

Diversity, systematics and phylogeny of dotillid crabs (Crustacea: Brachyura: Ocypodoidea: Dotillidae) in the Indonesian Archipelago

DEWI CITRA MURNIATI

Introduction and purpose

Dotillidae, also known as dotillid crabs, inhabited intertidal area, have small carapace sizes, plays important roles in ecosystem, and some species display waving behavior. This crab is a burrowing and deposit feeder that prefers sandy or muddy substrata. In total, there are 67 species of Dotillidae in the world. In the present study, I provide the biosystematics of dotillid crab in Indonesian Archipelago, including: 1) diversity, distribution, and morphological identity, 2) morphology of teeth of the gastric mil, 3) genetic structure, and 4) recognition of new species.

Material and Methods

Specimens used in the present study originally from three sources, i.e., 1) reference collection of Museum Zoologicum Bogoriense (MZB) (Indonesia), Osaka Museum of Natural History (OMNH) (Japan), Naturalis Biodiversity Center (The Netherlands), and Lee Kong Chian Natural History Museum (LKCNHM) (Singapore), 2) grant from colleagues, 3) fieldwork conducted from May to September 2020 in Java and Sulawesi, and on June 2021 in Sulawesi. Outer morphology was examined for each species, and additionally gastric mills were observed, which is structure consisting of several ossicles, including median and lateral teeth plate. DNA analysis was also made for the sequences of 16S and COI genes, with analysis using MEGA, Mr. Bayes, DNASP v6.12.03, and Network 10.2

Results

1) Integrative diversity

In Indonesia, there are 12 recorded species of dotillid crabs from coastal areas, i.e *Dotilla myctiroides* (H. Milne Edwards, 1852), *D. wichmanni* de Man, 1892, *Ilyoplax delsmanni* de Man, 1926, *I. dentata* Ward, 1933, *I. integra* Tesch, 1918, *I. logicarpa* Tweedie, 1937, *I. pacifica* Kitaura & Wada, 2006, *I. strigicarpus* Davie, 1990, *Scopimera gordonae* Serène & Moosa, 1981, *S. intermedia* Balss, 1934, *Tmethypocoelis*

ceratophora (Koelbel, 1897) and *T. liki* Murniati, Asakura, Nugroho, Hernawan, Dharmawan, 2022.

Differences between these species are distinctly shown by the characters of the carapace, male cheliped, and male gonopod. Each species has specific distribution area.

2) *Morphology of teeth of the gastric mill*

Species that inhabited sandy substrata had complex structures of teeth, meanwhile the species that inhabited muddy substrata had simple structures. Therefore, the teeth morphology of the gastric mill is correlated with habitat preference. The morphology of those teeth is species-specific hence this character is useful to distinguish species and cryptic species.

3) *Genetic structure*

In the present study, *Tmethypocoelis* aff. *ceratophora* was collected from Sumatra, Kalimantan, Java, Bali, Lombok, and Sumbawa. There is a distinct population separation into four, i.e., Sumatra, Kalimantan, Java-Bali, and Lombok-Sumbawa. This population break of intertidal crabs is driven by different currents of the Indonesian seas. The phylogenetic tree also confirms that *Tmethypocoelis* aff. *ceratophora* is in separate clade from *T. ceratophora* hence *Tmethypocoelis* aff. *ceratophora* is a different species from *T. ceratophora*. Eventually, phylogenetic tree and haplotype network confirm that the four populations are presumably four cryptic species.

4) *New species*

I recognized two new species, *Tmethypocoelis simplex* sp. nov. and *T. celebensis* sp. nov from Sulawesi that have conspicuously different morphology from each other and different from the congeners. The diagnostic characters are male chela, male gonopod (G1) and teeth of the gastric mill. In *Tmethypocoelis simplex* sp. nov. dactylus upper-margin of the chela has median row of granules, narrower distally matching shape of upper margin. Meanwhile in *T. celebensis* sp. nov. this character is with row of tubercles terminating with triangular upturned tooth subdistally. In *Tmethypocoelis simplex* sp. nov. G1 with apical portion consist

of 3 conspicuous curved setae on outer margin becoming slightly longer distally, 2 or 3 long setae apically, and 4 short setae on inner margin. Meanwhile in *T. celebensis* sp. nov. G1 is with 3 short setae on outer margin, 2 or 3 long setae apically, 4 or 5 short setae on mesial margin. Observation on median tooth of gastric mill shows that in *Tmethypocoelis simplex* sp. nov. the lateral margins of propyloric ossicle is evenly convex with slight truncation, meanwhile in *T. celebensis* sp. nov. it is quadrate with anterior lobes discrete, prominent and rounded. *Tmethypocoelis simplex* sp. nov. was recorded from the west coast and *T. celebensis* sp. nov from the east coast. The Makassar Strait and the Celebes Sea are to Sulawesi's west and east coasts, respectively. The sea currents from both channels are never mixed with each other hence this pattern has led to speciation of this sister taxa.

Discussion

In total, there are 14 species of dotillid crabs in Indonesia and 4 presumably cryptic species. The diagnostic characters that differ between the species are male cheliped and male gonopod. Another character that is newly recognized for distinguishing dotillid crab is teeth of the gastric mill. Each species also has a specific distribution area which is affected by the sea currents. Two species have a wide distribution area, i.e., *Ilyoplax strigicarpus* and *Scopimera intermedia*. Meanwhile, other four species recorded only from one locality. *Ilyoplax pacifica*, *Tmethypocoelis celebensis* and *Tmethypocoelis simplex* recorded from Sulawesi. In addition, *Tmethypocoelis liki* recorded only from from Papua.