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## Short Notes

### **An observation on the ecology and behaviour of *Metallyticus splendidus* on a dead dipterocarp tree in Sabah, Malaysia (Mantodea, Metallyticidae)**

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### **Abstract**

*Metallyticus* is a genus of rare mantids, occurring mostly in SouthEast Asia. Five species have been described. However, their ecology and behaviour remain virtually unknown. In this study, we describe a small population of *Metallyticus splendidus* Westwood, 1889 on a dead dipterocarp tree standing in disturbed tropical rainforest around Danau Girang Field Centre, Sabah, Malaysia. At dawn, in the afternoon and at night, four individuals, two adults and two nymphs, were monitored. Our findings confirm earlier behavioural observations: they hold their bodies flat when running. We did not observe any lurking behaviour: the mantids were walking fast across the tree stem and in tree holes. *M. splendidus* was found at dawn, in the afternoon, and at night only on this single dead tree in a plot of 50 X 50 m. This suggests that *M. splendidus* is day and night-active and that its habitat is restricted to dead standing trees. We failed to find other individuals on other dead as well as living trees. Our findings show that the habitat of *M. splendidus* could be restricted to large dead trees, giving novel insights into the ecology of Metallyticidae.

**Keywords:** *Mantodea, mantis, Metallyticus, rainforest, ecology*

## Introduction

*Metallyticus* Westwood, 1835 is the only genus within the family Metallyticidae (Mantodea) and occurs mostly in Southeast Asia (Giglio-Tos 1927, Wieland 2008; Patel & Singh, 2016). The genus can be easily recognized by some autapomorphies among extant mantids, such as iridescent body coloration and the enlargement of the first posteroventral spine of the fore femora (Wieland 2008, Brannoch et al., 2017). Five species have been described (Wieland, 2008). However, their ecology and behaviour remain poorly known (Patel & Singh, 2016). Little research has been conducted on *Metallyticus*, with only a single recent synopsis on the genus having been published, combining earlier observations and collected specimens (Wieland, 2008).

In the early 20th century, Robert Walter Campbell Shelford described *Metallyticus* behaviour (Shelford, 1903). Shelford described that *Metallyticus* species live on tree bark where they hunt cockroaches. Unlike other mantis species, their bodies lie flat against the substrate when running. He also stated that these species can run fast and, unlike other mantids, are probably hunters rather than lurkers. However, relevant information, such as its natural habitat as well as the composition of the vegetation, were not described properly. There are, however, other descriptions of its habitat and exhaustive, long-term observations of this species under artificial conditions (Schütte et al., 2013; Schwarz, 2018). Both articles suggest that *M. metallyticus* thrives both on dead as well as living trees. To confirm these findings, more research is needed on *Metallyticus* ecology and behaviour to confirm his observations and provide new insights.

In this study, we examined a small population of *Metallyticus splendidus* Westwood, 1889 on a dead dipterocarp tree standing in disturbed tropical rainforest around Danau Girang Field Centre, Sabah, Malaysia. At dawn, in the afternoon and at night, four individuals (two adults and two nymphs) were monitored. Additionally, we identified all plant species present in a 10 X 10 m plot around the tree. Our results show that *M. splendidus* is day- and night-active. The habitat of *M. splendidus* could be restricted to large dead trees, a fact not previously known for Metallyticidae.

## Materials and Methods

On a dead dipterocarp tree within a 50 X 50 m plot (5° 24'50.6"N 118° 02'21.8"E) in seasonally inundated riverine forest in the lower Kinabatangan Valley, the *Metallyticus* mantids were caught using insect nets as well as by hand. All

individuals were measured with a caliper and recognized individually by length. From all plants in a 10 X 10 m plot with the tree at its center, branches with leaves were collected, imaged at 1200 dpi and later identified using specimens in the herbarium at Naturalis Biodiversity Center.

## Results

### *Description of the habitat*

All individuals were found on a dead *Vatica rassak* Blume of approximately 9 m tall (Figure 1). The diameter at breast height (dbh) was 82 cm. The wood was dry with various holes presumably made by insect larvae. The core of the tree, which had rotted away, was not examined for mantids and other insects, since we lacked the proper equipment.

To examine the habitat, all plant species were identified in a plot of 10 X 10 m with the tree at its center. The following plant species were found: *Dalbergia ferruginea* Roxb. (Fabaceae), *Dillenia excelsa* (Jack) Martelli ex Gilg. (Dilleniaceae), *Helminthostachys zeylanica* (L.) Hook. (Ophioglossaceae), *Crateva religiosa* G.Forst. (Capparaceae), *Nauclea orientalis* (L.) L. (Rubiaceae) and *Lygodium salicifolium* C.Presl (Schizaeaceae). The tree was surrounded by tall dipterocarp trees (*Dipterocarpus* C.F.Gaertn. and *Vatica* L.) with buttress roots.



