Norwegian University of Science and Technology
Department of Biology
Faculty of Natural Science and Technology
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EXAM IN: BI2021 Plant ecophysiology **ENGLISH**

DATE: 15. December 2014

Total hours: 3

Study points: 7,5

Pages: 2

Sensor date: 15. January 2014

Permitted materials:

Open-book exam; textbook, scientific articles, dictionary and notes

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By prior agreement, questions are given in English, but students may write in English, Nynorsk, or Bokmål.

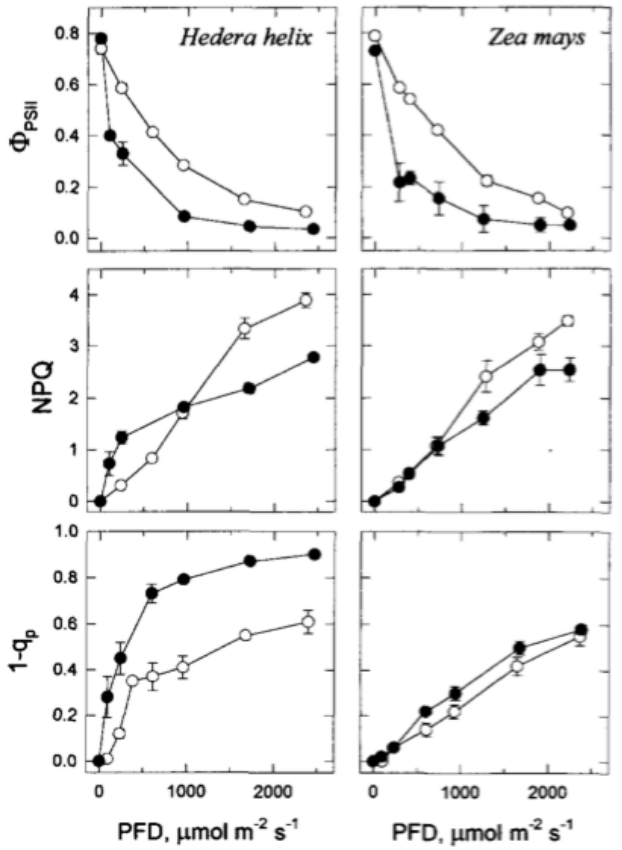

Fig. 2. Light response curves of the actual photon yield of PSII photochemistry (Φ_{PSII}), Stern-Volmer non-photochemical quenching (NPQ) and the reduction state of PSII centres ($1 - q_p$) in sun (open symbols) and shade (closed symbols) leaves of *Hedera helix* (left panels) and *Zea mays* (right panels). Error bars indicate SE (*Hedera helix*, n = 4; *Zea mays*, n = 3).

Source: Brugnoli, E., Scartazza, A., De Tullio, M. C., Monteverdi, M. C., Lauteri, M., & Augusti, A. (1998). Zeaxanthin and non-photochemical quenching in sun and shade leaves of C-3 and C-4 plants. *Physiologia Plantarum*, *104*(4), 727–734.

1. The figure at left shows some chlorophyll fluorescence data for sun and shade leaves of *Hedera helix* (common ivy, bergflette), a C3 species, and *Zea mays* (maize, mais), a C4 species. PFD is photon flux density, equivalent to PAR.

a. Explain in general terms what the Yield and NPQ measurements are, and why Yield decreases and NPQ increases with increasing PFD.

b. Compare and explain the changes in NPG in the sun and shade leaves of *Hedera helix*.

c. Compare and explain the results for the C3 and C4 species; how and why are they similar or different? Is this what you would expect based on what you know about C3 and C4 species in general?

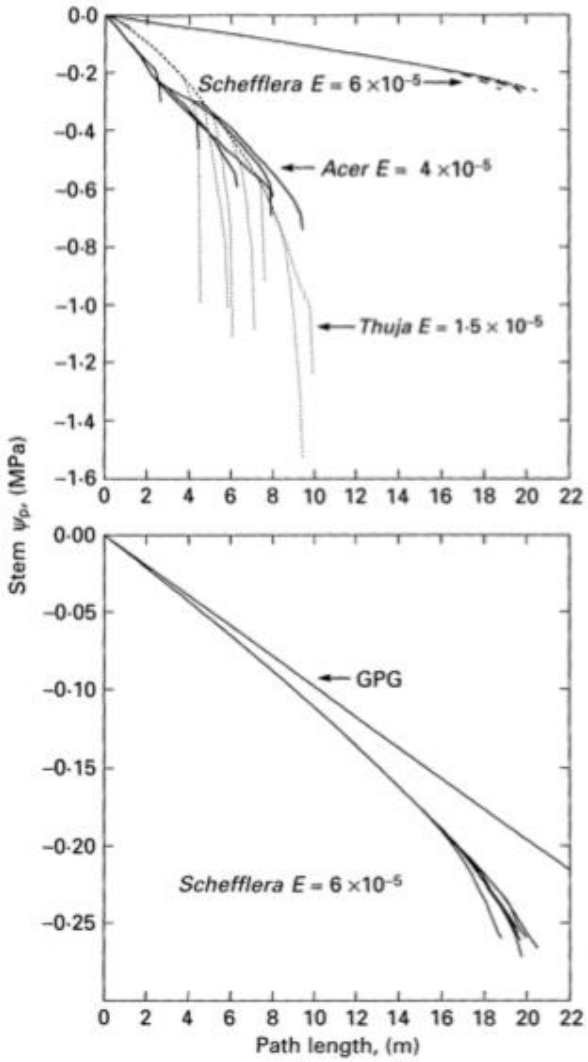

Figure 5. Profiles of pressure potential of stems versus the distance (path length) water must travel from the base of the tree to a stem apex. The lower diagram shows *Schefflera* on an expanded scale of ψ_p. All values include the gravitational potential gradient (GPG) required to lift water up the tree. These curves are calculated from the hydraulic maps and representative evaporative flux density (E kg s^{-1} m^{-2}) for each species in the graph (modified from Tyree *et al.*, 1991).

2. The figure at left is taken from the paper by Tyree et al. (1991) that is included in the pensum for the course.

a. Why does xylem pressure decrease from the bottom to the top of the tree? Why does it decrease more steeply towards the tips of the branches? What is the significance of the GPG?

b. Compare the pressure profiles of the three species. How do they reflect the growing environments, hydraulic architecture, and growth strategies of these species?

Source: TYREE, M., & EWERS, F. (1991). The hydraulic architecture of trees and other woody plants. *New Phytologist* 119:345-360

3. Discuss the environmental factors that influence the phenology of bud break in temperate zone tree species and the possible effects of global warming on the timing of bud break.