Acclimation of Populus to wind: kinetic of the transcriptomic response to single or repeated stem bending

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Acclimation of Populus to wind: kinetic of the transcriptomic response to single or repeated stem bending.

Storms are the 1st cause of damages to European forests. Trees are sensitive to stem bending due to chronic wind. After 1 bending, they respond by modifying their growth during several days [1]. However, repeated stem bending induce a reduction in tree responsiveness, a phenomenon called accommodation [2,3]. Due to climate changes, strong wind may be more frequent [4]. How will trees acclimate or not to such new wind regimes?

First global and kinetic picture of molecular responses to stem bending

Long-term time series expression profiling

Gene expression modifications were assessed at 0.5 h, 2 h, 24 h and 72 h after a transitory controlled bending (with Affymetrix microarray).

- 2,633 differentially expressed genes (DEG)
- 75.6% of DEG are detected at 0.5 h and 2 h after the bending
- Many DEG are detected at several time points.

Refinement of the early time course analysis for the biological processes involved

Refined time course analysis using Q-PCR → 6 extra time points between 0.5 h and 24 h for representative genes of each cluster

Chosen genes represent the temporal patterns and the GO annotations of the cluster.

- Early regulated genes are related to “stress response”:
  - Transcription factors families (e.g. fig. A);
  - Jasmonic acid and ethylene signaling (e.g. fig. B).

- Some early up-regulated genes are down-regulated in later stages (see PtaAZ2 fig. B).

- Negative feedback mechanism?

- Late up-regulated genes (21 h - 72 h), seem to be linked to a remodeling of cell wall-related processes.

Toward a better understanding of the accommodation process

Objectives: to investigate the extent of the molecular accommodation and to identify potential molecular actors.

Gene expression 0.5 h after 1 bending VS. Gene expression 0.5 h after 2 bending (24 h interval)

96% of the early regulated genes after a 1st bending are less regulated after a 2nd bending.

This mechanism may allow the plant to avoid over-reaction to successive bending.

Perspectives: We are currently working on new methods of gene network inference to understand the fine regulation of this mechanical signaling pathway.