

香榧种实发育与其源库碳水化合物积累的关系

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摘要:【目的】香榧为我国南方特有的经济树种, 严重的落果现象制约了产业的健康发展。然而, 香榧的落果机制尚不清楚。【方法】以3年生结果枝组(花簇和种实同时存在)为研究对象, 通过测定香榧主要源(1年生和2年生枝条)的净光合速率、非结构性碳水化合物(NSC)及主要库(种子、花簇和叶稍)的干重和NSC的周年变化, 分析关键落果期内各库中蔗糖-淀粉代谢相关基因表达量的差异, 并估算各源库的碳平衡变化趋势。【结果】1) 从当年100-172 d, 香榧的累积落果率显著增至91.5%。2) 从当年100-172 d, 主要源(1年生和2年生枝条)中NSC浓度显著降低, 而其净光合速率则显著增强; 同时主要库(种子、花簇和叶稍)中的NSC快速积累, 且细胞壁蔗糖转化酶 *TgCWIN* 与其库中的蔗糖、果糖和葡萄糖含量均呈显著正相关性。3) 碳平衡估算结果显示, 从100 d-172 d, 主要源的净光合能力持续稳定, 其储藏碳源供应能力显著降低(从8.72降至3.02 mM C d⁻¹); 而主要库的碳需求则呈持续增加趋势(从3.14增至7.71 mM C d⁻¹)。4) 落果关键期内, 外源注射蔗糖处理可显著降低香榧的落果率。【结论】香榧种实发育过程中, 存在多库发育竞争碳水化合物及储藏碳源不足是导致香榧落果的关键原因。

关键词: 香榧; 种实发育; 源库; 碳水化合物

The relationship between seed development and carbohydrate accumulation of its sources and sinks in *Torreya grandis* cv. *Merrillii*

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Abstract: 【Objective】 *Torreya grandis* cv. *Merrillii* is a well-known nut in South China with high nutritional value. Severe premature seed abscission (about 80 - 90%) limits the industrial development of *T. grandis* by causing serious economic losses. However, the physiological mechanisms of seed abscission in *T. grandis* remain poorly understood. 【Method】 To gain insight into the relationships between carbohydrate state and seed abscission, we determined the seasonal photosynthetic rate, non-structural carbohydrate (NSC) dynamics of the main sources (one-year-old and two-year-old shoots), as well as the dry weight and NSC concentrations of the sinks (the seed, the

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current flower cluster, and the current vegetative cluster). **【Result】** The accumulative seed abscission rate significantly increased to 91.5% from 100 d to 172 d of the year. The NSC concentration in the main sources showed a decreasing trend, which was accompanied by increasing photosynthesis during that period. Furthermore, significant NSC accumulation was observed in these three sinks, and *TgCWIN* was significantly correlated with the sucrose, fructose, and glucose content. The carbon supply capacity of the main sources significantly decreased from 100 d to 172 d of the year, whereas the carbon demand of the three sinks showed a continuously increasing trend, as estimated based on the photosynthetic rate, NSC, and dry weight. In addition, sucrose supplementation significantly decreased the cumulative seed abscission rate. **【Conclusion】** These results suggest that multiple sinks compete for the carbohydrate and storage carbohydrates are the major factor contributing to the regulatory mechanism of seed abscission in *T. grandis*.

Keywords: *Torreya grandis*; Seed development; Sources and sinks; Carbohydrate