



New distribution record of the soldier crab, *Dotilla myctiroides* (Milne-Edwards) from Lubuk Damar Coast, Aceh Province, Indonesia

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Abstract. *Dotilla myctiroides* was collected in the sandy beach area of Lubuk Damar, Aceh Tamiang, Aceh Province - Indonesia. Along the coast was covered by mangrove vegetation, such as *Aegiceras floridum*, *Excoecaria agallocha*, *Bruguiera sexangula*, *Xylocarpus granatum*, *Rhizophora apiculata*. This paper was aimed to firstly report on the presence of *D. myctiroides* (Milne-Edwards) from the study site. This animal has a distinctive behavior to dig burrow and produces ball-like pellets from the sand of its burrow. The specimens were collected by hand, and preserved in 96% alcohol. In laboratory specimens were identified morphologically and genetically. Identification of species morphology is supported by molecular analysis with the 16S rRNA gene. The mean value of carapace length, carapace width, and weight of all specimen are 1.097 cm, 0.988 cm, 0.902 g, respectively. The sediment of habitat consists of 68% sand, 23% silt, and 9% clay.

Key Words: first record, bubbler crab, Decapoda, molecular analysis, mangrove ecosystem.

Introduction. Genus *Dotilla* Stimpson, 1858 (Kemp 1919; Tweedie 1937; Vogel 1983) is a member of subfamily Scopimerinae and order Decapoda. Several studies proved that this genus lives in muddy or sandy beach in the Indo-Pacific (e.g. Hartnoll 1973; Maitland 1986; Bradshaw & Scoffin 1999; Gherardi & Russo 2001; Takagi et al 2010; Padate et al 2015). In addition, Vogel (1984) asserted that they live in the tropics and subtropics of the east coast of Africa to the Philippines and Australia. Dotillids are commonly called as sand-bubbler crabs (Maitland 1986; Takagi et al 2010). This crab is a deposit feeder (Gherardi et al 1999; Gherardi et al 2002; Lee & Lim 2004) and has a unique behavior by digging sand in the burrow and throwing the sand out as sand balls (Lee & Lim 2004; Allen 2010; Allen et al 2011). Such behavior renders the dotillids to be an important ecological bioturbators in intertidal area.

In Lubuk Damar beach, Aceh – Indonesia *Dotilla* could be found only in region covered by mangrove vegetation such as especially *Aegiceras floridum*, *Excoecaria agallocha*, *Bruguiera sexangula*, *Xylocarpus granatum*, and *Rhizophora apiculata*. Interestingly, a large number of dotillids on the beach made the area gray and orange. *Dotilla* mostly emerge during low tide and is only found at a distance of 100 m from the coastline to lowerpart of the intertidal area.

A number of studies on Indonesian decapods have been reported (e.g Lemaitre 1997; Rahayu 2000; Rahayu & Ng 2000; Rahayu & Davie 2002; Rahayu & Hortle 2002;

Komai & Rahayu 2004; Ng & Clark 2008; Rahayu & Nugroho 2012; Anker et al 2014; Susanto & Irnawati 2014; Ardika et al 2015; Hamid & Wardiatno 2015, 2018a, 2018b; Mashar et al 2015; Mashar & Wardiatno 2016; Wahyudin et al 2016; Wardiatno et al 2016a, 2016b, 2016c; Murniati 2017; Pramithasari et al 2017; Pertiwi et al 2018; Hamid & Wardiatno 2018a, b), but only two researchers wrote about the existence of Dotillidae in Indonesia, i.e. in Perancak Jembrana Bali (Indarmawan & Manan 2011) and in the estuary of mangroves in the eastern part of Lombok Island (Murniati 2017).

Biological information of some dotillid species have been informed from all over the world, for instance distribution and behavior (Hartnoll 1973), population ecology and biology (Fishelson 1983), distribution and shape of burrows (Matsumasa et al 1992), physiological adaptation to the burrows (Takeda et al 1996b), first occurrence (Allen 2010), food sources and subsequent roles in organic matter cycle (Takagi et al 2010), feeding behavior (Bulcao & Hodgson 2012), distribution, population structure and morphometric characters (Sharifian et al 2017), and social behavior (Wada 2018).

