NATURE IN SINGAPORE 2010 **3**: 125–131
Date of Publication: 25 May 2010

FINAL INSTAR CATERPILLAR AND METAMORPHOSIS OF *BIRTHOSEA BISURA* (MOORE, 1859) IN SINGAPORE (LEPIDOPTERA: LIMACODIDAE)

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INTRODUCTION

Members of the lepidopteran family Limacodidae are frequently referred to as either slug or nettle moths (Barlow, 1982; Cock et al., 1987). The first vernacular name is indicative of its characteristic larval locomotion, crawling about on its smooth, sticky venter in the absence of abdominal prolegs, accompanied by a reduction of the thoracic legs. The second name is derived from the fact that many (not all) limacodid larvae are armed with defensive stinging spines radiating from lateral and dorsolateral protuberances known as scoli (singular, scolus). A third name, cup moths, has also been applied for this family, in reference to the cup-like shape of their post-eclosion cocoon (Zborowski & Edwards, 2007).

These peculiar characteristics were consistently witnessed in the larvae of *Birthosea bisura* (Moore, 1859), during attempts to rear them to metamorphosis. The type locality for this species is Java, and its geographic range includes Sundaland, as well as Thailand (Holloway, 1986). A published record of this species for Singapore may be based on an illustrated specimen featured by Cock et al. (1987: Pl. 21, Fig. 31—adult male from Singapore). Previous descriptions and illustrations of the diagnostic larva/cocoon have been by Horsfield & Moore (1859), Piepers & Snellen (1900), Wood (1968), Holloway (1986), Cock et al. (1987: Pl. 26, Fig. 8—young larva; Pl. 27, Fig. 1—mature larva; Pl. 31, Fig. 7—cocoon and wasp parasitoid). Here, the observations of its final instar larvae are summarised, with additional contributions to its list of larval hostplants, based on encounters in the central nature reserves of Singapore.

Fig. 1. Lateral view of final instar larva of *Birthosea bisura* (head on the left), feeding on its hostplant, *Parishia maingayi* (Anacardiaceae) at the Bukit Timah Nature Reserve (Jungle Fall Path) on the night of 12 Dec.2009 (2350 hours). Note dorso-ventrally flattened body profile, with a hemispherical outline.

OBSERVATIONS

While conducting a faunal survey within the Bukit Timah Nature Reserve on the night of 12 Dec.2009, a final instar larva of *Birthosea bisura* was encountered along the Jungle Fall Path at ca. 2350 hours. It was perched at waist-level, on the underside of the leaf of *Parishia maingayi* (family Anacardiaceae) and in the process of feeding along the distal margin (Figs. 1, 2). A drop of milky white sap was noticeable at the exposed portion of the mid-vein, but did not appear to deter the larva in the least.

The larva was an overall fluorescent green, with a pale mid-dorsal stripe running the length of its body. A prominent pair of dark blue ocelli ('roundels') with yellow-orange centres was situated between the dorsolateral scoli of the third and fourth abdominal segments (A3 and A4). The lateral scoli were largely uniform in size and spine density, while the dorsolateral scoli displayed more variation, with those on T3, A1, A5, A8, and A9 being more pronounced than the rest. This larva was 22 by 11 mm.

In captivity, feeding activity of the larva paused on the 13 Dec.2009. On the 14 Dec.2009, its body began to turn yellowish, as it excreted a watery discharge that was accompanied by a white, creamy paste. On the 15 Dec.2009, it settled upon a leaf and began to attach loose leaf debris around itself with silk strands. Its body continued to contract further. By the night of 15 Dec.2009, an entire cocoon had been completely formed, with the outer shell almost hardened. The cocoon was slightly elliptical, with a dark, coffee brown colour and measured 10 by 8 mm (Fig. 3).

Fig. 2. Dorsal view of final instar larva (as in Fig. 1, head towards left). Note prominent pair of dark blue rings situated between the dorsolateral scoli on the third and fourth abdominal segments (A3 and A4). This larva was 22 by 11 mm.

Fig. 3. The cocoon was completely formed and hardened by the night of 15 Dec.2009. It was anchored to the leaf blade surface with sparse silk threads. It measured 10 by 8 mm.

Fig. 4. Dorsal view of the adult male moth (ZRC.LEP.275, body length: 15 mm, forewing length: 12 mm) freshly emerged on the morning of 5 Jan.2010.

Fig. 5. Frontal view of male moth (ZRC.LEP.275). Note degree of bipectination in the antennae.

On the morning of 5 Jan.2010, a well-formed male moth eclosed from within the cocoon (Figs. 4, 5). The moth had a background colour of dark-brown, peppered with black and cream on its wings and body. It was subsequently preserved as a voucher specimen at the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research (RMBR), National University of Singapore (ZRC.LEP.275, body length: 15 mm, forewing length: 12 mm). There does not appear to be existing specimens of this species at the ZRC, prior to this deposition.

