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Phylogenetic Diversity of Organophosphorous Pesticide-Degrading Coral Bacteria from Mid-West Coast of Indonesia

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Abstract: The present study aimed to investigate the general insights into the diversity of the bacterial community associated with the corals which capable of degrading organophosphorous pesticide. The diversity of indigenous bacteria associated with corals from several sites in the Indonesia coastal waters able to degrade organophosphorous compounds (OPs) was investigated using of culture-based methods and molecular analyses. Twenty five strains among 103 isolates (24.36%) demonstrated their capability of degrading selected organophosphates (diazinon, chlorpyrifos, profenofos and ethion) as sole source of carbon and energy. A rapid grouping of the 25 selected isolates by using repetitive extragenic palindromic (rep)-PCR genomic fingerprinting with ERIC and BOXA1R primers was carried to estimate the richness of the isolates and 6 representative strains were examined further. Following partial sequencings of the 16S rDNA, it was shown that these strains belonged to three major groups of bacteria: (i) members of the division *Bacillus*, (ii) *Actinobacteria* and (iii) γ-Proteobacteria. Strain KM5, JM33, BM5, SB3, KF4 and BY6 were closely related to *Brachybacterium* sp., *Kytococcus* sp., *Brevibacterium* sp., *Chromohalobacter* sp., *Oceanobacillus* sp. and *Bacillus* sp., respectively. This study provides the first evidence of organophosphorous pesticide-degrading bacteria isolated from corals.

Key words: Coral, bacteria, degradation, organophosphorous, rep-PCR, 16S rDNA

INTRODUCTION

Coral reef is an ecosystem in the tropical ocean floor which has been built primarily by scleractinian corals and coralline algae, together with other commensal organisms including a variety of flatworms, polychaete worms, shrimps, crabs, brittle stars, molluscs and fish (Veron, 1986). About 85.707 km^2 or 14% of total corals in the world are extending all the way in the Indonesian sea (Tomascik *et al*., 1997). Some benefits have been provided by corals to fulfill the human life necessities, such as, drugs, mariculture and nutrients, spawning, nursery, feeding ground and growing place for school of fish and as barrier of coastal erosion (Sammarco and Coll, 1992; Ben-Haim and Rosenberg, 2004). It has commonly been known that in developing countries, reefs near coastal areas, are under serious stress from coral mining, cyanide, blasting and land pollution in particular agricultural runoff as the results of the application of pesticides to control the pests and weeds.

In Indonesia, the use of herbicides began in the 1960's when the government launched plantation rehabilitation programme. Due to the undesirable effects on environmental quality, the usage of organochlorine compounds was banned during the 1980s. Subsequently, organophosphates are being increasingly used to substitute for the organochlorines due to their rapid breakdown into environmentally safe products. However, most of these compounds have far more immediate toxicity than DDT and other related products (Wolterding, 1981). In most cases, when reefs are polluted and when the stress is severe or lasts long enough, the corals will die. Glynn *et al*. (1984) reported that herbicides killed corals at low concentration (0.02 mg L^{-1}) under brief exposure. In the previous study, Sabdono *et al*. (2007) reported that organophosphate compounds were detected in dead coral tissues.

It is well known that microorganisms attach firmly to almost any surface submerged in marine environments in which the cells grow, reproduce and produce extracellular polymers that provide structure to the assemblage termed as biofilm. Prokaryotes is believed as the most diverse component of coral reef communities (Rohwer *et al*., 2002). In addition, bacteria are abundant and active around and in the coral surface layer (Kushmaro *et al*., 1997). Furthermore, Kim (1994) mentioned that it is not surprised coral surfaces are often covered by microorganisms mostly are undestructive to corals.

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