

The Brahmaeidae (Lepidoptera) of the Philippines

Wolfgang A. NÄSSIG¹ and Colin G. TREADAWAY

Dr. Wolfgang A. NÄSSIG F.R.E.S., Entomologie II, Forschungsinstitut Senckenberg,
Senckenberganlage 25, D-60325 Frankfurt am Main, Germany

Colin G. TREADAWAY F.R.E.S., Entomologie II, Forschungsinstitut Senckenberg,
Senckenberganlage 25, D-60325 Frankfurt am Main, Germany

Abstract: Based on 106 specimens of *Brahmaea hearseyi ardjoeno* KALIS, 1934, from 5 islands of the Philippines, information about imaginal morphology, phenology, distribution and other observations on the species are given. The species is known so far from the islands Luzon, Mindoro, Panay, Negros, and Mindanao. The preimaginal stages are not known from the Philippines. *B. hearseyi ardjoeno* is the only species of the family on the Philippines. The taxonomic and phylogenetic status of the Philippinian populations will require further studies; there is a considerable amount of individual and also geographical variability. Both sexes from some of the islands and the genitalia are illustrated.

Die Brahmaeidae (Lepidoptera) der Philippinen

Zusammenfassung: Auf der Basis von 106 Faltern von *Brahmaea hearseyi ardjoeno* KALIS, 1934, von fünf Inseln der Philippinen werden Angaben zur Imaginalmorphologie, zur Phänologie, zur Verbreitung und weitere Informationen gegeben. Bisher ist die Art bekannt von den Inseln Luzon, Mindoro, Panay, Negros und Mindanao. Die Präimaginalstadien sind von den Philippinen bisher noch unbekannt. *B. hearseyi ardjoeno* ist die einzige Art der Familie auf den Philippinen. Der taxonomische und phylogenetische Status der philippinischen Populationen erfordert noch weitere Studien; es liegt eine beträchtliche individuelle sowie auch geografische Variabilität vor. Die Zuordnung der philippinischen Population zum Taxon *ardjoeno* ist vorläufig. Beide Geschlechter (von mehreren Inseln) sowie die Genitalmorphologie werden abgebildet.

Introduction

The Brahmaeidae are a small family of bombycoid moths in the tropical, subtropical and northern temperate regions of the old world. The family comprises ca. 5–10 species of the genus *Dactyloceras* MELL, 1930 in Africa, 1 species of *Calliprogonos* MELL, 1937 in China (Shensi: Tabai Shan) and

¹ Studies in Brahmaeidae no. 2 (No. 1: see NÄSSIG & PAUKSTADT 1990).

ca. 9 species of the genus *Brahmaea* WALKER, 1855 *sensu lato* (including the synonyms² *Brahmophthalma* MELL, 1930, *Brahmaeops* BRYK, 1949, *Brahmidia* BRYK, 1949, *Acanthobrahmaea* SAUTER, 1967, syn. n.³, and *Brachygnatha* ZHANG & YANG, 1993, syn. n.³) in South Italy, in the region Asia Minor-Transcaucasia-Iran, and in South, South East and East Asia (see SEITZ 1911, MELL 1928, SAUTER 1967, 1987, INOUE et al. 1982, NÄSSIG & PAUKSTADT 1990, OBERPRIELER & DUKE 1994). The position of *Spiramiopsis comma* HAMPSON, 1901 from southern Africa within the family remains obscure due to apparent problems in the interpretation of synapomorphies shared with other species (see the discussions in MINET 1994 and OBERPRIELER & DUKE 1994, and references therein).

On the island archipelagos of South East Asia, two species of *Brahmaea* are found: *Brahmaea celebica* TOXOPEUS, [1939] (TOXOPEUS, [1939] 1937: Zool. Meded. 20: 183), an endemic of the Indonesian island of Sulawesi (HOLLOWAY 1987, NÄSSIG & PAUKSTADT 1990, L. H. & U. PAUKSTADT 1996) and the polytypic *Brahmaea hearseyi* WHITE, [1862], known from the Himalaya in northern India and southern China through the Indochinese Peninsula to Sundaland and the Philippines.

The nominotypical subspecies inhabits the continental part of the range except the Malayan Peninsula; in Sundaland (definition of the term Sundaland see in NÄSSIG & TREADAWAY 1998, in this issue), ssp. *ardjoeno* KALLIS, 1934 is found.

The systematic position of the Philippine populations remains somewhat problematic; they are subordinated here tentatively to *ardjoeno*. The situation within the species *Brahmaea hearseyi* is difficult to interpret, because there is some intraspecific variability in the morphology of the ge-

² The splitting of the few, morphologically quite homogenous Eurasiatic species into several genera or even into two subfamilies as done by MELL (1930), BRYK (1949), SAUTER (1967, 1987) or ZHANG & WANG (1993) was not based on clear phylogenetic analyses and synapomorphic character states and, moreover, definitively appears to be exaggerated and unnecessary in such a small family of moths. This view is also more or less shared by INOUE et al. (1982), HOLLOWAY (1987), NÄSSIG & PAUKSTADT (1990) and OBERPRIELER & DUKE (1994). Generally, all taxa above the species level should (1) be demonstrated to be monophyletic, and (2) their sister-groups should, as far as possible, be identified, and (3) these sister-groups should then also be proven to be monophyletic. Therefore, the genus *Brahmaea* is understood here in the wide sense. — The use of two subgenera *Brahmaea* s. str. and *Brahmaea* (*Brahmophthalma*) (see, e.g., L. H. & U. PAUKSTADT 1996) appears to be feasible and can be justified. We do not use them here, as there remain some unsolved questions about the monophyly of one of the two subgenera (*Brahmaea* s. str.), while the monophyly of *Brahmaea* in the wider sense as used here (as well as the monophyly of the second subgenus *Brahmaea* (*Brahmophthalma*)) is beyond doubt.

³ The two names *Acanthobrahmaea* and *Brachygnatha* were used in synonymy of *Brahmaea* for the first time by OBERPRIELER & DUKE (1994), but these authors did not synonymize them formally.

nitalia (of both sexes), and a phylogenetic analysis of the relationships of the different populations is still lacking. For the time being, the subspecies-complex of *B. hearseyi* is (as long as the taxon *hearseyi* can only be defined on the level of morphospecies) best characterized as a polytypic paraspecies⁴ (*sensu* ACKERY & VANE-WRIGHT 1984: 21; for the definition of that term see also NÄSSIG & TREADAWAY 1998, in this issue).

