

专论与综述

水稻化感作用及其分子生态学研究进展

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摘要 综述了近年来国际上研究水稻化感作用的新进展, 比较分析了当前常用于室内评价水稻化感作用潜力的几种生物测试法的优缺点, 指出了琼脂迟播共培法是较为理想的室内生物测试法并已广泛应用于化感作用研究中。在此基础上, 分析了水稻化感作用的数量遗传特性及其QTL定位的研究现状; 阐明了水稻化感作用的遗传多样性及其分子生态特性; 并就当前普遍关注的焦点问题: 逆境条件(如低氮或高伴生杂草密度胁迫)常引起水稻化感作用潜力增大的生理过程与分子机制进行了阐述。结合近年来应用差异蛋白组学和生物信息学的研究实例, 阐明了逆境引起水稻化感作用增强与其酚类合成代谢相关酶蛋白表达丰度增加, 萜类合成代谢相关酶蛋白表达丰度下降有关。就究竟什么是水稻的化感物质及其作用方式等问题作了分析与讨论, 指出水稻的化感抑草效应是其众多化感物质综合作用的结果, 应重视区分化感物质对靶标杂草的原生作用和进入土壤生态系统中经生物转化后的次生作用。根据当前植物化感作用研究的发展趋势, 阐明了进一步研究水稻化感作用的焦点问题, 提出了水稻化感作用的根际生物学特性与分子生态学机制, 是未来国际上竞相角逐的重点研究领域, 并认为以现代系统生物学理论为指导, 运用基因组学、蛋白质组学和代谢组学等技术方法, 是揭示这一分子生态学过程与机制的重要技术选择和优先研究领域。

关键词 水稻; 化感作用; 性状遗传; 基因定位; 分子生态学

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Advances in the investigation of rice allelopathy and its molecular ecology

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Abstract This article reviewed the recent advances in the investigation of rice allelopathy. The author discussed the advantages and limitations of several bioassay methods commonly used in laboratories for studying rice allelopathy. Relay seeding co-culture bioassay in agar (RSCA) is widely used in allelopathy research and perhaps the best method for laboratory bioassay. The author described the present status of quantitative genetics, QTL mapping, genetic diversity, and molecular ecological properties of allelopathy in rice. A discussion on the physiological process and its molecular mechanism of increased allelopathic potential in rice induced by the stress such as lower nitrogen supplies or higher densities of companion weed was also presented. Based on our proteomic studies, it appears that the increase in allelopathic potential of rice exposed to stresses is due to increased expression of enzymes involved in phenolic synthetic metabolism and decreased expression of enzymes associated with terpenoid synthetic metabolism. We also discussed the possible allelochemicals and their modes of action on the target weed. The inhibitory effect of allelopathic rice accessions on the target weed seems to be resulted from joint action of many allelochemicals with different cellular target sites. It is important to distinguish the primary effect of allelochemicals on the target weed from the secondary effect of allelochemicals when they are released into rhizosphere system and transformed by soil microorganism. Finally, the author highlighted the important

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nt issues critical to allelopathy studies in rice. Rhizosphere biological properties of allelopathy in rice and its mechanism are likely to be the key research areas worldwide. Recent development in systems biology and the systematic approaches such as genomics, proteomics and metabolomics would be expected to be used to reveal the process and its mechanism of molecular ecology on rhizospheric biology of allelopathy in rice.

Key words [rice \(Oryza sativa L.\)](#) _ [allelopathy](#) _ [quantitative genetics](#) _ [gene mapping](#) _ [molecular ecology](#)

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