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New bagworms (Lepidoptera, Psychidae) from oil palm plantations in Papua New Guinea

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Five species of the family Psychidae were reared from oil palms in Papua New Guinea. Two of them are known: *Eumeta variegatus* (Snellen, 1879) (Dierl, 1965) and *Mahasena corbetti* Tams 1928. Three smaller species, one of which is a minor pest in oil palm plantations, are described as *Amatissa bilomia* sp.n., *Amatissa nava* sp.n. and *Manatha conglacia* sp.n. Adults & larvae are described.

Keywords: *Eumeta variegatus*, *Mahasena corbetti*, *Amatissa bilomia* sp.n., *Amatissa nava* sp.n., *Manatha conglacia* sp.n., Oil palm, Papua New Guinea (PNG), West New Britain Province, Northern (Oro) Province, Milne Bay Province.

INTRODUCTION

Five species of the family Psychidae (Lepidoptera), also known as «bagworms» or «case moths» are discussed and three species are recognised as new, as some species of this family are of importance as pests of oil palm. All oil palm plantations mentioned here are in Papua New Guinea, located between 2° and 11° South and between 145° and 154° East (Fig. 1). Oil palm plantations are often surrounded by natural forest and smallholder oil palm blocks that are threatened by phytophagous insects which attack the palms (Figs 2a–c). This study involves Lepidoptera, Psychidae collected from several plantations from widely separated Provinces of Papua New Guinea. None of the new species described has required control intervention through Targeted Trunk Injection (TTI).

We also discuss the main characteristics of two well known and widespread species *Mahasena corbetti*, which is sometimes a serious pest of oil palms especially in West New Britain Province (WNBPN), and *Eumeta variegatus* which has never been considered of any economic importance in WNBPN, but may sometimes be found in appreciable numbers in oil palm plantations and smallholder blocks.

Plantations from where samples were collected were: Malilimi, Togulo, Bilomi, Haella, Dami & Kumbango in West New Britain Province (New Britain Palm Oil Ltd. NBPOL), Ambogo Estate at Higaturu Oil Palms (NBPOL) in Northern (Oro) Province) and Bishops Block (#1190), Milne Bay Estates, (NBPOL) Milne Bay Province PNG

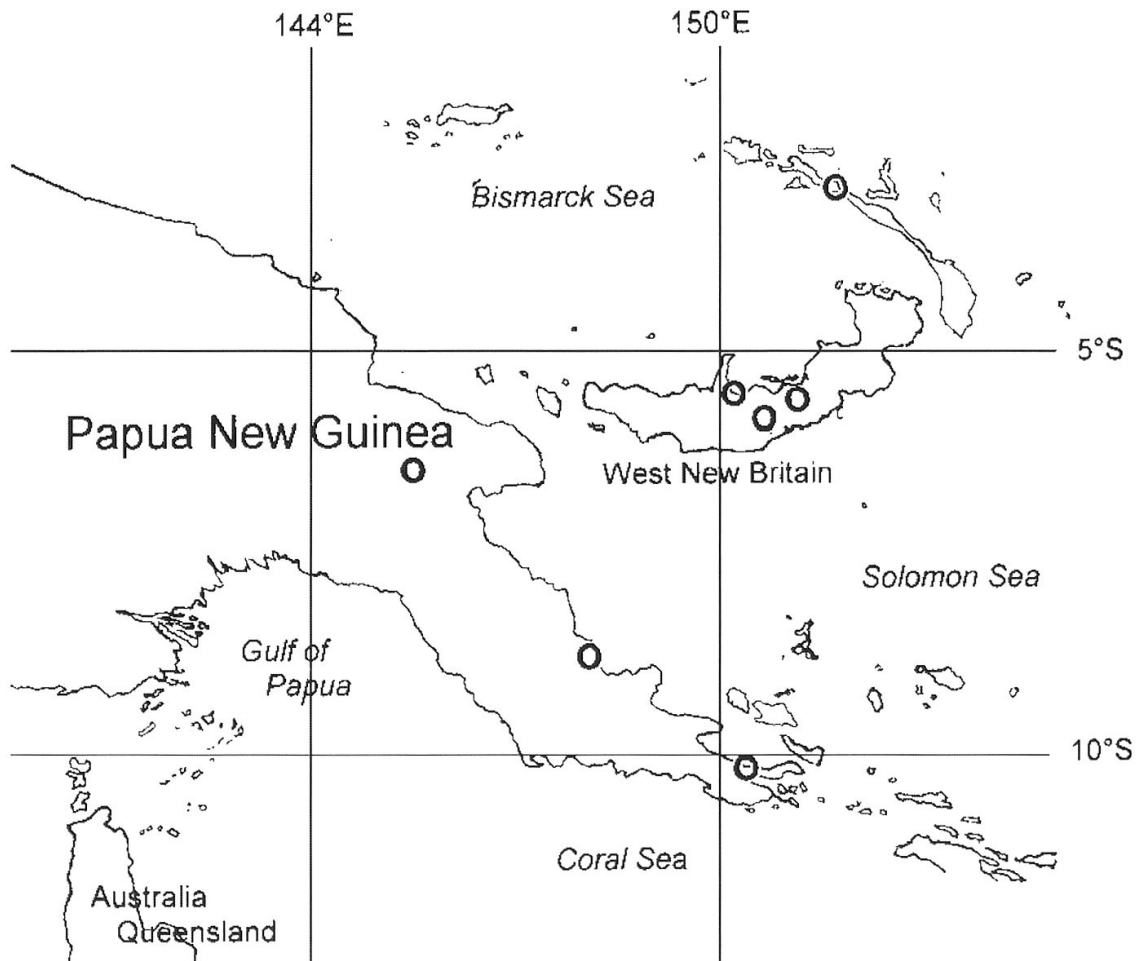


Fig. 1. Papua New Guinea, West New Britain Province. Collection localities are marked with circles.

The following species of Psychidae (Subfamily Oiketicinae, Tribe Acanthopsychini), *Eumeta variegatus* (Snellen, 1879), *Mahasena corbetti* Tams, 1928, and three new species, *Amatissa bilomia*, *Amatissa nava* and *Manatha conglacia* were recorded from oil palms and collected for detailed studies.

The larvae of all five species construct a bag in which they spend their whole life protected to some extent against natural enemies. The larvae of the five species make very different bags which provide individual species recognition (Fig. 3). In all five species only the male imagines are winged, the females are apterous and remain within the bag their entire life. The larvae may only change location during their life either by crawling from host plant to host plant, or as small larvae by passive dispersal suspending themselves on long silken threads and being blown by the wind, known as ballooning (Davis 1964). Adult males, however, are strictly nocturnal, fully winged, very active and fly vigorously. In captivity they rapidly destroy their wings by their frenetic activities. They are short-lived and do not feed (Fig. 4). The antennae are strongly pectinate. Males search out females by following a pheromone scent trail.

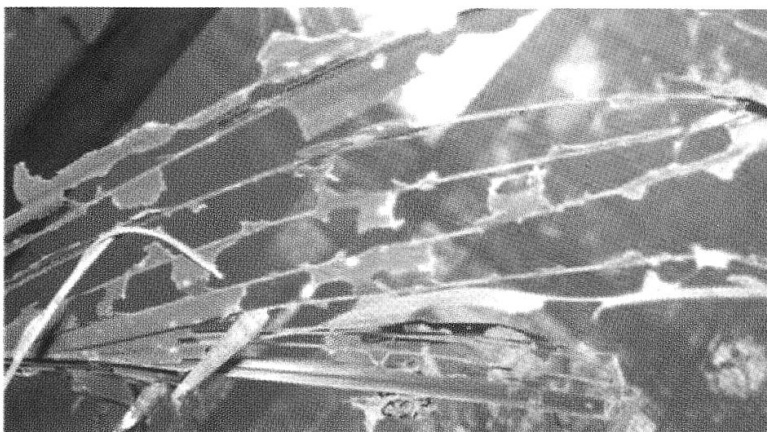


Fig. 2a. Damage done by the bagworm larvae of *Eumeta variegata*.



Fig. 2b. Damage by young larvae of the «ice cream cone bagworm» *Manatha conglacia* sp. n. in an early stage.



Fig. 2c. Palm tree damaged by larvae of *Amatissa nava* sp. n. in Milne Bay, the type locality of this species.

