

专论与综述

珊瑚及共生藻在白化过程中的适应机制研究进展

李秀保^{1,2}, 黄晖^{1,*}, 练健生¹, 董志军¹, 黄良民¹

1. 中国科学院南海海洋研究所, 广州510301 2. 中国科学院海南热带海洋生物实验站, 海南 三亚572000

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摘要 珊瑚礁生态系统具有非常重要的生态学功能。但是随着全球气候变暖和CO₂浓度的升高, 珊瑚白化事件越来越频繁, 珊瑚礁生态系统面临严重的危机。影响珊瑚白化的重要因子主要有海水温度的异常(过高或过低), 太阳辐射与紫外线辐射, 海水盐度的偏离, 珊瑚疾病, 海洋污染, 长棘海星的爆发, 人类的过度捕鱼和全球CO₂浓度升高等。其中, 海洋表面水体温度(SST)的异常升高为珊瑚白化的主要因素。珊瑚主要是通过珊瑚与共生藻的生理适应机制以及更换共生藻基因型机制两种方式适应环境胁迫的。生理适应机制主要通过叶黄素循环、珊瑚色素荧光(热)、活性氧清除系统(自由基)、分泌紫外线吸收物质MAAs(紫外光)、产生热休克蛋白HspS(热)来实现的。珊瑚共生藻基因型更换适应机制是指珊瑚的适应性白化假说。珊瑚的适应性白化假说还有很多争议, 还需要更多的实验证据提供支持。未来的研究重点将在珊瑚白化过程中共生藻-珊瑚共生功能体作为整体性的研究, 尤其是珊瑚宿主在白化过程中对共生功能体作出贡献的研究。

关键词 珊瑚; 共生藻; 温度; 白化; 适应机制

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Progress of adaptive mechanism of coral and symbiotic algae during bleaching

LI Xi u-Bao^{1,2}, HUANG Hui ^{1,*}, LIAN Jian-Shen¹, DONG Zhi -Jun¹, HUANG Li ang-Mi n¹

1 South China Sea Institute of Oceanology, Chinese Academy of Science, Guangzhou 510301, China

2 Tropical Marine Biological Research Station in Hainan, Chinese Academy of Sciences, Sanya 572000, China

Abstract A coral reef ecosystem has important functions. It can provide marine life with habitat, protect coastlines from storm damage, erosion and flooding, and provide resources for tourism, construction materials, pharmaceuticals and other chemicals. But with the rise of global climate temperature and CO₂ concentration, coral bleaching has become more frequent and coral reef systems face more challenges. Factors which can cause coral bleaching include abnormal sea water temperature, solar and ultraviolet radiation, reduced salinity, coral disease, marine pollution, Crown-of-Thorns Starfish, over-fishing of marine species and the rise of global CO₂ concentration. Abnormal high Sea surface temperature (SST) is the key factor causing coral bleaching. Corals can adapt to environmental changes by two mechanisms: physiological acclimatization and exchange of symbiotic algae. The mechanism of physiological acclimatization involves the xanthophyll cycle, fluorescent coral pigments, oxidative enzymes, MAAs and heat shock proteins (Hsps). The mechanism of exchange of symbiotic algae is the Adaptive Bleaching Hypothesis, which is still disputed and needs more evidence. Future research work should pay more attention on coral holobiont, especially on the contribution of host factors to symbiosis. The Australian coral scientist Ove Hoegh-Guldberg proposes that corals and their zooxanthellae will be unable to acclimate or adapt fast enough to keep pace with the present rapid rate of warming of tropical oceans. Some climate models still project that, over the next 50 years, temperature increases will exceed the temperature conditions under which coral reefs have flourished over the past half million. The future of coral reefs is not exciting.

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Key words [coral](#) _ [symbiotic](#) [algae](#) _ [temperature](#) _ [bleaching](#) _ [adaptive](#) [mechanis](#)

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通讯作者 黄晖 coralreef@scsio.ac.cn