**Figure 1.** The habitat of *Metallyticus splendidus* near Danau Girang Field Centre. 1: The *Vatica rassak* (Korth.) Blume tree all mantids were found on. 2: The other side of the dead tree. 3: *M. splendidus* individual 3 on the tree (center of the image). 4: Some of the holes the dead tree was riddled with.

### Description of individuals

In all individuals, the coxae of the raptorial forelegs were metallic green and the alae were smoky, concluding all were *M. splendidus* according to a key to the species by Giglio-Tos (Giglio-Tos, 1927; Wieland, 2008). To reduce ecological impact, the animals were not harvested for collections or identifications. Instead, identification and measurements of the head-to-abdomen length were performed near the tree (Table 1), and the animals were released afterwards. Pictures of the individual mantids are shown in Figure 2.



Figure 2. Total of *M. splendidus* individuals found. Individuals 1 and 2 are juveniles. Individuals 3 and 4 are adult females.

Table 1. Measurements and sightings of the *M. splendidus* individuals. Individuals 1 and 3 were seen at all three points of time. Individuals 2 and 4 were not seen during the night.

	Individual 1	Individual 2	Individual 3	Individual 4
Head-to-abdomen length (mm)	19.6	20.8	25.9	31.0
Stage	nymph	nymph	adult	adult
Seen at dawn (9:00)	yes	yes	yes	yes
Seen in the afternoon (15:00)	yes	yes	yes	yes
Seen at night (21:00)	yes	no	yes	no

### Behavioural observations

As shown in Table 1, *M. splendidus* was found at dawn, in the afternoon, and at night. The mantids were not seen on the ground, but only at a tree height between 1.5 and 3 meters on bark. When running, their bodies were held flat against the tree surface, unlike other mantis species. We did not observe any lurking behaviour. When approached, most individuals tried to run away fast. No individuals were found on other trees in the forest, even though we worked in a 50 X 50 m plot (on a different research project) for 22.5 hours during 2 consecutive days.

## Discussion

We observed the same behaviour described by Shelford (1903). *M. splendidus* was found on tree bark. Since we did not find any cockroaches, we did not observe hunting behaviour. Unlike other mantis species, their bodies were held flat against the substrate when running. We did not observe lurking behaviour. This partly contradicts captive observations of *M. splendidus*, where individuals were mostly hiding in crevices, and also lurking there for prey during the day (Schwarz, 2018). However, we did not examine the crevices on the dead trees. Earlier observations gained so far show that *M. splendidus* indeed lurks for prey, darting out of crevices when a prey approaches (Schwarz, 2018). When *M. splendidus* leaves its shelter, predation might not be the primary goal since its striking colours could easily attract predators.

*M. splendidus* could be found at dawn, in the afternoon and at night only on the single dead tree in a plot of 50 X 50 m. This suggests that *M. splendidus* is day and night-active and that in this specific habitat is restricted to dead standing trees. Other observations, however, point out that *M. splendidus* does not only live on dead standing trees, but that it inhabits the trunk of larger dipterocarp living trees as well (Schütte et al., 2013; Schwarz, 2018). *M. splendidus* seems to have a preference for older, bigger trees with a relatively smooth surface, since they like to hide in the cavities formed by crippling of the bark (Schütte et al., 2013). The bark breaks or cripples only after the tree reaches a certain age, restricting habitat of *M. splendidus* presumably to older, larger trees.

We did not find individuals in other dead trees nor did we find them in living trees. A possible explanation for not finding individuals on other dead standing trees could be that the *M. splendidus* as well as dead standing trees were both scarce in the area where we performed our research. Additionally, *M. splendidus* often hide in cavities and other holes formed in the trunk of trees and only hunt for a short period (Schwarz, 2018). The absence of *M. splendidus* on living trees could be explained by the absence of a tree species that satisfied their preferences or that *M. splendidus* could inhabit higher parts of the trunk. This remains to be tested. Therefore, we suggest that the natural habitat of *Metallyticus splendidus* seems to be restricted to dead trees with prey animals that feed on dead wood, such as cockroaches and termites. We would also like to point out that the quick behaviour, size, and metallic colours may allow *Metallyticus* to mimic *Ampulex* wasps, which are predators of cockroaches, a finding which has been postulated by Schwarz (Schwarz, 2018). However, this remains to be further investigated. The fact that we found multiple individuals on a single tree appears contradictory to the lifestyle of many mantis species,

which tend to be cannibalistic (Lawrence, 1992). This may suggest that *Metallyticus* is a non-cannibalistic mantis. For further research, we suggest long-term monitoring and observation of this or similar *Metallyticus* populations.

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### Author contributions

Maarten Lubbers and Sofie Hovius conducted behavioural experiments, measurements and tree measurements. James Byng identified all the plant species in the 10 x 10 m plot to species level. Menno Schilthuizen helped to identify the individual mantids to species level. Rayzigerson Rodney Chai provided feedback to the manuscript.

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