

First record of marine wood borer (Mollusca: Teredinidae) *Dicyathifer mannii* Wright (1866) in Sabah, Malaysia, with detailed measurement metrics

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Abstract

The present study describes the new record of *Dicyathifer mannii* under the family Teredinidae Rafinesque, 1815. Sampling was conducted in the mangrove area of Kuala Penyu and sample was collected from dead wood debris. The pallets of *Dicyathifer* is half-conical in shape and 8mm in length. The cone measured 3.9mm in length and 3.6mm in width. The cavity is 1.2mm deep; the curve of the opening on the cone is about 98% of the depth of the cone. Inside the cone cavity, from the center, a ridge with rib-like feature runs down the length of the cavity. Only one species of *Dicyathifer* is recorded and the present species is the first new record described in Malaysia with some additional measurement metrics for future taxonomic identification purposes.

Keywords: Teredinidae, *Dicyathifer*, Measurements, Sabah, Description

Introduction

The first occurrence of *Dicyathifer* was reported by Wright E.P. in 1866 and the species identified was *Dicyathifer mannii*. In 1936, another new species, *Dicyathifer caroli*, was described by Iredale which was later determined to be synonym of *D. mannii* in 2010. Distribution of *D. mannii* had been documented worldwide: Australia (Felbeck, 1990; Brearley et al., 2003; MacInTosh et al., 2012), India (Nair, 1992), Singapore (Tan and Woo, 2010), Indonesia (Mushlich and Rulliaty, 2010), United Kingdom (Shipway, 2013), and Malaysia (Yahya and Lai, 2004).

Several studies related to shipworms conducted in Malaysia, mostly covered the distribution and ecological aspects. Tan (1970) and Chong (1979) discovered that *Teredo* and *Bankia* were the two most common genera found in marine and brackish waters of Malaysia, while Singh and Sasekumar (1994) focused on the distribution of wood borers in Lumut, Perak, followed by Yahya and Lai (2004) in Blunpei Bay Mangrove Area, Sarawak. Lately, the research scope shifted towards the resistance of five different mangrove tree species to marine wood borer attacks (Roszaini and Salmiah, 2014).

Although several ecological studies have been conducted in Malaysia, yet the database on the morphological descriptions of the species for taxonomic identifications in the region is still limited. Although the pallet of the specimen is similar in most species belonging to the same genus but it still shows slight differences as

mentioned in the work of Turner (1966). No detailed measurement metric was mentioned in some of the previous studies causing problems on the morphological comparison between the species. Due to the limited literature and proper taxonomic metrics on the existing species of marine wood borer in the region, it placed researchers in a dilemmatic situation in the species identification. Hence, the present study was undertaken to describe the new record of *D. mannii* under the family Teredinidae Rafinesque, 1815 in Sabah with some detailed measurements on the pallet. This will help in providing the standard measurement metrics for future taxonomic studies.

Materials and Methods

Specimen was collected from dead wood debris found in the mangrove area of Kuala Penyu, Sabah (5°31'49.70"N, 115°41'20.11"E) on 10 March 2019 (Figure 1). Collection of the specimen was carried out by splitting the wood bit by bit and extracting it from the exposed wood of *Rhizophora* sp. The sample was fixed in 10% formalin. The pallets and shells were digested in 10% Hydrogen Peroxide to dissolve any residual organic matter so as to clearly observe the features. The specimen was sorted by examining the shape and features of the pallet. The pallets were then examined under a stereo microscope (Olympus SZ61) with camera attachment (Xcam Alpha 61) and the measurements were carried out using computer software (analySIS getIT and MeasureIT). The measurement metrics are described in Table I. Drawings were produced using computer software

(Adobe Photoshop CS6). All units of measurement are in cm for the specimen and in mm for the pallet. Identification of species was carried out using the work of Turner (1966) and World Register of Marine Species (WoRMS) as reference.



Figure 1. Map of study site showing sampling location.

