ABSTRACT

The Himalayan poplar, *Populus ciliata* Wall. ex Royle, is a large deciduous, dioecious and native tree of the Himalayas. Sex chromosomes are not identified in this species and at juvenile stage male and female trees do not show any significant phenotypic differences like other dioecious plants. However, at maturity male and female trees are differentiated from each other on the basis of biomass, growth rate and habitat etc. Near human settlements, propagation of female plants is not recommended because seed production causes many health problems like allergies, respiratory diseases, etc. Reliable and quick methods are, therefore, needed for determination of sex in juvenile plants of *P. ciliata*. It has been hypothesised that in plants where sex chromosomes are not identified, there may be a gene in a plant’s genome that influences its gender.

The present study dealt with the development of RAPD and isozyme markers for gender determination. The variation in leaf morphological characters was also studied on mature trees. In addition monthly variation in the concentration of two phenolic glycosides (salicin and populin) and their role in flowering from the bark and buds of both sexes was also investigated. Out of ten random primers used, OPK-20 gave significant difference between male and female trees and identified as female specific marker (OPK-20₄₀₀, OPK-20₅₀₀ and OPK-20₈₀₀). The isozyme analysis was conducted with seven enzyme systems namely peroxidase, esterase, malate dehydrogenase, alcohol dehydrogenase, catalase, ribulose bisphosphate carboxylase and acid phosphatases. Peroxidase and esterase enzymes successfully showed differentiation between male and female genotypes. Peroxidase produced one female specific band at a RM value 0.29 whereas esterase produced one male and one female specific band at Rm values 0.30 and 0.11 respectively; thus distinguishing the female and male plants genetically.

Qualitative traits like shape of leaf blade, tip of leaf blade, sinus with petiole, pubescence on the lower surface of leaf lamina, leaf margin and colour of leaf blade were analysed. Female and male trees were distinguished by the shape of base of leaf blade, its sinus and leaf margin. On the other hand all quantitative traits excepting shape factor, leaf area, average value in percentage for the ratio of lamina length to lamina width (L/W %), average value in percentage for the ratio of petiole to medial nerve (P/N %), perimeter of leaf, aspect
ratio showed non-significant differences. Study of monthly variation of salicin and populin showed accumulation of phenolic glycosides during flowering season but did not indicate their role in flowering. This study concludes that qualitative differences exist between male and female trees besides specific markers. However, for identification of gender at seedling stage molecular markers (RAPD and isozyme) are best suited. Gender determination would help in determining sex of juvenile plants of *P. ciliata* for plantations and also in its non-flowering trees for clonal propagation.