Abbreviations and terminology used

w = wing; fw = forewing; hw = hind wing; dc = discoidal cell; r_1 to r_5 = radial veins; m_1 to m_3 = median veins; cu = cubital veins; pcu = cubitus postal; an = anal vein; rr = radial ramus; ex.l = adult reared from larva; ex.p = reared from pupa.

Wing scales are identified between the discoidal cell and apex (Sauter 1956, Sauter & Hättenschwiler 1999). Class 1 = narrow, hair like; 6 = wide, broad.

Abbreviations for insect collections :

NHML = Collection of the Natural History Museum in London.

PNGOPRA = Collection of the Papua New Guinea Oil Palm Research Association, Dami, Kimbe, West New Britain Province, Papua New Guinea.

ANIC = Collection in the Australian National Insect Collection CSIRO, Division of Entomology G.P.O. Box 1700. Canberra City, A.C.T. 2601, Australia.
CRPH = Collection of R. & P. Hättenschwiler, Uster, Switzerland.

SYSTEMATICS

Psychidae, Oiketicinae, Acanthopsychini

***Eumeta variegatus* (Snellen, 1879) (see Dierl 1965)**

Material. We studied four males collected in West New Britain, Bebere Plantation, Division 2, ex.p emerged 16.4.2008, 5.3.2009 and two males ex.p emerged on 14.5. 2009.

Description. Bag: (Fig. 3A). The male bag is 35–45 mm long, 10–12 mm diameter, female bag is considerably larger at 40–60 mm long, diameter 13–16 mm. It is made by the larva from grey coloured silk. Plant material used is tightly attached to the surface, only rarely standing out from the bag.

Full grown larva: Male 25 mm long, 7 mm diameter, female larva 35 mm long, 8–9 mm diameter, both sexes with abdominal segments grey brown, thorax and head dark brown with light coloured dorsal markings (Fig.9A).

Male: (Fig. 4A) fw dull brown with light grey to brown markings and fine stripes; wingspan 33–47 mm (Fig. 3A), fw with 9 veins branching off dc; r_3+r_4 and m_2+m_3 stalked; hw 6 veins off dc r_2+r_3 stalked, both with a very long intercalated cell which, in the fw, often reaches down to the base of the wing. Wings covered with short, wide scales class 5–6 (Sauter 1956). Antennae short, approximately $\frac{1}{3}$ of wing length with 30–45 segments (Fig. 5A) excluding the two basal segments, all filaments pectinate. Eyes large, distance between eyes approximately 1–1.2 times the height of the eye. Forelegs with a long epiphysis reaching near to the end of the tibia. Male genitalia with short saccus (Fig. 7A). Valvae short, stout, phallus (aedeagus) reaches nearly the length of the whole genitalia. Short-lived, lacking mouthparts and only flying at night. When it is ready to emerge, the male pupa protrudes from the distal end of the bag from which the imago then emerges.

Female: Creamy white, apterous and all body appendages reduced to minute stumps. Abdomen cylindrical 22–34 mm long, 10–13 mm in diameter, head and thoracic segments darker, dark-brown ring of hair-like scales on abdominal segment 8 (Fig. 8A).

Comments. This species is widespread over large parts of Asia. Specimens from Japan, China, Sumatra, Thailand, the Philippines and Solomon Islands have been compared. This species may be recognised by the large, grey coloured smooth bags that hang beneath the leaflets of the host plant. In PNG it is known as the smooth bagworm (SBw).

***Mahasena corbetti* Tams, 1928**

Material. Togulo Plantation, Division 1. 2 ♂♂ ex.p emerged 24.5.2011 and 26.5.2011, from Togolu Plantation Division 2; 3 ♂♂ ex.p emerged 6.2.2009, 9.2.2009 and 22.2.2009.

Description. Bags: Very variable in appearance and typically «untidy» depending on the type and variety of plant material used (Fig. 3B). Occasionally almost

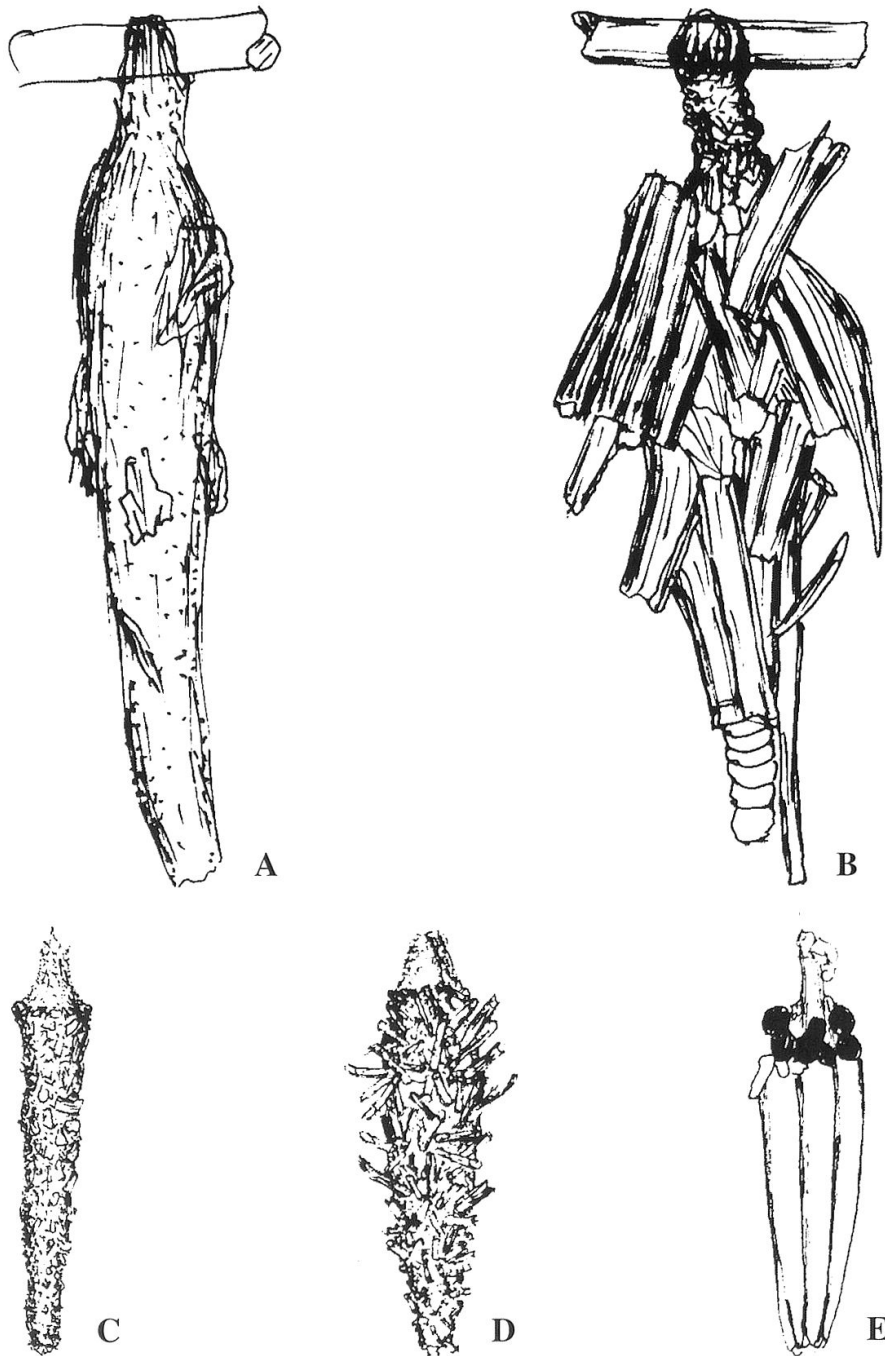


Fig. 3. Bags. — A: *Eumeta variegatus*. — B: *Mahasena corbetti*. — C: *Amatissa bilomia* sp.n. — D: *Amatissa nava* sp.n. — E: *Manatha conglacia* sp.n

naked bags without any attached plant material are found. This species uses plant material not only as food but it is also built into the structure of the bags. Mature male bags are 35–50 mm long, while the larger female bags may be 60–80 mm long.

Larva: They have a wide food plant spectrum, and hence use diverse material for construction of the bags; when large pieces are used, they change in shape and colour when dry.