Abbreviations and conventions see NÄSSIG & TREADAWAY (1998, in this issue).

Brahmaea WALKER, 1855

Brahmaea WALKER (1855 [November 10], List specimens lepid. insects colln. Brit. Mus. 5: 1200; 6: 1315). TS: *Bombyx certhia* FABRICIUS, 1793, by subsequent designation by HAMPSON ([1893]: 29), confirmed by the ICZN in OPINION 1698 (1992). See also NÄSSIG & NYE (1991).

Brahmaea hearseyi WHITE, [1862]

Brahmaea Hearseyi WHITE, [1862]: Proc. entomol. Soc. London 1861 [= (3) 1]: 26. Type locality North India. Type(s) not examined.

= *whitei* BUTLER, 1866: Proc. zool. Soc. London 1866: 119. Type locality North India. Type(s) not examined.

Brahmaea hearseyi ardjoeno KALIS, 1934

Brahmaea hearseyi ardjoeno KALIS, 1934: Entomol. Rdsch. 51: 209. Type locality Java. HT not examined, possibly lost (see NÄSSIG & PAUKSTADT 1990).

= *luchti* [nec *luchli*, misspelling] DUPONT, 1937: Entomol. Meded. Ned.-Indië 3 (1): 11. Type locality Java. HT not examined, possibly lost (see NÄSSIG & PAUKSTADT 1990).

Brahmophthalma hearseyi ardjoeno: NÄSSIG & PAUKSTADT (1990: 117–136).

Distribution on the Philippines: Known from Luzon, Mindoro, Panay, Negros, Mindanao (see distribution map, Fig. 1).

Distribution outside the Philippines: Sundaland (Sumatra, Java, West Malaysia, Borneo), according to the concept of the subspecies *ardjoeno* applied here.

Material examined: **Luzon** (in total 31 ♂♂, 5 ♀♀): 1 ♂, Ifugao, Banaue, 1100 m, 5. v. 1995. 1 ♀, dto., 10. iv. 1990. 17 ♂♂, 1 ♀, dto., 3600 ft., 17. ii. 1990, 22. iii. 1989, 22. iii. 1990, 24. iii. 1989, 18. iv. 1990, 22. iv. 1991 (1 ♂, 1 ♀, ♀-GP 1176/97), 18. v. 1990, 24. v. 1990, 6. vi. 1990, 12. vi. 1990, 13. vi. 1988 (GP 1173/97), 15. vi. 1990, 16. vi. 1988, 16. vi. 1990, 16. vi. 1996, 21. vi. 1991, 28. ix. 1989. 1 ♂, dto., 3700 ft., 11. v. 1990. 1 ♀, Ifugao, Kinakin,

⁴ Because *Brahmaea celebica* possibly may not be the sister-species to *B. hearseyi* as a whole, but may instead be an offspring of one of the South-East Asian populations (Mindanao or Borneo?) of *B. hearseyi* only, thereby leaving the morphospecies *B. hearseyi* as the “paraphyletic residue” on species-level (*sensu* ACKERY & VANE-WRIGHT 1984). More research on that problem is necessary, especially on the conspecificity of the populations presently united under the name *hearseyi*. It appears feasible that there are, in fact, some more phylogenetically definable, but yet undescribed taxa hidden in the complex.

4000 ft., 10. x. 1988. All in CCGT. 1 ♀, dto., 1200 m, 22. ix.–16. x. 1988. 10 ♂♂, dto., 1000 m, 27. iii. 1990, 3. iv. 1988, 4. iv. 1988 (2×), 8. iv. 1988, 17. v. 1988, 3. vi. 1988, 5. vi. 1988 (2×), 8. vi. 1988. 1 ♂, nr. Banaue, 1200 m, xi. 1988. 1 ♂, Banaue, vi. 1986. 1 ♀, Ifugao, Hunduan, 20. iii. 1985. All in CWAN. **Mindoro:** 1 ♂, Mt. Halcon, 7. iv. 1996, CCGT, GP 1174/97 **Panay** (in total 6 ♂♂, 4 ♀♀): 2 ♂♂, 2 ♀♀, Antique, Mt. Madja-as, 15. v. 1996 (♂), 15. vi. 1996 (♂), 1. xi. 1995, 5. xi. 1995. 1 ♀, Antique, Mt. Balabag, 24. iii. 1995. 1 ♀, Antique, Mt. Malindog, 20. vii. 1995. 4 ♂♂, Aklan, Mt. Malindog, 25./26. vi. 1997. All in CCGT. **Negros** (in total 26 ♂♂, 4 ♀♀): 24 ♂♂, 3 ♀♀, Mt. Canlaon, 29. iii. 1995, 1. iv. 1995, 25. iv. 1991, 3. v. 1994 (♀), 6. v. 1995 (♀, GP 1177/97), 7. v. 1995, 8. v. 1995, 9. v. 1995, 12. v. 1996 (2×), 10. vi. 1995 (2×), 13. vi. 1995, 5. vii. 1995 (♀), 6. vii. 1995, 20. viii. 1995 (2×), 21. viii. 1995, 22. viii. 1995, 23. viii. 1995, 24. viii. 1995, 26. ix. 1994, 12. x. 1995 (2×), 13. x. 1995, 16. x. 1995, 17. x. 1995. All in CCGT. 1 ♂, Negros occ., Mambucal, 3. ii. 1985. 1 ♀, dto., 2000 ft., 26. ix. 1988. 1 ♂, Mambucal, Mt. Kanlaon [sic], 10. x. 1986. All in CWAN. **Mindanao** (in total 26 ♂♂, 3 ♀♀): 1 ♂, “NE-Mindanao, xii.”, ex coll. Semper in SMFL. 3 ♂♂, N-Cotabato, Mt. Apo (1× 1600 m), 26. ii, 8. ii, 15. iii. 1994. 1 ♀, dto., 1600 m, 14. iii. 1994. 4 ♂♂, 2 ♀♀, S-Cotabato, Mt. Matutum, 9. ii. 1996, 15. ii. 1996, 22. vi. 1996 (♀), 23. vi. 1996, 24. vi. 1996, 10. vii. 1996 (♀). 3 ♂♂, Bukidnon, Mt. Kitanglad, 30. iii. 1994, 21. ix. 1991 (GP 1175/97), 12. x. 1995. 1 ♂, Bukidnon, Mt. Kitanglad, 7000 ft., 12. iv. 1997. 3 ♂♂, Bukidnon, Mt. Kalatungan, 3. iii. 1996, 23. v. 1994, 8. ix. 1994. 2 ♂♂, Bukidnon, Mt. Kitanglad; 1× nr. Intavas, 5000 ft., 6. xi. 1994; 1× 17. x. 1993. 1 ♂, Davao del Norte, Buan, 12. vi. 1996. 1 ♂, Davao del Norte, Mt. Tagubod, 6000 ft., 7. x. 1996. All in CCGT. 1 ♂, Bukidnon, Mt. Kitanglad, 15. viii.–15. ix. 1993. 1 ♂, Bukidnon, 15 km NW Maramag, Mt. Kalatungan, 1250 m, 29. xii. 1991. 3 ♂♂, Bukidnon, 40 km NW Maramag, Dalongdong, 800 m, 31. xii. 1991–2. i. 1992. 1 ♂, dto., 1.–3. x. 1988. 1 ♂, S. Cotabato, Mt. Parker, Salacafe, 760 m, 2.–11. iv. 1985. All in CWAN.

