GENERAL INFORMATION

author(s)	Van Wittenberghe S
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data	

MATERIALS & METHODS

study area	5n (scientific zone – tower)
time period	March 2008–January 2009
goal	- study of the physiological, anatomical, and physical leaf characteristics for 4 tree species, and evaluate the phenoplasticity (based on measurements during the growing season) - determination of the variation in leaf characteristics (anatomic, physiologic, phenoplastic) at different heights within a crown of an adult beech tree and for young beeches located at the same heights
set-up	4 species, young vs. adult tree - 25 potted plants for oak, beech, birch and pine (2–3 years old) - adult beech next to the measuring tower in 5n - 3 potted beech trees at ground level, 7 m, 14 m, 21 m, 28 m at the measuring tower <u>ANATOMICAL/PHYSICAL</u> stomatal density and size (nail polish method) - 2 trees per species, 1 branch per tree, leaf 2,5,9,10 from the top bud - 2 branches per height level for the adult beech, same leaves sampled - sunny day leaf structure: vertical tissue structure - 2 trees per species, 2 branches per tree, 8-10 leaf segments of random leaves - microscopic leaf cross sections leaf wettability - drop volume 7.5 x 10^{-3} ml for broadleaved species, 3 x 10^{-3} ml for coniferous species - photographs of drops on the abaxial and adaxial leaf surface - young trees: 10 leaves of 2 trees, 4th leaf of each branch - adult tree: 10 leaves per height level cuticular surface - scanning electron microscope (SEM) - 1 cm2 leaf samples - 2 leaves per species, adaxial and abaxial

	PHYSIOLOGICAL stomatal conductivity - 10 leaves per species (except pine) cuticular permeability (leaf disk method) - leaf surface with and without stomata for the broadleaved species - 12 samples of 3 leaves per species: 4 for adaxial permeability, 4 for abaxial permeability, 4 for relative water content chlorophyll content - 5 leaves of 5 different branches for 2 trees per species and height level - labelled leaves on the measuring tower - 3 measurements per leaf chlorophyll fluorescence - the labelled leaves on the measuring tower (young and adult beech)
data collection	ANATOMICAL/PHYSICAL stomatal density and size - number of stomata on a fixed leaf area - dimensions of opened stomata on the 5^{th} and 9^{th} leaf of a branch leaf structure - thickness of upper epidermis, palisade mesophyll, spongy mesophyll, lower epidermis leaf wettability - left and right contact angle between drop and leaf surface cuticular surface - quantitative description PHYSIOLOGICAL stomatal conductivity - 10 measurements of total conductivity for water vapour at a light intensity just below the saturation value (LI-6400) cuticular permeability - mass, permeability chlorophyll content - chlorophyll content meter chlorophyll fluorescence - adaxial surface
remarks	Table 2.1 gives an overview of the sampling dates (p 37) Table 2.3 gives an overview of the number of measurements for each variable (p 56).

RESULTS

Birch leaves show the highest mesophyll conductivity. Birch and pine show the highest stomatal conductivity. Thus, birch showed a high potential for gas exchanges. Contact angle at the abaxial surface was highest for oak and pine; birch had low contact angles and easily wettable leaves. Leaf wettability increases from summer to autumn (except for beech).

The leaf structure varied along the vertical gradient, for the adult as well as for the young beeches. The most optimal structure for photosynthesis (thick leaf, low palisade coefficient) occurred at 21 m height for the adult tree. The highest level (28 m) was associated with high stress. The stomatal conductivity was lowest at 28 m for the young beech trees because of the low stomatal density and lower stomatal surface area. For the adult tree, stomatal conductivity increased with height till 21 m because of the increase in stomatal density, and between 21 and 28 m because of the larger stomatal surface area. The contact angle was highest at 21 and 28 m during the summer months, and the contact angle decreased in autumn, mainly

for the 4th level. The lower levels show no significant changes in contact angle for the adaxial and abaxial surface.