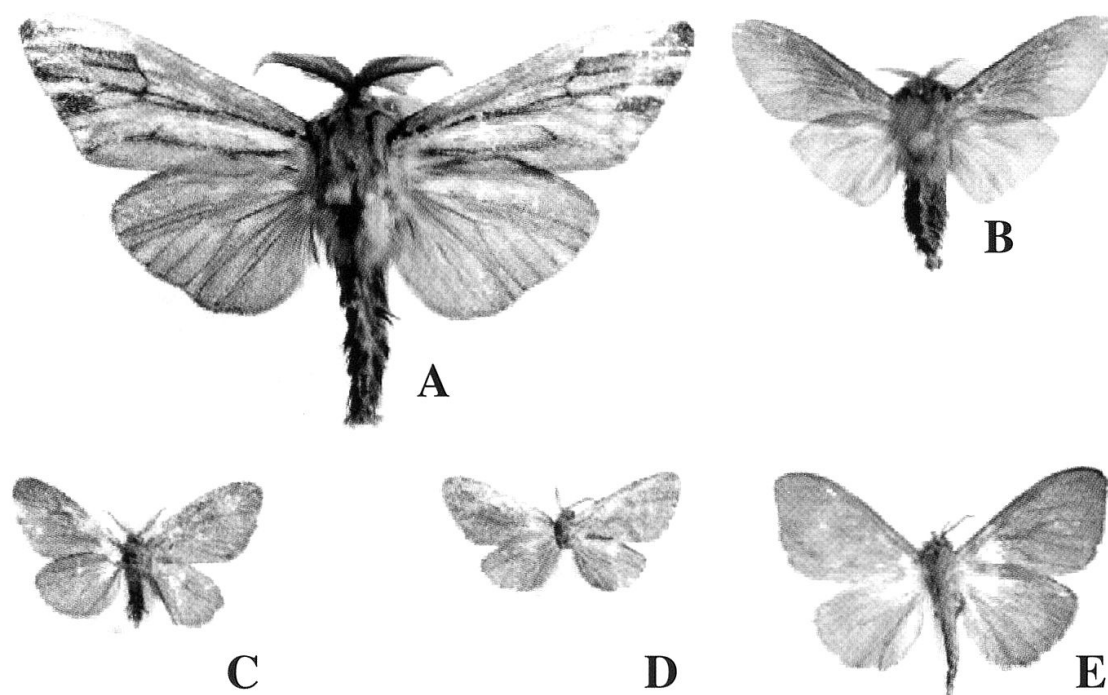


Fig. 4. Males. — A: *Eumeta variegatus*. — B: *Mahasena corbetti*. — C: *Amatissa bilomia* sp.n. — D: *Amatissa nava* sp.n. — E: *Manatha conglacia* sp.n.

Male: Unicolorous dark brown fw; hw lacking any spots or markings, covered with medium wide scales of class 3–4 (Sauter 1956). Wingspan 20–25 mm (Fig. 4B); fw with 10 veins branching off dc (specimens with 9 dc veins can be observed) with short intercalated cell, r_3+r_4 and m_2+m_3 stalked, hw 6 veins off dc, intercalated cell present, m_2+m_3 stalked (Fig. 5B). Antennae short, length approximately $\frac{1}{4}$ of the wing length, (Fig. 6B) with 21–28 segments, most of them pectinate, with sensory hairs. Forelegs with long epiphysis reaching to the end of the tibia. Eyes small, distance between them approximately twice the height of the eye. Male genitalia with long, pointed saccus, Valvae long, phallus (aedeagus) very long, longer than the length of the entire genitalia (Fig. 7B). Males have no mouthparts, are nocturnal and very active, with a short life-span.

Female: Body cylindrical creamy-white, 20–25 mm long, 8–12 mm diameter (Fig. 8B), lacking wings; all body appendages strongly reduced or absent; the hair-scales on segment 8 light brown in colour. Mouthparts absent.

Larva: Full grown larva with head and thorax segments brown, abdomen light yellowish brown; male (Fig. 9B) approximately 15–18 mm long, 4–5 mm diameter, female 20–30 mm long, 8–10 mm diameter.

Biology: The flight period in PNG appears to be from April to June. Larval infestations on oil palms are commonly found during the windy seasons, as the wind is the predominant dispersal mechanism. Emergence may occur throughout much of the year without specific seasonality. The number of eggs laid appears to be very variable, but from our limited laboratory observations about 1,600 eggs are laid (S. Makai, pers. comm.), this is similar to Wood (pers. comm.) who suggest between 1,119–3,000 eggs may be laid. According to Syed (pers. comm.) egg hatching is similar to *Eumeta variegatus* and takes about 16 days. The larval stage may last for

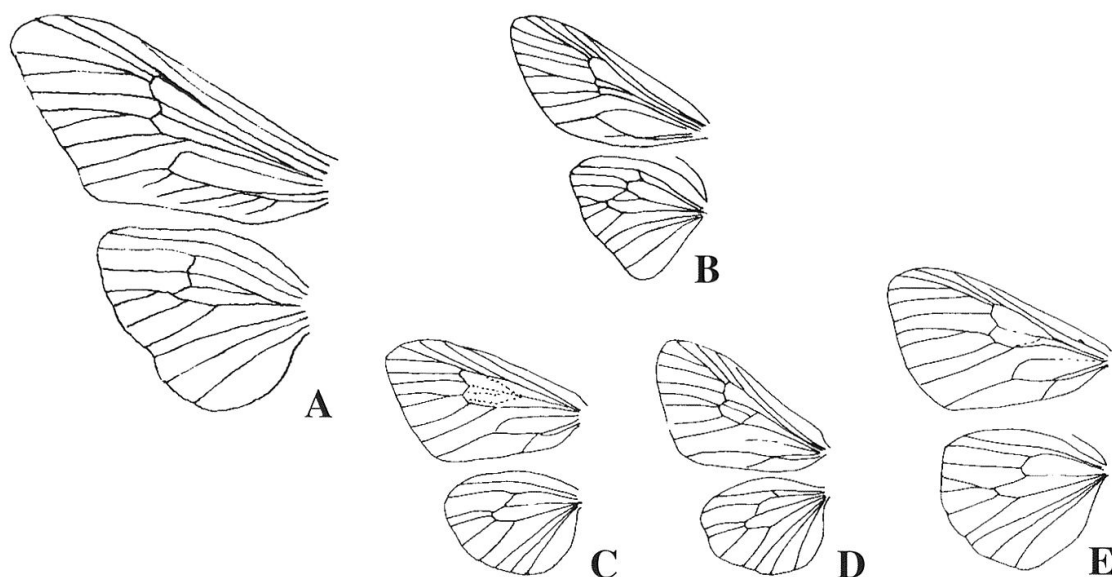


Fig. 5. Wing venation. — A: *Eumeta variegatus*. — B: *Mahasena corbetti*. — C: *Amatissa bilomia* sp.n. — D: *Amatissa nava* sp.n. — E: *Manatha conglacia* sp.n.

12-17 weeks, and the pupal stage approximately 3-4 weeks (R.N.B. Prior, unpublished). The female pupa is only partially extruded from the bag prior to emerging.

Comments. Known as the «rough bagworm» in PNG, this species, of similar distribution as *E. variegatus*, is reported throughout Asia. Specimens from China, Sumatra, the Philippines and Solomon Islands have been included in this study.

Amatissa bilomia sp. n.

Material. **Holotype** ♂, *Amatissa bilomia* sp.n. with bag, leg. S. Makai, Papua New Guinea, West New Britain Province (PNG), Bilomi Plantation, Division 1, No. 909, ex. oil palm, coll. 16.7.2011, ex.p emerged 26.7.2011, deposited in NHML. **Paratypes** ♂♂, numbers 905 through to 908 and 911, 912 all collected 16.7.2011 and ex.p emerged between 20.7.–15.8.2011, they are in the collections of PNGO-PRA, ANIC and CRPH.

Type locality. Bilomi Plantation, West New Britain Province, Papua New Guinea.

Description. The genus *Amatissa* is represented in South East Asia by several, mostly small to medium size species with uniformly dark coloured brown wings lacking any markings.

