of the Philippines (sometimes even in Indonesia and Malaysia!) and sell all their material from their home address, often without labelling the envelopes. Therefore, we are quite confident that the specimens from Palawan or Balabac are mislabelled or, maybe, introduced, but do not belong to a permanently

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breeding, ***autochthonous*** population (this view is also explicitly confirmed by A. Zwick, pers comm.).

In addition, it appears to be very unlikely based on zoogeographical reasons that *A. caesar* really inhabits these islands: There are no direct colonization pathways from the Mindanao/East Visayan region to the Palawan region; the only ways would have been: (a) via the Sulu Archipelago and Borneo (but *A. caesar* does not exist on Borneo) or (b) across at least two, possibly three of the other faunal regions of the northern Philippines; but within these regions there do not appear to live autochthonous populations of *A. caesar*, see above – or (c), most unlikely, directly across the Sulu Sea, about some 350 km minimum distance of open sea. Usually, species inhabiting the Palawan ***and*** the Sulu/Mindanao regions are either Bornean species invading along two pathways into the Philippines, or they are species widely distributed all over the Philippines (de Jong & Treadaway 1993); *A. caesar* is neither of these examples. Therefore and because there has never been a reliable confirmation, we think that the natural range of the species does ***not*** include Palawan and Balabac (i.e., the Palawan region of Vane-Wright 1990).

To our way of thinking, only the localities marked with solid black symbols on map 2 are reliable localities of *A. caesar*, restricting the natural range of that species to the southern and south-eastern islands of the Archipelago, and south-westward from Mindanao on the Sulu Archipelago at least as far as Jolo, i.e., strictly to the East Visayan/Mindanao and Sulu regions of Vane-Wright (1990).

Attacus lorquinii C. & R. Felder, 1861

Attacus lorquinii C. & R. Felder, 1861 (Wien. entomol. Monatsschr. 5: 306). LT (designated by Peigler 1989: 71) in BMNH, not examined. l.t.: Luzon. Full synonymy see Peigler (1989).

Attacus atlas, var. *lorquinii:* Semper (1896: 383, pl. C, figs. 1-5 [preimaginals]; he had "over 100 specimens" from Luzon, Mindoro and Cebu, but only a few of these are still preserved in SMFL).

D: Northern Philippines: Luzon, Polillo Islands, Mindoro, Marinduque, Sibuyan, Masbate, Panay, Guimaras, Negros, Cebu (SMFL, CCGT, CMBH, CRLN, CSNB, CWAN, Peigler 1989). Some doubtful (see discussion) records from Mindanao: Zamboanga Peninsula and NE Mindanao (Peigler 1989), Bohol (CSNB, CUBH), Samar (Peigler 1989), and Dumaran (CCGT). DM 3.

ED: None except a few mislabelled specimens (see Peigler 1989).

Material studied (only ± reliable locality data listed): **Luzon** (in total 57 ♂♂, 12 ♀♀): S. Luzon, Quezon Prov., Concepcion, 22. viii. 1985. 1 ♂, 1 ♀, Quezon Prov., Infanta, 16. viii. 1985 (2×). 2 ♂♂, 1 ♀, Manila, Tondo, 30 m, 15. viii. 1954, 20., 27. x. 1956. 4 ♂♂,

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3 ♀♀, Manila, Malate, 20 m, 20. x. 1953, 14. viii. 1954, 10., 23., 25. xi. 1955, 11. ii. 1956 (2×). 1 ♂, Manila, Desmariñas, ca. 70 m, 15. xii. 1987. 1 ♂, N. Luzon, Baguio, 20. x. 1953. 2 ♂♂, 2 ♀♀, N. Luzon, Abra, Bucay, 2., 3., 10., 17. iii. 1994. 1 ♂, Ifugao, Banaue, 1000 m, street light, 7. v. 1988. 1 ♂, 2 ♀♀, Banaue, 3600', 8. vi. 1988, 18. v. 1990, 31. i. 1991. All these in CCGT. 2 ♂♂, 2 ♀♀, Quezon City, 4. xi. 1984. 1 ♂, Quezon, Tanawan, 600 m, 23. i. 1988, Černý & Schintlmeister. 1 ♂, Nueva Viscaya, Dalton Pass, Santa Fé, 800 m, 21. ix./17. x. 1988, Černý & Schintlmeister. 1 ♂, Mountains Prov., 7 km SE Bontoc, Talubin, 1200 m, 14./17. ii. 1987, Černý & Schintlmeister. 1 ♂, Mts. Prov., Chatol, 15 km SE Bontoc, 1600 m, 24. ix./14. x. 1988, Černý & Schintlmeister. 4 ♂♂, Ifugao, Mayoyao, 600–800 m, 17. vi., 4. ix. (3×) 1988, Settele et al. 12 ♂♂, Ifugao, Lawig, 200–300 m, 18. viii. (3×), 19. viii. 1988, 21. i., 31. i. (7×) 1989, Settele et al. 9 ♂♂, Ifugao, Kiangan, 750 m, 30. v., 7. vi. (2×), 10. vi., 9. ix. (2×), 13. ix. (2×), 18. ix. 1985, Settele et al. 13 ♂♂, 1 ♀, Ifugao, Banaue, 1000–1200 m, 8./11./12. ii. (7×) 1988, 15, vii., 12. ix. (♀), 22. ix./ 16. x. 1988, x. 1988–i. 1989, 10. i., 26. i., 1. ii. 1989, Settele, Achilles et al. *or* Černý & Schintlmeister. All these in CWAN. **Polillo Islands:** 1 ♂, 1 ♀, Quezon Prov., Polillo Is., 28. iv. 1994, CRLN. **Mindoro:** 1 ♂, Calapan, 23. viii. 1956, CCGT. 1 ♀, “Mindoro”, 14. ii. 1997, CMBH. **Marinduque** (in total 15 ♂♂, 7 ♀♀): 7 ♂♂, 3 ♀♀, near Boac, 20. ii. 1981, 3., 6. vi. 1982, 1., 10. (2×) ii. 1983, 15. viii. 1984, 1. xi. 1986, 30. vii. 1987. 1 ♂, “Marinduque”, 19. ix. 1977. All these in CCGT. 1 ♂, 1 ♀, “Marinduque” (ex imported cocoon), 1., 25. v. 1979, e.p. T. Weers, CWAN. 2 ♂♂, Boac, Togus, vi. 1996. 4 ♂♂, 3 ♀♀, “Marinduque”, viii. 1993 (2 ♂♂, 1 ♀); 3. x. 1993 (2 ♂♀). All these in CSNB. **Sibuyan:** 2 ♂♂, Magdiwang, 25. vi. 1986, CCGT. 1 ♀, España, 1. iv. 1984, CCGT. **Masbate** (in total 5 ♂♂, 1 ♀): 3 ♂♂, “Masbate”, 16./17. vi. 1996, CSNB. 1 ♂, 1 ♀, “Masbate”, iv. 1996, CUBH. 1 ♂, “Masbate”, iv. 1997, CMBH. **Panay:** 1 ♂, Culasi, Mt. Madja-as, 10. x. 1993, CCGT. **Negros** (in total 14 ♂♂, 4 ♀♀): 1 ♂, S. Negros, Amlan Hydro, 500 m, 5. vii. 1985. 5 ♂♂, Mambucal, 15. v. 1988, 3., 15., 18., 29. x. 1992. 1 ♂, Mt. Canlaon, 16. iii. 1996. 1 ♂, Negros Or., Liptong, 13. vii. 1985. All these in CCGT. 4 ♂♂, 4 ♀♀, Negros Or., Liptong, Valencia, 200 m, 13. i. (2×), 3. ii. (2×), 7. iii., 23. iii., 5. xii. (2×) 1986, ex CCGT in CWAN. 2 ♂♂, Negros Or., Lake Balinsasayao, 24. vii. 1985, Settele, CWAN. **Cebu** (in total 5 ♂♂, 6 ♀♀): 2 ♂♂, 2 ♀♀, “Cebu”, SMFL (coll. Semper). 2 ♂♂, 4 ♀♀, Cebu City, 50 m, 10. iii. 1953, 2., 3., 5. xi. 1955, 11. iv. 1956, 2. vii. 1976. 1 ♂, Minghanilla, 23. vii. 1979. All these in CCGT. – And some further specimens not listed here.

Figured: Imagines in Col. pls. 2: 5, 7, 8, 9; 3: 15; 13: 83, 84. Preimaginal instars in Col. pls. 14 & 15. Genitalia in B&W pl. 2: 4 (♂).

Attacus lorquinii is defined by several plesiomorphic characters, and the evolutionary direction of the few possible apomorphic characters is hard to decide. So we think that *A. lorquinii,* in spite of the easily recognizable external appearance, may in fact turn out to be a paraspecies. There is, similar to *A. caesar,* some insular variability, but the individual variability is much more prominent. Nevertheless it should still be termed a monotypic paraspecies.

Description and diagnosis. (See Col. pl. 2, Figs. 5, 7, 8, 9; Col. pl. 3, Fig. 15.) *Attacus lorquinii* can be separated from *A. caesar* as covered under this species – i.e., the presence of a red line in the fw. subapical area for

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lorquinii (although there are also a few specimens in which this red line is noticeably reduced). For *A. lemairei* and *A. atlas*, both ♂♂ and ♀♀ of *lorquinii* can be differentiated by the distinctive pale violet ground colour in the subapical area of the fw. (versus dark yellowish for the other two species). Although normally both sexes of *lorquinii* have only one window on the fw., occasional specimens of both sexes occur with a small second window (often only a black dot, without a hyaline centre) usually penetrating the postdiscal band. ♂ genitalia see on B&W plate 2, Fig. 4; the valves are fairly narrow and perhaps most similar to *A. atlas*, although distinct.

Table 3: Forewing length of *Attacus lorquinii*. Material of colls. SMFL, CCGT, CMBH, CRLN, CWAN. Specimens with doubtful or inexact locality data and reared specimens excluded. "All islands together" includes some specimens and islands not listed under the single-island counts above.

Attacus lorquinii Island	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Luzon	♂♂	111.6	7.49	59	92	125
	♀♀	115.4	9.28	14	95	127
Marinduque	♂♂	105.3	11.55	9	79	115
	♀♀	106.5	8.39	4	94	112
Negros	♂♂	107.8	6.98	18	90	117
	♀♀	116.6	4.69	7	110	123
Cebu	♂♂	108.7	6.38	6	100	116
	♀♀	107.7	5.75	6	98	114
All islands together	♂♂	109.9	8.25	98	79	125
	♀♀	112.9	8.16	35	94	127

Insular and individual variability. This species is not as variable in appearance as *A. caesar* but nevertheless does have several colour forms of note. For both ♂♂ and ♀♀ there are three colour forms – (a) a deep red-brown form (perhaps the most common one), (b) a lighter red-brownish form and (c) a very dark blackish brown form for which the pale violet subapical patch of the fw. stands out rather distinctively. These colour forms do not seem to be specific to any island; it may be the weather-dependent variability as noted before in different Attacini species (JANZEN 1984 b etc.). A few specimens at our disposal are of a bright sandy pinkish- to sandy orange-brown colour for which all the black markings stand out quite prominently. These specimens appear somewhat "artificial" and could well be aberrants or, perhaps more likely, artificially bleached (during a too wet relaxation process or during contact with chemicals?) specimens. A form with prominently widened white postdiscal fasciae similar

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to that in *A. caesar* is also known in *A. lorquinii* (see Col. pl. 13, Figs. 83/84, in CRLN).

Phenology. Specimens of *Attacus lorquinii* can be found the whole year round, but our data (reared specimens and such with dubious labels excluded) suggest a reduced population density in March to May and possibly a second one in December (see Table 4). March to May is, for most areas of the northern Philippines, on average a drier season.

Table 4: Phenology data (collecting dates) of *Attacus lorquinii* from different islands or regions and for the entire material available (n = 126). Geographical or climatical effects not separated, reared or dubiuos specimens excluded.

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Luzon, Polillo	12	12	4	1	3	5	1	9	10	6	7	1
Mindoro	0	1	0	0	0	0	0	1	0	0	0	0
Negros	2	2	3	1	1	0	6	0	0	4	0	3
Marinduque	1	4	0	0	0	4	1	2	1	0	1	0
Masbate	0	0	0	3	0	2	0	0	0	0	0	0
Cebu	0	0	1	1	0	0	2	0	0	1	3	0
Panay	0	0	0	0	0	0	0	0	0	1	0	0
Sibuyan	0	0	0	1	0	2	0	0	0	0	0	0
All islands	**15**	**19**	**8**	**7**	**4**	**13**	**10**	**12**	**11**	**12**	**11**	**4**

Altitudinal distribution. The known locality data range from sea level to about 1600 m elevation, and, in contrast to the few specimens for *A. caesar*, there are 62 specimens bearing altitudinal information on their labels (see Text-Fig. 1). However, *A. lorquinii* is as well not a "high mountain species"

Preimaginal stages. The first illustration of the larva of *A. lorquinii* was that of SEMPER (1896: 383, pl. C, figs. 1-5). His illustrations are neither very good nor informative. The mature larva is also illustrated in NÄSSIG (1983), PEIGLER (1983, 1989) and PEIGLER & WANG (1996). See Col. pls. 14 & 15. – Differences between *A. caesar* and *A. lorquinii* are found in all instars (for details see the colour plates): *A. lorquinii* has more black pattern in L_1 and more orange pattern in L_2 and L_3 than *A. caesar*. From L_4 onward, *caesar* is always readily recognized by its orange or red spiracles, while those of *lorquinii* are in the ground colour and inconspicuous. The dorsal and subdorsal scoli of *lorquinii* are always longer and more prominent than in *caesar*, the difference is gradually increasing from L_4 to L_6. Also, the lateral scoli of *lorquinii* are usually black (with blue base) and al-

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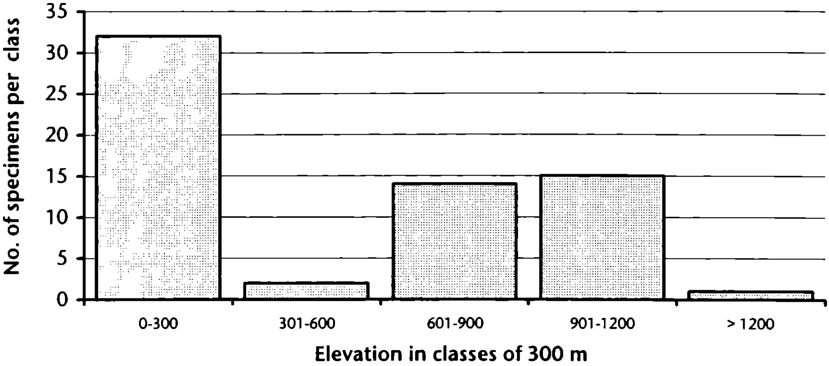
ways longer than in *caesar*, where they are in last instar reduced to yellow warts or dots. The main difference is found in the equipment with spraying cupolas: shortened scoli in *caesar* which have (depending on their location and size) from 2 to ca. 10 big one-cell reservoirs from which the caterpillars can actively (most likely by increasing their hemolymph pressure) squirt a strongly citrus- or similarly smelling (i.e., terpenoids?) secretion across some tens of cm (NÄSSIG 1983). These squirting cupolas are gradually developing from 4th to 6th instar in *caesar* only (they are totally lacking in *lorquinii*) and found dorsally and subdorsally on T2, T3, A1, A9/10 of *caesar*, which is at least on one segment (A1) more than in any other *Attacus* caterpillar known today (LAMPE 1984 a, 1984 b, NÄSSIG 1983, 1989 a, NÄSSIG & PAUKSTADT 1985, U. & L. H. PAUKSTADT 1986, 1991 a, 1991 b, 1992, 1993 b, DEML & DETTNER 1994, NÄSSIG et al. 1996, NÄSSIG & TASCHNER 1996, PEIGLER & WANG 1996, VEENAKUMARI et al. 1995, L. H. PAUKSTADT et al. 1996 b, L. H. & U. PAUKSTADT 1997 b).



Text-Fig. 1: Altitudinal distribution of *Attacus lorquinii* on the Philippines, data from 62 specimens, all islands combined. Not all elevation classes were comparably as often visited! Minimum is ca. sea-level, maximum is 1600 m a.s.l.

Discussion. The distribution records of this species (as well as of *A. caesar*, see above) are obscured by man-made extralimital introductions or plain labelling mistakes. *A. lorquinii* is reported from Mindanao, Bohol, Samar, and Dumaran[15] (PEIGLER 1989, CSNB, CUBH, CCGT); these are is-

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[15] The three saturniid specimens listed here, supposedly mislabelled, are the only records of Saturniidae bearing a "Dumaran" label. We do not know of any reliable, serious expedition collecting saturniids on Dumaran thus far. – This singleton of *A. lorquinii* in CCGT is remarkable for a narrow, very widely produced apex and a few peculiarities in genitalia. It is probably just an extreme variant, but it may be speculated whether this specimen, though in external habits and genitalia clearly a *lorquinii*,

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lands (belonging to the Mindanao, East Visayan and Palawan regions of Vane-Wright 1990, respectively) which we believe do not form a part of the natural range of the species. There are only a few records from these islands, although Samar, Bohol and especially Mindanao were often visited by collecting expeditions during the last two decades. However, not a single specimen of *A. lorquinii* was collected on any of these islands during these recent serious expeditions by reliable scientists (neither in primary biotopes nor in cities). Moreover, the Dumaran specimen (GP 1179/97) was received together with a ♂ of *Antheraea semperi* (and, in addition, with a ♀ of *Antheraea platessa*, see under that species) with nearly identical data, which, to our knowledge, as well does not belong to the fauna of the Palawan region; these two, possibly three specimens appear to originate from the West Visayan or Mindoro but, however, evidently not from the Luzon region. Therefore, we believe that the reliable distribution data of *A. lorquinii* include only the Luzon, Mindoro and West Visayan faunal regions of Vane-Wright (1990).

According to larval morphology, *A. lorquinii* and *A. caesar* may not be sister-species (see above). The similarities of the two larvae are most likely plesiomorphies.

Attacus lemairei Peigler, 1985

Attacus lemairei Peigler, 1985 (Nachr. entomol. Ver. Apollo, Frankfurt am Main, N.F. 6: 53). HT in coll. C. Lemaire in MNHN, Paris, not examined; the HT was not illustrated by Peigler (1983, 1985, 1989). l.t.: Palawan, Roxas.

Attacus Atlas: Pagenstecher (1890: 14).

Attacus atlas: Semper (1896: 384).

D: Balabac, Palawan (CCGT, CWAN, Peigler 1989). DM 1.

ED: None.

Material studied: **Balabac:** 1 ♂, Busay, 250 m, 12. vi. 1997, 0:30 h, leg. C.G.T., CCGT. **Palawan** (in total 26 ♂♂, 10 ♀♀): 1 ♂, N Palawan, Roxas, 6. x. 1981. 1 ♂, 2 ♀♀, C Palawan, Irawan, 15. iii. 1986. 1 ♂, C Palawan, Binduyan, 5. i. 1983. 1 ♂, S Palawan, Rio Tuba, Batabasa, 21. v. 1982. 1 ♂, 1 ♀, S Palawan, Mt. Bayog, 3000 ft., 4. iv. 1982. 1 ♂, 3 ♀♀, S Palawan, Brooke's Point, Lanao, 24. viii. 1980 (♀), 28. ii. 1981 (♀), 10. iv. 1981 (♂♀). All these in CCGT. 6 ♂♂, 1 ♀, N Palawan, Languhan, 200 m, 5. vii. 1988 (3 ♂♂), 7. vii. 1988 (♀), 8. vii. 1988 (3 ♂♂). 3 ♂♂, N Palawan, 20 km NNE Roxas, S. Vicente, 400 m, 12.–17. i. 1988. 2 ♂♂, dto., 200 m, 13.–16. xii. 1991. 2 ♂♂, 1 ♀, "Pala-

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might possibly be the product of a hybridization (perhaps in F_2 or even a later backcross?) of *lorquinii* with *lemairei* or, less likely, *atlas*. – Dumaran is so close to NE-Palawan that there surely was some faunistic exchange between the two islands during the lower sea level periods of the ice-ages. It is highly unlikely that saturniid species from the Panay or Mindoro areas are occurring there, while lacking elsewhere in the Palawan region.

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wan", 12. III. 1984, 12. I. 1991 (♂♀). All these in CWAN. 3 ♂♂, 1 ♀, Roxas, Caramay, 21. XI. 1993, 11. XII. 1993 (♀), 12. XII. 1993, 19. XII. 1993. 1 ♀, N Palawan, Ulanguan, 6. V. 1996. 2 ♂♂, "Palawan", 18. III. 1984, 28. I. 1993. All these in CRLN. 1 ♂, C Palawan, Mt. Salakot, 700 m, 2. VIII. 1984. 1 ♂, Salakot pass, 350 m, 28.–30. VI. 1997 4 ♂♂, Irawan, 50 m, VIII. 1997. 2 ♀♀, Ulanguan, 0 m, 24. x. 1997 (e. l. from mature larva). All these in CSNB. 1 ♂, "Prawan" [= probably Irawan], IV. 1997, in CUBH.

Figured: Imagines in Col. pl. 3: 11–14. Genitalia in B&W pl. 2: 5 (♂). (PT ♂ and ♀ see in PEIGLER 1983, 1989.)

Attacus lemairei is obviously a monotypic cladospecies, restricted to a small area. The most conspicuous external imaginal autapomorphy is the black portion of the red dash in the forewing apex. Notwithstanding, this character is rarely also found in specimens of *A. atlas* (sometimes in specimens from Paramalaya [in CWAN] and very rarely in Sumatran specimens, e.g., in a ♂ from Aek Nauli in N. Sumatra, Indonesia, collected there on 3. I. 1997 by E. W. DIEHL, or in Bornean specimens: PEIGLER 1983, 1989). This, in combination with other external similarities and similarities in the shape of the valves of the ♂ genitalia (see below), may possibly suggest some close relationship with Sundanian *A. atlas*, which would not be any surprise in terms of zoogeography.

Description and diagnosis. (See Col. pl. 3, Figs. 11–14.) Lfw. see Tab. 5. As previously mentioned under *A. caesar* and *A. lorquinii*, *A. lemairei* can be readily separated from these two species by its yellow ground colour for the fw. subapical area. From *A. atlas* the visual separation is more of a challenge. Normally, for both sexes of *A. lemairei* the fw. red subapical line has its outer third black. However, a reasonable number of ♀♀ occur which have only a shortened red line, totally lacking the black distal third. For some ♂♂, the black distal third is only lightly marked. With respect to the fenestrae, normally there are two for the fw. of both sexes. The auxillary fenestra varies from a small vague elongated black patch (sometimes on one wing only) to, especially for the ♀♀, a fully developed, 20 mm long fenestra. Additionally there are also ♂♂ and ♀♀ totally lacking in any auxillary fenestra on the fw. ♂ genitalia see on B&W pl. 2, Fig. 5; the valves are very stout and short, compared with other species.

Table 5: Forewing length of *Attacus lemairei*. Material in colls. CCGT, CRLN, CWAN, SMFL from Palawan and Balabac.

Attacus lemairei Palawan, Balabac	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
♂♂	103.7	10.54	25	76	117
♀♀	98.1	13.30	10	75	115

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Insular and individual variability. This species is known so far only from Balabac and Palawan. All the material at our disposal is rather uniform in overall appearance and ground colour. Individual variation concerning the fw. subapical line and the auxillary fenestrae have so far only been found on Palawan, which surely is also a matter of the small number of specimens known from Balabac.

Phenology. As often, the data (Table 6) will most likely reflect more intensively the dates of expeditions spent on Palawan than real activity rhythms. Most specimens were found in January and July, with nearly as many in March, April and December, but there is an obvious gap in February as well as an extended low count period from September to November. Two or three generations, depending perhaps on triggering effects of temperature and/or humidity, might be expected, but they do not show up. An acyclic development does not appear to be likely, as there are often well expressed drier seasons on parts or all of Palawan.

Table 6: Number of specimens of *Attacus lemairei* collected per month (n = 42), data from Balabac and Palawan combined.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of specimens	7	1	5	5	2	2	7	6	0	1	1	5

Altitudinal distribution. The elevation data of *A. lemairei* range from ca. sea level (A. Zwick, pers. comm.) to ca. 1000 m elevation. There is not enough information available for a conclusive interpretation; especially as the true high elevations on Palawan are rather inaccessible such that collecting expeditions only rarely reach these areas.

Preimaginal stages: Still unknown. It is possible that Philippine traders have already reared the species (a rearing of *A. lemairei* will surely not offer more problems than any other *Attacus* species), but no description has been so far published. Once (1988) some ova of *A. lemairei* from N Palawan were sent from a joint expedition by J. Settele and C.G.T. to W.A.N., but the larvae did not hatch due to damage and bad conditions during mailing. The eggs were similar to those of *A. atlas*, with pinkish-orange adhesive secretion, slightly larger than those of *A. atlas*.

Discussion. In our opinion, *A. lemairei* does not very closely resemble *A. caesar* (compare Peigler 1989: 121). The shape of the valves, especially of the "median lobe" sensu Peigler (see illustrations), resembles much more

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closely that of *A. atlas* (although the valves are distinctly shorter than in *atlas*), as does the general external appearance of the moths. However, a more conclusive statement about the phylogenetic relationships between *lemairei* and both *atlas* and *caesar* (and *lorquinii* etc.) can probably only be achieved when the preimaginal instars of *A. lemairei* become known. At least it can be expected then that the question whether or not *A. lemairei* is the closest relative of *A. caesar* will probably be solved. Considering the fact that autochthonous sympatry of *A. caesar* and *A. lemairei* in Palawan and Balabac does not appear to be likely (see discussion under *A. caesar*), the scene is wide open to look for more conclusive hypotheses about the relationships within the genus.

Genus *Samia* Hübner, [1819]

Samia Hübner, [1819] 1816 (Verzeichniss bekannter Schmettlinge [sic]: 156). TS: *Phalaena cynthia* Drury, 1773, by subsequent designation by Grote (1865, Proc. entomol. Soc. Philad. **5**: 228).

= *Philosamia* Grote, 1874 (Proc. Amer. phil. Soc. **14**: 258; TS *Phalaena cynthia* Drury, 1773, by original designation); junior objective synonym of *Samia* Hübner.

= *Desgodinsia* Oberthür, 1914 (Étud. Lépid. comp. **9** (2): 56; TS *Desgodinsia watsoni* Oberthür, 1914, by monotypy); junior homonym of *Desgodinsia* Senna, 1894 (Coleoptera) and junior subjective synonym of *Samia* Hübner (see Fletcher & Nye 1982).

A revision of the genus is in preparation (R. S. Peigler, S. Naumann). Therefore we deal here only with the internal Philippine aspects of the taxa involved. The new species from Palawan is described in a separate paper by Naumann (1998 a, in this issue). Many taxonomic problems of the genus *Samia* still await a solution, see Peigler (1992). The ontogeny of the wing venation of a *Samia* species was analyzed by Pruscha (1985). *Samia* species are often used in commercial sericulture ("eri silk"; see, e.g., Peigler 1992, 1993), and there are fully domesticated stocks which most likely are the result of hybridization (Peigler & Wang 1996). Therefore, specimens must be carefully examined to determine whether they may be of hybrid or domesticated (sericulture) origin. Fortunately, this problem does not appear to be a relevant factor on the Philippines.

Samia luzonica (Watson, 1914)

Philosamia cynthia luzonica Watson, 1914 (Ann. Rep. Trans. Manchester ent. Soc. (1913) **11**: 50), 2 ST in BMNH (S. Naumann, pers. comm.), not examined. l.t.: Luzon, Albay.

= *Philosamia cynthia mindanaënsis* [sic] Rebel, 1924 (lecture of H. Rebel, in: Bericht der Sektion für Lepidopterologie, meeting of 4th May, 1923 [published June 1924], Verh. zool.-bot. Ges. Wien **73** (1923): (109). l.t.: "Mindanao", ST in NHMW, examined).

= *Philosamia cynthia insularis manillensis* Bouvier (1927: 933, infrasubspecific).

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Attacus ricini: Semper (1896: 384, pl. C: figs. 6, 7; *partim*). Semper listed “over 100 specimens from Luzon, Mindoro, Cebu and Palawan” without giving further details; those from Palawan belong to the next species. Today, there is only a small remnant of this formerly numerous material still located in SMFL.

Samia luzonica: Naumann (1998 a, in this issue).

D: Reported from most major and some smaller islands of the Philippines (except the Palawan region): Camiguin de Luzon, Luzon, Mindoro, Marinduque, Borocay (NE of Panay), Panay, Negros, Samar, Leyte, Mindanao, Jolo. DM 4.

ED: None.

Material studied: **Batanes group, Camiguin de Luzon:** 1 ♀, “Batanes”[16], vii. 1984, CCGT. **Luzon** (in total 57 ♂♂, 27 ♀♀): 2 ♀♀, C-Luzon, Manila, sea level, 10. x. 1953 (2×). 1 ♂, 1 ♀, S-Luzon, Mt. Isarog, iii. 1983 (2×). 11 ♂♂, 14 ♀♀, N-Luzon, Ifugao, Banaue, ca. 1000–1200 m (3600 ft.), Settele, Achilles, Treadaway et al., 13. iii. 1988, 11. iv. 1988 (2×), 16./17. v. 1988 (3×), 28. ix. 1988 (2×), 29. xi. 1988, 10.–20. v. 1990 (13×), 2. vi. 1990 (2×), 3. viii. 1990. All these in CCGT. 12 ♂♂, S-Luzon, Quezon Forest Natl. Park, 250 m, 8.–10. x. 1988. 1 ♂, Nueva Vizcaya, Santa Fé, Dalton Pass, 21. ix.–17. x. 1988. 2 ♂♂, Benguet, 15 km S. Baguio, 1600 m, 12. x. 1988. 3 ♀♀, Ifugao, 14 km SE Lagawe, Bolog, 500 m, 7. ii. 1988. 1 ♂, 1 ♀ N-Luzon, Ifugao, Kiangan, 750–800 m, 21. vi. 1985, 13. xi. 1985. 29 ♂♂, 5 ♀♀, Ifugao, Banaue, 1000–1200 m, 8./11./12. ii. 1988 (5×), 16./17. v. 1988 (5×), 3.–7. vi. 1988 (8×), 7.–9. viii. 1988 (5×), 10. viii. 1988 (5×), 12. viii. 1988 (3×), 17. viii. 1988, x. 1988, 9. xi. 1988. All these in CWAN. 1 ♀, vic. Legazpi, Camalig, ix. 1978, Cabides & Lobin, SMFL. **Mindoro:** 1 ♂, Mt. Sinai, 20. iii. 1996, CCGT. **Marinduque** (in total 4 ♂♂, 6 ♀♀): 1 ♂, 1 ♀, near Boac, v. 1982 (2×). 1 ♀, Binunga, 15. ix. 1995. All these in CCGT. 1 ♂, 1 ♀, “Marinduque”, 2. v. 1992, CUBH. 2 ♂♂, 3 ♀♀, “Marinduque”, xi. 1979 (3×), 5. ii. 1992, iv. 1994, CRLN. **Borocay** (NE of Panay; in total 9 ♂♂, 7 ♀♀): 5 ♂♂, 3 ♀♀, 31. xi. 1991 (2 ♀♀), 31. x. 1997 (2 ♂♂), 1. xi. 1997 (2 ♂♂), 3. xi. 1997 (♂♀), CUBH. 2 ♂♂, 2 ♀♀, Borocay, ex larva, 31. x.–2. xi. 1991, CMBH. 2 ♂♂, 2 ♀♀, Borocay, ex larva, 28. x.–3. xi. 1991, CRLN. **Panay** (in total 2 ♂♂, 12 ♀): 1 ♂, NW-Panay, Mt. Madja-as, 28. v. 1993, CCGT. 1 ♂, Panay occ., Sibalom, Bontol, 50 m, Černý, 11. xii. 1991, CWAN. 12 ♀♀, Aklan, Laserna, 300 m, 15. vii.–15. viii. 1990 (11×), 1. xi. 1991, CWAN. **Negros** (in total 9 ♂♂, 11 ♀♀): 1 ♀, Negros Or., Amlan Hydro, Schoenig, 17. iv. 1981. 1 ♀, Negros Or., Lake Balinsasayao, 830 m, Settele, 25. vii. 1985. 2 ♂♂, 1 ♀, Mambucal, 25. i. 1990, 10. vi. 1992 (2×). 1 ♀, S-Negros, Liptong, viii. 1987. 5 ♂♂, 8 ♀♀, Negros Occ., Mt Kanlaon, 19. ix. 1985, xi. 1991, 10. iv. 1995 (2×), 21. viii. 1995, 20. ix. 1995, 3.–13. xii. 1995 (4×), 8. vi. 1996, 13. i. 1997 (2×). All these in CCGT. **Samar** (in total 9 ♂♂, 3 ♀♀): 3 ♂♂, 3 ♀♀, N-Samar, near Bondo, xii. 1993 (5×), 9. iv. 1994. 1 ♂, C-Samar, near Hinabangan, Arizona, 27. iii. 1996. 1 ♂, Catarman, 16. x. 1994. 3 ♂♂, C-Samar, Bagacay, 250 m (800 ft.), 1.–10. viii. 1979. All these in CCGT. 1 ♂, C-Samar, Bagacay, 250 m, 7. viii. 1979, Treadaway, CWAN. **Leyte** (in total 10 ♂♂, 14 ♀♀): 3 ♂♂, C-Leyte, Mahaplag, Hilusig, Mt. Balocaue, 600 m, 4. v. 1986, 2. xii. 1986, 21. viii. 1987. 1 ♀, S-Leyte, St. Bernard, Catmon, 250 m, 10. iii. 1977. All these in CCGT. 6 ♂♂, 1 ♀, Baybay, Visca, 50 m, 21.–25. iii. (4×), 15. vi. 1994 (3×). Leyte, 20 km E Ormoc, Alto Peak, 700 m, 4.–6. vii. 1994. All these in CPSS. 1 ♂, 12 ♀♀, S-Leyte, San Juan, reared, Mercado via Brockmann, xii. 1983–i. 1984, CWAN. **Mindanao** (in total 27 ♂♂, 8 ♀♀): 3 ♂♂, 1 ♀, Bukidnon, Mt. Kitanglad, 1250 m (4100 ft.), 25. vii. 1990 (2×), 3. i. 1996 (2×). 1 ♂, Mt. Apo, 26. ii. 1994. 13 ♂♂, 2 ♀♀, S-Cotabato, Mt. Matutum, 10.–21. i. 1996 (5×), 3. ii. 1996, 15./16. ii. 1996 (2×), 16. x. 1996, 22. xii. 1996 (2×), 15./18. iii. 1997 (2×), 23. iii. 1997, 28. iii. 1997. 7 ♂♂, 2 ♀♀, S-Cotabato, Mt. Busa,

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All Batanes material in CCGT (at least of these years) originates from Camiguin de Luzon.

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16. x. 1996, 26. xi. 1996, 12.–18. vi. 1997 (7×). 1 ♂, Mt. Busa, 1600 m, 27. xi. 1996. 1 ♂, S-Cotabato, near Koronadal, Barrio 8, 30. xii. 1989; and 1 ♀, S-Cotabato, Koronadal, 20. xii. 1989; these two leg. de los Reyes. 1 ♂, Zamboanga del Norte, Mutya, 6. ii. 1988. 1 ♀, W-Mindanao, Zamboanga del Norte, Tamuangan, 11. viii. 1994. All these in CCGT. 1 ♀, West flank of Mt. Apo, 1200 m, 28.–30. vii. 1993, CWAN. **Sulu Archipelago, Jolo** (in total 17 ♂♂, 22 ♀♀): 1 ♂, 7 ♀♀, "Jolo", 6.–11. xii. 1995 (5×), 14.–16. ii. 1996 (3×). 16 ♂♂, 9 ♀♀, Patikul, 5.–15. xii. 1995 (10×), 10.–16. ii. 1996 (15×). 3 ♀♀, Jolo City, 10.–12. xii. 1995. 3 ♀♀, Maimbung, 26. xi. 1994 (2×), 1. vi. 1995. All these in CCGT. – And many further specimens in CSNB and other collections.

Figured: Imagines in Col. pls. 3: 17; 5: 26, 27, 33. Preimaginal instars in Col. pl. 16: 115–122. Genitalia in B&W pl. 3: 6–8 (♂).

Table 7: Forewing length of *Samia luzonica*. Material in colls. SMFL, CCGT, CWAN. Specimens with doubtful locality data excluded. "All islands together" includes some specimens and islands not listed under the single-island counts above.

Samia luzonica Island	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Luzon	♂♂ ♀♀	62.6 68.5	4.97 4.69	56 24	46 58	72 79
Panay	♂♂ ♀♀	62 71.8	– 2.67	1 13	– 68	– 75
Negros	♂♂ ♀♀	64.7 71.2	5.62 4.33	7 11	53 64	71 76
Samar	♂♂ ♀♀	62.4 68.7	3.24 3.06	9 3	56 66	67 72
Leyte	♂♂ ♀♀	64.0 70.3	2.86 7.37	12 15	61 53	69 78
Mindanao	♂♂ ♀♀	65.6 70.3	3.24 5.28	24 8	60 64	73 76
Jolo	♂♂ ♀♀	61.3 69.5	2.05 4.07	17 22	57 62	66 75
All islands together	♂♂ ♀♀	63.0 69.8	4.29 4.78	138 99	46 53	73 79

Description and diagnosis. (See Col. pl. 3, Fig. 17; Col. pl. 5, Figs. 26, 27, 33.) Lfw. see Table 7. The specimens are fairly uniform (see paragraph on variability), and there is only little sexual dimorphism, mainly in size and wingshape. We compare here *S. luzonica* with *S. (insularis)*[17] *tetrica* (Rebel, 1924) from Borneo and *S. treadawayi* from Palawan: The ground colour is

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[17] The question whether those *Samia* taxa of the *insularis*-group from Sundaland to the Philippines and Sulawesi or even further are a conglomerate of subspecies (see Nässig et al. 1996 for Sundaland), semispecies (the concept tentatively applied here for the Sundaland populations of *S. insularis*, in contrast to Naumann's 1998 [in this issue] interpretation as full species) or distinct species (and which of the taxa have what taxonomic rank) can probably only be decided barely from external morphology alone; best would perhaps be a molecular study, like, e.g., a DNA analysis.

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brightest in *luzonica*, of a olive to orangy brownish colour, compared with dark chocolate-brownish ground colour in *tetrica* and intermediate colour in *treadawayi*. *S. (insularis) tetrica* is the smallest of the three, with the most acute apex (always in ♂♂); *S. treadawayi* is intermediate in the size and in the shape of the apex.

♂ genitalia see on B&W pl. 3, Figs. 6–8. Again in comparison to *S. treadawayi* and *S. (insularis) tetrica*, *S. luzonica* has the longest aedeagus (shorter in *tetrica* and even more so in *treadawayi*). The saccus is broadest in *luzonica* (less so in *tetrica*, least so in *treadawayi*). The vesica is smallest in *luzonica*, without sclerites or cornuti; in *tetrica* it is larger, but also without sclerites; in *treadawayi* it usually has a small sclerite or cornutus.

Table 8: Phenology data (collecting dates) of *Samia luzonica* from different islands or regions and for the entire material available (n = 243). Geographical or climatical effects not separated, specimens labelled as reared excluded.

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Luzon	0	8	2	1	24	13	1	15	4	15	3	0
Marinduque	0	0	0	1	4	0	0	0	1	0	0	0
Negros	4	0	1	3	0	3	1	2	2	0	1	4
Panay	0	0	0	0	1	0	6	5	0	2	3	1
Samar	1	0	1	1	0	0	0	3	0	1	0	5
Leyte	6	0	5	0	1	3	3	1	0	0	0	9
Mindanao	7	6	6	0	1	8	5	1	0	2	2	4
Jolo	0	12	0	0	0	1	0	0	0	0	2	15
All islands	18	26	15	6	31	28	16	27	7	20	11	38

Insular and individual variability. Our rather extensive series of specimens do not illustrate any obvious insular difference which would justify the use of subspecies names in *S. luzonica* (neither do the genitalia). Further, the slight variations that occur can be found across the range of the species. The overall ground colour for both sexes is usually a dark brown with olive or sometimes dark orangy tint. However, numerous specimens possess a much lighter orangy brown ground colour. It is an open point as to whether this ground colour difference could be related to the freshness of the individual when caught or to exposure to light thereafter. Two elder, damaged specimens we have stand out as having a very light fawnish brown appearance. Other minimal variations consist of a slight variation in the extent of the pink postdiscal border to the discal white line on both fw. and hw. A few ♀♀, in the fw. apical area, have a rather more ob-

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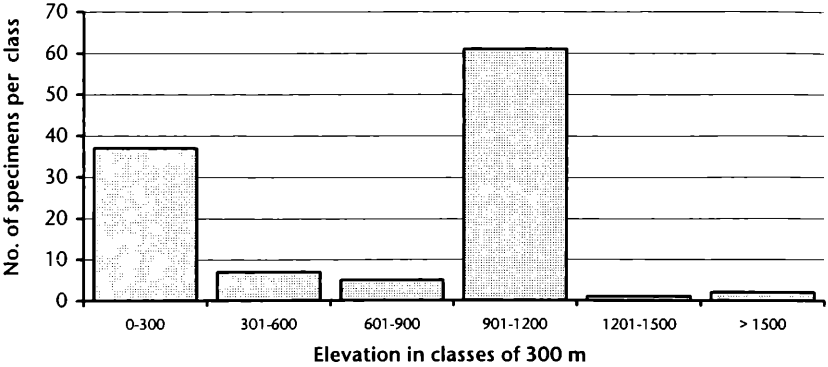
vious orangy submarginal patch. Further for both sexes the fw. "quarter moon" window normally just touches the discal white line, but for a few specimens it can either penetrate through this white line or not quite reach it.

Phenology. See Table 8. *Samia luzonica* can be found in all months of the year, with peaks in the time October–March and May–August.

Altitudinal distribution. See Text-Fig. 2. The peak at 900–1200 m mainly reflects the long-term stays of J. Settele and others in the Banaue area of North Luzon.



Text-Fig. 2: Altitudinal distribution of *Samia luzonica* on the Philippines, data from 113 specimens, all islands combined. Not all elevation classes were comparably as often visited! The peak at 900–1200 m comes from the many specimens collected during long-term visits in the Banaue area, especially by Settele et al. Minimum is ca. sea-level, maximum is ca. 1600 m a.s.l.

Preimaginal stages: In July 1988, some ova of *Samia luzonica* (from N-Luzon) were sent by J. Settele to one of the authors (W.A.N.). A rearing was attempted and resulted in a few caterpillars which eventually appeared to be in the ultimate instar, but then became sick and died; no cocoon or imago was achieved. The first instar was not photographed due to travelling. The early instars (L_2-L_4, see Figs. 115–120 on Col. pl. 16) are basically similar to those of the related *S. vandenberghi* from Sulawesi (see Naumann 1995: pl. I; L. H. Paukstadt et al. 1996), but the blackish pattern on the waxy white ground is distinctly different; it resembles (in L_4 only) more closely that of *S.* *(insularis)*[18] *tetrica* from West Malaysia as

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[18] See previous footnote.

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illustrated by Nässig et al. (1996), while the L_4 larva of *S. (insularis) vaneeckei* from Sumatra looks somewhat different.

The mature caterpillar (Col. pl. 16, Figs. 121/122) of *S. luzonica* is somewhat outstanding within the known larvae of *Samia* of the *insularis*-group. Such a reddish-orange colour of the scoli (already noticed by Semper 1896: larval col. pl. C, fig. 6) was not known from any other larva of the genus, until Prashant Mohanraj et al. (1998) published the larval morphology of *Samia fulva* Jordan, 1911 (from the Andaman Islands). There is no similarity with the caterpillar illustrated under the name "*Samia ricini* (Donovan, 1798)[19] (Philippines)" by Peigler & Wang (1996: 97); this domesticated form was probably imported from elsewhere and obviously does not belong to the *insularis*-group. The mature larvae of *S. luzonica* are clearly different from those of *S. (insularis) vaneeckei* (Sumatra) and *S. (insularis) tetrica* (West Malaysia; see illustrations in Nässig et al. 1996), which both differ in the contrast between ground colour and scoli and in the black pattern, as well as from those of *S. vandenberghi* (Sulawesi, see Naumann 1995), which appear to have much less waxy coating on the turquoise ground colour and yellowish scoli, and also a few differences in the black pattern. The caterpillars of another member of the *insularis*-group, *S. yayukae* U. Paukstadt et al., 1993, from Timor and Flores (illustrated by U. & L. H. Paukstadt 1993 c and Peigler & Wang 1996), again are clearly different.

Discussion. See also under *S. treadawayi*. It would be interesting to check the small "bridging" archipelagos (compare, e.g., Holloway [1998]) to Borneo (the Sulu Archipelago SW of Jolo), Taiwan (northern Batan Islands) and possibly to Sulawesi or Halmahera (via Kepulauan Sangihe and/or Kep. Talaud) for the presence of *Samia* taxa and clear their identity.

Samia treadawayi Naumann, 1998

Samia treadawayi Naumann (1998 a: 451, in this issue). HT in CCGT, assigned to SMFL (examined) (see Col. pl. 3, Fig. 16); l.t.: S-Palawan, nr. Brooke's Point, Mt. Bayog.

Material studied (all specimens known are paratypes [though not all paratypes were seen by us]): HT & PTs in CCGT, CSNB, CPSA, CRBP, CWAN, SMFL and other collections; see PT list in Naumann (1998 a, in this issue).

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[19] As written by Peigler & Wang (1996: 100), *ricini* is not a true species, although their form of listing would indicate specific status. Usually such anthropogenic taxa are treated as forms or, rarely, subspecies of the wild species from which they were artificially selected. A chemotaxonomic or DNA-analytic study should perhaps clear the status of *ricini* (species, subspecies or domesticated form of which natural species or hybrid of which species? Is it a single entity at all or perhaps just a conglomerate of different artificial populations or hybrids?).

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Attacus Ricini: PAGENSTECHER (1890: 14).

Attacus ricini: SEMPER (1896: 384; *partim*, see also previous species)

D: Known only from Palawan. DM 4.

ED: None known.

Figured: Imagines in Col. pls. 3: 16; 13: 85, 86. Genitalia in B&W pl. 3: 9 (♂).

Description and diagnosis. (See Col. pl. 3, Fig. 16.) Lfw. ♂♂: 59.1 mm ± 2.09 (standard deviation), n = 16; ♀♀: 62.0 mm ± 10.22, n = 5 (further details see NAUMANN 1998 a). ♂ genitalia see on B&W pl. 3, Fig. 9 (for comparison with *tetrica:* B&W pl. 2, Fig. 10). The diagnosis see under *S. luzonica.*

Individual variability. The relatively small number of specimens does not exhibit any significant variability. Most specimens are fairly uniform, only some variation of a generally lighter or darker appearance is visible.

Phenology. See Table 9. There are two peaks in March and July, and gaps in between. This may possibly indicate two generations.

Table 9: Number of specimens of *Samia treadawayi* collected per month (n = 38), all Palawan specimens combined where data available.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of specimens	6	1	16	1	0	1	10	2	0	0	1	0

Altitudinal distribution. Elevation data is provided from only 26 specimens. The lowest reported elevation is ca. 50 m a.s.l., the maximum record is ca. 700 m. 10 specimens come from below 300 m, 15 specimens from between 301 and 600 m, and 1 specimen from above 600 m. As there is not much data available from the rather inaccessible Palawan mountains anyway, there may well later come further specimens from higher areas.

Preimaginal stages: Unknown.

Discussion. The taxa of the *insularis*-group range from Sundaland (on Borneo: *S. (insularis) tetrica* (REBEL, 1924), see NAUMANN 1998 a) across Palawan (*S. treadawayi*) and the other islands of the Philippines (*S. luzonica*) to Sulawesi[20] (*S. vandenberghi* (WATSON, 1915)) and furtheron to the Moluccas

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[20] On Sulawesi, *Samia* exhibits a unique constellation within insular SE Asian Attacini genera: The presence of a second species, *S. peigleri* NAUMANN & NÄSSIG, 1995 (both taxa endemic to Sulawesi and, for *vandenberghi*, some surrounding islands: NAUMANN 1995), which is evidently more distantly related (see the discussion by NAUMANN & NÄSSIG 1995 and NAUMANN 1995), but supposedly also a member of the *insularis*-group. Except some islands on the continental shelf (like, e.g., Taiwan), islands usually

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and, probably along different dispersal routes, to the Lesser Sunda Islands (both areas not studied by us). All these taxa are closely related and can be separated on the morphospecies level by minor details of pattern, genital morphology and (as far as known) larval morphology; a reasonable proof for species distinctness on the biospecies level is still lacking, although it appears quite likely. This resembles the distribution pattern of the *maenas*-group of *Actias* (see Nässig 1994 c and below). The situation in the other Attacini genus *Attacus* is somewhat different: The affinities of the Palawan species (*A. lemairei*) towards the other taxa still remains to be analyzed; there is evidently no series of closely related species along this chain Sundaland–Palawan–Philippines proper–Sulawesi (see also Holloway [1998]) and further into central and eastern Indonesia; the taxa on the Philippine corelands are much diversified and most likely not closely related (see above: *lorquinii* and *caesar* are most likely not sister-species). Thus it may be expected that *S. treadawayi* has a zoogeographical and evolutionary history different from *A. lemairei*, but possibly similar to *Actias philippinica bulbosa* (see below). Evidently, the evolutionary and dispersal history of the relatively few saturniid species on the Philippines is highly diverse. It appears that the genus *Samia*, with its centre of diversity on the Asian continent, dispersed from there to the Indo-Australian islands, while the species of *Attacus*, most diverse on the Philippines and in eastern Indonesia and with an old sister-group (*Coscinocera*, see Peigler 1989, Friedlander et al. 1998) in the Australian region and with the most plesiomorphic members in the northern Philippines and in eastern Indonesia and Australia, possibly took the opposite way. According to Friedlander et al. (1998), *Samia* is probably not closely related to the genus-group of *Attacus*, *Coscinocera* and *Archaeoattacus*, but may be more closely related to African (*Epiphora*) and North American (*Callosamia/Hyalophora*) species.

Tribe Saturniini Boisduval, [1837]

= Actiadini[21] Testout, 1941, syn.
= Graellsiini Vives Moreno, 1994, syn.[22]

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possess only one species of each Attacini genus. On the Banggai Archipelago close to Sulawesi there is another species, possibly closely related to *peigleri*: *Samia naumanni*, see U. Paukstadt et al. (1998).

[21] Described as "Actiini", emendation; Testout (1941: 151). The vernacular French name "Actiens" as used by several French authors before Testout (e.g., Sonthonnax 1899: 9) cannot be accepted as a valid source for the tribal name (in contrast to Kuznetzov's & Stekolnikov's 1985: 39 interpretation), because it apparently does not fulfill the requirements of Article 11 (f) (iii) of ICZN (1985).

[22] See Leraut (1997: 175). – Obviously Vives Moreno (1994) was not aware of the vast literature concerning the systematics of the green, tailed "lunar moths" in Africa, America and Asia. It was definitively superfluous to erect a new tribal name here. If it later becomes necessary on basis of a phylo-

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This tribe, as understood presently (see, e.g., Oberprieler & Nässig 1994, Nässig et al. 1996), is much less precisely defined than the Attacini, and most likely is a paraphyletic residue. For example, the genus *Rhodinia* currently placed within the Saturniini may be the sister-group of the tribe Attacini (but compare Friedlander et al. 1998). The relationships between the different tribes and genera of the Saturniinae still require a thorough phylogenetic analysis. Therefore, it appears not adviseable today to extract further supposedly monophyletic subunits (like, e.g., the "Actiadini"[23], see footnotes), because thereby the "remnants" within the Saturniini will most likely become even more of a paraphyletic conglomerate.

Genus *Actias* Leach, 1815

Actias Leach, 1815 (in: Leach & Nodder, Zool. Miscell. **2**: 25 [author according to Schüssler 1936: Macleay in Leach]). TS: *Phalaena luna* Linnaeus, 1758, by subsequent designation by Grote (1874, Proc. Amer. phil. Soc. **14**: 257).

Generic synonymy (see also Fletcher & Nye 1982, Leraut 1997), as understood presently (sorted by type species and date):
= *Tropaea* Hübner, [1819] (Verzeichnis bekannter Schmettlinge: 152, TS *Phalaena luna* Linnaeus, 1758, by subsequent designation by Grote, 1895, Can. Entomol. **27**: 268); junior objective synonym of *Actias*.
= *Meceura* Billberg, 1820 (Enumeratio Insectorum Mus. G. J. Billberg: 83, TS *Phalaena luna* Linnaeus, 1758, by monotypy); junior objective synonym of *Actias*.
= *Artemis* Kirby & Spence, 1828 (Introduction to Entomology (edn. 5) **3**: 248, TS *Phalaena luna* Linnaeus, 1758, by monotypy); junior objective synonym of *Actias*.

= *ǂEchidna* Hübner, [1807] (Sammlung exotischer Schmettlinge [sic] **1**: pl. [173]; TS *Echidna selene* Hübner, [1807], by monotypy); junior homonym of *Echidna* Forster, 1788 (Pisces) (see Fletcher & Nye 1982 for some more problems in the case), senior subjective synonym of *Actias*, but invalid due to homonymy.
= *Plectropteron* Hutton, 1846 (Ann. Mag. nat. Hist. **17**: 60, TS *Plectropteron dianae* Hutton, 1846, by monotypy; a junior subjective synonym of *selene*); possible replacement name for *Echidna* Hübner nec Forster and junior subjective synonym of *Actias*.

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genetic study to classify the genera *Actias* (*sensu lato*, including *Graellsia*) and *Argema* (*sensu lato*) in a separate tribe, the name Actiadini, which has decades of priority over Graellsiini, will be certainly sufficient. There would appear to be little, if any, justification to place the single species *isabellae* and the other species of *Actias* and *Argema* into two separate tribes. See also next footnote.

[23] See the discussion in Nässig et al. (1996: 29-31). Although it appears feasible that a tribe Actiadini as the sistergroup of a newly shaped, then monophyletic tribe *Saturniini or of the [*Saturniini + Attacini] (or something similar) may come out at the end of a phylogenetic analysis of the subfamily, this tribal resurrection can be done only on the basis of a broadly based, thorough research. Kuznetzov's & Stekolnikov's (1985) work, though very interesting and offering helpful new aspects, is based on too small a number of taxa being studied; many of the phylogenetically interesting species, especially of the African and Neotropical faunal regions, still lack examination of these characters. — However, Friedlander et al. (1998), who studied only two genes and 6 Saturniini species (besides 15 Attacini species), placed two *Actias* species (all they studied) very peripherical into the Saturniini. If this position proves correct with study of more data, a separate tribe Actiadini would appear to be plain nonsense under phylogenetical terms.

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- = *Graellsia* GROTE, 1896 (Mitt. Roemermus. Hildesheim **6**: 3; TS *Saturnia isabellae* GRAËLLS, 1849, by original designation), junior subjective synonym of *Actias*. – See also the discussion of this case by NÄSSIG (1991 b) and FERNÁNDEZ-VIDAL (1992)[24]
- = *Euandrea* WATSON, 1913 (Rep. Trans. Manchester entomol. Soc. **1912**: 42, TS *Tropaea dubernardi* OBERTHÜR, 1897, by original designation), junior subjective synonym of *Actias*.
- = *Sonthonnaxia* WATSON, 1913 (Rep. Trans. Manchester entomol. Soc. **1912**: 42, TS *Actias maenas* DOUBLEDAY, 1847, by original designation), junior subjective synonym of *Actias*.
- = *Proactias* ARORA & GUPTA, 1979 (Mem. zool. Survey India **16** (1): 8, 15; TS *Tropaea sinensis* WALKER, 1855, by original designation), junior subjective synonym of *Actias*.

The genus *Actias*, as understood here, comprises ca. 20 species in Asia (with special focus on China), southwestern Europe, and eastern North and Central America; its relationship to *Argema* WALLENGREN, 1858[25] from sub-Saharan Africa and Madagascar (are the African species the sister-group of all *Actias* or of the *maenas*-group only?) remains to be assessed (see NÄSSIG 1994 c, NÄSSIG et al. 1996), and the status of *Argema* as a separate genus is therefore retained here for the time being. Its present-day distribution in Eurasia including the eastern islands of SE Asia and eastern North America, with close relatives in Africa, dates its origin possibly back into a time when, on one side, the Neotropic realm (i.e., South America) was already isolated, but, on the other side, the northern Atlantic Ocean was not yet an impenetrable barrier, i.e. at least into early Tertiary.

Actias philippinica NÄSSIG & TREADAWAY, 1997

NÄSSIG & TREADAWAY (1997 a: 327); HT ♂ via CWAN in SMFL (SMFL-Nr. 4152), examined; l.t.: N. Luzon, Ifugao, Bolog.

D: endemic to the Philippines. DM 5.

ED: None.

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[24] The argumentation of FERNÁNDEZ-VIDAL (1992), YLLA I ULLASTRE & SARTO I MONTEYS (1993), and YLLA I ULLASTRE (1997) (and others) concerning the spelling of the specific epithet (as well as the whole recent Spanish tradition in this subject) is, as we think the Code (ICZN 1985: Article 32) has to be interpreted, not in accordance with the ruling of the Code (NÄSSIG 1991 b). The Code is, in our opinion, definitively clear about the problem (see NÄSSIG 1991 b), and thus the case does not at all require a decision of the Commission, as suggested by KARSHOLT (*in* KARSHOLT & RAZOWSKI 1996: 327, note 6791). Only our Spanish colleagues may possibly like to request for a decision of the Commission to ***deviate*** from the Code (that is, to legalize the secondary spelling variant with one "l" only – which, in our opinion, would be obsolete). Further, FERNÁNDEZ-VIDAL's biogeographic arguments dealing with the present-day distribution patterns of *Actias isabellae* cover only the Pleistocenic glaciation period, which is probably not the adequate time frame for this problem. The relationships and evolution of *Actias isabellae* can only be studied in connexion with other *Actias/Argema* species, for example *A. luna* or the Asiatic species, and not as an isolated, local problem of SW Europe. The *Actias*-group is surely an old group, and the ancestor of *isabellae* probably reached what is now Europe very early in the Tertiary, if not even earlier in the Mesozoic.

[25] Synonyms of *Argema*: *Angas* WALLENGREN, 1865; *Cometesia* BOUVIER, 1928 (FLETCHER & NYE 1982).

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Polytypic species, with two subspecies. It is possibly a paraspecies. The other species of the *maenas*-group (Sundaland and Asiatic continent: *A. maenas* DOUBLEDAY, 1847; Andaman Islands: *A. ignescens* MOORE, 1877; Sulawesi: *A. isis* (SONTHONNAX, [1897]); Sumba, Flores, Timor: *A. groenendaeli* ROEPKE, 1954; see NÄSSIG 1994 c) are closely related. Their phylogeny is not yet studied in detail, and they are treated as distinct species on the morphospecies level for the time being[26]

Table 10: Length of saccus (from cephal end to the first separation of the cuticle into two lateral parts; due to individual variability of the structure and maceration intensity with some uncertainty) and aedeagus (from cephal end of the muscle insertion = coecum penis to the very tip of the sclerotization, without the soft vesica) of different *Actias* species of the *maenas*-group. (From NÄSSIG & TREADAWAY 1997 a, supplemented.) The size of the genitalia appears ***not*** to be dependent on the overall size of the specimens within the *maenas* group, at least for most part of the natural lfw. variability range (see NÄSSIG & TREADAWAY 1997 a: 331); the variability range in size of the genitalia is distinctly smaller than the lfw. variability, in contrast to *A. selene brevijuxta*, see under that species.
* = Individual data with possible error due to preparation damage or pathological malformation.