Taxonomic classification

Class Bivalvia

Order Myida

Family Teredinidae Rafinesque, 1815

Teredinidae possesses greatly reduced shells at the anterior end, specialized organs called pallets at the base of the siphons and a long worm-like body. The pallets of shipworms are unique among the genera with some exceptions. The identification of species is carried out primarily from the features of the pallets (Turner, 1966). However, when a species has pallets with features similar to that of another genus, dissection of specimen is carried out for comparing the differences and deciding on its genus.

Genus *Dicyathifer* Wright, 1866

The pallet of *Dicyathifer* is half-conical in shape. The tip of the cone has an opening at the front which reveals almost the entire inner layer of the pallet. At the center of the back wall is a ridge with rib-like features that lines the whole length of the opening. The siphons are short and separated and the gills stretch from the base of the siphon to half of the animal's length where the gonad is attached to it. *Dicyathifer* and *Kuphus* have strong similarities between their pallets (Figure 2). However, the feature that differentiates is the muscular collar surrounding the shells (Turner, 1966). Internal anatomy of the genera has noticeable differences; the gills of *Kuphus* stretch to almost the whole body length while in *Dicyathifer* they only reach half of the body length. The gonads in *Kuphus* is small and located at the right side of the stomach while *Dicyathifer* is large and posterior to the digestive glands (Turner, 1966).



Figure 2. Pallets of *Kuphus polythalamia* (left) (modified from Shipway et al. 2018) and pallet of *Dicyathifer mannii* (right). Present scale bars: A,B = 5mm.

Dicyathifer mannii

(Table I; Figures 3-6)

Dicyathifer mannii has the pallet that is similar to that in *Kuphus* but there is a marked difference in length of the gills. From the work of Turner (1966), it is obvious that the genus *Kuphus* has much longer gills that spans to about 90% of the total body length while the genus *Dicyathifer* has gills extending up to about 50% of the total body length. Another distinct feature is the size of the gonad and anal cavity in *Dicyathifer*. These structures are clearly visible in this species whereas in *Kuphus* they are hardly visible. The siphons of *Kuphus* appear to be longer than those of *Dicyathifer*.

Description of specimen

Holotype, the total body length of the specimen is 88mm in length. Siphons of the specimen are separated and are 50mm in length (Figure 3). The gills are 38mm in length, broad, flattened and extend to almost half of the body length (Figure 3). The gonads (white) are attached to the gills and the anal canal (black) and positioned above the gonads (Figure 3). The measurements taken for the specimen are listed (Table I).

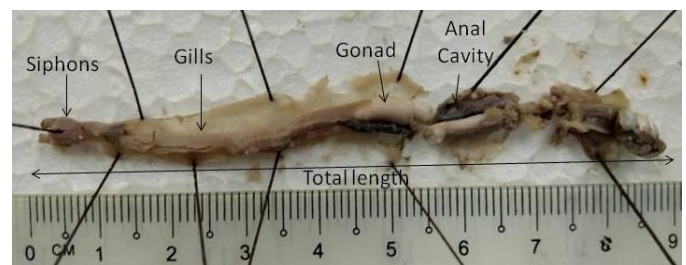


Figure 3. Photo of specimen *Dicyathifer mannii* with labels, ruler is used to scale.

Table 1. Measurements on the specimen *Dicyathifer manni*.

	Specimen (cm)	Gill (cm)	Siphons (mm)	Pallet (mm)
Total length	8.80	3.80	50.00	8.00
Stalk length	-	-	-	4.10
Stalk width	-	-	-	0.40
Cone length	-	-	-	3.90
Cone width	-	-	-	3.60
Cone depth	-	-	-	1.20

Pallet features

The pallet of genus *Dicyathifer* is half-conical in shape and 8mm in length. The cone itself measures 3.9mm in length and 3.6mm in width (Figure 4). The cavity is 1.2mm deep; the curve of the opening on the cone is about 98% of the depth of the cone (Figure 4). Inside the cone cavity, from the center, a ridge with rib-like feature runs down the length of the cavity (Figure 4). Both the cone and stalk have similar length. The stalk of the pallet is 4.1mm with a width of 0.4mm (Figure 4). List of measurements for the pallet are listed (Table 1).

