

Induction of unreduced megaspores in *Eucommia ulmoides* by high temperature treatment during megasporogenesis

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Abstract *Eucommia ulmoides* Oliver is an important temperate species because it contains *Eucommia* rubber, iridoids, and other medicinal substances. Triploid breeding may be an effective way to improve the contents of gutta percha and other secondary metabolites in *Eucommia* leaves. To obtain triploid trees, 2n female gametes were induced by exposing female buds to high temperatures. The results showed that although the *Eucommia* female flower bud development is not synchronous, it still exhibits regularity. We estimated the period of megaspore mother cell meiosis based on the number of days since the adjacent male flower produced its pollen. Using female buds at 1–4 days after pollination, we obtained triploid seedlings after female buds were treated with different temperatures and durations to induce megaspore chromosome doubling. Among the offspring, 23 of *Eucommia* triploid seedlings were detected. Our findings indicate that the most suitable condition for

inducing megaspore chromosome doubling occurred at 3 days after adjacent male tree produce pollen when the meiosis of the megasporocytes was between pachytene and diplotene. The best treatment of 45 °C for 4 h gave triploid induction of 5.74 %.

Keywords *Eucommia ulmoides* Oliver · High temperature · Megasporogenesis · Triploid breeding · Unreduced megaspore

Introduction

Eucommia ulmoides Oliver (*Eucommia*), which is native to central and southern China, is a Tertiary relict deciduous plant. The leaves of the *Eucommia* tree contain 2–3 % long-chain trans-1,4-polyisoprene, which is commonly called “*Eucommia* rubber” (Bamba et al. 2002). TP1 is a component of both plastic and rubber, and can be applied to aerospace and military materials (Yan 2007, 2010; Zhang 2011). In addition, *Eucommia* contains iridoid glycosides, chlorogenic acid, and other medicinal substances (Deyama et al. 2001; Du 2003; Hotiit et al. 2010). Given the industrial and medical importance of *Eucommia*, there is significant interest in improving the levels of secondary metabolites in *Eucommia* leaves.

Eucommia ulmoides is the only species of the *Eucommia* genus in the Eucommiaceae family (Du 1996; Li 2001); thus, offspring cannot be obtained by heterosis using interspecies hybridization. Although

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