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Importance of regulation mechanisms for the climatic adaptation of tree species (An example *of Picea abies*)

Annual Progress Report for the period

from 01-12-2001 to 01-12-2002

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Progress in the second year:

Work packages 1.1 - 4.1

WP No. 1.1
Crossing experiments with the same genotypes under different environments in a phytotron.

- Finished in the first project period.

WP No. 1.2
Characterisation of frost resistance and budset phenology differences between full-sib families from crossings made under different climatic conditions.

- Traits measured in field trials were not influenced by the early selection for cold hardiness.

WP No. 1.3
How fast can Norway spruce adapt to different climatic conditions?

- Offspring from spruce plantations identified by mitochondrial DNA markers to be of Central European origin were more similar to local Norwegian than to their parental provenances.
- Progenies were influenced by both maternal temperature and photoperiod in an interactive way.

WP No. 1.4
Morphological characterisation of drought resistance differences between full-sib-families from crossings made under different environments.

- The analyses of variance for early height growth, based upon growth- and phenology-data after on growth period, indicate significant effects of temperature and drought treatments. Family variance components for growth and time to budset are high, amounting to 0.28 and 0.14, respectively. Both of them are highly significant. Family x treatment interaction is significant for temperature but not for drought, indicating specific genetic adaptation to temperature only.
- The environment in which the seeds were produced and matured is a highly significant factor for phenology but not for height growth. The seeds from warm green-house produce seedlings with a significantly delayed budset as compared to seedlings originating from seeds in an outdoor seed-orchard.

WP No. 1.5
Investigations of physiological traits of metabolic pathways which are involved in drought and frost tolerance.

- Chlorophyll fluorescence and protein content are influenced by drought stress.
- Chlorophyll fluorescence was used as a parameter to quantify stress in plants with respect to the activity of PS II.

WP No. 2.1
Investigations on the basis of alloenzyme markers. Analyses of seed samples (megagametophyte/embryo).

- The trees 5994 and 2707 are the most likely male parents of the seedlot No 15879, therefore this family will be considered as a half-sib family only.

WP No. 2.2
Genetic characterisation of full-sib families derived from different crossing environments through molecular markers.

- The first results suggest that selective effects could occur during reproduction (gametogenesis and/or early embryogenesis).
- The distorted markers appeared to be linked in small genomic blocks distributed on several chromosomes.

WP No. 2.3
Investigations on the basis of EST-markers.

- DNA polymorphism in viable seeds was verified by means of six EST markers.

WP No. 3.1
Environmental effects on methylation of DNA and translation of phytochrome genes.

- Three phytochrome genes were transcribed at higher level in progenies from cold compared to warm maternal conditions.
- Under warm maternal conditions (indoor), a higher level of methylated cytosine (mC) was observed as compared to cold maternal conditions (outdoor) revealing opposite trends with respect to light treatment (12 h vs. 24 h).

WP No. 3.2
Differential display of newly identified genes.

- Macroarrays of 130 cDNA clones derived from a stress-induced cDNA-library on nylon membranes for hybridisation with RNA isolated from different stress treatments were distributed.
- Intact mRNA could be isolated from seedlings of different drought stress stages and was used for DDRT-PCR in order to identify differentially expressed genes.
- The first results show that after applying drought stress the seedlings respond selectively by the activation of a transcription factor, known as a dehydration- responsive element.

Dissemination of research results

New address of the project web site: http://www.adaptability.de/index1.htm