

Bioethical Considerations on the Sustainable Use of Marine Invertebrates and their Microbial Symbionts in the Search for Marine Natural Products

Ocky Karna Radjasa

Coral reefs are the habitats of rare and, in some cases, endangered species and constitute important sources of biological diversity. Coral reefs are also extremely fragile habitats for unique species that are particularly sensitive to ecological changes.

Bioethical wisdom that combines ecological knowledge with a sense of moral responsibility for a livable world is what is needed at the moment. What we must do for the health and survival of the next several generations in a recovering biosphere is also what we must do for generations in the distant future.

The collection of marine organisms for the discovery and development of pharmaceuticals has been perceived variously as both sustaining and threatening conservation, especially regarding issues of over collection of target marine organisms for bioprospecting. (Hunt and Vincent, 2006). A further discussion of the protection and sustainability of coral reefs in regard to the use of reef invertebrates as sources of bioactive compounds was published by Sukarmi and Radjasa in 2007. It was noted that ecological ethics must be taken into account, especially in light of the importance of coral reefs for humans in tropical communities. There has been less attention given to the widening gap between the exploitation of marine organisms and its ethical implications. Thus, considering the bioethical perspective and finding alternative solutions to the supply problem for marine natural products produced by reef invertebrates must be given top priority and consideration.

Keywords: *Biotechics, sustainable, coral reefs, invertebrates, microbial symbionts, natural products*

Introduction

To date, the primary target for marine bioprospecting has been tropical seas. Coral reefs have been targeted for bioprospecting because they host a high level of biodiversity and are often characterised by intense competition for space, leading to a chemical warfare among sessile organisms. Coral reefs are some of the most productive ecosystems on earth, and are certainly the most productive and species-rich environments in the oceans.

One of the most serious bottlenecks in developing natural products from marine sources during the past decades has been the availability of biomass and/or of optimised cultivation conditions to gain sufficient amounts of substances for preclinical and clinical studies. It is also almost impossible to harvest such large amounts of organisms from nature without destroying the habitats (Raghukumar 2008). Further problems occur in scenarios in which aquaculture is seen as an alternative solution, but sufficient amounts cannot be produced due to low yield compared to wild samples of invertebrates (Munro et al, 1999). Because most of the macroorganisms contain a great variety and considerable amounts of associated microorganisms, the importance of studying the ability of these microorganisms to produce secondary metabolites is now recognised. This phenomenon has raised the importance of microbial symbionts of reef invertebrates as sources of secondary metabolites with diverse biological activities applicable for health and industrial purposes.

Bioethical and supply issues in utilizing marine invertebrates

It is important to note that, although marine invertebrates from coral reefs have shown promise in development of drugs from the sea, however the availability of source organisms in bulk is inevitably required for systemic development. Successful development of drugs from the sea, in particular those from reef invertebrates, is completely reliant on the availability of source organisms to provide a continuous supply of the targeted compounds when chemical synthesis cannot be developed or the aquaculture of the producing organisms does not produce similar compounds.

The collection of marine organisms for the discovery and development of pharmaceuticals has been perceived variously as both sustaining and threatening conservation, especially regarding issues of overcollection of target marine organisms for bioprospecting. (Hunt and Vincent, 2006). A further

discussion of the protection and sustainability of coral reefs in regard to the use of reef invertebrates as the sources of bioactive compounds was published by Sukarmi and Radjasa in 2007. It was noted that ecological ethics must be taken into account, especially in light of the importance of coral reefs for humans in tropical communities. There has been less attention given to the widening gap between the exploitation of marine organisms and its ethical implications.

A significant threat regarding the development of drugs from reef invertebrates (Sukarmi and Radjasa, 2007) and perhaps the most significant problem that has hampered the investigation of secondary metabolites produced by reef invertebrates, is their low concentration. In marine invertebrates, many highly active compounds contribute to $<10^{-6}$ % of the body-weight (Proksch et al, 2002). Hence, providing sufficient amounts of these biologically active substances may be a difficult task (Radjasa et al 2007).

Studies regarding screening on secondary metabolites-producing invertebrate-associated bacteria are important for understanding principal processes inhibitory interaction among invertebrate-associated bacteria as well as their biotechnological potentials. In this context, it is of importance to assess the application of sustainable approach on the screening of invertebrate-associated microbial populations with specific consideration of the secondary metabolites-producing part which has been up to now strongly neglected in comparison to the invertebrate parts (Radjasa and Sabdono, 2009).

Concluding remarks

Bioprospecting of reef invertebrates in an environmentally sustainable manner must be continued as part of exploring novel bioactive molecules with potential applications in health and industrial sectors. The bioethical aspect, however, must be given careful consideration in conjunction with conservation efforts of one of the most productive ecosystems in coastal areas.

The field study of marine microbial natural products from microbial symbionts of reef invertebrates is inchoate, but the growing and accumulating results have prompted the development of the under-utilized groups, marine actinomycetes and marine fungi, as sustainable sources of novel marine natural products with various applications. ■

References

- Hunt, Bob and A. C. J. Vincent. (2006). Scale and sustainability of marine bioprospecting for pharmaceuticals. *Ambio*. 35: 57-64.
- Moore, B.S., J. A. Trischman., D. Seng., D. Kho, P. R. Jensen., and W. Fenical. (1999). Salinamides, Antiinflammatory Depsipeptides from a Marine Streptomycete. *J. Org. Chem.* 64: 1145-1150
- Proksch P, R.A. Edrada, R. Ebel, (2002). Drugs from the seas-current status and microbiological implications. *Appl. Microbiol. Biotechnol.* 59:125-134
- Radjasa, O.K., T. Martens., H-P. Grossart., T. Brinkoff., A. Sabdono., and M. Simon. (2007). Antagonistic activity of a marine bacterium *Pseudoalteromonas luteoviolacea* TAB4.2 associated with coral *Acropora* sp. *J. Biol. Sci.* 7(2):239-246.
- Radjasa, O.K., and A. Sabdono. (2009). Bacterial symbionts of reef's invertebrates as a sustainable source of marine natural products. *Curr. Res. Bacteriol.* 2(1): 7-13.
- Raghukumar, C. (2008). Marine fungal biotechnology: an ecological perspective. *Fungal. Divers.* 31:19-35.
- Sukarmi and O.K. Radjasa. (2007). Bioethical consideration in the search for bioactive compounds from reef's invertebrates. *J. Appl. Sci.* 7(8): 1235-1238.