Male: (Fig. 4C) Wings unmarked dark brown, wingspan 12–14 mm but a much larger range can be expected (Hättenschwiler 2007): fw 10 veins off the dc, with intercalated cell which, because the veins are very fine, may be difficult to recognize; veins r_3+r_4 and m_2+m_3 stalked, with wide scales of class 5–6; hw with 5 veins off dc and with m_2+r_3 stalked, no connection between rr and sc, (Fig. 5C); scales a little narrower in class 4–5 (Sauter 1956). Antennae short, length approximately $\frac{1}{4}$ of wing length and with 19–22 segments (Fig. 6C), with the exception of the two basal segments; all segments pectinate with sensory hairs. Head with no ocelli, eyes round, small, distance between eyes approximately twice the height of

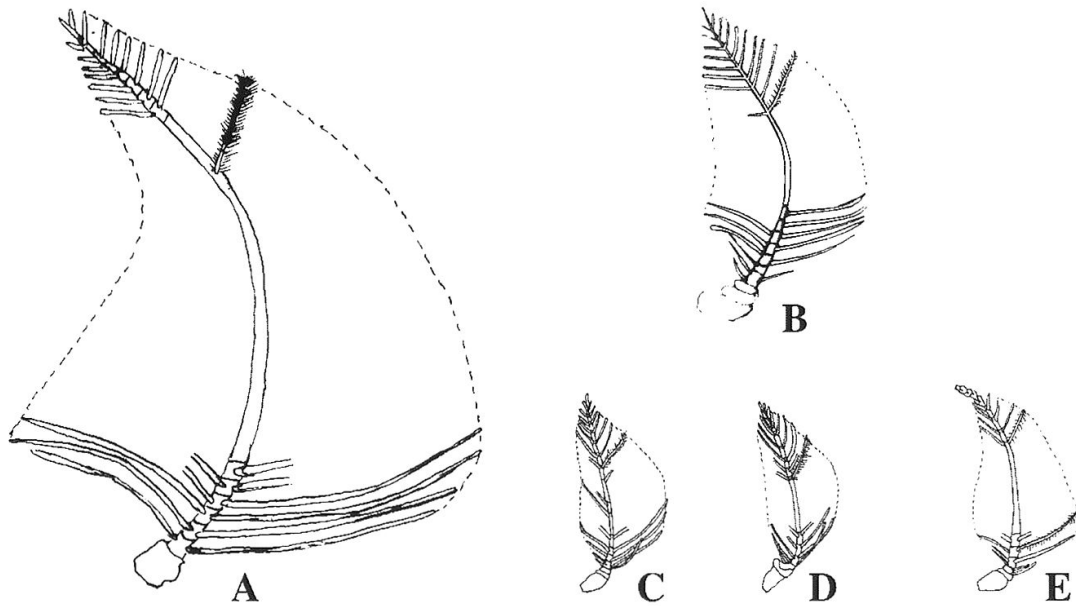


Fig. 6. Male antennae. — A: *Eumeta variegatus*. — B: *Mahasena corbetti*. — C: *Amatissa bilomia* sp.n. — D: *Amatissa nava* sp.n. — E: *Manatha conglacia* sp.n.

the eye. Labial palps strongly reduced to practically invisible stumps. Forelegs with long epiphysis, middle and hind legs without spurs. Genitalia without saccus, but vinculum strongly extended. Valvae with sacculus shorter than tegumen. Phallus (Aedeagus) slightly longer than the length of the genitalia, forming a curve over its whole length (Fig. 7C).

Female: (Fig. 8C) We were unable to collect an adult female because the apparently very short time between emergence and the 'empty' body being found after having laid eggs. Based on study of the empty pupal exuvia and the size of the full grown larva, we estimate the size and structure of the female as approximately 5–6 mm long, 1.5 mm diameter, light coloured and apterous. Mouthparts lacking.

Eggs: Less than 1 mm in length, slightly oval, whitish when newly laid; as the embryo develops, the colour gradually changes to dark grey.

Larva: Full grown larvae (Fig. 9C) are 6–7 mm long, 1.3–1.7 mm diameter, thoracic legs 3-segmented, with 4 ventral and 1 pair of abdominal legs with a ring of dark coloured hooks. Abdomen light cream colour, but may be variable or grey, head and first 3 sclerotized dorsal plates whitish with scattered dark dots and marks often forming undefined loose stripes running from the head over the thoracic segments. Ventral side of labrum with 4 pairs of spines (Davis 1978) (Fig. 10C).

Bag: The bag is 14–16 mm long, 3–4 mm top diameter, bag tapered over the whole length, basal opening approximately 1mm diameter. Exterior of the bag covered with fine, flat fragments of bark and plant material (Fig. 3C).

Pupa: (Figs. 11a–d). Male pupa 5–6 mm long, 1.5–2 mm diameter, light brown and as the moth develops the pupa gradually darkens. Head with 4 pairs of bristles. Wing, antennae and leg sheaths clearly visible. Abdominal segments 7 and 8 dorsally with a row of thin rear-facing spines and the last segment ventrally with a pair of strong downward pointing setae.

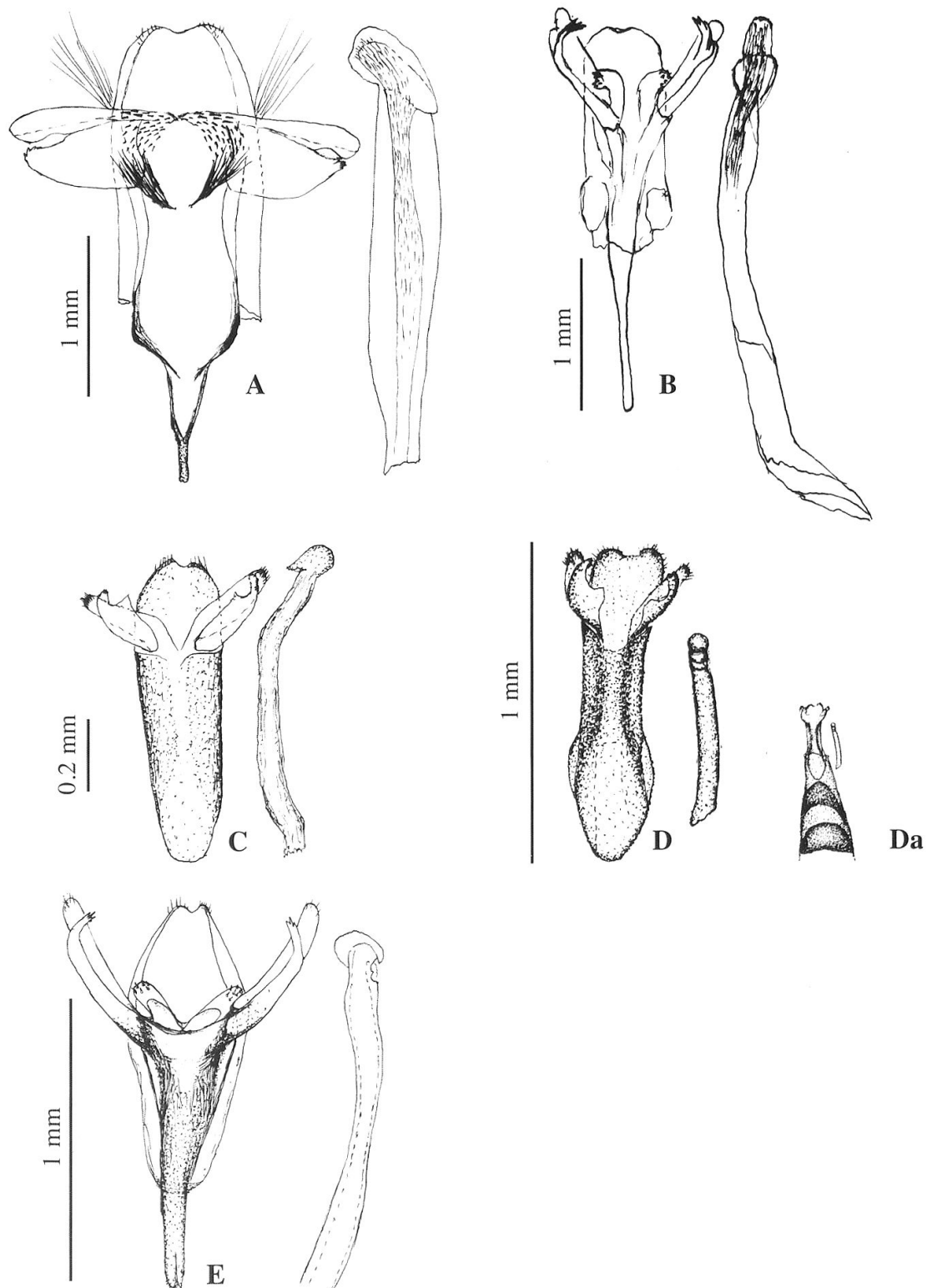


Fig. 7. Male genitalia, left ventral view, right phallus (aedeagus). — A: *Eumeta variegatus*. — B: *Mahasena corbetti*. — C: *Amatissa bilomia* sp.n. — D: *Amatissa nava* sp.n. — Da: idem, reduced size. — E: *Manatha conglacia* sp.n.

