NATURE IN SINGAPORE 2009 **2**: 171–176
Date of Publication: 28 April 2009

FINAL INSTAR LARVA AND METAMORPHOSIS OF *HYPOPYRA PUDENS* WALKER IN SINGAPORE (LEPIDOPTERA: NOCTUIDAE: CATOCALINAE)

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INTRODUCTION

The noctuid moth, *Hypopyra pudens* Walker, 1858, belongs to the tribe Hypopyrini of the subfamily Catocalinae (Holloway, 2005). This species is wide-ranging in Asia and has been recorded from Japan, India, the Andaman Islands, Sundaland, and Sulawesi (Holloway, 2005). In Singapore, an early report by Michael W. F. Tweedie (former director of the Raffles Museum, Singapore: 1946–1971) noted the arrival of a "leaf-like" example of "*Enmonodia pudens*" to over-ripe pineapple bait placed in forest near the MacRitchie Reservoir (Tweedie, 1953). Three examples of a common noctuid, *Erebus ephesperis* (Hübner, 1827), were also attracted to this fruit bait (Tweedie, 1953: pl. 8). In addition, there are representative voucher specimens of *Hypopyra pudens* deposited in the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research (RMBR), National University of Singapore. Locally, there have been no published accounts of its caterpillar. This article documents the final instar larva and metamorphosis from a specimen encountered in the Central Catchment Nature Reserve, Singapore.

OBSERVATIONS

While conducting a nocturnal faunal survey on the night of 14 Feb.2009 in the Chestnut Track forest, a greyish caterpillar was encountered perched on a twig about 0.5 m above the forest floor (Fig. 1). It was photographed in situ and collected for subsequent rearing to determine its identity.

Fig. 1. Lateral view of final instar caterpillar of *Hypopyra pudens*, found at the Chestnut Track forest on the night of 14 Feb.2009. Its body length was 56 mm. Note the degree of limb reduction in the third and fourth pair of abdominal prolegs (A3 and A4 respectively).

Fig. 2. Close-up of the head of the final instar larva of *Hypopyra pudens*. Note the sparse distribution of hairs around its head.

The caterpillar was 56 mm long and had a smoky-grey ground colour, with closely spaced, fine, dark speckling over the entire body. There was a sparse distribution of short, fine hairs over its body and on its head. The abdominal prolegs of the fifth and sixth segments were of normal proportions, but those on the fourth (A4) were noticeably reduced, and those on the third (A3) significantly smaller. The relative limb reductions in A3 and A4 are comparable to the known larva of *Hypopyra vespertilio* (Fabricius, 1787) and consistent with those of the genus (Holloway, 2005). The head was beautifully pigmented with symmetrical shades of cream and brown (Fig. 2).

On the morning of 15 Feb.2009, the larva initiated the onset of its pupal phase, weaving silk onto leaf debris to enshroud itself. By the afternoon of 17 Feb.2009, pupation was complete and the larval exuvia was removed for preservation. On the 23 Feb.2009, the pupa was carefully examined and found to be 36 mm long by 11 mm wide (Fig. 3). It was a uniform, dark-brown with a smooth surface and shallow constrictions between the abdominal segments. The cremaster consisted of a simple, short row of recurved hooks at the end of the abdomen.

On the afternoon of 3 Mar.2009, the adult moth emerged and found to be a female (Fig. 4). It was photographed, then preserved as a voucher specimen (ZRC.LEP.113, forewing: 43 mm, body length: 32 mm). This moth agreed most closely with an image of a female *Hypopyra pudens* specimen illustrated by Kobes (1985: Pl. 5—moth #5) and its identity was subsequently confirmed by Jeremy D. Holloway (The Natural History Museum, London, UK).

At rest, the outline of the moth did bear some resemblance to a dead leaf. Dorsally, its two-toned colour scheme was well-delineated, with a pinkish-orange anterior half, bordering a coffee-brown posterior half. Its underside was a more uniform, but deeper shade of pinkish-orange, with symmetrical, dark, evenly spaced transverse lines (Fig. 5). The mid- and hind-legs were armed with sharply pointed tibial spurs, banded in black and white (Fig. 6).