Species, subspecies	Length of saccus [mm]		Length of aedeagus [mm]		GP-No.
	Individual data	Average	Individual data	Average	(in CWAN)
A. maenas maenas	5.2; 3.8* (n = 2)	4.5	11.0; 9.0*	10.0	673, 414
A. maenas diana	6.3; 5.0; 6.0; 5.5; 5.5; 5.5* (n = 6)	5.6	9.5*; 11.4; 11.6; 11.2; 11.9; 11.8	11.2	422, 138, 865, 866, 421, 423
A. maenas (Σ)	n = 8	5.4		10.9	
A. philippinica philippinica (all islands except Palawan region)	3.3; 3.5; 3.0; 3.2; 3.7; 4.1; 3.8 ; 3.7; 3.2 (n = 9)	3.5	9.2; 8.9; 8.9; 8.6; 9.3; 8.5; 8.8; 8.6; 7.1	8.7	682, 867, 869, 868, 870, 683, 415, 967, 968
A. philippinica bulbosa (Palawan)	3.3; 3.0; 3.3 (n = 3)	3.2	8.0; 8.1; 7.5	7.9	864, 966, 965
A. philippinica (Σ)	n = 12	3.4		8.5	
A. isis	1.7; 1.9 (n = 2)	1.8	5.2; 4.6	4.9	418, 419
A. groenendaeli	1.4; 1.2 (n = 2)	1.3	4.8; 4.3	4.6	664 [Timor], 672 [Flores]

The ♂ genitalia morphology of *A. philippinica* is somehow intermediate between *A. maenas* and the Indonesian *A. isis* and *A. groenendaeli*, with the construction in *A. philippinica* being more apomorphic than in the southeastern species and less apomorphic than in *A. maenas* (see B&W pl. 4, Figs. 11–15, for comparison of the species). However, the differences are not clinal, there are no intermediates known. The aedeagus and saccus length is, according to the material we have seen thus far, safely diagnostic for the different species involved (NÄSSIG & TREADAWAY 1997 a; see Table 10). The differences in sac-

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At least *A. groenendaeli* is certainly a separate biospecies, and the differences in genitalia morphology between the other taxa are so obvious and constant (and lacking intermediates) that it appears very likely to us that they are as well "real" biological species.

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cus and aedeagus length between *A. maenas* and *A. philippinica* are statistically highly significant (see NÄSSIG & TREADAWAY 1997 a: 331–333).

Actias philippinica philippinica NÄSSIG & TREADAWAY, 1997

Actias maenas DOUBLEDAY: SCHULTZE (1925: 567). To our information, SCHULTZE was the first author who reported *A. philippinica* (under the name of *A. maenas*) from Luzon (Benguet, Baguio, 1450 m); the deposition of his specimen(s) is unknown to us.

D: Known from the islands of Luzon, Marinduque, Mindoro, Masbate, Panay, Negros, Leyte, Bohol, Mindanao. DM 5.

ED: None.

Material studied: see the list in NÄSSIG & TREADAWAY (1997 a): 1 ♂ HT, 43 ♂♂, 16 ♀♀ PTs from **Luzon**. Further specimens listed in the description, no PTs: 1 ♂ from **Mindoro**; 1 ♀ from **Masbate**; 8 ♂♂, 3 ♀♀ from **Panay**; 33 ♂♂, 15 ♀♀ from **Negros**; 62 ♂♂, 5 ♀♀ from **Leyte**; 21 ♂♂, 5 ♀♀ from **Mindanao**. – Additional specimens seen only after the description was published: **Mindoro:** 2 ♂♂, "95 km near Mt. Halcon"[?], 3./12. XI. 1996, CUBH. **Panay:** 1 ♂, Aklan, nr. Nabas, Mt. Malindog, 15. V. 1997, CCGT. 2 ♂♂, Antique, Mt. Madja-as, 3. XII. 1996, CCGT. **Negros:** 2 ♂♂, 1 ♀, Negros Or., Bais, Mt. Tindang Batu, 29. X.–3. XI. 1997 (3 very dark specimens), CCGT. **Marinduque:** 1 ♂, E of Jasan, 2000 ft., 3. III. 1995 (similar to Luzon specimens), CCGT. **Bohol:** 1 ♂, Bilar, 3. IX. 1997 (similar to Mindanao specimens), CCGT. **Mindanao:** 12 ♂♂, 1 ♀, S. Cotabato, Mt. Busa, 26. XI. 1996 (1 ♂), 11.–18. VI. 1997, CCGT. 2 ♂♂, Bukidnon, Mt. Kitanglad, 7000 ft., 15. V. 1997, 16. III. 1997, CCGT. And some further specimens not listed here.

Figured: Imagines in Col. pl. 4: 18–21. Genitalia in B&W pl. 4: 13 (♂).

Description and diagnosis. (See Col. pl. 4, Figs. 18–21.) Lfw. see Table 11. Besides the genitalia differences (see above) there are only few, if any, external differences between the brighter (mostly northern) populations of *A. philippinica* and *A. maenas*. Some of the southern populations of *A. philippinica* are on average much darker than Sundanian or continental *A. maenas*, but never to the extreme extent seen in most specimens of *A. isis*, although dark specimens from Negros may come quite close to these. – A safe determination of externally intermediate specimens within the group is best done by dissection of the genitalia or by locality data; the species of the *maenas*-group are strictly allopatric. For the differences between the two subspecies of *A. philippinica*, see the insular variability analysis below and under ssp. *bulbosa*.

Insular and individual variability. ♀♀ show but slight variation, varying marginally only in ground colour from a greenish yellow to a slightly more orange yellow. ♀♀ from Negros, on average, appear very slightly darker than from Luzon.

The visual appearance of the ♂♂ within an island shows very little variation (mainly in the extension of the dark pattern). However, between certain is-

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lands there exists a noticeable difference. **Luzon** specimens are of an overall lighter appearance, the ground colour being a slightly greenish yellow with the red-brown markings appearing smaller in size than for other islands. On the fw. the basal dark area and the fw. submarginal area never meet along or near the inner margin. The postdiscal zig-zag brown line of the fw. and hw. is, for most specimens, rather lightly marked. For **Negros,** ♂ specimens have all the red-brown markings a more intense chocolate-brown and being nearly always more extensive such that the fw. submarginal and basal dark areas meet at or near the inner margin. The postdiscal zig-zag lines for the fw. and hw. are rather heavily marked. Further the ground colour for almost all Negros specimens is a richer yellow than for Luzon specimens. Though not quite as intensively marked and coloured, the **Mindanao** specimens are on average (with a few specimens as bright as the Luzon ones) closest to the Negros specimens in appearance. However, the fw. submarginal and basal dark brown areas very seldom meet. **Leyte, Panay** and **Mindoro** specimens are more heavily marked than Luzon but with the red-brown areas not quite as extensive as for Negros.

Table 11: Forewing length of *Actias philippinica*. Data from NÄSSIG & TREADAWAY (1997 a).

A. philippinica per Island	sex	lfw. [mm] (average)	± SD	n
Luzon	♂♂ ♀♀	74.8 84.0	4.60 2.52	35 13
Negros	♂♂ ♀♀	75.1 83.4	4.36 3.80	18 11
Leyte	♂♂ ♀♀	76.7 84.0	2.30 4.18	20 5
Mindanao	♂♂ ♀♀	75.1 83.4	5.33 8.08	7 3
Panay	♂♂ ♀♀	70.0 85.5	3.67 3.80	5 2
Palawan (ssp. *bulbosa*)	♂♂ ♀♀	67.5 81.0	3.38 1.14	8 2

The **Palawan** ♂♂ (= ssp. *bulbosa,* see below) are significantly smaller than from the other islands (see Text-Fig. 3 and Tab. 11), with the redbrown markings fairly similar to Luzon specimens, except that the fw. and hw. postdiscal zig-zag lines are more obvious than for Luzon though of a far lighter redbrown than Negros. However, the yellow ground colour has a tendency to be a little more intense than for Luzon specimens. The ♀♀ from Palawan are characterized by almost lacking some of the markings of ♀♀ of

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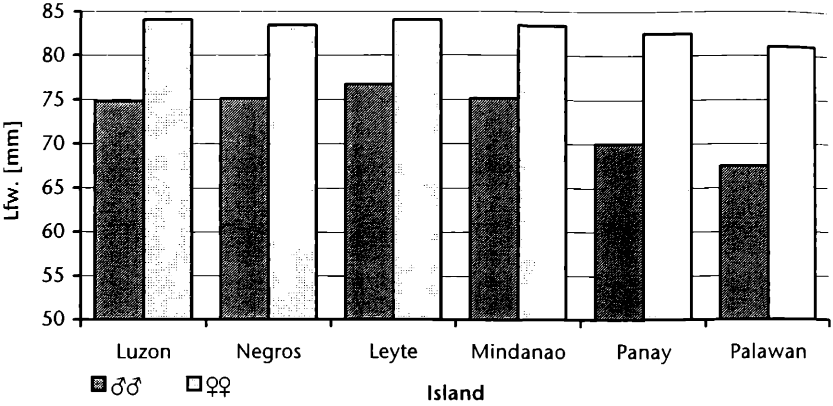
other islands, especially the postdiscal zig-zag lines and very nearly the basal lines (all wings are nearly uniformly yellow), but combined with more prominent eye-spots especially on the fw. The size, pattern and especially the genitalia differences (described under ssp. *bulbosa*) are the deciding factors in separating *bulbosa* from the nominate subspecies.



Text-Fig. 3: Length of forewing of the different insular populations of *Actias philippinica*, according to islands and sex, standard deviation see Tab. 10. The ♂♂ of Panay (ssp. *philippinica*) and Palawan (ssp. *bulbosa*) are (after square transformation of data) significantly smaller compared with the other insular populations. (Analysis of variance, $F_{5;85} = 6.940$, $p < 0.0001$; homogenity of variances checked with BARTLETT's test, subsequent multiple comparison with test of STUDENT-NEWMAN-KEULS at $p = 0.05$.) When a higher level of confidence is chosen ($p = 0.01$), the Panay ♂♂ are intermediate in size. Only the Palawan ♂♂ (= spp. *bulbosa*) remain statistically separable. (From NÄSSIG & TREADAWAY 1997 a.)

Phenology. See Table 12. The collecting data is well distributed through the year (specimens were found in all months), but with a peak in June/July and low counts in December to March and October.

Altitudinal distribution. See Text-Fig. 4. *A. philippinica philippinica* was observed from ca. sea-level to ca. 2200 m. The peak at 900–1200 m comes from the many specimens collected during long-term visits in the Banaue area in North Luzon, especially by SETTELE et al. On Palawan, high elevations are rather inaccessible and have rarely been collected.

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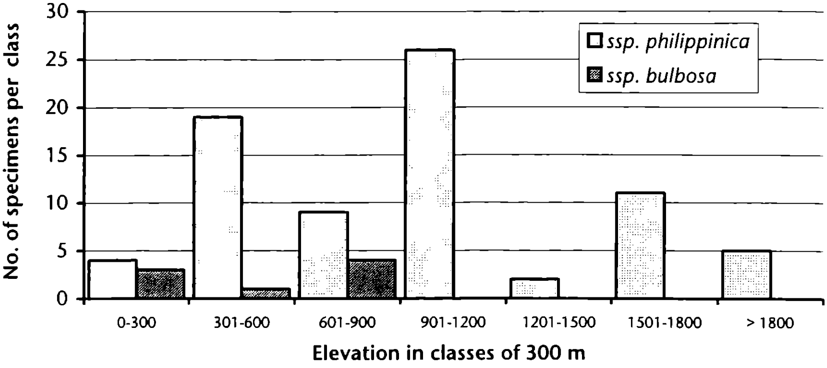
Table 12: Phenology data (collecting dates) of *Actias philippinica* from different islands or regions and for the entire material with data available (n = 144 for ssp. *philippinica* and n = 14 for ssp. *bulbosa*). Geographical or climatical effects not separated, reared specimens excluded.

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Luzon, Marinduque	0	1	2	2	3	9	3	1	2	0	3	2
Mindoro	0	0	0	0	1	0	0	0	0	1	2	0
Negros, Masbate	0	0	1	5	1	4	6	10	8	5	9	0
Panay	0	0	0	0	2	0	0	0	2	0	0	2
Leyte, Bohol	4	1	2	3	7	0	3	0	3	3	0	0
Mindanao	0	1	2	1	0	13	10	1	2	0	1	0
All islands, ssp. *philippinica*	**4**	**3**	**7**	**11**	**14**	**26**	**22**	**12**	**17**	**9**	**15**	**4**
Palawan, ssp. *bulbosa*	**0**	**1**	**3**	**0**	**0**	**1**	**1**	**2**	**2**	**0**	**4**	**0**



Text-Fig. 4: Altitudinal distribution of *Actias philippinica* on the Philippines, data from n = 76 specimens, all islands combined, of *A. philippinica philippinica* and n = 8 specimens of *A. philippinica bulbosa* from Palawan. Not all elevation classes were comparably as often visited! Minimum is ca. sea-level, maximum is ca. 2200 m a.s.l. for ssp. *philippinica*, minimum is sea-level and maximum ca. 900 m for ssp. *bulbosa*.

Preimaginal stages: In 1985 the species was reared *ex ovo* on *Liquidambar* (Hamamelidaceae) from eggs sent to Germany from N-Luzon, Ifugao, Kiangan, by J. SETTELE to one of the authors (W.A.N.); the resulting specimens (1 ♂, 2 ♀♀) are smaller than specimens collected in the wild, but show the typical Luzon colour and pattern (in CWAN). At that time the different populations of *A. maenas*, *A. philippinica* and *A. isis* were not yet dissected, and therefore deemed to be conspecific. The larvae (all in-

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stars) from Luzon virtually did not differ from West Malaysian lifestock reared in 1982–1984 (see NÄSSIG & PEIGLER 1984), therefore the photographic documentation was not very elaborate. Colour illustrations of larvae of *A. maenas* see in NÄSSIG et al. (1996) or PEIGLER & WANG (1996). This similarity is not surprising, because also the larvae of *A. isis* are still quite similar (see NAUMANN 1995), in contrast to the caterpillars of *A. groenendaeli* (see U. & L. H. PAUKSTADT 1993 e, PEIGLER & WANG 1996). It would appear helpful now, after having identified the Philippine populations as a separate morphospecies, to rear the larvae of *A. philippinica* again and compare them in more detail with the larvae of *A. maenas* (and perhaps also *A. isis*), and also try to hybridize the two or three taxa and clear the fertility of the resulting hybrids and possible backcrosses.

Discussion. The homogenity in genitalia morphology of the different insular populations of *A. philippinica philippinica* contrasts strikingly with the heterogenity of the external morphology. Therefore, we are quite confident that *A. philippinica* is a separate species.

Actias philippinica bulbosa NÄSSIG & TREADAWAY, 1997

NÄSSIG & TREADAWAY (1997 a: 336); HT ♂, via CCGT in SMFL (GP 966/96, SMFL-Nr. 4153), examined; l.t.: S. Palawan, Brooke's Point.

D: Thus far known from Palawan only. DM 5.

ED: None.

Material studied: see the paratypes list in NÄSSIG & TREADAWAY (1997 a): 12 ♂♂ (incl. HT), 2 ♀♀, Palawan. Additional material: 1 ♂, Irawan, 50 m, 20. IX. 1997, CSNB.

Figured: Imagines in Col. pls. 4: 22, 23. Genitalia in B&W pl. 4: 12 (♂).

Description and diagnosis. (See Col. pl. 4, Figs. 22, 23.) The subspecies *bulbosa* is most clearly defined by the name-giving bulbous or heart-shaped “knot” at the cephal end of the saccus of the ♂ genitalia (Fig. 12); the length of both saccus and aedeagus is not significantly distinct from that in the nominotypical subspecies. ♂♂ are smaller than in the nominotypical subspecies; in general appearance and colour they are close to Luzon specimens. The ♀♀ (only two known presently) are also somewhat smaller than in the nominotypical subspecies, and their fw. eyespots are much darker and contrasting, very prominent within the more uniform yellow ground colour.

Individual variability. For a detailed analysis, there are not enough specimens known of subspecies *bulbosa*. The known specimens do not vary very much.

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Phenology. See Tab. 12. Specimens are known from the months ii, iii, vi, vii, viii, ix, xi, which appears to be a fairly even distribution across the year for a total of only 14 specimens.

Altitudinal distribution. See Text-Fig. 4. The specimens for which altitudinal data is provided come from sea level to about 900 m at ma ximum.

Preimaginal stages: Unknown, probably similar to the nominotypical subspecies as well as to *A. maenas*.

Discussion. The differences between the Palawan population (= ssp. *bulbosa*) and the nominotypical subspecies both in ♂ genitalia and in external morphology are so clear that it may even be possible that *bulbosa* is a separate species. We retained *bulbosa* as a subspecies due to its saccus length, which is almost identical to *philippinica* s. str.

Actias selene (Hübner, 1806)

Hübner (1806, Sammlung exotischer Schmetterlinge **1**: 3); deposition of ST/HT unknown (possibly lost in a fire in Vienna in 1848, see Horn et al. 1990), not examined; l.t.: India.

D (as tentatively interpreted by Nässig & Treadaway 1997 b): From Afghanistan and the Indian subcontinent through continental S and SE Asia to N China, Taiwan, the Philippines, and Sundaland.

Polytypic paraspecies[27] with one subspecies on the Philippines:

Actias selene brevijuxta Nässig & Treadaway, 1997

Nässig & Treadaway (1997 b: 92), HT ♂ via CWAN in SMFL (GP-Nr. 632/90, SMFL-Nr. 4159), examined; l.t. Luzon, Ifugao, Kiangan.

D: Thus far only known from some of the higher mountains of Luzon, Mindoro, and Mindanao. DM 6.

ED: None.

Material studied: see the paratypes list in Nässig & Treadaway (1997 b): 37 ♂♂ (incl. HT), 1 ♀ Luzon, 3 ♂♂ Mindoro, 2 ♂♂ Mindanao; in CCGT, CRBP, CWAN. Additional specimens, seen after publication of the description: Mindanao: 2 ♂♂, Bukidnon, Mt. Kitanglad, 2000 m, 14./16. iii. 1997; 1 ♂, dto., Mt. Kalatungan, 5. vii. 1997; CCGT. Mindoro: 3 ♂♂, "nr. Mt. Halcon"[?], 9. iii., 15. iii. (2×, 1 of them GP 1148/97, this specimen & slide now in SMFL) 1997; CUBH. 1 ♂, Mindoro, Mt. Halcon, 1000 m, 18. vii. 1996; CSNB.

Figured: Imagines in Col. pl. 5: 24, 25. Genitalia in B&W pl. 5: 16/17 (♂).

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[27] Or, alternatively, a group of closely related species which is not yet phylogenetically and taxonomically resolved.

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Description and diagnosis. Lfw. ♂♂: 79.7 mm ± 3.74 SE, n = 32, Luzon population only; ♀: 87 mm, n = 1. A comparatively large species with a turquoise ground colour and, for the ♂, slightly concave fw. leading to a sharp apical point. Hw. strongly angulated at the boundary of the anterior margin and the termen, with long tails (50–60 mm), broader than in the *A. maenas* group, partly pink in colour. The costal area of the fw. is a pale purple outwardly and deep purple inwardly. There are grey-brown inwardly curved lines at the fw. postdiscal and hw. submarginal area, and similar but outwardly curved dark basal lines at fw. and hw. Both wings have, at the end of the cell, a yellow circular spot (in the centre often a narrow hyaline patch) with inwardly a prominent black lunule with an inner pink or red edge, often also with a narrow whitish blue line. The yellow is often partly mixed with pinkish.

Insular and individual variability. For the ♂♂ the ground colour varies slightly from a pale turquoise to a somewhat deeper turquoise, sometimes with a greenish to yellowish tinge, particularly in the submarginal area of the fw. The faint, dark blackish or brownish postdiscal and basal lines can vary, to a limited extent, in depth of colour, while the pink scales on the tails can cover from $^1/_3$ to $^2/_3$ of the tail length. Such minor variations are not isolated to any particular island. In the larger specimens from Mindoro (see discussion) the fw. eyespots are not so outstanding as they have appeared in the three small specimens known earlier (see NÄSSIG & TREADAWAY 1997 b).

Phenology. See Table 13. The number of specimens is probably not sufficient for a reliable analysis of the generations per year.

Table 13: Phenology data (collecting dates) of *Actias selene brevijuxta* from different islands and for the entire material available (n = 49). Geographical, altitudinal or climatical effects not separated.

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Luzon	0	18	1	0	1	6	0	3	4	0	3	0
Mindoro	0	0	5	0	0	0	1	0	0	0	1	0
Mindanao	0	0	3	0	0	0	1	0	0	1	0	0
All islands	**0**	**18**	**9**	**0**	**1**	**6**	**2**	**3**	**4**	**1**	**4**	**0**

Altitudinal distribution. See Text-Fig. 5. *Actias selene brevijuxta* is, in contrast to the *maenas*-group of species, clearly a species of mountainous distribution; the lowest elevation data is from ca. 600 m, the highest from

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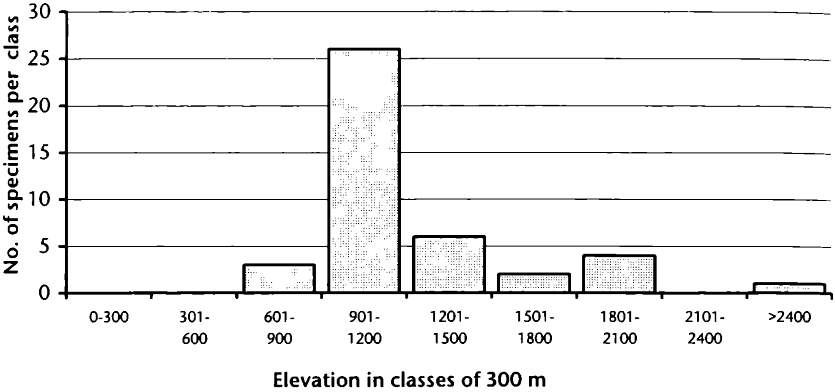
certainly above 2400 m. Although HOLLOWAY (1987) reported specimens of *A. selene seitzi* KALIS, 1934 from the lowlands of Borneo, most of the specimens originate from around or above 1000 m, in the Himalaya (nominotypical subspecies, maximal elevation data known is ca. 3000 m), on Sundaland (ssp. *seitzi*) and as well on the Philippines (ssp. *brevijuxta*).



Text-Fig. 5: Altitudinal distribution of *Actias selene brevijuxta* on the Philippines, data from 42 specimens, all islands combined (data from NÄSSIG & TREADAWAY 1997 b, supplemented with some new data). Not all elevation classes were comparably as often visited! Minimum is ca. 600 m, maximum is ca. 2600 m a.s.l.

Preimaginal stages: Still unknown for the Philippine *brevijuxta*. The continental (N-Indian) and Taiwanese populations of the *selene*-group are well-known and have repeatedly been described (see, e.g., HEPPNER et al. 1988, PEIGLER & WANG 1996, NÄSSIG et al. 1996 and further citations therein).

Discussion. Three specimens of *A. selene brevijuxta* in CUBH from Mindoro (seen only after the description was published) show about the same lfw. (lfw. ♂: 77.3 mm ± 3.21 SD, n = 3) as the specimens from Luzon (lfw. ♂: 79.7 mm, see above); a fourth Mindoro specimen in CSNB is also larger than the three specimens in CCGT. The genitalia of a dissected specimen (GP 1148/97) are larger[28] than in the earlier studied specimens (which showed a lfw ♂ of only 68.0 mm ± 5.20 SE, n = 3, see NÄSSIG & TREADAWAY 1997 b), and the juxta protuberances are about the same size

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[28] In contrast to *A. philippinica* (see there), where even small specimens usually have genitalia of normal size, in *A. selene brevijuxta* there seems to be some size variability in the genitalia depending on the absolute size of the specimens, measured as the lfw.

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as in the Luzon specimens. This supports the opinion of NÄSSIG & TREADAWAY (1997 b) that there is only one subspecies of *Actias selene* on the Philippines.

The question whether *brevijuxta* is a subspecies or a separate species cannot be answered from morphology alone. The morphological distinctness would also justify species status; but we think it better to search for further support using chemotaxonomic techniques like pheromone or DNA analyses, etc. And the status of *brevijuxta* should best be cleared up in connexion with a revision of the whole *selene*-group.

The presently known distribution pattern of this species is quite patchy (from one island each of the Luzon, Mindoro and Mindanao regions only), and it is very likely that intensive collecting at higher elevations (above 1000 m) will result in many new records on other islands.

Genus *Cricula* WALKER, 1855

Cricula WALKER, 1855 [November 10] (List specimens lepid. insects coll. Brit. Mus. 5: 1158 (key), 1186). TS: *Saturnia trifenestrata* HELFER, 1837, by monotypy.

= *Euphranor* HERRICH-SCHÄFFER, 1855 [December] (Syst. Bearb. Schmett. Europ. 6: 89); TS: *Saturnia trifenestrata* HELFER, 1837, by monotypy. Junior objective synonym.

The genus *Cricula* was recently revised (NÄSSIG 1989 a, 1995 a), and the new taxa from the Philippines were described (NÄSSIG & TREADAWAY 1997 a). The determination of *Cricula* species only based on external characters is usually difficult, in some cases next to impossible; at least it requires much experience. A safe and reliable determination of *Cricula* specimens *always* requires a dissection; both sexes of the different species on the Philippines can easily be determined by their genitalia (see figs.). In ♂♂, the vesica of the aedeagus must be expelled from the aedeagus tube (best done during dissection with a fine injection needle inserted into the anterior [cephal] end of the aedeagus tube along the ductus seminalis and hydraulic pressure; NÄSSIG 1993: 336–337)[29]; and when publishing photographs or drawings, a scale must be provided because related species sometimes may have structurally similar genitalia, but in constantly different sizes. – In the special case of the Philippines, where three species-groups, one (= *trifenes-*

The basic method is similar to the one described by FIBIGER (1997: 15) for noctuids, but this vesica inflation is generally easier in saturniid than in noctuid moths (except in species with very narrow or distorted aedeagi) and should be done in the water before dehydrating the armature in higher alcohol concentrations. Staining of the vesica is usually not necessary in Saturniidae, as long as the maceration process is not extended for too long a time.

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trata) with usually four big cornuti and the other two (= *luzonica* and *mindanaensis*) without any spinous cornuti in the vesica are known, ♂♂ of the *trifenestrata*-group may also be determined externally under a microscope after brushing away most of the scales around the genitalia: at least two of the cornuti of *trifenestrata* are usually visible in the opening at the tip of the aedeagus. But this method is not always reliable, and for safe results dissecting is inevitable.

The three species of Philippine *Cricula* belong to three different species-groups[30]: *C. trifenestrata* is a member of the most widely distributed *trifenestrata*-group; *C. luzonica* forms the separate, endemic Philippinian *luzonica*-group, and *C. mindanaensis* belongs to the *elaezia*-group known from Sundaland, Sulawesi and Mindanao.

Cricula trifenestrata (Helfer, 1837)

Saturnia trifenestrata Helfer, 1837: J. Asiatic Soc. Bengal 6 (10): 45. HT obviously lost (see Nässig 1989 b: 184). l.t.: "Assam".

The perhaps best example in Saturniidae of a polytypic paraspecies. It seems quite likely that one or another of the subspecies, especially those from the easternmost areas, today ascribed to *trifenestrata*, will come out as separate species when modern chemotaxonomic methods are applied (sexual pheromone analyses, DNA-analyses, etc.). The systematics of the group is quite problematic, and the identity of several of the populations (some of which are presently dealt with as subspecies) remains to be studied (forms, subspecies, species?).

Cricula trifenestrata treadawayi Nässig, 1989

Cricula trifenestrata treadawayi Nässig (1989 b: 190); HT via CCGT in SMFL, GP 608/88, SMFL-no. 4169, examined. l.t.: Negros, nr. Mambucal.

D: Tentatively we interprete the situation such that all Philippine populations belong to ssp. *treadawayi*: Palawan, Linapacan (off NE Palawan), Mindoro, Negros, Cebu, S-Mindanao. A somewhat dubious record from Leyte, see discussion. DM 7.

ED: None for ssp. *treadawayi* as interpreted here. Other subspecies of *trifenestrata* range from S-India, N-India and S-China across the Indochinese Peninsula and most of the SE Asian islands (of Malaysia and Indonesia) probably to the western edge of West Irian.

Material studied: **Palawan:** 1 ♂, S-Palawan, Aboridin Baraki, 3. xi. 1995. 2 ♂♂, 3 ♀♀, S-Palawan, nr. Brooke's Point, Mt. Bayog, 1000 ft., 5. i. 1981 (♂, GP 613/89), xi. 1983 (♂,

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[30] These species-groups (five in total, after Nässig 1995 a) can each (except the *trifenestrata*-group) be demonstrated to be monophyletic (see Nässig 1995 a), while the relationships between the groups are often obscure. Therefore the use of five groups makes much more sense (and thus is preferable) than the two groups suggested by Nässig (1989 a), because these two groups ***both*** were not convincingly monophyletic. The mere number of groups and species included (compare U. & L. H. Paukstadt 1998: 140) is irrelevant as long as the groups are clearly demonstrated to be monophyletic and do not just consist of a single monotypic species each.

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GP 657/90), v. 1984 (♀♀). 1 ♀, Brooke's Point, v. 1980. 3 ♀♀, S-Palawan, Sundarapi Peak, 400 m, 15.–17. iv. 1997. 1 ♀, S-Palawan, Mt. Gantung, 11. iv. 1997. 3 ♂♂, C-Palawan, Puerto Princesa, Solomon, 7. iii., 17. iii. (2×) 1996. 3 ♂♂, C-Palawan, Irawan, 50 m, 20. x. 1986 (GP 884/95), 22. ii. 1996, 15. iii. 1996. 22 ♂♂, C-Palawan, Mt. Salakot, 350 m, iii. 1996, GP 987/96. 3 ♂♂, Mt. Salakot, 400 m, 18.–20. iii. 1996. 1 ♂, Mt. Salakot, 700 m, 18. iii. 1996. 7 ♂♂, Napsan, Salakot Falls, 330 m, 19./20. iii. 1996 (6×, GP 988/96), 23.–25. iii. 1996. 2 ♀♀, N-Palawan, Olanguan: 500 m [sic], 9. vii. 1988; 500 ft. [sic], 7. vii. 1988. All these in CCGT or via CCGT in CWAN. 2 ♂♂, Mt. Gantung, 200 m, 19.–21. i. 1988, ČERNÝ & SCHINTLMEISTER (GP 637, 638/90). 2 ♂♂, N-Palawan, San Vicente, 20 km "NEE" [= ENE] Roxas, 400 m, 12.–17. i. 1988, ČERNÝ & SCHINTLMEISTER. All these in CWAN. 1 ♂, Salakot Pass, 350 m, 24. viii. 1997, PETERSEN. 1 ♂, Irawan, 50 m, 28. ix. 1997, PETERSEN. All these in CSNB. 1 ♂, Irawan, iv. 1997, CUBH. **Linapacan** (small island NE Palawan): 1 ♂, 4. ix. 1995, CCGT. **Mindoro:** 1 ♂, 1 ♀, Bagtu, 5. v. 1954 (♂, GP 888/95), 5. v. 1956 (♀, GP 889/95), CCGT. 1 ♂, Mt. Sinai, 17. ii. 1996. 40 ♂♂, 2 ♀♀, Mt. Halcon (23× 1300 m), all 1996: 3. iv. (♀), 20. iv. (♀), iv. (7×), v. (24×), vi. (1×), ix. (8×), ♂-GP 989, 990/96, 1065/97. All these in CCGT or via CCGT in CWAN. 1 ♂, Mt. Halcon, 20. ix. 1996, CMBH. 2 ♂♂, Mt. Halcon, 27. vi. 1996, 5. vii. 1996, CSNB. 2 ♂♂, "near Mt. Halcon"[?], 6. v. 1996, 10. viii. 1996, CUBH. **Negros:** besides the type-series of *treadawayi* (1 ♂ HT [GP 608/88], 2 ♂♂ [GP 658/90], 2 ♀♀ [GP 539/87] PT, via CCGT in SMFL, see NÄSSIG 1989 b) and the material reared by C.G.T. (GP ♂ 350/86) the following material: 22 ♂♂, 20 ♀♀, Mt. Canlaon, different dates from 1984 to 1998 (GP 1066/97). 1 ♂, 3 ♀♀, Mambucal, x. 1984 (1 ♀), i. 1986 (3×). 2 ♂♂, 2 ♀♀, Amlan Hydro, 6. xii. 1978 (2 ♂♂, 1 ♀), 20. vi. 1984 (♀). 1 ♂, Bais, 600 ft., 19. x. 1997. 4 ♂♂, Bais, Mt. Tindug-Bato, 2./3. xii. 1997 (2×), 5. i. 1998 (2×). All these in CCGT. **Cebu:** 7 ♂♂, 5 ♀♀, Minglanilla, Mt. Luay: 600 m, 27. vii. 1984 (1 ♂, 2 ♀♀); 700 m, 26.–28. vi. 1985 (6 ♂♂, 3 ♀♀, GP ♂♂ 541/87, 655/90, 882/95, 896/95). 2 ♂♂, Sibonga, Libo, 600 m, 21. xii. 1987. All these in CCGT. **Leyte:** Ca. 8 ♀♀, all only with "Leyte", x. 1990, trader's material, probably unreliable, in CRLN and via CRLN in CWAN (GP 892, 893/95). **S-Mindanao:** 59 ♂♂, 14 ♀♀, S-Cotabato, Mt. Matutum, i.–ii./iii., x. 1996 (GP 1015, 1025/96 [♂♂], 1026/96 [♀]). 6 ♂♂, S-Cotabato, Mt. Busa, 28. xi. 1996 (1500 m), 11.–18. vi. 1997 (5×). All these in CCGT.

Figured: Imagines in Col. pl. 5: 29–32, 34. Preimaginal instars in Col. pl. 16: 123–125. Genitalia in B&W pls. 6: 18 (♂); 7: 23 (♂), 24, 25 (♀).

Description and diagnosis. (Lfw. see Tab. 14.) Similar to the colour comparison with other species of the genus elsewhere in its enormous range, *C. trifenestrata* is the least colourful and most sombrely coloured species also on the Philippines. ♂♂ (Col. pl. 5) in their ground colour are of a dull ochreous brown, the submarginal area more greyish; on the fw. the basal part of the costal area may have a shade of pinkish. The fw. ocelli are usually two: one blackish dot along the crossvein with a small hyaline centre and a second dot above that, usually without a hyaline centre. The basal fascia of the hw. is usually quite broad and prominently blackish brown, often with a reddish touch, from the anal edge to the vein just above the single hw. ocellus (which is usually very small and without a hyaline centre). ♂♂ externally may often be extremely similar to *luzonica* ♂♂.

♂ genitalia (see b&w pls. 6 & 7): As usual for the *trifenestrata*-group, the aedeagus has 4 cornuti (spiculi *sensu* ROEPKE 1940) placed in pairs on the two

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tubes of the vesica, which can be everted ventrally, with the two distal cornuti facing in different directions. The left basal cornutus may sometimes be reduced in size; then the two cornuti on that side are always connected with a row of minute sclerites. The sella (sensu ROEPKE 1940; a distoventral prolongation of the juxta) is usually broad, at the distal tip rounded, rarely slightly bipartite. The scaphium (sensu ROEPKE; an alteration of the transtilla or gnathos) is broad and not or little incised. The wings of the collare (ROEPKE: disto-dorsolateral prolongations of the juxta) have a triangular shape and are usually pointed. The harpe of the valves is comparatively small, often slightly covered from the distal part of the valve's costa.

The ♀♀ (Col. pl. 5) are usually of a dark orangy vine-red, slightly shaded with blackish. The hw. ocellus is small, but has a hyaline centre; the fw. usually has three hyaline patches. The ♀♀ of *trifenestrata* are much less colourful than the deep vine-red variants of *C. luzonica* and lack the other forms of that species.

♀ genitalia (see b&w pl. 7): The ostium and ductus bursae are strongly sclerotized, large; lamella postvaginalis and the entrance area of the ostium are both medially deeply indented. This "double indentation" is typical for *trifenestrata*.

Table 14: Forewing length of *Cricula trifenestrata,* different populations of the Philippines. Material in colls. SMFL, CCGT, CRLN, CWAN; evidently reared specimens and dubious Leyte material excluded.

C. trifenestrata Island	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Palawan, Linapacan	♂♂	33.8	2.18	46	28	37
	♀♀	43.4	2.46	11	38	47
Mindoro	♂♂	35.2	1.87	45	30	38
	♀♀	43.3	4.16	3	40	48
Negros	♂♂	34.0	2.02	39	29	37
	♀♀	41.4	3.00	20	35	45
Cebu	♂♂	33.6	1.81	9	31	36
	♀♀	40.6	3.65	5	35	45
Mindanao	♂♂	34.6	1.31	64	32	37
	♀♀	42.9	1.96	14	39	46
All islands together	♂♂	34.4	1.88	203	28	38
	♀♀	42.2	2.84	53	35	48

Insular and individual variability. Insular variability is practically absent. Besides a general individual variability in size, variation in both sexes is,

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compared with the other species-groups of *Cricula*, small. ♂♂ vary in the ground colour, which may be more bright and orangy or darker and brownish; the size and number of the fw. ocelli is rarely varying. The ♀♀ are barely variable at all and evidently lack the orangy colour variants of their congeners on the Philippines.

Table 15: Phenology data (collecting dates) of *Cricula trifenestrata* from different islands (n = 260). Geographical or climatical effects not separated, specimens labelled as reared as well as the dubious Leyte specimens excluded.

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Palawan, Lin.	5	1	37	5	4	0	2	0	1	1	2	0
Mindoro	0	1	0	9	27	2	1	1	9	0	0	0
Negros	14	2	2	4	0	6	2	1	13	8	1	12
Cebu	0	0	0	0	0	9	3	0	0	0	0	2
Mindanao	24	42	1	0	0	0	0	0	0	6	0	0
All islands	43	46	40	18	31	17	8	2	23	15	3	14

Phenology. (See Tab. 15.) As the collecting data is relatively sparse (many of the collectors did not collect *Cricula*, until they were sent photographs of the species and were specifically requested to collect it), and because the species may often arrive in large numbers in a single night, the data in the table might possibly be not very helpful to clear the annual life-cycle. We know from elsewhere (e.g., Sundaland) that the members of the *trifenestrata*-group tend to be acyclic at least in the lowlands, so this might perhaps be expected from the Philippines as well; whether or not the species has a dormant phase during dry seasons is still unknown.

Table 16: Altitudinal data of *Cricula trifenestrata* from different islands (n = 101), as far as data is supplied. Specimens labelled as reared as well as the dubious Leyte specimens excluded. Minimum is around sea level, maximum elevation on a label is ca. 1300 m. No altitudinal data for Mindanao provided. Not all elevations were collected comparatively often!

Altitude	0–300 m	301–600 m	601–900 m	901–1200 m	1201–1500 m	> 1500 m
Palawan, Lin.	5	41	1	0	0	0
Mindoro	0	0	0	0	23	0
Negros	11	3	8	0	0	0
Cebu	0	6	9	0	0	0
Mindanao	0	0	0	0	0	0
All islands	16	44	18	0	23	0

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Altitudinal distribution. (See Tab. 16.) The altitudinal data for *Cricula trifenestrata* is relatively sparse, but it confirms the preference of *trifenestrata* for lowlands and lower montane zones. In contrast to the *andrei*-group (in N-India and the Indochinese Peninsula) and the *luzonica*-group, *trifenestrata* is rarely found higher than ca. 1800 m.

Preimaginal stages: Larvae of the Negros population of the subspecies *treadawayi* were described by TREADAWAY (1986); some of his pictures of the last instar larva taken in the wild on Negros are repeated here (Col. pl. 16, Figs. 123–125). His description and the pictures taken were one important basis for the description of the taxon (see also NÄSSIG et al. 1996). The mature larvae of *trifenestrata treadawayi* (as well as the other *trifenestrata* caterpillars known today) differ clearly from the supposed larvae of *C. luzonica* (see below, under that species) in the intensity of the black ground-colour (always jet-black in *trifenestrata*), the isolation of the red scoli within this black (usually not connected by red or orange rings), and in the generally much darker appearance. The L_1 larvae are still unknown.

Discussion. The subspecies *Cricula trifenestrata treadawayi* was mainly described after the larval morphology: The yellow dots (i.e., the colourful hair bases of secondary hairs) on the body of the mature larva from Negros are brighter than in the nominotypical N Indian subspecies (but not whitish as in Sundanian larvae), and they are much more sparsely covering the surface. Genitalia differences are only minor, and a safe genitalic diagnosis of the subspecies is usually not possible.

As a plesiomorphic character, the palpi alongside the strongly reduced galeae were found present in dissected specimens of *C. t. treadawayi* from Cebu, while they are totally reduced in other populations from outside the Philippines studied thus far (NÄSSIG 1995 a: b&w pl. I, fig. 8). As we have not yet studied this character in a sufficient number of specimens from different islands, we cannot yet acknowledge its value in defining the different subspecies. Therefore, the complex of *C. trifenestrata* from the Philippines[31] must be considered as not yet resolved in detail; the subsumption of all *trifenestrata* populations of the Philippines under *treadawayi* remains tentative. We plainly do not yet know enough about the different populations.

Presently there are similar problems in defining some of the continental Asiatic populations of the *trifenestrata* complex.

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It appears feasible that the different insular populations of *C. trifenestrata* on the Philippines reached their present distribution area from different origins, on different routes, and at different times; further research is necessary. The population from Palawan, for example, may possibly be an offspring of the Bornean[32] subspecies. It remains to be cleared whether the Mindanao population of *trifenestrata* is of a different origin (e.g., from the South, from Sangihe or Talaud?), compared with the Cebu, Negros, and Mindoro populations as well as the Palawan population. Such questions could best be solved by chemotaxonomic methods, especially by a DNA analysis.

C. trifenestrata is known on Mindanao thus far only from the province of S-Cotabato in the South of the island, from two different mountain ranges (Mt. Matutum and Mt. Busa). It is, according to present knowledge, not syntopic with *C. luzonica kareli*, but the latter species was found in Salacafe (S-Cotabato), which is not very far from Mt. Busa. Mindanao is the only island of the Philippines from which three different species-groups are known (NÄSSIG & TREADAWAY 1997 a), although todate not all at the same places. The material from Leyte (a small series of ♀♀ in CRLN and CWAN from a trader) is somehow dubious (it appears to be a reared series because only ♀♀ were received), but all the other records are probably reliable.

It must again be repeated: a safe and reliable determination of the different species (*trifenestrata, luzonica, mindanaensis*) is in any case only possible using the genitalia. External morphology may be severely misleading: For quite a time we had placed the 5 ♂♂ from Mt. Busa under "*C. luzonica kareli*", until we noticed a difference when comparing longer series from Mindanao and confirmed this eventually by finding the typical *trifenestrata*-like cornuti in the aedeagus of these specimens after brushing.

Last supplements to *Cricula trifenestrata*

Shortly before going to press, we have to supplement some late additions of *Cricula trifenestrata* from Mindanao: In late April 1998, one of us (C.G.T.) received 2 ♂♂ and 1 ♀ of *Cricula trifenestrata* from Bukidnon, Mt. Kalatungan (see DM 7), 1 ♂ collected on 16. III. 1998, 1 ♂ (GP 1208/98), 1 ♀ on 22. III. 1998. In the same series there were also 2 ♂♂ of

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[32] The identity of another Bornean species of the *trifenestrata*-group is also still unclear: *Cricula bornea* WATSON, 1913. Whether or not this has any consequences for the interpretation of the Philippine *trifenestrata*-complex (especially from Palawan) is as well unknown presently. – The same is true for the most recent discovery of the new "subspecies" *cameronensis* (see U. & L. H. PAUKSTADT 1998) from West Malaysia. It appears almost impossible that two subspecies of the same species intermingle so closely and can be found nearly sympatric within the Cameron (and Genting?) Highlands. The taxon *cameronensis* might, in fact, either be a separate species (more likely) or just a local or altitudinal form of *trifenestrata;* further studies are necessary. In any case, the results from West Malaysia may also have influence on the interpretation of the Bornean and Philippine taxa of *trifenestrata*.

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Cricula luzonica kareli, with identical collecting locality, collecting date 22. III. 1998. This means that:

a) *C. trifenestrata* on Mindanao is not restricted to S-Cotabato, but occurs also in Bukidnon, much further to the North.

b) The regional overlap of *C. luzonica kareli* and *C. trifenestrata* covers a much larger area.

c) Both of these two species can be collected at the same day at the same place.

d) *C. trifenestrata* is now also known from the province of Bukidnon; from this province *all three* Philippine species-groups of *Cricula* have been reported (although *C. trifenestrata* and *C. mindanaensis* have not yet been reported from the same mountain).

Cricula luzonica JORDAN, 1909

Cricula trifenestrata luzonica JORDAN (1909, Novit. Zool. **16**: 306). HT ♂ (by monotypy) in BMNH, examined (GP BMNH Sat. 435). l.t.: N-Luzon.

Cricula luzonica: NÄSSIG (1989 b, 1995 a), NÄSSIG & TREADAWAY (1997 a).

D: Thus far known from Luzon, Leyte and Mindanao only, in three different subspecies. There may be more islands inhabited by this species, probably mainly in the eastern parts of the Archipelago, within the Luzon and East Visayan/Mindanao regions of VANE-WRIGHT (1990). DM 7.
ED: None.

Cricula luzonica differs from the Philippine populations of *C. trifenestrata* in general colouration (*luzonica* is on average more vivid in ground colour and much more variable, showing a wide range of ground colours and pattern) and especially in genitalia morphology (♂♂: whole armature relatively small, fragile; aedeagus without cornuti, but sometimes slight sclerotizations on the tips of the two sacks of the vesica; sella long and – especially in sspp. *luzonica* and *leyteana* – thin; wings of the collare always rounded, sometimes auriculate; valves and harpe fragile; ♀♀: no heavily sclerotized ostium and ductus bursae, no “double indentation”). For the differences with *C. mindanaensis*, see under that species.

C. luzonica is a polytypic cladospecies with three subspecies, which are defined by external appearance and genitalia differences:

Cricula luzonica luzonica JORDAN, 1909

Cricula luzonica luzonica: NÄSSIG (1995 a), NÄSSIG & TREADAWAY (1997 a).

D: Luzon, only known from the North. DM 7.

ED: None.

Material studied (all from **Luzon**): 1 ♂, Ifugao, Mayoyao, 16. VI. 1988, SETTELE, CWAN. 82 ♂♂ (CWAN) + 19 ♂♂ (CCGT), 18 ♀♀ (CWAN) + 3 ♀♀ (CCGT), Ifugao, Banaue (+ Lagawe), ca. 1000–1200 m, 1988–1994 (different dates and details, SETTELE et al., ČERNÝ & SCHINTLMEISTER etc.), GPs ♂♂ 639/90, 644/90, 647/90, 649/90, GP ♀ 897/95. 2 ♂♂, Mts. Prov., Mt. Sta. Tomas, 5000 ft., 20./21. XII. 1973. 1 ♂, Mts. Prov.,

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Chatol, 1600 m, 24. IX.-24. X. 1988, ČERNÝ & SCHINTLMEISTER, GP 650/90. 1 ♂, Mts. Prov., Baguio, 3500 ft., 19. XII. 1973. All these in CCGT and CWAN. 2 ♂♂, Mts. Prov., Chatol, 1850 m, ČERNÝ & SCHINTLMEISTER, 23./24. VII. 1993, CRLN. 1 ♂, 1 ♀, Ifugao, Banaue, 1000 m, 5. IV. 1988, 25. I. 1989, CSNB. 1 ♂, Ifugao, Kiangan, 17. II. 1985, SETTELE, CSNB.

Figured: Imagines in Col. pl. 6: 35, 40. Supposed preimaginal instars in Col. pl. 17: 126–135. Genitalia in B&W pls. 6: 19 (♂); 7: 26 (♀).

Description and diagnosis. (Lfw. see Tab. 17.) The nominotypical subspecies is the least variable and most uniform of the three. ♂♂ are usually rather light in colour (no unicolorous dark variants as in the other two subspecies), with nearly always 2 dots on the fw. (one with a hyaline centre, the other only black). They are usually very similar to ♂♂ of *trifenestrata*. The main external difference (but not always reliable) is the ground colour, which usually consists of a mixture of dark orangy-brown and bright orange scales, with the submarginal area often with a clear tinge of reddish brown.

♂ genitalia: The wings of the collare are still somewhat triangular, but rounded. Scaphium (see ROEPKE 1940) broad, rounded, in the centre slightly incised. Sella round, thin and long. The vesica is a ventral sack, only with two weak distal tips, which are slightly sclerotized (but no real cornuti).

The ♀♀ are as well not as variable as their conspecifics from further south; they are usually dark orangy vine-red in ground colour and differ from similarly coloured ♀♀ of *trifenestrata* by the much more prominent bright area at the tornal angle of the fw. and hw. Also, the ground colour may sometimes become much more orangy than in any Philippine *trifenestrata* we have seen thus far. There are usually 3 fw. ocelli, but with some slight differences in size and arrangement of the patches, compared with *trifenestrata*. The **♀ genitalia** are as described for the species *C. luzonica*, with the lamella postvaginalis roundedly rectangular and with a triangular notch in the ventral centre.

Table 17: Forewing length of *Cricula luzonica*, different subspecies of the Philippines (total n = 162). Material in colls. SMFL, CCGT, CRLN, CWAN.

C. luzonica Island	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Luzon	♂♂	36.0	1.99	43	32	42
(ssp. *luzonica*)	♀♀	41.7	3.08	18	35	47
Leyte	♂♂	39.8	2.26	14	35	43
(ssp. *leyteana*)	♀♀	47.6	1.83	12	45	50
Mindanao	♂♂	36.1	2.11	64	31	40
(ssp. *kareli*)	♀♀	44.0	4.43	11	35	51

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Table 18: Phenology data (collecting dates) of the three subspecies of *Cricula luzonica* (n = 222). Geographical or climatical effects not separated.

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Luzon (ssp. *luzonica*)	5	4	6	18	2	5	4	2	2	2	3	7
Leyte (ssp. *leyteana*)	1	0	0	0	0	0	0	9	15	1	0	0
Mindanao (ssp. *kareli*)	1	1	11	9	1	5	60	6	17	2	22	1
All islands	7	5	17	27	3	10	64	17	34	5	25	8

Individual variability. As written above, the nominotypical subspecies of *C. luzonica* is the least variable of the three. There is only very little variability in the ground colour, in the shape and number of fw. eyespots etc.

Phenology. (See Tab. 18.) Similar to the case of *C. trifenestrata*, this data set will probably not be very helpful to clear the real life-cycle of the species in Luzon. As in *trifenestrata*, *luzonica* can arrive in large numbers in one night, and thus one good collecting night may result in an enormous peak. We expect that the species may be acyclic at higher altitudes (where there are no well-expressed dry seasons), but probably will have a dormant period during extended dry seasons.

Altitudinal distribution. (See Tab. 19.) Similar to the phenology data, the altitudinal data is not very conclusive due to irregular collecting. At least, *C. luzonica* is a species of higher altitudes than *C. trifenestrata*, with no specimens from sea level, but from highest elevations of ca. 2400 m.

Table 19: Altitudinal data of the three subspecies of *Cricula luzonica* (n = 202), as far as data is supplied. Minimum is ca. 300 m, maximum elevation on a label is ca. 2400 m. Not all elevations were collected as comparatively often!

Altitude	0–300 m	301–600 m	601–900 m	901–1200 m	1201–1500 m	1501–1800 m	1801–2100 m	> 2100 m
Luzon (ssp. *luzonica*)	0	0	0	54	3	1	2	0
Leyte (ssp. *leyteana*)	0	4	22	0	0	0	0	0
Mindanao (ssp. *kareli*)	0	1	10	5	2	73	18	7
All islands	0	5	32	59	5	74	20	7

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Preimaginal stages: In early 1988, one of the authors (W.A.N.) received some eggs from N-Luzon from A. Schintlmeister and K. Černý. These were reared up to the last instar, but then died by infections and did not result in any specimens; they were believed to be of *trifenestrata* at that time. Foodplants were *Pyracantha coccinea* for the first and second instar larvae, later *Prunus* cf. *cerasus* (both Rosaceae). The ♀ ovipositing was not correctly identified on the envelope and is unknown. Therefore, the identity of the reared larvae remains somewhat doubtful. Nevertheless, as there is only one species of the genus *Cricula* known from the island of Luzon thus far (see map), it will most likely have been a rearing of *C. luzonica luzonica,* and thus the larvae are described here as such.

Description (see Col. pl. 17): First instar (L_1): ground colour a warm yellow, with black head, bipartite black prothoracal shield, black anal plate and dark scoli. The dorsal scoli on A8 are slightly closer together than the other dorsal scoli, but not fused; there is a dark dorsomedian stripe between these scoli on A8.

In L_2 and L_3 the larvae become gradually darker; the ground colour turns into brownish to blackish, with brighter dots (the bases of reduced secondary hairs) and a brownish ring around each segment across the scoli. The prothoracic and the anal shield turn gradually into a reddish tone.

L_4-L_6 are quite similar to each other, the changes in these instars are minor. The ground colour is black, but much less intensive than in most *trifenestrata* larvae; the larvae appear much brighter, more "yellowish" than those of *trifenestrata.* Head and prothoracic shield, scoli, the segmental rings containing them, a sublateral stripe, the prolegs, and the anal segments are more or less red; especially the segmental rings and the sublateral stripe have a strong tendency towards orangy or yellowish colour when the new skin expands after each moult due to feeding. The ventral side is brownish with yellowish parts. The thoracic legs are blackish. The body is quite densely covered with the yellowish hair bases of reduced secondary hairs; those secondary hairs which still are present are white. The stinging bristles (which did not show up with very strong stinging abilities during the rearing) on the scoli are inconspicuous and in the reddish colour of the scoli. The dorsal scoli on A8 are fully separate, only slightly approached as in *trifenestrata.*

The similarity of these larvae from Luzon (i.e., putative *C. luzonica*) with *C. trifenestrata* is not very surprising; the black ground colour of the mature caterpillars with the aposematic red and/or yellowish pattern and white hairs is

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probably the plesiomorphic pattern of mature larvae within the genus, see, for example, *C. agria* JORDAN, 1909 (colour pictures by LAMPE in NÄSSIG 1995 a: col. pl. B, figs. 4, 5), which also possesses a similar (though much darker and more contrasting) mature larva. And similar yellow L_1 larvae are also known from some populations of *C. trifenestrata* (see, e.g., NÄSSIG 1995 a, NAUMANN 1995), as well as from *C. hayatiae* PAUKSTADT & SUHARDJONO, 1992 (see U. & L. H. PAUKSTADT 1993 d and NÄSSIG 1995 a, col. pl. B, figs. 6–8)[33] The differences between these Luzon larvae and true *trifenestrata* larvae are small, but probably diagnostic: The black ground colour is not so dominant as in any presently known *trifenestrata* subspecies; the scoli are standing in a median ring of reddish (when freshly moulted) to orangy or even yellow (when fully grown within the same instar) colour per segment, not isolated from each other; also, the sublateral line and the ventral side are more orangy to yellowish instead of pure red, respectively black. In total, the *luzonica* larvae have a much more orangy to yellowish appearance than any true *trifenestrata* larva seen by us thus far. Fully grown larvae of the late instars appear always somewhat "shining" and, ventrally, somewhat translucent and lack that deep, dark velvety black of *trifenestrata* larvae and of freshly moulted Luzon larvae. However, the young larvae from Luzon resemble quite closely those of *C. trifenestrata kransi* (Sulawesi) figured by NAUMANN (1995).

Discussion. In external morphology, ♂ specimens of the nominotypical *C. luzonica* from N-Luzon, which is the least variable *luzonica* population of the three subspecies, are usually nearly indistinguishable from Philippine populations of *C. trifenestrata*. A dissection is always necessary to confirm the identity. Thus far, *C. luzonica* appears to be the only *Cricula* species living on Luzon.

Cricula luzonica leyteana NÄSSIG & TREADAWAY, 1997

NÄSSIG (1995 a): *Cricula luzonica* ssp. nov. L1 (undescribed).

Cricula luzonica leyteana NÄSSIG & TREADAWAY (1997, Nachr. entomol. Ver. Apollo N.F. **17** (4): 352). HT ♂ via CCGT in SMFL (GP 642/90, SMFL-Nr. 4155), examined. l.t.: C-Leyte, Mahaplag, Mt. Balocaue, 700 m.

D: Leyte. DM 7.

ED: None.

Material studied (all from Leyte): see the paratypes list (13 ♂♂, 10 ♀♀) in NÄSSIG & TREADAWAY (1997 a). No additional material received later.

Figured: Imagines in Col. pl. 6: 36, 41. Genitalia in B&W pl. 6: 20 (♂).

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[33] And they are as well known from *Cricula cameronensis* U. & L. H. PAUKSTADT, 1998 (i.e., in our opinion this taxon probably is a separate species, defined by differences in ♂ genitalia and preimaginal morphology).

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Description and diagnosis. A big subspecies (lfw. see Tab. 17). Dimorphic or nearly polymorphic; the most colourful and spectacular taxon of the Philippine *Cricula*. ♂♂ are known in a dark reddish-brown and in a brighter orangy brown variant, evidently connected by intermediates. The darkening of the the fw. may show transitional stages: in the median and costal area, the anal $\frac{1}{3}$ of the wing may still be orange in some specimens. The wing ocelli show some remnants of ringing in more than one colour, but the fw. dots remain two, the one along the crossvein with the hyaline centre and the other without this above. ♀♀ are found in dark vine-red, dark orangy brown and bright orange forms. The colouration and pattern is quite elaborate, and there is a tendency in ♀♀ to show more fw. fenestrae: Many specimens have 3 enlarged windows, and some have 1 or 2 accessory dark or hyaline ocelli in a small "archipelago".

Genitalia morphology, in comparison with the nominotypical subspecies: ♂♂ have a clearly deeper incised, broader scaphium, the sella is longer and thinner, the wings of the collare are more rounded, auriculate. In some specimens the vesica has only one tip, the second one is reduced. In ♀♀ the lamella postvaginalis is much less incised, more rounded and for a large proportion very closely adhering to the sternite or grown together with it.

Individual variability. Both sexes are variable in ground colour, and the ♀♀ also in the number and size of the fw. fenestrae.

Phenology. (See Tab. 18.) See comment for the nominotypical subspecies.

Altitudinal distribution. (See Tab. 19.) All known specimens were collected in the lowlands between ca. 450 and 700 m. This low altitude may possibly be responsible for the big size of the specimens (compare ssp. *kareli*).

Preimaginal stages: Unknown, but see under *C. luzonica luzonica;* most likely they will be similar.

Discussion. It appears highly unlikely that this subspecies should be restricted to Leyte; we expect it as well from Samar and possibly other islands. *C. luzonica leyteana* is in several aspects intermediate between the Luzon and Mindanao subspecies, which caused our interpretation that they are subspecies of one species; without the existence of the Leyte population we would surely have described *C. l. kareli* as a separate species. The large size of *leyteana* may be caused by the low collecting localities, see the material of *kareli* collected in Surigao del Sur at 500–650 m elevation (Müller), which is also extremely large.

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Cricula luzonica kareli NÄSSIG & TREADAWAY, 1997

NÄSSIG (1995 a): *Cricula luzonica* ssp. nov. L2 (undescribed).

Cricula luzonica kareli NÄSSIG & TREADAWAY (1997, Nachr. entomol. Ver. Apollo N.F. 17 (4): 353). HT ♂ via CWAN in SMFL (GP 636/90, SMFL-Nr. 4156), examined. l.t.: Mindanao, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, Talakag.

D: Mindanao. DM 7.

ED: None.

Material studied (all from Mindanao): see the paratypes list (105 ♂♂, 14 ♀♀) in NÄSSIG & TREADAWAY (1997 a) (in colls. CCGT, CWAN, SMFL, CRBP, CRMG, CMWM, CSNB), GPs 645, 646, 648/90, 878/95, 961, 1016, 1027, 1039, 1040/96 (♀), 1079/97 (♀). Additional specimens: 33 ♂♂, 1 ♀, Bukidnon, Mt. Kitanglad and Mt. Kalatungan, up to 2000 m, 1997 (different dates and details), GPs 1157, 1158, 1159/97, CCGT.

Figured: Imagines in Col. pl. 6: 37–39, 42/43. Genitalia in B&W pls. 6: 21 (♂); 7: 27 (♀).