The first record of *Brahmaea hearseyi* from the Philippines was by SEMPER (1896: 386). He reported a big (lfw. 67 mm) ♂ from NE-Mindanao (collected in December), which did “not differ from MAASSEN’s illustration [= MAASSEN 1872: fig. 17] and from a ♂ from N India” in his collection. This Mindanao ♂ is still preserved in SMFL (SMFL 4111, GP 614/89).

The presently known distribution pattern on the Philippines (Fig. 1) is somewhat strange and suggests that the species may be found on some other islands as well. The species is not known from the Palawan region (sensu VANE-WRIGHT 1990), although it lives on Borneo, and thus far it has not been found in the East Visayan subregion. More intensive collecting will surely close some of the gaps. As long as the ecology and life cycle of this species on the Philippines is not known in more detail, any encountering of the species is purely by chance.

Description, ♂. Lfw. see Table 1 and Fig. 2. See Col. Pl., Figs. 7–13. This species cannot be confused with any other species on the Philippines. It is

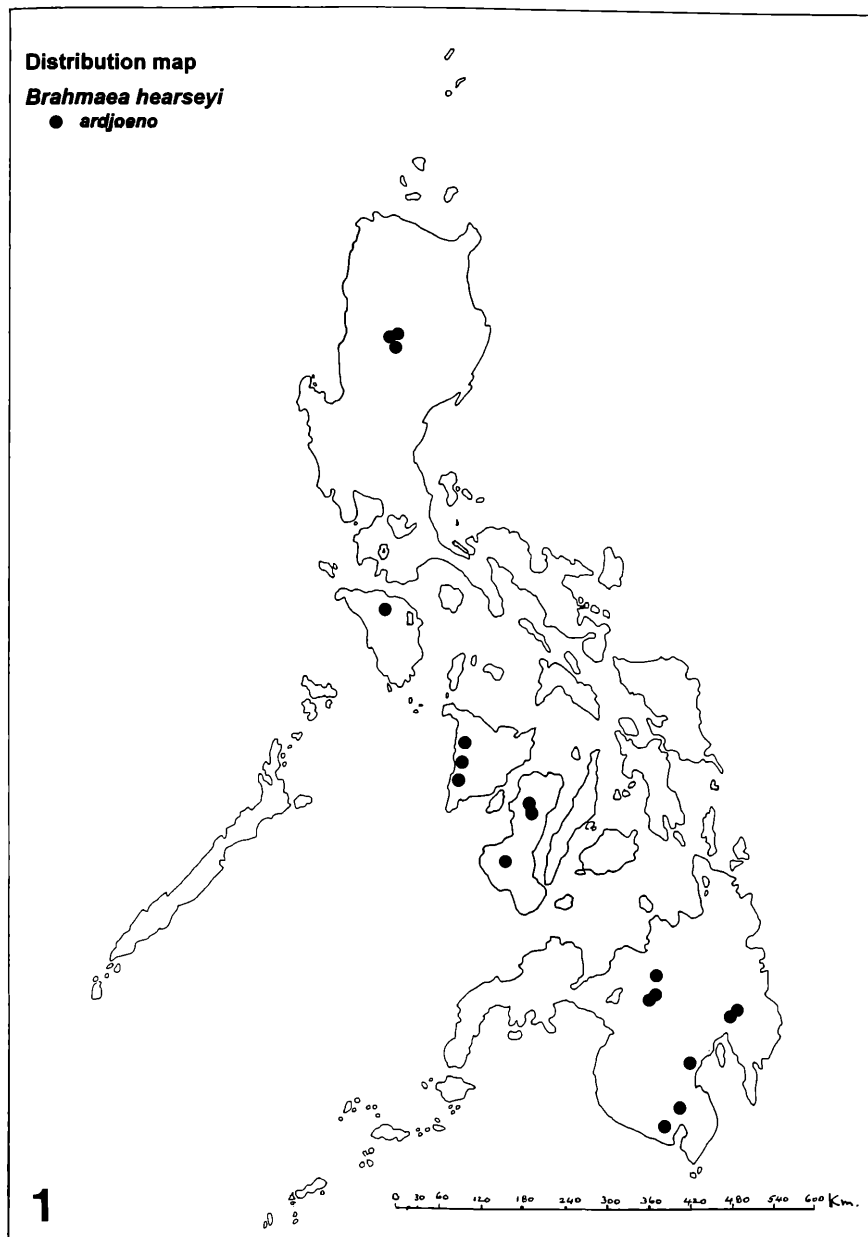


Fig. 1: Distribution map of *Brahmaea hearseyi ardjoeno* on the Philippines. — Map compiled by C.G.T. Scale 600 km, with steps of 60 km.

rather large with the wing ground colour basically dark blackish-brown and a complicated wavy wing pattern varying from a creamy-white to an ochre-brown or dark reddish-brown. The fw. show a narrow black basal area, distally followed by a series of ca. 5–7 narrow wavy fasciae in different brownish colours (dark reddish brown, ochre or yellowish brown or mixed with white scales, bordered with black). In the black edged medial area the ground colour is dark brownish (brighter towards the proximal part), with whitish lines and numerous small black dots along the veins. Interestingly, the number of these black spots not only varies from specimen to specimen, but there can be different numbers even on the two forewings of the same specimen.