The empty cocoon and vacated pupal case were preserved and similarly catalogued as well (Fig. 6). Upon closer examination of the eclosed pupa, it could be observed that the antennal sheath was not attached to the pupal body (Fig. 6a), yet another character demonstrated by the limacodids. The upper portion of the cocoon had also been neatly severed, to flip open as a hemispherical hatch (Fig. 6b).

Prior to this successful rearing to metamorphosis, another final instar larva was earlier found on 26 Dec.2008 within the Upper Seletar Reservoir forest. It was measured to be 17 by 8 mm, and had been feeding on the young leaves of *Calophyllum* species (family Calophyllaceae). By the 28 Dec.2008, it had entered its pre-pupal phase and its body began to turn yellowish, as the dorsal ocelli also started to fade (Fig. 7). While in captivity, observations of its locomotion were most intriguing and attempts were made to photograph its underside, to illustrate the adhesive ventral surface (Fig. 8). As the larva glided along, slug-like, regular waves of muscular contraction could be clearly seen. Its head was retractable and potentially shielded within a green, membranous shroud of the prothorax.

Earlier records of larval hostplants for *Birthosea bisura* have documented seven genera in six families (Holloway, 1986; Robinson et al., 2010). These include: *Coffea* (Rubiaceae), *Elaeis*, and *Metroxylon* (Palmae), *Lagerstroemia* (Lythraceae), *Nephelium* (Sapindaceae), *Ricinus* (Euphorbiaceae), and *Zingiber* (Zingiberaceae). Thus, our present records contribute two additional genera (and families) to this list, namely: *Parishia* (Anacardiaceae) and *Calophyllum* (Calophyllaceae).

Until recently, *Birthosea* Holloway, 1986 had remained a monospecific genus. Two more additions to this limacodid genus were subsequently discovered in China, namely: *Birthosea trigramma* from Yunnan, and *Birthosea trigrammoidea* from Shandong (Wu & Fang, 2008). However, neither larval descriptions nor illustrations have been positively assigned to both species as yet (C-S. Wu, pers. comm., Jan.2010).

Fig. 6. Various perspectives of the cocoon (post-eclosion) to view the vacated pupal case (a), and circular cocoon lid (b), which facilitated exit of the emergent moth. As is typical of limacodid pupae, the antennae (arrowed), limbs and wing cases were largely unfused with the main body.