Description and diagnosis. (Lfw. see Tab. 17.) Originally (NÄSSIG & TREADAWAY 1997 a: 356) interpreted as the “smallest and darkest” of the 3 subspecies, we found now, after all material being set, that there are indeed very small, but also very large specimens, and we think that this may be individually connected with altitudinal factors or climate etc. rather than with geography. The subspecies is polymorphic; in ♂♂, the ground colour may vary (similarly to *C. elaezia* JORDAN, 1909) from bright orangy brown to dark reddish brown or to a monochromous pale or dark brown with a greyish to olive tinge. The fw. eyespots are very variable, from only two small ones (rarely reduced) to an “archipelago” of ca. 5, mostly hyaline, spots of different size, similar to the ♀♀. **♂ genitalia:** Scaphium narrow, almost not incised; harpe more pronounced than in the other populations; wings of the collare very round (auriculate); sella much broader than in the other two subspecies, comparatively short, distally usually slightly incised; vesica with two slightly sclerotized tips (sometimes a third one, posteriorly of the other two ones, is developed[34]). In the ♀♀, the ground colour is (like in *leyteana*) dark vine-red, dark orangy-brown or bright orange, always with colourful pattern. The fw. postmedian line of the ♀♀ shows in all subspecies of *luzonica*, but most clearly in *kareli*, an double bending. The fw. windows vary from 3 to 4, but they are usually smaller and less developed than in *leyteana*. **♀ genitalia:** The lamella postvaginalis is deeply triangularly indented, but else similar to the other two taxa.

Individual variability. See above under description.

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[34] This character of a third vesica tip is similar to the *agria*-group of *Cricula* (from South India), but it is most probably a parallel development, because this third vesica tip is just on the other side as compared with *agria*.

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Phenology. (See Tab. 18.) See comment for the nominotypical subspecies.

Altitudinal distribution. (See Tab. 19.) *C. luzonica kareli* is known from ca. 500 m to ca. 2400 m elevation and spans thereby from lowlands to upper mountain forest.

Preimaginal stages: Unknown, but see under *C. luzonica luzonica;* most likely they will be similar.

Discussion. The differences to the other subspecies are so conspicuous that originally we intended to describe *kareli* as a separate species. It was only the presence of *leyteana,* which appears to be transitional in some (not all!) characters between *luzonica* and *kareli,* that changed our mind. Nevertheless, we still think that *kareli* may well be a separate species, with clear genitalia differences.

C. l. kareli is known from nearly all over the large island of Mindanao (only the Zamboanga Peninsula is not reported). Remarkable is the presence of *C. trifenestrata* in the same province of S-Mindanao (S-Cotabato). The two species have not yet been found at the same places, but Mt. Busa and Salacafe are not far apart. *C. l. kareli* and *C. mindanaensis* have been found at the same places on Mt. Kitanglad in Bukidnon (N-Mindanao).

Cricula mindanaensis NÄSSIG & TREADAWAY, 1997

NÄSSIG (1995 a): *Cricula* spec. nov. 1 (undescribed).

Cricula mindanaensis NÄSSIG & TREADAWAY (1997, Nachr. entomol. Ver. Apollo N.F. 17 (4): 346). HT ♂ via CWAN in SMFL (GP 877/95, SMFL-Nr. 4154), examined. l.t.: Mindanao, Bukidnon, Mt. Kitanglad, S slope, Intavas, 1200 m.

D: Mindanao, known only from the type locality: Mt. Kitanglad, Bukidnon. DM 7.

ED: None.

Material studied (all from Mindanao): see the paratypes list (2 ♂♂) in NÄSSIG & TREADAWAY (1997 a). Additional specimens: 1 ♂ in CRLN, like the PT, only discovered later. 1 ♂, Mindanao, Bukidnon, Mt. Kitanglad, 26. XI. 1997, CCGT, GP 1195/98.

Figured: Imago in Col. pl. 5: 28. Genitalia in B&W pl. 6: 22; pl. 21: 135 (♂).

A monotypic paraspecies: it is similar to *C. quinquefenestrata* ROEPKE, 1940 from Sulawesi, Indonesia.

Description and diagnosis. A small species (♂♂ lfw. 34.3 mm ± 1.56 SD, n = 5; min. 33 mm, max. 36 mm), smaller than the ♂♂ of the *luzonica*-group, with a dark, dull brownish colouration and an extended fw. apex. The hw. fenestrae are usually very large (larger than in *C. luzonica*), sometimes basally slightly indented, and the fw. fenestrae are larger and

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more in number (3–6) compared with *luzonica kareli* (usually 1, with a second one just indicated above; rarely up to 3 or 4). The hw. postdiscal fascia is often outwardly bordered with some whitish scales (similar to *Cricula elaezia* JORDAN, 1909 or *C. agria* JORDAN, 1909). The vesica (only one small bulbus to the ventral-left side, with the ductus ejaculatorius ventrally everting to the ventral-right side) is totally lacking any tips, cornuti or sclerotization. Differences with *C. luzonica* are found in size, wingshape, colouration and pattern; the known specimens of *C. mindanaensis* lack the orange scales on most parts of the wing which are so characteristic for most specimens of *C. luzonica*. The ♂ genitalia of *C. mindanaensis* are typical for the *elaezia*-group with a big, hollow ("spoon-like") harpe, small and rounded valves, small wings of the collare, and a short and broad sella; the uncus is much less deeply bifurcate than in the *luzonica*-group. Differences with the very variable Sulawesian *C. quinquefenestrata* are more complicated; besides the most common orangy colour variants of *quinquefenestrata* which are unknown, at least so far, in *mindanaensis*, the main differences are found in details of the wing pattern and genitalia morphology: the aedeagus is slightly smaller in *mindanaensis;* the harpe of the valve, however, is larger. *C. quinquefenestrata* also has a larger wingspan on average (most specimens have a lfw. just slightly below 40 mm). *C. mindanaensis* is known only from Mt. Kitanglad in Mindanao, while *C. quinquefenestrata* is an endemic of Sulawesi.

The ♀ of *C. mindanaensis* is unknown.

Individual variability. The two ♂♂ in CWAN and CCGT and the specimens in CRLN are externally quite similar: small, dark purplish brown, with a falcate fw. apex, and the hw. window always large. Differences are found mainly in the number of the fw. fenestrae (varying from 3 to 6) and in the genitalia: The sella may be nearly undivided (GP 877/95, HT, B&W pl. 6, Fig. 22) or distally bifurcate (GP 1195/98, B&W pl. 21, Fig. 135); genitalia variability generally appears to be relatively high in ♂♂ of *C. mindanaensis* and *C. quinquefenestrata* (NÄSSIG unpubl.).

Phenology. The few specimens were collected in VIII./IX. and X. only.

Altitudinal distribution. Only some specimens carry altitudinal data: ca. 1200–1700 m elevation on Mt. Kitanglad.

Preimaginal stages: Unknown; even the larvae of the relatively well-known related species *C. quinquefenestrata* (Sulawesi) and *C. elaezia* JOR-

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DAN, 1909 (Sundaland) are still unknown, except a few vague notes by KALSHOVEN (1981) and deductive observations by U. & L. H. PAUKSTADT (1993 a), both on *C. elaezia.*

Discussion. When *C. mindanaensis* was described, there was some doubt according the accuracy of the labelling of the type series (see NÄSSIG & TREADAWAY 1997 a: 345, footnote 6). This doubt was removed when in III. 1998 another specimen was received (collected 1997) from a fully independent source. There are now two dissected specimens (the HT and the 1997 specimen) and three further ♂♂ (2 ♂♂ PT in CRLN and CRBP, one additional [non-PT, because identified later] ♂ in CRLN; these specimens in CRLN and CRBP were not dissected according to the wish of the owners) confirming the identity and full species status of *Cricula mindanaensis.* It is zoogeographically quite interesting that there are three *Cricula* species on Mindanao, one is a close relative of a Sulawesian and a Sundanian species (possibly with sister-group relationships as follows: [*elaezia*/[*quinquefenestrata*/*mindanaensis*]]), one (*luzonica*) is an endemic of the eastern islands of the Philippines[35] (Luzon, East Visayan and Mindanao regions of the Philippines), which appears presently to be in the process of further speciation, and one is a member of the widespread *trifenestrata* complex.

One important question about the relationships within the *elaezia*-group of *Cricula* remains open: how did the three species *elaezia* (Sundaland), *quinquefenestrata* (Sulawesi) and *mindanaensis* (Mindanao) evolve? Relationships of the scheme [Sundaland/[Philippines/Sulawesi]] are also known in other groups (see HOLLOWAY [1998]), but these often include further members within other areas, while the outgroup of the *elaezia*-group as a whole is still unidentified.

The province of Bukidnon, especially the mountain range of Mt. Kitanglad (which is the highest peak in a big range) is zoogeographically quite interesting; two of the rarest insular endemic saturniid species of the Philippines are known from this mountain range only: *Lemaireia schintlmeisteri* and *C. mindanaensis.*

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[35] Another example of a species restricted to the eastern Islands of the Philippines (i.e., to the Luzon, East Visayan and Mindanao regions) is *Pachliopta mariae* SEMPER, 1878 (Papilionidae), known with three subspecies from Luzon, Polillo, Samar, Leyte, Bohol and Mindanao (see TREADAWAY 1995: 17). There are further examples.

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Genus *Antheraea* Hübner, [1819]

Antheraea Hübner ([1819] 1816, Verz. bek. Schmett.: 152). TS: *Phalaena mylitta* Drury, 1773, by subsequent designation by Kirby (1892, Synonymic Cat. Lepid. Heteroc. **1**: 759).

Remark: According to the dominating interpretation of more than a century of publications (see, e.g., Hampson [1893], van Eecke 1926/1930, Seitz 1928, Nässig et al. 1996), *mylitta* (from N India) is considered to be a junior subjective synonym of *paphia* Linnaeus, 1758. However, Aurivillius (1882) and Rothschild (1895) interpreted the situation differently: according to them, the Linnean type specimen of *paphia* (which is said by Aurivillius and Rothschild to be deposited in the Museum of Queen Ludovica Ulrica in Uppsala, Sweden[36]) originates from Ambon. If this would be true, then *rumphii* C. & R. Felder, 1861 would be reduced to a synonym of *paphia*, and *mylitta* would have to be re-established as the oldest name from N India. Linnaeus himself (1758: 496), however, described *paphia* as existing in Guinea (Africa) and cited the pre-Linnean works of Petiver and Catesby (the former illustrating an African species of *Imbrasia* sensu lato, the latter depicting the North American *Antheraea (Telea) polyphemus* (Cramer, 1775)) as sources. Linné's description is too short and ambivalent to give a clear identity. Other, again diverging, opinions on this problem were published by Westwood (1850), who uses *paphia* as an older synonym of the American *A. polyphemus*, and Karsch (1892), who interpreted *paphia* as being an African species. Bouvier (1936), however, treated *paphia* and *mylitta* as two distinct Asiatic species, with the following synonyms, for *paphia: rumphii, jana, celebensis, platessa* [sic!] etc.; for *mylitta: cingalesa* etc. The matter is highly complicated and requires intensive study and a search for the type specimen(s) (in case there are any; Linné may well have written the description only based on the Catesby and Petiver books!) in the Linnean collection, today in London and in Sweden, or other contemporary collections. This problem can probably only be finally settled by a ruling of the ICZN; the best solution might perhaps be to suppress the name *paphia*, to avoid further problems on three continents.

This is most likely the genus with the largest number of species of all Saturniidae in Asia, with some further species in North and Central America (Nässig 1991 a). It is well defined (and surely monophyletic) by a very peculiar synapomorphic construction of the male genitalia: The valves are deeply bipartite, with a soft, hairy ventral lobe and a sclerotized dorsal branch, usually with specialized distal bristles. The transtilla has enormously developed dorsal protuberances, the labides[37], often also carrying specialized terminal bristles. The whole armature is withdrawn under the 8th tergite, which in most species is transformed into a sclerotized "hood", which is connected to the tegumen by a sclerotized middorsal, mostly bifurcate "superuncus". This hood seems to play a rôle in the pairing at least in some species. In the subgenus *Antheraeopsis* it almost fully encircles the tegumen

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[36] The question whether this really was the one or one of possibly several Linnean "type specimen(s)" remains open; possibly Linnaeus did not have a real specimen before him when writing the text. — Thanks to U. Brosch and U. Paukstadt for their information and support on this problem.

[37] Singular: labis.

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and has a ventrolateral clamping function for the armature (fully and closely surrounding the ventral, bulbous part of the valves with a second sclerotization). In many species there are large amounts of densely packed hair-like scales in soft pouches of the intersegmental membrane under the "hood" The long and hard apical bristles of the peculiar dorsal branch of the valves and (sometimes) of the labides (these very peculiar transformations of the transtilla) reach into these pouches. The most plausible explanation is that these hair-like scales are some kind of a male (contact-?) pheromone system used during courtship and/or pairing. A detailed study is still lacking. Often the genitalia morphology is very similar in related species, and therefore in many species-complexes the borderlines between morphologically defined species cannot be drawn with certainty at present (see, e.g., NÄSSIG 1991 a, NÄSSIG et al. 1996, HOLLOWAY et al. 1996, U. PAUKSTADT et al. 1997 b). Not surprisingly, for most of the taxa we do not have enough data to characterize them as biological or evolutionary species.

The subdivision of the genus *Antheraea* into three subgenera follows NÄSSIG (1991 a) and NÄSSIG et al. (1996). These three subgenera appear to be sufficiently characterized as monophyletic taxa[38] Only two of the three subgenera are known from the Philippine islands; *Antheraea (Telea)* is known only from the Himalaya and America.

Subgenus *Antheraeopsis* WOOD-MASON, 1886

> *Antheraeopsis* WOOD-MASON (1886, Ann. Rep. Indian Mus. 1885–1886: 21). TS: *Saturnia assama* WESTWOOD, 1848 (a junior synonym of *assamensis* HELFER, 1837, according to current interpretation), by monotypy.

This subgenus is surely monophyletic; it is defined by several apomorphic character states in the ♂ genitalia (most remarkable: the apical part of the labides of the transtilla is moveable[39] and can be folded in medioventrally; a unique construction in the family!), while the larval morphology retains several plesiomorphic characters (see NÄSSIG et al. 1996). This moveable

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[38] While most of the species-groups, -subgroups, "clusters", and other complexes below that subgeneric level are presently no more than an informal aid for preliminary classification. Due to the preliminary and supposedly ephemeral chracter (at least some of these groups will not prove to be monophyletic!) of these groups it was never intended to propose these names as taxonomically valid taxa on the genus-group level; such acts would have to wait for a phylogenetic revision, including type studies. These group names were therefore always meant in the sense of Art. 1 (b) (6) of ICZN (1985).

[39] The mobility and the active movements of this distal part can easily be seen when live specimens are observed from the ventral side under a binocular microscope; even easier, when a freshly killed (with the injection of a small amount of an ammonium and nicotine solution into the thorax) specimen, where the anal end of the abdomen is still moving a little, is observed while the valves are opened by slightly sqeezing the abdomen with the fingers. When one has seen these active movements and the moving axis before, it is easy to test the mobility of dissected, macerated genitalia during the preparation process.

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distal part of the labides seems as well to have some function in connexion with the hairy scales in the intersegmental pouches; often the cavity formed by the moveable tip and the base of the labis is totally filled with the supposed pheromone scales. The situation within the subgenus is still problematic, especially on the Asiatic continent. Evidently there are a few more species involved than generally accepted, but due to the partly difficult accessibility of the type specimens (most species will supposedly already have a name) the identity of the continental members of the group remains obscure for the time being. The Sundanian population, known from the large islands of Sundaland except Palawan, was interpreted as a subspecies of the Indian *assamensis* Helfer, 1837 by Holloway (1987) and of the continental *castanea* Jordan, 1910 by Nässig et al. (1996), but we think now that the Sundanian population should be interpreted as a separate species: *A. (Ao.) youngi* Watson, 1915, **stat. rev.** as separate species[40]

Antheraea (Antheraeopsis) paniki Nässig & Treadaway, n. sp.

Holotype: ♂, "Philippinen, N-Luzon, Ifugao, Mt. Pulis, 16 km SSE Bontoc, 17°02′ N. L., 121°01′ E. Br., Nebelurwald, primär, 1900 m, 9. ii.–13. ii. 1988, leg. Černý & Schintlmeister; (23)", "coll. W. A. Nässig, Mühlheim/Main", via CWAN in SMFL, SMFL-no. 4164. See Col. pl. 7, Fig. 45.

Paratypes (in total 178 ♂♂, 16 ♀♀): **Luzon** (in total 19 ♂♂, 4 ♀♀): 1 ♂, N-Luzon, Ifugao, Kiangan, J. Settele, 6. ix. 1985. 1 ♂, Ifugao, Mt. Pulis, 16 km SSE Bontoc, 17°2′ N, 121°1′ E, 2000 m, Černý & Schintlmeister, 23. ix. 1988, GP 1128/97. 8 ♂♂, 1 ♀, Ifugao, Banaue, 1000–1200 m, Settele, Vermolen, Černý & Schintlmeister, different dates in 1988, GP ♂♂ 997/96, 1127/97. All these in CWAN. 8 ♂♂, 2 ♀♀, Ifugao, Banaue, 3000–3700 ft., "1988", 15. iii. 1988, 26. iii. 1988, 16. v. 1988, 1. xi. 1988, 23. ii. 1989, 18. ii. 1990 (♀), 17./18. v. 1990 (♀), 23. xi. 1990, 19. ii. 1991. Achilles et al. 1 ♂, Mt. Polis, 1900 m, 6. x. 1994. 1 ♀, N-Luzon, Benguet, Fort del Pilar, street light, 17. v. 1987. All these in CCGT. **Mindoro** (in total 48 ♂♂, 3 ♀♀): 1 ♀, "Mindoro Isl.", i.–ii. 1979, CWAN. 6 ♂♂, Mt. Sinai, iii. 1995, ii. 1996, iii. 1996 (2×, GP 1112/97), 15./16. iii. 1996 (2×), CCGT. 9 ♂♂, 2 ♀♀, Mt. Halcon, iv. 1993, x. 1993, xii. 1996 (3 ♂♂, 1 ♀), 25. v. 1997 (♂), 26. v. 1997 (♀), 25. ix. 1997 (3 ♂♂), 1000 m (1 ♂, all other without elevation data), CCGT. 3 ♂♂, Mt. Halcon, 5., 16., 22. iii. 1997, CMBH. 2 ♂♂, Mt. Halcon, 4. xi. 1996, 14. iii. 1997, CSNB. 5 ♂♂, "nr. Mt. Halcon", ix. 1996, 4. ix. 1996, 12. iii. 1997, 22., 21. iii. 1997, CUBH. 1 ♂, Mt. Halcon, iii. 1997, GP 0644 A/B Paukst., ex CMBH in CUPW. 1 ♂, "nr. Mt. Halcon", 23. iii. 1997, ex CUBH in CUPW. 8 ♂♂, Mt. Halcon, 1500 m, 18.–26. xii. 1997. 13 ♂♂, Mt. Halcon, 1000 m, ii./iii. 1998. All these in CUPW (1 ♂ will go into CRLN). **Negros** (in total 54 ♂♂, 6 ♀♀): 2 ♂♂, Negros Oriental, vic. Liptong/Valencia, ca. 9°15′ N,

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[40] The differences between the Sundanian *youngi* and its relatives on the Indochinese Peninsula north of the Malayan Peninsula both in external characters (size, colouration) and in ♂ genitalia morphology are so significant that today (in contrast to Nässig et al. 1996) we think it a more plausible explanation to interprete these taxa as specifically distinct. Further research is necessary to clear the situation in S-Thailand, where *youngi* and its relatives may possibly meet. The correct names for the continental populations, however, still remain to be assessed. – Thanks to U. Paukstadt for discussion here.

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123°15′ E, 14. x. 1988, 200 m, (90), Settele & Vendiola. 1 ♂, Negros Oriental, way to Mt. Talinis, ca. 9°16′ N, 123°12′ E, 15. x. 1988, 1000 m, (91), Settele & Vendiola. All these in CWAN. 1 ♂, S. Negros, Amlan Hydro, 16. iv. 1974, GP 1116/97. 1 ♂, Mambucal, 18. x. 1989, GP 1115/97. 1 ♀, Mt. Canlaon, 25. xi. 1995. 10 ♂♂, Mt. Canlaon, xi. 1991, 23. xi. 1993, 1. x. 1994, 6. vii. 1995, 3. ix. 1996, 5. xii. 1996, 12. iii. 1997, 12. vi. 1997, 750 m (1×, all other without elevation data), 20., 24. ix. 1997. 4 ♂♂, Mt. Canlaon, 6.–14. viii. 1997. 4 ♂♂, Mt. Kanlaon (= Canlaon), 1000–1200 ft., 2.–7., 23., 24., 25. i. 1998. 1 ♂, Mambucal, 23. ix. 1992. 1 ♂, [Bais], Mt. Malindog, xi. 1984. 3 ♀♀, Negros Or., Bais, Mt. Tindug-Bato, 5. xii. 1997 (2×), 3. i. 1998. All these in CCGT. 2 ♂♂, Mt. Kanlaon, W-Route via Mambucal, 820 m, 15. vii. 1996. 11 ♂♂, 2 ♀♀, Mt. Kanlaon, W-Route via Mambucal, 1010 m, 17.–18. vii. 1996. 5 ♂♂, Mt. Kanlaon, W-Route via Mambucal, 600 m, i. 1997. 4 ♂♂, Mt. Kanlaon, Mambucal, 600 m, iii. 1997. All these in CRBP. 6 ♂♂, Mt. Kanlaon, W-Route via Mambucal, 600 m, ix. 1997, CRBP (3 ♂♂) + CMWM (3 ♂♂). 1 ♂, "Negros", 900 m, 17. ii. 1998, CUPW. **Panay** (in total 4 ♂♂): 2 ♂♂, [Antique], Mt. Madja-as, 22./23. iv. 1997, CCGT. 2 ♂♂, Aklan, Mt. Malindog, 600–800 m, v. 1997, CRBP. **Samar** (in total 25 ♂♂): 2 ♂♂, Bagacay, 1000 ft., GP 1129/97, ex CCGT in CWAN. 23 ♂♂, Bagacay, i. 1978, iv. 1980 (22×), GP 1113/97, CCGT. **Leyte**: 3 ♂♂, Mt. Bolog, 1140 m, 10 km E Mahaplag, vi. 1997, CRBP. **Homonhon**: 3 ♂♂, Magellanus, [0–30 m], v. 1988, 2× CRMG (GP 1111/ 97), on loan in CCGT; 1× CCGT. **Mindanao** (in total 22 ♂♂, 3 ♀): 1 ♂, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, Talakag, 7°53′ N, 123°54′ E, 31. xii. 1991–2. i. 1992, Černý, CWAN. 4 ♂♂, 2 ♀♀, Bukidnon, Mt. Kitanglad, ix. 1995 (Intavas, 500 ft.[?]); (5000–6000 ft.): 12. x., 20. x., 10. xii. 1995, 24. iv. 1997 (♀); (above Intavas, 6000 ft.): 3. xi. 1991 (♀, Col. pl. 7, Fig. 44). 1 ♂, Bukidnon, Mt. Kalatungan, 5. vii. 1997. 1 ♂, N. Davao, Mt. Tagubod, 4500 ft., 16. viii. 1996, GP 1114/97. 2 ♂♂, [N-]Cotabato, Mt. Apo, 25. ii. 1994; 8. iii. 1994 (1600 m). 1 ♂, S-Cotabato, Mt. Busa, 11.–16. vi. 1997. 3 ♂♂, S-Cotabato, Mt. Matutum, ii. 1996. All these in CCGT. 2 ♂♂, Cotabato, Sumangani Prov., Mt. Busa, near Kainba, 700 m, viii. 1997. 2 ♂♂, Davao del Sur, Mt. Apo, SE-Route via Kapatagan, 1570 m, 10.–12. vii. 1996. 1 ♀, Bukidnon, Mt. Kitanglad, S-side, Intavas, 2200 m, 15. viii.–15. ix. 1993, Sinjaev. All these in CRBP. 1 ♂, Surigao del Sur, Tandag, Hitaub Creek, 500–600 m, 16.–19. iv. 1995. 4 ♂♂, Surigao del Sur, Carmen, 600–650 m, 21.–24. iv. 1996. All these in CRMG.

D/ED: see below. Endemic to the Philippines.

Etymology: The name comes from the Tagalog word for "bat": "paniki". This large, dark species has some resemblance to a bat when arriving at the light at night.

This distinctive species cannot be confused with any other Philippine saturniid species. It is the largest species of the subgenus *Antheraeopsis*. The character description see below for the nominotypical subspecies. It was a bit of a surprise for us that this conspicuous, large species was not discovered and described before. Although it is evidently not a rare species today, is was not published as part of the Philippine fauna before, except a short notice by Nässig et al. (1996)[41] *Antheraea paniki* is an endemic species of the Philippines and has two well-defined subspecies:

At the time of writing this 1996 publication, the Philippine specimens were not yet dissected and studied in detail, and the Philippines were out of the scope of that book.

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Antheraea (Antheraeopsis) paniki paniki Nässig & Treadaway, 1998

D: Known from the islands Luzon, Mindoro, Negros, Panay, Samar, Leyte, Homonhon, and Mindanao. On Palawan there is a separate subspecies, see below. DM 8.

ED: None.

Figured: Imagines in Col. pl. 7: 44, 45. Genitalia in B&W pls. 8 & 9 (♂).

Description and diagnosis. (See Col. pl. 7, Figs. 44 [♀], 45 [♂].) Lfw. see Tab. 20. A large Saturniidae species with a dark ground colour varying from a lighter chestnut-brown to a dark, deep purplish chestnut-brown.

The fw. of the ♂♂ has an extended apical hook showing a squared end for practically all specimens and with a substantially concave termen. The fw. costa is cream from the base to the end of the straight part (approximately $^2/_3$ of its length). The creamy band is continuous across the prothorax from one costal base to the other. There is a curved very dark brown, almost black SML (possibly a close parallel combination of the postdiscal fascia and the submarginal fascia?) stretching from the inner margin to the apex, which has distally a cream coloured edge and proximally a few bright scales and a shadow-like, diffuse blackening of the postdiscal area. This proximal black "shadow" is abruptly, at approximately a 90° angle, bent proximally back from the former direction to the costa at the subapical vein (probably vein R_4 according to Pruscha 1985: 95, in *A. yamamai*). The distal part of the SML is leading into the apex, but fading away in the apical area. Between the bent part of the "shadow" line, the costa, and the further proceeding part of the SML there is a whitish to light lilac triangular patch, quite a contrast in the dark surrounding. The submarginal field is of a distinctly lighter brownish colour than the median and basal part of the wing, more so for the fw. than the hw. That part of the median area which lies just below the bent part of the "shadow" line, extending towards the wing base, sometimes tends to show a lighter colour (dark orangy-brownish) than the other parts of the median and basal area. The postbasal line is blackish, basally sometimes with a few white scales, curving from the inner margin to the basal beginning of the discoidal cell at the costa. That small part of the basal line which is found within the first third of the cell with some offset to the main part of the basal fascia shows always a contrasting white patch basally; sometimes a fairly big white triangle. The hw. also has a narrow submarginal chestnut-brown band with black edges. Distally this sinous band is edged with a faint creamy colour. The basal black portion of the band loops around the hw. eyespot anteriorly, often disappearing near the

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anterior margin. The fw. eyespots are practically always without a hyaline centre. They are largely orange or dark orangy-brown, with a few blue or white and some black scales basally; rarely this remnant of the eye-like pattern is totally lacking, but sometimes it may be more prominent. The hw. ocelli usually have a tiny, narrowly elongate elliptic clear window in the centre along the discoidal vein. Further, usually almost the full basal half of the eyespot is dark brown to black, with a more prominent whitish to bluish lunule inwardly. The fw. ocellus is rarely, the hw. ocellus usually encircled with a thin black line.

Table 20: Forewing length of *Antheraea (Antheraeopsis) paniki*. Material of colls. SMFL, CCGT, CMBH, CUBH, CWAN.

Anth. paniki Island	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Luzon	♂♂ ♀♀	89.1 94.3	3.32 5.56	20 4	79 89	92 100
Mindoro	♂♂ ♀♀	91.5 97.7	3.85 6.66	18 3	85 90	98 102
Negros	♂♂ ♀♀	88.5 99.4	3.70 4.16	15 3	81 96	94 104
Samar	♂♂	88.2	4.49	15	80	95
Mindanao, Homonhon	♂♂ ♀♀	86.9 96	3.15 –	12 1	82 –	92 –
ssp. *paniki* together	♂♂ ♀♀	89.0 96.7	3.96 5.14	80 11	79 89	95 104
Palawan (ssp. *sahi*)	♂♂	79.8	2.06	4	78	82

The ♂ **genitalia** (see B&W plates 8 & 9) of *A. paniki paniki* are at least as large as those of the Sundanian *A. youngi*. Differences to *youngi* are as follows: In *paniki paniki*, the ventral branch of the valves is more clearly bilobate (in *youngi*, the ventro-distal portion of the ventral branch is not so strongly segregated from the dorso-distal tip). The labides of *paniki* are larger; especially the distal, moveable part is broader, not constricted and usually flattened (in *youngi*, this distal, moveable part is smaller, more rounded instead of flattened and clearly constricted between the insertion and the tip). The shape of this distal part of the labides is quite variable individually (see B&W pl. 9, figs. 41–50), but the differences between *paniki paniki* and *youngi* are always clear; for *paniki sahi* see below.

The main differences between *A. paniki paniki* and its Sundanian and continental relatives are in the shape of the ♂ fw. apex and the genitalia

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morphology. Also, *A. paniki paniki* is on average darker and larger than the Sundanian *youngi*. The dark orange form known from the population of N-Thailand (and interpreted there as a dry-season form) is not known for *A. paniki* (but it is as well not known for the Sundanian *A. youngi*).

The ♀♀ show considerable sexual dimorphism compared to their mates[42] They have basically the same ground colour as the ♂♂ though none seem to match the darkest ♂♂. In size they are also variable but on the average are larger than the ♂♂ (sometimes significantly) and certainly so when considering wing area. The fw. apex is not as falcate as in the ♂♂, but there is a clear small apical point. The usual ♀ colour is brown to dark brown on which the triple submarginal (or closely parallel postdiscal + submarginal?) colourful fascia (inwardly white, then sandy brown with white scales, then yellowish or creamy) really stands out. In the fw., the apical area is similar to the ♂♂, but with many more white scales covering almost the entire apical area. The postbasal lines of all wings are also more intensively edged with creamy to white scales and stand out in the wing more prominently than in the ♂♂. The marginal area of all wings is usually not lighter than the median and basal areas. The wing ocelli for the ♀♀ are somewhat larger than for the ♂♂, having on average less orange filling. The basal black and white pattern of the fw. eyespot is more prominent than in ♂♂. The hw. ocellus is outwardly much darker, nearly of the ground colour of the median area.

Insular and individual variability. There is some individual variability; besides minor pattern variation (e.g., sometimes slightly more conspicuous blackish fasciae in specimens from Negros) mainly in the ground colour, which may be lighter (more orangy) or darker (blackish brown). But there appears not to be any important insular variability (much less than in, e.g., *Actias philippinica*) except on Palawan, see below.

Phenology. According to the material in collections, there are two abundance peaks through the year (Tab. 21): in (March/)April and July. But specimens can be encountered in any month.

Altitudinal distribution. The elevation data ranges from about sea level to ca. 1900 m (Text-Fig. 6). The available data is relatively sparse, but it appears that the species prefers lowlands and intermediate elevations.

And the ♀♀ of several *Antheraeopsis* species have sometimes been described as new taxa in association with quite different species, see under the synonymies listed in HOLLOWAY (1987) or NÄSSIG et al. (1996).

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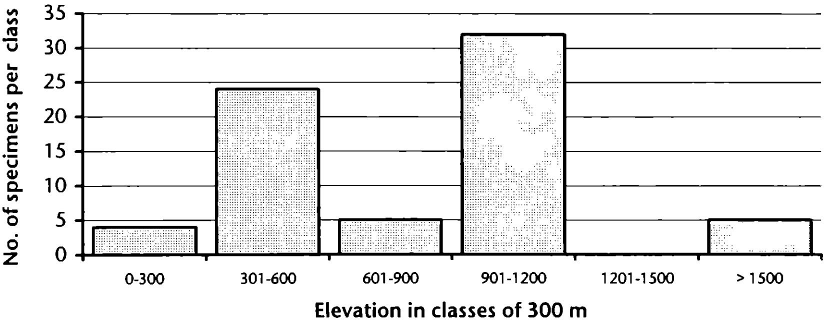
Preimaginal stages: Still unknown for both subspecies of *A. paniki*. The larva of the related species *A. ?castanea* Jordan, 1910[43] from N Thailand was illustrated by Nässig et al. (1996: Appendix I, pls. 1, 2, 6, 7), that of *A. "assamensis* (Helfer, 1837)" (= *formosana* Sonan, 1937[44]) from Taiwan by Wang ([1994]) and Peigler & Wang[45] (1996). Further citations see in Nässig et al. (1996). The caterpillars will most likely be oligophagous for plants of the family Lauraceae, as this appears to be the main foodplant family for the subgenus *Antheraeopsis* (see, e.g., Thangavelu et al. 1988: 10; see also Nässig et al. 1996).

Table 21: Phenology data (collecting dates) of *Antheraea (Antheraeopsis) paniki paniki* from different islands or regions (n = 135). Geographical or climatical effects not separated, dubiuos specimens excluded.

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Luzon	0	5	2	1	3	3	0	3	3	1	2	0
Mindoro	1	1	7	1	3	0	0	0	2	1	1	4
Negros	5	0	6	1	0	1	16	3	4	6	4	2
Samar, Homonhon	1	0	0	18	3	0	0	0	0	0	0	0
Mindanao	1	3	1	6	0	2	3	1	0	2	1	1
All islands	8	9	16	27	9	6	19	7	9	10	8	7



Text-Fig. 6: Altitudinal distribution of *Antheraea (Antheraeopsis) paniki paniki* on the Philippines, data from 70 specimens, all islands combined. Not all elevation classes were comparably as often visited! Minimum is ca. 300 m, maximum is ca. 1900 m a.s.l.

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[43] The correct name and identity of this population is unclear presently.

[44] The Himalayan *assamensis* and the Taiwanese *formosana* are surely not conspecific, according to their genitalia morphology. *A. (Ao.) formosana* is definitively a separate species on the morphospecies level, see Nässig et al. (1996).

[45] Wang in Peigler & Wang (1996: 220, bottom left) repeated a photographic identification error which was already published by Wang ([1994]: 49, bottom): the caterpillar depicted as "*A. pernyi*, 3rd instar" in fact is a larva (in penultimate or, probably, ultimate moult) of *A. formosana* from Taiwan. Larvae of *A. pernyi* are quite different in appearance, see, e.g., the illustrations in Nässig et al. (1996).

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Discussion. This large and very distinctive subspecies is widely distributed on the Philippines except on Palawan (separate subspecies, see below) and, as far as presently known, in the Sulu Region. No constant differences between the different islands were detected.

Antheraea (Antheraeopsis) paniki sahi Nässig & Treadaway, n. ssp.

Holotype: ♂, "Phil. 10 May 1993, Palawan S., nr. Brooke's Point; *A. youngi* [sic], leg. Roy", "Collection C. G. Treadaway", GP 1109/97, CCGT, assigned to SMFL, SMFL-no. 4163. See Col. pl. 7, Fig. 47.

Paratypes (in total 3 ♂♂): 1 ♂, "Philippines, Palawan, Port Barton, June/July [19]95? [sic], leg. Colin Walker", SMFL. 2 ♂♂, Mt. Matalingahan [sic], 800 m, xii. 1997, leg Bal, CRBP.

D: Known only from Palawan. DM 8.

ED: None.

Etymology: The name comes from the Cebuan word "sahi": "different from the rest" The new subspecies *sahi* is not only different from the Sundanian *A. youngi*, but also from the other Philippine populations of *A. paniki*.

Figured: Imago in Col. pl. 7: 47. Genitalia in B&W pls. 8 & 9 (♂).

Description and diagnosis. (See Col. pl. 7, Fig. 47.) Lfw. ♂: 79.8 mm ± 2.06 (n = 4; single data: 78, 78, 81, 82 mm; see Tab. 20). Palawan specimens are noticeably smaller than the nominotypical populations, with a lighter, slightly more reddish chestnut-brown ground colour as well as a less prominent hooked apical area almost lacking the squared end.

A. paniki sahi resembles the Sundanian *youngi* and, to some degree, continental species of *Antheraeopsis*. However, the shape of the apex is posteriorly a little more extended in *sahi* than in the Sundanian and continental taxa. The main differences between *A. paniki sahi* and the Sundanian *A. youngi* are found in the ♂ genitalia: although the armatures of *sahi* are distinctly smaller than in the nominotypical subspecies (and also smaller than in the Sundanian *youngi*), the distal, moveable part of the labis is flattened and broad as in *paniki* and not round, narrow, and partly constricted as in *youngi*. – The ♀ of *sahi* is unknown.

Individual variability. The two specimens known (the specimens in CRBP were not seen by us) are very similar; the Port Barton one is damaged (with one hw. almost totally missing) and does not allow a detailed comparison.

Phenology. The 4 ♂♂ were collected in May, "June/July" and December (2×).

Altitudinal distribution. No data available, except for the material in CRBP: 800 m elevation.

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Preimaginal stages: Still unknown, see above.

Discussion. There was for several years only one specimen from Palawan available to us; therefore we originally did not intend to describe it. But now, after Andreas Zwick mediated the second (worn) specimen to us in late summer 1997, we found that the differences (size, wing shape, especially in the apex, genitalia) are well-expressed and sufficient to describe this Palawan population as a separate subspecies. General genitalia morphology (with the flattened distal moveable process of the labis) indicates clearly that this taxon does not belong to the Sundaland members of *Antheraeopsis*. The differences in external morphology as well as in genitalia to both the Sundanian *youngi* and the Philippine *paniki paniki* are so large (and intermediates are unknown thus far) that *sahi* may quite likely be another separate species; further material is to be awaited for a more detailed study. The material in CRBP was brought to our knowledge just before going to press and was not seen by us.

A. paniki sahi on first glance appears to be a parallel case to *Actias philippinica bulbosa*, except that there evidently is no *Antheraeopsis* on Sulawesi and further to the East, in contrast to the *maenas*-group of *Actias* (which makes it likely that the evolutionary and distributional pathways of these two species-groups were nevertheless different).

Subgenus *Antheraea* Hübner, [1819]

Antheraea Hübner ([1819] 1816, Verz. bek. Schmett.: 152). TS: *Phalaena mylitta* Drury, 1773, by subsequent designation by Kirby (1892, Synonymic Cat. Lepid. Heteroc. **1**: 759).

This subgenus is the most species-rich within the genus. Its monophyly is indicated by several characters (see Nässig et al. 1996), but a thorough phylogenetic analysis of the group is still lacking.

Notes on some unidentified Philippine *Antheraea (Antheraea)* larvae

In February (rearing A) and July (rearing B) 1988, respectively, two batches of *Antheraea (Antheraea)* eggs from the Philippines were sent to Germany (W.A.N.). Regrettably, neither the ovipositing ♀♀ were marked as such on the envelope, nor did the larvae result in imagines. Therefore, the identity of the two rearings remains obscure. However, a description and illustration of the larvae appears to be helpful for a future identification, when the same taxon can be reared again. – For the recommended methodology of identification of ovipositing females, see Nässig et al. (1996: 113–114).

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Figured: Preimaginal instars in Col. pls. 17: 136–138 (= no. B below); 19: 151–162 (= no. A below).

A) The rearing of February 1988: In late February 1988 some eggs were received from A. Schintlmeister, most likely collected on Luzon (?, no data accompanying the ova). The eclosed larvae (Fig. 151) clearly belonged to the *paphia/frithi*-group of species, indicated by their typical pattern. The larvae were fed with evergreen *Pyracantha coccinea* and *Rosa* sp. (Rosaceae), but only one of them grew successful into the last instar. Due to the participation at the SEL congress in San Remo of 1988, an infection occurred in the rearing, and by late April the last larva died without spinning a cocoon.

Description: L_1 (Col. pl. 19, Figs. 151 [just hatched], 152/153 [in first moult]): The dorsal scoli on A8 fused basally, but the bristle-bearing coloured tops still separate. Prothoracic dorsal and subdorsal scoli (within the prothoracic plate) on both sides fused. The substigmal scoli on T1 and (less obvious) A9 elongated; this character (especially on T1) in the first instar appears to be quite common in the *paphia/frithi*-group and is known from at least *A. rumphii* (L. H. Paukstadt et al. 1996 a), *A. cordifolia* (L. H. & U. Paukstadt 1997 a), *A. rosieri, A. cingalesa* and *A. gschwandneri* (Nässig et al. 1996: 130). – Ground-colour of body, when newly hatched, deep orangy yellow, later (after feeding) turning brighter yellow. Head, thoracic legs and little black shields laterally on the prolegs deep shining black, unified prothoracic shield, anal plate and anal prolegs deep velvety black. Laterally, especially on the abdominal segments (on thorax only weakly so), with a conspicuous black pattern: intersegmental area yellow, then a broad deep black dash before and behind the scoli, which are yellow and standing in a median yellow ring (the spiracles are contained in the black zone). Dorsally, only thin dark brownish rings before and behind the scoli are visible connecting these black pattern elements of the two sides. Sublaterally, an additional small and short black dash, which is not connected across the dorsal side with its partner of the other side, is found at the cephal begin of the segment.

L_2 (Col. pl. 19, Figs. 154–157): ground colour yellow. Head dark brown, with a bright brownish "face". Prothoracic shield, anal prolegs and some of the scoli (individually variable) especially on thorax and at the rear end blackish; other scoli (and the bases of the black scoli) reddish orange. The black lateral pattern is gone; the supraspiracular lateral stripe is already faintly developed. – Ca. L_3 and L_4 not photographed due to absence.

Ca. L_5 (probably last instar) (Col. pl. 19, Figs. 158–162): ground colour yellowish green, with the typical pattern of *Antheraea (Antheraea)* larvae: yellow supraspiracular lateral stripe, triangular brown anal patches, bordered with whitish yellow, etc. Below the supraspiracular stripe, the abdominal (brown) spiracles are cephally accompanied by a brighter (nearly whitish) patch. Scoli very much reduced; lateral and dorsal abdominal ones mainly bright bluish, with a very few short bristles and one longer hair; dorsal ones on the thoracic segments brighter, whitish blue, with a yellowish corona. The dorsal ones on A8 basally slightly fused. Intersegmental between T1 and head dark brown, but prothoracic shield now bright (nearly whitish) yellow. Head with a blackish brown band on both sides; front dorsally bright sandy brown, with blackish brown patches. Secondary hairs on the body sparse, very short, yellow.

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The caterpillar is in all instars quite similar to that of *Antheraea (A.) gschwandneri* from Sumatra (see illustrations in Nässig et al. 1996), but differs from it by having bluish instead of red scoli, and in a few more details.

B) The rearing of August 1988 (Col. pl. 17: 136–138): In August 1988, some ova of an *Antheraea*-♀ from Palawan were received, collected by J. Settele[46] The L_1 larva is similar to that of the other rearing, see above (with some differences in details like the shape and extent of the black pattern). – Only one larva eclosed from the ova. This single L_1 caterpillar did not accept any of the foodplants offered (*Quercus robur*, Fagaceae, *Rosa* sp., Rosaceae, and a few more) and died after some days.

The L_1 larvae of the two rearings were so similar that they possibly may have belonged to the same species. However, the only *Antheraea (Antheraea)* species common to both Palawan and Luzon would be *A. larissa* (the eggs from Palawan were named "possibly *larissa*" by Settele); but on the other side the mature caterpillar of the February rearing does not at all agree with the pictures of *larissa larissa* published by Holloway (1987, with longer secondary hairs and prominent silvery air-filled patches), and thus it appears quite unlikely that this could be *larissa*. It appears more plausible that the larvae were possibly those of the closely related species *A. semperi* and *A. gulata*, although there is no resemblance whatsoever between the mature larvae of the February rearing and the illustration published by Semper (1896: larval col. pl. C, fig. 8) – which, in fact, is surely inaccurate. Another alternative would be that the Palawan stock was *A. gschwandneri zwicki* and the Luzon one again *A. semperi*.

Therefore, the identity question of the two rearings must remain open for the time being, although we think these two rearing attempts may have been larvae of *A. semperi* from Luzon and *A. gulata* or *A. gschwandneri zwicki* from Palawan.

The Philippine species of *Antheraea (Antheraea)*

The first species is a member of the surely monophyletic *helferi*-group *sensu* Nässig (1991 a). This group is especially defined by the "upper eyelid" of the hindwing ocellus and by the morphology of the L_1 larvae (Nässig et al. 1996).

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[46] It is unlikely that these ova were layed by the ♀ paratype of *A. gschwandneri zwicki* listed in the paratype list as having oviposited, because this specimen was collected in early July. This would mean a development time of the eggs of at least 4 weeks, which would be unusually long for tropical *Antheraea*.

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Antheraea (Antheraea) halconensis Paukstadt & Brosch, 1996

Antheraea halconensis Paukstadt & Brosch, 1996 (Entomol. Z. **106** (12): 516), HT preliminarily in colls. CUPW (genitalia slide) and CUBH (specimen), not examined (but illustrated in the description); l.t.: Mindoro, Mt. Halcon.

Antheraea (Antheraea) halconensis: Lampe et al. (1997)[47]

D: Known from Luzon, Mindoro, Negros, Panay, Samar, Leyte, Bohol, Mindanao. DM 9. ED: None.

Material studied: **Luzon:** 12 ♂♂, 4 ♀♀; **Mindoro:** 3 ♂♂; **Negros:** 7 ♂♂, 3 ♀♀; **Panay:** 3 ♂♂, 2 ♀♀; **Samar:** 1 ♂, 1 ♀; **Leyte:** 22 ♂♂, 22 ♀♀; **Mindanao:** 2 ♂♂, 5 ♀♀ (details see in the list of Lampe et al. 1997). Additional specimens received after submission of that manuscript: **Mindoro:** 2 ♂♂, 2 ♀♀ (1 ♂, 2 ♀♀ Mt. Halcon, 13. x. 1996 [♂], 4. ii. 1997, 1. iv. 1997; 1 ♂, Mt. Sinai, 25. ii. 1997, all in CCGT). **Negros:** 1 ♂, 1 ♀, Bais, 600 ft. (200 m), 18./19. x. 1997, CCGT. 7 ♂♂, 2 ♀♀ Mt. Canlaon, viii./ix. 1997, CCGT. **Bohol:** 1 ♂, 1 ♀, Bilar, 400 ft. (130 m), the ♀ with a very strong blackish pattern, especially on the undersides of the wings, 22./23. ix. 1997, CCGT (new island record). **Mindanao:** 13 ♂♂, S. Mindanao, S. Cotabato, Mt. Busa, 11.–18. vi. 1997; 1 ♂, dto., 6. ix. 1997, all in CCGT. – Further specimens in CRLN, CMBH, CUBH, CUPW, etc.

Figured: Imagines in Col. pls. 7: 46, 48, 49; 8: 50, 51. Preimaginal instars in Col. pl. 18: 139–150. Genitalia in B&W pl. 10 (♂).

Description and diagnosis. (See Col. pls. 7: 46, 48, 49; 8: 50, 51.) Lfw. see Tab. 22. The ♂♂ are quite variable in colour and pattern which seems to bear some relationship to the island of origin moving from North to South. In general over the Philippines, ♂♂ vary from a ground colour of yellowish brown to reddish brown (always with a pinkish tone to it) and exceptionally a greyish brown. The fw. termen is obviously concave, leading to an apical hook. The veins of both wings, but to a greater extent the fw., are quite often clearly indicated by being a dark brown. The fw. submarginal line [= SML in the following] can be a single dark brown to black, more or less straight line but slightly curving towards the apex, or a brown sinuous line outwardly concave between the veins. In both cases with, for a number of specimens, a faintly duplicated closely parallel second line. In every case there is a small black triangular patch, outwardly bordered with white and, to a variable extent, pink or red scales, where the SML joins the costa. The submarginal area for all specimens more or less matches the ground colour. However, this field may or may not have the veins marked in brown for these specimens where the veins stand out. The dark bar connecting the fw.

This paper was originally intended to describe the species then published as *halconensis* by Paukstadt & Brosch under another name. Our unpublished manuscript name ("aureorubescens", after the colourful ♀♀) was already repeatedly used in correspondence and can still be found on several genitalia slides and labels in the authors' collections. Due to communication problems, our colleagues Paukstadt & Brosch then published their description of *halconensis* a few weeks before we intended to publish our text.

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ocellus to the costa along the vein can be substantial and black with or without the sandy brown streak and pinkish edging below (rarely also above, where it is usually just black alone); it is found in most specimens, including such which otherwise do not show the „dark veins" pattern, but in some of these it is very faint. (In related species like *helferi* Moore, 1859 or *rosemariae* Holloway, Nässig & Naumann, 1995 this connection between the eyespot and the costa is only rarely developed, and usually much less conspicuous.) This particular marking varies considerably, both individually and across the Philippines, where for some islands this connection is merely a slightly darker brown colour for the vein or even the same brown as the veins generally. However, in many specimens the pattern is more elaborate, with more than one colour, and in some specimens even the vein below the cell may also show at least an indication of this pattern. The fw. ocelli are often slightly smaller than the hw. ocelli. The clear window in the centre varies from almost non-existant to being an obvious circular small patch. The Mindoro specimens show a more intensively coloured band around the clear window – red inwardly and sandy yellow distally. The hw. ocelli vary as the fw. ocelli, but have the striking black "eyelid". The fw. and hw. postbasal lines are present in all specimens but can be purple, brown or black and with or without an inward red and/or violet tinge. For some specimens, especially from Mindoro, the basal area has a reddish flush, and sometimes a yellow patch along the costa. The ♂♂ from Luzon and Mindoro are somewhat outstanding, see below under the insular variability.

Table 22: Forewing length of *Antheraea halconensis*. Data from Lampe et al. (1997, based mainly on the material of colls. SMFL, CCGT, CWAN). Additional new data (received after the publication of Lampe et al. 1997) only from Mindoro included.

A. halconensis Island		lfw. [mm] (average)	± SD	n
Luzon	♂♂ ♀♀	74.7 74.0	1.79 1.41	11 2
Mindoro	♂♂ ♀♀	76.2 81.0	1.72 1.41	6 2
Panay	♂♂ ♀♀	79.0 82.5	3.60 3.54	3 2
Negros	♂♂ ♀♀	79.8 85.0	1.94 3.00	6 3
Samar	♂♂ ♀♀	81 87	– –	1 1
Leyte	♂♂ ♀♀	79.1 83.0	3.36 4.38	22 22
Mindanao	♂♂ ♀♀	81.5 86.3	7.78 2.87	2 4

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The ♂ **genitalia** (the ♀♀ have not yet been examined on a broad base) see on Pl. 10 and also in PAUKSTADT & BROSCH (1996) and LAMPE et al. (1997). The outer horizontal diameter of the whole tegumen ring is in *A. halconensis* (ca. 3.3 mm) slightly larger than in *A. rosemariae* (ca. 3.0 mm), but distinctly smaller than in *A. helferi* (ca. 4.0 mm). Differences between these species are found, apart from the size, in the distal teeth on the aedeagus (present in *helferi* and *halconensis*, lacking in *rosemariae*), in the shape and relative size of aedeagus and uncus, in the shape of the valves and labides, and as well in the shape and the intensity of the sclerotization of the dorsal "hood" of the 8th tergite. These differences are constant and clear.

All the ♀♀ across the Philippines have a similar orangy yellow ground colour. The fw. termen is only very slightly, if at all, concave such that the apex is pointed. A majority of the ♀ specimens has the wing veins lined with black, with some being quite obvious so, others only vaguely or not at all. The fw. SML is black, usually straight, but broadening apically when approaching the costa and giving the appearance of elongate triangular patches. The SML can be banded distally by a fine white or maroon, then fine red, pink or violet line or by a shading in these colours. The hw. SML is also black and parallel to the hw. termen. However, this red or violet sinuous shading especially for the hw. can be for a few individuals quite substantial. The broad submarginal field varies in colour with most individuals. It can be the same as the wing ground colour, or slightly more orange, to orange, to a beautiful deep orange, sometimes shaded with red ("aureorubescens") or black scales. In specimens with such a deep orange submarginal field, the red sinuous shading of the SML can be sometimes very elaborate. The connection between the fw. ocellus and the costa, as for the ♂♂, varies from a narrow but firm black line bordered below with red, to a slight black line with or without a faint red indication, to no indication of any special connection. The fw. and hw. ocelli are about the same size and larger than for the ♂♂. Usually the fw. ocellus has a larger clear window than the hw. ocellus. The Mindoro ♀♀, just as the ♂♂, have more colourful ocelli with much more noticable and beautiful red inwardly from the clear window. For all specimens the black "eyelid" over the hw. ocelli is clearly visible. The fw. and hw. postbasal lines are a red or a light to dark reddish brown; for the fw. usually reaching the costa but sometimes not, while for the hw. never. The variations listed above occur on all islands from which we have specimens with the exception that the Mindoro are the most colourful and with the brightest red.

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For both sexes of *A. halconensis* visual separation from all other Philippine Saturniidae is simple and safe through the presence on the hw. ocelli of the striking black "eyelid".

Insular and individual variability. See also Lampe et al. (1997). For the individual variability see also in the general description. – There are two populations within the Philippines which appear to stand out a little from the other populations:

- The first one is that of **Luzon,** which is smaller than the others (see Table 22, Text-Fig. 7), exhibits reduced variability (only one main colouration as well as pattern in the ♂♂: only bright pinkish brown with dark veins), and shows rather minor differences in the genitalia (in the Luzon population, the whole armature is slightly smaller, the transtilla is smaller, and its apical process shorter). The differences in size and colour pattern are minor and may perhaps best be interpreted as adaptations to a mountain environment (Lampe et al. 1997).
- The second one is the population of **Mindoro** (known only from the Mt. Halcon area[48] thus far) which has colourful uniform reddish-orangy brown ♂♂ (which exhibit no genitalia differences to other ♂♂ from the southern Philippines) without the "dark venation" pattern[49] and a more reddish inner (basal) lunule of the wing ocelli in both sexes; the ♀ of this population is illustrated here for the first time (Col. pl. 8, Fig. 50). Often the eyespots are also more colourful on the underside. However, both of these insular populations fit well into the variability range of the other populations. The Mindoro specimens, for example, would fit quite well within the populations of the southern Philippines, especially of Mindanao.

Both the Luzon and Mindoro populations appear to have a very much reduced variability, with only one, rather uniform, form for each sex known thus far on each island. In contrast, the populations of islands other than Luzon and Mindoro are quite variable and show a wide range of colour and pattern variation (see illustrations in Lampe et al. 1997), especially in ♂♂. However, the differences between the insular populations are – in our opinion – no more prominent than those found between insular populations of, e.g., *Actias philippinica philippinica;* therefore, we do not think presently that a description of subspecies is necessary.

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[48] Mt. Sinai is close to Mt. Halcon.

[49] The first two ♂♂ from Mindoro showing this "dark venation" pattern were received in early 1998 by L. H. Paukstadt (*in litt.* 17. iii. 1998, with photograph), which again narrows the morphological "gap" between the insular forms. – Thanks to L. H. and U. Paukstadt for their cooperation.

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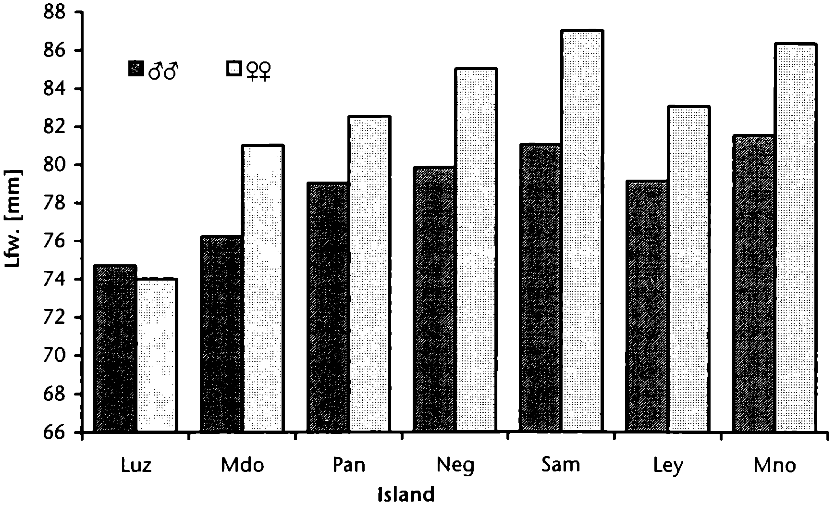
♂♂ from **Panay** and **Negros** can be yellow brown, reddish brown and grey brown, some with the veins clearly marked, others with the veins poorly indicated but for most specimens the veins are not obvious. The ♂♂ from **Leyte** and **Samar** we have are large and vary from a light yellowish brown to a lighter reddish brown. The specimens from **Mindanao** most often do not show the darkened veins. Their ground colour is most often dark reddish brown, but occasionally yellowish brown ♂♂ also occur.

The length of forewing in *A. halconensis* significantly decreases from the South to the North (Lampe et al. 1997). Calculation of Spearman's rank correlation coefficient (forewing length versus latitude of collecting locality) gives for ♂♂: $r_S = -0.4975$, $p < 0.0002$ [n = 49], and for ♀♀: $r_S = -0.3785$, $p = 0.0014$ [n = 34] (see also Text-Fig. 7 and Tab. 22). We do not yet have a convincing interpretation for this fact, besides that such a size gradient appears to be a general rule for other Lepidoptera species at least at higher latitudes (see, e.g., Nylin & Svärd 1991 for European butterflies).



Text-Fig. 7: Lfw. of different populations of *A. halconensis*, sorted by islands and sex. Standard deviation and n see Table 22. Data from Lampe et al. (1997), with recently received specimens from Mindoro supplemented. Abbreviations of the island names see Treadaway (1998, in this issue).

Phenology. (Tab. 23.) This species has been found in all months. The "gaps" of fewer specimens per month may perhaps reflect either differences in the insular climate or collecting artifacts caused by travelling times.

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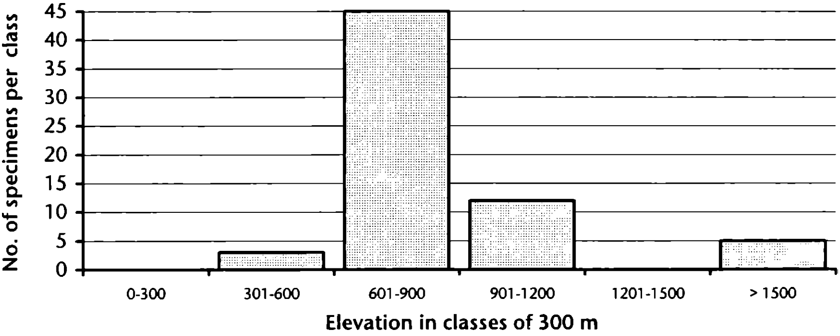
This species, however, was collected in such quantity (as only for a few of the other species) that there appears to be a chance for a more in-depth analysis of the flight pattern by islands (and by clima zones) in future, especially when further specimens become known.

Table 23: Phenology data (collecting dates) of *Antheraea (Antheraea) halconensis* from different islands or regions and for the entire material available (n = 130). Geographical or climatical effects not separated, reared or dubiuos specimens excluded. Not all islands were visited in all months over the years!

Island\Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Luzon	0	7	5	0	2	3	1	0	0	0	0	4
Mindoro	0	3	3	1	1	0	1	0	1	2	0	3
Negros	0	0	0	0	0	7	0	2	7	2	0	0
Panay	0	1	3	0	0	0	0	0	0	0	1	0
Samar, Leyte, Bohol	8	7	9	6	3	0	0	0	10	1	0	4
Mindanao	0	1	2	2	1	13	0	0	1	1	1	0
All islands	8	19	22	9	7	23	2	2	19	6	2	11

Altitudinal distribution. (Text-Fig. 8.) Specimens are known from ca. 300 m to ca. 2600 m.



Text-Fig. 8: Altitudinal distribution of *Antheraea (Antheraea) halconensis* on the Philippines, data from 65 specimens, all islands combined. Not all elevation classes were comparably as often visited! Minimum is ca. 305 m, maximum is ca. 2575 m a.s.l. (the class "> 1500 m" consists of: 2× 1600 m, 2× 1830/1900 m, 1× ca. 2575 m).

Preimaginal stages: The complete life-cycle of the Luzon population was described in detail and illustrated by Lampe et al. (1997); this plate is repeated

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here (Col. pl. 18, Figs. 139–150). Compare with other *helferi*-group larvae illustrated by HEPPNER et al. (1990), NÄSSIG et al. (1996, additional citations therein), L. H. & U. PAUKSTADT (1996 a), and PEIGLER & WANG (1996).

