Pollen contamination and after-effects in Scots pine

Jan-Erik Nilsson, Department of Forest Genetics and Plant Physiology, Swedish University of Agricultural Sciences, SE-901 83 Umeå, Sweden E-mail: Jan-Erik.Nilsson@genfys.slu.se

Approximately half of the seeds produced in mature forest tree seed orchards in Scandinavia are from fertilization with the natural background pollen cloud. In young seed orchards with no male flowering pollen contamination is close to 100 %. Due to pollen contamination only between 50% and 75 % of the genes in young and mature seed orchards respectively, originate from the selected seed orchard clones and the genetic gain of the seed orchard progeny is reduced compared to all-internal pollination.

In northern latitudes pollen is usually found in the air one or more weeks before local pollen dispersal. The early pollen is often assumed to originate from more southern areas with higher temperatures in early summer and accordingly earlier pollen dispersal. For northern seed orchards southern pollen reduces the hardiness of the seed crop, mainly from delayed autumn cold acclimation. However fluctuations in wind directions, temperatures and rain fall in early summer can carry pollen from other directions, with other genetic composition, and with other effects on the seed orchard crops.

From artificial freeze testing comparing wind pollinated progenies with reference progenies from controlled pollination with pollen of known latitude origin, the hardiness and geographical origin of the natural pollen cloud can be estimated. However, evaluation of progeny tests at low age means that physiological after-effects from maternal environment etc. might affect the results and hide the genetic differences that are of main interest in such pollen cloud studies.

By producing both wind pollinated progenies and controlled crosses on the same trees , the maternal effects are largely eliminated from within tree comparisons, and the observed progeny differences will reflect genetic differences between pollen clouds (different days and/or different localities) and reference pollen.

As a basis for studies of genetic variation in the natural pollen cloud across central and northern Sweden, based o the described method of progeny testing, a series of small clone archives (with the same ten clones) has been established on 19 localities in Sweden between latitude 61 and 67^{o} N.

To make it possible to the study the pollen cloud on any localities, also a clone archive of mobile grafts was recently established. From this archive trees will be lifted from the soil and transported for pollination at selected localities just before female receptivity and the pollinated trees are returned to the clone archive immediately after pollination to allow all seeds to develop in the same locality and environment. Thus after-effects from maternal environment can probably be further reduced compared to the permanent clone archives, enhancing the precision in estimates of genetics pollen clouds differences.

Initial studies of lifting mother trees for pollination on different localities followed by seed development on the original locality show insignificant treatment effects on progeny cold

acclimation in freeze tests of one year seedlings. This indicates that the method of utilizing clone archives as collectors of the natural pollen cloud followed by progeny freeze testing of young seedlings can be useful to understand more about the genetic variation and geographical origin of the natural pollen cloud of Scots pine over time and space. More knowledge about variations in the natural pollen cloud should also guide in establishing new seed orchards.