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研究论文

UV-B辐射增强对两种不同抗性水稻叶片光合生理及超显微结构的影响

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摘要 在UV-B辐射增强条件下，研究了两个不同水稻品种叶片光合作用系统的变化。结果表明：(1) UV-B辐射胁迫使两个水稻品种叶片总叶绿素含量，叶绿素a与叶绿素b (Chla/Chlb) 比值下降,叶绿素a荧光诱导动力学参数改变，光系统Ⅱ活性受抑制，光合作用效率降低，其中Dular受抑制的程度较Lemont大。(2) 利用扫描电镜（SEM）和透射电镜（TEM）进一步研究表明，UV-B辐射胁迫使水稻叶片气孔器受破坏，叶绿体结构变形，基粒片层排列稀疏紊乱，两个供试品种结构上受破坏的程度与它们光合生理受抑制的程度一致。(3) 叶片边缘受破坏的程度较主脉两侧轻,这可能与硅质乳突密度较大有关。（4）两个供试品种叶片表面主脉两侧的硅质乳突数量及其受UV-B辐射影响的特性存在明显的差异，Lemont叶表面的乳突分布密度较大，且在UV-B辐射胁迫下有增加的趋势，而Dular则相反。这说明硅质体的累积特性可能是水稻对UV-B辐射胁迫的适应机制之一。

关键词 光合作用系统；UV-B辐射；水稻；超显微结构

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Influence of enhanced ultraviolet-B radiation on photosynthetic physiologies and ultrastructure of leaves in two different resistivity rice cultivars

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Abstract Depletion of stratospheric ozone (O3) caused by anthropogenic chlorofluorocarbons has increased the amount of ultraviolet radiation, especially ultraviolet-B (280-320,UV-B) radiation reaching the Earth's surface. For every percentage decreases in stratospheric ozone, the amount of biologically effective UV-B radiation (UV-BBE) is predicated to increase by approximately double that percentage. Enhanced UV-B radiation causes damage to the growing development and physiobiochemical processes of plants. e.g. photosynthesis, which would induce the change of morphological characteristics and alter normal metabolic processes.

This study was conducted to determine the effect of UV-B radiation on the photosynthetic physiology and the ultrastructure of leaves in rice (*Oryza sativa* L.) . Three-leaf-aged seedlings of rice Lemont (tolerant) and Dular (sensitive) were subjected to UV-B radiation 18.6kJ m^{-2} d^{-1} for treatment in a network for 3 weeks, and natural light for control.. Under 3-weeks of UV-B treatment, photosynthetic pigment, fluorescence induction kinetics parameters of chlorophyll a, photosynthetic efficiency, ultrastructure of leaf surface and mesophyll were investigated. The results showed as follows: (1) UV-B radiation stress significantly decreased chlorophyll content, and the ratio of chlorophyll a to chlorophyll b (Chla/Chlb), changed fluorescence induction kinetics parameters of chlorophyll a, and in turn reduced photosynthetic efficiency. The tested rice cultivar, Dular, was inhibited more seriously than Lemont. (2) Further studies with transmission electron microscopic (TEM) observation and scanning electron microscope (SEM) observation, revealed that the stomatal apparatus was damaged, the chloroplast structure was distorted, the arrangement in the lam

ellae of the grana and stroma was loose and disordered. The effect of UV-B radiation stress on th e ultrastructure of leaves in the two rice cultivars tested was consistent with their changes in photo synthetic physiology. (3)The adaxial surface was damaged more seriously than the abaxial surfac e in the two rice cultivars. This might contribute to its higher density of silicic papillae. (4) The amo unt of silicic papillae on the adaxial surface in the two rice cultivars and their responses to UV-B r adiation stress were significantly different, i.e. the amount of papilla in Lemont was higher than Dul ar, and was elevated by UV-B radiation. The reverse was true in the case of Dular. The findings s uggested that the characteristics of silicic cumulation might be one of the mechanisms for rice adap tive to enhanced UV-B radiation stress.

Key words Oryza sativa L. photosynthetic physiology Ultraviolet-B radiation ultrastructure

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