

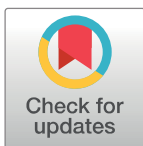
RESEARCH ARTICLE

Evaluation of efficiency of controlled pollination based parentage analysis in a *Larix gmelinii* var. *principis-rupprechtii* Mayr. seed orchard

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Abstract

Controlled pollination (CP) is an important tool for breeding programs to improve seed quality, as it rapidly generates desirable genotypes and maximizes genetic gains. However, few studies have evaluated the success rate of CP, especially in *Larix gmelinii* var. *principis-rupprechtii* Mayr. seed orchards. In this study, we estimated the rate of correct parentage in 257 CP progeny in an *L. gmelinii* var. *principis-rupprechtii* seed orchard from ten candidate parents using 13 microsatellites. The parentage exclusion probabilities of all combined loci in the single parent and parent pair tests were > 0.99, which was sufficient to distinguish the relatedness of the sampled individuals. Comparing the maximum likelihood-based parentage analysis results with breeding records revealed that the percentages of correctly identified maternal and paternal parents were 22.6% and 35.0% at 95% CL, respectively, suggestive of parent mislabeling and pollen contamination in the CP population. We conducted a pedigree reconstruction by identifying the expected parents and assigned maternity, paternity, and parent pairs to 176 (68.5%), 199 (77.4%), and 132 (51.4%) progeny, respectively. This study provides a reference for future selection of elite genotypes for commercial production. To increase the efficiency of CP, molecular markers should be used to correctly identify individuals in seed orchards before conducting CP.

Introduction

Prince Rupprecht's larch (*Larix gmelinii* var. *principis-rupprechtii* Mayr.) is one of the most important native conifer species in northern China used for reforestation and to build non-food forests due to its growth speed, high timber quality, and numerous applications [1]. Natural populations are mainly distributed in Hebei and Shanxi provinces, China. Pinaceae species were first targeted for scientific breeding programs in China in the 1960s [2]. Currently, Prince