The aim of this paper was to inform the occurrence of *Dotilla myctiroides* from mangrove ecosystem located in Lubuk Damar, Aceh Province – Indonesia as new distribution record in the country. The report enhances the occurrence list of decapod crustaceans and enriches the marine biodiversity lists of Indonesia.

Material and Method

Description of the study site. Twenty-three of dotillid specimens were obtained on January 2017 from mangrove ecosystem in Lubuk Damar, Aceh Tamiang, Aceh Province – Indonesia; situated at 98°15'27.16" E and 4°17'38.73" N (Figure 1). All specimens were collected by hand and preserved with alcohol 96%. Morphology and molecular identification works were conducted in Biomicro- and Aquatic Biology Molecular Laboratory, Department of Aquatic Resources Management, Faculty of Fisheries and Marine, Bogor Agricultural University. Morphological picture of the specimens was taken by the camera of Canon Power Shot D30 and stereo microscope Olympus type SZ61. Substrate sediment sample was taken from the surface of substrate for substrate analysis. Substrate analysis was conducted in Soil Laboratory, Faculty of Agriculture, University of Syiah Kuala, Aceh.

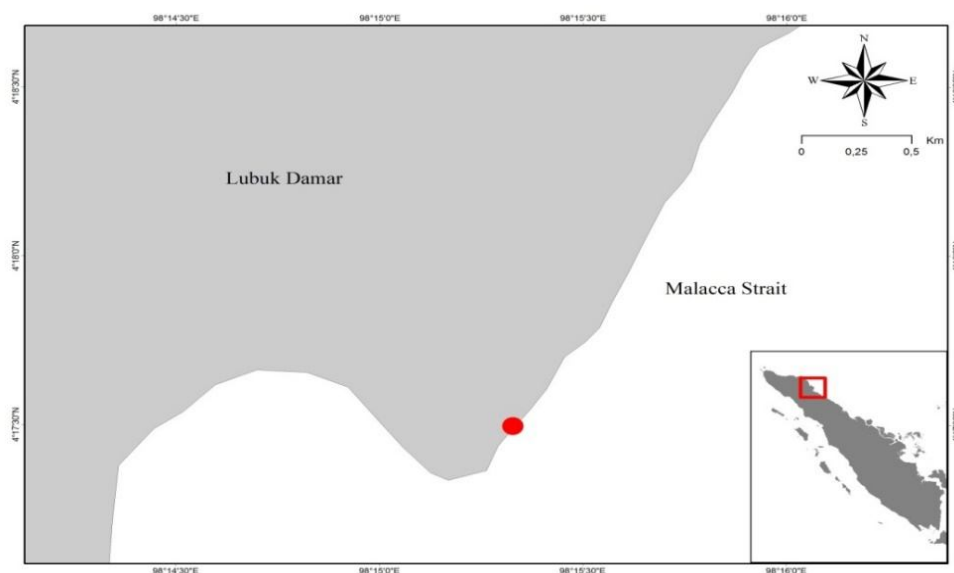


Figure 1. The location of *Dotilla myctiroides* specimen collection as indicated by red circle in a mangrove ecosystem located at Lubuk Damar, Aceh Province – Indonesia.

Identification based on morphological characters was done according to descriptions by Kemp (1919) and Padate et al (2015). Molecular analysis was conducted by 16S rRNA gene sequences. DNA was extracted from tissue following manual protocol of DNA Extraction Kit (Gene Aid) with some modification. Amplification was conducted by

Polymerase Chain Reaction (PCR) with a commercial kit (Kapa Extra HotStart). Total PCR products were 25 μ L with composition 4.5 μ L of ddH₂O, 12.5 μ L of Buffer Taq DNA Polymerase, 1.5 μ L of each primer (10 pM), and 4 μ L of DNA template. The primer of 16S rRNA was designed by Dr. Nurlisa Alias Butet (2013, unpublished). The PCR performed initial denaturation at 94°C for 5 min, followed by 35 cycles of denaturation at 94°C for 45s, annealing at 46°C for 1 min, elongation at 72°C for 1 min, with post-elongation 72°C for 5 min. The PCR product was visualized by electrophoresis on a 1.2% agarose gel. The PCR products with good quality were sequenced using Sanger et al (1977) method. Sequence was edited and created a phylogeny tree with Mega 5 software.

