

## 欧洲垂枝桦对PEG诱导干旱胁迫的响应机制

**摘要:** 干旱是限制植物生长发育的重要非生物因素之一, 欧洲垂枝桦 (*Betula pendula* Roth) 原产欧洲, 1981 年引种到辽东山区, 为探讨欧洲垂枝桦在干旱胁迫下的生理响应机制, 明确欧洲垂枝桦幼苗在干旱胁迫下各生长生理参数与光合特性的变化, 以综合评价欧洲垂枝桦幼苗对干旱胁迫的响应。本研究采用不同浓度的 PEG-6000 处理模拟干旱胁迫, 对胁迫后与复水后欧洲垂枝桦幼苗进行生长生理指标的测定和叶片解剖结构、气孔结构以及细胞器超微结构观察, 探寻欧洲垂枝桦对 PEG 浓度的最大阈值和抗旱能力。结果表明: PEG 浓度和胁迫时间的增加, 对欧洲垂枝桦幼苗的生长特性具有极显著影响 ( $p < 0.01$ ); 抗氧化酶活性、膜脂过氧化与渗透调节物质浓度随胁迫浓度增加和胁迫时间的延长而增加且具极显著差异 ( $p < 0.01$ ); 光合参数与光合色素随胁迫浓度增加和胁迫时间的延长而极显著降低 ( $p < 0.01$ ); 不同 PEG 浓度处理下幼苗叶片解剖结构变化较为明显, 并且幼苗叶片平均气孔长度变化具有显著影响 ( $p < 0.05$ ), 对气孔平均结构变化具有极显著影响 ( $p < 0.01$ )。通过多项式分析表明: 当 PEG 浓度为 25% 时, 欧洲垂枝桦幼苗的抗氧化酶仍具有较高活性, 说明欧洲垂枝桦抗旱性较强。该研究结果已筛选出欧洲垂枝桦抗旱植株, 为欧洲垂枝桦优良品种选育奠定了研究基础。

**Abstract:** Drought is one of the important abiotic factors limiting plant growth and development. The European pendant birch (*Betula pendula* Roth) is native to Europe and was introduced to the Liaodong mountains in 1981. This study used different concentrations of PEG-6000 treatment to simulate drought stress and clarify the changes of various growth physiological parameters and photosynthetic characteristics of European pendant birch seedlings under drought stress, in order to investigate the physiological response mechanism of European pendant birch under drought stress and to comprehensively evaluate the response of European pendant birch seedlings to drought stress. The findings demonstrated that stress duration and increasing PEG concentration had a highly significant impact on the growth traits of European pendant birch seedlings ( $p < 0.01$ ); With increasing stress concentration and stress time, antioxidant enzyme activity, membrane lipid peroxidation, and osmoregulatory substance concentrations increased with highly significant differences ( $p < 0.01$ ); With increasing stress concentration and duration, photosynthetic parameters and pigments decreased highly significantly ( $p < 0.01$ ); Under different PEG concentration treatments, the anatomical structure of seedling leaves changed more noticeably; there was a significant effect ( $p < 0.05$ ) on the change in mean stomatal length and a highly significant effect ( $p < 0.01$ ) on the change in mean stomatal structure. According to a polynomial analysis, European pendant birch seedlings still had high antioxidant enzyme activity at a 25% PEG concentration, indicating that the species is more drought resistant.