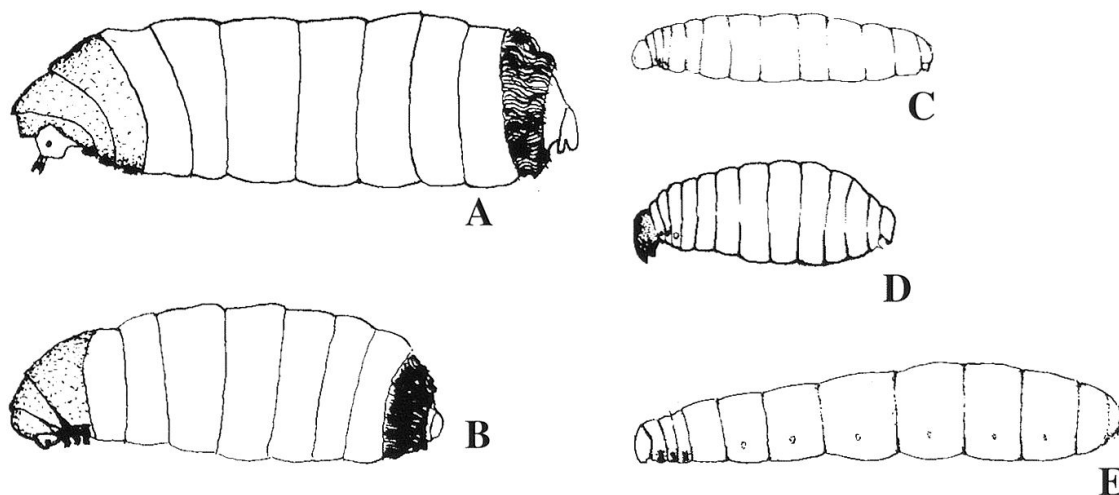


Fig. 8. Females. — A: *Eumeta variegatus*. — B: *Mahasena corbetti*. — C: *Amatissa bilomia* sp.n. — D: *Amatissa nava* sp.n. — E: *Manatha conglacia* sp.n. (Sketches of C and E based on pupa and pupal exuvia)

Biology. Specimens emerged in the laboratory between April and September and also in November.

Derivatio nominis. This species was originally collected in Bilomi Plantation (NBPOL Kapiura Group) in West New Britain Province, Papua New Guinea; therefore this new species is named *A. bilomia* referring to the Plantation where it was first collected.

Amatissa nava sp. n.

Material: **Holotype** ♂ with bag, Dami Research station, CFD and Y. Tomda coll. 3.4.2009, ex.p.17.4.2009. Deposited in NHML. 2 **Paratypes:** 1 ♂: CFD coll. 3.4.2009, ex.p. 16.4.2009, damaged specimen, deposited in PNGOPRA. 1 ♂: Milne Bay Province Hagita CFD coll. 30.3.2008, used for preparations, slides 2678 and 2728, only fragments left. Deposited in CRPH.

Type locality. Dami Research Station, Milne Bay Province, Papua New Guinea.

Description. Male: (Fig. 4D) all wings unicolorous dark brown, wingspan of three males checked was 13–14 mm, but a much larger range can be expected (Hättenschwiler 2007). Fw 10 veins off the dc, with an unclear intercalated cell, $r_3+r_4+r_5$ on one stem, m_2+m_3 close or on short stem. Wing covered with wide scales: class 5–6 (Sauter 1956), hw 5 veins off dc, m_2+m_3 close, vein between rr and sc; scale class 4–5 (Fig. 5D). Antennae short, approximately of wing length with 16–22 segments (Fig. 6D; with the exception of the two basal segments, all are pectinate and possess sensory hairs. No ocelli, eyes round, small, distance between eyes approximately 2–2.5 times the height of the eye. Labial palps strongly reduced to nearly invisible stumps, mouthparts lacking. The forelegs with a long epiphysis, middle and hind legs without spurs. Genitalia without saccus but vinculum long and extended, valvae with sacculus shorter than tegumen. Phallus (aedeagus) nearly straight, approximately $\frac{2}{3}$ length of the genitalia (Fig. 7D).

Female: apterous, no legs, no antennae, lacking mouthparts, body whitish to light grey, head darker grey to brown, length 5.5–6.5 mm, nearly cylindrical, 1–1.5

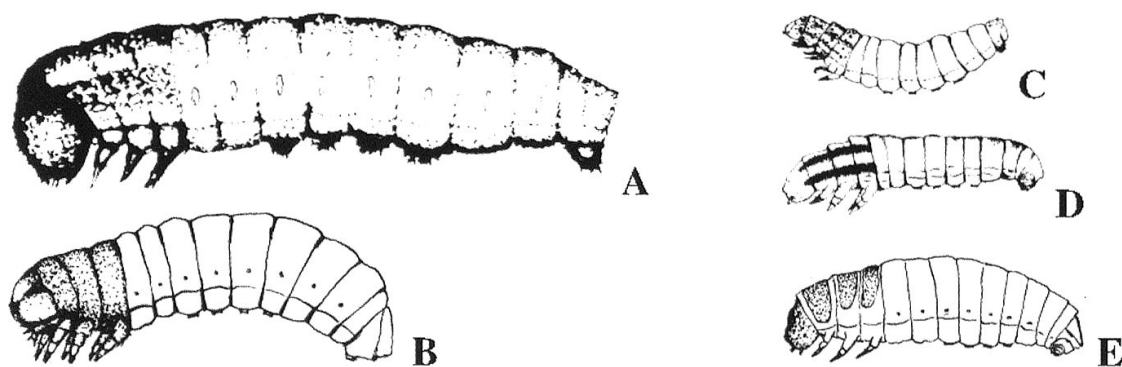


Fig. 9. Sketches of the larvae. — A: *Eumeta variegatus*. — B: *Mahasena corbetti*. — C: *Amatissa bilomia* sp.n. — D: *Amatissa nava* sp.n. — E: *Manatha conglacia* sp.n.

mm diameter, when empty after all eggs are laid, the thin skin collapses and is flat (Fig. 8D).

Eggs: when newly laid whitish to creamy, length 0.6–0.7 mm long, 0.3 mm diameter, the eggshell is transparent prior to hatching, with the miniature larva visible within.

Larva: full grown larva is 7–9 mm long, approximately 1.3–2 mm diameter, abdomen cream-white, head and 3 sclerotized thorax segments whitish with 4 dark stripes running from the head over all three segments (Fig. 9D). Ventral side of the labrum (Davis 1978) is illustrated (Fig. 10D).

Pupa: light brown when newly formed, during development the colour changes to dark brown; head plate with 4 pairs of setae, antennae, leg- and wing sheaths are clearly visible in males but contents are difficult to see in the female pupae (Figs 11e–h).

Bag: 15–22 mm long, tapered over the whole length, front opening 3–4 mm, rear opening 1–1.5 mm diameter. The silk bag is decorated with plant material as short pieces of plant fibres of different length from 1–5 mm, some erect; some are spun in lengthwise and in transverse directions to the bag. Front end soft silk, both ends are alternatively used but one end always remains closed (Fig. 3D).

Biology. Adult specimens were reared between March and April.

Derivatio nominis. This species is named *A. nava* after the small River Nava flowing near the plantation (Bishops Block #1190), Milne Bay Estates (NBPOL, Kula Group), PNG from where the bags of this species were first collected.

