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The role of marine plants in the restoration of the ecosystem of coral reefs after damage by natural influences

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The coral reef ecosystem is a collection of diverse species that interact with each other and with the physical environment. The latitudinal distribution of coral reef ecosystems in the oceans is determined by the seawater temperature, which influences the reproduction and growth of hermatypic corals; the main component of the ecosystem. Benthic algae are one of the most important components of reef ecosystems. Their role in healthy coral reefs is defined as primary production of organic matter and its turnover, the construction of reefs, nitrogen fixation, Marine initial link of food chains, environment for marine animals and protection of reefs against deleterious effects from surf. Severe physical disturbances such as typhoons/hurricanes/cyclones and tsunamis cause extensive damages in coral colonies. Coral bleaching is often caused by unusually high sea temperatures combined with periods of slack wind, calm seas, high solar radiation, leads to reduced photosynthesis, a tissue growth, calcification and subsequently to the death of corals. The mass mortality of corals under the influence of severe physical disturbances leads to disruption of the homeostasis of the ecosystem and at their frequent repetition to the destruction of coral reefs. The coral reef restoration can last for decades. Recovery of a coral reef hampers or contributes to a variety of abiotic and biotic factors. Many abiotic and biotic factors hinder or contribute to the restoration of coral reefs. In the report we discuss the possible role of benthic algae in the process of restoring coral reefs damaged by severe physical disturbances and for the first time expressed the hypothesis of their positive role in this process. We suggest that this is mainly achieved through the colonization of newly formed substrates by marine algae, with the following characteristics: (1) Maintenance of high ecosystem productivity through settlement of highly productive morpho-functional algal forms, (2) Protection of coral reef basis and newly formed carbonate substrata (dead coral colonies) from erosion and continuation of carbonate reef base building, (3) Colonization of vacant substrates by algae enhances the biodiversity of an entire reef assemblage, (4) Symbiotic relations between algae and corals also promote homeostasis and coral reef recovery in damaged reef systems through transport of assimilates from endolithic symbiotic algae to coral tissue, which intensifies during a bleaching episode or by coral digestion of own zooxanthellae that intensifies under extreme conditions, (5) Release of secondary chemicals by encrusting calcareous algae (or their bacterial biofilm) promoting planula settlement and growth on their surfaces, (6) Planulae and young colonies attached to calcareous algae at the base of algal turf are protected from predatory/grazing organisms and from desiccation and bleaching in the intertidal. Coral growth is enhanced by the accumulation of zooplankton and other organisms in algal turfs.

Biography

Eduard A Titlyanov, PhD is a Professor, an honored scientist of the Russian Federation. He is the author of more than 200 scientific papers and co-author of the books: 1. Ahnfeltia tobuchiensis: Biology, Ecology, Productivity (1993) [in Russian]; 2. Titlyanov E.A. Zooxanthellae of hermatypic corals: life strategy (1999) [in Russian]; 3. Marine plants of Asia-Pacific region countries, their use and cultivation (2012) [in Russian, descriptions of marine plants in English]; Marine plants of Trinity Bay and adjacent waters (Peter the Great Bay) (2013) [in Russian]; 4. Useful Marine Plants of the Asia-Pacific Region Countries (2016) [in Russian, descriptions of marine plants in English]; 5. Coral reef Marine Plants of Hainan Island (2017) [in English]. His current research deals with the study of the physiology, biochemistry and ecology of marine photosynthetic organisms. His more recent research has concentrated on floristic studies of the tropical and subtropical seas of the Pacific Ocean.

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