The L_1 larva shows the typical pattern of the *helferi*-group, but the yellow ground colour is quite dark in comparison to the other taxa. Later instars are generally similar to the rearing of West Malaysian *A. helferi* illustrated by NÄSSIG et al. (1996), but somewhat less yellowish. The suprastigmal lateral stripe is more prominent by a reddish borderline dorsad, enhancing the cryptic countershading, which is lacking in *helferi*. There is not very much similarity to the Sulawesian *A. rosemariae* (larval instars described by L. H. & U. PAUKSTADT 1996 a), which is the most outstanding larva within the *helferi*-group known today (with, e.g., comparatively long secondary hairs and a strongly reduced suprastigmal lateral stripe).

Discussion. *A. halconensis* shows similarities to the Sundanian and continental *A. helferi*, especially in larval and external morphology, while the genitalia are more similar to *A. rosemariae* from Sulawesi. This *helferi*-group of species may be another example of closely related species along the "chain" Sundaland–Philippines–Sulawesi (see also HOLLOWAY [1998]) and then into the Moluccas[50] and/or the Lesser Sunda Islands (as in *Actias* of the *maenas*-group and possibly in *Samia*), although there is no member of the *helferi*-group known from Palawan thus far. Further, the *helferi*-group has more species in Sundaland and on the continent than for the other examples. A detailed phylogenetic analysis of the evolution of the group (presently thought to consist of nine species, see LAMPE et al. 1997, NÄSSIG & SCHULZE 1997, NAUMANN & NÄSSIG 1998) is yet lacking.

The next species was classified by NÄSSIG (1991 a) and NÄSSIG et al. (1996) into a separate, monotypic species-group, but perhaps will have to be included into the *paphia/frithi*-group after a phylogenetic analysis.

Antheraea (Antheraea) rosieri (TOXOPEUS, 1940)

> *Loepantheraea rosieri*[51] TOXOPEUS (1940, Entomol. Meded. Ned.-Indië 6: 59). HT (by monotypy and original designation) not examined, in MZB, Bogor? l.t.: Sumatra.

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[50] See NAUMANN & NÄSSIG (1998) for the Moluccan members of the *helferi*-group.

[51] TOXOPEUS (1940 c: 59) described the species after a single specimen collected by "Miss C. M. Th. J. ROSIER" (but without an explicite dedication to her). Therefore the spelling "*rosieri*" could be interpreted as an ***incorrect original spelling***. In that case it must be corrected to *rosierae* (ICZN 1985: Art. 32 (c), (d)). However, as Miss ROSIER evidently had a relative called "J. P. ROSIER" (because this person — probably male? — published a paper beginning subsequently to TOXOPEUS' paper on the same page as his paper ends), it appears feasible that TOXOPEUS in fact dedicated his new species to a ***male*** member of the ROSIER

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Loepantheraea rosieri: ALLEN (1981), HOLLOWAY [*in* BARLOW] ([1983]), LAMPE (1984, 1985).
Antheraea rosieri: HOLLOWAY (1987), NÄSSIG et al. (1996).

A. rosieri is a Sundaland species reaching out northward into Thailand and Burma. The single Mindanao record is discussed below. Apparently, the population of Palawan is slightly, but constantly different from the other populations, justifying its description as a separate subspecies:

Antheraea (Antheraea) rosieri imeldae NÄSSIG & TREADAWAY, n. ssp.

Holotype: ♂ [yellowish form], "Philippines, Palawan, Napsan, Mt. Salakot, 700 m, 19./20. II. 1996, leg. J. S. PETERSEN", "Collection C. G. TREADAWAY", SMFL-no. 4166, in CCGT, assigned to SMFL (Col. pl. 8, Fig. 52).

Paratypes (in total 49 ♂♂, 1 ♀, all from Palawan): 2 ♂♂ (dark, yellow), S-Palawan, Mt. Mantalingajan, GP 1086/97, 18. IV. 1990. 1 ♂, S-Palawan, near Brooke's Point, 12. V. 1993. 3 ♂♂ (2× dark, 1× yellow), Palawan, Napsan, Salakot Falls, 330 m, GP 1063/97, 1085/97, 23.–25. III. 1996, 8. VIII. 1996 (2×). 1 ♂ (dark, Fig. 53), C-Palawan, Mt. Salakot, 350 m, 20. III. 1996. 4 ♂♂ (3× dark, 1× yellow), S-Palawan, Sandurapi Peak, 400 m, 15.–17. IV. 1997. All these in CCGT. 2 ♂♂ (dark, yellow), N-Palawan, S. Vicente, 20 km NEE [sic!] Roxas, 400 m, 12./17. I. 1988, CWAN. 2 ♂♂, Salakot Falls, 300 m, 1.–19. III. 1996; 1 ♂, same locality, 23./24. III. 1996, CAZS. 28 ♂♂ (12 dark, 16 yellow), 1 ♀ (dark), Mt. Matalingahan [sic], 800 m, XII. 1997, leg BAL, CRBP. 3 ♂♂ (2 yellow, 1 dark), Mt. Magcasaw, 600–900 m, Mainit, Brooke's Point, 3.–6. XI. 1996, leg. BAL, CRBP. 1 ♂, Mt. Salakot, 700 m (B. TURLIN), CSNB. 1 ♂ (yellow), Palawan, Mantalingajan, Pinigisan, 600 m, 13. IX. 1961 (mercury light, 18:00 h–2:00 h), Noona Dan Exp. 1961/62, ZMUC.

Additional material, no paratype: 1 ♂, "Mindanao, summer 1992", GP 1089/97, CSNB.

D: Palawan. DM 10.

ED: None for the new subspecies. The nominotypical subspecies is known from Sundaland, Thailand, and Burma. A single, somehow dubious record (trader's material) from "Mindanao" (CSNB), see discussion.

Etymology: The new subspecies is named after Imelda, the wife of Roy RODRIGUEZ, Palawan, who collected the first specimens of this new taxon that came into C.G.T.'s hands.

Figured: Imagines in Col. pl. 8: 52, 53. Genitalia in B&W pls. 11 & 12, figs. 54–65 (♂).

Description and diagnosis. This is a comparatively small saturniid species (lfw. ♂♂ 47.0 mm ± 2.43 S.D., n = 20; min. 43 mm, max. 51 mm; see Tab. 24) which, despite its variability, cannot be confused with any other species on the Philippines. The overall ground colour of the ♂♂ varies from almost completely greyish brown (in fresh specimens with a greenish tint) to light yellow with brown markings (mostly the extremes are found, intermediates

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family. Considering, first, this uncertainty and, second, the fact that all authors using TOXOPEUS' name never doubted the spelling, we prefer, in accordance with the Preamble of the Code ("The object of the Code is to promote stability and universality in the scientific names of animals"), not to change anything here.

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between yellow and brown, showing transitional proportions of brown obscuring the yellow, appear to be rare on Palawan). The fw. is sharply hooked apically and has a small but distinct white patch at the apex. All forms of the ♂♂ have, for the fw., a submarginal brown line which for some darker specimens is edged distally with pale lilac to white. For these specimens, the submarginal area is of a lighter brown colour. The SML stretches from the hind margin in a slight curve to the apical area where the submarginal area is much narrower (much less than half the width on average) than at the tornal angle. Yellow specimens show the usual pattern of wing fasciae of *Antheraea* (of the *frithi*-group) more completely, in tones of dark greyish-brown to purplish-brown, on all wings. In all ♂♂, the [M_3 + Cu] stem vein below the fw. discoidal cell is covered with dark scales forming a narrow line. However, all specimens have, instead of the usual Saturniini wing ocelli, a series (an “archipelago”) of small, irregular eyespots – for the fw. usually 2-4 and for the hw. 2-3 – with only exceedingly small clear windows (with some ocelli being without any hyaline centre).

The only known ♀ is dark, lfw. 58 mm; we have not seen it due to late arrival.

Differences with the nominotypical Sundanian *rosieri* are externally only minor. *A. r. imeldae* ♂♂ tend to be either decidedly yellowish or greyish-brown, intermediate specimens are obviously much rarer than in Sundaland. The white apical patch is on average more prominent in *imeldae*. The main differences between the two subspecies are found in the ♂ genitalia (see B&W pls. 11 & 12, figs. 54-65): The genitalia of the nominotypical subspecies appear on average slightly larger and more massive and “bulky” than those of *imeldae*. The aedeagus of *r. imeldae* is slightly shorter than that of *r. rosieri*. The ventral branch of the valves has basally a lobe which is in the nominotypical subspecies (Figs. 57-61) on average larger and tends to be more quadrangular, while in *imeldae* (Figs. 62-64) it is smaller, more fragile and usually triangular. In the Sundanian subspecies, the dorsal branch of the valves tends to bear slightly larger bristles and often one more than the Palawan subspecies. The dorso-caudal juxta spine (the protuberance above the anellus or aedeagus sheath) is on average more strongly bent and more massive in *r. rosieri* than in *r. imeldae*.

There is some individual variability; perhaps the most reliable differences appear to be the length of the aedeagus and the general size relationships of the genitalia in direct comparison. In all cases, the singleton from Mindanao fits better to the nominotypical subspecies rather than to *imeldae*. The over-

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all size of the specimens (measured as the lfw.) of the Sundanian populations (including ssp. *imeldae*) does not differ significantly from island to island, while the Burmese specimens appear to be larger than the rest (see Tab. 24).

Table 24: Length of forewing of *Antheraea rosieri imeldae* compared with Sundanian and continental *A. rosieri rosieri* (material from mainly CCGT, CWAN and SMFL with a few additions).

Taxon/Area (♂♂ only)	average lfw. [mm]	± S.D.	n	minimum [mm]	maximum [mm]
A. rosieri imeldae					
Palawan	47.0	2.43	20	43	51
A. rosieri rosieri					
Sumatra	45.4	0.58	3	45	46
Borneo	43	–	1	–	–
West Malaysia	46.0	2.94	4	43	50
Thailand	47	–	1	–	–
Burma	51.3	1.71	4	49	53
Total *A. rosieri rosieri*	47.3	3.35	13	43	53

Individual variability. The individual variability is mainly expressed in the ground colour (yellow with dark pattern or dark; intermediates are rare) and in the size. Most Palawan specimens available to us are quite worn, and a detailed analysis of the variability should await more and fresh material.

Phenology. The distribution over the year (Tab. 25) is somewhat uneven, but the small numbers (perhaps caused mainly by the small number of expeditions spent on Palawan) will probably not allow a safe interpretation of the number of generations per year.

Table 25: Number of specimens of *Antheraea rosieri imeldae* collected per month (n = 49).

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of specimens	2	0	5	6	1	0	0	2	1	0	3	29

Altitudinal distribution (Text-Fig. 9). Collecting on Palawan took mainly place in the lower areas; the mountains are largely unexplored. Evidently, *A. rosieri imeldae* is not a species of the coastal areas on Palawan. As a comparison, Sundanian specimens are known from ca. 50 m to ca. 1500 m elevation. Thus further specimens of *imeldae* may be expected from higher localities on Palawan.

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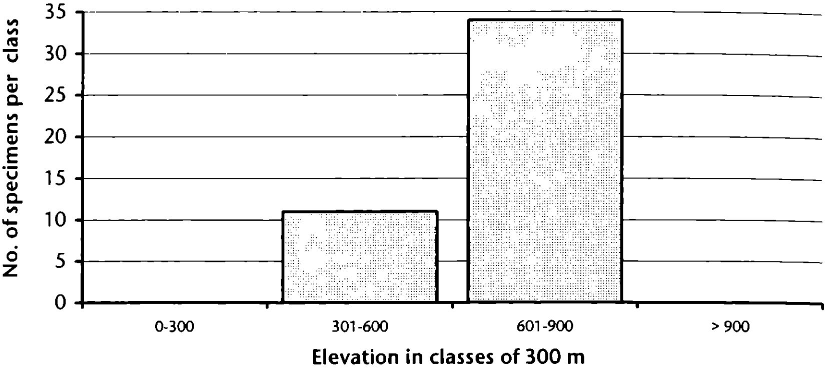
Preimaginal stages: Except a few words about the L_1 larva of the Sumatran population of *rosieri* s. str. (Nässig et al. 1996: 130), nothing is known.



Text-Fig. 9: Altitudinal distribution of *Antheraea rosieri imeldae* on the Philippines (Palawan), data from 45 specimens. Not all elevation classes were comparably as often visited!

Discussion. *A. rosieri imeldae* is a somewhat weakly defined subspecies on Palawan of a Sundanian species. It is adviseable to have a closer look on the northern (Burmese) population of *rosieri*, which is larger than the Sundanian population; its status remains to be assessed. This appears to be a parallel case to the increase in size of *A. larissa larissa* in Thailand and Burma, compared with Sundaland.

The singleton with label "Mindanao" in CSNB may either be a mislabelled trader's specimen from Sundaland, or it may possibly belong to a population of the Sundanian *A. rosieri* having invaded Mindanao directly from Borneo via the Sulu Archipelago. The genitalia (GP 1089/97) are larger than those of ssp. *imeldae*, similar to nominotypical *rosieri*. For a conclusive interpretation of the situation on Mindanao more and reliably labelled material would be necessary. – We received information so lately about the material in CRBP (which arrived in early 1998) that this was not seen and studied in detail by us.

The following five species belong to the *frithi*-subgroup of the *paphia/frithi*-group sensu Nässig (1991 a). This group as a whole is the most species-rich subdivision of the genus and still offers a lot of problems (Nässig et al. 1996, U. Paukstadt et al. 1997 b). It appears to be a paraphyletic residue (it

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can at present be defined only by characters which must be considered to be plesiomorphies or at least do not appear to be clear apomorphies), and a thorough study will be necessary to analyze the phylogenetic relationships within this complex. Within the Philippines, these species may tentatively be subdivided into three morpho-typologically defined "clusters"[52]:

1. *A. larissa,* which is a well-defined polytypic cladospecies. No species or species-group at this time has been reliably identified as the direct sister-group.
2. *A. semperi* and *A. gulata,* which are closely related and form, together with *A. brunei* Allen & Holloway, 1986, and possibly *A. alleni* Holloway, 1987 (both from Borneo), a cluster of small species, defined by their smaller ♂ genitalia (similar in shape to the following cluster of taxa).
3. *A. platessa* Rothschild, 1903 and *A. gschwandneri zwicki,* which have ♂ genitalia structurally very similar to the preceding group, but larger (ca. 20–50 % on average). Further species of the "big genitalia type" are, besides others, *Antheraea (Antheraea) paphia* (Linnaeus, 1758) (i.e., *mylitta*?), *frithi* Moore, 1859, *moultoni* Watson, 1927, *celebensis* Watson, 1915, and *rumphii* (C. Felder, 1861).

The *Antheraea*-species of the *frithi*-group with the "small genitalia" are fewer in number, largely allopatric, and each species has a comparatively small distribution range. In contrast, under the "big genitalia" taxa there are several widely distributed species (or species-complexes) (see especially *A. platessa, A. frithi*), and many of the species overlap in their distribution.

Therefore, it seems likely that the "big genitalia" type is the older and plesiomorphic construction within the *paphia/frithi*-group, and the deviations from that groundplan will most likely be the apomorphic character states. This viewpoint is further supported by the fact that the *helferi-* (in part) and the *pernyi*-groups basically show the same groundplan and size of the ♂ genitalia.

Antheraea (Antheraea) larissa (Westwood, 1847)

Saturnia larissa Westwood (1847, Cabinet of Oriental entomology: 49). ST/HT probably in Oxford Zoological Museum, UK (not examined). l.t. [Indonesia], Java.

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[52] Another such provisional cluster would be that of the Sulawesian species except *celebensis*, see Holloway et al. (1996). – These "clusters" of *Antheraea* species will probably not all be monophyletic; they are only tentative and informal aids for a preliminary classification (Art. 1 (b) (6) of ICZN 1985). Further, for many of the taxa involved we do not yet know whether they are real biological species, or something below that level. It appears that these questions cannot be solved with the methods of classical morphology alone; additional studies of activity patterns, pheromones, DNA-analyses, etc., but also of preimaginal morphology and behaviour, will be necessary (see Holloway et al. 1995, 1996; Nässig et al. 1996, Treadaway & Nässig 1997, U. Paukstadt et al. 1997 a, 1997 b).

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= *Antheraea ridlyi* [sic] MOORE, 1892: Ann. Mag. Nat. Hist. (6) 9: 452, l.t. N-Borneo.
= *Antheraea delegata* SWINHOE, 1893: Ann. Mag. Nat. Hist. (6) 12: 210, l.t. Singapore.

A polytypic cladospecies, well defined by the unusual external appearance. Revisional notes on the species were published by TREADAWAY & NÄSSIG (1997). Three allopatric subspecies are currently recognized: *A. larissa larissa* on the Asiatic continent (Peninsular Malaysia, S-Thailand and S-Burma) and on Sundaland including Palawan; *A. larissa mindoroensis* on Mindoro; and *A. larissa philippirissa* on the other islands of the Philippines except Palawan and Mindoro (see Text.-Fig. 10). The status of the extremely large specimens from S-Burma and Thailand just north of the Isthmus of the Malayan Peninsula requires further study (see TREADAWAY & NÄSSIG 1997). A wide range of variability of the different populations and subspecies is illustrated in colour by TREADAWAY & NÄSSIG (1997). The ♀♀ of *larissa* have clear, unscaled windows within their wing ocelli which, for the fw., probably have a record diameter within the genus; this obviously correlates with the length of the discoidal cross-vein.

The specimens of *A. larissa* s. l. belong to the most beautifully coloured species of *Antheraea;* warm combinations of yellow, orange, red, brown, and violet in a typical pattern give them the special appearance. The proportions of red (or reddish-brown) and yellow (or orangy yellow) are very variable, both geographically and individually. We believe that at least some part of the individual variability is caused by seasonal aspects of the climate or just by the actual weather; supposedly drier weather during a receptive phase (probably in the pupal stage) will result in more yellowish specimens, more humid weather in darker (i.e., more reddish) specimens, similar to *Rothschildia lebeau* (GUÉRIN-MÉNEVILLE, 1868) in Costa Rica (JANZEN 1984 b). The Sundanian populations including Palawan have on average a much more orangy red appearance, while the populations from the Philippines may often appear much darker, or more contrastingly variegated. Further details of the geographical aspects of this variability are described below under the 3 subspecies.

The yellow and red scales on most parts of the upperside of (especially) the fw. are of different length and shape: yellow scales are usually of normal spatulate shape, while the red scales (especially along the fw. costal area and at the wing bases, but to a lesser extent also in other areas) are elongate, sometimes hair-like, and much longer than the normal scales. These red (or brownish) scales, therefore, form a second (upper) covering layer (in primarily yellowish specimens a proportion of the elongate scales is also

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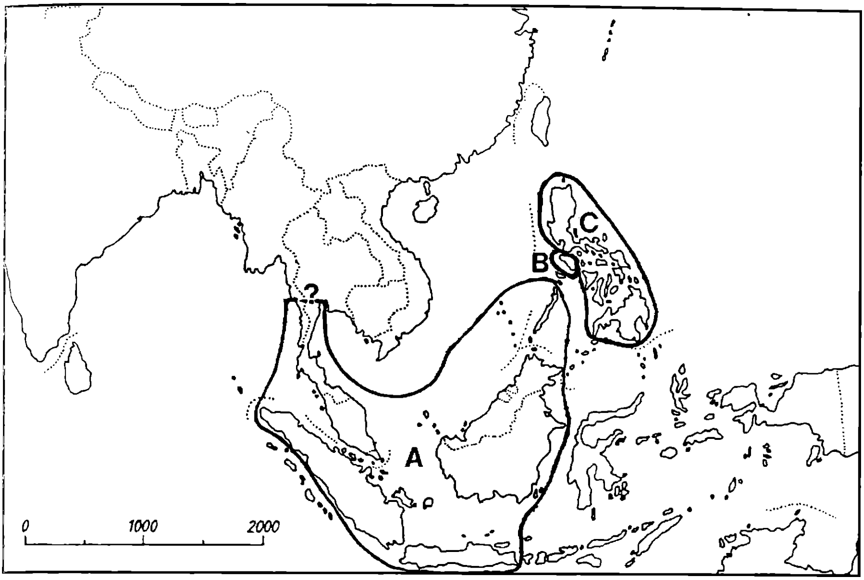
yellowish). When a specimen is worn, these covering scales are the first to be lost and leave the yellow underlayer openly visible. Worn specimens thus have often a brighter appearance and may sometimes even be asymmetrical in their colouration on both sides.



Text-Fig. 10: Distribution pattern of the subspecies of *A. (A.) larissa*, schematic. **A** = *A. larissa larissa* (northern limits in Burma and Thailand unknown); **B** = *A. larissa mindoroensis*, restricted to Mindoro; **C** = *A. larissa philippirissa*. Figure from Treadaway & Nässig (1997: fig. 1). Thus far no data are available from the smaller islands of Sundaland (e.g., Bali, Nias etc.) or the Philippines. — Scale in km. Map W.A.N.

The variability both in external and genitalia (see below) morphology within *A. larissa* is very large and caused us to interprete these populations as subspecies of one species. *A. mindoroensis* was originally described as a separate species, but there is considerable overlap in most characters with other Philippinian populations, and we do not believe that the populations are specifically distinct.

The species *larissa* as understood here is characterized by a surprisingly wide variability range of the male genitalia morphology, both in the shape of the different parts (see B&W Plates 13 & 14) and in the size (see Tread-

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AWAY & NÄSSIG 1997). Thereby the variability in size of the genitalia (measured as the horizontal width of the tegumen or – much easier to measure – as the length of the sclerotized proportion of the aedeagus) is ***not*** strictly correlated with the actual size of the specimen (measured as the lfw.); also small specimens may have large genitalia, and vice versa. For some examples see Tab. 26: The aedeagi figured in B&W Figs. 84, 86 and 88 are approximately of the same length, while the lfw. of these specimens vary from 69 mm to 82 mm. The aedeagus figured in Fig. 85 is clearly longer, while the corresponding specimen has a lfw. of only 79 mm, not as large as might be expected when there would be a strict correlation between these two measurements. Similar variability ranges are found in the nominotypical subspecies. The aedeagi of ssp. *mindoroensis* (Figs. 82 and 83), however, are always longer than in the other subspecies while the corresponding specimens are not excessively large.

Table 26: Examples of independent variability in the size of the genitalia (measured as the length of the sclerotized part of the aedeagus) and of the specimens (measured as the length of the fw.) for the two endemic subspecies from the Philippines of *Antheraea larissa*.

Taxon	B&W Fig. no.	GP no.	Aedeagus length [mm]	Lfw. [mm]	Island
larissa	84	1021/96	ca. 7.5	69	Negros
ssp. *philippirissa*	86	1053/97	ca. 7.5	75	Panay
	88	1047/97	ca. 7.5	82	Mindanao
	85	1022/96	ca. 8.5	79	Negros
larissa	82	1045/97	ca. 9.0	78	Mindoro
ssp. *mindoroensis*	83	1043/97	ca. 9.0	79	Mindoro

Preimaginal stages: Except for the illustration of 2 mature larvae of West Malaysian *A. larissa larissa* in HOLLOWAY (1987: pl. 20), nothing is known about the larva of *A. larissa* s. l.

Antheraea (Antheraea) larissa larissa (WESTWOOD, 1847)

Antherea [sic] *Larissa:* PAGENSTECHER (1890: 15, "Das vorliegende Exemplar (♀) stimmt mit der WESTWOOD'schen Abbildung und Beschreibung überein" – "the ♀ to my hands fits WESTWOOD's illustration and description"). – The deposition of PAGENSTECHER's specimen is presently unknown. However, WESTWOOD (1847: col. pl. 24) figured a ♂, not a ♀.

Antheraea larissa: SEMPER (1896: 385; possibly he did not refer to an actual specimen in SMFL, but to PAGENSTECHER's publication? No SEMPER specimen of this species is preserved in SMFL); SEITZ (1928: 512).

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Antheraea (Antheraea) larissa larissa: TREADAWAY & NÄSSIG (1997: 178, 185).

D: Palawan. DM 11.

ED: The nominotypical subspecies is known from South Burma and South Thailand (just north of the northern end of the Malay Peninsula) to Sundaland (Java, Sumatra, West Malaysia, Borneo), including Palawan (see TREADAWAY & NÄSSIG 1997).

Material studied: **Palawan:** 10 ♂♂, 2 ♀♀, CCGT, CWAN (details see in the list of TREADAWAY & NÄSSIG 1997). GP 1019/96, 1050/97, 1056/97 (further dissections from other localities). Additional specimens: 2 ♂♂, Napsan, Mt. Salakot, 1000 m, 25. III. 1998, CCGT. 1 ♂, Salakot pass, 350 m, 28.–30. VI. 1997, CSNB.

Figured: Imagines in Col. pl. 8: 54, 55. Genitalia in B&W pls. 13, 14 & 15 (♂).

Description and diagnosis. A fairly large Saturniidae species (lfw. see Tab. 27) – although the Palawan population is the smallest of the Philippines –, which, in ground colour, varies between orange and orangy red. **♂♂.** The outer field of the wings can be a little darker than the ground colour but has often practically the same colour. Between the fw. ocellus and the costa along the median vein stem M_{1+2} there is a fairly broad and conspicuous band, outwardly black and inwardly brownish or dark yellowish. The wing veins, particularly for the fw., have an orangy brown to grey brown appearance, slightly darker than the submarginal field. The fw. termen is concave leading to an obvious but somewhat blunt hook. The margin of the hw. is slightly wavy being concave between the veins. The fw. & hw. submarginal double lines (SML) are also wavy being convex between the veins. The outer SML has outwardly a bluish or greyish shading which is often more obvious for the hw. than for the fw. Parallel to the SML but more or less straight there is a somewhat diffuse orangy brown to brown median band bisected by the fw. and hw. ocelli, sometimes partly bordered on both sides by yellow patches. The fw. apical area possesses an obvious black streak at the point where the outer SML meets the costa but bordered inwardly by a yellow patch. Further, the black streak is prolonged towards the apex with a red or violet field spotted with white scales. The fw. & hw. ocelli are all about the same size and have a small either round or elliptical, sometimes drop-shaped clear window. The front legs, and often the head, body and other legs, are usually orangy-red.

♂ genitalia. The whole armature is small to medium in size, compared with other species of the genus, but with considerable variability (see above). Specifically the Palawan population on average is rather small. The "hood" of the 8th abdominal tergite is not very much sclerotized, and also the connexion between this "hood" and the tegumen (the "hyperuncus" after NÄSSIG 1991 a) is only weak. The intersegmental membrane

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between 8th and 9th segment is, especially dorsally and laterally, filled with supposed pheromone scales/hairs. Besides the aedeagus, the only strongly sclerotized part is the fully fused uncus. The variability range (in shape and size) of the different subspecies of *A. larissa* is illustrated in B&W plates 13–15. Further details see in Treadaway & Nässig (1997).

Table 27: Length of forewing of *Antheraea larissa larissa, A. l. mindoroensis and A. l. philippirissa* (data from Treadaway & Nässig 1997).

Taxon	Origin	♂♂				♀♀			
		Lfw. [mm]	n	± SE	Min./Max.	Lfw. [mm]	n	± SE	Min./Max.
larissa larissa	S-Burma, S-Thailand	84.6	14	4.57	79/91	96	1		
	W-Malaysia	78.6	5	2.19	75/80		0		
	Malay Peninsula in total	83.1	19	4.86	75/91	96	1		
	Sumatra	73.1	11	4.57	65/82	86	1		
	Borneo (Brunei)	63.0	2	5.66	59/67		0		
	Palawan	71.9	10	3.38	68/76	82	2	–	82/82
larissa mindoroensis	Mindoro	80.0	9	3.01	75/85	87.0	2	1.41	86/88
larissa philippirissa	Luzon	77.3	43	3.72	66/83	81.3	3	2.52	79/87
	Negros	74.8	25	3.14	70/80	83.2	5	6.87	76/91
	Panay	76.8	6	4.45	73/85	86	1		
	Samar	78	1				0		
	Leyte	76.8	8	5.26	72/85	86.8	5	4.66	80/91
	Mindanao	81.1	33	3.46	71/88	87	1		

The ♀♀ have as usual a greater wing area than the ♂♂. The ground colour is, on Palawan, according to the few ♀♀ known today, similar to the ♂♂, being an orangy to reddish brown (more red than brown), on average perhaps slightly darker than for the ♂♂. The wing ocelli are much larger than for the ♂♂, with the fw. ocelli somewhat larger than for the hw. The clear windows of these wing ocelli are enormously large and almost round; they reach (with their colourful outer margin) to the costa. The fw. termen is slightly concave leading to an apical point.

Individual variability. There is, in general, much variability in the different (extra-Philippinian) populations combined under the nominotypical subspecies today (see Treadaway & Nässig 1997), but the population from Palawan is, according to the relatively few specimens known, fairly uniform, both in size and colouration. This is a clear difference to some of the other islands of the Philippines, see below.

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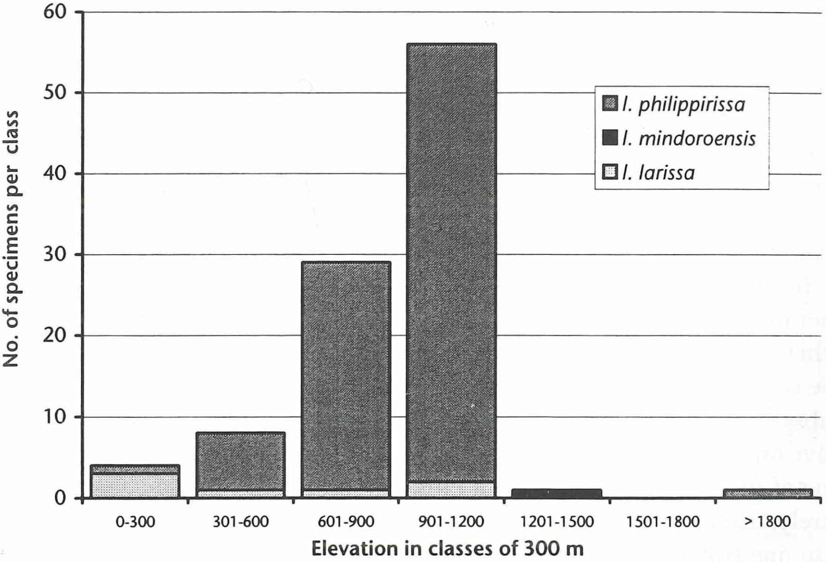
Phenology. See Tab. 28. The number of specimens known from Palawan is too small for a reliable interpretation of the generations per year.

Table 28: Number of specimens of the three subspecies on the Philippines of *Antheraea larissa* collected per month (n = 182). For *A. larissa philippirissa,* "All islands together" includes also other Philippine islands in addition to Luzon, Negros and Mindanao.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Palawan (*larissa larissa*)	0	2	5	0	0	0	1	5	0	0	0	1
Mindoro (*larissa mindoroensis*)	1	3	1	1	2	0	0	0	3	1	1	0
Other islands (*larissa philippirissa*):												
Luzon	10	11	0	8	2	3	1	9	1	1	0	0
Negros	3	0	0	1	2	5	19	1	5	7	5	0
Mindanao	0	18	1	4	0	6	0	0	0	11	0	1
All islands together	14	31	1	14	8	16	21	11	10	20	6	3



Text-Fig.11: Altitudinal distribution of the three subspecies of *Antheraea larissa* on the Philippines, data from 99 specimens (*larissa larissa:* Palawan only, *larissa mindoroensis:* Mindoro, *larissa philippirissa:* from the other islands of the Philippines). Not all elevation ranges were comparably as often visited!

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Altitudinal distribution. See Text-Fig. 11. Again, not enough specimens are known from Palawan for a detailed analysis; the range is from near sea level to 1000 m elevation, lowland rain forests to lower mountain rain forests (after WHITMORE 1988). The general altitudinal distribution of *A. larissa* s. l. appears to be restricted to just these forest zones, the highest record thus far from Sundaland is at ca. 1300 m, a singleton only was collected on Luzon (ssp. *philippirissa*) on Mt. Polis at ca. 1900 m.

Discussion. The population from Palawan fits very well into the other Sundanian populations; in a few characters, however, it resembles the Philippine members of the species (see TREADAWAY & NÄSSIG 1997).

Antheraea (Antheraea) larissa mindoroensis BROSCH & PAUKSTADT, 1996

Antheraea mindoroensis BROSCH & PAUKSTADT (1996, Entomol. Z. **106** (12): 515), HT preliminarily in colls. CUPW (genitalia slide) and CUBH (specimen), not examined (but illustrated in the description); l.t. Mindoro, Mt. Halcon.

Antheraea (Antheraea) larissa mindoroensis: TREADAWAY & NÄSSIG (1997: 186).

D: Known only from Mindoro: Mt. Halcon area. DM 11.

Material studied: **Mindoro:** 9 ♂♂, 2 ♀♀ (details see in the list of TREADAWAY & NÄSSIG 1997), GP 1043/97, 1044/97, 1045/97. No additional specimens in CCGT & CWAN.

Figured: Imagines in Col. pl. 9: 56, 57. Genitalia in B&W pls. 13, 14 & 15 (♂).

Description and diagnosis. Lfw. see Tab. 27. The ground colour of the ♂♂ is a dark red (much less orangy than in the Palawan population) while the outer field is a darker red brown or grey brown. Though close to the nominotypical form in pattern and appearance, the following visual differences stand out: The fw. & hw. SML can have a slight indication of a bluish grey shading outwardly from the outer SML. However, a number of specimens (3 from 9 plus the HT) are totally without this shading which appears rather obvious in the other subspecies. The most noticeable difference to the other subspecies is the lack of the dark band between the fw. ocellus and the costa along the M-stem vein, which for nearly all specimens of the other subspecies is quite large and obvious. However, from the specimens we have on hand this dark band does occur in 5 of 9 ♂♂ as a thin black line; in one of these cases there is also a faint greyish-brown interior. Further, very rarely, usually from the southern Philippines (Samar, Leyte, Mindanao, but also one from Luzon), occasional specimens in ssp. *philippirissa* occur with only a thin dark stripe or line instead of the otherwise very obvious band. The legs are usually very intensively wine red, on average more outstanding than in the other populations.

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In the ♂ **genitalia,** the general size is on average larger than in the Palawan *larissa,* especially the aedeagus length. Further differences to the other subspecies are few, and due to the variability often not constant. The labis is usually slender-conical to cylindrical, but even this most clearly diagnostic difference is sometimes variable, see Fig. 103 (GP 1017/96 from Sumatra) and Fig. 106 (GP 1047/97 from Mindanao) which show a similar shape. The differences in the uncus shape and in the bristles on the uncus mentioned by PAUKSTADT & BROSCH (1996, who based their differential diagnosis on the HT specimen only) are not valid to distinguish the subspecies safely.

The larger ♀♀ of *mindoroensis* (lfw. see Tab. 27) have a dark brownish ground colour, but with an intensive yellowish pattern in the median field. We suppose that this colour combination (dark brownish with yellow highlights) represents the dry season form, and we expect that there might also be other forms with a more reddish appearance than those prevalently found in *philippirissa.* A red tone is absent from these two ♀♀, except for the wing ocelli. The two ♀♀ known to us have a thin stripe of ground colour between the wing ocelli and the costa, in contrast to the ♀♀ of the other two subspecies, where the ocellus edge usually reaches the costa.

Individual variability. There is some variation in the intensity and tone of the ground colour and in the contrast between this and the yellowish highlights; there are ♂ specimens in a more uniform red tone with inconspicuous yellowish pattern and darker ♂♂ with a more brownish to grey brownish ground colour but with a higher proportion of yellowish pattern. This appears to be the equivalent to the variability especially on Negros and Panay (see below), but much less intensive.

Phenology. See Tab. 28. The number of specimens known from Mindoro is too small for a reliable interpretation of the generations per year.

Altitudinal distribution. See Text-Fig. 11. Although the summit of Mt. Halcon is at 2585 m, the specimens with label “Mt. Halcon” were not collected on the mountain top. We suppose that the specimens without data were not collected at higher elevations than ca. 1500 m (data supplied gives 1200 m only).

Discussion. We discussed internally very intensive about the status of the taxon *mindoroensis.* We think that within a group of such variable populations (both in external and in genitalia morphology!) there should be

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more than only a few "more or less" constant morphological characters to separate them on the level of morphospecies. According to our present knowledge, we cannot decide other than interpreting the different populations as subspecies within a very variable and polymorphic species *A. larissa* s. l. The best methods to clear such questions would be alloenzyme or DNA studies of the different populations involved; merely morphological studies (both of external and genitalia morphology) do not help in cases like this. Such studies could also help to clear the status of the different insular populations of the next subspecies.

Antheraea (Antheraea) larissa philippirissa TREADAWAY & NÄSSIG, 1997

Antheraea (Antheraea) larissa philippirissa TREADAWAY & NÄSSIG (1997, Entomol. Z. **107** (5): 192). HT ♂ via CWAN in SMFL (SMFL-Nr. 4158), examined. l.t.: N Luzon, Ifugao, Kiangan.

D: Known from Luzon, Negros, Panay, Samar, Leyte, Mindanao. DM 11.

Material studied: All PTs. **Luzon:** 42 ♂♂, 3 ♀♀ (GP 1024/96, 1069/97); **Negros:** 43 ♂♂, 5 ♀♀ (GP 1021/96, 1022/96, 1054/97, 1055/97); **Panay:** 6 ♂♂, 1 ♀ (GP 1052/97, 1053/97); **Samar:** 1 ♂; **Leyte:** 8 ♂♂, 5 ♀♀ (GP 1023/96, 1051/97); **Mindanao:** 36 ♂♂, 1 ♀ (GP 1020/96, 1046/97) (details see in the paratypes list of TREADAWAY & NÄSSIG 1997). A few additional specimens in CCGT received after the publication of the description, mainly from Mindanao and Negros.

Figured: Imagines in Col. pl. 9: 58–61. Genitalia in B&W pls. 13, 14 & 15 (♂).

Description and diagnosis. Lfw. see Tab. 27. The Philippine populations other than that from the Sundanian island Palawan (but including ssp. *mindoroensis*) have on average a much darker ground colour than the nominotypical subspecies and, in ♂♂, broader triangular wings, less elongate. The brown of the submarginal field in ♂♂ is spread for the most part over the whole wing area replacing to a great extent the red tone. The yellow markings are for most **Luzon** specimens (for the insular variability see below; Luzon is the type locality of ssp. *philippirissa*) minimal. When a specimen is lighter in colour the yellow appears only in limited areas unlike ssp. *larissa* s. str. where the yellow is spread more or less overall. For Luzon specimens the yellow can appear as a double row of small yellow spots on either side of the wavy postmedian line as well as between the fw. ocellus and the costa and including a costa patch distally from the postbasal line and usually before the postbasal line. The bluish-grey shading outwardly from the SML, as compared to the nominotypical form, is found on most specimens, but on some is rather faint and on a few others almost non-existent. The SML can be dark brown or red but inwardly with a darker brown edging. The connexion between the fw.

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ocellus and the costa along the M-stem vein is usually very obviously visible but on average smaller than in *larissa larissa*. However, specimens occur in which this bridge can be further reduced or almost absent.

The ♂ **genitalia** are often in the upper part of the size variability range, but small genitalia may also occur. The shape of the different parts of the genitalia is quite variable, especially that of the labides (see illustrations, B&W plate 15). The stiff long bristles distally on the dorsal branch of the valves may sometimes be longer and increased in number.

The ♀♀ have prevalently a brown ground colour (red is found only in some specimens), but the proportion of yellowish pattern on average is quite high. In the brightest forms, the dark submarginal field is often brightened to an orangy brown, most often in a cuneiform shape along the veins, but sometimes also the entire field. ♀♀ are individually very variable, but do not differ visibly from island to island, in contrast to the ♂♂, where the zoogeographical regions (usually not the islands) for several specimens can be determined just from external appearance.

Insular and individual variability. Insular variability appears to be clinal for some of the characters – one important cause for us not to further split up ssp. *philippirissa*. On **Luzon** the prevalent ♂ form is dark and relatively unicolourous, without most of the yellow pattern. Supposed drier season forms with a larger proportion of yellow are rare. On **Negros,** the ♂♂ appear usually in the most contrastingly variegated forms, with a very patchy pattern of dark red, brown and yellow. Both prevalent yellow (drier season?) and prevalent dark (humid season?) forms are common, in contrast to Luzon. The dark colour component tends to be really black in the apical parts of the postmedian line and, outwardly, the postbasal line. In the area of the postmedian line there is usually only one row of yellow patches, but these are very conspicuous. The Negros ♀♀ have their inward proportion of the fw. ocelli very conspicuously red and enlarged, in some specimens the red is even penetrating through the ring of the ocellus into the discoidal cell. The rings of the ♀ wing ocelli are the broadest in Negros (and Leyte) specimens. The Negros-♀♀ presently known include the darkest forms as well as forms with the most intensive brightening with yellow and yellowish orange pattern elements; but the ground colour is in all cases always brown, without any red. The **Panay** ♂♂ are similar to Negros ♂♂, but with a larger percentage of red forms; the single ♀ does not differ from the Negros specimens. In ♂♂ from **Leyte** and

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Samar the proportion of red (instead of brown) is much larger than on Negros and Panay, and the specimens appear less variegated. These populations appear to be intermediate and transitional between the very contrastingly variegated Negros/Panay forms and the more unicolourous red Mindanao forms. Also, one of the ♀♀ from Leyte exhibits a reddish instead of brown ground colour. On **Mindanao,** the ground colour in ♂♂ is less variegated, usually a deep red; although the proportion of bright specimens with a high percentage of yellow area (drier season forms?) is considerable, the specimens usually do not appear so contrastingly chequered as the Negros forms. The ♀♀ have dark red or brown ground colour.

Phenology. See Tab. 28. *A. larissa philippirissa* is found in all months, with a low count in March and another in November/December. But there are strong differences from island to island, and we have not yet correlated the collecting data with either actual travelling times or prevalent seasonal weather data.

Altitudinal distribution. See Text-Fig. 11. One specimen was collected on ca. 1900 m elevation in N-Luzon (Mt. Polis), and due to the long and intensive collecting in the Banaue area by several entomologists there is a peak around 1000–1200 m. However, it appears that in the Philippines the altitudinal focus is a little higher (perhaps centered on the lower montane zone) than in Sundaland. But this could well be influenced by the drastic loss of primary habitats in the lowlands.

Discussion. According to our present knowledge it makes no sense to subdivide a group of such variable populations, with evidently clinal transitions along the Visayan islands, into more than one subspecies. Besides the Mindoro population, which is already named as a separate subspecies, we do not see any other clearly separable island population.

It would be very interesting to find out the real distributional limits of the Philippine *A. larissa:* If we consider the Babuyan and Batan Island groups or the Talaud group etc. – how far does the species spread out along these islands? Is there any genetical introgression (or even ongoing interchange) between *larissa larissa* and *larissa philippirissa* along the Sulu Islands chain?[53] What is the sister-species (or sister-group) of *larissa*?

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[53] Similar questions arise for the northern distributional limits on the Asiatic continent in S-Burma and S-Thailand: Where are these limits, and why are the specimens so large there? Further, some of these phenomenons might be comparable to *Antheraea rosieri,* see under this species.

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13 Colour plates/imagines

The colour plates of imagines are to different scales. When there is no scale given within the plate, the lfw. for all specimens figured is provided. Plates 1–12 were kindly taken by Ulrich Brosch, Hille, with technical assistance by Martin Beeke, Hille (with Hasselblad camera on Kodak Ektachrome 6×6 cm). — We have tried to figure a cross-section of the variability range, but we did not illustrate every variant.

Colour plate 1 (p. 322)
Fig. 1 (top left): *Attacus caesar,* ♂, green form, Bohol, e. o. reared by W.A.N. in 1981/82, hatched 31. v. 1992, lfw. 116 mm, CWAN. **Fig. 2** (top right): *Attacus atlas,* ♂, Batanes Islands, Itbayat, xii. 1983, lfw. 98 mm, CCGT. **Fig. 3** (bottom left): *Attacus caesar,* ♂, reddish form with little green on the forewings, Leyte, Hilusig, Mt. Balocaue, 600 m, 7 ix. 1988, lfw. 121 mm, CCGT. **Fig. 4** (bottom right): *Attacus caesar,* ♀, greenish form, Mindanao, S. Cotabato, Tboli, Siman, 800 m, 14. xii. 1983, lfw. 117 mm, CCGT.

Colour plate 2 (p. 323)
Fig. 5 (top left): *Attacus lorquinii,* ♂, extreme bright form, Marinduque, near Boac, 6. vi. 1982, lfw. 92 mm, CCGT. **Fig. 6** (top right): *Attacus caesar,* ♂, aberrant reddish form with wide white fasciae, Bohol, Bilar, xi. 1992, lfw. 116 mm, CCGT. **Fig. 7** (centre left): *Attacus lorquinii,* ♂, red form, N-Luzon, Abra Bucay, 17. iii. 1994, lfw. 123 mm, CCGT. **Fig. 8** (centre right): *Attacus lorquinii,* ♂, blackish brown form, Marinduque, ex imported pupa, 1. v. 1979, lfw. 100 mm, CWAN. **Fig. 9** (bottom left): *Attacus lorquinii,* ♀, dark reddish form, Marinduque, nr. Boac, 10. ii. 1983, lfw. 94 mm, CCGT. **Fig. 10** (bottom right): *Attacus caesar,* ♀, orange form, Bohol, Bilar, ix. 1984, lfw. 127 mm, CCGT.

B&W plate 1 (p. 324)
Figs. 1–3: ♂ genitalia of *Attacus* species; aedeagus separate at the right, scale = 1 mm, valid for all illustrations on the plate. **Fig. 1:** *Attacus atlas,* Taiwan, GP 1138/97. **Fig. 2:** *Attacus atlas,* Philippines, Itbayat, GP 1137/97. **Fig. 3:** *Attacus caesar,* Mindanao, GP 1136/97. — All b&w photographs by W. A. Nässig, if not indicated otherwise.

B&W plate 2 (p. 325)
Figs. 4–5: ♂ genitalia of *Attacus* species; aedeagus separate at the right, scale = 1 mm, valid for all illustrations on the plate. **Fig. 4:** *Attacus lorquinii,* Luzon, GP 1135/97. **Fig. 5:** *Attacus lemairei,* Palawan, GP 1134/97. — **Fig. 10:** *Samia tetrica* (Rebel, 1924) *sensu* Naumann (1998), Borneo, GP 1078/97. (For comparison, see also Plate 3.)

Colour plate 3 (p. 326)
Fig. 11 (top left): *Attacus lemairei,* ♀, bright form, Palawan, Linao, Brooke's Point, 10. iv. 1981, lfw. 95 mm, CCGT. **Fig. 12** (top right): *Attacus lemairei,* ♂, bright form, S-Palawan, Rio Tuba, Batabasa, 21. v. 1982, lfw. 102 mm, CCGT. **Fig. 13** (centre left): *Attacus lemairei,* ♀, dark red form, S-Palawan, Mt. Bayog, 3000 ft., 4. iv. 1982, lfw. 110 mm, CCGT. **Fig. 14** (centre right): *Attacus lemairei,* ♂, dark red form, N-Palawan, Roxas, 16. x. 1981, lfw. 103 mm, CCGT. **Fig. 15** (bottom left): *Attacus lorquinii,* ♀, dark reddish form, S-Luzon, Quezon Prov., Infanta, 16. viii. 1985, lfw. 113 mm, CCGT. **Fig. 16** (bottom right, upper specimen): *Samia treadawayi,* ♂, **HT**, dark [normal] form, C-Palawan, Mt. Salakot, 350 m, 20. iii. 1996, GP 1150/97, SMFL-no. 4165, lfw. 59 mm, CCGT. **Fig. 17** (bottom right, lower specimen): *Samia luzonica,* ♂, bright brownish form, S-Luzon, Mt. Isarog, vi. 1984, lfw. 59 mm, CCGT.

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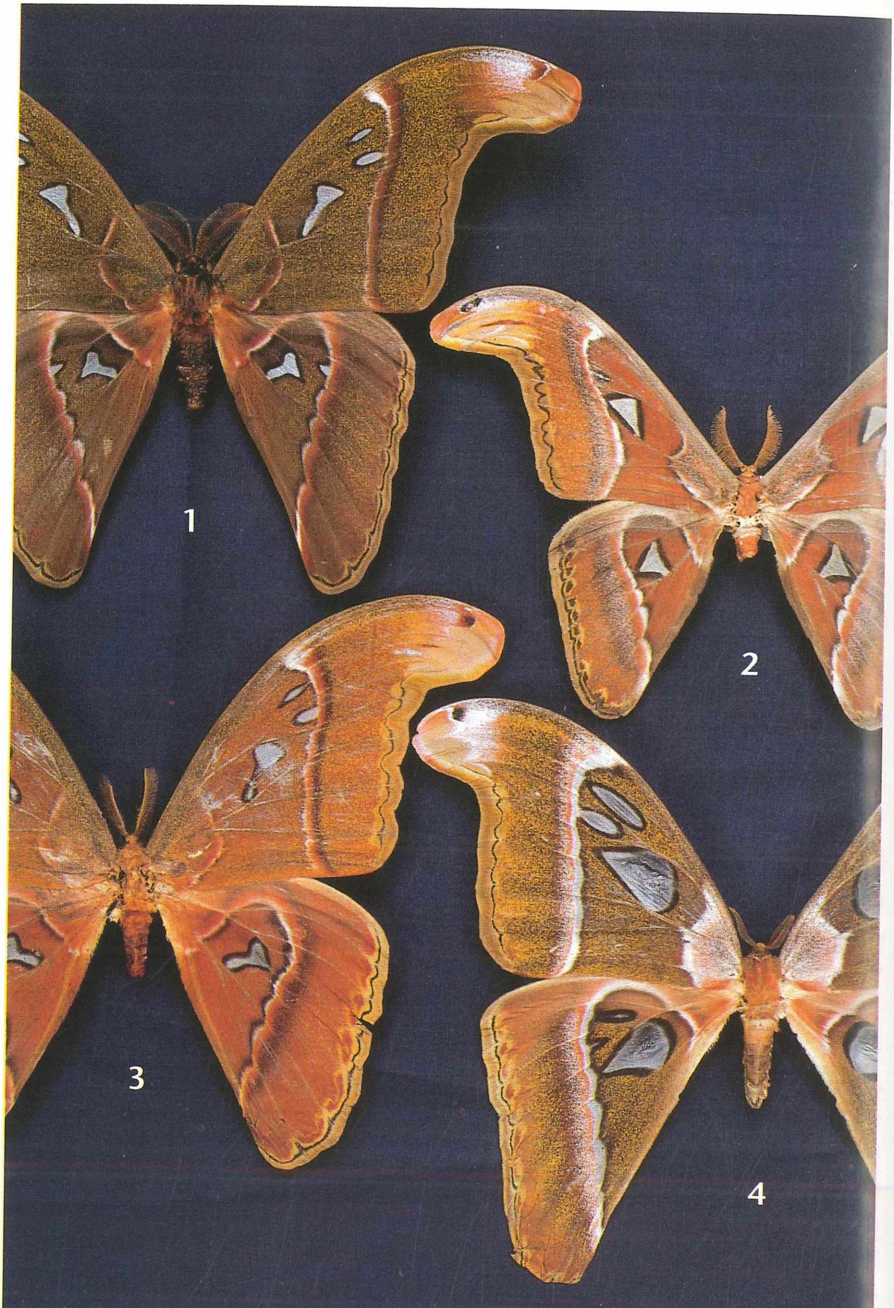

Colour plate 1 (see p. 321)

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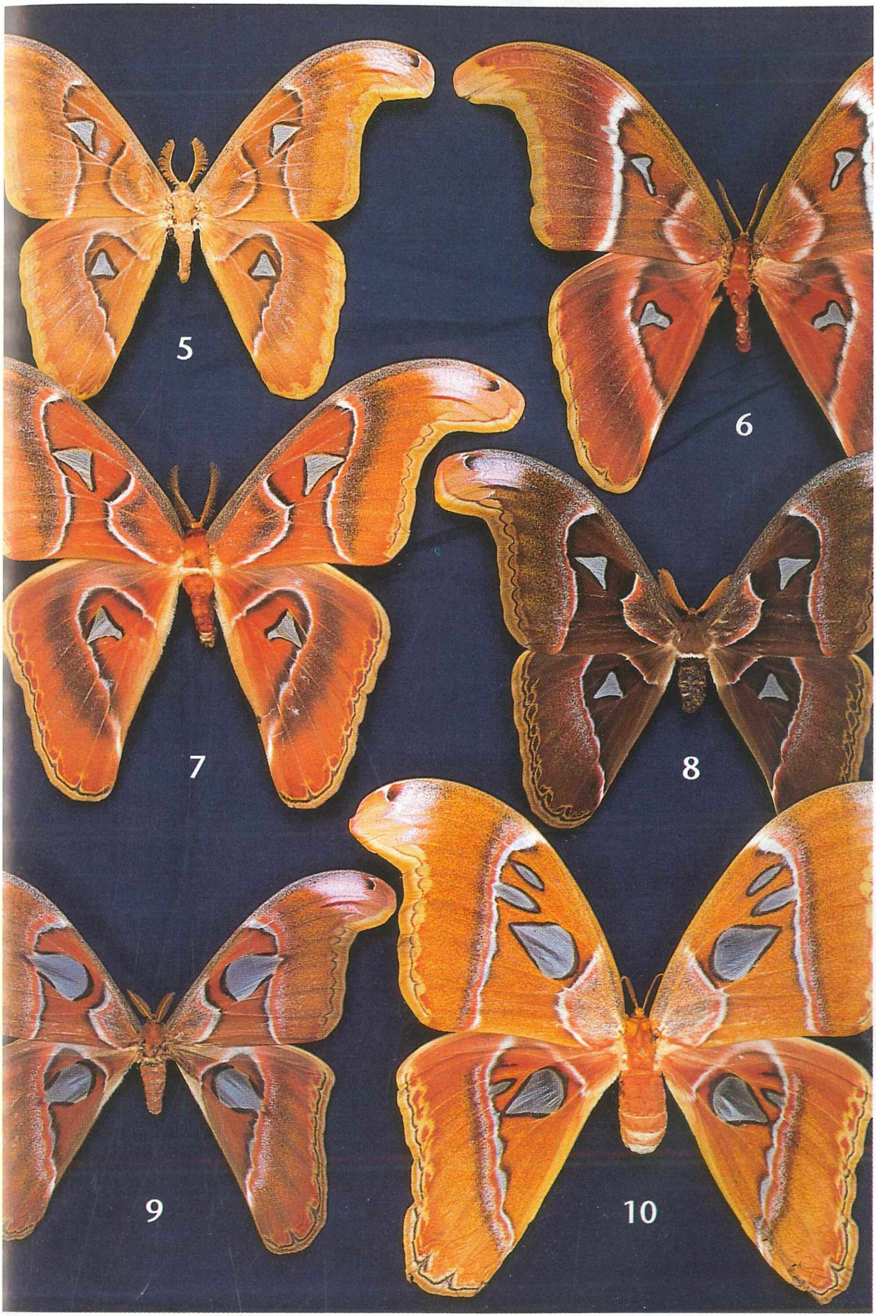

Colour plate 2 (see p. 321)

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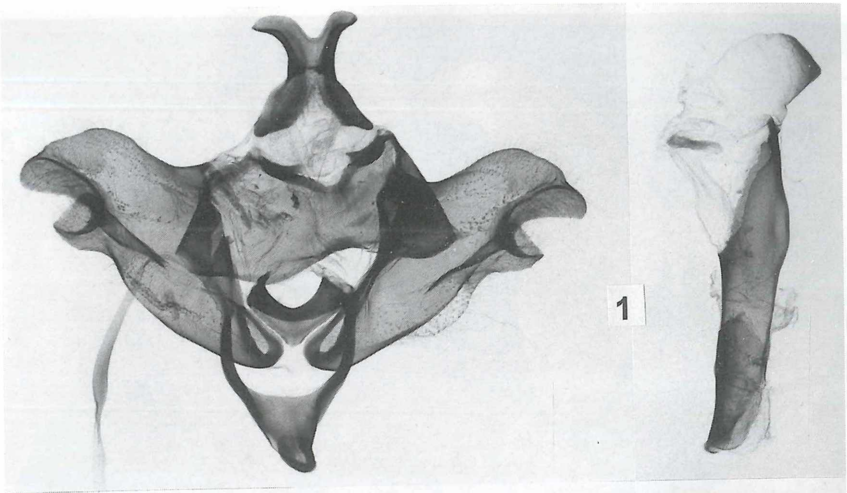
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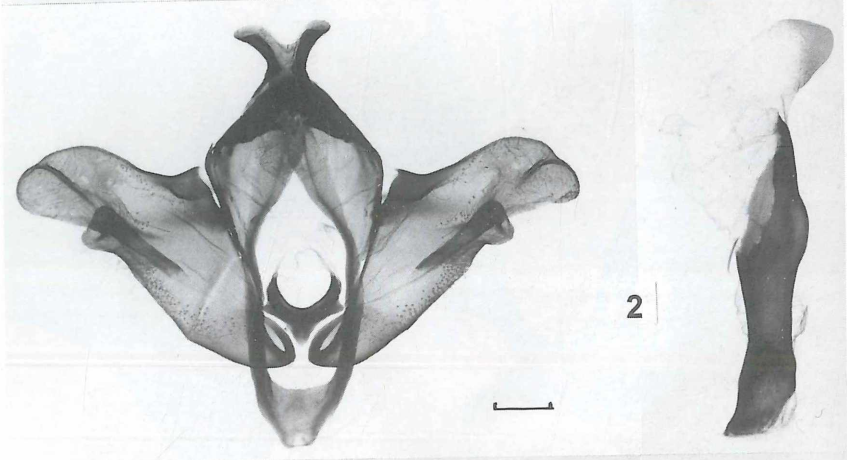
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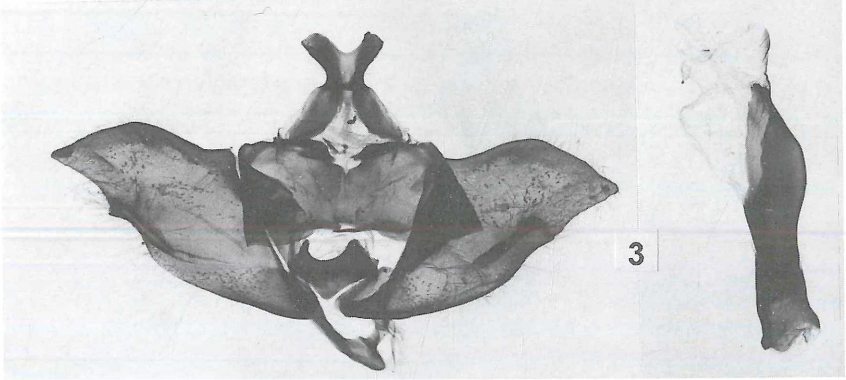
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B&W plate 1 (see p. 321)

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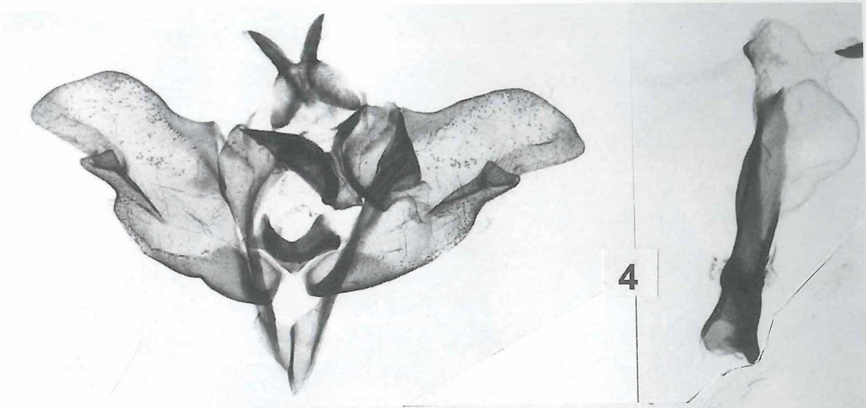