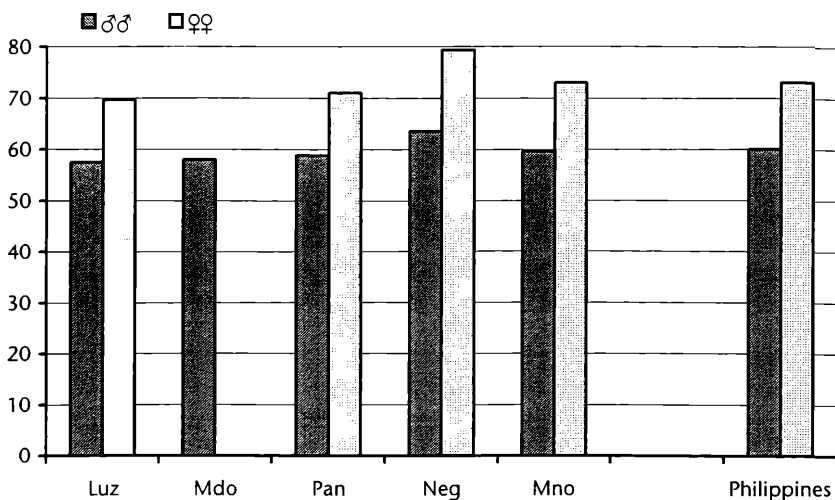


Fig. 2: Length of the forewing in mm, separately for ♂♂ and ♀♀, for different islands of the Philippines (abbreviations see TREADAWAY 1998, in this issue) and for the Philippines in total (right column). (Details of data and standard deviation see Table 1.)

This median area shows a prominent rounded eyespot at the hind margin. Distally, there is a prominent apical area with a more yellowish-brown ground colour, white arrow-like marks along the veins, and prominent black submarginal spots in the apex. Below that apical area in the tornal area, there are again (about 8–11) wavy fasciae. The overall appearance of the basal wavy fasciae is, on average, brighter than that of the wavy fasciae in the tornal field. All four wings have a comparatively broad margin in medium brown, proximally usually whitish.

Table 1: Length of the forewing in mm, separately for ♂♂ and ♀♀, for different islands of the Philippines and for the Philippines in total. All values are arithmetic means \pm one standard deviation.

fwl. [mm]	Luzon	Mindoro	Panay	Negros	Mindanao	Philippines (106 in total)
♂♂	57.5 \pm 2.34 (n = 31)	58.0 (n = 1)	58.8 \pm 1.17 (n = 6)	63.5 \pm 2.70 (n = 26)	59.6 \pm 3.79 (n = 26)	60.0 \pm 3.88 (n = 90)
♀♀	69.6 \pm 3.97 (n = 5)	— (n = 0)	71.0 \pm 1.41 (n = 4)	79.3 \pm 1.50 (n = 4)	73.0 \pm 2.65 (n = 3)	73.0 \pm 4.62 (n = 16)

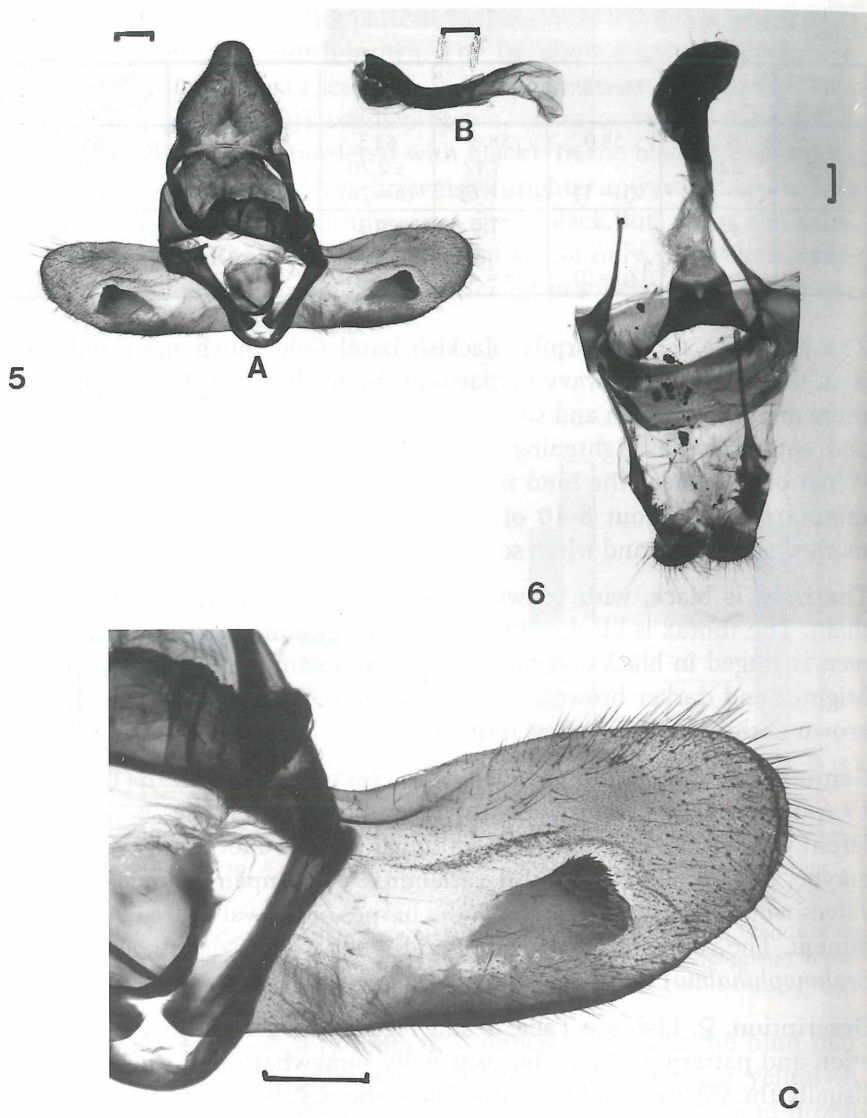
The hw. have the uniformly blackish basal field much more enlarged, with the basal area of wavy fasciae and the median area lacking. Instead, there are black, brown and sometimes white hairs along the inner margin and, sometimes, a brightening of the black ground colour in round interveinal patches near the hind margin or, rarely, almost all over. Distally, there are again about 8-10 of the wavy fasciae. The veins are usually marked with black and white scales.

