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RECORDS OF MONKEY MOTHS FROM SINGAPORE, WITH NOTES ON THE CATERPILLAR AND METAMORPHOSIS OF *EUPTEROTE NIASSANA* (ROTHSCHILD) (LEPIDOPTERA: EUPTEROTIDAE)

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INTRODUCTION

Moths of the family Eupterotidae are commonly referred to as monkey moths (Barlow, 1982). Three species are presently documented for Singapore, all belonging to the genus *Eupterote*. They are *Eupterote asclepiades* (C. Felder & R. Felder, 1874), *Eupterote naessigi* Holloway, 1987 and *Eupterote niassana* (Rothschild, 1917). Thus far, all records and sightings of these species in the country have only been from the Central Nature Reserves, highlighting the importance of conserving such forest habitats for these and other groups of native moths.

OBSERVATIONS AND DISCUSSION

During past and recent forays into the forests of the Central Catchment Nature Reserve, the author and his fellow surveyors have occasionally encountered adults of both *Eupterote asclepiades* and *Eupterote naessigi* in the field. In *Eupterote asclepiades*, the wings have a beige background that is ornamented with symmetrical, dark brown markings. Males are easily recognisable by the degree of pectination in their antennae (Fig. 1). This species was referred to as '*Tagora pallida* Walker' by Barlow (1982) but this name has since been regarded as a junior synonym of *Eupterote asclepiades*.

In the Lepidoptera collection of the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research (RMBR), two locally collected specimens of *Eupterote asclepiades* had recently been deposited (ZRC.LEP.35-36, both males, collected by T. M. Leong at the Bukit Kallang office of the MacRitchie Reservoir Forest on 19 May.2004 and 7 Jul.2004, respectively). The forewing lengths of ZRC.LEP.35 and ZRC.LEP.36 are 60 mm and 58 mm, respectively. *Eupterote asclepiades* is geographically distributed from India to Peninsular Malaysia, Sumatra and Borneo (Barlow, 1982).

Fig. 1. Dorsal (left) and frontal (right) views of a male *Eupterote asclepiades* encountered along a forest trail in MacRitchie Reservoir Forest on the night of 13 Sep.2008 at around 2200 hrs. Note its bipectinate antennae.

Fig. 2. Dorsal (left) and frontal (right) views of a male *Eupterote naessigi* that was attracted to lights at Jelutong Tower (MacRitchie Reservoir Forest) on 27 Sep.2008 at around 0200 hrs.

Fig. 3. A Bornean example of *Eupterote naessigi* photographed on 24 Mar.2007, when it was attracted by lights at a forest field research station in Bintulu Division, Sarawak, Malaysia.

Voucher specimens for *Eupterote naessigi* are also represented in the ZRC, which presently holds two males and one female of this species. The earliest specimen is a male (ZRC.LEP.39, forewing length 46 mm) collected by S. L. Yang from 'Seletar Reservoir' (presumably the present Upper Seletar Reservoir) on 22 Aug.1990. The second male (ZRC.LEP.37, forewing length 49 mm) was collected by T. M. Leong from Upper Seletar Reservoir Park on 30 May 2004. The only female (ZRC.LEP.38, forewing length 61 mm) was collected by T. M. Leong at the National Parks Board (NParks) Bukit Kallang office on 24 Jul.2004. Recent encounters with this species include a male that was attracted to lights (intended for moths) set up at the Jelutong Tower (MacRitchie Reservoir Forest) in the early morning hours of 27 Sept.2008 (Fig. 2). This is probably the most attractive eupterotid in Singapore, with bright yellow wings decorated with rich, brown markings. A central, brown patch is present on the dorsum of its thorax. Outside Singapore, the author has also encountered this species in Sarawak, Malaysia (Fig. 3) and it is also known to occur in Sumatra and Peninsular Malaysia (Holloway, 1987).

Fig. 4. Last instar larva of *Eupterote niassana* feeding on the leaf of its documented hostplant, *Ixonanthes reticulata* at the Upper Peirce Reservoir Forest in Apr.2005. The full-grown caterpillar was 95 mm long. Each segment bears a dense aggregation of reddish brown, sharp-tipped spines (to 8 mm long) concealed beneath rows of fine, black hairs (up to 26 mm long). (Photograph by: Kelvin K. P. Lim).

Fig. 5. Pupa of *Eupterote niassana* before (left) and after (right) emergence of the adult moth. The caterpillar proceeded to the pupa stage on 11 May 2005 and the fully formed adult emerged on 15 Jun.2005. Note waste fluids (meconium) expelled into the pupal case upon emergence.

The third Singapore congener, *Eupterote niassana*, appears to be the least common species. The single adult voucher specimen was actually reared from a final instar caterpillar found by the author in the Upper Peirce Reservoir Forest on the night of 22 Apr.2005. It was then feeding on the lower leaves (at 1.5 m above ground) of a sapling of *Ixonanthes reticulata* (Family Ixonanthaceae) (Fig. 4). The total length of this caterpillar was approximately 95 mm. Its overall body colour was dark brown, with pale yellow spiracles clearly visible along its flanks. Its entire body was coated with fine strands of soft hair (up to 26 mm long) that appeared to conceal underlying rows of densely packed, sharp-tipped spines (up to 8 mm long). This larva eventually pupated on 11 May 2005, exhibiting a unique pupal shape with a highly inflated thoracic region and an abdominal region with distinct, inter-segmental constrictions. A dense row of fine, short hooks, the cremaster, was visible at the distal end. The pupa was 50 mm long and 20 mm at its widest; glossy black, with a generally smooth texture (Fig. 5).

Fig. 6. Dorsal (left) and ventral (right) views of the recently emerged female *Eupterote niassana* (ZRC.LEP.47, forewing length 66 mm).

On 15 Jun.2005, the fully formed moth emerged, leaving behind some pinkish-beige liquid excrement (meconium) in the cast shell (Fig. 5). The emergent was found to be a female (Fig. 6) and subsequently preserved as a voucher specimen (ZRC.LEP.47, forewing length 66 mm). Recently, another caterpillar, believed to be that of *Eupterote niassana* was found by Chew Ping Ting and Debbie Lim (NParks) in the MacRitchie Reservoir Forest while conducting a botanical survey on the morning of 23 Sep.2008. In the process of collection, Debbie Lim accidentally pricked her fingers on its sharp, defensive spines, which caused some localised soreness. This caterpillar shared very similar morphological characteristics with that of ZRC.LEP.47 (larval stage). In captivity, it was fed with leaves of both *Ixonanthes icosandra* and *Ixonanthes reticulata* and was seen to consume both without hesitation. However, there was a drastic change in its behaviour on the 10 Oct.2008, when it abruptly stopped feeding and displayed symptoms of watery faeces. At this juncture, it was presumed that it was being fatally infected by internal parasites (possibly tachinid flies) and so it was preserved as a voucher larval specimen (ZRC.LEP.48, total length 90 mm, width 13 mm). *Eupterote niassana* is known to occur in Nias, Sumatra, Peninsular Malaysia and Borneo (Barlow, 1982).

Previous records of foodplants known to be consumed by members of the genus *Eupterote* in the Oriental region have a current representation of 43 genera in 28 families (Robinson et al., 2008). This report contributes an additional genus (*Ixonanthes*) and its respective family (Ixonanthaceae) to the list. Barlow (1982) stated that the larvae of *Eupterote asclepiades* are polyphagous and provided a brief written account. In Singapore, the diagnostic larvae of either *Eupterote asclepiades* or *Eupterote naessigi* have yet to be encountered. It is hoped that future field studies may yield answers as to their comparative larval morphology and preferred hostplants.

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