Comments. Three adult males with bags, 1 ex. oil palm ex.p. emerged 16.3.2008 Hagita (Bishops Block #1190) Plantation Milne Bay Estates, 1 male each on ex.p. emerged 3.4.2009 and 17.4.2009 (one damaged) and many bags from Haella Plantation (WNBP) with dead larvae, pupae, or females and a pupal exuvia, containing a female and eggs, were preserved and used for study.

Manatha conglacia sp.n.

Material: **Holotype** ♂. Papua New Guinea, Northern Oro Province, Ambogo Estate coll. 14.2.2012, ex.p. 24.2.2012. Nr. 902 deposited in NHML. 3 **Paratypes**: all coll. CFD and S. Mikai, 11.2.2012; 1 ♂: ex.p. 18.5.2009, 1 ♂: ex.p. 21.2.2012, 1 ♂: ex.p. 27.2.2012, deposited in the collections of PNGOPRA, ANIC and CRPH.

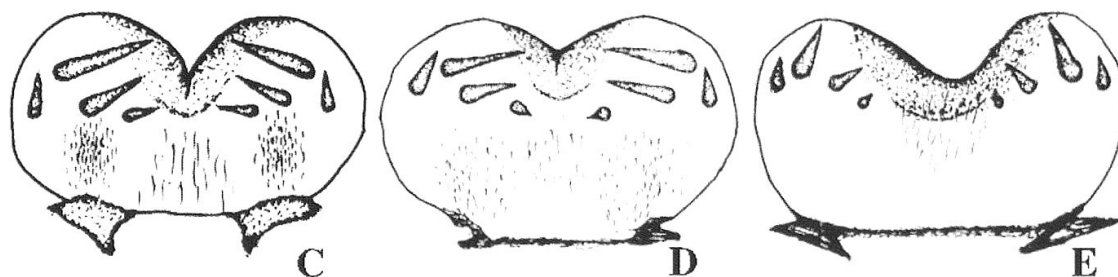


Fig. 10. Ventral side of larval labrum. — C: *Amatissa bilomia* sp.n. — D: *Amatissa nava* sp.n. — E: *Manatha conglacia* sp.n.

Type locality. Ambogo Estate, Northern Oro Province, Papua New Guinea.

Description. Male: (Fig. 4E) Wings unmarked dark brown, wingspan 16–18 mm, fw 10 veins off the dc, $r_3+r_4+r_5$ on one stem and m_2+m_3 stalked, with wide scales class 5–6 (Sauter 1956), hw 6 veins off dc with m_2+m_3 stalked, no connection between rr and sc (Fig. 5E), scales a little narrower, class 4–5. Antennae short, length approximately $\frac{1}{4}$ of wing length with 21–24 segments, (Fig. 6E) with the exception of the two basal segments, all segments pectinate with sensory hairs. Head with no ocelli, eyes round, small, distance between eyes approximately 0.8–1.0 x the height of the eye. Labial palps are reduced to small stumps, with no functional mouthparts. The forelegs with an epiphysis, hind legs femur and tibia with dark brown hairs, tarsal segments covered with flat, white scales. Genitalia with long sacculus, vinculum shorter, valvae with sacculus longer than tegumen; phallus (aedeagus) slightly bent and nearly the length of the genitalia (Fig. 7E).

Female: No adult females were collected, however, with the pupal exuvia and the fully grown larva we estimate the approximate size and structure of the female as being 7–8 mm in length and 1.5 mm in diameter (Fig. 8E).

Eggs: Examples of eggs were not available.

Larva: The full grown larvae are 9–12 mm long, 2–3 mm diameter, cream coloured, head and the three thoracic segments sclerotized dorsally, dark brown divided by a pale coloured line from the head along the length of the prothorax, intersegmental membranes whitish. Three pairs of legs on thorax, one pair each ventrally on abdominal segments 3 to 6, and one pair on last segment (Fig. 9E). The ventral side of the labrum is illustrated (Fig. 10E) (Davis 1978).

Bag: General appearance 15–21 mm long, 4–6 mm at distal end, strongly conical over the whole length, basal opening closed, except for ejecting faeces or for maintenance or enlarging the bag and for emergence of the adult stage. Surface of the bag is smooth but deeply ridged with 9 or 10 ridges around the bag, but with no additional plant material coating (Fig. 3E). Proximal part of the bag is hard and stiff and offers a good mechanical protection against natural enemies. Hymenoptera and Diptera parasitoids have been reared from this species. At the front end of the bag, there is a flexible lightly spun portion without supporting ribs. This part can be pulled into the bag by the larva when disturbed. This soft part offers some protection for the larva, but still allows movement; it is of fine grey tightly woven and therefore very strong silk. When the larva moults the moulted head capsules are attached to this soft silk around the opening thus giving the bag the appearance of a miniature «ice cream cone». Enlarging the bag after each moult is only done by adding material between the hard front end and the flexible part of the cone.

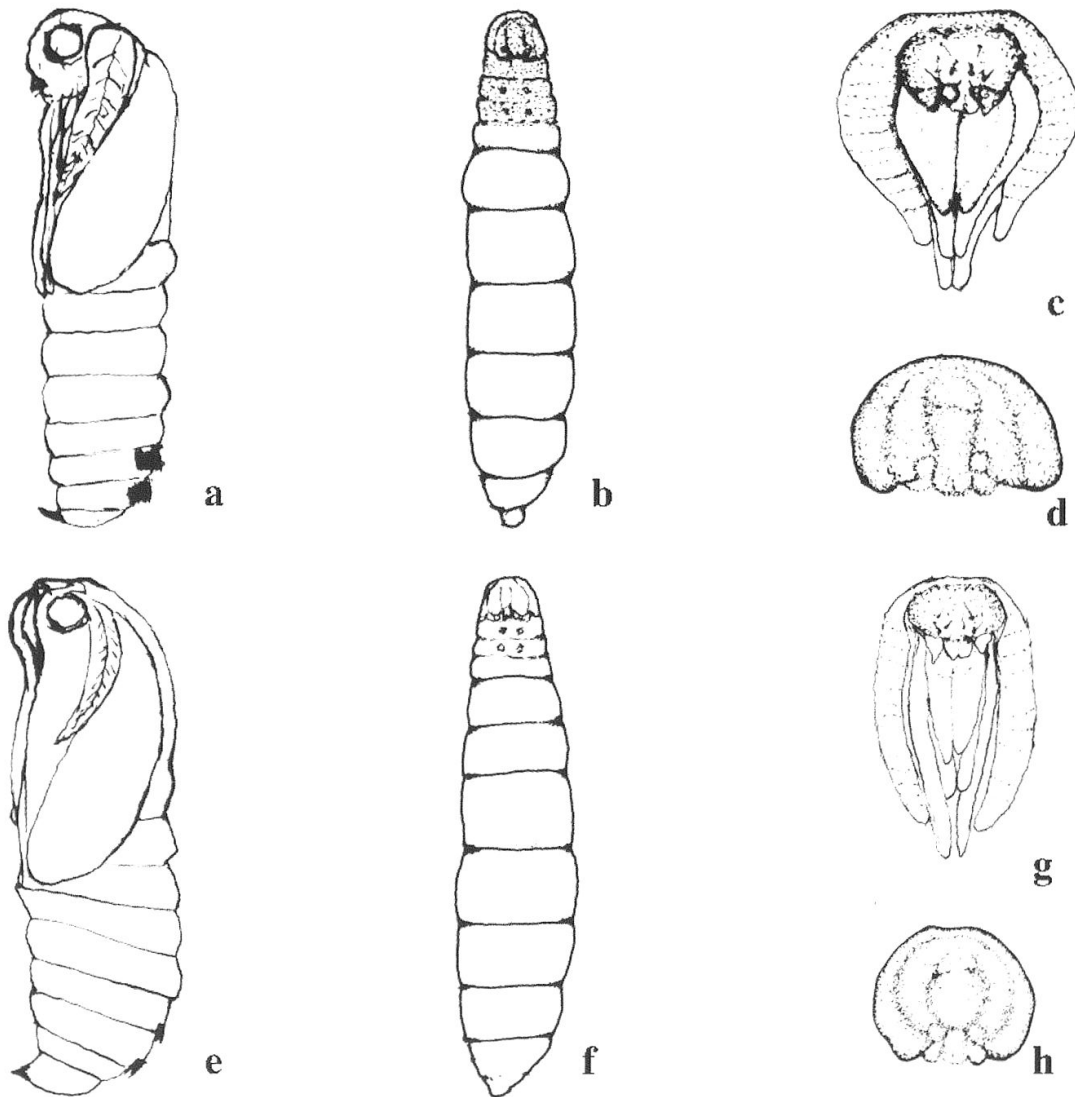


Fig. 11. Exuviae of the males and females (at different scales, for size consult description): of *Amatissa bilomia* sp.n. — a: male pupa side view. — b: exuvia of female pupa ventral view. — c: male head-thorax plate. — d: head-thorax plate of female pupa. — Idem of *Amatissa nava* sp.n. — e: male pupa lateral. — f: female pupa ventral view — g: male head-thorax plate — h: head-thorax plate of female pupa.