The head is black, with brown antennae and a brownish dot between them. The thorax is black, with a brown longitudinal pattern. The abdomen is ringed in black and brown (the latter sometimes subdivided into brighter and darker brown), with the black portion in the proximal, the brown in the distal part of each segment.

Genitalia, ♂. See Fig. 5. Compare also NÄSSIG & PAUKSTADT (1990: figs. 19 A-19 H). There appear not to be significant differences between different populations of *B. hearseyi*, although there is a lot of individual and, maybe, also some geographical variability. The unpaired uncus and the valves work like a “triple forceps”; the harpes of the valve are usually prominent. The vesica forms a wide blind tube (without cornuti, as usual for *Brahmophthalma*) to the dorsal-left side.

Description, ♀. Lfw. see Table 1 and Fig. 2. The ♀ has the same colouration and pattern as the ♂, but is usually somewhat more round-winged. Usually the ♀♀ are decidedly larger than the ♂♂, but there may be specimens only of the size of a large ♂.

Genitalia, ♀. See Fig. 6. Compare also NÄSSIG & PAUKSTADT (1990: figs. 20 A-20 C). The bursa has two signa in the form of short, curved spines, one on the ventral, the other on the dorsal side of the corpus bursae. The placing of the signa within the bursa appears to be variable; they can be



B&W Plate: Fig. 5: ♂ genitalia of Philippine *Brahmaea hearseyi ardjoeno*, GP 1174/97, Mindoro. A = genitalia with aedeagus removed. B = aedeagus with vesica inflated. C = valve, enlarged. Fig. 6: ♀ genitalia of Philippine *Brahmaea hearseyi ardjoeno*, GP 1177/97, Negros. — Scale = 1 mm. Photographs W.A.N.

closer to the cephal or to the caudal end. The corpus bursae is often filled with the hard secretion wall of an ovoid spermatophore, which frequently obscures the two signa. The form of the sclerotization of the ductus bursae appears to be variable as well.

General remarks. The populations of *B. hearseyi ardjoeno* on the Philippines are quite variable. Besides a certain degree of insular variability (see below), there is also considerable individual variation. The first specimens of the species which we received from Luzon (1 ♂ Banaue, vi. 1986, GP 570/88, CCGT; 1 ♀ Ifugao, Hunduan, 20. iii. 1985, GP 626/89, CWAN; 1 ♂ Ifugao, Banaue, x.-xii. 1988, CWAN⁵) were unusually small and "round-winged", and when we received them we were at first strongly inclined to describe them as a new subspecies. But the specimens received later all showed the normal, elongate wing shape. Possibly there is some variability in the genetically fixed wing shape in northern Luzon, which appears to be recessive and is only rarely expressed phenetically; or other, unknown, factors may have been responsible for that effect.

On average, sexual dimorphism in size is very well developed in *B. hearseyi*, more than in the other *Brahmaea* species⁶. This holds also true for the Philippine populations: some ♀♀ are huge (in wing area nearly twice as large as the ♂♂), although there sometimes are small ♀♀ which have just the size of a big ♂.

Insular variability. Specimens from Luzon (Figs. 7, 8) and Mindanao (Fig. 10) are on average the brightest; their ground colour contains a higher proportion of white scales, and the brown scales are less dark than in the other populations. These bright populations are externally quite similar to Sundanian specimens and material collected at low elevations⁷ in the Darjeeling and Kumaon Himalaya area in N India by W. THOMAS (in

That means: from three different years and two different localities. It is very unlikely that these specimens are direct descendants from each other.

In other species of *Brahmaea* the lfw. of the ♀♀ is — on average — less than 1 cm larger than that of their ♂♂, while in *B. hearseyi* the difference in lfw. between ♂♂ and ♀♀ is — on average — larger than 1 cm. There may be *hearseyi*-♀♀ of about the same lfw. as in ♂♂, but giant ♀♀ often found in *B. hearseyi* are lacking in other species.

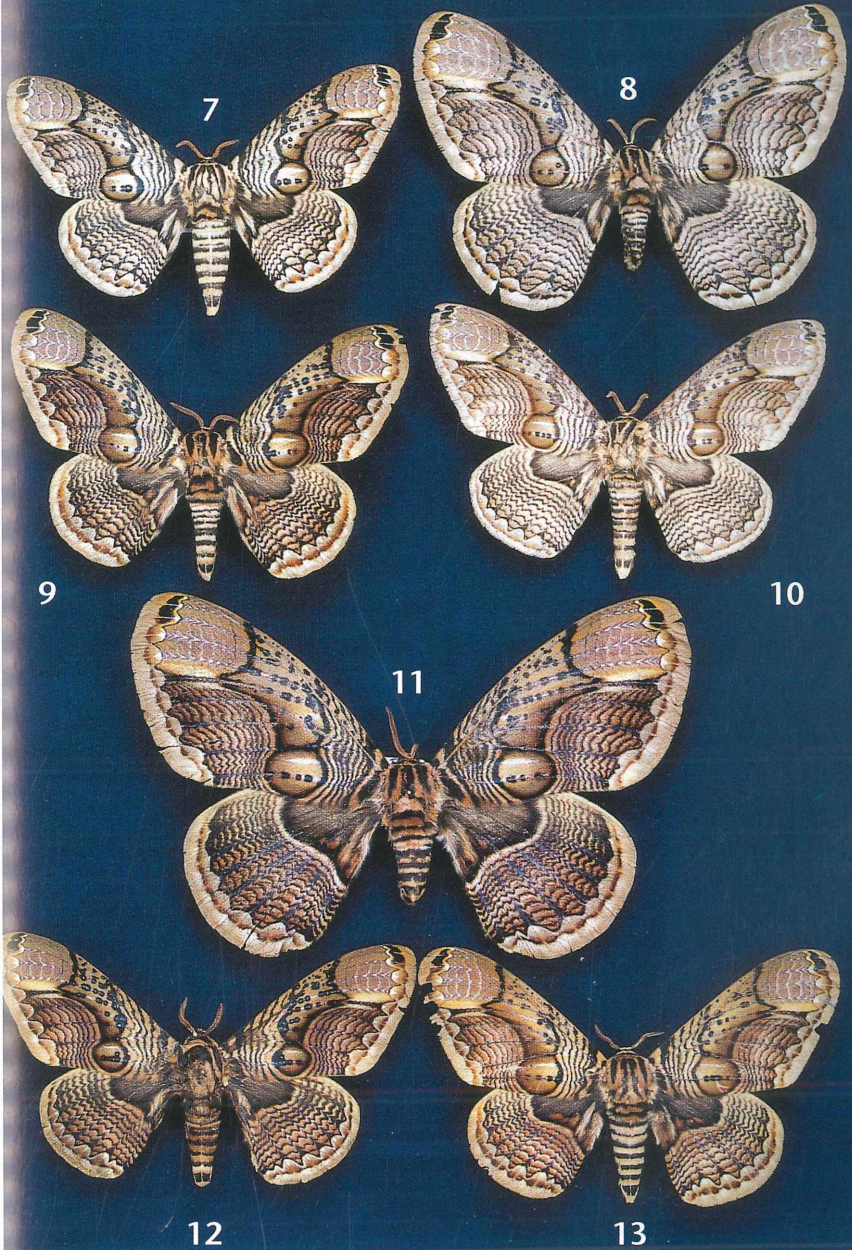
As in N-Thailand, *B. h. hearseyi* is found in N-India at lower elevations in tropical climate and *B. wallichii* (GRAY, 1831) higher up in the mountains under more temperate conditions. However, although their ecological focus is different, both species can be encountered at the same places. It is not yet clear whether *B. hearseyi ardjoeno*, which, in contrast to the nominotypical subspecies, does not overlap with *B. wallichii*, is found at higher maximum elevations than the continental subspecies. Closer to the equator, average temperature may also be higher in the mountains at the same elevation as in N-Thailand or the Himalaya.