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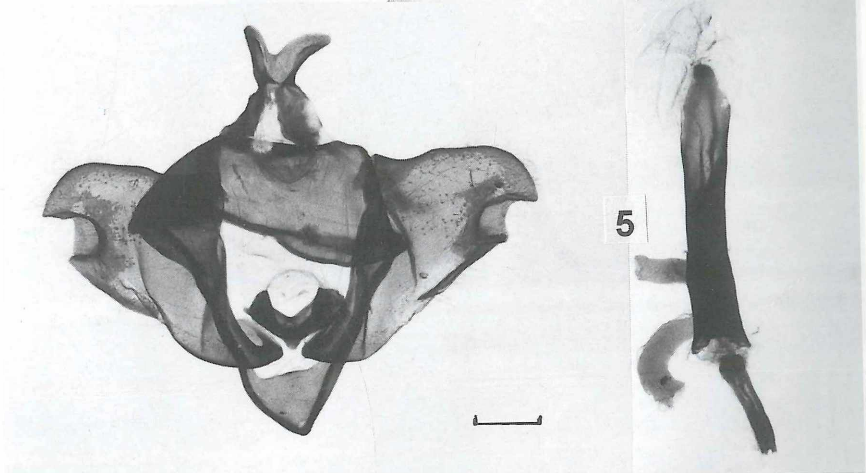

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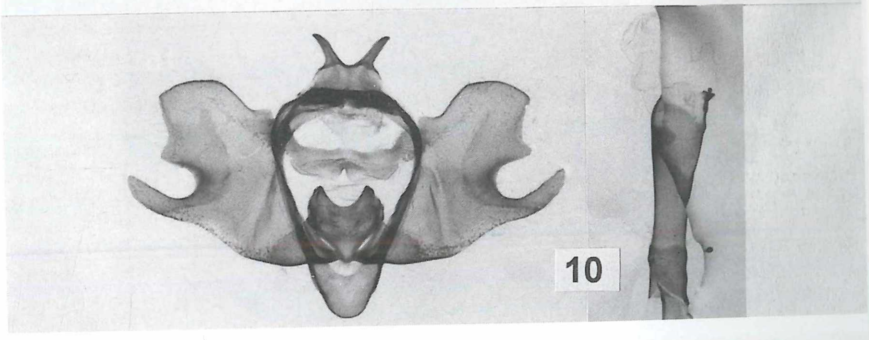

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B&W plate 2 (see p. 321)

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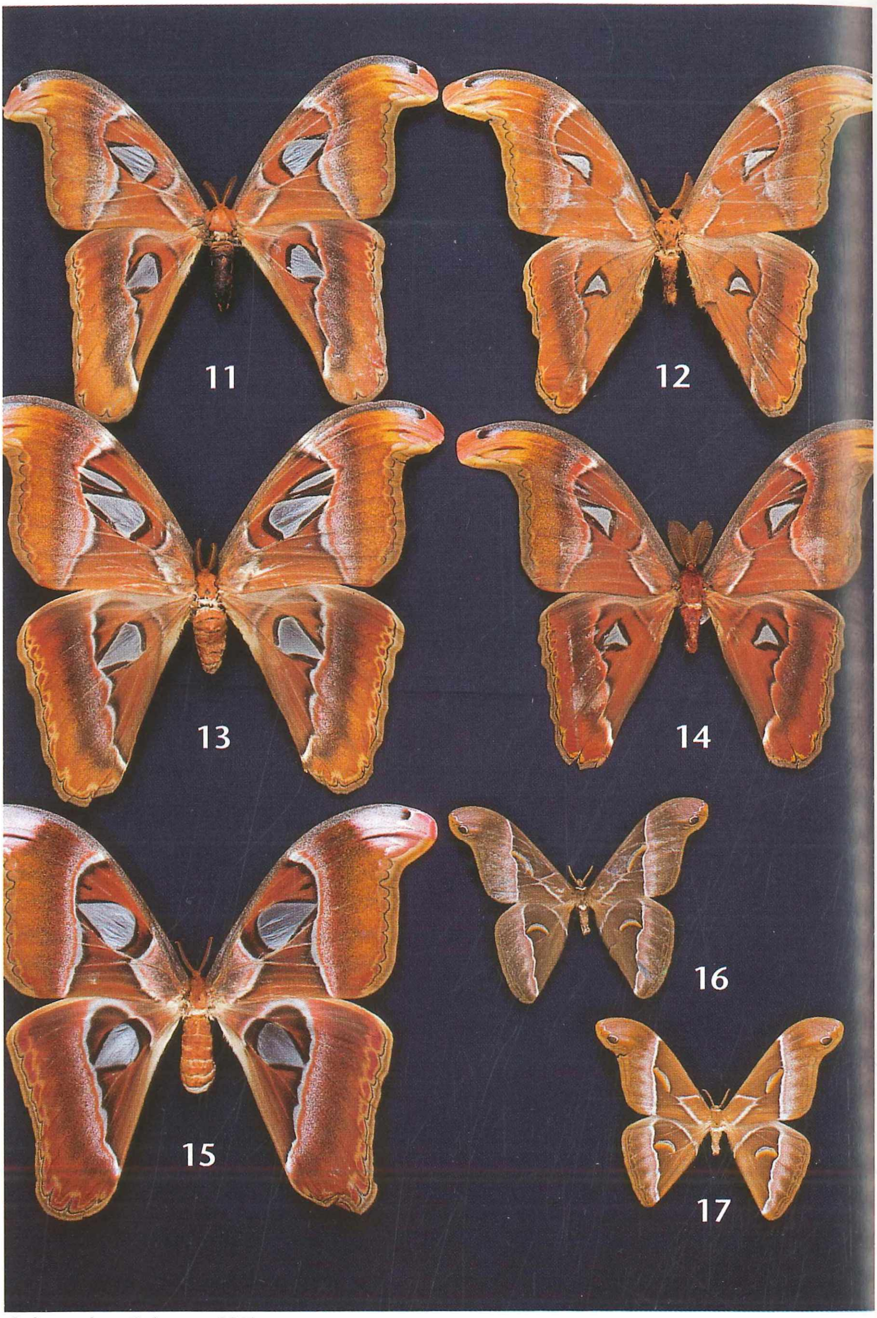

Colour plate 3 (see p. 321)

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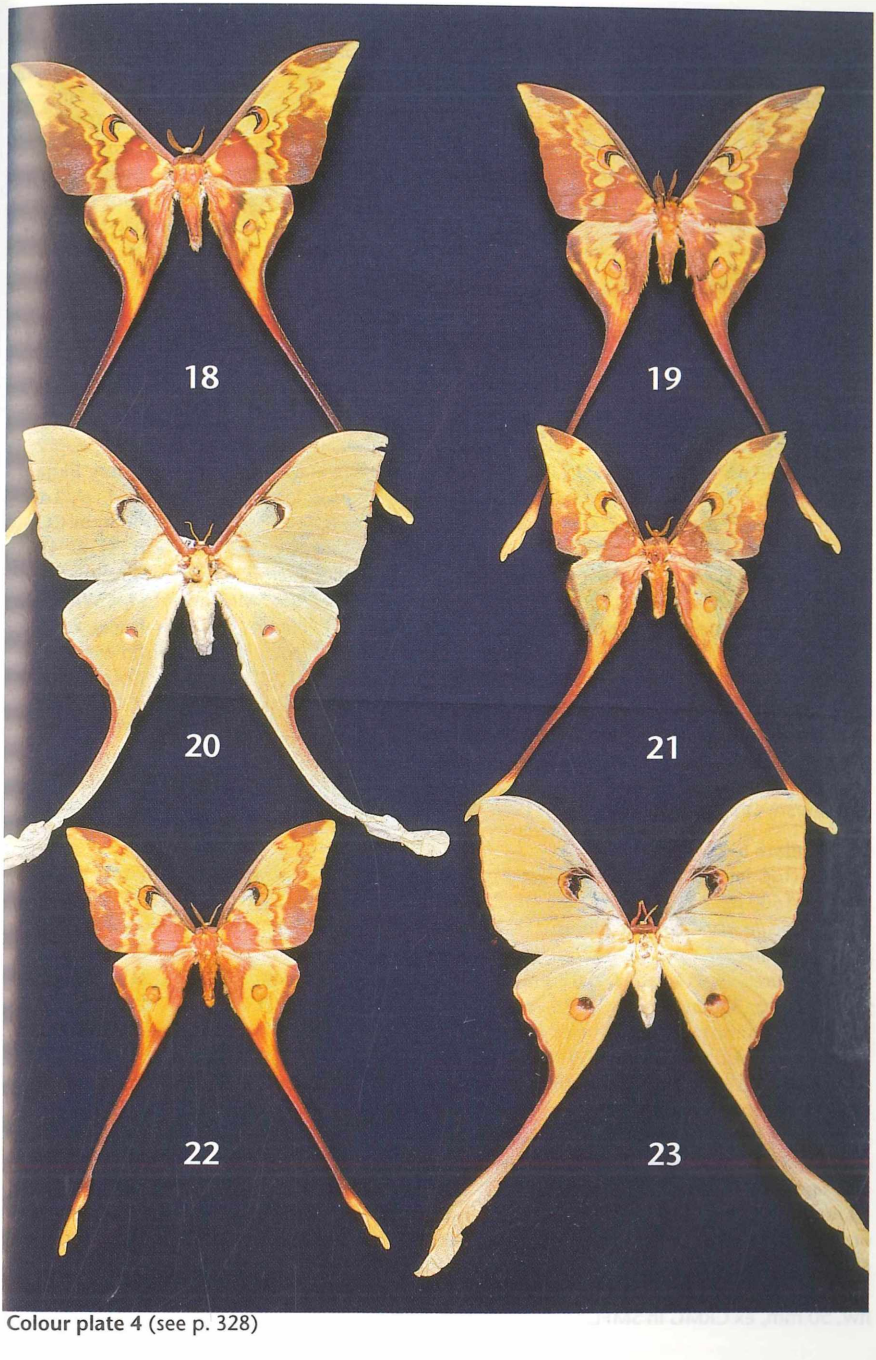

Colour plate 4 (see p. 328)

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Colour plate 4 (p. 327)

Fig. 18 (top left): *Actias philippinica philippinica,* ♂, Leyte, 60 km E Ormoc, Alto Peak, 700 m, 4. VII. 1994, lfw. 76 mm, leg. P. SCHÜTZ, on loan in CCGT. **Fig. 19** (top right): *Actias philippinica philippinica,* ♂, Negros, Mambucal, 7 III. 1987, lfw. 70 mm, CCGT. **Fig. 20** (centre left): *Actias philippinica philippinica,* ♀, PT, N-Luzon, Ifugao, 3600 ft., Banaue, 17 VII. 1988, lfw. 83 mm, CCGT. **Fig. 21** (centre right): *Actias philippinica philippinica,* ♂, PT, N-Luzon, Banaue, 3600 ft., 7 V. 1988, lfw. 63 mm, CCGT. **Fig. 22** (bottom left): *Actias philippinica bulbosa,* ♂, PT, Palawan, Ulanguan, 1. VIII. 1995, lfw. 65 mm, CCGT. **Fig. 23** (bottom right): *Actias philippinica bulbosa,* ♀, PT, Palawan, PPC, Irawan, 15. III. 1996, lfw. 82 mm, leg. A. ZWICK, on loan in SMFL.

B&W plate 3 (p. 329)

Figs. 6–9: ♂ genitalia of *Samia* species; aedeagus separate at the right, scale = 1 mm, valid for all illustrations on the plate. **Fig. 6:** *Samia luzonica,* Luzon, GP 1077/97 **Fig. 7:** *Samia luzonica,* Mindoro, GP 1102/97. **Fig. 8:** *Samia luzonica,* Mindanao, GP 1144/97 **Fig. 9:** *Samia treadawayi,* PT, Palawan, GP 1079/97. (For comparison, see Fig. 10 on Plate 2, *Samia tetrica.*)

Colour plate 5 (p. 330)

Fig. 24 (top left): *Actias selene brevijuxta,* ♂, PT, N-Luzon, Ifugao, Banaue, 1200 m, 8.–12. II. 1988, lfw. 80 mm, CWAN. **Fig. 25** (top right): *Actias selene brevijuxta,* ♀, PT, N-Luzon, Banaue, 3600 ft., 16. II. 1991, lfw. 87 mm, CCGT. **Fig. 26** (2nd row, left): *Samia luzonica,* ♂, Leyte, 60 km E Ormoc, Alto Peak, 700 m, 6. VII. 1994, lfw. 64 mm, leg. P. SCHÜTZ, on loan in CCGT. **Fig. 27** (2nd row, right): *Samia luzonica,* ♀, Panay, Aklan, La Laserna, 300 m, e. o. 31. XI. 1991, lfw. 67 mm, CWAN. **Fig. 28** (3rd row, left): *Cricula mindanaensis,* ♂, **HT,** Mindanao, Mt. Kitanglad, 1200 m, 16. VIII.–15. IX. 1994, lfw. 33 mm, GP 877/95, SMFL-no. 4154, CWAN. **Fig. 29** (3rd row, centre): *Cricula trifenestrata treadawayi,* ♂, **HT,** Negros, nr. Mambucal, X. 1985, lfw. 35 mm, GP 608/88, SMFL-no. 4169, CCGT. **Fig. 30** (3rd row, right): *Cricula trifenestrata treadawayi,* ♀, Negros, 18. XII. 1990, lfw. 40 mm, CCGT. **Fig. 31** (4th row, left): *Cricula trifenestrata ?treadawayi,* ♂, C-Palawan, Irawan, 20. X. 1986, lfw. 37 mm, GP 884/95, CCGT. **Fig. 32** (4th row, right): *Cricula trifenestrata treadawayi,* ♂, Cebu, Minglanilla, Mt. Luay, 700 m, 26. VI. 1985, lfw. 35 mm, CCGT. **Fig. 33** (bottom left): *Samia luzonica,* ♂, N-Luzon, Banaue, 1000 m, 10. VIII. 1988, lfw. 65 mm, CWAN. **Fig. 34** (bottom right): *Cricula trifenestrata ?treadawayi,* ♀, N-Palawan, Olanguan, 500 ft., 7. VII. 1988, lfw. 45 mm, CCGT.

Colour plate 6 (p. 331)

Fig. 35 (top left column): *Cricula luzonica luzonica,* ♂, N-Luzon, Mt.-Prov., Chatol, 15 km SE Bontoc, 1600 m, 24. IX./14. X. 1988, lfw. 36 mm, GP 650/90, CWAN. **Fig. 36** (2nd in left column): *Cricula luzonica leyteana,* ♂, **HT,** orange form, Leyte, Mahaplag, Mt. Balocaue, 700 m, 5. IX. 1984, lfw. 38 mm, GP 642/90, SMFL-no. 4155, CCGT. **Fig. 37** (3rd in left column): *Cricula luzonica kareli,* ♂, **HT,** small, dark orange form, Mindanao, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, 1.–3. X. 1988, lfw. 34 mm, GP 636/90, SMFL-no. 4156, CWAN. **Fig. 38** (4th in left column): *Cricula luzonica kareli,* ♂, PT, big dark orange form with reduced eyespots, Mindanao, Bukidnon, 45 km NW Maramag, Mt. Binansilang, 1200 m, 2. X. 1988, lfw. 41 mm, GP 651/90, CWAN. **Fig. 39** (bottom left column): *Cricula luzonica kareli,* ♂, PT, small dark form, Mindanao, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, 1.–3. X. 1988, lfw. 31 mm, GP 643/90, CWAN. **Fig. 40** (top right column): *Cricula luzonica luzonica,* ♀, N-Luzon, Banaue, 1000 m, 7. IV. 1988, lfw. 42 mm, CWAN. **Fig. 41** (2nd in right column): *Cricula luzonica leyteana,* ♀, PT, orange form, Leyte, Mahaplag, Mt. Balocaue, 700 m, 31. VIII. 1984, lfw. 49 mm, GP 898/95, CCGT. **Fig. 42** (3rd in right column): *Cricula luzonica kareli,* ♀, PT, dark orange form, Mindanao, Bukifdnon, Mt. Kitanglad, Intavas, 4100 ft., 27. VII. 1990, lfw. 44 mm, GP 915/95, CCGT. **Fig. 43** (bottom right column): *Cricula luzonica kareli,* ♀, dark vinered form, PT, Mindanao, Surigao del Sur, Tandag, Hitaub Creek, 500–600 m, 16.–19. IV. 1995, lfw. 50 mm, ex CRMG in SMFL.

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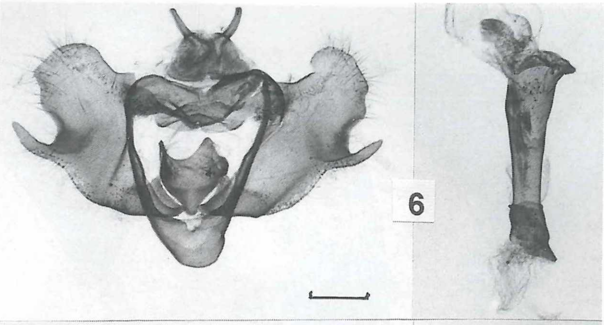
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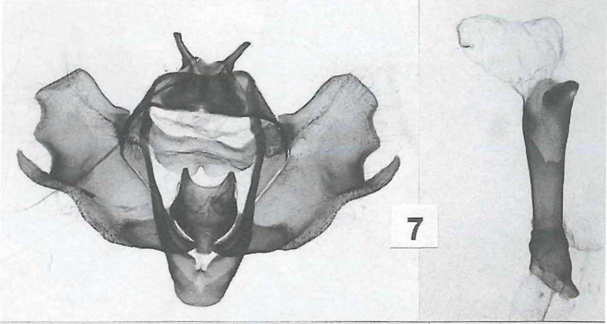
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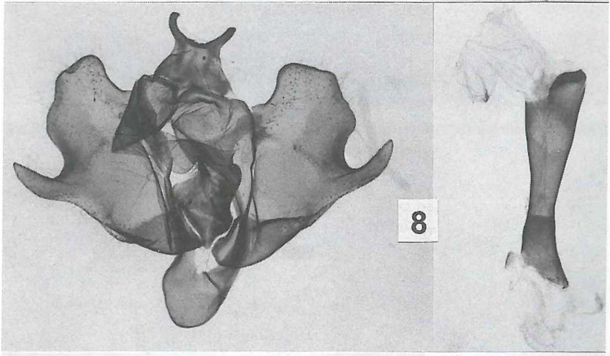
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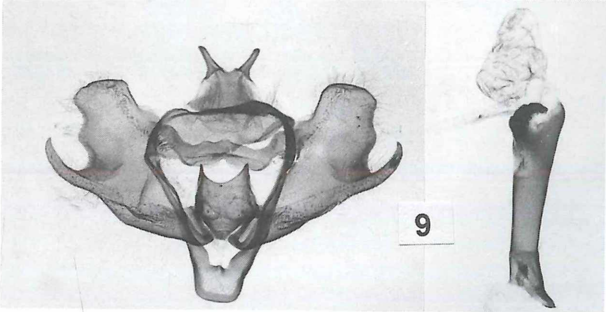
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B&W plate 3 (see p. 328)

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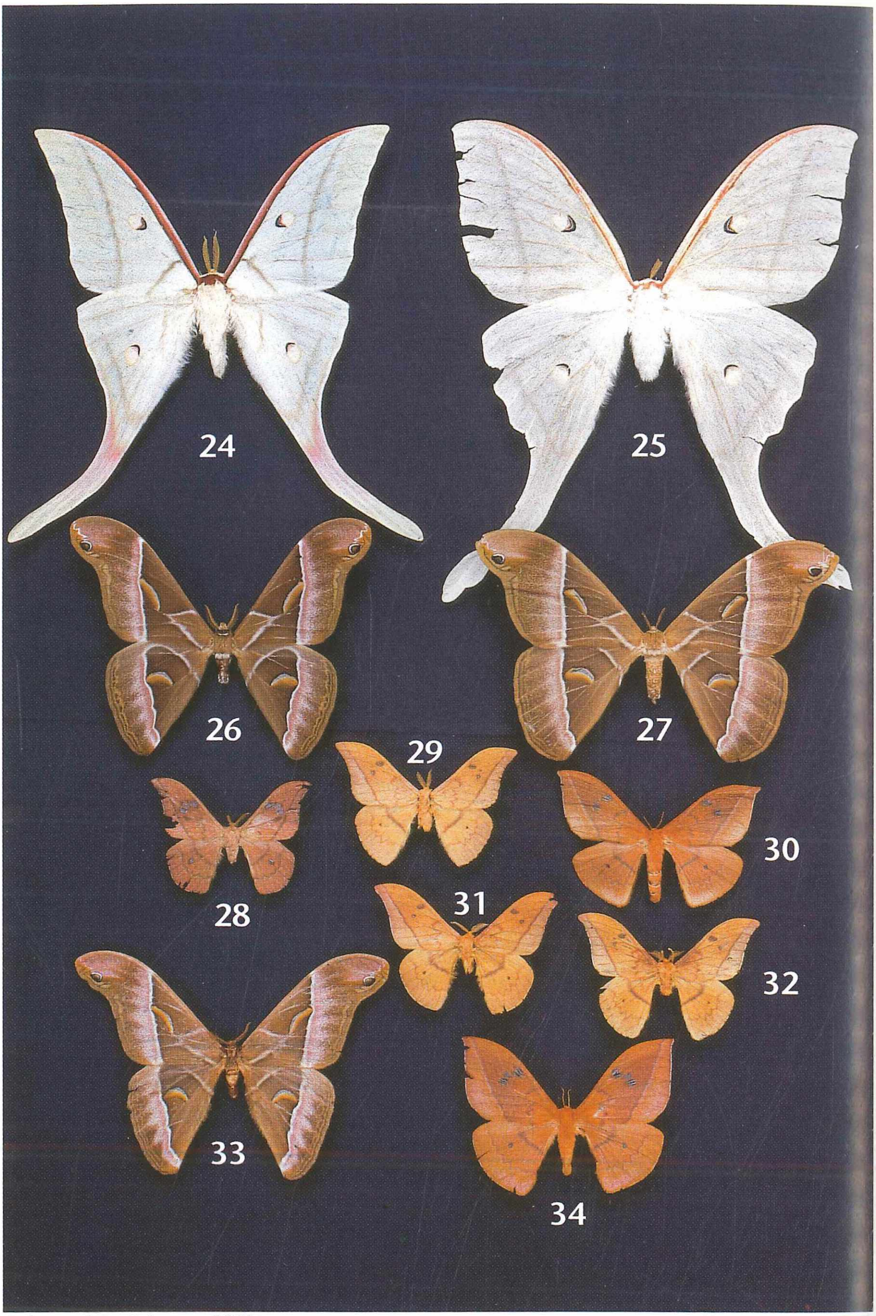

Colour plate 5 (see p. 328)

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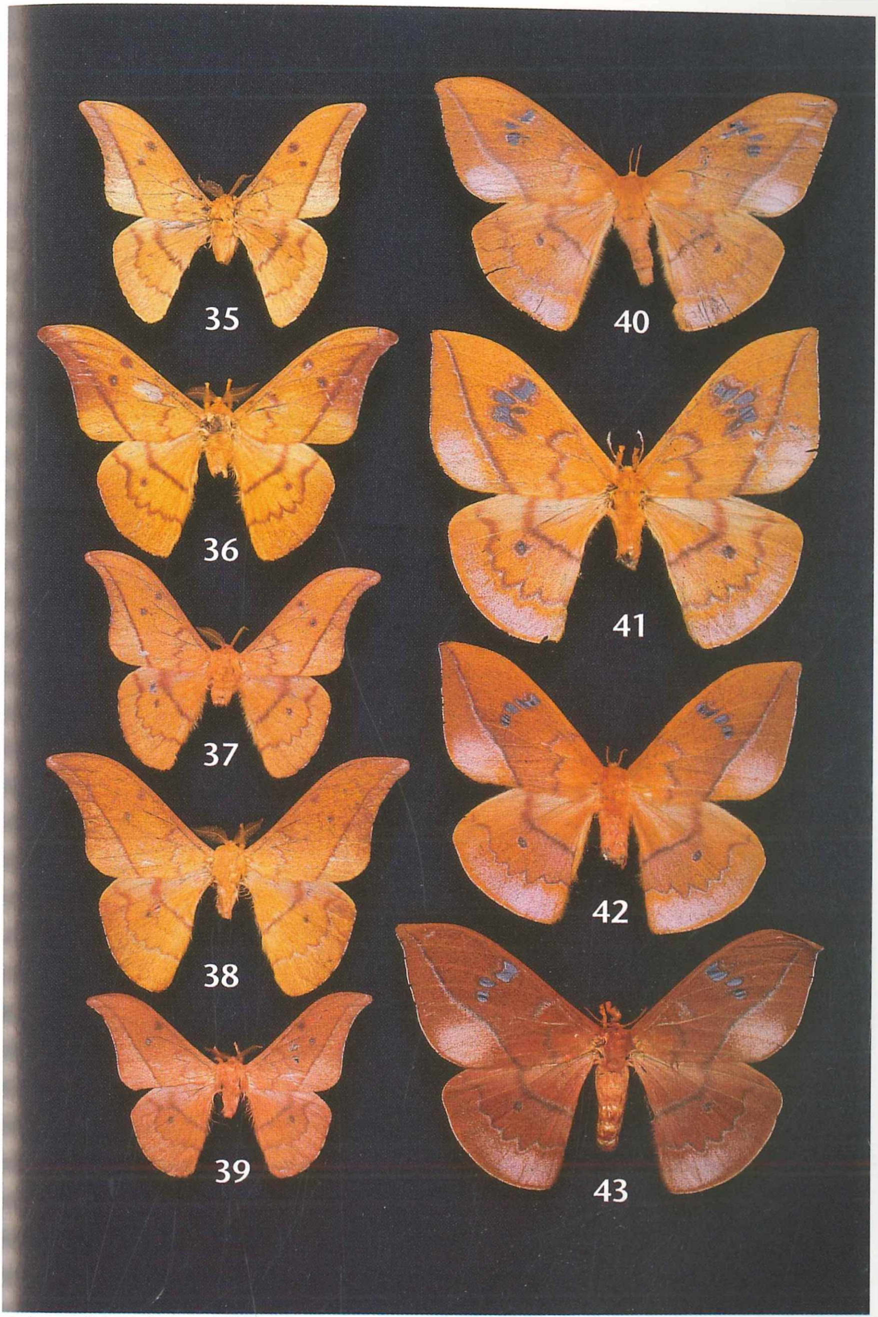

Colour plate 6 (see p. 328)

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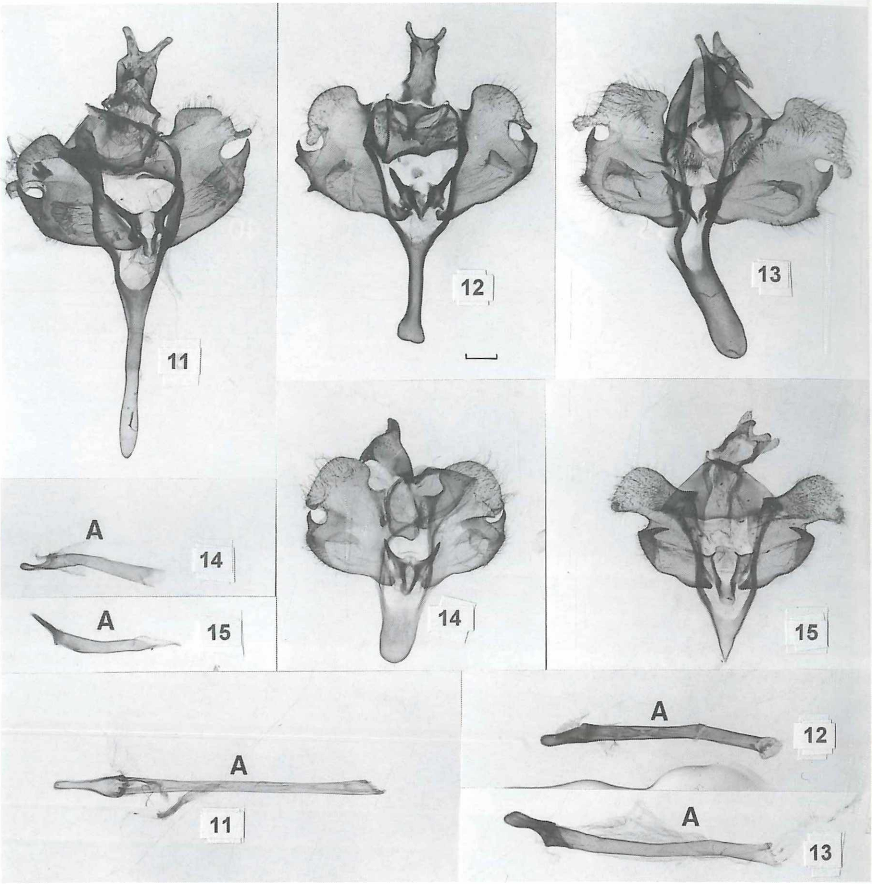

B&W plate 4

Figs. 11–15: ♂ genitalia of *Actias* species of the *maenas*-group; aedeagus separate (A), scale = 1 mm, valid for all illustrations on the plate. **Fig. 11:** *Actias maenas diana,* Java, GP 865/95. **Fig. 12:** *Actias philippinica bulbosa,* PT, Palawan, GP 965/96. **Fig. 13:** *Actias philippinica philippinica,* PT, Luzon, GP 682/93. The saccus of this specimen is extraordinarily broad; usually the saccus is approximately as broad as in ssp. *bulbosa,* but without the bulbous "knot" at the cephal end. **Fig. 14:** *Actias isis,* Sulawesi, GP 419/86. **Fig. 15:** *Actias groenendaeli,* Timor, GP 664/91. — Plate from Nässig & Treadaway (1997 a: figs. 5–9).

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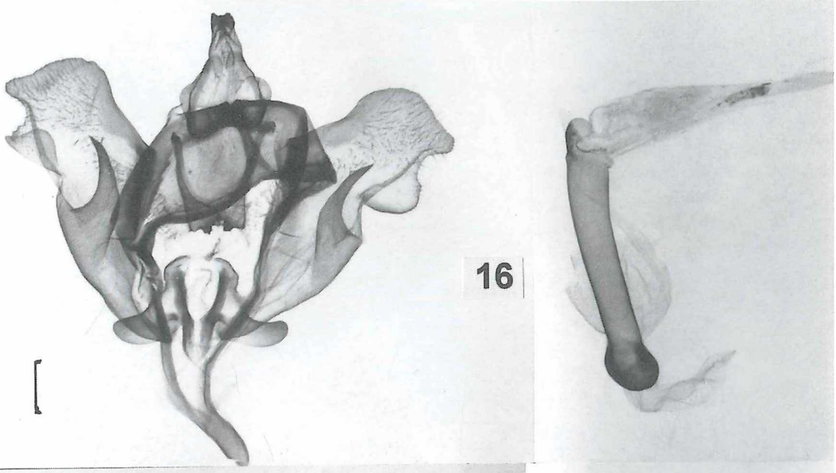

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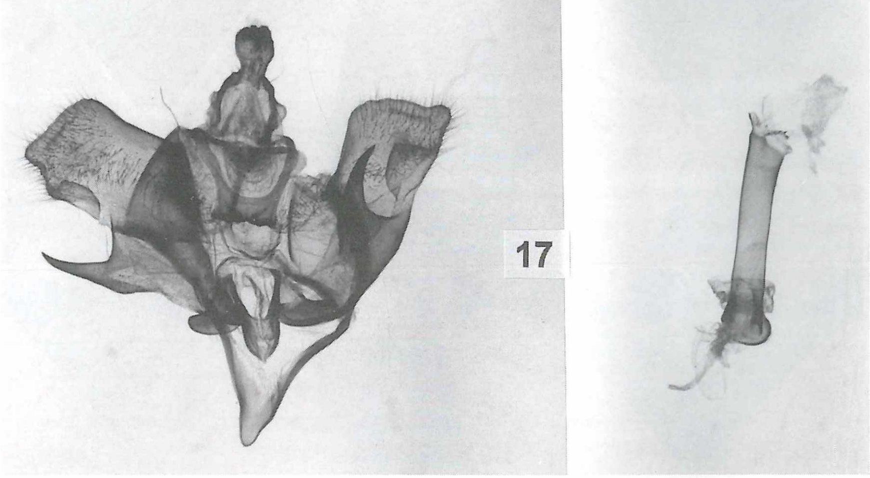

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B&W plate 5

Figs. 16–17: ♂ genitalia of *Actias* species of the *selene*-group; aedeagus separate at the right, scale = 1 mm, valid for all illustrations on the plate. **Fig. 16:** *Actias selene brevijuxta,* Luzon, GP 632/90. **Fig. 17:** *Actias selene brevijuxta,* Mindoro, GP 1148/97, ex CUBH in CWAN. This specimen is in wingspan and genitalia size as well as in the length of the juxta protuberances approximately as large as the Luzon specimens, in contrast to the dwarf from Mindoro illustrated by Nässig & Treadaway (1997 b); only the aedeagus and saccus are slightly smaller than in the Luzon population.

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Colour plate 7 (see p. 336)

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Colour plate 8 (see p. 336)

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Colour plate 7 (p. 334)

Fig. 44 (top left): *Antheraea (Antheraeopsis) paniki paniki,* ♀, PT, Mindanao, Bukidnon, Mt. Kitanglad, above Intavas, 6000 ft., 3. XI. 1991, lfw. 90 mm, CCGT. **Fig. 45** (top right): *Antheraea (Antheraeopsis) paniki paniki,* ♂, **HT**, N-Luzon, Ifugao, Mt. Pulis, 1900 m, 9.–13. II. 1988, lfw. 91 mm, SMFL-no. 4164, CWAN. **Fig. 46** (centre left): *Antheraea (Antheraea) halconensis,* ♂, a typical Luzon-form, small, pinkish bright brown, with enhanced vein patterning, N-Luzon, Banaue, 3600 ft., 21. II. 1989, lfw. 76 mm, CCGT. **Fig. 47** (centre right): *Antheraea (Antheraeopsis) paniki sahi,* ♂, **HT**, S-Palawan, nr. Brooke's Point, 10. V. 1993, lfw. 78 mm, GP 1109/97, SMFL-no. 4163, CCGT. **Fig. 48** (bottom left): *Antheraea (Antheraea) halconensis,* ♀, Panay, Antique, Mt. Madja-as, 5. XI. 1995, lfw. 76 mm, CCGT. **Fig. 49** (bottom right): *Antheraea (Antheraea) halconensis,* ♂, yellowish specimen with pronounced vein patterning, Leyte, Hilusig, Mt. Balocaue, 700 m, 24. IX. 1989, lfw. 80 mm, CCGT.

Colour plate 8 (p. 335)

Fig. 50 (top left): *Antheraea (Antheraea) halconensis,* ♀, Mindoro, Mt. Halcon, 1. IV. 1997, lfw. 78 mm, CCGT. **Fig. 51** (top right): *Antheraea (Antheraea) halconensis,* ♂, typical Mindoro-form, Mindoro, Mt. Halcon, 13. X. 1996, lfw. 78 mm, CCGT. **Fig. 52** (centre left): *Antheraea (Antheraea) rosieri imeldae,* ♂, **HT**, Palawan, Napsan, Mt. Salakot, 700 m, 19./20. II. 1996, lfw. 49 mm, SMFL-no. 4166, CCGT. **Fig. 53** (centre right): *Antheraea (Antheraea) rosieri imeldae,* ♂, PT, C-Palawan, Mt. Salacot, 350 m, 20. III. 1996, lfw. 43 mm, CCGT. **Fig. 54** (bottom left): *Antheraea (Antheraea) larissa larissa,* ♂, Palawan, Irawan, 50 m, 14. VIII. 1996, lfw. 77 mm, CCGT. **Fig. 55** (bottom right): *Antheraea (Antheraea) larissa larissa,* ♀, Palawan, Maoyan, 3. II. 1985, lfw. 82 mm, CCGT.

B&W plate 6 (p. 337)

Figs. 18–22: ♂ genitalia of *Cricula* species; aedeagus separate (A), scale = 1 mm, valid for all illustrations on the plate. **Fig. 18:** *Cricula trifenestrata,* Mindanao, GP 1025/96. **Fig. 19:** *Cricula luzonica luzonica,* Luzon, GP 649/90. **Fig. 20:** *Cricula luzonica leyteana,* **HT**, Leyte, GP 642/90. **Fig. 21:** *Cricula luzonica kareli,* **HT**, Mindanao, GP 636/90. **Fig. 22:** *Cricula mindanaensis,* **HT**, Mindanao, GP 877/95. — Plate from NÄSSIG & TREADAWAY (1997 a: figs. 10–14).

Colour plate 9 (p. 338)

Fig. 56 (top left): *Antheraea (Antheraea) larissa mindoroensis,* ♀, bright orange-yellowish form, Mindoro, Mt. Halcon, 13. IV. 1996, lfw. 89 mm, CCGT. **Fig. 57** (top right): *Antheraea (Antheraea) larissa mindoroensis,* ♂, Mindoro, Mt. Sinai, 16. III. 1996, lfw. 85 mm, CCGT. **Fig. 58** (centre left): *Antheraea (Antheraea) larissa philippirissa,* ♂, PT, N-Luzon, Banaue, 3000 ft., 11. IV. 1991, lfw. 76 mm, CCGT. **Fig. 59** (centre right): *Antheraea (Antheraea) larissa philippirissa,* ♀, medium orange form, PT, Negros, Mt. Mandalagan, 27. VIII. 1993, lfw. 78 mm, CCGT. **Fig. 60** (bottom left): *Antheraea (Antheraea) larissa philippirissa,* ♂, PT, typical "chequered" Negros-form, Negros, Mt Canlaon, 7. VII. 1995, lfw. 75 mm, CCGT. **Fig. 61** (bottom right): *Antheraea (Antheraea) larissa philippirissa,* ♂, Mindanao, S-Cotabato, Mt. Busa, 18. VI. 1997, lfw. 87 mm, CCGT.

Colour plate 10 (p. 339)

Fig. 62 (top left): *Antheraea (Antheraea) semperi noeli,* ♂, **HT**, Mindoro, Mt. Sinai, 24. III. 1996, lfw. 72 mm, GP 1093/97, SMFL-no. 4167, CCGT. **Fig. 63** (top right): *Antheraea (Antheraea) semperi semperi,* ♂, pure yellow form, Luzon, Quezon City, V. 1988, lfw. 70 mm, CCGT. **Fig. 64** (centre left): *Antheraea (Antheraea) semperi semperi,* ♂, contrastingly variegated orange form, Bohol, Bilar, 30. VI. 1990, lfw. 66 mm, CCGT. **Fig. 65** (centre right): *Antheraea (Antheraea) semperi semperi,* ♂, uniform greyish-brown form, Leyte, Mahaplag, Hilusig, Mt. Balocaue, 600 m, 26. II. 1987, lfw. 67 mm, CCGT. **Fig. 66** (bottom left): *Antheraea (Antheraea) semperi semperi,* ♀, yellow form, Mindanao, Surigao del Sùr, 2. IX. 1984, lfw. 74 mm, CCGT. **Fig. 67** (bottom right): *Antheraea (Antheraea) semperi semperi,* ♀, orange-brown form, S-Luzon, Quezon City, 150 m, X. 1984, lfw. 70 mm, CCGT.

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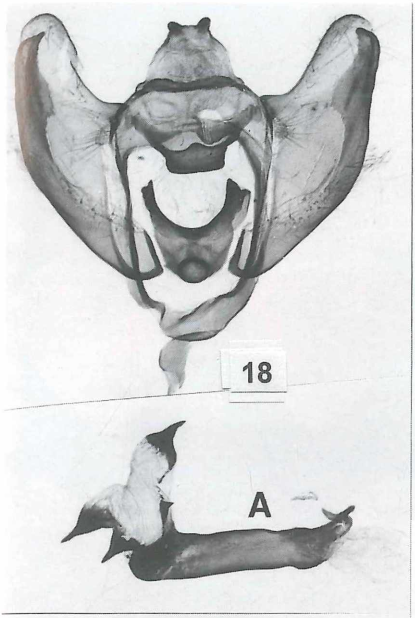
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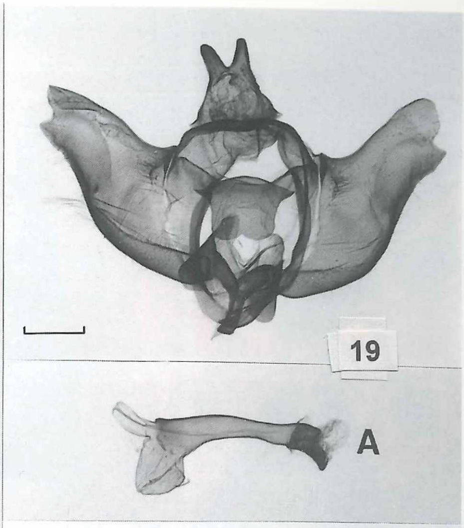
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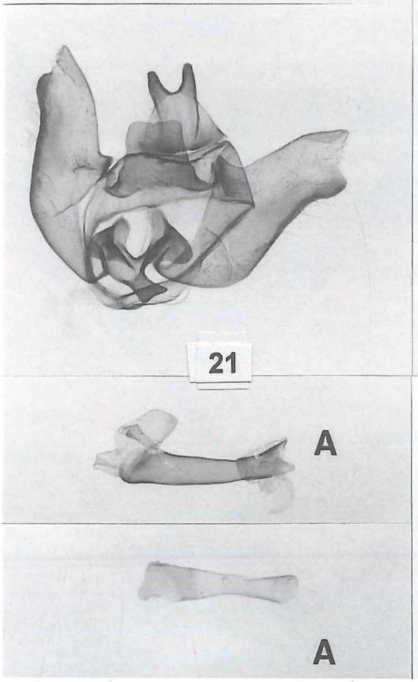
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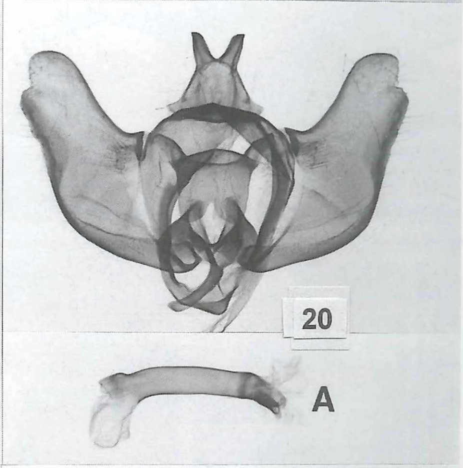
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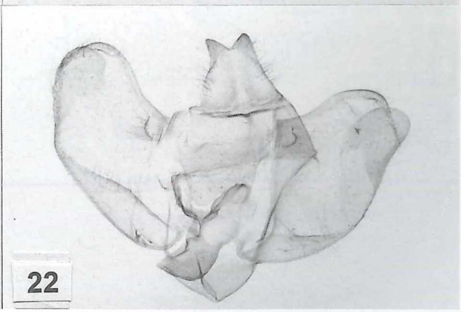
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B&W plate 6 (see p. 336)

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Colour plate 9 (see p. 336)

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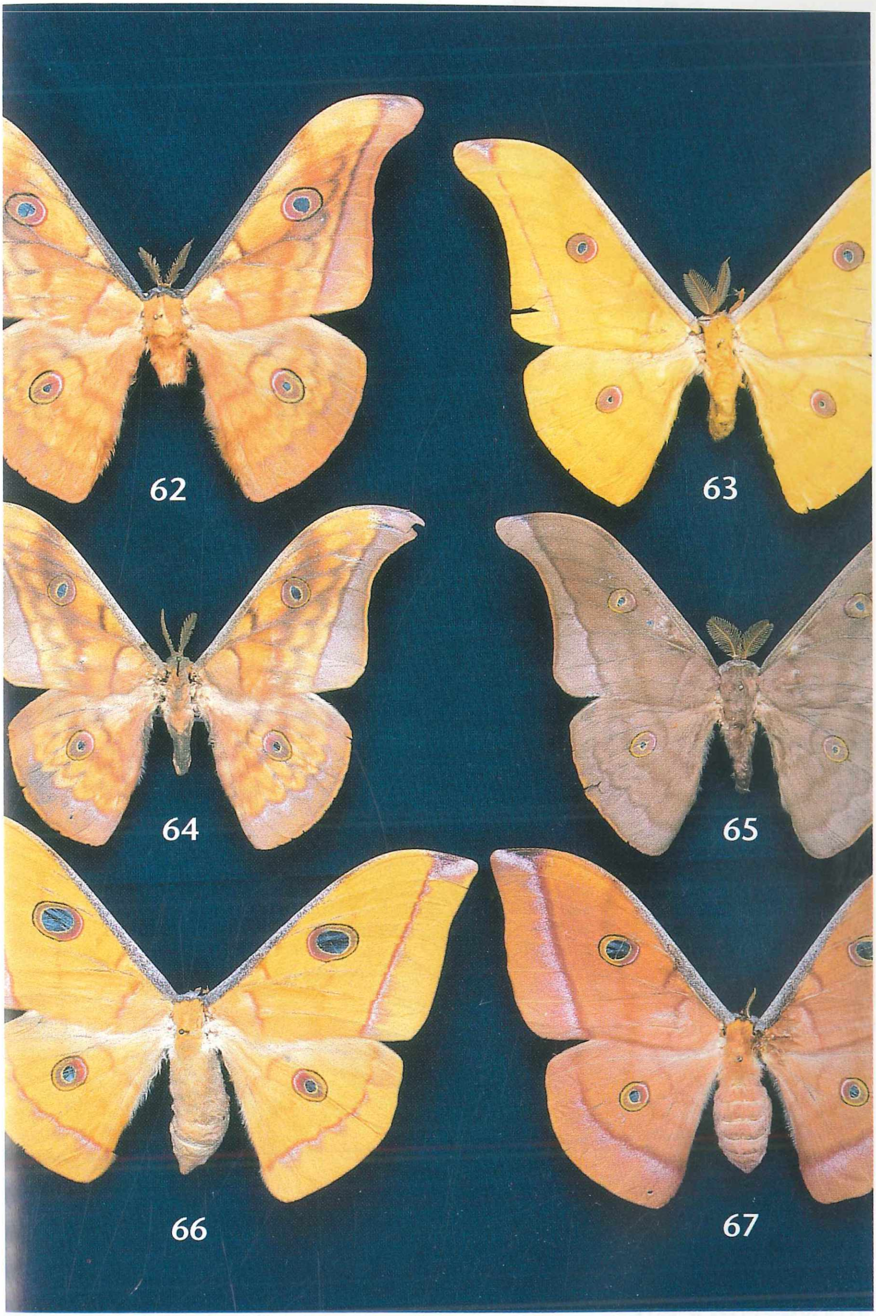

Colour plate 10 (see p. 336)

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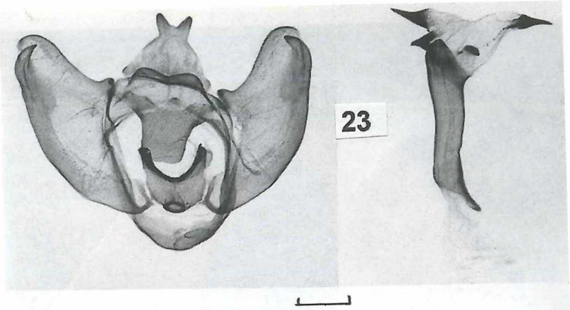

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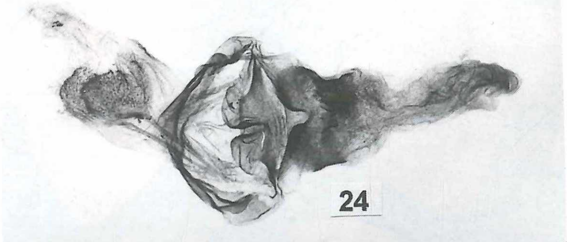

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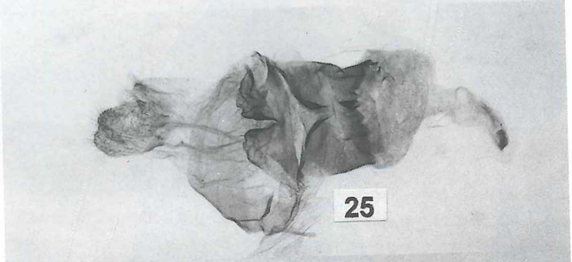

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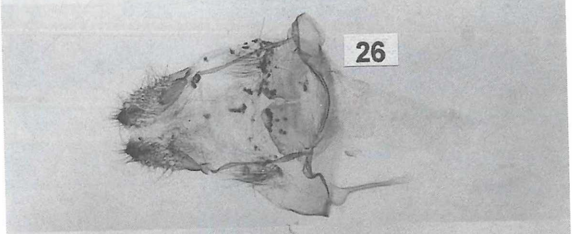

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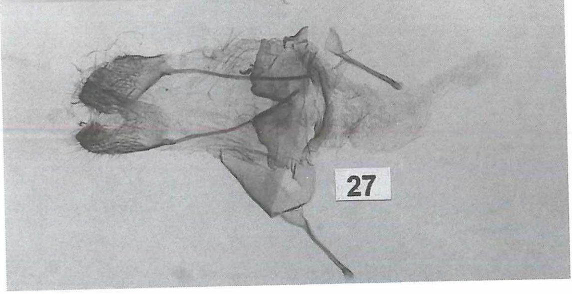

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B&W plate 7 (see p. 341)

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B&W plate 7 (p. 340)

Figs. 23–27: ♂ and ♀ genitalia of *Cricula* species; scale = 1 mm, valid for all illustrations on the plate. **Fig. 23:** *Cricula trifenestrata treadawayi*, **HT**, ♂, Negros, GP 608/88. **Fig. 24:** *Cricula trifenestrata*, ♀, Mindanao, GP 1026/96. **Fig. 25:** *Cricula trifenestrata treadawayi*, ♀, Negros, GP 539/87. **Fig. 26:** *Cricula luzonica luzonica*, ♀, Luzon, GP 897/95. **Fig. 27:** *Cricula luzonica kareli*, PT, ♀, Mindanao, GP 915/95.

Colour plate 11 (p. 342)

Fig. 68 (top left): *Antheraea (Antheraea) gulata*, ♀, PT, Palawan, Jacana, VII. 1973, lfw. 61 mm, CCGT. **Fig. 69** (top row, centre): *Antheraea (Antheraea) gulata*, ♂, **HT**, Palawan, Jacana, VII. 1973, lfw. 58 mm, SMFL-no. 4162, CCGT. **Fig. 70** (top right): *Antheraea (Antheraea) gulata*, ♂, PT, N-Palawan, Mt Maoyon, 1500 ft., 10. III. 1985, lfw. 57 mm, GP 1092/97, CCGT. **Fig. 71** (centre left): *Antheraea (Antheraea) platessa*, ♀, Mindanao, Bukidnon, Mt. Kitanglad, above Intavas, 6000 ft., 3. XI. 1996, lfw. 81 mm, CCGT. **Fig. 72** (centre right): *Antheraea (Antheraea) platessa*, ♂, Panay, Antique, Mt. Madja-as, 15. V. 1996, lfw. 73 mm, CCGT. **Fig. 73** (bottom left): *Antheraea (Antheraea) gschwandneri zwicki*, ♀, PT, C-Palawan, Mt. Salakot, 350 m, 19. III. 1996, lfw. 85 mm, CCGT. **Fig. 74** (bottom right): *Antheraea (Antheraea) gschwandneri zwicki*, ♂, **HT**, Palawan, Irawan, 50 m, J. F. PETERSEN,16. IX. 1996, lfw. 68 mm, GP 1059/97, SMFL-no. 4168, CCGT.

Colour plate 12 (p. 343)

Fig. 75 (top row, left): *Loepa nigropupillata*, ♂, PT, N-Luzon, Mts. Prov., Mt. Amuyao, 22 km SE Bontoc, 2450–2700 m, cloud forest, 15.–17. II. 1988, lfw. 59 mm, CWAN. **Fig. 76** (top row, right): *Loepa nigropupillata*, ♂, PT, N-Luzon, Ifugao, Mt. Pulis, 16 km SSE Bontoc, 1900 m, 9.–13. II. 1988, lfw. 56 mm, CWAN. **Fig. 77** (2nd row, left): *Loepa nigropupillata*, ♀, PT, same data as Fig. 76, lfw. 60 mm, CWAN. **Fig. 78** (2nd row, right): *Loepa mindanaensis*, ♂, Mindanao, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, Talakag, 1.–3. X. 1988, lfw. 59 mm, CWAN. **Fig. 79** (3rd row, left): *Loepa palawana*, ♂, **HT**, Palawan, Mt. Mantalingajan, 20. IV. 1990, lfw. 55 mm, GP 678/93, SMFL-no. 4157, CCGT. **Fig. 80** (3rd row, right): *Loepa mindanaensis*, ♀, Mindanao, S. Cotabato, Mt. Matutum, 18. II. 1996, lfw. 65 mm, CCGT. **Fig. 81** (bottom left): *Lemaireia schintlmeisteri*, ♀, PT, Mindanao, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, Talakag, 1.–3. X. 1988, lfw. 46 mm, CWAN. **Fig. 82** (bottom right): *Lemaireia schintlmeisteri*, ♀, PT, same data as Fig. 81, lfw. 41 mm, CWAN.

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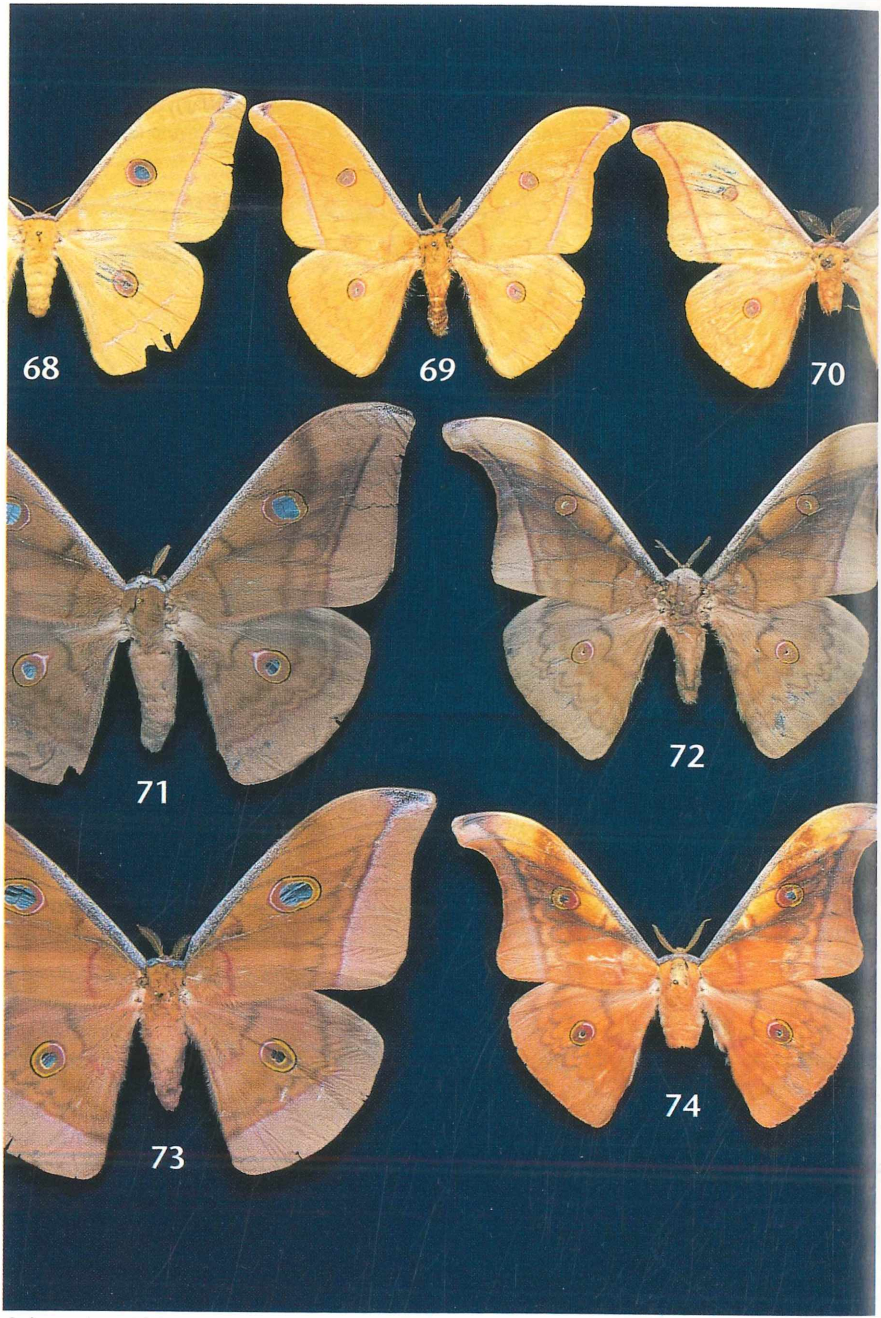

Colour plate 11 (see p. 341)

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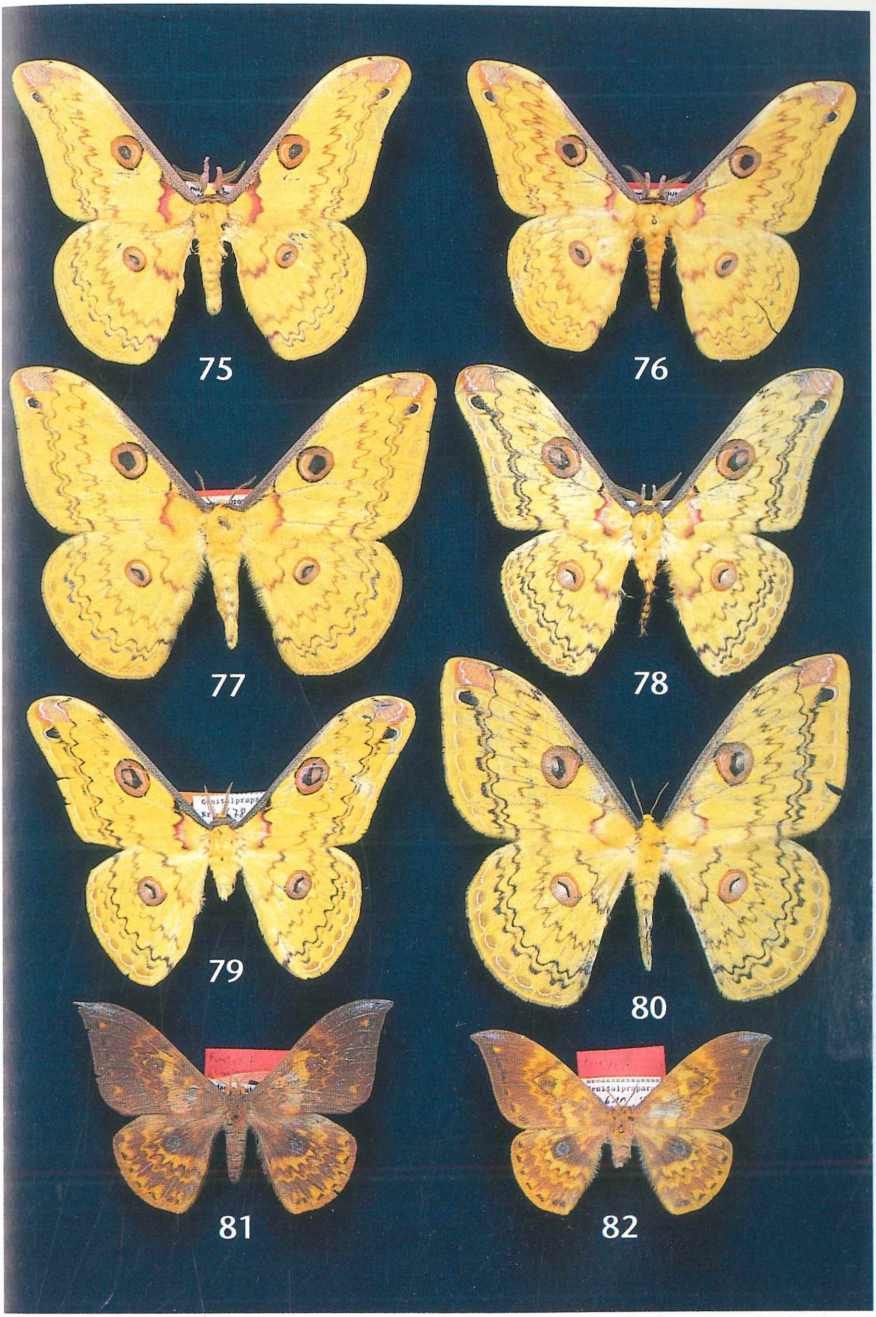

Colour plate 12 (see p. 341)

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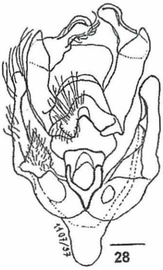

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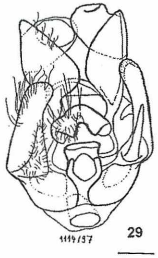

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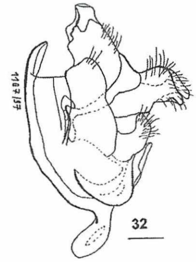

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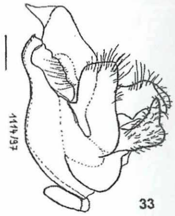

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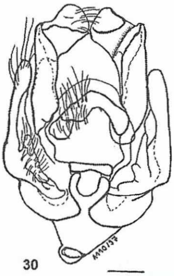

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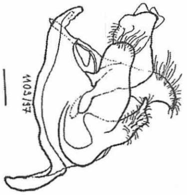

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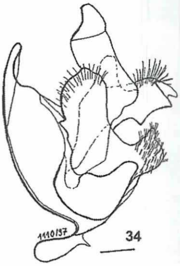

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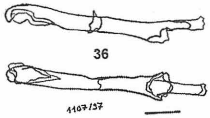

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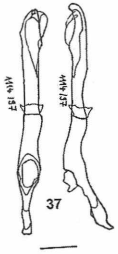

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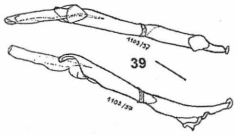

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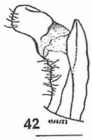

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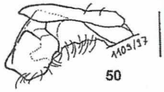

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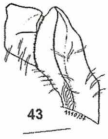

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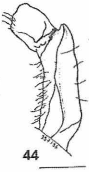

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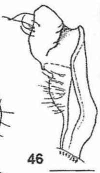

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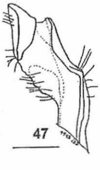

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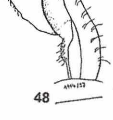

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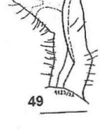

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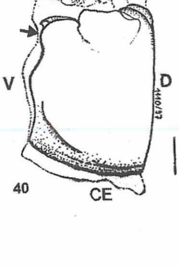

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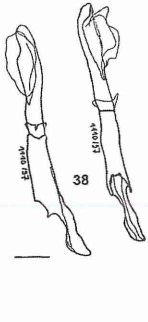

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B&W plate 8 (p. 344, top)

Figs. 28–35: ♂ genitalia of *Antheraea (Antheraeopsis)* species, scales = 1 mm. Caudo-ventral view of genitalia, aedeagus removed: **Fig. 28:** *Antheraea (Antheraeopsis) youngi,* West Malaysia, GP 1107/97 **Fig. 29:** *A. (Ao.) paniki paniki,* PT, Mindanao, GP 1114/97. **Fig. 30:** *A. (Ao.) paniki paniki,* PT, Luzon, GP 1110/97. **Fig. 31:** *A. (Ao.) paniki sahi,* **HT**, Palawan, GP 1109/97 — Lateral view of genitalia, aedeagus removed: **Fig. 32:** *Antheraea (Antheraeopsis) youngi,* West Malaysia, GP 1107/97. **Fig. 33:** *A. (Ao.) paniki paniki,* PT, Mindanao, GP 1114/97 **Fig. 34:** *A. (Ao.) paniki paniki,* PT, Luzon, GP 1110/97. **Fig. 35:** *A. (Ao.) paniki sahi,* **HT**, Palawan, GP 1109/97 — Drawings S. FRANZ, Senckenberg, in part after indications by J. KLEIN, Bayreuth. Hairs are here and in the following drawings usually indicated on one side only.