Results and Discussion

Taxonomy. The classification of the soldier crab (*Dotilla myctiroides*) is as follows:

Phylum Crustacea

Class Malacostraca

Order Decapoda

Family Dotillidae Stimpson, 1858

Genus *Dotilla* Stimpson, 1859

Dotilla myctiroides (Milne-Edward)

Material examined. In this study twenty-three male specimens were collected for describing and examining of the species.

Description. *Dotilla* has a rounded/oval body shape which has almost the same length and width. Previous studies by Maitland (1986) and Padate et al (2015) indicated that the size of the genus is small, and the body is a round shape. Dorsal part of the body is without sculpture. Natural color the specimen in the original environment is grayish and brown (Figure 2). The color of the body is gray-blackish with a yellow-orange claw, even after being preserved in alcohol 96% (Figure 3). *D. myctiroides* has four pairs of road legs. This type has a short antenna with orange to brown color with elongated brownish-black eyes.

Measurement. The sample in Figures 2 and 3 have the carapace length 1.16 cm, carapace width 1.11 cm, and weight 1.0468 g. The mean value and range of carapace length, carapace width and weight of the whole collected specimens are as follow: (1.097 cm; 0.42-1.29 cm), (0.988 cm; 0.39-1.11 cm), and (0.902 g; 0.058-1.118 g), respectively.



Figure 2. *Dotilla myctiroides* off mangrove ecosystem in Lubuk Damar, Aceh Province - Indonesia in its original habitat: (a) the crab digging up burrows, and (b) the crab on the surface of substrate.



Figure 3. A specimen of *Dotilla myctiroides* collected from mangrove ecosystem in Lubuk Damar, Aceh Province - Indonesia: (a) dorsal view and (b) ventral view.

Molecular identification. Species validation tests were conducted based on nucleotide sequences showed that the samples were close to *Dotilla myctiroides* (LC150395.1). These results supported and strengthened morphological identification. The specimen of *D. myctiroides* with access code of LC150395.1 originated from Singapore (Shih et al 2016). The species similarity was 97% and indicated that there were differences in nucleotide base composition between Aceh and Singapore. So, 15 nucleotide bases became the identifier of this species in Indonesia. The use of 16S rRNA gene as a marker successfully supported and strengthened morphological identification. The sequences of *D. myctiroides* from this study had been submitted to NCBI with access code of MK055335.

The sequences of this species was aligned with another crabs 16S rRNA gene sequences to construct phylogenetic tree. The 16S rRNA gene sequences was obtained from GenBank, i.e. same species (*Dotilla myctiroides* LC150395.1), genus *Charybdis* and *Portunus* (Figure 4). The phylogenetic tree based on Neighbor-Joining tree showed that *D. myctiroides* from this study and *D. myctiroides* from GenBank has the nearby genetic distance so they have the closest branch. There were two subclades, consist of Dotillidae clade and Portunoidea clade.