CWAN). Specimens from Negros (Figs. 9, 11) and Panay (Fig. 12) and the singleton from Mindoro (Fig. 13) on average appear much darker, of a warm deep brown with a dark reddish hue; there are fewer white scales in the bright parts of the pattern, and the proportion of black scales is larger; also, the brown colour itself is often darker. The colouration of the dorsal pattern of black and brownish rings around the abdomen differs on average as well: The bright populations have many more white scales and hairs in the brown rings, with broader bright brown to nearly white rings, while the dark populations sometimes have a nearly black abdomen with only a narrow dark brown ring per segment. The specimens of Negros (not those of Panay) are also the largest of the Philippines (see Table 1 & Fig. 2). The fact that the Negros and the Panay populations are darker and more reddish-brownish than the other populations within the Philippines is also seen in some Saturniidae, e.g., *Actias philippinica*, *Antheraea larissa* etc., see NÄSSIG & TREADAWAY (1998, in this issue). We do not know an explanation for this observation.

Preimaginal instars and life history. The larva of *Brahmaea hearseyi* *hearseyi* was described and illustrated by MELL (1930, from S-China), that of *B. h. ardjono* by PAUKSTADT & PAUKSTADT (1986, from Sumatra), HOLLOWAY (1987, from Peninsular Malaysia) and NÄSSIG & PAUKSTADT (1990, from Sumatra). For the related *B. celebica* refer to L. H. & U. PAUKSTADT (1996). The populations of *B. hearseyi* from the Philippines have not yet been reared, their larvae are unknown, but will supposedly be very similar to the Sundanian ones. The foodplants of *B. hearseyi* in the wild are still unknown; in captivity, plants of the family Oleaceae (e.g., *Ligustrum*) are readily accepted as food, as it is typical for *Brahmaea* s.l. Larvae of Brahmaeidae grow generally very fast (if enough food in good quality

Colour Plate: Philippine specimens of *Brahmaea hearseyi ardjono*.

Fig. 7 (top left): ♂, Luzon, Banaue, 3600 ft., 13. vi. 1988, leg. SETTELE, CCGT, GP 1173/97, lfw. 55 mm. **Fig. 8** (top right): small ♀, N-Luzon, Banaue, 3600 ft., 22. iv. 1991, leg. ACHILLES, CCGT, GP 1176/97, lfw. 64 mm. **Fig. 9** (2nd row left): ♂, Negros, Mt. Canlaon, 13. vi. 1995, CCGT, lfw. 62 mm. **Fig. 10** (2nd row right): ♂, Mindanao, Bukidnon, Mt. Kitanglad, 21. ix. 1991, CCGT, GP 1175/97, lfw. 58 mm. **Fig. 11** (3rd row): huge ♀, Negros, Mt. Canlaon, 6. v. 1995, CCGT, GP 1177/97, lfw. 80 mm. **Fig. 12** (bottom left): ♂, Panay, Antique, Mt. Madja-as, 15. vi. 1996, CCGT, lfw. 59 mm. **Fig. 13** (bottom right): ♂, N-Mindoro, Mt. Halcon, 7. iv. 1996, CCGT, GP 1174/97, lfw. 58 mm. — Photograph taken by Ulrich BROSCHE, Hille, with technical assistance by Martin BEEKE, Hille (with Hasselblad camera on Kodak Ektachrome 6×6 cm).



and sufficient temperatures are supplied)⁸ and pupate in the soil without a cocoon (see, e.g., PAUKSTADT & RAGUS 1990). Imagines of *B. hearseyi* are able to take up water and – in captivity – honey or sugar solution with their probosces, a behaviour which significantly increases the imaginal life span (PAUKSTADT & PAUKSTADT 1987). Not very much is known about the ecology and behaviour of imagines and preimaginal instars in the wild. The moths are obviously strictly nocturnal. They were only collected at light; there they often sit on the ground, which perhaps may be the normal resting place. During a collecting expedition on the Philippines, one of the authors (C.G.T.) observed two imagines of the species at a camp fire on Mindanao (Mt. Kitanglad). These two specimens landed near the fire, then crawled on the ground into it and finally burned themselves. They did not try to avoid the heat.

