

Genetic Relationship between Reproductive Morphology and Growth Characteristics of Korean Pine (*Pinus koraiensis*)

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Korean pine (*Pinus koraiensis*) is an important species for timber as well as pine nut production in Korea. The selection of “plus” trees began in 1959 and seed orchards have been established with grafts and seedlings propagated from these selected individuals. There are 300 “plus” trees and 100 ha seed orchards of *P. koraiensis* in Korea. Further, 244 open-pollinated families are being tested at four 18.5-ha sites. The main purposes of this study were: (1) to investigate the correlation among cone, seed, and growth traits of *P. koraiensis*; (2) to examine the possibility that such traits could be useful indicators for progeny testing and further selection; and (3) to provide information on genetic parameters for the establishment of advanced-generation seed orchards.

Open-pollinated cones of *P. koraiensis* plus trees were collected in 1981, and the morphological characteristics of cones and seeds were examined. The seeds were sown in a nursery in 1982 and grown for 4 years. In 1986, the seedlings were planted in three sites containing 20 trees in each of 6 replications with 1.8-m × 1.8-m spacing as a progeny test plantation. The correlations between morphological traits of cones and seeds from each plus tree and growth characteristics (height, diameter at breast height [d.b.h., diameter at 1.37 m] and volume) in plantations were investigated. Variance components and heritabilities for growth characteristics were estimated in the plantation at ages 10, 20, and 30 years.

Seedling height at the nursery bed showed a strong correlation with most cone and seed characteristics. Numbers of cones per tree and seeds per cone were negatively correlated with seedling height and statistically significant at the nursery bed. Cone diameter and cone weight showed a positive correlation with seedling height. Seed length, width, thickness, and weight were all positively correlated with seedling height at the nursery and in the plantation at age 5. From age 10, tree height, d.b.h., and volume were compared with cone and seed traits. None of the cone traits was correlated with growth characteristics from age 10. Some seed traits such as seed length, thickness, and weight were correlated with growth until age 10. After that age, the correlations between seed traits and growth characteristics were also nonsignificant, except between seed length and d.b.h. at age 20. Analyses suggest that the correlation between reproductive morphology and growth characteristics becomes weaker as trees grow older. It seems likely that cone and seed traits of *P. koraiensis*, which bears middle-sized seeds, are related until trees enter the mid-term growth phase.

Heritability estimation showed that growth characteristics were under genetic control. Family heritability was much higher than individual heritability, implying that family selection would be a better option for the establishment of advanced-generation seed orchards of *P. koraiensis*.

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