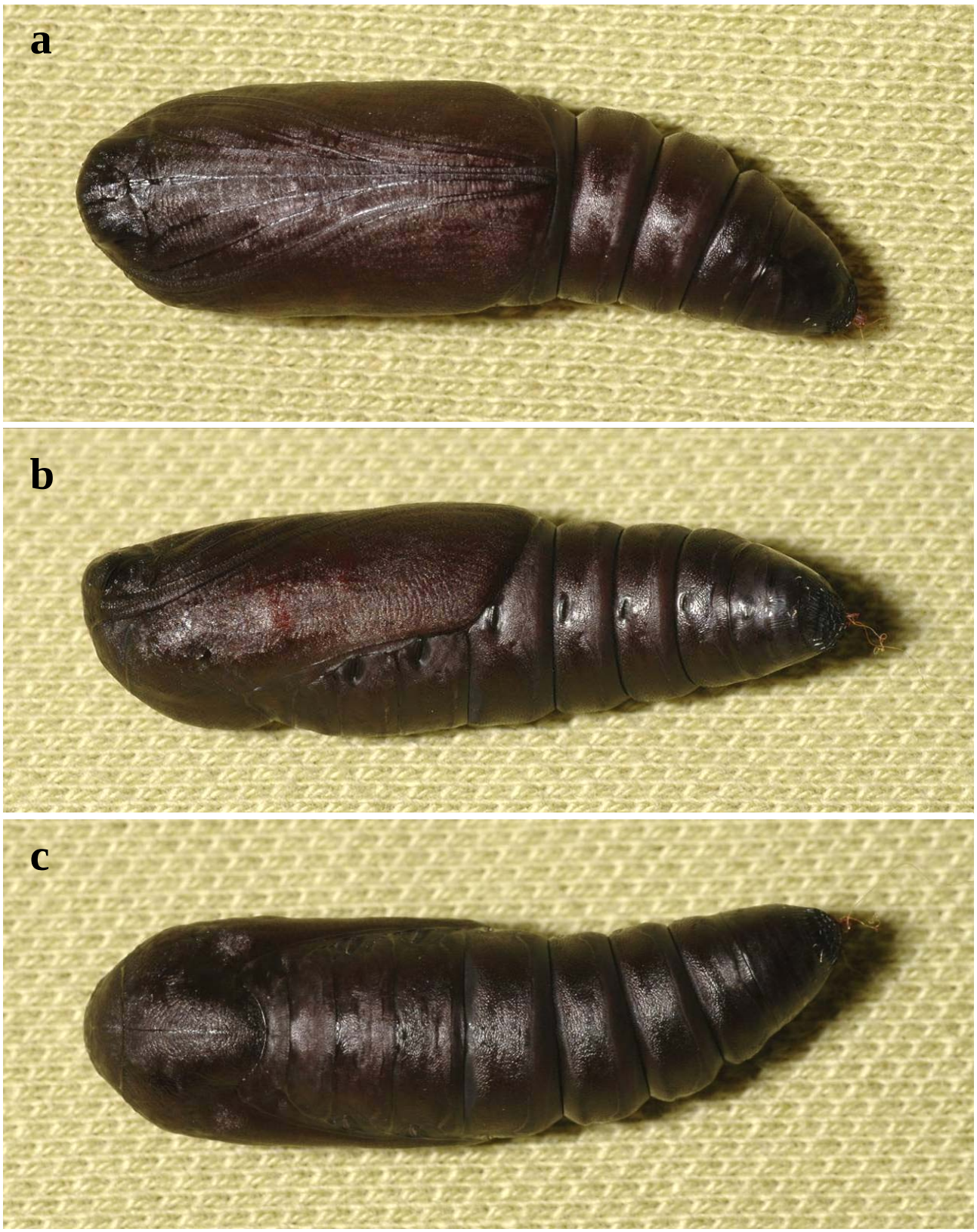

Fig. 3. Views of the pupa of *Hypopyra pudens* (photographed on 23 Feb.2009): a, ventral, b, lateral and c, dorsal. This pupa was 36 mm long by 11 mm wide.

DISCUSSION

Inclusive of this recent addition (ZRC.LEP.113), there are nine specimens (three males, six females) of this species at the ZRC, with details as follows (FW=Forewing Length, BL=Body Length): ZRC.LEP.105 (male, 'Singapore', collector and date not indicated, FW: 42 mm, BL: 39 mm); ZRC.LEP.106 (female, Singapore, coll. R. Morrell, possibly early 1950's, FW: 42 mm, BL: 31 mm); ZRC.LEP.107 (female, Nee Soon, pineapple bait, coll. R. Morrell, 5 Apr.1953,

Fig. 4. Dorsal view of female *Hypopyra pudens* (ZRC.LEP.113; forewing length: 43 mm, body length: 32 mm), freshly emerged on the afternoon of 3 Mar.2009.