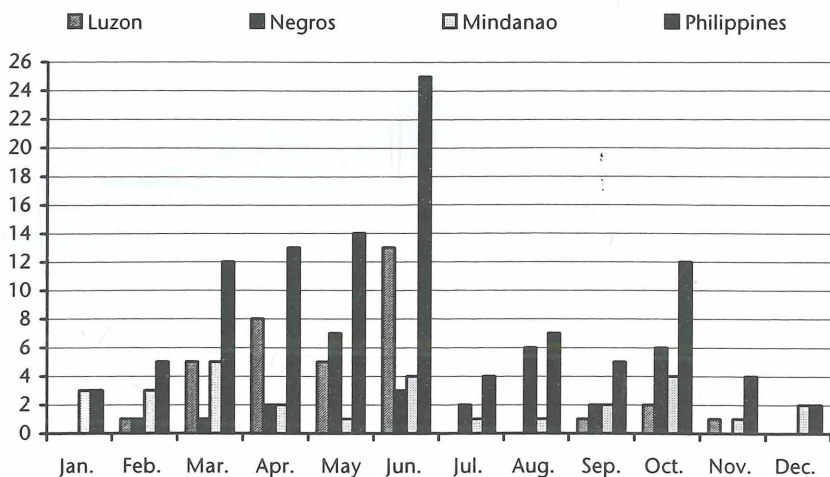


Fig. 3: Phenology data (number of specimens collected per month), separately for the islands of Luzon ($n = 36$), Negros ($n = 30$) and Mindanao ($n = 29$), and for the Philippines in total ($n = 106$), including Panay ($n = 10$) and Mindoro ($n = 1$).

⁸ According to PAUKSTADT & PAUKSTADT (1986), *B. hearseyi* appears to need some more time for larval development than *B. japonica* (BUTLER, 1873) and other species. However, at least some part of that delay in development reported by PAUKSTADT & PAUKSTADT was caused by low rearing temperatures: PAUKSTADT & PAUKSTADT reared under relatively low temperatures (18–20° C), while *B. hearseyi* as a species of tropical climate is adapted to much higher temperatures. Under optimal conditions, the Palearctic *B. japonica* and *B. europaea* HARTIG, 1963 need only about two to three weeks from egg to prepupa at 22–25° C (MELL 1930, NÄSSIG unpubl.).

Phenology. Estimating phenology from data which are casually collected during travels and expeditions rather than by someone who is living in the area all year round, are always problematic: such data tend to represent the usual traveling seasons rather than true life cycles. Further, the pattern of climatological zones (monsoon or raining seasons, etc.) in the Philippines (as well as generally in tropical areas) varies within and between islands (U. & L. H. PAUKSTADT 1996, TREADAWAY 1998, in this issue). In addition, there may be differences in local climate (begin and intensity of rainfalls, combined with differences in temperature) even from year to year at the same place. Due to such plasticity, even if there may be a good synchronization of the hatching of the imagines in one year at one place, the combination of data of many years may often result in a more or less equal distribution over the year. Therefore, the data given in Fig. 3 must not be overinterpreted. We have not yet analyzed the phenetic data in comparison with local weather and climate. However, Fig. 3 shows an accumulation of records for the period March to June and low counts in July to September as well as November to January; this pattern does not appear to be influenced by the usual traveling seasons and may possibly reflect one and a partial second generation.

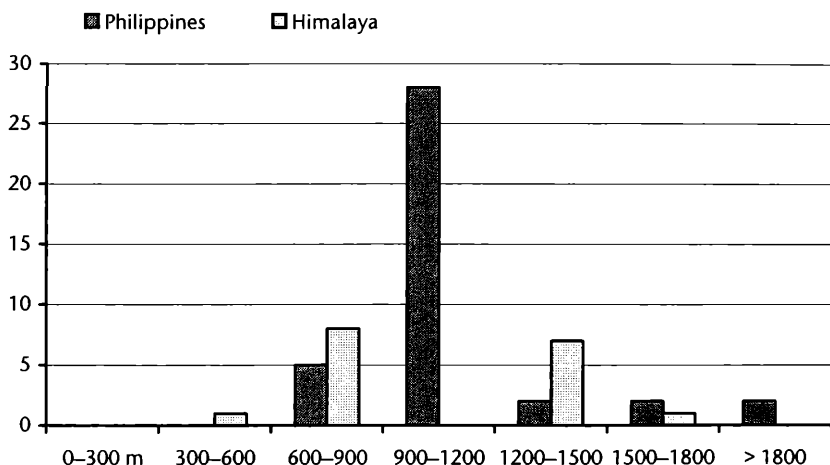


Fig. 4: Altitudinal distribution of *Brahmaea hearseyi* on the Philippines. Elevation data available from $n = 39$ specimens. Elevation plotted in steps of 300 m. The peak at 900–1200 m a.s.l. is mainly caused by the multitude of specimens from the Banaue area. — For comparison: data from Himalaya specimens in CWAN, $n = 17$.

Altitudinal distribution. Elevation data on the labels is only available in less than 40 % of the specimens (39 of the 106 specimens); see Fig. 4. No specimens were collected at low elevations (but this may well just be caused by the fact that lowlands are nowadays generally denuded of forest and primary habitats), and data above ca. 2000 m is lacking (which may also be influenced by the fact that collecting at such elevation is difficult). The peak at about 1000–1200 m could be primarily caused by the many specimens collected by SETTELE and ACHILLES (and others) during several long-term and often year-round collecting in the area and must not necessarily be a “real” effect. Nevertheless, this elevation data may perhaps indicate a slight preference for higher elevations in *B. hearseyi ardjono* on the Philippines than observed in *B. hearseyi hearseyi* from the Himalaya.

Acknowledgements

For hospitality, cooperation, material supply, and other support we thank T. ACHILLES, Thailand, P. ARIMAS, Philippines, K. ČERNÝ, Zirl, J. JUMALON, Philippines, R. LUMAWIG, Philippines, the MOHAGAN family, Philippines, R. MÜLLER, St. Gallen, J. NUYDA, Philippines, A. SCHINTLMEISTER, Dresden, J. SETTELE, Leipzig, and M. TINDONGAN, Philippines. The manuscript was critically read by K. FIEDLER, Bayreuth.