Pupa: The fully grown larva passes through two distinct stages before it pupates. First the larva, head towards the large top opening, moults to become a prepupa (Figs 12a–g) and pushes the larval exuvia out through the rear opening, where it often remains (Fig. 12e). In this stage the prepupa looks similar to the previous stage, but is white to light yellow, the forelegs are complete but less robust and the prepupal larva is able to move and spin silk threads as before, but does not feed.

Second stage: A few days later the larva fixes the front end of the bag to a solid substrate and turns around within the bag, head now towards the rear opening and prepares the interior of the bag and especially the rear opening through which it will emerge. The larva moults to the pupal stage and the exuvium, a fine skin, is pushed into the now closed front opening. The male pupa is 6–8 mm long, 1.2–1.6

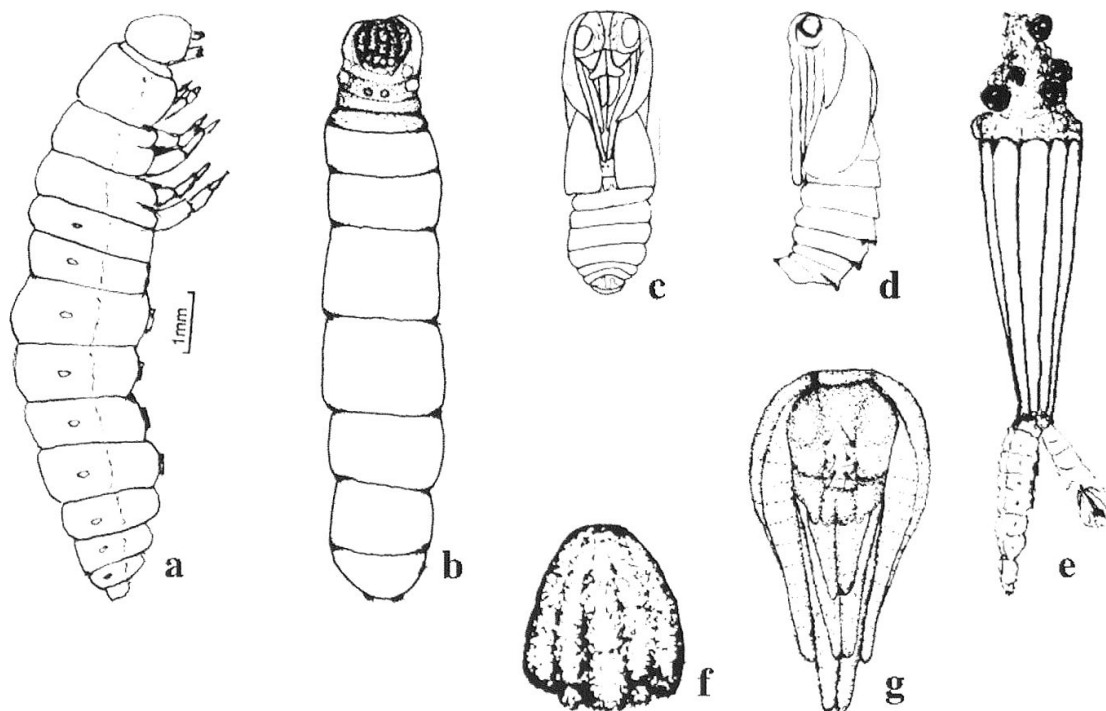


Fig. 12. Different stages of *Manatha conglacia* sp.n (at different scales, for size consult description). — a: white larva (male pre pupa) — b: female pupa ventral view, the large abdomen full of eggs. — c: male pupa ventral — d: male pupa lateral. — e: bag with (long) exuvia from the larva and (short) exuvia from the pupa — f: head-thorax plate of female pupa. — g: head-thorax plate of male pupa.

mm diameter, when newly formed it is light brown, gradually becoming dark brown as the pupa ages. The head-thorax plate of the final pupa with 4 pairs of setae.

The male pupa partly extrudes from the distal part of the bag and the male emerges from the exposed pupa whose exuvia typically remains attached to the bag.

The female pupa is 14–16 mm long, 2–2.5 mm diameter, colour as in the male, but the head-thorax (prothoracic shield) plate is strongly reduced, the different sheaths can no longer be recognized (Fig. 12f). The apterous female never leaves the bag and lacks legs and mouthparts.

Biology. Adult males were reared in February, March and again in October / November, they are nocturnal, short-lived, very active. The life cycle is currently only partially known.

Derivatio nominis. The bag made by this species looks very much like a miniature ice cream cone. We therefore name this species *conglacia* sp.n. «con» refers to the conical shape and «glacia» to ice and glaciers, describing well, together, the creamy white appearance and shape of the bag.

Comments. In PNG, this species is known as the «Ice cream cone bagworm», a very good description of the appearance of these bags.

T. Sobczyk (pers. comm.) has seen a bag in the Natural History Museum London collection, although this single bag was not named, it was labelled Sulawesi 3.7.1990. No distribution records from outside this region is currently known. In Papua New Guinea we have only found this insect in two localised parts of Northern (Oro) Province, feeding on oil palm leaflets, typically on the lower fronds. Populations appear to be controlled by natural enemies (insects and pathogens), but larvae may cause localised damage to oil palm leaflets (Fig. 2b).

KEYS FOR IDENTIFICATION OF PSYCHIDAE FROM OIL PALMS IN PAPUA NEW GUINEA
BASED ON THE MORPHOLOGY OF THE LAST LARVAL STAGE BAG AND THE MALE GENI-
TALIA:

Key to bags

1. Bag longer than 22 mm 2
- Bag shorter than 22 mm 3
2. Bag round in cross section with no large pieces of plant material on exterior, having a smooth appearance and very tough texture, typically hanging from underside of leaflet; bags large when mature (Fig. 3A) ... *Eumeta variegatus*
- Bag covered with plant material, often with quite large pieces in lengthwise direction, typically very untidy in appearance; may be found on both leaflet surfaces (Fig. 3B) *Mahasena corbetti*
3. Bag, grey brown coated with small pieces of plant material 4
- Bag without any obvious plant material, pale yellowish in colour made entirely of silk, and deeply ribbed, coated with silk, conspicuously cone-shaped; on leaflet undersides (Fig. 3E) *Manatha conglacia* sp.n.
4. Bag with smooth surface made from small pieces of plant material tightly attached externally; commonly found attached to the green frond bases as well as underside of leaflets (Fig. 3C) *Amatissa bilomia* sp.n.
- Bag with rough somewhat “spiky” surface made of plant material, proximal part of the bag lacking plant material and made only of silk. Found on underside of leaflets and frond bases near palm trunk (Fig. 2D) .. *Amatissa nava* sp.n.

Key to male genitalia

1. Saccus pronounced, pointed, genitalia cylindrical shape (Figs 7A, 7B) ... 2
- Saccus absent (Figs 7C, 7D) 3
2. Saccus short, phallus (aedeagus) shorter than the whole genitalia (Fig. 7A), valvae broad *Eumeta variegatus*
- Saccus long, phallus (aedeagus) remarkably longer than the whole genitalia, valvae narrow (Fig. 7B) *Mahasena corbetti*
3. Saccus absent or if present pointed, phallus as long as the whole genitalia (Fig. 7C) 4
- Saccus absent, phallus (aedeagus) shorter than the whole genitalia (Fig. 7D) *Amatissa nava* sp.n.
4. Saccus absent, phallus (aedeagus) longer than whole genitalia (Fig. 7C)
- *Amatissa bilomia* sp.n.
- Saccus present, pointed, phallus (aedeagus) little shorter than genitalia, tapered at both front and rear end (Fig. 7E) *Manatha conglacia* sp.n.