B&W plate 9 (p. 344, bottom)

Figs. 36–50: ♂ genitalia of *Antheraea (Antheraeopsis)* species, scales = 1 mm. Aedeagi, lateral and dorsal views: **Fig. 36:** *Antheraea (Antheraeopsis) youngi,* West Malaysia, GP 1107/97. **Fig. 37:** *A. (Ao.) paniki paniki,* PT, Mindanao, GP 1114/97. **Fig. 38:** *A. (Ao.) paniki paniki,* PT, Luzon, GP 1110/97 **Fig. 39:** *A. (Ao.) paniki sahi,* **HT**, Palawan, GP 1109/97. — The "hood" of the 8th abdominal tergite, lateral view: **Fig. 40:** *A. (Ao.) paniki paniki,* PT, Luzon, GP 1110/97 Abbreviations: D =dorsal, V = ventral side, CA = caudal, CE = cephal side. The arrow indicates the caudo-ventral lobe of the tergite which is sclerotized and works as a ventral "clamping grip" around the bulbous sacculus lobes of the valves. — Enlarged pictures of the transtilla protuberances, the labides (always the right labis, seen from medio-caudo-ventral): **Fig. 41:** *A. (Ao.) youngi,* West Malaysia, GP 1107/97. **Fig. 42:** *A. (Ao.) youngi,* Sumatra, GP 1108/97. **Fig. 43:** *A. (Ao.) paniki paniki,* PT, Luzon, GP 1110/97. **Fig. 44:** *A. (Ao.) paniki paniki,* PT, Luzon, GP 997/96. **Fig. 45:** *A. (Ao.) paniki paniki,* PT, Mindoro, GP 1112/97. **Fig. 46:** *A. (Ao.) paniki paniki,* PT, Homonhon, GP 1111/97. **Fig. 47:** *A. (Ao.) paniki paniki,* PT, Negros, GP 1115/97. **Fig. 48:** *A. (Ao.) paniki paniki,* PT, Mindanao, GP 1114/97. **Fig. 49:** *A. (Ao.) paniki paniki,* PT, Samar, GP 1129/97 **Fig. 50:** *A. (Ao.) paniki sahi,* **HT**, Palawan, GP 1109/97 — Drawings S. FRANZ, Senckenberg, in part after indications by J. KLEIN, Bayreuth.

B&W plate 10 (p. 346)

Figs. 51–53: ♂ genitalia of *Antheraea (Antheraea)* species of the *helferi*-group, scales = 1 mm (attention, the drawings are to different scales! *A. helferi* [Fig. 53] is largest, followed by *A. halconensis* [Fig. 51] and *A. rosemariae* [Fig. 52]). a = caudo-ventral view, b = lateral view of genitalia with aedeagus removed, c = the "hood" of the 8th abdominal tergite, d = lateral view of aedeagus. **Fig. 51:** *Antheraea (Antheraea) halconensis,* Luzon, GP 925/95. **Fig. 52:** *A. (A.) rosemariae,* Sulawesi, GP BMNH Sat. 637 (Figs. 52.a, 52.b, 52.d) and GP 923/95 (Fig. 52.c). **Fig. 53:** *A. (A.) helferi,* GP 718/94 (Figs. 53.a, 53.b), Sumatra, and GP 922/95 (Figs. 53.c, 53.d), West Malaysia. — Drawings (except Fig. 53.d): J. KLEIN, Bayreuth; Fig. 53.d: C. KLINGER, Senckenberg. — Plate from LAMPE et al. (1997: figs. 3–5).

B&W plate 11 (p. 347)

Figs. 54–56: ♂ genitalia of *Antheraea (Antheraea),* subspecies of *rosieri,* scales = 1 mm. a = ventral view, b = lateral view of genitalia with aedeagus removed, c = the "hood" of the 8th abdominal tergite (top = dorsal, left = caudal), d = lateral and dorsal views of aedeagus. **Fig. 54:** *Antheraea (Antheraea) rosieri rosieri,* S-Burma, GP 1081/97. **Fig. 55:** *A. (A.) rosieri imeldae,* PT, Palawan, GP 1063/97. **Fig. 56:** *A. (A.) rosieri* ssp.?, ?Mindanao, GP CWAN 1089/97, in CSNB. — Drawings: J. KLEIN, Bayreuth.

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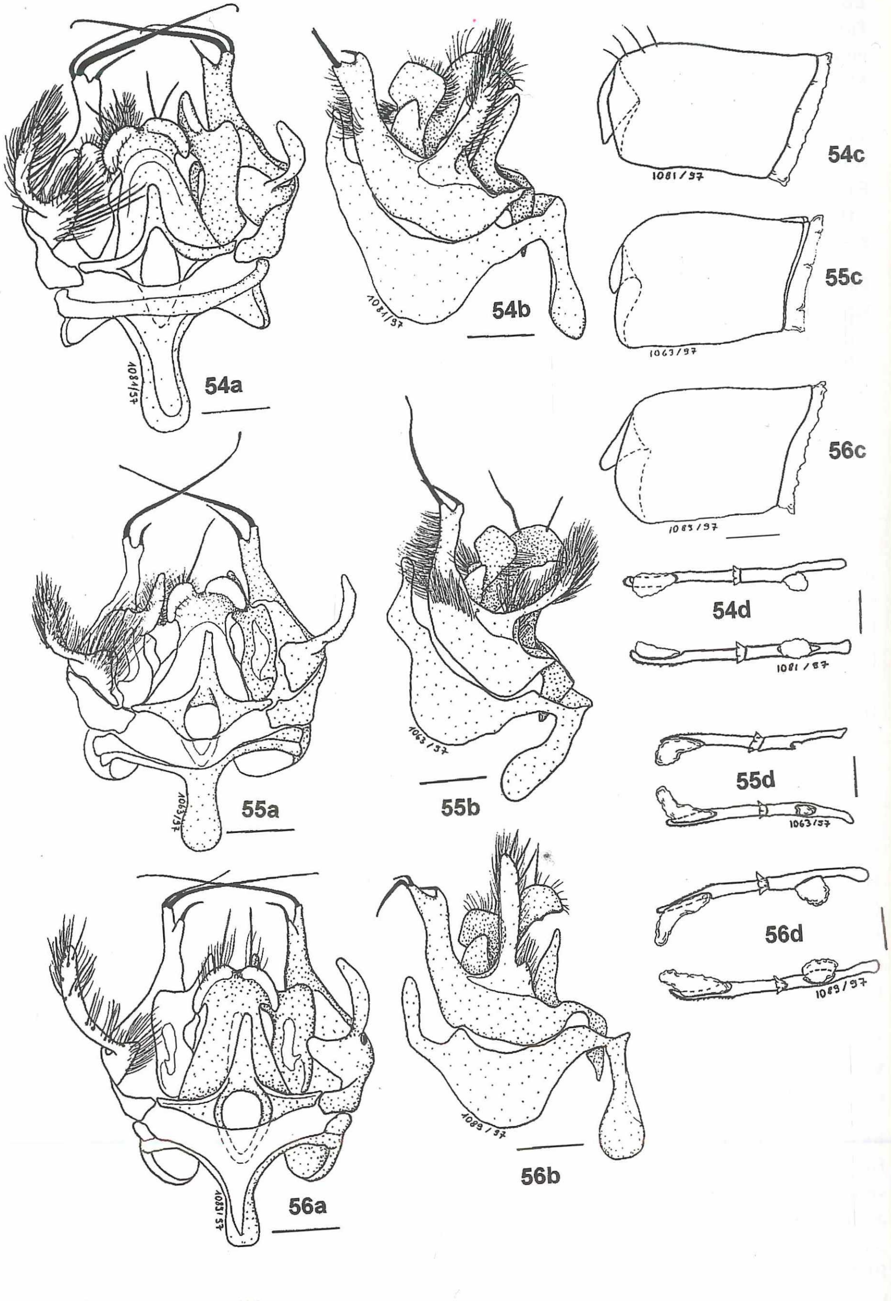

B&W plate 10 (see p. 345)

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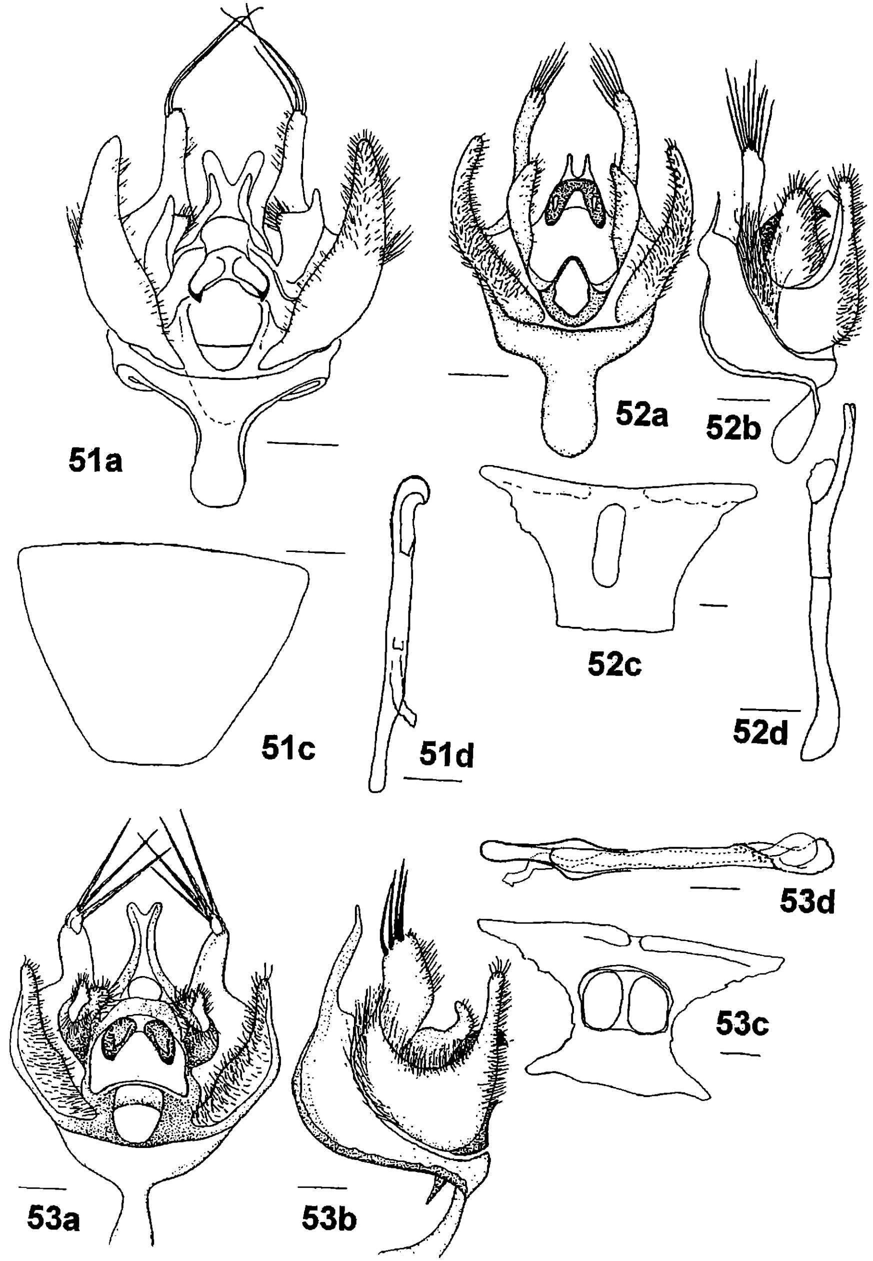

B&W plate 11 (see p. 345)

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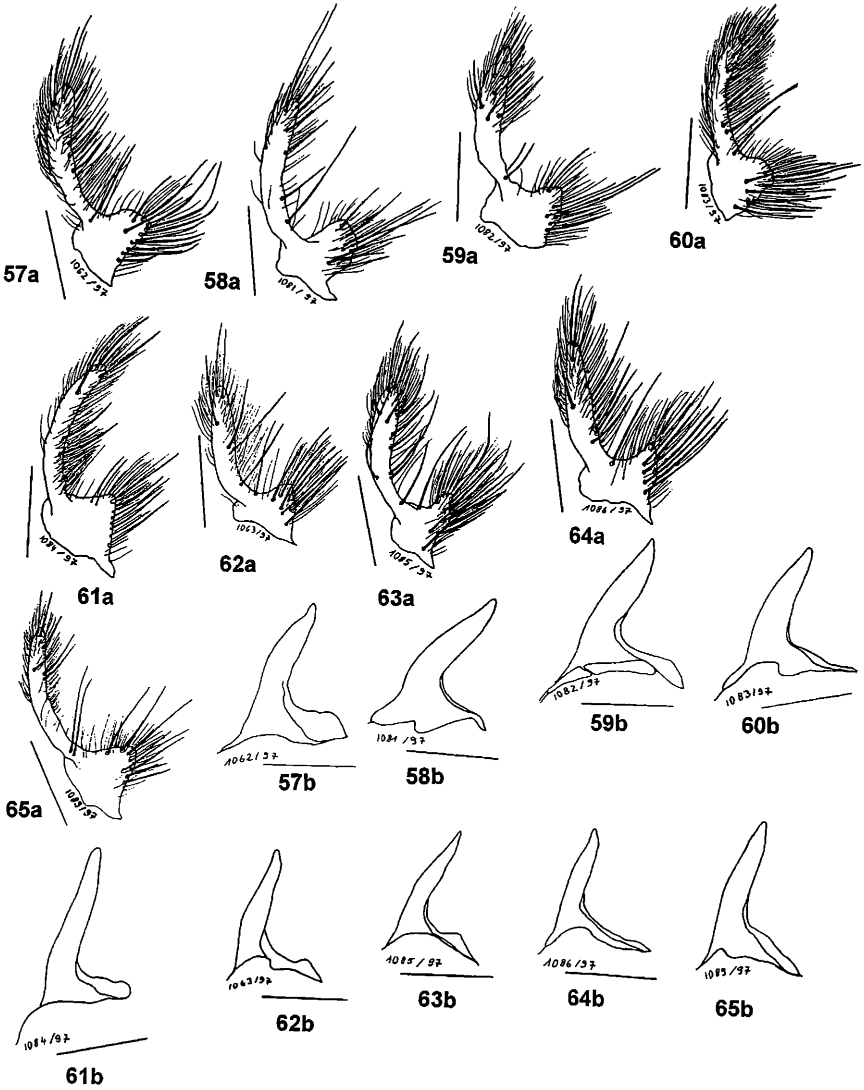

B&W plate 12: Figs. 57–65: ♂ genitalia of *Antheraea (Antheraea),* subspecies of *rosieri,* scales = 1 mm. a = enlarged lateral view of the ventral branch of the left valve, b = lateral view of the caudal juxta spine dorsad of the aedeagus sheath. **Fig. 57:** *Antheraea (Antheraea) rosieri rosieri,* Sumatra, GP 1062/97 **Fig. 58:** *A. (A.) rosieri rosieri,* S-Burma, GP 1081/97. **Fig. 59:** *A. (A.) rosieri rosieri,* S-Burma, GP 1082/97. **Fig. 60:** *A. (A.) rosieri rosieri,* West Malaysia, GP 1083/97. **Fig. 61:** *A. (A.) rosieri rosieri,* Borneo, GP 1084/97. **Fig. 62:** *A. (A.) rosieri imeldae,* PT, Palawan, GP 1063/97. **Fig. 63:** *A. (A.) rosieri imeldae,* PT, Palawan, GP 1085/97. **Fig. 64:** *A. (A.) rosieri imeldae,* PT, Palawan, GP 1086/97. **Fig. 65:** *A. (A.) rosieri* ssp.?, ?Mindanao, GP CWAN 1089/97, in CSNB. — Drawings: J. Klein, Bayreuth.

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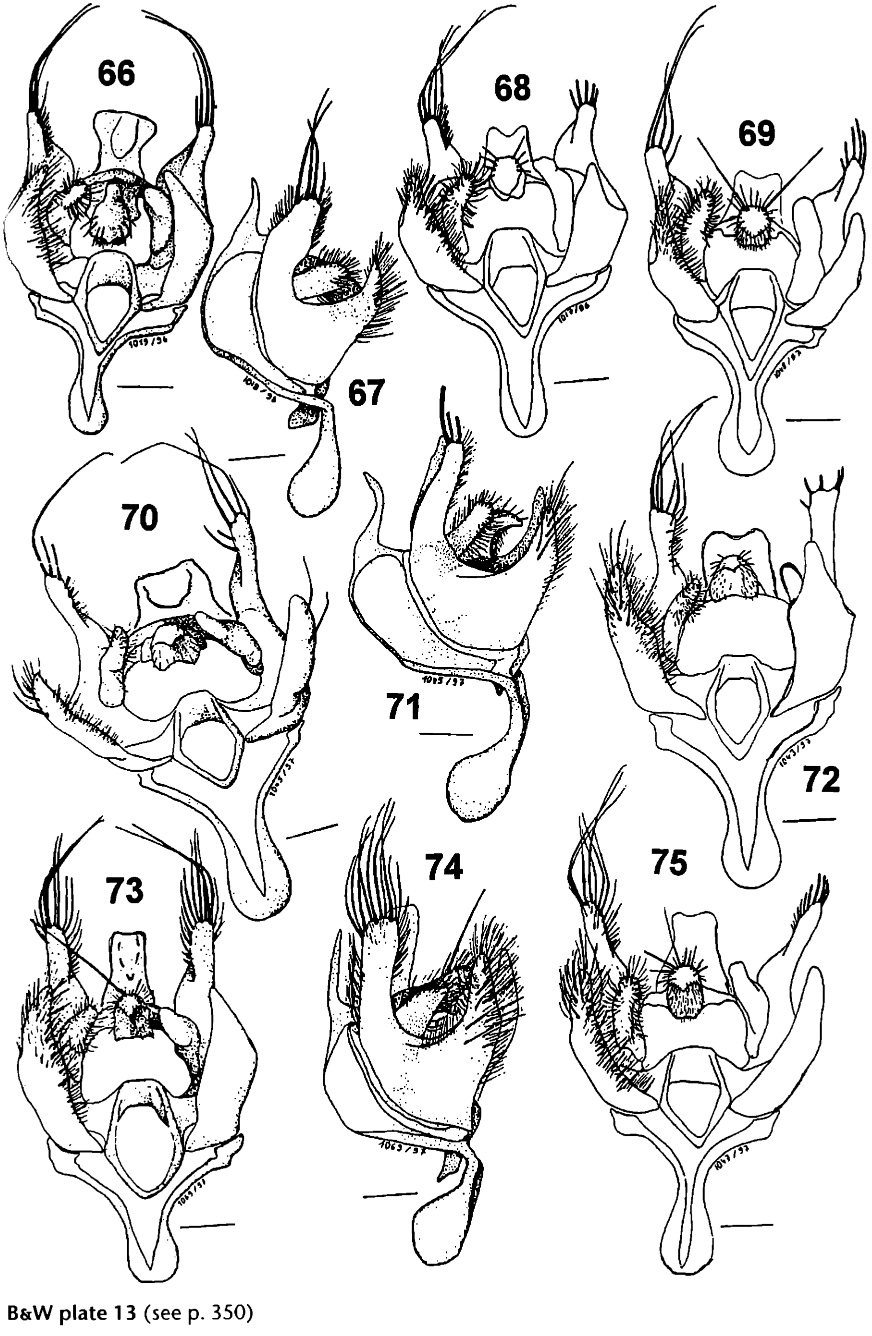

B&W plate 13 (see p. 350)

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B&W plate 13 (p. 349)

Figs. 66–75: ♂ genitalia of *Antheraea (Antheraea),* subspecies of *larissa,* scales = 1 mm. Caudoventral (CV) and lateral (L) views; longest bristles sometimes cut distally, aedeagus removed. **Figs. 66/67:** *Antheraea (Antheraea) larissa larissa,* Palawan, GP 1019/96, Fig. 66 CV, Fig. 67 L. **Fig. 68:** *A. (A.) larissa larissa,* Sumatra, GP 1017/96, CV. **Fig. 69:** *A. (A.) larissa larissa,* Sumatra, GP 1048/97, CV. **Figs. 70/71:** *A. (A.) larissa mindoroensis,* Mindoro, GP 1045/97, Fig. 70 CV, Fig. 71 L. **Fig. 72:** *A. (A.) larissa mindoroensis,* Mindoro, GP 1043/97, CV. **Figs. 73/74:** *A. (A.) larissa philippirissa,* PT, Luzon, GP 1069/97, Fig. 73 CV, Fig. 74 L. **Fig. 75:** *A. (A.) larissa philippirissa,* PT, Mindanao, GP 1047/97, CV. — Drawings: J. KLEIN, Bayreuth. — Plate from TREADAWAY & NÄSSIG (1997: figs. 43–52).

Colour plate 13 (supplementary, p. 351)

Fig. 83 (top row, left): *Attacus lorquinii,* ♂, "Luzon", lfw. 105 mm, CRLN. Aberrant form with enlarged white fasciae. **Fig. 84** (top row, right): *Attacus lorquinii,* ♀, "Luzon", lfw. 105 mm, CRLN. Aberrant form with enlarged white fasciae. Figs. 83/84: R. E. J. LAMPE. **Fig. 85** (2nd row, left): *Samia treadawayi,* ♂, PT, C-Palawan, Solomon, 17. III. 1996, CCGT. **Fig. 86** (2nd row, right): *Samia treadawayi,* ♀, PT, S-Palawan, Mt. Bayog, Brooke's Point, Jan. 1984, CCGT. Figs. 85/86: W. A. NÄSSIG, scales in cm with subdivisions in mm. **Fig. 87** (3rd row, left): *Antheraea semperi semperi,* ♂, **LT**, "Philippines" [probably Luzon], GP BMNH Sat. 446 ♂, ex FELDER coll. in BMNH. **Fig. 88** (3rd row, right): *Antheraea semperi semperi,* ♀, PLT, "Manille", ex FELDER coll. in BMNH. **Fig. 89** (bottom left): *Antheraea semperi noeli,* ♂, PT, Mindoro, Mt. Halcon, 11. VII. 1996, CSNB. Figs. 87–89: S. NAUMANN, scale in cm with subdivisions in mm. **Fig. 90** (bottom centre): *Lemaireia schintlmeisteri,* ♂, **HT**, upperside, Mindanao, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, Talakag, 1.–3. X. 1988, lfw. 33 mm, GP CWAN 609/89 = BMNH Sat. 628, ex CWAN in BMNH (phot. 89X-11). **Fig. 91** (bottom right): same specimen as in Fig. 90, underside (phot. 89X-21). The holotype of *L. schintlmeisteri* is figured here for the first time in colour. Figs. 90/91: W. A. NÄSSIG. — Plate 13 was mounted with paper copies made from colour slides or negatives, taken by different photographers; the accuracy of the colours is therefore in some cases not optimal.

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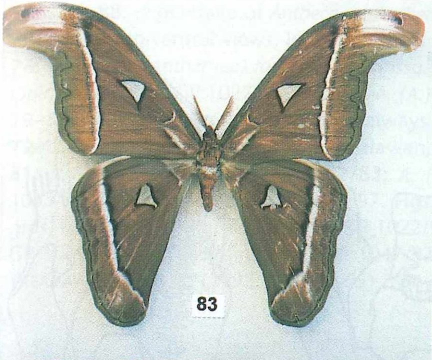
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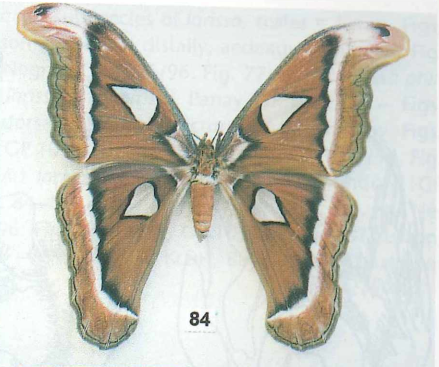
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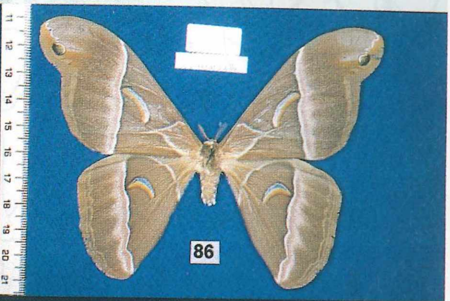

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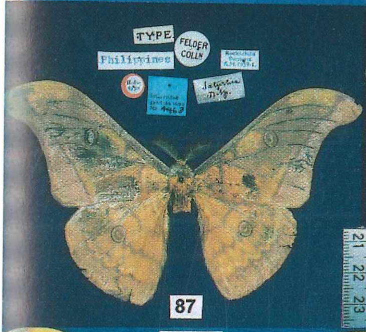

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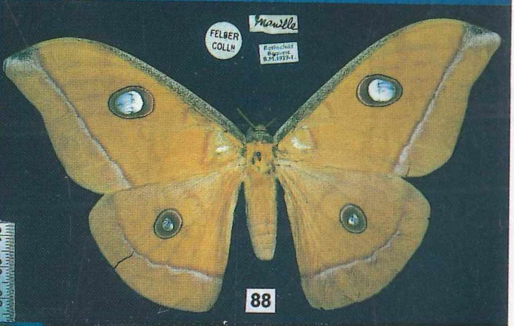

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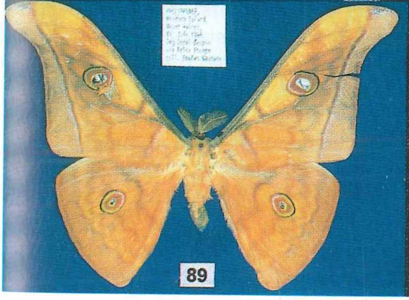
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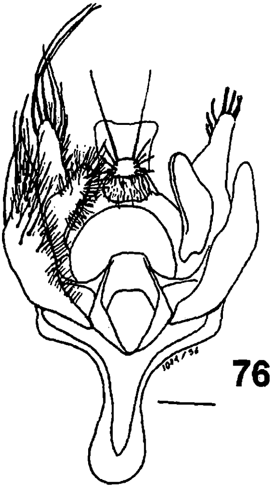

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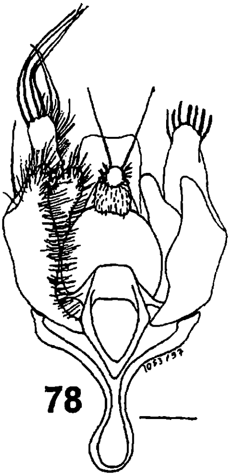

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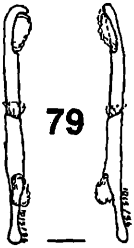

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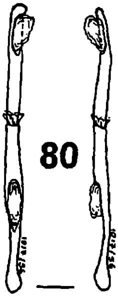

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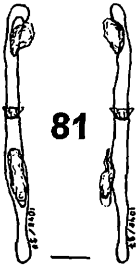

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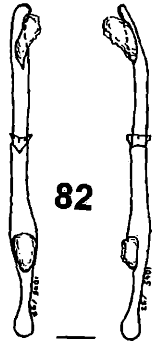

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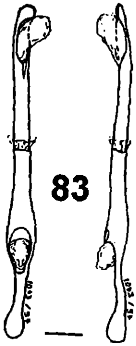

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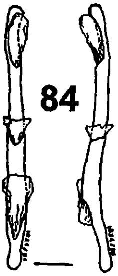

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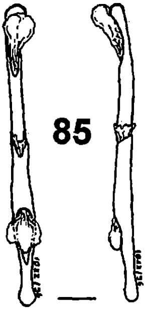

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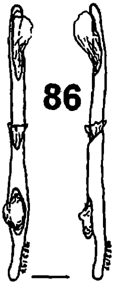

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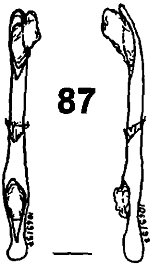

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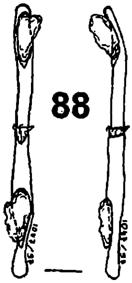

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B&W plate 14 (p. 352)

Figs. 76–88: ♂ genitalia of *Antheraea (Antheraea)*, subspecies of *larissa*, scales = 1 mm. **Figs. 76–78:** Caudo-ventral views; longest bristles sometimes cut distally, aedeagus removed. **Fig. 76:** *Antheraea (Antheraea) larissa philippirissa*, Negros, GP 1021/96. **Fig. 77:** *A. (A.) larissa philippirissa*, Negros, GP 1022/96. **Fig. 78:** *A. (A.) larissa philippirissa*, Panay, GP 1053/97 — **Figs. 79–88:** Aedeagi separate, left picture always dorsal view, right picture left lateral view. **Figs. 79–81:** *A. (A.) larissa larissa*. **Fig. 79:** Palawan, GP 1019/96. **Fig. 80:** Sumatra, GP 1017/96. **Fig. 81:** Sumatra, GP 1048/97. **Figs. 82/83:** *A. (A.) larissa mindoroensis*. **Fig. 82:** Mindoro, GP 1045/97. **Fig. 83:** Mindoro, GP 1043/97. **Figs. 84–88:** *A. (A.) larissa philippirissa*. **Fig. 84:** Negros, GP 1021/96. **Fig. 85:** Negros, GP 1022/96. **Fig. 86:** Panay, GP 1053/97. **Fig. 87:** Luzon, GP 1069/97. **Fig. 88:** Mindanao, GP 1047/97. — Drawings: J. KLEIN, Bayreuth. — Plate from TREADAWAY & NÄSSIG (1997: figs. 53–65).

6 Colour plates/preimaginals

The colour plates of the preimaginal instars are to different scales. All preimaginal plates were mounted with paper copies made from colour slides or (sometimes) colour negatives. The accuracy of the colours is therefore not always optimal.

Colour plate 14 (p. 354)

Fig. 92: *Attacus caesar*, eggs. **Fig. 93:** *Attacus lorquinii*, eggs. **Fig. 94:** *A. caesar*, L_1 caterpillar. **Fig. 95:** *A. lorquinii*, L_1 caterpillar. **Fig. 96:** *A. caesar*, L_2 caterpillar. **Fig. 97:** *A. lorquinii*, L_2 caterpillar. **Fig. 98:** *A. caesar*, L_3 caterpillar. **Fig. 99:** *A. lorquinii*, L_3 caterpillar. **Fig. 100:** *A. caesar*, L_4 caterpillar. **Fig. 101:** *A. lorquinii*, L_4 caterpillar. **Fig. 102:** *A. caesar*, L_5 caterpillar. **Fig. 103:** *A. lorquinii*, L_5 caterpillar. — All photographs on plates 14 & 15 by R. E. J. LAMPE from rearings of the two species at different times; foodplants were *Ligustrum* sp. (Oleaceae) and/or *Prunus laurocerasus* (Rosaceae).

Colour plate 15 (p. 355)

Fig. 104: *Attacus caesar*, L_6 (= ultimate instar) caterpillar, short time after last moult. **Fig. 105:** *Attacus lorquinii*, L_6 (= ultimate instar) caterpillar, short time after last moult. **Fig. 106:** *A. caesar*, L_6 caterpillar, fully grown. **Fig. 107:** *A. lorquinii*, L_6 caterpillar, fully grown. **Fig. 108:** *A. caesar*, L_6 caterpillar, details of head and thorax. **Fig. 109:** *A. lorquinii*, L_6 caterpillar, details of head and thorax. **Fig. 110:** *A. caesar*, L_6 caterpillar, details of anal segments. **Fig. 111:** *A. caesar*, cocoon. **Fig. 112:** *A. caesar*, pupa. **Fig. 113:** *A. lorquinii*, cocoon. **Fig. 114:** *A. lorquinii*, pupa. — All photographs on plate 15 by R. E. J. LAMPE.

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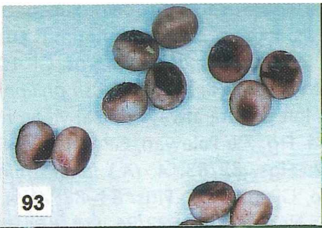
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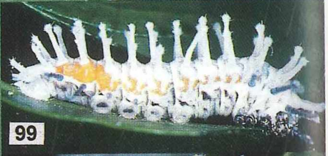
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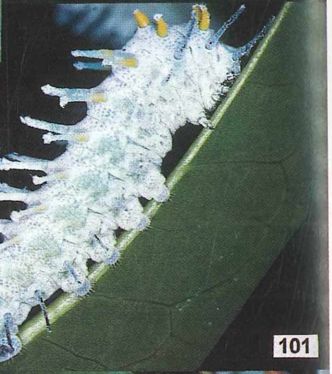
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Colour plate 14 (see p. 353)

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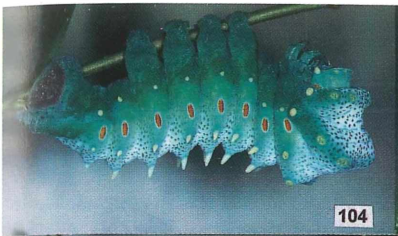
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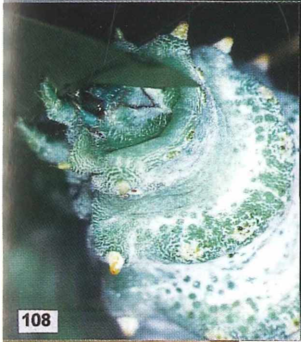
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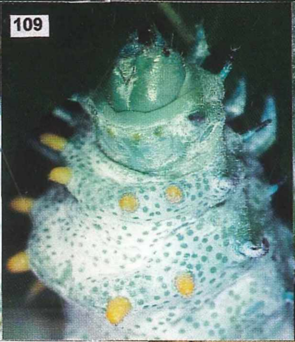
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Colour plate 15 (see p. 353)

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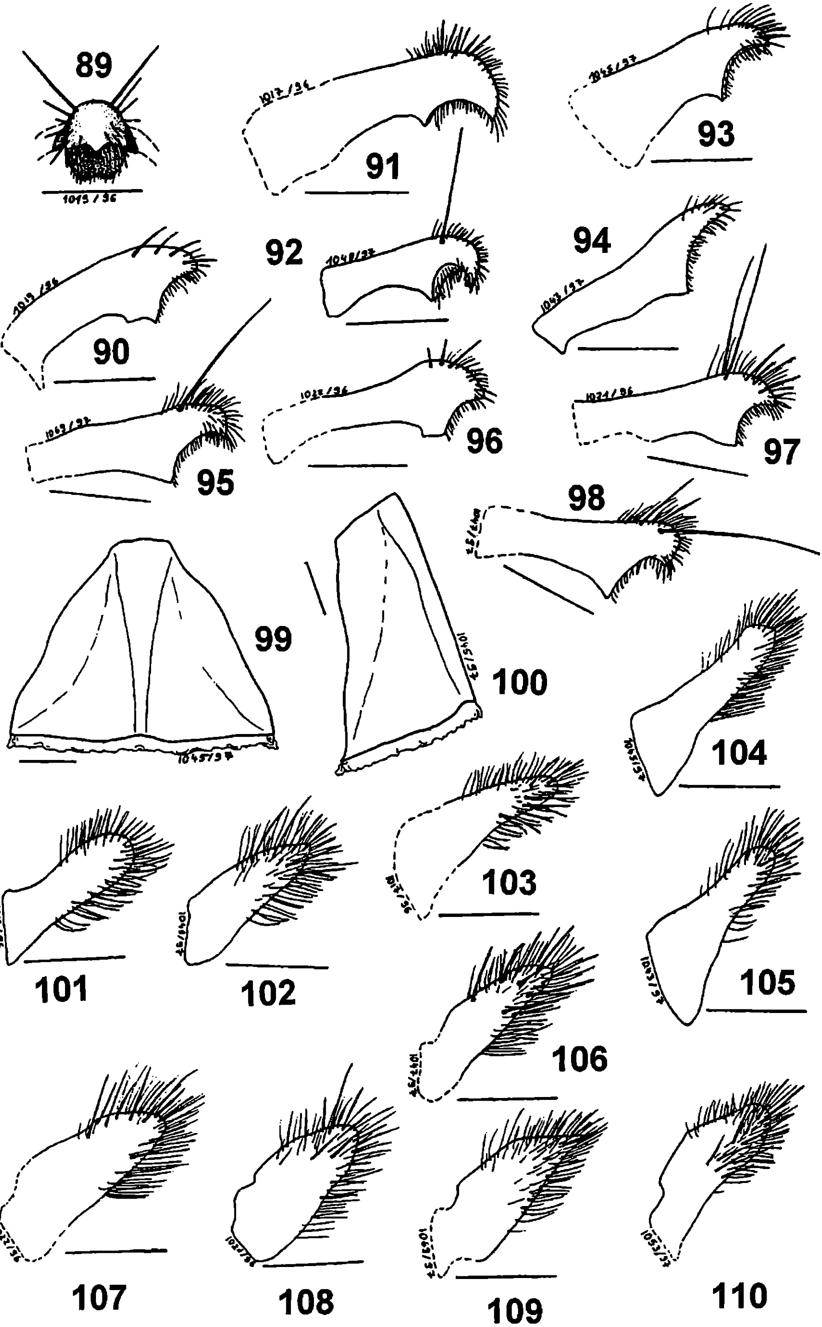

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B&W plate 15 (p. 356)
Figs. 89–110: ♂ genitalia of *Antheraea (Antheraea),* subspecies of *larissa,* scales = 1 mm. **Figs. 89–98:** Enlarged: variability of uncus shape, Fig. 89 caudo-ventral view, Figs. 90–98 lateral view. **Figs. 89–92:** *Antheraea (Antheraea) larissa larissa.* **Figs. 89/90:** Palawan, GP 1019/96. **Fig. 91:** Sumatra, GP 1017/96. **Fig. 92:** Sumatra, GP 1048/97. **Figs. 93–94:** *A. (A.) larissa mindoroensis.* **Fig. 93:** Mindoro, GP 1045/97. **Fig. 94:** Mindoro, GP 1043/97 **Figs. 95–98:** *A. larissa philippirissa.* **Fig. 95:** Luzon, GP 1069/97. **Fig. 96:** Negros, GP 1022/96. **Fig. 97:** Negros, GP 1021/96. **Fig. 98:** Mindanao, GP 1047/97. — **Figs. 99/100:** "Hood" of the 8th abdominal tergite, Fig. 99 dorsal, Fig. 100 lateral view. Top = caudal end. Mindoro, GP 1045/97 (= ssp. *mindoroensis;* the "hoods" of the other two subspecies do not differ markedly). — **Figs. 101–110:** Enlarged: variability of labides (transtilla processes), lateral views. **Figs. 101–103:** *Antheraea (Antheraea) larissa larissa.* **Fig. 101:** Palawan, GP 1019/96. **Fig. 102:** Sumatra, GP 1048/97. **Fig. 103:** Sumatra, GP 1017/96. **Figs. 104/105:** *A. (A.) larissa mindoroensis.* **Fig. 104:** Mindoro, GP 1045/97. **Fig. 105:** Mindoro, GP 1043/97. **Figs. 106–110:** *A. (A.) larissa philippirissa.* **Fig. 106:** Mindanao, GP 1047/97. **Fig. 107:** Negros, GP 1022/96. **Fig. 108:** Negros, GP 1021/96. **Fig. 109:** Luzon, GP 1069/97. **Fig. 110:** Panay, GP 1053/97. — Drawings: J. Klein, Bayreuth. — Plate from Treadaway & Nässig (1997: figs. 66–87).

Colour plate 16 (p. 358)
Figs. 115–122: *Samia luzonica,* from Luzon; reared on *Prunus* cf. *cerasus* (Rosaceae). The rearing was not successful, no larva went through the last instar and pupated. **Figs. 115–118:** $L_{2/3}$ (most specimens L_3, a few L_2 left) caterpillars (88C-4, 88B-34, 88B-36, 88C-1). **Figs. 119/120:** L_4 (= penultimate instar) (88C-22, 88C-25). **Figs. 121/122:** L_5 (= ultimate instar) caterpillar, last specimen, which died from an infection of the digestion tract; dorsal and lateral view of the dead larva (88E-28, 88E-29). — Figs. 115–122 by W. A. Nässig, with film & picture numbers. — **Figs. 123–125:** *Cricula trifenestrata treadawayi,* ca. ultimate instar (probably L_5/L_6). Pictures taken in the wild on Negros, larvae feeding on seedlings of avocado (*Persea* sp., Lauraceae), see Treadaway (1986). — Figs. 123–125 by C. G. Treadaway.

Colour plate 17 (p. 359)
Figs. 126–135: *Cricula* sp. from N-Luzon, probably *C. luzonica luzonica.* Rearing started with evergreen *Pyracantha* sp. (Rosaceae), later instars were transferred to *Prunus* cf. *cerasus* (Rosaceae). The larvae died all due to infections; a few reached the ultimate instar, but no cocoon was achieved. **Fig. 126:** L_1 larva (ZL-28). **Fig. 127:** L_2 larvae (ZN-27). **Fig. 128:** L_3 larvae (ZO-9). **Figs. 129–131:** L_4 larvae (ZO-25, -24, -26). **Figs. 132, 133:** L_5 larvae (ZO-31, -34). **Figs. 134, 135:** L_6 larvae (ZR-35, -34). **Figs. 136–138:** *Antheraea (Antheraea)* spec. indet., L_1 from Palawan (88A-12, -11, -13) (rearing no. B in text, possibly *gulata* or *gschwandneri zwicki*?). The larva did not accept *Quercus robur* (Fagaceae) and some Rosaceae as food and died. — Figs. 126–138 by W. A. Nässig, with film & picture numbers.

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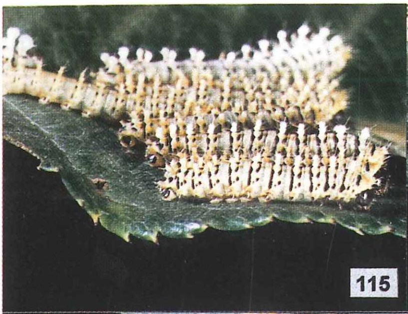
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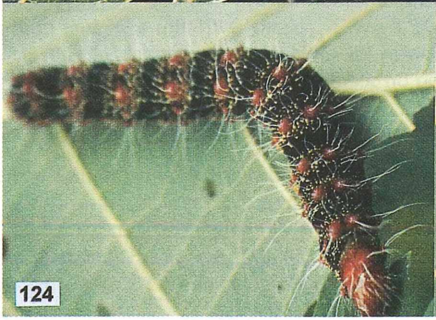
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Colour plate 16 (see p. 357)

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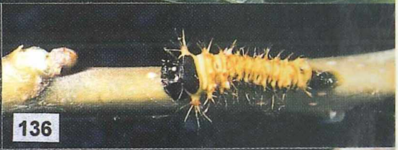
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Colour plate 17 (see p. 357)

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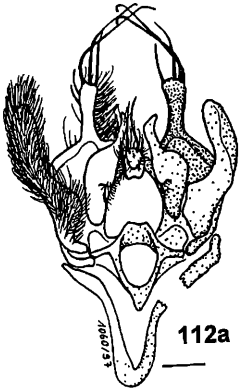

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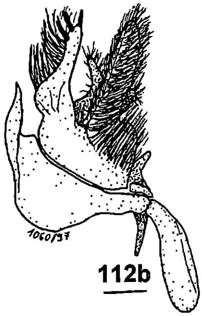

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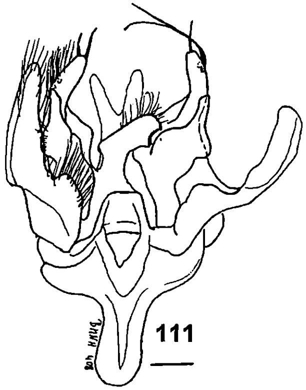

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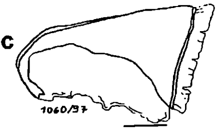

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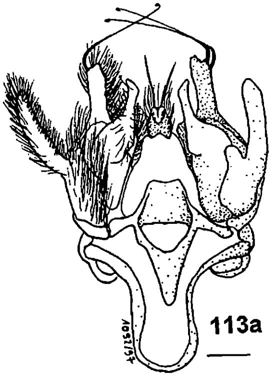

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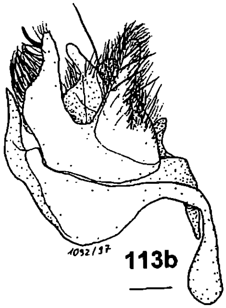

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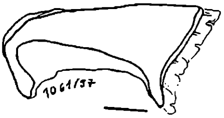

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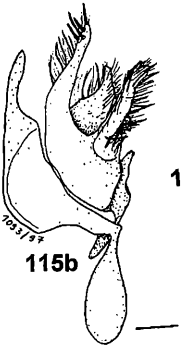

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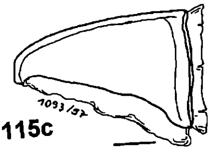

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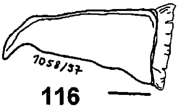

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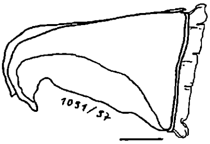

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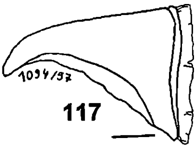

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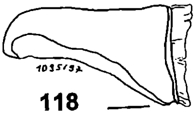

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B&W plate 16 (p. 360)

Figs. 111–119: ♂ genitalia of *Antheraea (Antheraea), frithi*-group, complex of *semperi;* scales = 1 mm. **Fig. 111:** *Antheraea (Antheraea) alleni,* Borneo, GP BMNH Sat. 408. **Figs. 112 & 119:** *A. (A.) brunei.* **Fig. 112:** Borneo, GP 1092/97; a = caudo-ventral, b = lateral view, c = "hood", the 8th abdominal tergite, lateral view. **Fig. 119:** Borneo, GP 1091/97, "hood" **Figs. 113/114:** *A. (A.) gulata.* **Fig. 113:** PT, Palawan, GP 1092/97; a = caudo-ventral, b = lateral view, c = "hood", lateral view. **Fig. 114:** PT, Palawan, GP 1061/97, "hood" **Figs. 115–118:** *A. (A.) semperi* sspp. **Fig. 115:** *A. (A.) semperi noeli,* HT, Mindoro, GP 1045/97. **Figs. 116–118:** *A. (A.) semperi semperi.* **Fig. 116:** Luzon, GP 1058/97. **Fig. 117:** Panay, GP 1094/97. **Fig. 118:** Luzon, GP 1095/97. — Drawings: J. Klein, Bayreuth.

Colour plate 18 (p. 362)

Figs. 139–150: *Antheraea (Antheraea) halconensis* from Luzon, Ifugao. Rearing started with evergreen *Pyracantha coccinea* (Rosaceae), the last instar was then transferred to *Malus hilleri* (Rosaceae). **Fig. 139:** Eggs. **Figs. 140/141:** L_1 larvae (lateral and dorsal views). **Fig. 142:** L_2 larva. **Fig. 143:** L_3 larva. **Fig. 144:** L_4 larva. **Fig. 145:** L_5 larva. **Fig. 146–149:** L_6 larva; 146 lateral view, 147 dorsal view, 148 head and thorax, 149 anal end. **Fig. 150:** Cocoon. — Figs. 139–150 by R. E. J. Lampe. Plate from Lampe et al. (1997: 104, figs. 26–37).

Colour plate 19 (p. 363)

Figs. 151–162: *Antheraea (Antheraea)* spec. indet. (possibly *semperi*?) from Luzon (rearing no. A in text). The larvae were fed at the begin with *Rosa* sp., later with evergreen *Pyracantha coccinea* (Rosaceae). **Fig. 151:** L_1 larva, just after hatching (ZH-2). **Figs. 152, 153:** L_1 larva, in moult to L_2 (ZH-16, -15). **Figs. 154–156:** L_2 larva, shortly after moult (ZH-20, -19, -21). **Fig. 157:** L_2 larva, fully grown. L_3 & L_4 (ca.) have not been photographed due to travelling. **Figs. 158–162:** Probably last instar larva (ca. L_5); lateral and dorsal view, head and thorax, head, and anal segments. — Figs. 151–162 by W. A. Nässig, with film & picture numbers.

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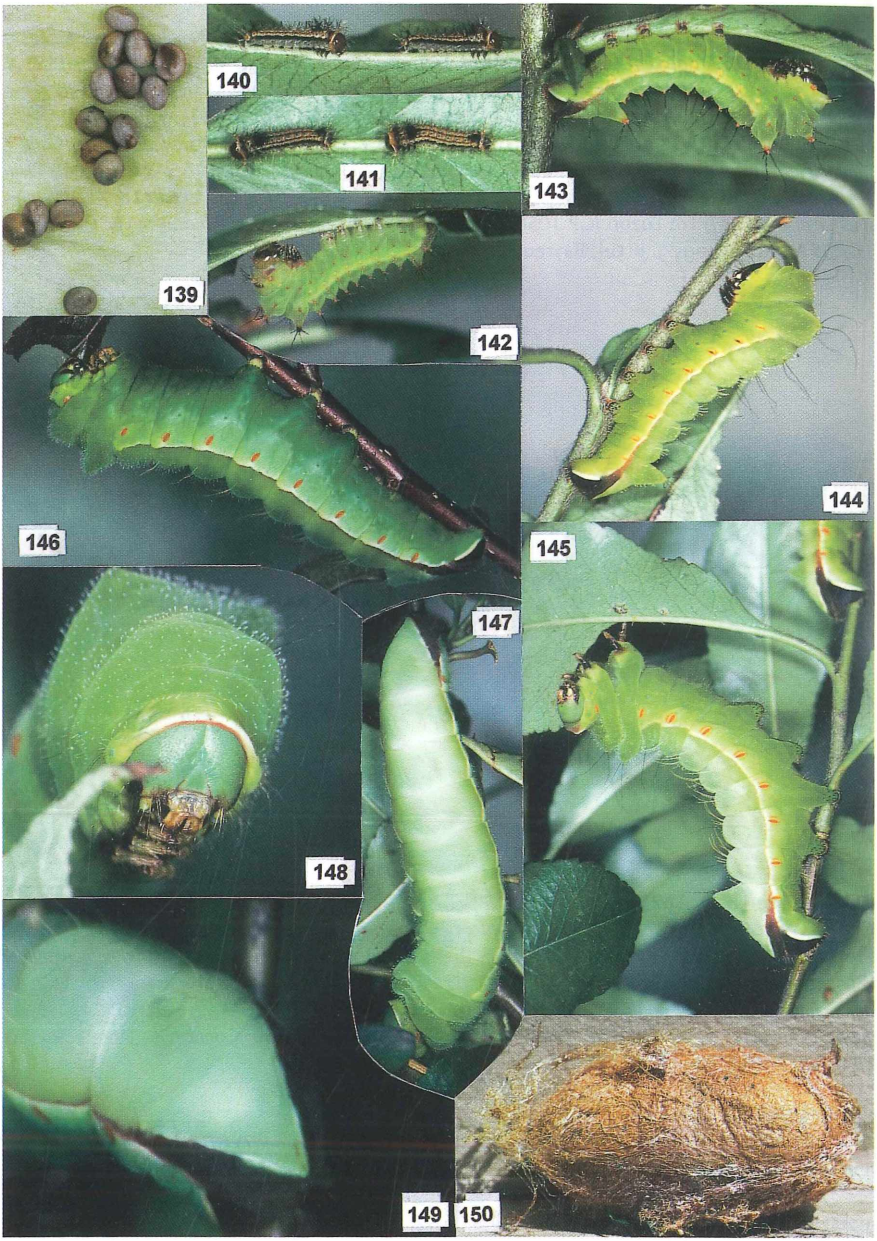

Colour plate 18 (see p. 361)

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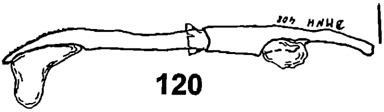

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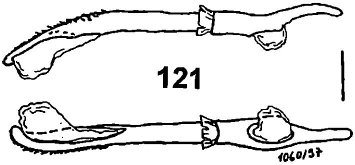

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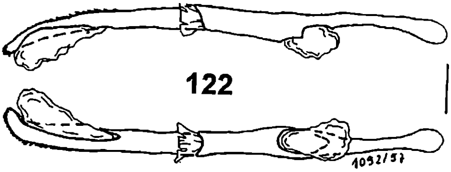

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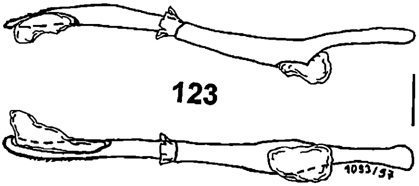

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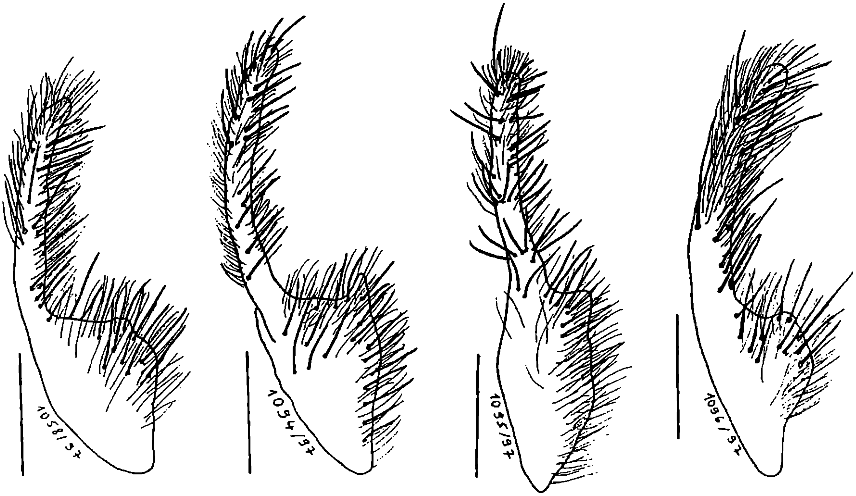

124a 124b 124c 124d

B&W plate 17

Figs. 120–124: ♂ genitalia of *Antheraea (Antheraea), frithi*-group, complex of *semperi;* scales = 1 mm. **Figs. 120–123:** Aedeagi, lateral and dorsal views. **Fig. 120:** *Antheraea (Antheraea) alleni,* Borneo, GP BMNH Sat. 408. **Fig. 121:** *A. (A.) brunei,* Borneo, GP 1092/97. **Fig. 122:** *A. (A.) gulata,* PT, Palawan, GP 1092/97. **Fig. 123:** *A. (A.) semperi noeli,* HT, Mindoro, GP 1045/97 **Fig. 124:** *A. (A.) semperi semperi,* enlarged: variability of lateral branch of the valve. **Fig. 124.a:** Luzon, GP 1058/97 **Fig. 124.b:** Panay, GP 1094/97. **Fig. 124.c:** Luzon, GP 1095/97. **Fig. 124.d:** Luzon, GP 1096/97. — Drawings: J. Klein, Bayreuth.

B&W plate 18

Figs. 125–127: ♂ genitalia of *Antheraea (Antheraea), frithi*-group, complex of *gschwandneri/celebensis;* scales = 1 mm. a = caudo-ventral, b = lateral view, aedeagus removed; c = aedeagus, lateral (top) and dorsal view (bottom); d = "hood", the 8th abdominal tergite, lateral view. **Fig. 125:** *Antheraea (Antheraea) platessa,* Luzon, GP 1068/97. **Fig. 126:** *A. (A.) moultoni,* Borneo, GP 1057/97. **Fig. 127:** *A. (A.) gschwandneri zwicki,* **HT**, Palawan, GP 1059/97. — Drawings: J. Klein, Bayreuth.