References

- BRYK, F. (1949): Zur Kenntnis der Großschmetterlinge von Korea, Pars II. — Arkiv f. Zool. 41 A (1): 1–224, 7 pls.
- HAMPSON, G. F. ([1893]): The fauna of British India, including Ceylon and Burma. Moths, vol. 1. — London (Taylor & Francis), 527 pp., “1892”.
- HOLLOWAY, J. D. (1987): The moths of Borneo, part 3, Lasiocampidae, Eupterotidae, Bombycidae, Brahmaeidae, Saturniidae, Sphingidae. — Kuala Lumpur (Southdene Sdn. Bhd.), 199 pp., 163 b&w pls., 20 col. pls.
- INOUE, H., SUGI, S., KUROKO, H., MORIUTI, S., & KAWABE, A. (1982): Moths of Japan, 2 vols. [most text in Japanese]. — Tokyo (Kodansha), 966 + 552 pp., 392 pls.
- MAASSEN, J. P. (1872): Beiträge zur Schmetterlingskunde, 2. Lieferung. — Elberfeld (the author).
- MELL, R. (1928): 15. Familie: Brahmaeidae. — Pp. 521–522 & pl. 56 C in: SEITZ, A. (ed.) (1911–1933), Die Groß-Schmetterlinge der Erde, 10. Band, Die indo-australischen Spinner und Schwärmer. — Stuttgart (A. Kernen), 909 pp, 104 pls.

- (1930): Beiträge zur Fauna sinica, V. Die Brahmaeiden und Eupterotiden Chinas. — Dtsch. entomol. Z. 1929 (5): 337–494, 10 pls.
- MINET, J. (1994): The Bombycoidea: phylogeny and higher classification (Lepidoptera: Glossata). — Entomologica scandinavica 25: 63–88.
- NÄSSIG, W. A., & NYE, I. W. B. (1991): Case 2737. *Brahmaea* WALKER, 1855 (Insecta, Lepidoptera): proposed confirmation of *Bombyx certhia* FABRICIUS, 1793 as the type species. — Bull. Zool. Nomencl. 48 (2): 137–139.
- , & PAUKSTADT, U. (1990): The Brahmaeidae of Sumatra. — Heterocera Sumatrana 6: 117–136.
- , & TREADAWAY, C. G. (1998): The Saturniidae (Lepidoptera) of the Philippines. — Nachr. entomol. Ver. Apollo, Frankfurt am Main, Suppl. 17: 223–424.
- OBERPRIELER, R. G., & DUKE, N. J. (1994): The life history and immature stages of *Spiramiopsis comma* HAMPSON, 1901 (Lepidoptera: Bombycoidea), with comments on its taxonomic position and on preimaginal characters of the Bombycoidea. — Nachr. entomol. Ver. Apollo, Frankfurt am Main, N.F. 15 (3): 199–244.
- OPINION 1698 (1992): *Brahmaea* WALKER, 1855 (Insecta, Lepidoptera): *Bombyx certhia* FABRICIUS, 1793 confirmed as the type species. — Bull. Zool. Nomencl. 49 (4): 294.
- PAUKSTADT, L. H., & PAUKSTADT, U. (1996): Beschreibung der Präimaginalstadien von *Brahmaea* (*Brahmophthalma*) *celebica* TOXOPEUS [1939] von Sulawesi, Indonesien, sowie Angaben zur Biologie und Ökologie (Lepidoptera: Saturniidae [sic!]). — Entomol. Z. 106 (11): 443–449.
- PAUKSTADT, U., & PAUKSTADT, L. H. (1986): Die Präimaginalstadien von *Brahmidia hearseyi* (WHITE 1861) (Lep.: Brahmaeidae). — Entomol. Z. 96 (11): 145–152.
- , & — (1987): Beitrag zur Biologie von *Brahmidia hearseyi* WHITE 1861 (Lepidoptera: Brahmaeidae). — Entomol. Z. 97 (9): 113–121.
- , & — (1996): Kritische Überlegungen zur Feststellung von Generationszyklen bei Saturniidae (Lepidoptera) der Großen Sundainseln, Indonesien. — Entomol. Z. 106 (3): 101–102.
- , & RAGUS, G. (1990): Ein Beitrag zur Kenntnis von *Brahmaea* (*Brahmaea*) *tancrei* AUSTAUT 1896 aus südkoreanischen Populationen (Lepidoptera: Brahmaeidae). — Entomol. Z. 100 (1/2): 11–30.
- SAUTER, W. (1967): Zur systematischen Stellung von *Brahmaea europaea* HARTIG (Lep., Brahmaeidae). — Mitt. schweiz. entomol. Ges. 40 (1/2): 125–129.
- (1986 [1987]): Zur Morphologie von *Acanthobrahmaea europaea* (HARTIG, 1963) und zur systematischen Gliederung der Brahmaeidae (Lepidoptera): Dactylocestrinae, subfam. n. — Nota lepidopt. 9 (3/4): 262–271.
- SEITZ, A. (1911): 15. Familie: Brahmaeidae. — Pp. 227–228 & pl. 35 in: SEITZ, A. (ed.) (1909–1913), Die Groß-Schmetterlinge der Erde, 2. Band, Die paläarktischen Spinner und Schwärmer. — Stuttgart (A. Kernen), 479 pp, 56 pls.

- SEMPER, G. (1896): Heterocera, Familie Brahmaeidae. — P. 386 in: SEMPER, G. (1896–1902), Die Schmetterlinge der philippinischen Inseln. Beitrag zur indo-malaysischen Lepidopteren-Fauna. Zweiter Band [Zweite Abtheilung]: Die Nachtfalter. Heterocera. [Ed. by C. SEMPER under the title: Reisen im Archipel der Philippinen, zweiter Theil, Wissenschaftliche Resultate, Sechster Band.] — Wiesbaden (C. W. Kreidel), pp. 381–728, pls. C–V [caterpillars], L–LXVI [imagines].
- TREADAWAY, C. G. (1998): Short introduction to Philippine natural and geological history and its relevance for Lepidoptera. — Nachr. entomol. Ver. Apollo, Frankfurt am Main, **Suppl. 17**: 7–16.
- ZHANG X. & YANG C.-K. (1993): [A new genus and species of Brahmaeidae (Lepidoptera)] [in Chinese]. — Entomotaxonomia **15** (1): 48–52.

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Nachrichten des Entomologischen Vereins
Apollo Supplement](#)

Jahr/Year: 1998

Band/Volume: [17](#)

Autor(en)/Author(s): Nässig Wolfgang A., Treadaway Colin G.

Artikel/Article: [The Brahmaeidae \(Lepidoptera\) of the Philippines
425-440](#)