DISCUSSION

Several genera are described for south East Asia from the Subfamily Oiketicinae, Tribe Acanthopsychini. However, the majority of these descriptions date back to the 19th or early 20th century. During this period, original descriptions were kept brief and details are missing; frequently the type specimens are not clearly defined or even lost.

With assistance from Dr. Erwin Hauser, Austria, and Dr Rodolphe Rougerie, Canada, mtDNA tests were undertaken. Sequencing was carried out under the worldwide «International Barcode of Life» – Project at the University of Guelph (Canada) (www.ibol.org and www.boldsystems.org). A fragment of mitochondrial DNA (COI-5P: Protrin-coding cytochrome c oxidase subunit 1) was amplified. For the calculation of the % values the Kimura-2 parameters were used. We were able to compare the two species *Amatissa bilomia* sp.n. and *A. nava* sp.n. Sequencing failed for *Manatha conglacia* sp.n. because of the lack of fresh enough specimens.

Preliminary results confirm the genetically close relationship between *A. bilomia* sp.n. and *A. nava* sp.n. (distance 7.1 %) and the validity of the two species, considering that the observed divergence most certainly corresponds to interspecific variation.

The genus Amatissa Walker, 1862

Type species. Amatissa inornata Walker, 1862.

Original description (Walker 1862). 182 *Amatissa inornata*, n.s. Mas. Cervina, lituris nullis. Male Fawn-colour, without any markings. Length of the body 6 lines (= 12.72 mm); of the wings 15 lines (= 31.7 mm).

Redescription (based on *Amatissa inornata* Walker). Male. Body stout, thickly clothed with long hairs. Proboscis not apparent. Palpi very short. Antennae short, broadly pectinated to the tips. Abdomen extending a little beyond the hind wings. Legs short. Wings large. Fore wings somewhat rounded at the tops; costa straight, except towards the tip where it is very slightly convex; exterior border straight, rather oblique: 1st and 2nd inferior veins contiguous at the base; 3rd more than twice as far from the 4th as from the 2nd.

Our short redescription contains clear information about the distance of the forewing veins mentioning the distance between the an and the cup which is about 1:2 compared with the distance between the cup and m₃. The two *Amatissa* species described in this paper show a similar ratio of the veins.

The type species *Amatissa inornata* shows a close affinity to these two species regarding the form of the male genitalia and the abdomen. The genitalia are without a pointed saccus and short valvae; the tegumen is less than one third of the length of the whole genitalia (Fig. 7D). The last sclerotized, ventral, abdominal segment plate with long side extensions (Figs 7D, 7Da) facing forwards.

Considering all facts, we decided to use the generic name *Amatissa* for our new species, instead of establishing a new genus for them (Sauter & Hättenschwiler 1991, 1999; Sobczyk 2008, 2011).

Larvae in the genus *Amatissa* make bags showing an upper opening with a narrower soft collar. In contrast, most species in the genus *Manatha* spin and build bags which are tapering over their whole length. The wide upper (front) opening is soft and usually brown coloured, and may be drawn into the bag or pushed fully out

providing protection for the larva during moving or feeding. Prior to pupation the larva moults and pushes the stiff, light brown skin partly through the proximal opening where it remains (Fig.12e).

Using these characters, *Manatha* bags can be readily recognized, *Manatha conglacia* sp. nov., however, can be further separated from all other known species by its unique bag design with 9–10 distinctly raised ribs running lengthwise and the pale yellowish, smooth form of the bag. The male genitalia also have a distinctly pointed saccus with longer valvae.

FURTHER OBSERVATIONS

During observation of a single young tree of «Kwila» (*Instia bijuga*) one of four recently planted at Dami Research Station, West New Britain Province, a different type of Psychidae bag was found on 11.7.2012 by CFD. On 16.7.2012 the larva pupated and on 30.7.2012 a male moth emerged from the long slim, bag. This species was not previously recorded from Papua New Guinea. It was sent to PH for identification where it was identified as *Acanthoecia larminati* (Heylaerts, 1904) (Subfamily Oiketicinae). It is not known to be harmful on oil palms (Kamarudin *et al.* 1994). The species is widespread in South East Asia; e.g. Tonkin (on tea), Thailand (Bangkok and Khao Lak), India, Burma, Vietnam and Sumatra. For more details see Joannis (1929).

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ZUSAMMENFASSUNG

Fünf Arten aus der Familie Psychidae wurden im Gebiet der Palmöl-Plantagen in Papua New Guinea beobachtet, zwei davon sind die bekannten Arten *Eumeta variegatus* (Snellen, 1879) (siehe Dierl 1965) und *Mahasena corbetti* Tams, 1928. Drei kleinere Arten, eine davon ist in den Palmöl Plantagen wenig schädlich aufgetreten, werden beschrieben als *Amatissa bilomia* sp.n., *Amatissa nava* sp.n. und *Manatha conglacia* sp.n. Von diesen drei neuen Arten werden Adulte und Raupen beschrieben.

REFERENCES:

- Davis, D.R. 1964, Bagworm Moths of the Western Hemisphere — United States National Museum Washington D.C., Bulletin 244: 1–233
- Davis, D.R. 1978. The North American moths of the genera *Phaeoses*, *Opogona* and *Oiniophila*, with a discussion of their supergeneric affinities. — Smithsonian Contributions to Zoology 282: 39.
- Dierl, W. 1965. Festlegung eines Lectotypus von *Eumeta variegata* (Snellen) — Zoologische Mededelingen, deel 40, no. 29, 11 November 1965: 277–279.
- Hättenschwiler, P. 2007. Wie unterschiedlich kann die Grösse der erwachsenen Tiere innerhalb einer Art sein? Beispiele von Sackträgern (Lepid. Psychidae) — Mitteilungen der Entomologischen Gesellschaft Basel 57 (1): 10–15.
- Hättenschwiler, P. 2008. Informationen zur Biologie der Psychidenlarven und interessante Details zu ihren Säcken. — Entomo Helvetica 1: 117–127.
- Heylaerts, F.J.M. 1904. Nouvelle espèce de Psychides, *Chalia larminati*. — Bulletin & Annales de la Société Entomologique de Belgique 48: 419–420.

- Joannis, J. de 1929. Lépidoptères hétérocères du Tonkin — Annales de la Société. Entomologique de France 98: 593–316.
- Kamarudin, N., Robinson, G. & Basri Wahid, M. 1994. Common Bagworm Pests of Oil Palm in Malaysia with Notes on Related South-east Asian Species, — Malayan Nature Journal 1994, 48: 93–123
- Robinson, G.S., Tuck, K.R., Shaeffer, M. & Cook, K. 1994. A field Guide to the Smaller Moths of South-East Asia. — Natural History Museum & Malaysian Nature Society:36–40, 215–216, Plate 1, 3, 4.
- Sauter, W. 1956. Morphologie und Systematik der schweizerischen *Solenobia*-Arten. — Revue suisse de Zoologie, tome 63 (27), fascicule 3 (22): 451–550.
- Sauter, W. & Hättenschwiler P. 1991. Zum System der palaearktischen Psychiden 1. Teil: Liste der palaearktischen Arten. — Nota Lepidopterologica 14 (1) : 69–89.
- Sauter, W. & Hättenschwiler, P. 1999. Zum System der palaearktischen Psychiden. 2. Teil: Bestimmungsschlüssel für die Gattungen, — Nota lepidopterologica. 22 (4): 262–295.
- Sobczyk, T. 2008. Beiträge zur Kenntnis der orientalischen Psychidae. 1. Taxonomische Korrekturen und Beschreibung neuer Arten aus Thailand, Myanmar und von den Philippinen — Entomologische Zeitschrift, Stuttgart 118 (5): 195–206.
- Sobczyk, T. 2011. Die Psychidae des Bismarck-Archipels gesammelt auf der Noona Dan Expedition 1961 / 62 aus dem Museum Kopenhagen mit einer Checkliste der Psychidae Papua Neuguineas. — Entomologische Zeitschrift, Stuttgart 121 (6): 243–253.
- Walker, F. 1862. On Heterocerous Lepidoptera collected at Sarawak — Journal of The Linnean Society, London 6: 188.
- Wood, B. J. 1968. Pests of oil palms in Malaysia and their control. — Incorporated Society of Planters, Kuala Lumpur. 204 pp..

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