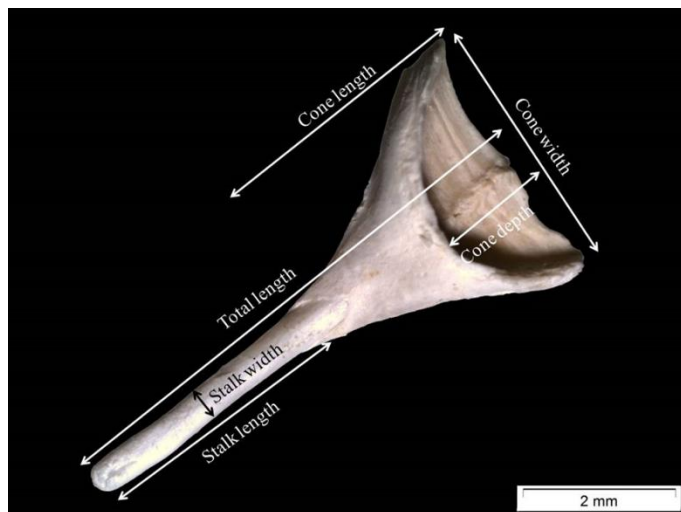


Figure 4. Pallet of *Dicyathifer manni*.

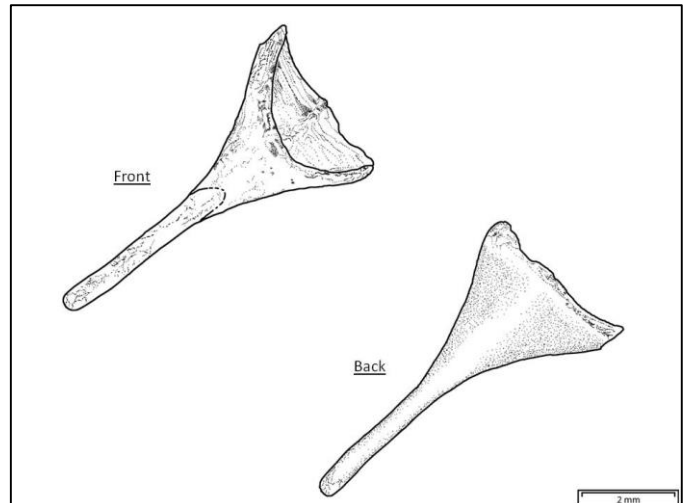


Figure 5. Front and back view of the pallet of *Dicyathifer manni*.

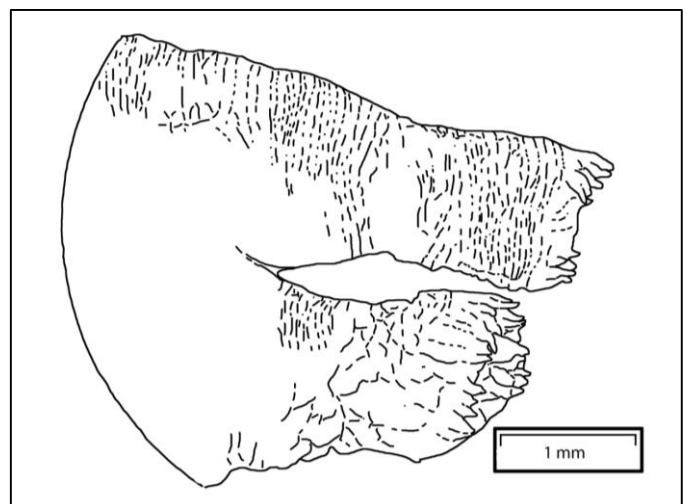


Figure 6. Magnified view of the siphons of *Dicyathifer manni*.

Conclusion

Dicyathifer is the first new record from Malaysia. The measurement metrics provided will help in future taxonomic identification.

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