Fig. 5. Ventral view of female (as in Fig. 4) to illustrate underwing colour/patterns.

FW: 44 mm, BL: 33 mm); ZRC.LEP.108 (female, Singapore, coll. R. Morrell, 1954, FW: 44 mm, BL: 32 mm); ZRC.LEP.109 (male, Bukit Timah, Hindhede Drive, coll. H. K. Lua, 5 Nov.1989, FW: 43 mm, BL: 36 mm); ZRC.LEP.110 (female, Nee Soon Swamp Forest, coll. Alvin Wong, 9 May.1992, FW: 44 mm, BL: 31 mm); ZRC.LEP.111 (male, Nee Soon Swamp Forest, pumphouse, fluorescent light trap, coll. Chang Chia Yi et al., 15 May.1992, FW: 44 mm, BL: 37 mm); ZRC.LEP.112 (female, Central Catchment Nature Reserve, Bukit Kallang, coll. Mawardi, 27 Jan.2005, FW: 42 mm, BL: 32 mm).

There is also a single Bornean specimen from 'Lio Matu', Baram River, Sarawak (ZRC.LEP.104, male, coll. J. C. Moulton, 14 Oct.1920, FW: 43 mm, BL: 38 mm). Although males and females do not exhibit any significant differences in their forewing lengths, the males appear to have slightly longer abdomens, contributing to their overall greater body length. In addition, the undersides of the males' hindwings bear long, wavy hairs and their limbs are also

Fig. 6. Ventro-lateral close-up of emergent female (as in Figs. 4, 5). Note the prominent tibial spurs on the mid- and hindlegs.

Fig. 7. A specimen of the noctuid moth, *Hexamitoptera lawinda* (also in the tribe Hypopyrini), encountered at Bukit Kallang, Central Catchment Nature Reserve on the morning of 27 Sep.2008, at ca. 0845 hours.

adorned with dense, long tufts, most noticeable on the hindlegs. These organs may serve as devices to enhance the dissemination of pheromones by the males (J. D. Holloway, pers. comm.).

The documented larval hostplant for *Hypopyra pudens* is the leguminous tree, *Falcataria moluccana* (formerly, *Paraserianthes falcataria*; family Fabaceae) (Robinson et al., 2009). In general, the larvae of *Hypopyra* species have

been documented to feed on *Acacia*, *Falcataria* (*Paraserianthes*) and *Pithecellobium* (all three from the Fabaceae), *Triplochiton* (Malvaceae), and *Camellia* (Theaceae) (Robinson et al., 2009). At the field site where the caterpillar of *Hypopyra pudens* was found, a number of *Falcataria moluccana* trees were present. The larva might have fed on the leaves at the crown level, and then descended towards the ground in preparation for pupation amongst leaf litter at the forest floor.

In Singapore, other members of the Hypopyrini have been recorded, including *Hypopyra vespertilio* (Fabricius, 1787), the type species for the genus, and *Hexamitoptera lawinda* (Pagenstecher, 1885) (Fig. 7). A few representative specimens of both species are present at the ZRC, catalogued as ZRC.LEP.101–103 (*Hypopyra vespertilio*) and ZRC.LEP.114 (*Hexamitoptera lawinda*). In the course of my field surveys within the Central Catchment Nature Reserve, I have occasionally met with a number of individuals of *Hexamitoptera lawinda* (Fig. 7). Although the larval hostplant for this species remains to be ascertained, there is a possibility that it might also be a legume. Hopefully, its immature stages and verified hostplant(s) will eventually come to light with further survey efforts.

ACKNOWLEDGEMENTS

I am most grateful to Jeremy D. Holloway (The Natural History Museum, London, UK) for kindly confirming the moth's identity and also sharing his wisdom on sexual dimorphism in moths. I thank Kelvin K. P. Lim and Lua Hui Kheng (Raffles Museum of Biodiversity Research) for granting access to the Lepidoptera collection to examine specimens under their care. My sincere appreciation to an efficient, anonymous lepidopterist reviewer for providing relevant recommendations, which helped to polish the original manuscript.

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