

Genetic Analysis of Two Sympatric Sea Urchins from Genus *Diadema* (Echinodermata: Echinoidea: Diadematidae) from Malaysian Borneo

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ABSTRACT

Genus *Diadema* (Echinoidea: Diadematidae) has been reported to be the most widespread and ecologically important shallow water tropical sea urchins. Morphological variations and species distributions are complicated to elucidate due to complexity in making reliable identifications. Genus *Diadema* had involved in many debates, particularly on the mode of speciation and the specific status of *Diadema setosum* and *Diadema savignyi*. Therefore, relationships among *Diadema* species found in Malaysian Borneo have been examined using 16S rRNA gene analysis. Monophyletic clade of genus *Diadema* with respect to the outgroup was obtained with high bootstrap values of 100% (MP), 100% (NJ), 100% (ML) and Bayesian Posterior Probability is equal to 1.00. Two monophyletic clades were apparent separating *D. setosum* (Clade I) and *D. savignyi* (Clade II), with strong support of 100% (MP), 100% (NJ), 80% (ML) and Bayesian Posterior Probability is equal to 1.00. In addition, high genetic variation among species had been recorded (9.85%), suggesting that *D. setosum* and *D. savignyi* are two distinct entities. Furthermore, *D. setosum* and *D. savignyi* are sympatric species based on their distribution and overlapping ranges in Malaysian Borneo.

Keywords: *Diadema*, sympatric species, phylogenetic, 16S rRNA gene

INTRODUCTION

Genus *Diadema* had been reported to be the most widespread and ecologically important shallow water genera of tropical sea urchins (Lessios, 2001) by controlling the population of algae and maintaining the balance of food chain relationship. Distinctions in their distributions among species of genus *Diadema*, are complicated to elucidate due to complexity in making reliable identifications (Pearse, 1998). Their systematics and biogeography are enmeshed in uncertainty until study conducted by Mortensen (1940) appeared to stabilize the systematics of *Diadema*. There are eight species in genus *Diadema*: *Diadema*-sp, *D. mexicanum*, *D. antillarum*, *D. ascensionis*, *D. palmeri*, *D. paucispinum*, *D. setosum* and *D. savignyi* (Lessios, 2001). However, only two species *D. setosum* and *D. savignyi* (Figure 1) could be found in Malaysian Borneo (Rahim & Nurhassan, 2012).

D. setosum Leske 1778, is a long spine black sea urchin characterized by the unique morphology of orange anal ring, green bands of

iridophores down the midlines of interambulacra and five blue or white spots on the anal tube (Coppard & Campbell, 2006). This species possesses three to five tubercles along the inner edge of the genital plates and at larval stage, it has several long arms to funnel food particles and facilitate their movement (Yokota *et al.*, 2002).

On the other hand, *D. savignyi* Michelin 1845 is known as a black sea urchin, has shorter spine compared to *D. setosum* with bold pattern of iridophores on the aboral surface forming connecting lines rather than spots. It possesses black anal tube, distinct arch-shaped depression on the genital plate in adult form and the black test was distinctively horizontally circular with white line radiated out from the genital plates down the midlines of inter ambulacra (Coppard & Campbell, 2006). The naked median areas can be observed with small red or brown spot during the day and the spots will be seen larger in size at night as the chromatophores retracted and revealed the test (Coppard & Campbell, 2006).

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