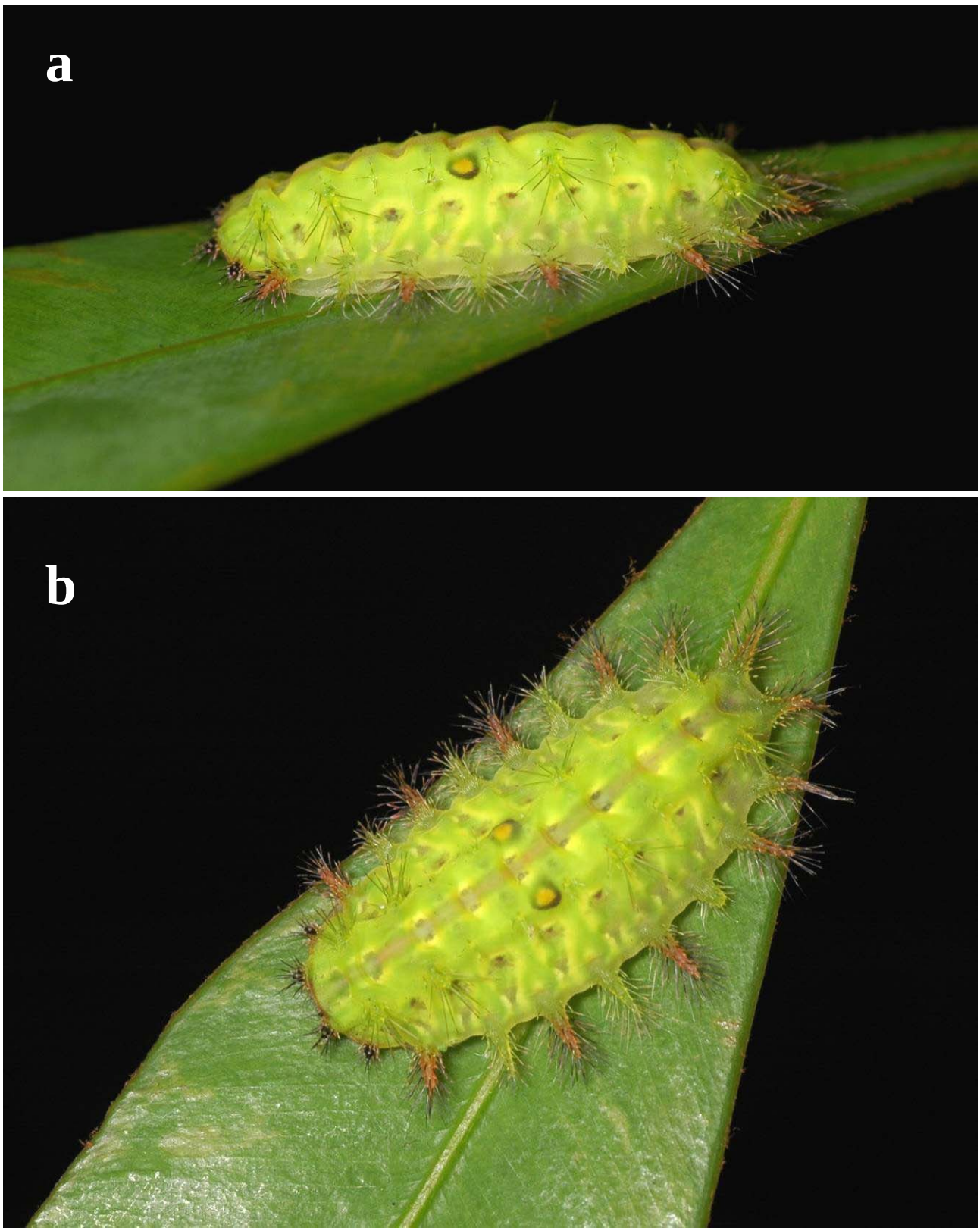

Fig. 7. Lateral (a) and dorsal (b) views of an early pre-pupal larva (head towards left), first found on 26 Dec.2008 at the Upper Seletar Reservoir forest, feeding on the leaves of *Calophyllum* species (Calophyllaceae). This larva was 17 by 8 mm.

ACKNOWLEDGEMENTS

My sincere appreciation goes to Jeremy D. Holloway (Natural History Museum, London) for his verification of the moth identity. I am grateful to Chun-Sheng Wu (Institute of Zoology, Chinese Academy of Sciences, Beijing) for kindly providing a copy of his paper on the new *Birthosea* species from China. I thank Gwee Aik Teck (Herbarium, Singapore Botanic Gardens) for the identification of the *Parishia maingayi* samples.

LITERATURE CITED

Barlow, H. S., 1982. *An Introduction to the Moths of South East Asia*. The Malayan Nature Society, Kuala Lumpur. vii + 305 pp., 50 col. pls.

Cock, M. J. W., H. C. J. Godfray & J. D. Holloway, 1987. *Slug and Nettle Caterpillars—The Biology, Taxonomy and Control of the Limacodidae of Economic Importance on Palms in South-east Asia*. CAB International, Wallingford, UK. x + 270 pp.

Holloway, J. D., 1986. The Moths of Borneo: Key to Families; Families Cossidae, Metarbelidae, Ratardidae, Dudgeoneidae, Epipyropidae and Limacodidae. *Malayan Nature Journal*, **40**(1−2): 1–165.

Horsfield, T. & F. Moore, 1859. *A Catalogue of the Lepidopterous Insects in the Museum of Natural History at the East-India House. Vol. II*. W. H. Allen, London. pp. 279–440.

Piepers, M. C. & P. C. T. Snellen, 1900. Énumération des Lépidoptères Hétérocères recueillis à Java. *Tijdschrift voor Entomologie*, **43**: 12–106.

Robinson, G. S., P. R. Ackery, I. J. Kitching, G. W. Beccaloni & L. M. Hernández, 2010. *HOSTS—A Database of the World's Lepidopteran Hostplants*. Natural History Museum, London. http://www.nhm.ac.uk/research-curation/research/projects/hostplants/. (Accessed: 18 Jan.2010).

Wood, B. J., 1968. *Pests of oil palms in Malaysia and their control*. Incorporated Society of Planters, Kuala Lumpur. 204 pp.

Wu, C-S. & C-L. Fang, 2008. Discovery of the genus *Birthosea* Holloway from China with descriptions of two new species (Lepidoptera, Limacodidae). *Acta Zootaxonomica Sinica*, **33**(3): 502–504.

Zborowski, P. & T. Edwards, 2007. *A Guide to Australian Moths*. CSIRO Publishing, Victoria. 214 pp.

Fig. 8. Ventral view of pre-pupal larva (as in Fig. 7, head towards left). Its locomotion was typically limacodid, demonstrating peristaltic waves gently rolling along its broad, adhesive 'sole', analogous to a crawling slug. The abdominal prolegs have disappeared entirely and the thoracic legs are reduced (in terms of size and function). The head is protected by a membranous hood, into which it can withdraw deeper for defensive purposes.