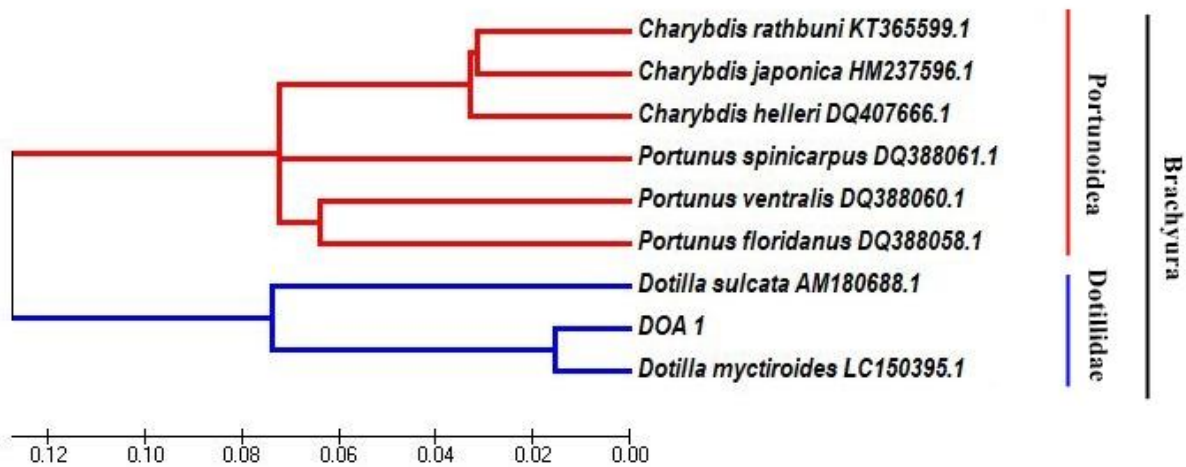


Figure 4. Phylogenetic tree of some crabs using Neighbor-Joining method based on 16S rRNA gene.

Remark. This paper present a new report of *Dotilla myctiroides* (Milne-Edwards) in morphologically and molecular approach, and firstly reported from Aceh region, Indonesia.

Ecology. The habitat of this species was sandy beach with the percentage of a fraction was 68% sand, 23% silt, and 9% clay. Of the 68% sand was from the fraction of 0% very coarse sand, 0.18% coarse sand, 17.85% medium sand, 45.39% fine sand and 4.58% very fine sand. A dominant particle of sand is fine sand with the diameter of particle 0.125-0.25 mm. From the sediment analyses, it can be concluded that *D. myctiroides* at the study site had preference of habitat with sand higher than silt and clay. This is similar to findings by Ali & Cakraborty (2015) who found the location of *D. myctiroides* in Mumbai, India consists of medium to fine grade sand. The density of this species at the study site was 56 ind m⁻² (Ananingtyas S. Darmarini 2018; unpublished data). The density of *D. myctiroides* in Lubuk Damar is more than that of *D. sulcata* in Oman estuarine (39 ind m⁻²) (Clayton & Al-Kindi 1998) and in Mumbai India (38-40 ind m⁻²) (Ali & Chakraborty 2015).

During low tide, *D. myctiroides* was actively performed bioturbation activities such as digging down the sandy unique burrows (Takeda et al 1996b; Padate et al 2015), and throwing out of unwanted sediment as sandy balls (pellets) to the sediment surface. This activities is believed to be related to food searching (Hartnoll 1975; Lee & Lim 2004). The size of pellets (sandy balls) are closely related to burrow diameters and the crab size (Lee & Lim 2004).

Distribution. The occurrence of *D. myctiroides* at the location extends the distribution of the species in global map. Previously, *D. myctiroides* was reported to occur in West Malaysia (Hails & Yaziz 1982), Negeri Sembilan, Malaysia (Takeda et al 1996b); Phuket Thailand (Takeda et al 1996a; Takagi et al 2010); Chilika lagoon, Orissa, India (Sahoo et al 2008); Puducherry coast, India (Varadhajaran et al 2013); and Goa, India (Padate et al 2015). Other species from the same genus were reported as follows: *D. malabarica* in Mahe, India (Vogel 1983), *D. intermedia* in Burma (Chopra & Das 1936), Chilika lagoon, Orissa, India (Sahoo et al 2008), Thailand (Allen et al 2011), Gujarat-India (Pandya & Vachrajani 2013), *D. fenestrata* in East African shores (Hartnoll 1973), Kenyan coast (Ruwa 1990), Kenya (Gherardi & Russo 2001) and Southern Mozambique (Litulo et al 2005), *D. sulcata* in Oman (Clayton & Al-Kindi 1998), *D. pertinax* in Chilika lagoon, Orissa, India (Sahoo et al 2008), *D. wichmanni* in Peninsular Malaysia (Luschi et al 1997) and Soc Trang, Hanoi (Khac et al 2012), and *D. blanfordi* in Oman Iran (Fatemi et al 2011).

Conclusions. The occurrence of *D. myctiroides* was first reported in Lubuk Damar, Seruway sub-district, Aceh Tamiang, Aceh Province. This report will add information about the existence of the species in Indonesian waters and the morphological identification is supported by molecular analysis to ensure *D. myctiroides* existence.

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