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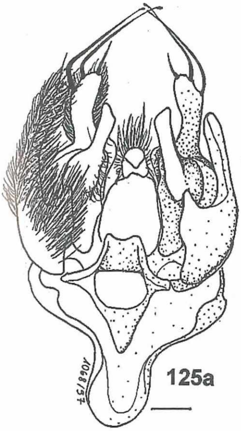

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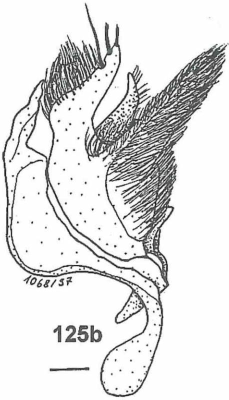

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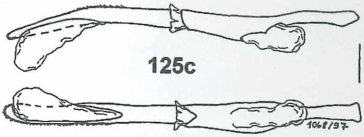

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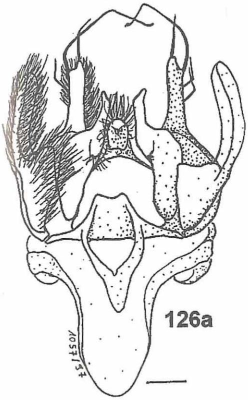

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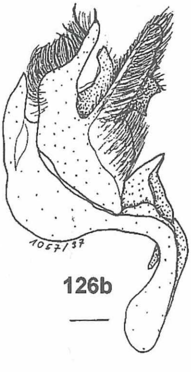

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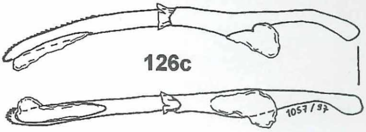

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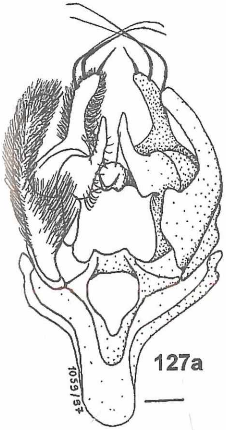

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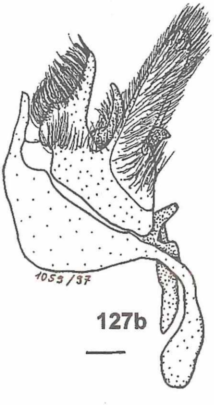

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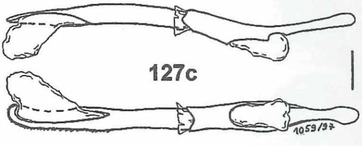

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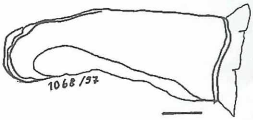

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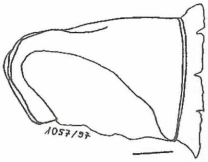

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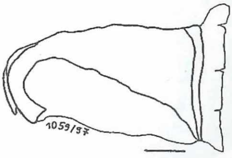

127d

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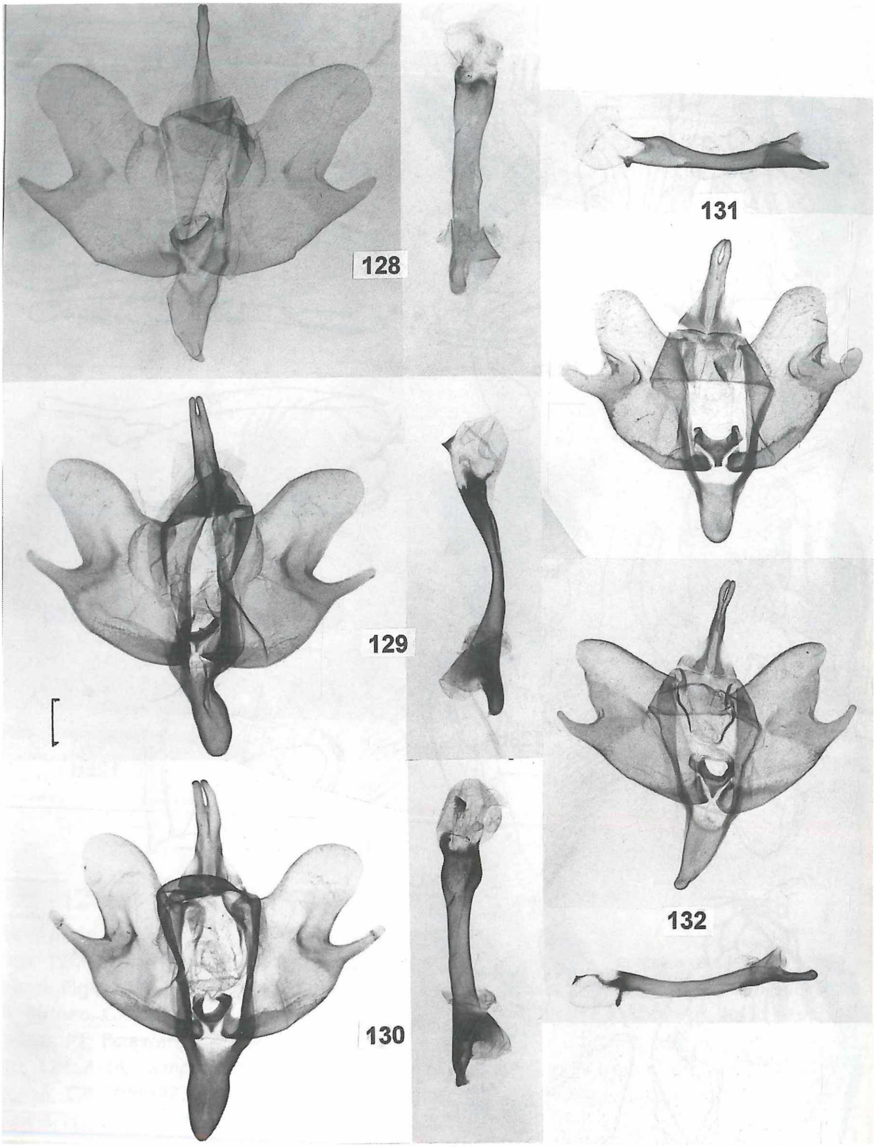

B&W plate 19

Figs. 128–132: ♂ genitalia of *Loepa* species, aedeagi separate; scale = 1 mm, valid for all illustrations on the plate. **Fig. 128:** *Loepa mindanaensis,* **HT,** Mindanao, coll. Semper in SMFL, GP 603/88. **Fig. 129:** *Loepa nigropupillata,* Luzon, GP 607/88. **Fig. 130:** *Loepa nigropupillata,* Luzon, GP 580/88. **Fig. 131:** *Loepa palawana,* PT, Palawan, GP 1014/96. **Fig. 132:** *Loepa* sp.?, Palawan, GP 879/95.

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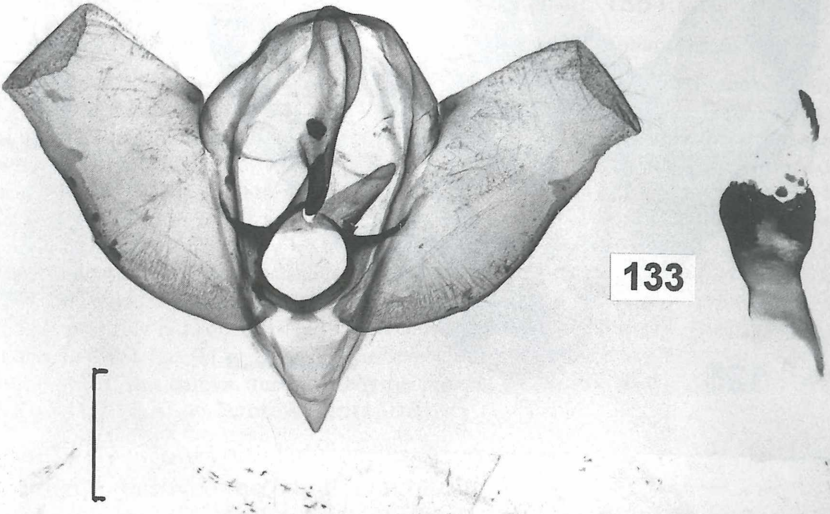

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B&W plate 20

Figs. 133/134: ♂, aedeagus separate, and ♀ genitalia of *Lemaireia schintlmeisteri;* scale = 1 mm, valid for all illustrations on the plate. **Fig. 133:** *Lemaireia schintlmeisteri,* **HT,** ♂, Mindanao, GP 609/89 = BMNH Sat. 628, in BMNH. **Fig. 134:** *L. schintlmeisteri,* PT, ♀, Mindanao, GP 610/89.

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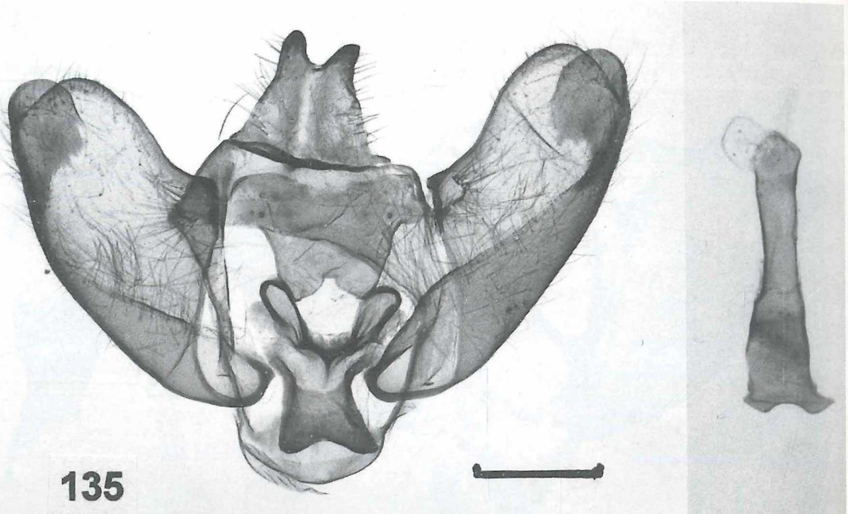

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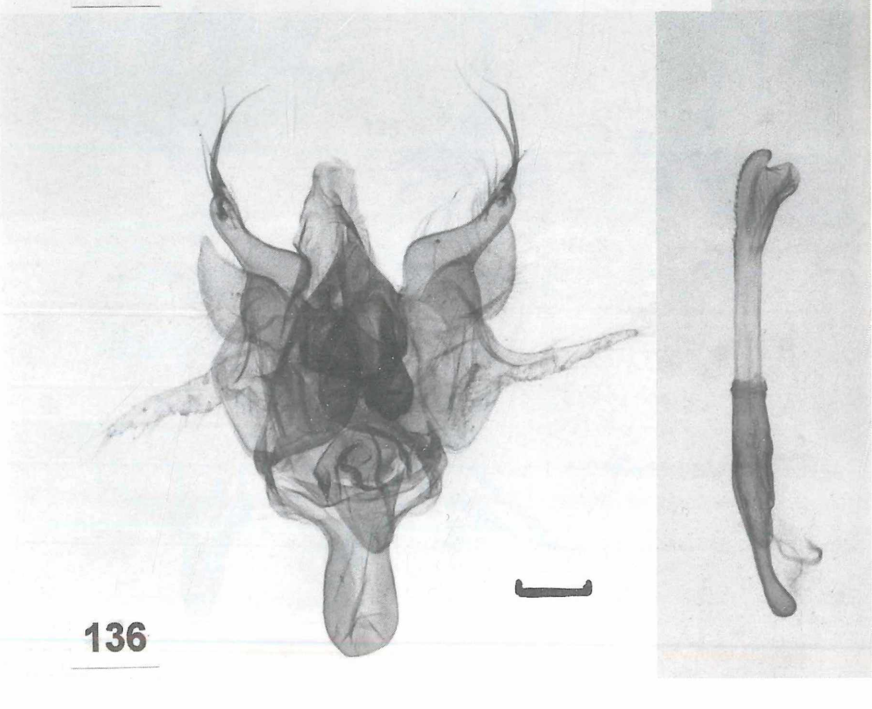

136

B&W plate 21 (supplements)

Figs. 135: ♂ genitalia of *Cricula mindanaensis,* aedeagus separate, GP 1195/98, scale = 1 mm, for comparison with Fig. 22. **Fig. 136:** ♂ genitalia of *Antheraea semperi,* **LT,** GP BMNH Sat. 446, aedeagus separate, scale = 1 mm, for comparison with B&W-Plates 16 and 17.

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The following two species are probably closely related to each other within the *paphia/frithi*-group.

Antheraea (Antheraea) semperi C. & R. Felder, 1861

Antheraea Semperi C. & R. Felder (1861, Wiener entomol. Monatsschr. 5: 305).

Note: Felder & Felder (1861) described the species after an unspecified number (larger than one) of specimens without fixation of a single type specimen. Semper (1896) had a total of ca. 80 specimens in his hands, many (most?) of them reared. Therefore, the ♂ specimen labelled as "HT" in BMNH ex coll. Felder (photograph, kindly taken by S. Naumann, examined; GP BMNH Sat. 446; see Col. pl. 13, Fig. 87, and B&W pl. 21, Fig. 136) is not a holotype. We have not found any subsequent designation of a LT specimen for the taxon *semperi* in literature. Therefore we **herewith designate** this mislabelled "HT" specimen (GP BMNH Sat. 446) in London as the lectotype of *Antheraea semperi* C. & R. Felder, 1861. A label will be added accordingly. The correct original number and current deposition of the PLTs is probably not conclusively to be reconstructed. We think that the material ex coll. Semper in SMFL (i.e., 11 or 12 specimens, see below) most likely was part of the original ST series, but as this cannot unequivocally be proven, we do not label these specimens as PLTs. – l.t. "Luzon" (ex Felder & Felder 1861).

Most likely a polytypic cladospecies. After some hesitation, we eventually decided to describe the population of the island of Mindoro as a separate subspecies, because it shows some almost constant differences in external morphology, although there is some overlap in the variability range, especially with specimens from Negros and Panay.

Preimaginal stages: Only partly known of the nominotypical subspecies. Already Semper (and O. Koch: see Semper 1896) reared the species from Luzon (and illustrated the larva; but his hand-painted illustrations of the preimaginal stages are inaccurate and not very helpful). Although repeatedly cocoons of *semperi* s. str. were imported (and, therefore, the preimaginal instars of *semperi* must be well-known for Philippine rearers), the obtaining of copulations in Europe appears to be a challenge (Lampe, Nässig unpubl. obs.). Regrettably, we cannot offer a detailed description nor photographs of the larva, except in case that the unsuccessful rearing of February-April 1988 (see under the subgenus *Antheraea (Antheraea)* above, no. A; Col. pl. 19) turns out to have been one of this species. Also, we do not know of a recent publication describing and illustrating the preimaginal instars of *A. semperi*.

Antheraea (Antheraea) semperi semperi C. & R. Felder, 1861

Antheraea semperi: Semper (1896: 385, pl. l, figs. 1–3, pl. li, fig. 1, pl. C, fig. 8 caterpillar, fig. 9 pupa). Semper lists "80 specimens from Luzon", of which 11 or 12 (the labelling of these old specimens is sometimes not fully conclusive) are still preserved in SMFL.

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D: Luzon, Panay, Negros, Cebu, Bohol, Leyte, Siargo (= Siargao), Mindanao. A doubtful record from Dumaran (see discussion). DM 12.

ED: None.

Material studied: **Luzon:** 1 ♂, Ifugao, Mayoyao, 600–800 m, 16. vi. 1988, Settele. 1 ♂, Ifugao, Banaue, 1000 m, 6. viii. 1988, Settele. 6 ♂♂, Quezon Forest Natl. Park, 250 m, 8.–10. x. 1988, Černý & Schintlmeister. 1 ♂, Nueva Viscaya, Dalton Pass, Santa Fé, 800 m, 21. ix./17. x. 1988, Černý & Schintlmeister. 1 ♂, “Luzon(?)”, I. Wallace, e.p., iv. 1987. 5 ♂♂, 6 ♀♀, vic. Quezon City, xi. 1984, Rillo. All these in CWAN. 4 ♂♂, 7 ♀♀, Quezon City, 150 m, x. 1984 (7×), v. 1988, vi. 1988 (3×), CCGT. 6 ♂♂, 5 ♀♀, Rizal-Prov., e.p., 1981, 1984, 1987, CRLN. – 13 old specimens in SMFL, most likely all from Luzon[?]: 1 ♂, coll. Seitz, “10402”[54] 7 ♂♂, 4 ♀♀, coll. Semper, “5” (a Semper location number); one with additional label “420”, one with “Koch RA51”, one with “RW50”; GP ♂ 1058/97. 1 ♂ without any label. **Panay:** 3 ♂♂, 3 ♀♀, Panay Occ., Sibalom, Bontol, 50 m, 9./10. xii. 1991, Černý, CWAN. 2 ♀♀, Antique, Culasi, 200 m, 25. iv. 1980, 15. xii. 1982. 3 ♂♂, 1 ♀, Antique, Mt. Madja-as, 7. ii. 1996 (3× incl. ♀), 12. ix. 1996. All these in CCGT. **Negros:** 4 ♂♂, Negros Or., Amlan Hydro, 11. ii. 1978, 2. xi. 1978, 11., 16. vi. 1984, Schoenig. 1 ♀, Negros Occ., Murcia, Mambucal, 2000 ft., viii. 1987. 2 ♂♂, Mambucal, 5. iii. 1989, 25. x. 1992. 7 ♂♂, Mt. Canlaon, [nr. Mambucal: 3×], [750 m: 1×], 13. x. 1985, 16. x. 1985 (2×), 9. xi. 1995, 13. v. 1996 (2×), 3. ix. 1996. Further 25 ♂♂, 3 ♀♀ from different localities (Mt. Canlaon, Bais etc.) recently received. All these in CCGT. **Cebu:** 2 ♂♂, 2 ♀♀, Cebu City, 6. xii. 1954 (♀), 25. xii. 1954 (2×), 21. iv. 1988 (♀), CCGT. **Bohol:** 1 ♂, 1 ♀, Bilar, 30. vi. 1990, CCGT. **Leyte:** 12 ♂♂, 4 ♀♀, Mahaplag, Hilusig, Mt. Balocaue, 600 m, 4. iii. 1986, 5. v. 1986 (♀), 23. xi. 1986, 24., 26., 27. ii. 1987, 3. iii. (2×), 7. iii. (♀) 1987, 2., 9. v., 23. v. (♀) 1987, 1. vi. 1987 (2×), 29. vii. 1987 (♀), 8. vi. 1988. 3 ♀♀, same locality, but 700 m, 9. iv. 1988, 7. vi. 1988, 5. iv. 1989. All these in CCGT. 5 ♂♂, 2 ♀♀, 20 km E Ormoc, Alto Peak, 700 m, 4.–6. vii. 1994, Schütz, CPSS. **Siargo** (off NE Mindanao): 1 ♂, Sampao, 9. x. 1976, Schoenig, CCGT. **Mindanao:** 2 ♂♂, Bukidnon, 40 km NW Maramag, Talakag, 800 m, 1.–3. x. 1988, Černý & Schintlmeister; 31. xii. 1991–2. i. 1992, Černý. All these in CWAN. 1 ♂, Davao Norte, Mt. Tagubod, 6000 ft., 7. x. 1996. 2 ♂♂, Bukidnon, Mt. Kalatungan, 30. iii., 23. v. 1994. 4 ♂♂, Bukidnon, Mt. Kitanglad, 2000 m, 25. vii. 1990, 1. xi. 1995, 5./6. iii. 1997. 1 ♂, Cotabato, Mt. Apo, 1600 m, 11. iii. 1994. 1 ♂, S-Cotabatom Mt. Matutum, 12. ii. 1996. 2 ♂♂, 2 ♀♀, Surigao Sud, 1./2. ix. 1984. All these in CCGT. – GPs seen: 1058/97 (Luzon), 1094/97 (Panay), 1095, 1096/97 (Luzon), CBH-007 (Luzon).

Figured: Imagines in Col. pls. 10: 63–67; 13: 87, 88. Genitalia in B&W pls. 16: 116–118; 17: 124 (♂), 21: 136 (♂ LT).

Description and diagnosis. Lfw. see Tab. 29. This species is the most variable of all *Antheraea* on the Philippines. The ♂♂ occur in a variety of colour forms ranging from light orangy yellow to reddish brown, to purplish brown, to light or dark grey. Further, the ♂♂ can range from being heavily marked in the discal, postdiscal and postbasal areas to being almost

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[54] This number is from the Seitz and Koch collection catalogues, preserved in the library of the Entomology Section II of SMFL. Under “10402” the following can be found: “*Antheraea* [i.e., undetermined species], Nov. [18]93 von Mann erhalten” (xi. 1893 received from Mann), no more data available.

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without such markings. However, the postbasal line (PBL) is always present, even if very faintly indicated. The wing form is fairly constant, with the fw. having a concave termen leading to a noticeable, but rounded apical hook. The submarginal line (SML) is a straight line extending from the inner margin at approximately one quarter the inner margin's length from the termen, to the costa close to the apex. It varies in colour from pink to reddish brown to a dark brown, occasionally with a greyish to white edging distally. The submarginal band distally of the SML can be light orangy yellow, light yellowish grey, light brown, grey-brown to purplish brown and can be the same colour, or lighter, or darker than the wing ground colour. The ocelli on both fw. and hw. are medium-sized, circular or almost so, with an elliptical to (rarely) round clear window; occasionally there are specimens without any window. This window is surrounded by a fine yellow line and then by a mixed purplish red and light to dark sandy brown ring, the whole encircled by a dark brownish black fine line.

Table 29: Forewing length of *Antheraea semperi,* both subspecies. Material of colls. SMFL, CCGT, CPSS, CRLN, CWAN. Specimens with doubtful locality data and reared specimens excluded.

Island	**sex**	**lfw. [mm] (average)**	**± SD**	**n**	**min. [mm]**	**max. [mm]**
Luzon	♂♂	65.4	3.03	18	58	71
	♀♀	68.3	7.36	13	56	77
Panay	♂♂	69.0	5.02	6	60	72
	♀♀	77.8	2.56	6	74	80
Negros	♂♂	67.6	2.87	38	62	73
	♀♀	70.0	9.93	4	56	78
Cebu	♂♂	61.5	3.54	2	59	64
	♀♀	74.0	1.41	2	73	75
Bohol	♂♂	65	–	1	–	–
	♀♀	80	–	1	–	–
Leyte, Siargo	♂♂	67.1	2.08	19	64	72
	♀♀	78.6	4.42	9	70	85
Mindanao	♂♂	68.2	4.95	13	61	77
	♀♀	74.5	1.41	2	74	75
All these islands together (= ssp. *semperi* s. str.)	♂♂	67.1	3.46	97	58	77
	♀♀	73.5	7.31	37	56	85
Mindoro (= ssp. *noeli*)	♂♂	67.8	3.82	29	60	75
	♀♀	80.5	6.36	2	76	85

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The heavily marked variegated orangy brown forms of ♂♂ of *semperi* can be confused with ♂♂ of *A. gschwandneri zwicki* from Palawan, but can often be separated for all but the Mindoro *semperi noeli* through the fw. SML which is usually straight for *semperi* but with a curve towards the apical area for *zwicki*. (The uniform, monochrome forms of *semperi* are unknown in *gschwandneri zwicki*.) For separation between the Mindoro *semperi noeli* and *gschwandneri zwicki* (when not labelled) it is adviseable to check the genitalia. For the rare light orangy yellow form of *semperi*, separation from *gulata* of the Palawan region is difficult. Usually *gulata* is smaller, usually but not always without a fw. PBL, and the fw. apical hook is not as extended as for *semperi*. To be certain of correctly identifying *gschwandneri zwicki*, *gulata* and *semperi* ♂♂, a genitalia check is essential. Notwithstanding, the distribution areas of *gschwanderi zwicki* and *gulata* in the Palawan region do not, as far as is currently known, overlap with *semperi noe*li on Mindoro and *semperi semperi* on the rest of the Philippines excluding the Sulu Archipelago and the Batanes and Babuyan Island groups.

♂ genitalia. The whole ♂ armatures are, in relation to the wingspan of the specimens, relatively small; compare Fig. 115 (*semperi noeli*) and Fig. 127 (*gschwandneri zwicki*), which have the same scale. In fact, the size of the armature is also slightly smaller than in *gulata* (Fig. 113) and *moultoni* (Fig. 111) and is, therefore, compareable with that of *brunei* (Fig. 112). The aedeagus of *semperi noeli* (Fig. 123) is slightly shorter than in *gulata* (Fig. 122), but distinctly longer than in *brunei* (Fig. 121). The shape of the sclerotized "hood" of the 8th abdominal tergite is different in *semperi* from the other species used for comparison (see B&W plates 16 & 17). We did not find useful differences between *semperi semperi* and *semperi noeli*. There is considerable variability within *semperi semperi*, especially in the shape of the soft, non-sclerotized ventral branch of the valve (see Figs. 124 a–d). The basic construction and shape of the armatures, however, is similar in all species compared here.

♀♀ of *A. semperi* show all the colour forms listed for the ♂♂ except for the rare very light grey form. ♀♀ also can range from being well marked on the postdiscal, discal and postbasal areas to being almost free of any such markings; however, the most strongly and contrastingly variegated forms are evidently lacking, and monochromous ♀♀ are more common than in ♂♂. For our three light orangy yellow ♀♀ there is only a vague indication of the fw. PBL. These specimens have a very fine delicate grey

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scaling along the veins. The wing shape is reasonably constant with only a slight concavity in the termen forming a point at the apex. The SML which extends in a straight line from the inner margin to the costa near the apex and ends in a small dark brown to black triangle, can be maroon or dark purple to a purplish brown; for some specimens it can be up to 2 mm in width. For most specimens the SML is edged distally with light violet which can be narrow and broken to being straight and 2 mm broad. The fw. apical area has a pale violet patch from the SML to the apex but bordering on the smallish dark costal triangle. Specimens other than the rare light orangy yellow ones show a light to well marked discal band varying in different specimens from a pinkish brown to purplish brown, to brown, to grey, stretching from the inner margin to the costa, often bisected by the ocellus. Further, a number of ♀ specimens have a lightly marked postdiscal band distally convex between each vein. The wing ocelli are, as can be expected, larger than for the ♂♂ with the hw. ocellus usually somewhat smaller than in the fw. The clear circular to slightly elliptical window is quite large (not as large as in *larissa*-♀♀), ringed with a fine yellow line, exterior from which is a band greyish sandy brown distally and pinkish purple to red, ringed with white to light violet basally; the whole encircled by a fine line black distally and purplish brown to black basally. – ♀ genitalia not studied.

As for the ♂♂, certain ♀ forms of *semperi* can be confused with *gschwandneri zwicki* or *gulata*. However, *zwicki* usually has a broader fw. and hw. submarginal band distally of the SML with the fw. SML curving towards the apical area. The wing ground colour in *zwicki* is relatively constant; it is more of a deep sandy-brown with the PBL and the SML being distinctly light pinkish purple. *A. semperi* has a straighter SML, with the PBL, for specimens approaching *gschwandneri zwicki* in ground colour, brown. For *gulata*, the ♀♀, as far as is yet known, totally lack the fw. PBL; also, *gulata* is smaller on average. Further the fw. and hw. ocelli are about the same size, smaller than in *semperi*, with a smaller window in the centre; in the rare light orange-yellow ♀♀ of *semperi* the fw. ocellus usually is slightly larger than the hw. ocellus. Separation visually of *semperi*-♀♀ from ♀♀ of *gschwandneri zwicki* and *gulata* is somewhat more reliable than for ♂♂.

Insular and individual variability. There is some insular variability in the frequencies of the different individual forms of ♂♂: monochromous forms, especially the orangy yellowish forms, are most commonly found on Luzon; the monochromous dark variants in greyish or purplish brown

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are most often encountered on Mindanao, but are also found on Negros. In the West Visayan region (especially on Negros), variegated orangy brown forms dominate clearly. However, from most of these islands usually most of the different forms are known, and when parts of the variability range are unknown from a specific island, this will often be just a matter of small series and lack of intensive collecting there. Only the Mindoro population (see below under *A. semperi noeli*) stands out inasmuch the monochromous forms are so far unknown from that island; only the orangy to light reddish brown, strongly variegated forms are known from Mindoro, with even the fw. SML often having a slight curve. The individual variability of *semperi semperi* exhibits the highest range amongst all Saturniidae from the Philipppines. – From the relatively large amount of ♀ material available to us we believe the individual colour forms cannot be assigned to any one island as most variations can occur on each island for which we have specimens. Individual variability is similar to that in ♂♂, see description.

Phenology. See Tab. 30. The data is different from island to island, but when summing up all the Philippines, moths can be encountered in any month. The effects of local climate and actual weather have not yet been studied in detail. Presumably the species will be polyvoltine, as far as the climate permits; dry seasons will most likely be avoided by a dormancy periode in the pupal stage.

Table 30: Number of specimens of the two subspecies on the Philippines of *Antheraea semperi* collected per month (n = 176). For *A. semperi semperi*, "All islands together" includes also other Philippine islands in addition to Luzon, Negros and Mindanao, but of course not Mindoro.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Mindoro (n = 34) (*semperi noeli*)	0	1	17	2	0	1	1	0	8	1	0	3
Other islands (*semperi semperi*):												
Luzon	0	0	0	1	1	4	0	1	5	13	10	0
Negros	1	1	1	0	2	2	0	21	5	7	2	0
Mindanao	1	1	6	2	1	0	1	0	4	2	2	0
All islands together (n = 142)	2	8	11	7	8	12	9	22	15	23	15	10

Altitudinal distribution. See Text-Fig. 12. *A. semperi* clearly prefers lowlands and the lower montane region; specimens from above 900 m (8 spe-

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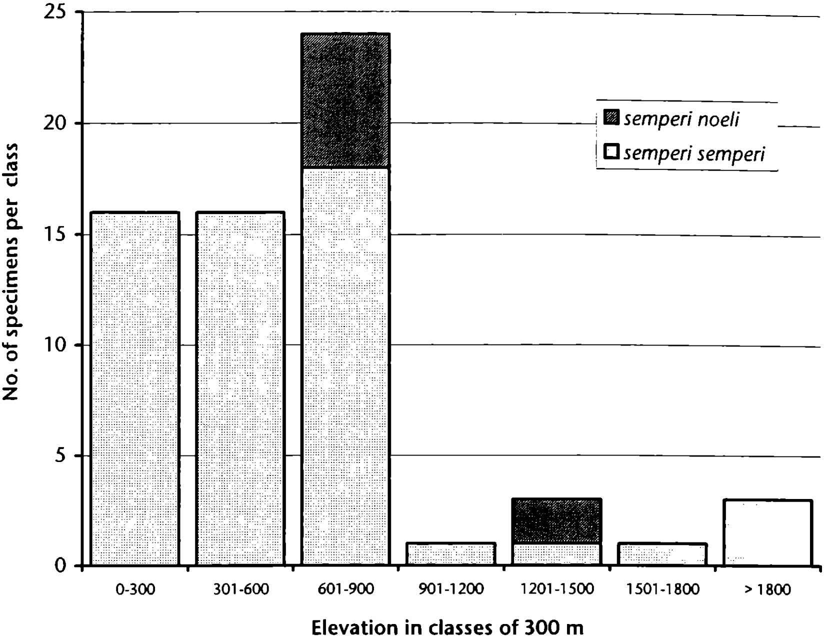
cimens, combined from both subspecies) make only $^1/_{8\text{th}}$ (12.5 %) of the total number of specimens for which elevation data is provided, while $^7/_{8\text{th}}$ (or 87.5 %) of the specimens are from below 900 m (56 specimens). However, there are a few specimens from around 2000 m altitude.



Text-Fig. 12: Altitudinal distribution of the two subspecies of *Antheraea semperi* on the Philippines, data from 64 specimens (*semperi noeli:* Mindoro, n = 8; *semperi semperi:* from the other islands of the Philippines except the Palawan region, n = 56). Not all elevation ranges were comparably as often visited!

Discussion. As already stated under *Attacus lorquinii*, we do not believe that the *semperi* singleton with a "Dumaran" label in CCGT really originated from the Palawan region. We think that this specimen is most likely mislabelled and probably originated from Negros or Panay (or, much less likely, Mindoro; = ssp. *noeli*, see below). It is, however, not a specimen of *gschwandneri zwicki*.

The status of the Mindoro population is not fully clear presently; we eventually decided to describe this as a new subspecies, because it is evidently much less variable than the other insular populations of *semperi*.

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Antheraea (Antheraea) semperi noeli Nässig & Treadaway, n. ssp.

Holotype: ♂, "Phil., 24. iii. 1996, N. Mindoro, Mt. Sinai, leg. Noël", "Collection C. G. Treadaway", GP 1093/97, SMFL-no. 4167; CCGT, assigned to SMFL (see col. pl. 10, fig. 62).

Paratypes (all from Mindoro; in total 47 ♂♂, 3 ♀♀): 6 ♂♂, Mt. Sinai, 1400 m (1× given only), 31. ii. 1996, 15. iii., 18. iii., 20. iii., 25. iii., 26. iii. 1996. 11 ♂♂, 2 ♀♀, Mt. Halcon, 1400 m (1× given only) or 2000 ft. (5× given), 8. iv., 13. iv. 1996, 16. ix. 1996, 12./13. xii. 1996 (3×), 25. ix. 1997 (5 ♂♂, 1 ♀), 17. x. 1997 (♀). All these in CCGT. 2 ♂♂, Mt. Halcon, 3./8. iii. 1997, CMBH. 3 ♂♂, Mt. Halcon, 20. vi. 1996, 1. vii. 1996, 11. vii. 1996, CSNB. 8 ♂♂, "near Mt. Halcon"[?], 1. ix. 1996, iii. 1997 (7×), CUBH (with GP 1146 [now in SMFL] and 1147/97). 1 ♂, Mt. Halcon, 12. iii. 1997, GP 0655A/B Paukst., ex CUBH in CUPW. 8 ♂♂, 1 ♀, Mt. Halcon, 1500 m, 18.–29. xii. 1997. 8 ♂♂, Mt. Halcon, 1000 m, ii./iii. 1998. All these in CUPW.

D: Mindoro. DM 12.

ED: None.

Etymology: The new subspecies is named after Noël Mohagan, Mindoro, who collected the new taxon on Mindoro.

Figured: Imagines in Col. pls. 10: 62; 13: 89. Genitalia in B&W pls. 16: 115; 17: 123 (♂).

Description and diagnosis. Lfw. see Tab. 29. As stated under the nominotypical subspecies, *noeli* is much less variable than the other insular populations of *semperi*. Only the orangy brown, strongly variegated forms are known from the ♂♂ of *noeli*, and they vary from lighter to darker variants. ♂ specimens from Mindoro in general appear to be larger than those of the nominotypical subspecies, although the average sizes (see Tab. 29, no reared specimens included) are not really much larger, and in fact the ♂♂ from Mindanao are slightly larger on average than the Mindoro ones. They differ especially from ssp. *semperi* by the fact that the hyaline centres of the wing ocelli are on average much larger than in all other insular populations. Externally (in the dominant colouration and pattern) the specimens known from Mindoro resemble to some degree *A. gschwandneri zwicki* n. sp. from Palawan (see below) or even *A. moultoni* from Borneo; but, however, not in the size of the genitalia. For a long time we hesitated to describe this as a separate subspecies in spite of the externally usually different appearance, because the genitalia of the Mindoro population do not appear to differ from the other island populations. Besides the average size and the wing ocelli, all other aspects of external variability fit quite well into the other island populations, and sometimes specimens of *semperi semperi* from the West Visayan region (e.g., Negros and Panay) may be fairly big, rarely even with big hyaline eyespot-centres, and resemble very closely the new ssp. *noeli* (i.e., they

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appear to be transitional forms between nominotypical *semperi semperi* and ssp. *noeli*). However, on average the big specimens of *semperi semperi* from Mindanao do not resemble *semperi noeli* very much externally; on Mindanao the ground colour usually is darker and the pattern less variegated.

Individual variability. As stated in the description, the variability is lower than for *semperi semperi* and mainly concerns the ground colour, which may be lighter or darker. All specimens are variegated.

Phenology. See Tab. 30. There is a clear peak in March and another, smaller one in September, but there are several specimens from other months, and the number of specimens in total is so small that we cannot for sure interprete this as two generations.

Altitudinal distribution. See Text-Fig. 12. Only 8 specimens have altitudinal information; these originate from 601–900 m and 1201–1500 m elevation.

Discussion. *Antheraea semperi noeli* is a subspecies mainly defined by its smaller variability range, in comparison to the other insular populations.

Antheraea (Antheraea) gulata Nässig & Treadaway, n. sp.

Antheraea brunei [partim]: Allen & Holloway ([1986]: 131), Holloway (1987: 105), Nässig et al. (1996: 56).

Holotype: ♂, "July 1973, Jacana, C. Palawan, Philippines, leg. Raddatz, ♂"; "Collection C. G. Treadaway"; CCGT, assigned to SMFL; SMFL-no. 4162. [Jacana is a coastal mangrove area near Puerto Princesa.] See Col. pl. 11, Fig. 69.

Paratypes: **Palawan** (in total 5 ♂♂, 2 ♀♀): 1 ♀, same data as HT. 2 ♂♂, 1 ♀, N. Palawan, Mt. Maoyon, 1500 ft., 4. I. 1985 (♂), 10. III. 1985 (♂♀, ♂ GP 1092/97). 1 ♂, C. Palawan, Sta. Monica, 13. VI. 1995, GP 1061/97. All these in CCGT. 2 ♂♂, Mt. Matalingahan [sic], 800 m, XII. 1997, leg. Bal, CRBP. **Balabac:** 1 ♂, Balabac, Palawan Bay, 7. X. 1961 (mercury light 19:00 h–6:00 h), Noona Dan Exp. 1961/62, GP 1140/97, ZMUC.

D: Palawan, Balabac. DM 13.

ED: None.

Etymology: This species is named after the Tagalog word for "surprise": "gulat". The species was repeatedly listed under the name of *A. brunei* in literature, and it was quite a surprise when we found out the differences.

Figured: Imagines in Col. pl. 11: 68–70. Genitalia in B&W pls. 16: 113, 114; 17: 122 (♂). – Colour illustrations of *A. brunei* Allen & Holloway, [1986] for comparison can be found in Allen & Holloway ([1986]), Holloway (1987), Nässig et al. (1996).

Description and diagnosis. This is a medium sized saturniid species for which both ♂♂ and ♀♀ have an overall deep yellow appearance.

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The ♂ has a moderately hooked fw. apex, its tip comparatively broad and quite evenly rounded, with accompanying concave termen. Lfw. in ♂♂: 58.2 ± 1.64 mm S.D., n = 5, min. = 57 mm, max. = 61 mm. The rather obvious fw. SML, usually not wavy, is a pinkish brown in colour but can be edged outwardly with pale lilac and runs from the inner margin joining the costa almost at the apex where it ends in a small dark triangle. This line is slightly curved such that the enclosed submarginal area decreases somewhat in width from tornus to apex. The SML on the hw. is slightly wavy. There can be a faint, irregular, wavy postdiscal greyish line starting at or near the fw. and hw. hind margin but often, for the fw., fading away before reaching the costa. The fw. eyespots are not large, with a narrow, elongate, hyaline centre, bordered with yellow scales, along the discoidal vein, usually surrounded (from the centre to the periphery) by a broad brownish, a thin yellowish and a thin black line outwardly and a broad pinkish brownish, a narrow whitish and a narrow reddish line inwardly. The hw. ocelli are similar to the fw. tending to have only a small, rounded central clear window with the surounding broad band basally more pinkish.

♂ genitalia: The aedeagus (Fig. 122) is much longer than in *A. brunei* (Fig. 121) and even slightly longer than in *A. semperi* (Fig. 123, ssp. *noeli*), which is in the latter case mainly caused by a longer *coecum penis* of *gulata;* it is also longer than in *A. alleni* (Fig. 120). The dorsal branch of the valves (Fig. 113 a, b) is relatively broad and much shorter than in *A. semperi noeli* (Fig. 115 a, b); this part is similar in *A. brunei* (Fig. 112 a, b), but the shapes of the valves are slightly different in *brunei* and *gulata.* This character in *A. alleni* (Fig. 111) is hard to compare, because the genitalia are flattened and fixed on a glass slide. There is, of course, some variability in the male genitalia (especially in the soft parts of the valves etc.), but the differentiating characters in shape and size relations appear to be reliable.

The ♂ can be separated from the similar yellow forms of *A. semperi* (Col. pl. 10, Fig. 63) by its (on average) smaller size, the lack of the median fascia and particularly by the slightly curved fw. SML which ends at the costa in a minutely small dark triangle. For *semperi,* this SML is, in most cases, straight and ends at the costa with a noticeably larger dark triangle. However, to be absolutely sure a genitalia check should be made, if no locality data is given (to our knowledge, *gulata* and *semperi* are not living sympatrically). *A. gulata* ♂♂ can be easily separated from *A. brunei* (Bor-

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neo) (apart from the genitalia) because *brunei* has a broken lunulate (wavy), nearly straight SML and usually a much more prominent wavy postdiscal line for the upperside (see illustrations of *brunei* specimens, e.g., in HOLLOWAY 1987) while *gulata* has an entire, not wavy, slightly curved submarginal and a faint or almost lacking postdiscal line. To date, the rare orangy brown form of *brunei* ♂♂ (see NAUMANN 1994) has not been found for *gulata*. Practically all ♂♂ of Bornean *brunei* (ca. 35 specimens in CCGT, CSNB and CWAN) are without a central clear window for the wing ocelli whereas *gulata* specimens have at least a minute window.

The ♀♀ of *A. gulata*, with a slightly larger wing area and expanse, are of the same orangy yellow wing colour as the ♂♂. Lfw.: 62.5 ± 3.54 mm, n = 2, single data: 60 mm, 65 mm. The details of the wing pattern are quite similar to the ♂♂, with the following exceptions: The fw. SML is of a mauve brown colour and irregularly (between the veins) outwardly edged with light pinkish-violet triangles. The postdiscal line is (in the two ♀♀ known) almost or totally missing. The wing ocelli are clearly larger than in ♂♂, with a relatively large, rounded (on the fw. almost circular) hyaline centre on all wings. The apex is nearly rectangular.

A. gulata ♀♀ can only with great difficulty be separated from the rather rare, usually larger, orange-yellow *semperi* ♀♀ which also do not have a fw. postdiscal line. However, such *semperi* ♀♀ have a straight submarginal fw. line rather than slightly curved, and this line ends in a much more obvious dark triangle at the costa. It is easier to separate *gulata* ♀♀ from *brunei* ♀♀ as they have the fw. SML in the form of a series of dark triangles between the veins. Further, the wing ocelli are smaller with either no or only a smaller hyaline window than *gulata*. – ♀ genitalia are not yet studied for all species involved. Usually the ♀ genitalia offer fewer species-specific differences in *Antheraea* than the ♂ genitalia.

According to its wing pattern, the ♂ from the Indonesian island of Belitung illustrated by NÄSSIG et al. (1996: 103, fig. 76) is most likely a true *A. brunei*. The identity of the two ♀♀ illustrated in figs. 77 (from Belitung) and 78 (from ?Sumatra) of the same publication is not quite clear and requires further studies.

Individual variability. In contrast to the extremely variable *A. semperi* and the (in ♂♂) dimorphic *A. brunei*, *A. gulata* appears (based on present knowledge) to be much less variable. Variability covers mainly small details of pattern and colouration only and is not significant, at least with

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the few specimens known. – The singleton from Balabac is so worn that pattern and colouration, especially of the fasciae, are not clearly visible.

Phenology. The 5 ♂♂ and 2 ♀♀ were collected in January, March (2×), June, July (2×), and October (Balabac).

Altitudinal distribution. The first specimens obtained (a pair in July 1973) came from a coastal mangrove swamp (Jacana, collected by U. RADDATZ). This was another hint to believe that *A. gulata* is identical with *A. brunei*, a mangrove species. But in the meanwhile there are also specimens known from higher altitudes and far outside the mangrove area: the highest altitude on a label is 1500 ft. (= ca. 500 m). So the altitude range spans from sea level to at least 500 m. Nevertheless, *A. gulata* appears to be a lowland species.

Preimaginal stages: As well as the preimaginals of the related *A. brunei* (only a few observations on the L_1 larva are published: NAUMANN 1994), the early stages of *A. gulata* remain unknown thus far. The other closely related species *A. semperi* has not been described in more detail (see under that species).

Discussion. Although *A. gulata* has been erroneously called *brunei* by several authors, it appears (after having seen larger series of all three species now, and after having dissected several specimens of the taxa involved) that it may in fact be more closely related to *A. semperi* than to *A. brunei*. The yellow forms of *semperi* may sometimes look astonishingly similar externally. We suppose that *A. gulata* is probably the offspring of an invasion of a *semperi*-like taxon to the Palawan region. The low variability of *A. gulata* (in comparison to *A. semperi*) might perhaps be explained by a “bottle-neck” event during the invasion, and/or by a different selection pressure on Palawan.

Presently it cannot be decided reasonably whether *A. brunei* is the offspring of an invasion of an ancestor of the *semperi/gulata*-complex to Borneo (which may be supported by the similarities in the colour and the ♂ genitalia), or derived independently from a Bornean ancestor from within the same species-group.

As there are several traders on Palawan, it appears possible that the Philippine species *A. semperi* may become established on the island. This would (a) cause external identification problems for the endemic *A. gulata* and (b) could possibly lead to hybridization between the two apparent-

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ly closely related species, which should be kept in mind in future. Studies on that problem appear adviseable.

The following two species belong to the cluster of species with "big genitalia" within the *frithi*-subgroup. Although this character is shared with the *paphia*-subgroup, we do not believe that this indicates a close phylogenetic relationship between the two; the "big genitalia" appear to be the plesiomorphic condition within the subgenus (see above).

Antheraea (Antheraea) platessa Rothschild, 1903

Antheraea platessa Rothschild (1903, Novit. Zool. **10:** 311). HT ♂ (by monotypy) in BMNH, examined (illustrated in Nässig 1992: fig. 2). l.t. Burma.

(= *Antheraea jana* sensu auctorum, nec Stoll, 1782; see Nässig 1992.) – Synonymy see Nässig (1992).

D: Known from Luzon, Marinduque, Negros, Panay, Samar, Leyte, Mindanao; a doubtful record from Dumaran, see discussion. DM 14.

ED: This species ranges from probably Larger Assam through Burma, Thailand and Vietnam to West Malaysia and the large islands of Sundaland (Sumatra, Java, Borneo) and the Philippines (not known from Palawan). A close relative (*Antheraea (A.) andamana* Moore, 1877) is known from the Andaman Islands. See Nässig (1992). There is a stray record from Sulawesi (U. & L. H. Paukstadt 1991 a), which is probably an introduced singleton (Naumann 1995).

Material studied: **Luzon:** 1 ♂, Nueva Vizcaya, Dalton Pass, Santa Fé, 800 m, 17. x. 1988, Černý & Schintlmeister. 1 ♂, Ifugao, Banaue, 1000 m, 6. xi. 1988, Settele. 1 ♀, Ifugao, 14 km SE Bolog, 500 m, 7. ii. 1988, Černý & Schintlmeister. All these in CWAN. 3 ♂♂, Ifugao, Kiangan, 750 m, 14. xi. 1985, 16. xi. 1985 (2×), Settele (GP 1068/97). 1 ♂, C-Luzon, Angat Dam, 1100 ft., 25. v. 1990. All these in CCGT. **Marinduque:** 2 ♀♀, no details, vi./vii. and vii./viii. 1976, via J.-M. Cadiou, CWAN. **Negros:** 1 ♂, Negros Or., Amlan Hydro, 14. vi. 1984. 7 ♂♂, 1 ♀ Negros Or., Bais, Mt. Tindug-Bato, 28. x. 1997, 2. xi. 1997, 2.–4. xii. 1997 (3 ♂♂), 3./4. i. 1998 (2 ♂♂, ♀). 7 ♂♂, Mt. Canlaon, 20. vii. 1994, 1. x. 1994, 8. viii. 1997, 10. viii. 1997, 26. viii. 1997, 30. viii. 1997, 2.–5. i. 1998. 1 ♂, Mt. Canlaon, [slopes,] 750 m, 4. ix. 1996. All these in CCGT. **Panay:** 1 ♀, Sibalom, Bontol, 50 m, 10. xii. 1991, Černý, CWAN. 2 ♂♂, Antique, Mt. Madja-as, 18. xi. 1995, 15. v. 1996 (col. fig. 72), CCGT. 1 ♂, Mt. Malindog, Nabas-Aklan, 10. iv. 1997, CCGT. 1 ♂, no details, ix. 1996, CRLN. **Samar:** 1 ♂, Bagacay, 900 ft., 9. viii. 1979, CCGT. **Leyte:** 1 ♂, Mahaplag, Mt. Balocaue, 600 m, 8. iii. 1986, CCGT. 1 ♂, Visca, Baybay, 25. iii. 1994, 50 m, CPSS. **Mindanao:** 2 ♂♂, Bukidnon, Mt. Nebu, 2. iii. 1993, 10. xii. 1993. 1 ♂, Bukidnon, Mt. Kitanglad, Intavas, 4100 ft., 25. vii. 1990. 1 ♀, Bukidnon, Mt. Kitanglad, above Intavas, 6000 ft., 3. xi. 1996 (col. fig. 71). 1 ♀, Bukidnon, Mt. Kitanglad, 20. ix. 1997. 2 ♂♂, S-Cotabato, Mt. Matutum, 8. ii. 1996, 30. vi. 1996. 1 ♂, S-Cotabato, Mt. Busa, 16.–18. vi. 1997. All these in CCGT.

Figured: Imagines in Col. pl. 11: 71, 72. Genitalia in B&W pl. 18: 125 (♂).

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Description and diagnosis. Lfw. see Tab. 31. The overall appearance of this species for the ♂♂ varies from a bright, whitish to yellowish brown to a deep dark brown (usually without orange or reddish colour) and with an obvious hooked (the tip sometimes nearly square) fw. apex. The ground colour is always much more uniform deep brown than in any other species on the Philippines. The fw. has an even darker brown line starting near the base of the wing and spreading out below the cell along the vein M_3 to the fw. eyespot, where it meets the faint dark median band. The part of the median band between costa and eyespot and the M_3 stem band between base and eyespot together with the costa form an extended triangle. This dark line along the vein resembles similar pattern elements in several species of the *frithi*-group, especially in Sulawesian *Antheraea,* e.g., in *cordifolia* Weymer, 1906 (which also resembles *platessa* in the most common ground colour). The unbroken (not wavy) submarginal band (purplish brown to darker brown) originates at the hind margin where the slightly lighter submarginal area is broadest and curves gently towards but reaches the costa just short of the fw. apex. Additionally there is inwardly from this line and more or less parallel to it the dark brownish postdiscal line curved outwardly concave between the veins, fading out in the paler apical field. The basal line is single, bowed between hind margin and costa, with a small part of it slightly offset distally within the cell. The fw. eyespots are inconspicuous, mainly in a brown similar to the wing ground colour, with a thin black outer ring, in the basal half often reddish and white, and a thin inner yellow ring. Usually there is a small, elongate hyaline centre within the eyespot along the crossvein (especially on the fw.), in contrast to Sundanian ♂♂, where the centre usually is filled with brown and (in the middle) yellow scales. The hw. is similar, with a slightly more prominent eyespot with a narrower hyaline centre. The submarginal area is only very slightly lighter than the overall ground colour. The ♂♂ cannot be confused with any other species on the Philippines; even the rare uniform brown form of *A. semperi* is always readily distinguished by the different tinge of the brown ground colour, by the less falcate and not "square" apex, by the larger, more prominent eyespots of always a more colourful composition and with a significantly larger hyaline centre, and by the always more richly combined colouration in details. – The ♂ genitalia of *platessa* appear not to be not diagnostic within the *frithi*-group; they are large, but very similar to most other species with large armatures.

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The ♀♀, apart from being substantially larger in wing area and usually also lighter brown in colour than the ♂♂ (Sundanian ♀♀ often are as dark as or even darker than the ♂♂), have for the fw. an almost straight termen from the tornal angle to the apex. The fw. slightly curved submarginal brown line has a purplish tinge and is outwardly finely edged with white. The eyespots are larger than for the ♂♂ having an enlarged clear central area with correspondingly reduced sandy-brown filling, the whole ringed outwardly with a fine black line and inwardly with a pale lilac narrow band edged basally with brown. The fw. markings are very light and straighter than in the ♂ with the innermost line of the ♂ wing replaced by a straight brown band running from the hind margin close to the SML to the wing ocelli and then on to the costa. The submarginal area of the hw. is obviously lighter than in the ♂. The ♀♀ of *A. semperi* for which the rare grey-brown examples (rather than the normal yellow, yellow-brown, orange-brown or red-brown) can be separated by the fw. SML which is a straight line from the hind margin to the costa while for *platessa*-♀♀ this is a curved line. The ♀ of *A. platessa* can also be confused with the ♀ of *Antheraea gschwandneri zwicki* from which it can be readily differentiated as *zwicki* has a distinct decorative pink edging to almost all brown lines.

Table 31: Forewing length of *Antheraea platessa*. Material of colls. CCGT, CRLN, CWAN. "All islands together" includes islands other than Luzon, Negros and Mindanao.

Anth. platessa Island	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Luzon	♂♂	69.2	3.71	6	66	76
	♀♀	81	–	1	–	–
Negros	♂♂	72.6	3.28	16	67	80
	♀♀	73	–	1	–	–
Mindanao	♂♂	65.4	3.78	5	60	69
	♀♀	80.5	2.12	2	79	82
All islands together	♂♂	70.6	4.57	33	60	82
	♀♀	80.7	4.42	7	73	87

Insular and individual variability. This species appears to be the only saturniid taxon which is distributed over most of the Indochinese Peninsula, Sundaland and the Philippines without exhibiting a significant subspecific subdivision across that range. A gradual phenetical cline appears to be found in the NW limits of its range in NE India (Assam; see Nässig 1992). The Philippine population shows only slight external differences to Sundanian or Indochinese specimens (see above). No differences were

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found in the genitalia. Insular variability within the Philippines is practically absent. Individual variability on the Philippines comprises mainly the size, the ground colour (lighter or darker; the lighter specimens probably to some degree bleached by light?) and the intensity of the pattern within the ground colour; in a few specimens the pale apical area may be rather yellowish.

Phenology. (See Tab. 32.) The specimens were collected in all months, with peaks in viii and xi/xii/i. At least the "winter peak" in November to January correlates with the preferred travelling time of European entomologists.

Table 32: Number of specimens of *Antheraea platessa* collected per month (n = 40), data from all islands combined.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of specimens	4	2	3	1	2	3	2	5	3	3	7	5

Altitudinal distribution. Only in a few specimens altitudinal data is provided. The range is from ca. 50 m to ca. 2000 m, with most specimens between ca. 500 and 1200 m, that is from the lowlands to the lower montane zone, with a few specimens from higher up.

Preimaginal stages: The early instars of *A. platessa* remain unknown thus far.

Discussion. It is somewhat surprising that a species with a distribution range from Assam to the Philippines has not yet been found on Palawan. It appears likely from zoogeographical reasoning that the species in fact inhabits the Palawan region, but has not yet been discovered.[55] This may be due to its relative scarceness; *A. platessa* is never found in big numbers. We have one ♀ record of *A. platessa* with a label "Dumaran" (in CCGT); but this specimen was accompanied by two most likely mislabelled specimens (see under *Attacus lorquinii* and *Antheraea semperi*); therefore we are in doubt whether this *platessa* ♀ could bear the only correct label of the series, and thus the locality is plotted as "dubious data" on the map. Further reliable search for the species on Palawan or other islands of the region appears adviseable to clear the case.

An alternative explanation would require the invasion of the Philippines by *A. platessa* either from the North (but *A. platessa* is unknown from Taiwan and continental S-China) or from Borneo along the Sulu Archipelago (where *A. platessa* was not yet found) to Mindanao, with afterwards secondary distribution onto most Philippine islands *except* those of the Palawan region – a rather unlikely scenario.

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The description of a separate subspecies for the Philippines appears to be obsolete, as the differences in external and ♂ genitalia morphology to Sundanian and Indochinese specimens are only very minor.

Antheraea (Antheraea) gschwandneri NIEPELT, 1918

Antheraea gschwandneri NIEPELT (1918, Lepidoptera Niepeltiana, Nachträge: 1, pl. XVIII, figs. 1, 2). HT ♂ (by monotypy) in Vienna Museum, examined by S. NAUMANN. l.t. Poerangie, Sumatra, [Indonesia].

Notes on synonymy see below under discussion.

As understood here (see discussion), *A. gschwandneri* is a Sundaland species. It has a separate subspecies on Palawan, which is much more uniform than the nominotypical Sundaland subspecies and lacks its high variability.

Antheraea (Antheraea) gschwandneri zwicki NÄSSIG & TREADAWAY, **n. ssp.**

Holotype: ♂, "Philippines, Palawan, Irawan, 50 m, 16. IX. 1996, leg. J. S. PETERSEN", "Collection C. G. TREADAWAY, *Antheraea celebensis*", GP 1059/97, SMFL-no. 4168, in CCGT, assigned to SMFL (Col. pl. 11, Fig. 74).

Paratypes (in total 22 ♂♂, 5 ♀♀), all from Palawan: 1 ♀, N-Palawan, Olanguan, 500 ft., SETTELE & C.G.T., 6. VII. 1988 ("layed 30 eggs July 7–9, but these did not hatch", C.G.T.). 2 ♂♂, Irawan, 50 m, 14. VIII., 16. IX. 1996 (GP 1059/97). 1 ♂, 1 ♀ (Fig. 73), C-Palawan, Mt. Salakot, 300–350 m, 19./20. III. 1996, leg. C.G.T. 1 ♂, Napsan, Salakot Falls, 300 m, 23.–25. III. 1996. 1 ♂, C-Palawan, Mt. Candis, 31. X. 1987. 1 ♂, C-Palawan, Puerto Princesa area, Solomon Village, 150 m, 7. III. 1996. 1 ♀, S-Palawan, near Brooke's Point, 500 m, 4. III. 1995. 1 ♀, S-Palawan, Mt. Mainit, 1. V. 1985. All these in CCGT. 1 ♂, Salakot Falls, Road (300 m), 19. III. 1996, leg. et coll. CAZS. 4 ♂♂, 1 ♀, Mainit Brooke's Point, Mt. Magcasaw, 600–900 m, 3.–6. XI. 1996, CRBP. 8 ♂♂, Mt. Matalingahan [sic, = Mantalingajan?], 800 m, XII. 1997, leg. BAL, CRBP. 2 ♂♂, Irawan, 50 m, 28. IX., 1. X. 1997, CSNB. 1 ♂, Inagawan, 50 m, 1. X. 1997, CUBH.

D: Palawan. DM 15.

ED: None for the subspecies, the new taxon is known only from Palawan.

Etymology: The new subspecies is named after Andreas ZWICK, Schlitz, who has collected intensively on Palawan and was very helpful and cooperative during the preparation of our manuscript.

Figured: Imagines in Col. pl. 11: 73, 74. Genitalia in B&W pl. 18: 127 (♂).

Description and diagnosis. Lfw. see Tab. 33. The ♂♂ we have are quite constant in their colour and markings being an orangy brown including the upperside of the body and thorax. This is very different from the extremely variable populations of *A. gschwandneri* from elsewhere in Sundaland. The fw. termen is distinctly concave leading to an obvious hooked fw. apex. The wing shape is especially pronouncing the tornal angle of the fw.; in this aspect, *zwicki* resembles *A. platessa*. There is a brown thin band at the pos-

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terior edge of the yellow cell on the fw. The ocelli at the end of the cell (also on the hw.) are circular. In the centre of the ocelli there is a conspicuous, more or less circular clear "window", surrounded by yellow scales (especially outwardly); then there is a broad band (purplish red with a few white scales in form of a lunule – distinctly more of them on the hw. – towards the basal area, yellowish brown towards the termen, closing with yellow scales again), and the total is ringed with a fine black line, especially outwardly. The submarginal area of the fw. and hw. ranges from an orangy brown to a darker reddish brown. For the fw. there is a firmly marked submarginal brown line, on the outside often bordered with some pinkish colour, starting at the anal edge and curving slightly outwardly as it reaches the apex, thus steadily reducing the width of the submarginal area from the tornus to the apex. The apex itself usually shows a triangle of black, white and red scales. The postmedian band is brownish, strongly wavy (inwardly tipped at the veins), fading out towards the apex; it is close to the submarginal band, usually not reaching the wing ocelli. The faint median fascia is only slightly darker than the rest of the wing, often nearly invisible, except in the yellowish costal area. The postbasal fascia is reddish to pinkish brown. Some ♂♂ of *A. semperi* are similarly coloured but can be differentiated by the fw. SML being straight and not curved slightly as in *A. g. zwicki.*

♀♀ of *A. g. zwicki* have a substantially larger wing area than ♂♂ and lack the falcate apex of the fw., having only a slightly concave termen. Sexual dimorphism is very distinct in colouration: The overall colour in appearance is nearly uniform brown but with a faint orangy to yellowish overtone for the wings, body and thorax. The apex shows a broad triangle of black and white scales, bordered with pink to red scales. The fw. SML is only slightly curved outwardly near the inner margin and apex. It has a distinct pink tone (outwardly often bordered with whitish scales), as do most other lines of the wings; the postbasal lines are sometimes with a purplish pink. The submarginal area of all wings is lighter than the ground colour and ranges from a yellowish grey to a pinkish brown. The wing ocelli are large, with a slightly oval large clear centre, but otherwise have the same color combination as the ♀♀, except for the outer fine black line which changes regularly to a deep pink for the basal edge of the ocelli. The ♀ can be readily differentiated from the ♀♀ of *A. platessa* and *A. semperi* by the abundance of pink overlay on most line markings on the wings.

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Table 33: Forewing length of *Antheraea gschwandneri zwicki*. Material of colls. CCGT, CUBH.

