

香榧花粉萌发油体相关蛋白鉴定及功能初探

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摘要: 香榧 (*Torreya grandis*) 是我国特有的珍贵经济树种之一, 属于裸子植物红豆杉科榧属的栽培类型。香榧果仁因其高营养价值、独特风味以及多种生物功能, 如抗氧化、镇咳、抗炎、抗菌和抗肿瘤等, 被视为珍稀坚果之一。然而香榧树通常为雌雄异株且雄株与雌株成熟时期不同, 需要人工授粉, 因此花粉活性很大程度上影响香榧果仁的产量和质量。目前, 花粉活性的检测主要依赖染色法, 但这种方法难以准确反映花粉的活性。同时, 花粉管的生长和发育需要囊泡和众多细胞器的协作, 这一过程需要源源不断的能量供应, 油体在花粉中普遍存在, 它参与花粉萌发并且为其提供能量, 本研究通过离体培养法获得萌发率较高的花粉, 通过对萌发油体的动态和蛋白组学鉴定, 初步探究油体参与花粉萌发的机制。结果表明: (1) 本研究先对香榧花粉离体萌发培养基进行筛选, 通过正交试验筛选了最优培养基和最佳培养条件, 进一步发现植物生长调节剂 NAA、GA3、和 2, 4-D 会低浓度促进香榧花粉萌发, 高浓度抑制花粉萌发。(2) 对香榧花粉形态观察发现, 其有明显的侧向萌发特征。并通过体内石蜡切片进一步验证其形态特征。(3) 追踪花粉萌发过程中花粉管的囊泡和油体的动态观察, 发现囊泡和油体的移动速率远远小于其他裸子植物, 且与花粉管的生长速率密切相关。(4) 稳定提取了花粉萌发油体, 进行纯度鉴定后, 从蛋白质组学的角度初步探究油体参与花粉萌发的机制。

Identification and function of *Torreya grandis* pollen germination oilbody-related proteins: a preliminary study

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Abstract: *Torreya grandis* is one of China's unique and precious economic tree species, belonging to the cultivated type of the gymnosperm family Taxaceae. The kernels of *Torreya grandis* are considered as rare nuts due to their high nutritional value, distinctive flavor, and various biological functions, including antioxidant, cough-suppressant, anti-inflammatory, antimicrobial, and anti-tumor properties. However, *Torreya grandis* trees are typically dioecious, with male and female trees maturing at different times, necessitating artificial pollination. Consequently, the pollen activity significantly affects the yield and quality of *Torreya grandis* kernels. Currently, pollen activity detection relies mainly on staining methods, which may not accurately reflect pollen activity. Furthermore, the growth and development of the pollen tube require the coordinated action of vesicles and numerous organelles, which demands a continuous energy supply. Lipid bodies are commonly present in pollen, participating

in pollen germination and providing energy. This study obtained pollen with high germination rates through in vitro cultivation and explored the mechanism of lipid bodies' involvement in pollen germination by studying their dynamics and proteomics identification. Results: (1) This study initially screened the in vitro pollen germination medium for *Torreya grandis*, and through orthogonal experiments, identified the optimal culture medium and conditions. Additionally, it was found that plant growth regulators NAA, GA3, and 2,4-D could promote *Torreya grandis* pollen germination at low concentrations while inhibiting germination at high concentrations. (2) Morphological observations of *Torreya grandis* pollen revealed distinct lateral germination features, further confirmed by in vivo paraffin sections. (3) Tracking the dynamics of vesicles and lipid bodies during pollen germination revealed that their movement rates were considerably slower than those in other gymnosperms and closely related to the pollen tube growth rate. (4) Stable extraction of pollen germination lipid bodies, after purity identification, allowed for an initial exploration of the mechanism of lipid bodies' involvement in pollen germination from a proteomics perspective.