华东师范大学学报 自然科学版
JOURNAL OF EAST CHINA NORMAL UNIVERSITY NATURAL SCIENCES

华东师范大学学报(自然科学版) » 20120, Vol. 2012 » Issue (6): 29-38 DOI:

崇明东滩芦苇光合特征对模拟增温的响应

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Responses of photosynthetic characteristics of Phragmites australis to simulated temperature enhancement in Eastern Chongming Island, China

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- 摘要
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摘要 采用开顶式生长室(Open-top chambers, OTC)模拟未来气候变暖的方法，研究崇明东滩湿地植物芦苇(〖WTBX〗Phragmites australis〖WTBZ〗)快速生长期光合特征对模拟增温的响应，并探究其响应机制.结果表明：增温使芦苇的净光合速(〖WTBX〗P n〖WTBZ〗)、蒸腾速率(〖WTBX〗T r〖WTBZ〗)和气孔导度(〖WTBX〗G s〖WTBZ〗)分别降低了11.9% 、22.5%和21.7%，但是对胞间CO 2浓度(〖WTBX〗C i〖WTBZ〗)和水分利用效率(〖WTBX〗WUE〖WTBZ〗)没有明显影响；此外，非线性拟合芦苇叶片光合响应曲线的结果显示，两种处理下芦苇的光合响应曲线均表现为先迅速增加后渐平缓的趋势，OTC内芦苇的光合响应曲线始终位于对照的下方；同时，增温显著地降低了芦苇的表观量子效率(〖WTBX〗AQY〖WTBZ〗)和光饱和点(〖WTBX〗LSP〖WTBZ〗)，分别降低了12.1%和22.0%；而芦苇的暗呼吸速率(〖WTBX〗R d〖WTBZ〗)和光补偿点(〖WTBX〗LCP〖WTBZ〗)却显著增加，分别为16.5%和14.9%，但对最大净光合速率(〖WTBX〗P 〖WTBZ〗max)无明显影响.增温条件下，芦苇的叶氮含量(〖WTBX〗N 〖WTBZ〗mass)显著减少，比叶重(〖WTBX〗LMA〖WTBZ〗)显著增加，但光合氮素利用效率(〖WTBX〗PNUE〖WTBZ〗)未产生显著的变化.另外，相关性分析的结果显示：〖WTBX〗LMA〖WTBZ〗与〖WTBX〗P 〖WTBZ〗max 、PNUE呈现出显著的负相关，与〖WTBX〗N〖WTBZ〗mass 呈现极显著的负相关.〖WTBX〗N 〖WTBZ〗mass 与〖WTBX〗PNUE〖WTBZ〗之间呈现极显著正相关，二者均与〖WTBX〗P 〖WTBZ〗max 显著正相关，其中〖WTBX〗N 〖WTBZ〗mass 与〖WTBX〗P〖WTBZ〗max 的相关性则达到了极显著的水平.总之，模拟增温效应对芦苇的光合特征产生了显著的影响.

关键词： 增温 芦苇 光合特征 影响因素

Abstract: Using the method of Open-top chambers (OTC) to simulate climate warming in the future, The study was carried out in reclaimed marsh in Eastern Chongming Island in rapid growth season. The results showed that the net photosynthetic rate(〖WTBX〗P n〖WTBZ〗), transpiration rate(〖WTBX〗T r〖WTBZ〗) and stomatal conductance(〖WTBX〗G s〖WTBZ〗) of 〖WTBX〗P. australis 〖WTBZ〗in OTC were significantly reduced by 11.9%, 22.5% and 21.7% , respectively, while the intercellular CO 2 concentration(〖WTBX〗C i〖WTBZ〗) and water use efficiency (〖WTBX〗WUE)〖WTBZ〗 were lower, but the changes were not significant. The net photosynthetic rate-light intensity (〖WTBX〗P n-PAR〖WTBZ〗) curves which were nonlinear fitted in OTC and CK showed the same trend that P n increased quickly and then hasten gentle by 〖WTBX〗PAR〖WTBZ〗. In OTC, photosynthetic response curve of the 〖WTBX〗P. australis〖WTBZ〗 was lower than the control plots; at the same time, the temperature enhancement made the light saturation point (〖WTBX〗LSP〖WTBZ〗) and apparent quantum efficiency (〖WTBX〗AQY〖WTBZ〗) dramatically reduced by 22.0% and 12.1%, respectively, but the dark respiration rate (〖WTBX〗R d〖WTBZ〗) and light compensation point (〖WTBX〗LCP〖WTBZ〗) respectively increased by 16.5% and 14.9%. The maximum net photosynthetic rate(〖WTBX〗P 〖WTBZ〗max) of 〖WTBX〗P. australis〖WTBZ〗 in OTC was not evidently effected. Meanwhile, the leaf nitrogen content(〖WTBX〗N〖WTBZ〗mass) of 〖WTBX〗P. australis 〖WTBZ〗in OTC were significantly reduced, while the leaf mass per area (〖WTBX〗LMA 〖WTBZ〗) was higher, but the changes of photosynthetic nitrogen use efficiency (〖WTBX〗PNUE〖WTBZ〗) was not significant. To 〖WTBX〗P. australis

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〖WTBZ〗 in Eastern Chongming Island, the 〖WTBX〗LMA 〖WTBZ〗was significantly negatively correlated with the 〖WTBX〗PNUE〖WTBZ〗 ,〖WTBX〗P 〖WTBZ〗mass (〖WTBX〗p〖WTBZ〗 ≤0.05) and 〖WTBX〗N 〖WTBZ〗mass (〖WTBX〗p〖WTBZ〗 ≤0.01), while the 〖WTBX〗N mass〖WTBZ〗 was positively correlated with the 〖WTBX〗PNUE〖WTBZ〗(〖WTBX〗p 〖WTBZ〗≤0.01) . The correlation analysis showed that the 〖WTBX〗P 〖WTBZ〗max was significantly positively correlated with 〖WTBX〗N 〖WTBZ〗mass (〖WTBX〗p 〖WTBZ〗≤0.01) and 〖WTBX〗PNUE(p〖WTBZ〗≤ 0.05 〖WTBX〗). 〖WTBZ〗In summary, the simulated warming significantly affected the photosynthetic characteristics of 〖WTBX〗P. australis.

Key words: temperature enhancement *Phragmites australis* photosynthetic characteristics factors

收稿日期: 2011-09-01; 出版日期: 2012-03-01

引用本文:

. 崇明东滩芦苇光合特征对模拟增温的响应[J]. 华东师范大学学报(自然科学版), 20120, 2012(6): 29-38.

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