A. gschwandneri zwicki	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Palawan	♂♂	67.7	2.87	7	65	73
	♀♀	84.0	1.15	4	83	85

Individual variability. The two sexes are each rather uniform; variability is mainly seen in ♂♂ in the intensity of the dark brownish lines (especially below the fw. cell), which in a few specimens can be quite dominant, while they are inconspicuous in most of them. ♀♀ mainly differ only in the ground tone, which may be slightly lighter or darker.

Phenology. Data is quite sparse (see Tab. 34). There are two clear peaks (in March and November), but it cannot reliably be concluded from the few data that there are just two generations per year, although this would be a likely interpretation.

Table 34: Number of specimens of *Antheraea gschwandneri zwicki* collected per month (n = 17) from Palawan.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of specimens	0	0	6	0	1	0	1	1	1	2	5	0

Altitudinal distribution. Specimens have been collected from ca. 50 m up to ca. “600–900 m”; no specimen thus far was found above 1000 m. This may in part be caused by the fact that higher elevations on Palawan are rather inaccessible with light collecting equipment, but at least the species clearly appears to prefer lowlands.

Preimaginal stages: Unknown. There is a low probability that the single L_1 caterpillar of August 1988 which did not accept the offered food and died (“rearing B” of the subgeneric introduction) might have been the larva of *A. gschwandneri zwicki*. This is, however, unlikely due to the long time between oviposition (early July, see in PT list above) and hatching of the single caterpillar (August).

Discussion. *A. gschwandneri zwicki* is closely related to, but, in our opinion, not identical with, *A. moultoni* WATSON, 1927 from Borneo (see HOLLOWAY 1987). *A. gschwandneri zwicki* is larger than *moultoni* and more variegated; this is just the same difference with *moultoni* as described for the species called “*celebensis* WATSON, 1915” by HOLLOWAY (1987), which

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we would also call *A. gschwandneri* today[56] (see below). In contrast to the very variable *gschwandneri* populations from Sumatra[57] (slightly less so on Borneo, but there is much less material known from Borneo today), *A. gschwandneri zwicki* is nearly uniform, with only minor variation in the intensity of the dark brownish pattern elements.

The subordination of *zwicki* as a subspecies of *gschwandneri* Niepelt, 1918 is preliminary and tentative. The members of the *frithi*-subgroup, known from North India and the Indochinese Peninsula (= *frithi* itself, plus taxa like *myanmarensis* Paukstadt et al., 1998, etc.) across Sundaland (and possibly the Andaman islands?) and the Lesser Sunda Islands to at least Ambon (= *rumphii* C. Felder, 1861) and Seram (= *ceramensis* Bouvier, 1930, probably a junior synonym of *rumphii*, as well as *buruensis* Bouvier, 1928 from Buru?) in the Moluccas are highly diverse, but in most of these "species" and populations similar morphological forms may occur: see, for example, the ♀ figured by U. Paukstadt et al. (1998: fig. 4) as PT of *myanmarensis* and the ♀♀ of *gschwandneri zwicki* described here. Holloway (1987) dealt with the Sundaland member of the *frithi*-group (with the big genitalia) under the name *celebensis;* another species (*sensu auctorum*) of that complex restricted to Borneo is *A. (A.) moultoni; A. alleni* Holloway, 1987 from Borneo is also somewhere involved in the case (but possibly closer to *A. brunei/gulata/semperi*, because its genitalia are smaller). We think that *celebensis* should better be interpreted as being restricted to Sulawesi (compare the discussion of the case by Naumann 1995 and Holloway et al. 1996). The next younger name in synonymy[58] in the *frithi*-group for the Sundanian population would be *gschwandneri;* this name was also used as a subspecific name for the Sundanian populations by Holloway (1987), and as a species name for the taxon living on Sumatra by Nässig et al. (1996). The HT of *gschwandneri* (illustrated by Niepelt 1918, under- and upperside in b&w) is a small, dark, rather contras-

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[56] While the subspecific name of this Bornean *gschwandneri* population still remains disputable!

[57] The Sumatran populations of this group were considered by Nässig et al. (1996) to be merely forms of the very variable (in size, ground colouration and pattern) *gschwandneri* species-complex on Sumatra, also including *prelarissa* Bouvier, 1928 and other, unnamed "forms", which we interpreted all as one species. However, further studies are necessary within this complex.

[58] It is feasible (or even likely) that one of the much older names *jana* Stoll, 1782 (type locality: Java; identity of this taxon unclear, no ST or HT preserved; see Nässig 1992) or *surakarta* Moore, 1862 (type locality: Java; type probably in BMNH, not examined) could be the valid oldest available name within this species-complex on Sundaland. As the identity of these two taxa is in doubt presently, we decided to retain the Sumatran name *gschwandneri* for the time being; there is no older name specifically from Borneo available. – The name *jana* may perhaps be applicable to specimens from E-Java and Bali (e.g., in CWAN and SMFL) showing a pattern and colouration similar to Stoll's (*in* Cramer) illustration.

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tingly variegated specimen. U. PAUKSTADT et al. (1997 b) described two more species of this group from Flores (again with only minor external and genitalia differences). Another species-complex is, e.g., that of *rumphii* from the Moluccas. A final settlement of the taxonomic problems in this complex can only be achieved during a phylogenetic and taxonomic analysis of the case. Most of the different taxa do not show significant differences in genitalia morphology. The best method to assess the case would be some pheromone or DNA-analytic study or similar of all populations involved, combined with type studies. In such cases where there are no clear and constant morphological differences, the classical morphospecies concept is not very useful.

Genus *Loepa* MOORE, 1859

Loepa MOORE (1859: 260) [*nec* MOORE ([1860], *in* HORSFIELD & MOORE ("1858-1859"), Cat. lepid. insects Mus. nat. hist. East-India House 2: 399)]. TS: presently unknown (see footnote[59]).

This genus consists of approximately 22–30 species, with a centre of diversity in China (see, e.g., NAUMANN 1998 b). It is characterized by the yellow ground colour and a typical wing pattern and by some peculiarities in the male genitalia (fusion of uncus at least basally, etc.). Presently we do not know whether some similarities in the wing pattern to the tribe Attacini are symplesiomorphic or synapomorphic characters or homoplasy.

Within *Loepa*, there are three main species-groups: the *oberthuri*-group with two species, only known from continental Asia, especially from China; the *miranda*-group with approximately 10 species, mainly from China; and the *katinka*-group with probably some more than 10 species. Only the latter group is known to occur on the SE-Asian islands. All three spe-

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[59] FLETCHER & NYE (1982) stated errorneously for the genus *Loepa* MOORE that it was published for the first time in [1860] (= "1858-1859", *in* HORSFIELD & MOORE, Cat. lepid. insects Mus. nat. hist. East-India House 2: 399). Consequently, they interpreted *Saturnia katinka* WESTWOOD, 1848, as the type species of *Loepa* by monotypy, because this was the only species included in the genus by HORSFIELD & MOORE ([1860]). However, MOORE (1859) was published earlier, and in this publication MOORE included *two* species in the genus *Loepa* (besides *katinka: Saturnia thibeta* WESTWOOD, 1853). As far as we know the relevant literature at present, all subsequent authors interpreted *katinka* to be the type species; however, we have not yet identified the oldest formally valid designation of a type species. – In addition, *Saturnia katinka* as a type species would have been a misidentification by MOORE ([1860]) anyway; he listed only Javanese specimens in the [1860] publication, but there is no true *Loepa katinka* in Sundaland (see NÄSSIG et al. 1996 and citations therein). *L. katinka* is a solely Himalayan species; MOORE had either *L. cynopis* NÄSSIG & SUHARDJONO, 1989 or *L. sikkima javanica* MELL, 1938, or a mixture of these two species, before him, which are the only species of the genus known from Java. A case of a misidentified type species must be ruled by the Commission (ICZN 1985, Art. 70b). As these problems of the priorities of the publications involved and of the valid oldest designation of a type species came to our mind only very late (caused by a hint by U. BROSCH), we have not yet scanned the literature sufficiently. – Thanks to U. BROSCH for critical remarks and support with rare literature on this problem.

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cies of *Loepa* known from the Philippines are members of the *katinka/megacore*-subgroup within the *katinka*-group of species. (The fourth, unnamed species may as well either belong to that subgroup or may possibly belong to the *sikkima*-subgroup.) The *katinka/megacore*-subgroup and the *sikkima*-subgroup are closely related, and their monophyly is not yet proven.

Considering the numbers of specimens which have sometimes been found at one place, it is very surprising that the number of *Loepa* localities reported from the Philippines is so small (see DM 16). This may be due to the fact that most of the different *Loepa* species appear to be mainly montane (at least not in the lowlands), and collecting at higher altitudes on the Philippines in the past has often been problematic due to difficult accessibility.

Systematic and taxonomic treatments of the genus *Loepa* in literature were (and sometimes still are) often confused by the fact that many authors did not identify the species correctly and often treated them as conspecific (usually under the oldest name *katinka*) due to external similarity. Often only the genitalia provide good characters to identify the species reliably and correctly (see, e.g., ROEPKE 1953, or NÄSSIG et al. 1996 and citations therein).

Loepa nigropupillata NÄSSIG & TREADAWAY, 1988

Loepa nigropupillata NÄSSIG & TREADAWAY (1988: 165), HT ♂ ex CWAN in BMNH, examined. l.t.: Luzon, Ifugao, Mt. Pulis, 1900 m. HT illustrated in colour by NÄSSIG & TREADAWAY (1988: 161, fig. 2).

D: This species is known thus far only from Luzon and Sibuyan. DM 16. [In the distribution map published by NÄSSIG & TREADAWAY (1997 a: 363) some of the PT localities were accidentially left out; these are supplemented here.]

ED: None.

Material studied: **Luzon:** PTs: 103 ♂♂, 2 ♀♀, in BMNH, CWAN, CCGT, coll. OWADA (Tokyo) and other colls. (and later in part dispersed to further collections), see the PT list in NÄSSIG & TREADAWAY (1988). Additional material: a few more ♂♂ and ♀♀ from N-Luzon, Ifugao (Banaue, Mt. Polis), CCGT. **Sibuyan:** 2 ♂♂, Mt. Guiting Guiting, I. 1983, leg. RADDATZ, CCGT.

Figured: Imagines in Col. pl. 12: 75–77. Genitalia in B&W pl. 19: 129, 130 (♂).

Description and diagnosis. Lfw. see Tab. 35. The species is unmistakeable by the black filling of the eyespots on all wings (name!) and the usually somewhat deeper chrome yellow ground colour. Further, the postbasal fascia is more red, with a smaller proportion of white and black scales than in

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most other species of the *megacore*-subgroup. The fasciae are usually very narrow; the postdiscal fascia is thin and reddish brown, the double submarginal fascia is blackish (often with some proportion of brown scales as well), but the two lines are usually not connected by interspersed blackish scales as in *mindanaensis*. For the differences with *L. palawana*, see under this species.

Genitalia morphology offers good characters to separate *L. nigropupillata* (GP ♂♂ 523/87 [loan from BMNH], 580/88 [Fig. 130], 606/88, 607/88 [Fig. 129]; BMNH Sat. 317): The uncus is broader, shorter and usually deeper bisected at its distal tip than in *mindanaensis*; further, the bulbous swelling just below the end of the bisection found in *mindanaensis* is lacking in *nigropupillata*. The shape of the valves is slightly different, and the cleft between the free ventral branch (harpe or ventral prolongation of the sacculus; this ventral branch is also longer than in *mindanaensis*) and the dorsal main proportion of the valves is narrower in *nigropupillata*. The cornutus of the vesica is more pronounced and sclerotized in *nigropupillata*. In ♀ genitalia (GP 605/88, see illustrations in NÄSSIG & TREADAWAY 1988) the similarity with *mindanaensis* (e.g., in the general form and the presence of a single round signum) is close; the main difference is found in the two longitudinal ridges in the transition of the two sclerotized parts of the bursa opening: these are more pronounced in *mindanaensis* than in *nigropupillata*. For the differences with *L. palawana*, see under this species.

Table 35: Forewing length of *Loepa nigropupillata*. Material of colls. CCGT, CWAN (more and in part other specimens than those measured by NÄSSIG & TREADAWAY 1988).

Loepa nigropupillata	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Luzon, Sibuyan	♂♂	57.7	2.53	73	52	64
	♀♀	60.4	1.82	5	58	63

Insular and individual variability. The two ♂♂ from Sibuyan are externally identical with the Luzon population. Their lfw. (both specimens 55 mm) is below the average (see Tab. 35). Individual variability is not very significant and mainly deals with the colour intensity and width of the fasciae. Some part of it might be a result of seasonality: Specimens from the same elevation and area collected in February have less pronounced submarginal fasciae than those collected in August (NÄSSIG & TREADAWAY 1988: 166). The eyespots of the wings are on average smaller than in *L. mindanaensis*, and there is not much variability in their diameters.

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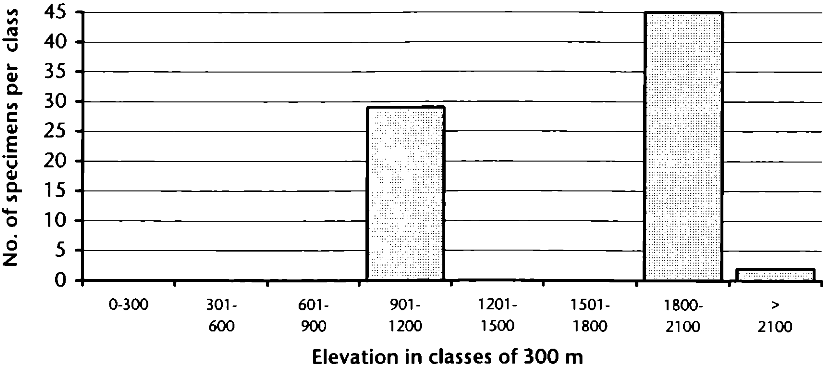
Phenology. From the first data available to us, it appeared that there were clearly two generations in the mountains of North Luzon (especially on Mt. Polis/Pulis at ca. 1900 m elevation): flying ♂♂ were found in February and August, but none were encountered in May. This formerly clear picture is now somewhat obscured by additional data (see Tab. 36) from other places and years. Possibly there may be more than two generations at lower altitudes.

Table 36: Number of specimens of *Loepa nigropupillata* collected per month (n = 78) from Luzon and Sibuyan.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of specimens	2	22	2	0	0	10	7	25	3	1	4	2

Altitudinal distribution. (See Text-Fig. 13.) Most specimens were found above 1000 m. The two clear peaks in the Text-Fig. originate from the few localities where the species was found. *L. nigropupillata* is clearly a mountain species and is unknown from the lowlands.

A few behavioural observations of the ♂♂ of *L. nigropupillata* on Mt. Polis in N-Luzon were provided by Settele (in Nässig & Treadaway 1988: 173); the specimens flew singly to the light between 21:00 and 02:00 h at night. Settele's suggestion that the specimens were migrating is unlikely as the moths do not have a functional proboscis and cannot take up food.



Text-Fig. 13: Altitudinal distribution of *Loepa nigropupillata* on the Philippines (Luzon, Sibuyan), data from 76 specimens. Not all elevation classes were comparably as often visited!

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Preimaginal stages: *L. nigropupillata* was reared in 1988 by Frank Rämisch, Dresden from material collected by A. Schintlmeister (see Nässig & Treadaway 1988: 170–172, col. figs. 4–6). The first two instars are black, with yellowish to reddish hairs; later the typical lateral triangular patches in luminescent whitish yellow to whitish green colour become visible, as in all other larvae of *Loepa* known thus far (see, e.g., Nässig et al. 1996). The differences in later instars to other, related species, namely *megacore* Jordan, 1911, *diversiocellata* Bryk, 1944, *katinka, minahassae* Mell, 1938 (see Naumann 1995, Nässig et al. 1996, L. H. & U. Paukstadt 1996 b, Nässig unpubl.), *sakaei* Inoue, 1965 (Arita et al. 1993) and *formosensis* Mell, 1929[60] (Wang 1988, Peigler & Wang 1995), are – as usual in the group – not very prominent, and due to the quality of the photographs taken by Rämisch (see Nässig & Treadaway 1988: figs. 4–6), a detailed comparison appears not to be possible. It would appear helpful to try another rearing and protocol it with a more elaborate photographic equipment. The foodplants used by Rämisch were Vitaceae (*Cissus* sp.), as usual for the SE-Asian species of the genus *Loepa*.

Discussion. *Loepa nigropupillata* is the most colourful member of the *megacore*-subgroup. It is a montane species in the northern Philippines known from Luzon (Luzon region) and Sibuyan (West Visayan region of Vane-Wright 1990). Most probably it will also be found on other islands within these regions, always in montane environment, usually above the altitude of 1000 m. It is evidently a peripheral offspring of the *megacore*-subgroup of the genus.

Loepa mindanaensis Schüssler, 1933

Loepa katinka mindanaënsis [sic] Schüssler (1933, Lepid. Catal. **56**: 93), HT ♂ (by indication and monotypy, see Nässig & Treadaway 1988) in SMFL, examined, GP 603/88, SMFL-no. 4110. l.t. S.E. Mindanao. HT illustrated in colour by Nässig & Treadaway (1988: 161, fig. 1).

Loepa katinka: Semper (1896: 385). Semper had only one specimen from SE Mindanao, which is still preserved in SMFL. His record was later, by Schüssler (1933), used as the basis for erecting the name *mindanaensis*. We (Nässig & Treadaway 1988) then interpreted and accepted this as a holotype designation by indication.

Loepa mindanaensis: Nässig & Treadaway (1988: 162; 1997 a: 357).

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[60] *Loepa formosensis* is evidently a separate species, clearly defined by its size and its genitalia morphology (as indicated by Nässig et al. 1996), and surely not conspecific with the Sundanian *L. megacore*, as considered by Owada & Wang (1992) or Peigler & Wang (1996). If it was conspecific with another *Loepa* species, then surely with one of the continental Chinese taxa (perhaps *kuangtungensis* Mell, 1938?), but not with the Sundanian *megacore* or the Himalayan species *katinka* or *diversiocellata*.

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D: This species is known from Mindanao and Leyte only. DM 16.

ED: None.

Material studied: Leyte: 1 ♂, Leyte, 700 m, 60 km E Ormoc, Alto Peak, prim. For., 4. vii. 1994, Schütz-no. N48, CPSS, on loan in CCGT. [There are some further specimens from Leyte in CRBP which we have not seen.] Mindanao: 1 ♂, "Davao or., 1889, Platen", in coll. Staudinger (via Mell?) in ZMHU. 11 ♂♂, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, Talakag, 1.–3. x. 1988, Černý & Schintlmeister, GP nos. 611, 612/89, 652, 653/90. 1 ♂, same place, 31. xii. 1991–2. i. 1992, Černý. All these in CWAN. 8 ♂♂, 1 ♀, Bukidnon, Mt. Kitanglad, 4000–6000 ft., different details, ix. 1989, 24. vii. 1990 (2×), 5. vii. 1994 (♀), 3. xi. 1996 (4×), 12. iv. 1997. 1 ♂, "Mt. Caxagan" [not located, possibly near Mt. Kitanglad?], 22. i. 1998. 1 ♀, S-Cotabato, Salacafe, 26. v. 1984, GP 604/88. 7 ♂♂, 2 ♀♀, S-Cotabato, Mt. Matutum, 14. ii. 1994, 28. i. 1996 (♀), ii. 1996, 1., 10., 12. ii. 1996 (12. 2×), 18. ii. 1996 (♀), 10. ii. 1997. 4 ♂♂, S-Cotabato, Mt. Busa, 16. x. 1991, 11. x. 1996, 11.–18. vi. 1997 (2×). All these in CCGT.

Figured: Imagines in Col. pl. 12: 78, 80. Genitalia in B&W pl. 19: 128 (♂).

Description and diagnosis. Lfw. see Tab. 37. The main differences with *L. nigropupillata* see also under that species. For the differences with *L. palawana*, see under this species. *L. mindanaensis* is (especially in ♀♀) a large species. The eyespots are very large, especially on the fw. Their centre is dark brownish, but at least the outer half is usually bright, and the "pupil" is never entirely black as in *nigropupillata*. The postbasal fascia is outwardly blackish, then red, inwardly then a broad field of white scales mixed under the red ones; the red colour never shows the large extent as in *nigropupillata*. The postdiscal fascia and the double submarginal fasciae are not reddish brown, but black instead. The two submarginal bands are nearly always connected by interspersed black scales. All fasciae are usually more heavily marked than in *nigropupillata*. ♀♀ tend to have narrower fasciae and fewer red and white scales within the postbasal band, which resembles the N-Sundanian species *megacore*.

Table 37: Forewing length of *Loepa mindanaensis*. Material of colls. CCGT, CWAN.

Loepa mindanaensis	sex	lfw. [mm] (average)	± SD	n	min. [mm]	max. [mm]
Mindanao	♂♂	57.2	2.85	25	50	63
	♀♀	66.3	2.22	4	64	69

The male genitalia (GP ♂♂ 603/88 HT [Fig. 128], 611/89, 612/89, 652/90, 653/90) show a less sclerotized cornutus, the uncus is narrower, often longer, the apical bisection is restricted to a shorter part, and usually there is a bulbous swelling below the bisection. The cleft between the (shorter) ventral branch and the dorsal main part of the valve is broader from the begin-

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ning to the end. In ♀ genitalia (GP 604/88, see illustration in Nässig & Treadaway 1988) the main difference are the two more prominent longitudinal ridges in the transition of the two sclerotized parts of the bursa opening.

Insular and individual variability. There are some further specimens of *L. mindanaensis* from Leyte in CRBP, which we have not seen and dissected. According to R. Brechlin (pers. comm.), these are all smaller than the Mindanao specimens, which is not apparent from the singleton in CPSS/CCGT, which fits with all aspects of morphology quite well into the Mindanao series. Further studies on larger series should clarify the differences between and the status of these different populations.

Individual variability mainly is covered by differences in the colour and extent of the fasciae. Some specimens may resemble the less marked *L. diversiocellata* or *L. cynopis*, others may look similar to the Sundanian *L. megacore* (lacking most of the red scales), but most specimens are typically marked with prominent black fasciae with many blackish scales around them.

Phenology. (See Tab. 38.) The number of specimens known is perhaps not large enough for a reliable interpretation.

Table 38: Number of specimens of *L. mindanaensis* collected per month (n = 29) from Mindanao.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of specimens	2	4	0	0	1	0	4	0	1	11	4	2

Altitudinal distribution. (See Text-Fig. 14.) In contrast to *L. nigropupillata*, *L. mindanaensis* tends to be found also at lower elevations, starting at around 700 m altitude. (The Sundanian *L. megacore* can also be found at even lower altitudes.) However, the maximum altitudes are also around 2000 m.

Preimaginal stages: The preimaginal instars of *L. mindanaensis* are still unknown.

Discussion. This is another mountain species of the *megacore*-subgroup, known from Mindanao (Mindanao subregion) and Leyte (East Visayan subregion) within the Mindanao region of Vane-Wright (1990). It may as well be expected from the mountains (above 800 m) of further islands of this region.

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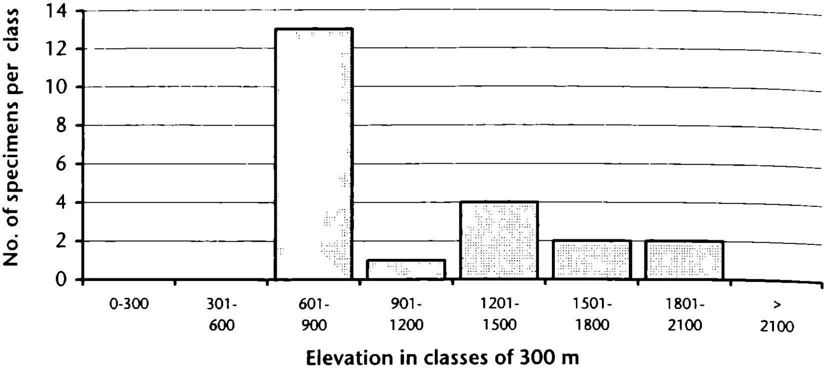

Text-Fig. 14: Altitudinal distribution of *Loepa mindanaensis* on the Philippines (Mindanao), data from 22 specimens. Not all elevation classes were comparably as often visited!

Loepa palawana Nässig & Treadaway, 1997

Nässig & Treadaway (1997 a: 360), HT ♂ in CCGT, assigned to SMFL (GP 678/93, SMFL-no. 4157), examined. l.t.: S-Palawan, Mt. Mantalingajan. See Col. pl. 12: fig. 79.

D: Known only from Palawan. DM 16.

ED: None.

Material studied: **Palawan:** 6 ♂♂ in CCGT and CRBP (details see in the paratype list of Nässig & Treadaway 1997 a). Some additional specimens in CRBP [received later] which we have not seen.

Figured: Imago in Col. pl. 12: 79. Genitalia in B&W pl. 19: 131 (♂).

Description and diagnosis. Lfw. ♂♂ aver. 53.6 mm ± 1.82 mm SD, n = 5; min. 49 mm. Externally, this species is mainly distinguished from *L. nigropupillata* by the lacking of the black “pupils” of the eyespots and from *L. mindanaensis* by the generally much less prominent fasciae and by the more prominent blackish section of the postbasal fascia within the cell. Further, the black subapical dot is slightly narrower than in *mindanaensis* and pointed apically, and the postmedian fascia, in the hw., touches the hw. ocellus over the full length (in *mindanaensis,* it usually is separate from it or touches it only towards the cephal part). It is externally quite similar to *L. cynopis* from Java or to *L. diversiocellata* from the continent.

The main differences, however, are found in the genitalia (only ♂♂ known, GP 678/93, 1014/96 [see in B&W Fig. 131], 1076/97 [the latter in CRBP]): The whole armature is shorter and “stouter” (or sturdier) than in the related species; the valves are shorter, the ventral branch (or harpe or process of the sacculus) is shorter and thicker than in related species; the

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cleft between main part of the valve and harpe is very short. Uncus shorter and thicker, the slight bulbous swelling below the bisection therefore less obvious; the bisection is longer than in *mindanaensis*. There is no cornutus in the vesica at the distant position (nearly two thirds of the way to the tip of the vesica) as in *mindanaensis* or *nigropupillata;* the cornutus is positioned very much basally, still connected with the sclerotized tube of the aedeagus.

The differences in ♂ genitalia between the different morphospecies of the *megacore*-subgroup are usually only small, but according to our present knowledge these differences are very constant and highly diagnostic. Variability in ♂ genitalia within the genus *Loepa* in general appears to be very small, so the genitalia obviously are reliably diagnostic (see NÄSSIG in BRECHLIN 1997; NAUMANN 1998 b).

The ♀ is still unknown.

Individual variability. As there are only a few specimens known, this cannot yet be analyzed in more detail.

Phenology. Two of the known specimens were collected in April, five in November.

Altitudinal distribution. Five of the specimens known were collected in the elevation range 601-900 m; no data available for other specimens.

Preimaginal stages: Unknown.

Discussion. *L. palawana* is a plesiomorphic member of the *megacore*-subgroup, just like *L. diversiocellata* of *L. cynopis*. It is externally quite similar to *L. mindanaensis*. It was described as a separate species because we think that Palawan more likely was colonized from Borneo and not from the Philippines (Mindanao); the similarities with *mindanaensis* are therefore interpreted as synplesiomorphies. Morphological differences in the ♂ genitalia are so evident that we have presently no doubt that *palawana* is, just as the other taxa, a separate species.

Loepa sp.?

NÄSSIG & TREADAWAY (1997 a: 362; col. pl. II, fig. 24; GP 879/95, fig. 16)

Material studied: 1 ♂, "Parawan [sic] Is., VI. 1977", GP 879/95, CWAN.

Figured: Genitalia in B&W pl. 19: 132 (♂). – The specimen see in NÄSSIG & TREADAWAY (1997 a: col. pl. II, fig. 24).

Only one very worn singleton of this species is known. We (NÄSSIG & TREADAWAY 1997 a) did not give it a name, because the labelling ("Para-

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wan Is.") is uninformative and looks somehow unreliable, and the specimen is so worn that many details of external morphology are barely visible. It is a species much smaller (lfw. 47 mm) than *L. palawana* (lfw. aver. 53.6 mm ± 1.82 mm SD, n = 5), its fw. apex is much less falcate, similar to the group of *L. sikkima* Moore, 1865. The genitalia indicate that it, in fact, is an undescribed species, and when further material with reliable data becomes available and confirms its presence on Palawan as the second species of *Loepa* on that island, a description would certainly be necessary. It really may be a species of the *sikkima*-group, although the ♂ genitalia are somewhat unusual for that group and would at first glance indicate a closer relationship to the *megacore/katinka*-group, e.g., to *sumatrana* Nässig, Lampe & Kager, 1989. The species may possibly be a species of higher altitudes which have not yet been intensively collected due to their inaccessibility on Palawan. It can be expected that, in the forseeable future, further specimens will be collected in such higher mountain areas. – Understandably, this species has not been counted here as one of the species of the Philippine saturniid fauna.

Genus *Lemaireia* Nässig & Holloway, 1987

Lemaireia Nässig & Holloway (1987, in: Holloway 1987: 108). TS: *Antheraea loepoides* Butler, 1880, by original designation.

The genus *Lemaireia* was erected for three species from the Asiatic continent and Sundaland, two of which have before been misleadingly included into the genus *Syntherata* Maassen, [1873] (Holloway 1987, Nässig & Holloway 1988). Two additional species have been described in the meanwhile: *L. schintlmeisteri* Nässig & Lampe, 1989 from Mindanao and *L. inexspectata* Nässig, 1996 from southern Vietnam. The preimaginal instars are known only for one of these species (*L. luteopeplus aureopeplus* Nässig & Holloway, 1988 from Thailand, see Lampe & Nässig 1989, Pinratana & Lampe 1990, Peigler & Wang 1996); the L_1 caterpillar is also known for *L. loepoides* (see Nässig et al. 1996).

It appears feasible that *Lemeireia loepoides* or a closely related species may live on Palawan. The larger islands of the Sulu Archipelago should be researched for *L. loepoides* or *L. schintlmeisteri* or intergrades of the two taxa or possibly an additional species[61] As *Lemaireia* species of the

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[61] The last two alternatives (intergrades or separate species) appear to be unlikely, but they are not impossible. Compare the case of the closely related sphingids *Ambulyx moorei* Moore, [1858] (widely distributed in Asia to Sundaland, including the Palawan region), *A. bakeri* (Clark, 1929) (Philippines except Palawan and Sulu regions), and *A. suluensis* Hogenes & Treadaway, 1998 (Sulu Archipelago:

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loepoides-group are inhabiting lowlands, they may have had the opportunity to disperse across narrow sea barriers during the glaciation.

Lemaireia schintlmeisteri NÄSSIG & LAMPE, 1989

Lemaireia schintlmeisteri NÄSSIG & LAMPE (1989: 240), HT ♂ ex CWAN in BMNH (GP 609/89 = BMNH Sat. 628), examined (see Col. pl. 13, Figs. 90, 91); l.t.: Mindanao, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m.

D: Known only from the type locality on Mindanao. DM 16.

ED: None.

Material studied: The type series: HT ♂, 5 PT ♀♀, same data. In BMNH, CCGT, CRLN, CWAN.

Figured: Imagines in Col. pls. 12: 81, 82; 13: 90, 91. Genitalia in B&W pl. 20: 133 (♂), 134 (♀). – The ♂ HT is figured here for the first time in colour.

Only the type series (1 ♂, 5 ♀♀) is known of this species.

Description and diagnosis. Lfw. ♂ 33 mm (n = 1), ♀ 43,6 ± 3,71 SD (n = 5). The species is similar to *L. loepoides*, but darkened variants which are only very rarely seen in *loepoides* (see NÄSSIG et al. 1996: col. pl. 8, fig. 38), appear to dominate in *schintlmeisteri*.

Individual variability. According to the small series known, the species varies especially in its size and in the intensity of the brownish pattern darkening the yellow ground colour.

Phenology. All specimens of the type series were collected 1.–3. x. 1988.

Altitudinal distribution. The type locality is at ca. 800 m. On average, *L. loepoides* and *L. schintlmeisteri* seem to prefer lower altitudes (lowlands to about 1200 m) than *L. chrysopeplus* and *L. luteopeplus* (ca. 800–1800 m), although there is considerable overlap (based mainly on Sumatran and Thai specimens in CWAN; most specimens do not carry altitudinal data).

Preimaginal stages: Nothing is known about the preimaginal instars of *L. schintlmeisteri*.

Discussion. This is an example of a species which was found only one time and never again on Mindanao (similar to *Cricula mindanaensis*, before the new specimen was received recently). In contrast to *C. mindanaensis*, where there originally was some doubt according the accuracy of the labelling (NÄSSIG & TREADAWAY 1997 a: 345, footnote 6), there was never any doubt regarding the authenticity of *Lemaireia schintlmeisteri*, which is, in addition, characterized by an enormous difference in genita-

Bongao, Tawitawi, Sibutu), demonstrating the case of a separate taxon endemic to the Sulu Archipelago (HOGENES & TREADAWAY 1998, in this issue).

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lia morphology (NÄSSIG & LAMPE 1989). As long as the ecology of the species remains unknown, any findings are purely by chance. *L. schintlmeisteri* is a close relative of *L. loepoides* from the northern part of Sundaland (Sumatra, West Malaysia, Borneo); these two species represent a separate group within the genus. All species of the genus appear to be difficult to locate and collect, although, in the meantime, the taxon *L. luteopeplus aureopeplus* has been collected in larger numbers from Thailand and S. Burma.

Both *Cricula mindanaensis* and *Lemaireia schintlmeisteri* are known only from Bukidnon, from a rather narrow area in the Mt. Kitanglad mountain range, both type localities only a few dozen kilometers apart, but at different elevations. How long such evidently rare species, with supposedly a specialized ecology, may withstand the human destruction of their habitats by chopping down the primary forests (especially in the lowlands) is unclear. It appears possible that *L. schintlmeisteri* may become extinct before any more specimens will be found again.

Distribution patterns and endemism of Philippine Saturniidae

The distribution data of saturniid moths available (as shown in Tables 39, 40 and 41 and in the distribution maps) can at this time only give a directional indication of the number of species on each of the islands or zoogeographical regions listed. It is known that the forests and mountains of some island have been visited more often and at different times of the year while others, usually because of more difficult accessibility to such areas, less frequently. With this background, considering numbers of species per island: Mindanao (14) has the highest count, followed by Luzon (12). Other islands with reasonably high species count are Palawan (10), Leyte (10), Negros (9), and Mindoro (9). Cebu (3), as could be expected, has a low count because this island is almost denuded of forest. Samar (6), Bohol (4) and the Sulu Archipelago (2) could well owe their low count partly due to lack of high mountains and partly to being far less frequently visited in recent years. Further observation and collecting of Saturniidae on these islands as well as the higher forested mountainous areas of Mindanao (14 species known today), Palawan (10), Mindoro (9), and Panay (7) could well yield additional species and possibly new endemic taxa. Two of the insular endemics on species level (*Cricula mindanaensis* and *Lemaireia schintlmeisteri*) are both only known from one mountain complex (in Bukidnon, Mindanao), for example.

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Table 39: Breakdown of numbers of Saturniidae species, endemic species, widespread SE Asian species and their subspecies of the Philippines.

Taxon	Species no.	Endemic species	Subspecies of endemic species	Endemic subsp. of widespread SE Asian species
Attacus atlas	1			
Attacus caesar	2	+		
Attacus lorquinii	3	+		
Attacus lemairei	4	+		
Samia luzonica	5	+		
Samia treadawayi	6	+		
Actias philippinica philippinica	7	+		
Actias philippinica bulbosa			+	
Actias selene brevijuxta	8			+
Cricula trifenestrata treadawayi	9			+
Cricula luzonica luzonica	10	+		
Cricula luzonica leyteana			+	
Cricula luzonica kareli			+	
Cricula mindanaensis	11	+		
Antheraea paniki paniki	12	+		
Antheraea paniki sahi			+	
Antheraea halconensis	13	+		
Antheraea rosieri imeldae	14			+
Antheraea larissa larissa	15			
Antheraea larissa mindoroensis				+
Antheraea larissa philippirissa				+
Antheraea semperi semperi	16	+		
Antheraea semperi noeli			+	
Antheraea gulata	17	+		
Antheraea platessa	18			
Antheraea gschwandneri zwicki	19			+
Loepa nigropupillata	20	+		
Loepa mindanaensis	21	+		
Loepa palawana	22	+		
Lemaireia schintlmeisteri	23	+		
Totals (percentage of endemic species = 69,6 %)	23	16	5	6

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Table 40: List of endemic and widely distributed Saturniidae species (and subspecies) of the Philippines, according to islands and zoogeographical regions (after VANE-WRIGHT 1990). Legend: E = Endemic Philippine species, E*, E** = Endemic subspecies of Philippine species, W = Widely distributed SE Asian species, W*, W** = Endemic Philippine subspecies of widely distributed SE Asian species. No symbol in a field may either mean species absent or not yet recorded. Dubious locality data (see text) ignored. All percentages levelled to nearest whole number. — Notes: [1] = *Loepa nigropupillata* is known from Sibuyan, included here under Panay. [2] = This Sibuyan recond is not counted for Panay, but for the West Visayan region.

Species/endemic species per island/zoogeog. region	(Region)	(Region)	(Region)	West Visayan Region			East Visayan/Mindanao Region				(Region)
							East Visayan Subregion				
Species	Palawan	Mindoro	Luzon	Panay	Negros	Cebu	Bohol	Samar	Leyte	Mindanao	Sulu-Arch.
Attacus atlas			W								
Attacus caesar							E	E	E	E	E
Attacus lorquinii		E	E	E	E	E					
Attacus lemairei	E										
Samia luzonica		E	E	E	E			E	E	E	E
Samia treadawayi	E										
Actias phil. philippinica * = ssp. *bulbosa*	E*	E	E	E	E		E		E	E	
Actias selene brevijuxta		W*	W*							W*	
Cricula trifenestrata treadawayi	W*[2]	W*			W*	W*			W*	W*	
Cricula luzonica luzonica * = ssp. *leyteana* ** = ssp. *kareli*			E						E*	E**	
Cricula mindanaensis										E	
Antheraea paniki paniki * = ssp. *sahi*	E*	E	E		E			E		E	
Antheraea halconensis		E	E	E	E		E	E	E	E	

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Antheraea rosieri imeldae	W*										
Antheraea larissa larissa * = *mindoroensis* ** = *philippirissa*	W	W*	W**	W**	W**			W**	W**	W**	
Antheraea semp. semperi * = ssp. *noeli*		E*	E	E	E	E	E		E	E	
Antheraea platessa			W	W	W			W	W	W	
Antheraea gschwandneri zwicki	W*										
Antheraea gulata	E										
Loepa nigropupillata			E	E[1]							
Loepa mindanaensis									E	E	
Loepa palawana	E										
Lemaireia schintlmeisteri										E	
no. of species per island	10	9	12	7[2]	9	3	4	6	10	14	2
% of total species (n = 23)	44	39	52	30	39	13	17	26	44	61	9
no. of species per subregion							11			14	
% of total species (n = 23)							48			61	
no. of species per region	10	9	12	10			14				2
% of total species (n = 23)	44	39	52	44			61				9
# of endemic specs. per island	6	6	8	5	6	2	4	4	7	10	2
% of total Philippine endemic species (n = 16)	38	38	50	31	38	13	25	25	44	63	13
# of endemic specs. per region	6	6	8	7			10				2
% of total Philippine endemic species (n = 16)	38	38	50	44			63				13

Table 41: Degree of endemism on the different islands and zoogeographical regions. The total degree of endemism for the Philippines as a whole is 70 % (16 endemic species of 23 total species).

Degree of endemism	(Region) Palawan	(Region) Mindoro	(Region) Luzon	West Visayan Region			East Visayan/Mindanao Region				(Region) Sulu-Arch.
							East Visayan Subregion			Mindanao	
				Panay	Negros	Cebu	Bohol	Samar	Leyte		
no. of species per island	10	9	12	7	9	3	4	6	10	14	2
% of total species (n = 23)	44	39	52	30	39	13	17	26	44	61	9
no. of endemic species per island	6	6	8	5	6	2	4	4	7	10	2
% of endemic species per island	60	67	67	71	67	67	100	67	70	71	100
no. of species per region	10	9	12	10			14				2
% of total species (n = 23)	44	39	52	44			61				9
no. of endemic species per region	6	6	8	7			10				2
% of endemic species per region	60	67	67	70			71				100

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However, it must be kept in mind that not-highly-mobile Lepidoptera (like Saturniidae) on the Philippines do not regularly have a wide distribution covering all islands (see, e.g., DE JONG & TREADAWAY 1993). As a general pattern, there are two main centres of endemicity: Mindanao in the South, which possesses 4 species and 1 subspecies of Saturniidae not known from the North (under a total of 10 Philippine endemics), and Luzon in the North, which has 2 species and 1 subspecies not known from the South (under a total of 8 Philippine endemics); the taxa of these endemism centres have to a different intensity dispersed onto the islands in between, sometimes resulting in further insular endemisms on them. In general, Palawan is either inhabited by Sundanian taxa, or it forms a third centre of Philippine endemism (in saturniids: 6 species and 2 further subspecies). The percentage of endemism on species level (species endemic to the Philippines as a whole as well as those endemic to the island or region alone, considered as a fraction of all species known from the island or region) for the larger islands is relatively constant between 60 and 71 % (Table 41); for the Philippines as a whole it is 70 % on species level (16 of 23 species); when endemic subspecies of more widely distributed SE Asian species are included in this consideration, this value of endemism goes even up to 21 of 23 species or 91 %. For the (on average) highly mobile Sphingidae, the value of endemism on species level of the Philippines is much lower: 24 of 117 species or 20.5 % are endemics (see HOGENES & TREADAWAY 1998, in this issue). Also the Lasiocampidae, still much less intensively studied than the Saturniidae or Sphingidae, show a lower degree of endemism on species level: 29 of 61 species or 47.5 % are endemics (see ZOLUTUHIN et al. 1998, in this issue).

It is interesting that of the total of 10 species known for **Palawan,** 3 have a close relationship to the other islands of the Philippines (*Actias philippinica bulbosa, Antheraea paniki sahi, Antheraea gulata*), 3 are clearly of Sundanian relationship (*Antheraea rosieri imeldae, Antheraea larissa larissa, Antheraea gschwandneri zwicki*), while the affinities of the remaining 4 species are not yet satisfactorily analyzed. Further, 4 of the 10 species of Saturniidae known from Palawan are endemic species of the Palawan region (or Palawan alone) only, and at least 4 of the then remaining 6 species are on subspecies level endemics of this island; only *Antheraea larissa larissa* and *Cricula trifenestrata ?treadawayi* are shared on subspecies level with surrounding larger islands. This picture differs sharply from the situation in the Sphingidae, where a high species count is combined with an extreme low count for Philippine or Palawan endemics (HOGENES & TREADAWAY 1998, in this issue): only 3 % (2 of 73 species, in contrast to 8 of 10 or 80 % in Saturniidae, including subspecies) of the

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Palawan sphingids are endemics. Although the differences in the total numbers of species known from Palawan (73 sphingids, 10 saturniids) make this comparison somewhat unbalanced, the differences in the degree of endemism most likely reflect the different long-distance flight abilities of Sphingidae and Saturniidae (compare JANZEN 1984 a).

The Sulu Archipelago in the Southwest and the islets in the North may show some influence of Bornean and Taiwanese species, respectively, when further material from there becomes available for study. And there may be more, sometimes complicated or patchy patterns of distribution caused by different dispersal histories. Because of this complexity, detailed and reliable distribution data is crucial for the study of Philippines butterflies and moths.

Distribution maps

The locality data was compiled (by C.G.T.) and plotted from the collections of the authors (CCGT & CWAN), from the Senckenberg-Museum (SMFL, including coll. SEMPER), from other collections available to us (see text), and from literature. Besides a few other publications, we mainly extracted distribution data from PAGENSTECHER (1890), SEMPER (1896) and (most helpful) PEIGLER (1989). Some incomplete locality data from labels were completed after personal knowledge of the place by C.G.T.

It can be expected that, as more material is collected, the actually known distribution of a taxon will cover a larger area and often also more islands than plotted on the maps. Most of the data compiled by us were collected more or less by chance (depending on the accessibility of the localities and the conditions limiting the collecting success), and the maps often give more information about the collecting intensity rather than about the real distribution. The density of collecting localities at artificial lights for nocturnal species is much smaller than that of diurnal collecting places figured by TREADAWAY (1995: 14, map 4).

When there are two types of symbols for the same taxon on one map, the locality is plotted as the **solid black symbol**, when there is no actual doubt about the accuracy of the label data. When there is any uncertainty about its accuracy, the **outline of the same symbol is filled with white.** Such uncertainty may concern:

The accuracy of the labelling itself (especially material obtained commercially from traders, Filipine as well as European, may be just plainly mislabelled or unlabelled).

The details contained in the label data (often there is no locality, only the island name is written on the label); we have plotted symbols on the island when there was at least a hint about the true locality somewhere to be found; in cases when there was no such hint, we have used an open symbol in the ocean with an arrow pointing to the island (see Maps 2, 3, 10).

The zoogeographical interpretation of the locality; some species have evidently been introduced to other islands by man (e.g., the southern species *Attacus caesar* to hotel gardens in the city of Manila, Luzon, northern Philippines), either accidentially or deliberatly.

Often it was not possible to decide reliably which of the above problems was involved in a given case.

A scale (600 km in steps of 60 km) is given on each map.

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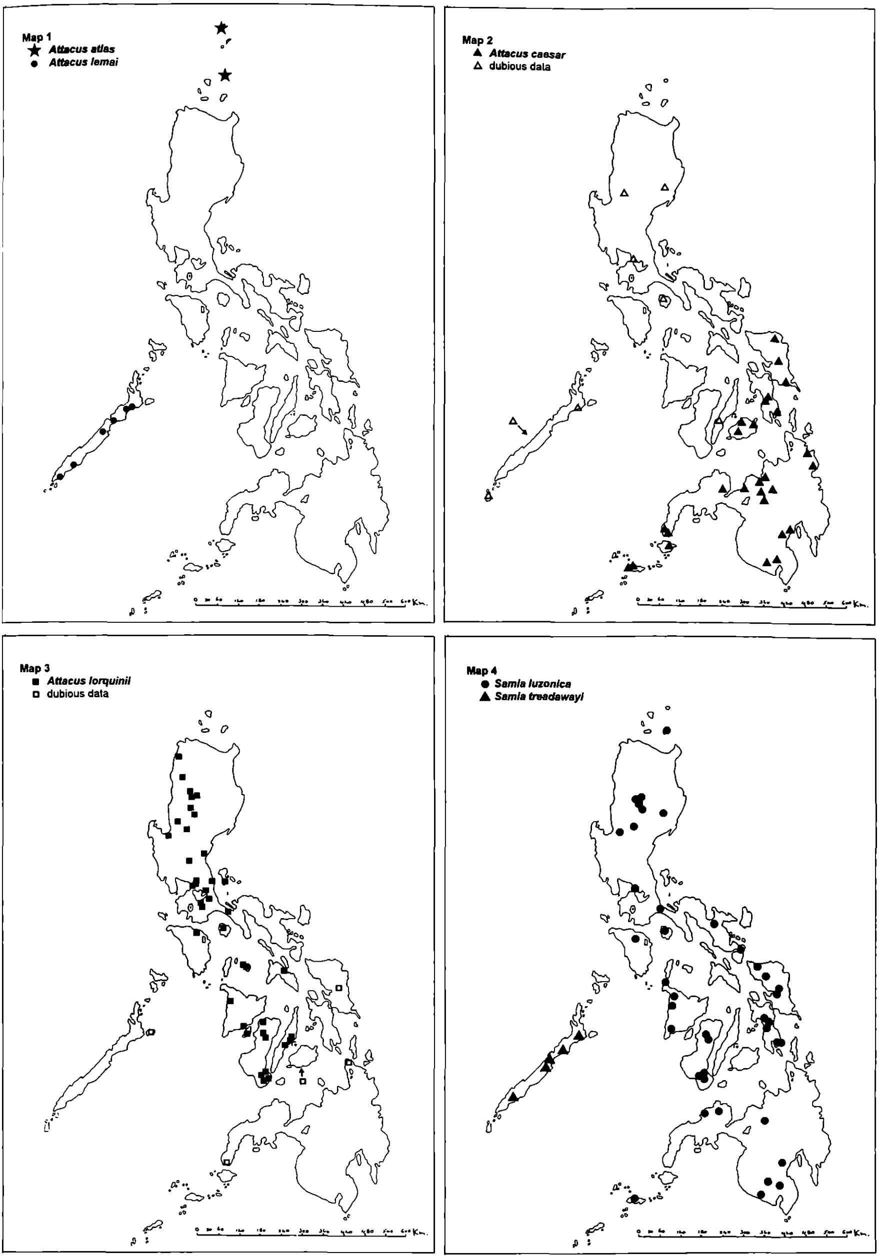

Distribution Map (DM) 1: *Attacus atlas* and *Attacus lemairei.* **DM 2:** *Attacus caesar.* **DM 3:** *Attacus lorquinii.* **DM 4:** *Samia luzonica* and *Samia treadawayi.*

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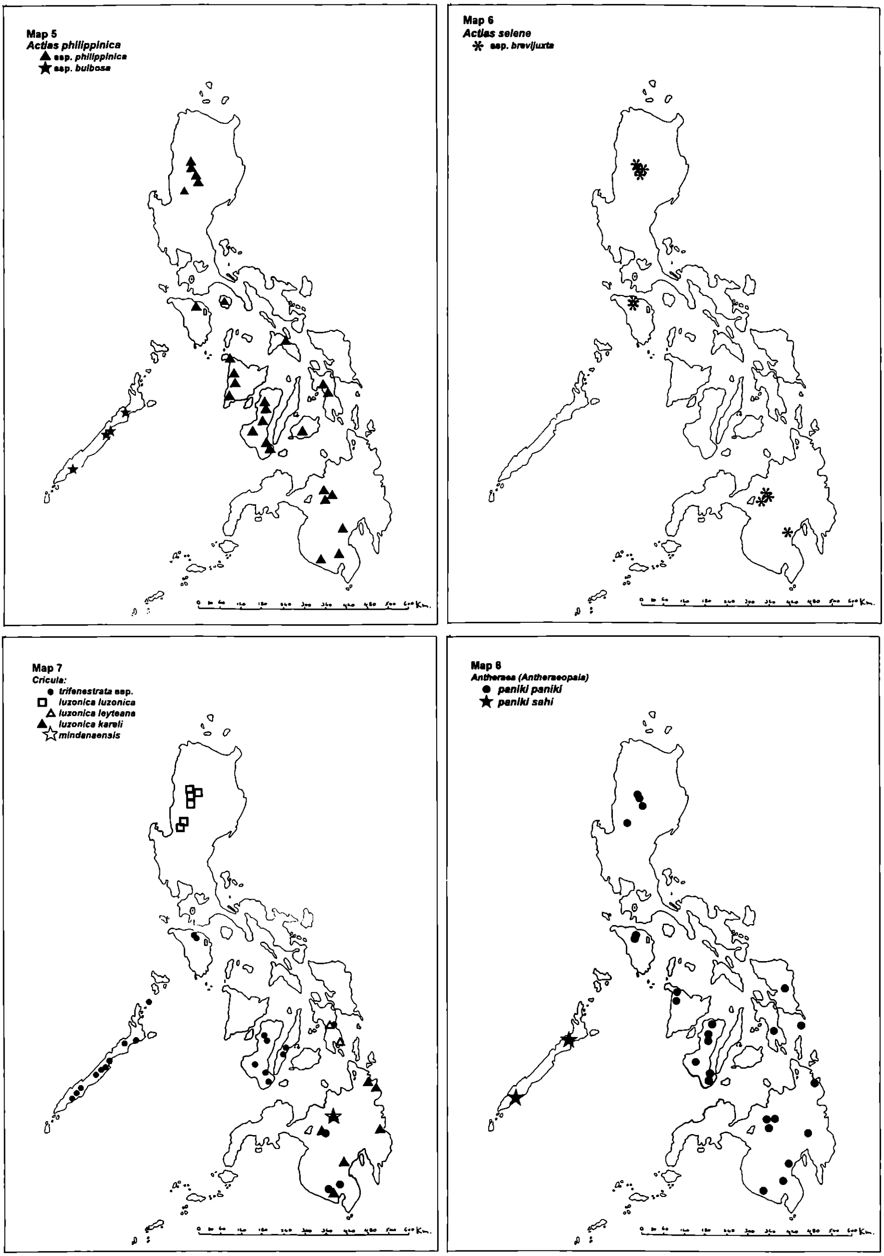

Distribution Map (DM) 5: *Actias philippinica* sspp. **DM 6:** *A. selene brevijuxta*. **DM 7:** *Cricula trifenestrata, C. luzonica* sspp., *C. mindanaensis*. **DM 8:** *Antheraea (Antheraeopsis) paniki* sspp.

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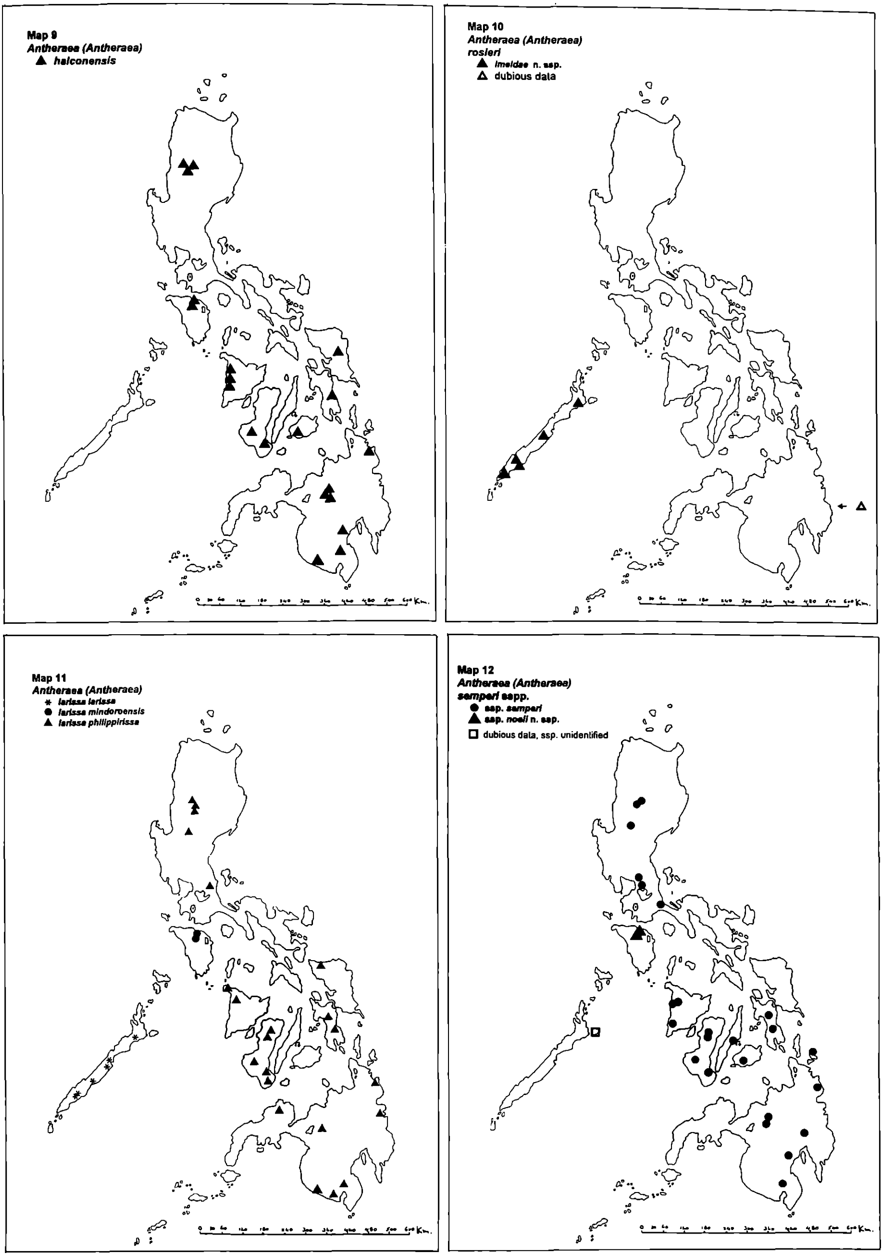

Distribution Map (DM) 9: *Antheraea (Antheraea) halconensis*. **DM 10:** *A. (A.) rosieri imeldae*. **DM 11:** *A. (A.) larissa* sspp. **DM 12:** *A. (A.) semperi* sspp.

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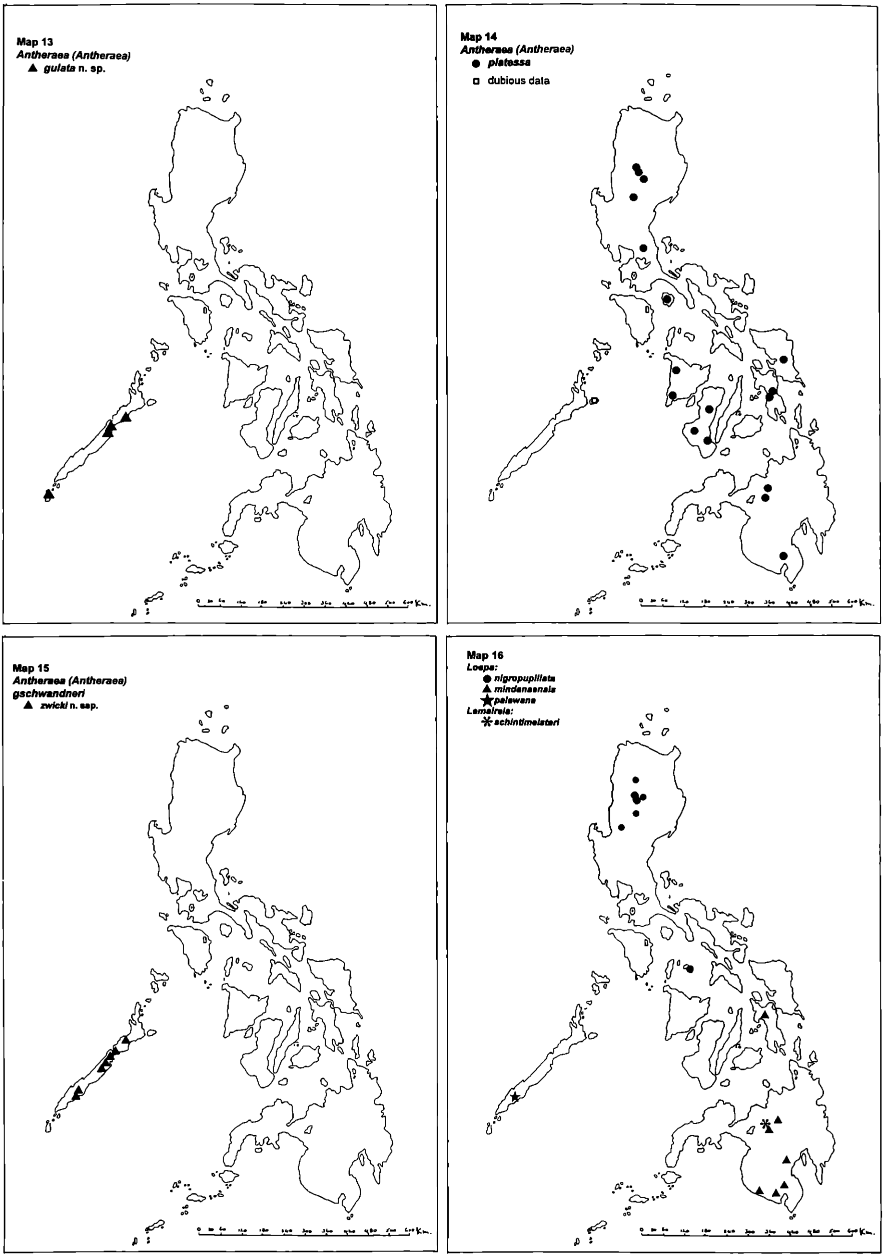

Distribution Map (DM) 13: *Antheraea (Antheraea) gulata*. **DM 14:** *A. (A.) platessa*. **DM 15:** *A. (A.) gschwandneri zwicki*. **DM 16:** *Loepa mindanaensis, L. nigropupillata, L. palawanica* and *Lemaireia schintlmeisteri*.

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[62] In the headline, not in the text, misspelled as "*casesar*".

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