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2.4.5 Drought responses in *Populus euphratica*: effects on water relations, growth, hydraulic properties and gas exchange

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Populus euphratica species is famous for its ability to cope with high salinity. Moreover, its distribution area comprises deserts with very hot and dry summers (and very cold winters). All species of the *Populus* genus are known to be drought sensitive and a phreatophytic behaviour of *P. euphratica* may explain its ability to grow in such dry areas. In this experiment, we studied the ecophysiological responses of *P. euphratica* to an increasing drought stress. Plantlets of *P. euphratica* were obtained by *in vitro* culture (from Ein Avdat natural park, Israel). After *ex vitro* acclimation, they were transferred and acclimated to Nancy's greenhouse. Climatic conditions depended on outside weather but temperature was regulated between 15 and 32°C.

A moderate, increasing drought stress was applied and controlled for 6 weeks. Soil volumetric water content was measured one to two times a day depending on the intensity of the stress (TDR and weighting). Plantlets were progressively brought to 5 stress levels: 10%, 7.5%, 5%, 3% HV and back to fully available water. Although soil water content decreased down to as 3.5%, predawn and minimum water potentials remained above -0.8 and -1.1 MPa, respectively. At this stage, relative leaf water content had declined from 96 to 89% and severe stress symptoms such as leaf yellowing, wilting and shedding were observed. Diameter growth significantly decreased as soon as soil volumetric water content (SWC) reached 16% and then very rapidly stopped. Height growth was affected at SWC around 12%, but reached 0 only when SWC has dropped to 6%. Leaf emission rate was affected 4 days after diameter growth reduction. Stomatal conductance (g_s) decreased very early, as soon as soil moisture was less than 10%. Net CO₂ assimilation decreased later than g_s , only when SWC reached 7-8%. A complete recovery of net CO₂ assimilation occurred about 5-6 days after rewatering but stomatal conductance did not completely recover even after 11 days. Water stress had no effect on total chlorophyll content. Soil-to-leaf hydraulic conductance (g_L) decreased with drought. Embolism developed early, when drought was rather weak and progressed with increasing stress to 60% PLC. For a given stress level, roots were less embolised than stem.

Although *P. euphratica* is tolerant to salinity, our results demonstrate that it is definitely a drought sensitive species; trees may grow and survive only when the access to a water source such as a water table is possible. This clearly explains why this species is mostly confined to river banks in arid zones.