

EFFECTS OF DROUGHT AND RE-WATERING ON WATER TRANSPORT IN *SEDUM SEDIFORME* (JACQ.) PAU

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Sedum sediforme (Jacq.) Pau is a widespread succulent species, common on rocky semi-arid substrates and on roofs in the Mediterranean area, where it grows with very little soil and water and optimizes photosynthetic carbon acquisition by shifting from C3 to CAM metabolism under drought conditions (Sajeva *et al.*, 1995).

In several leaf succulent species under water shortage, water shuttling between old and young leaves has been observed or hypothesized, but it is not clear if this is a common strategy to optimize water use by younger tissues (Rabas and Martin, 2003).

We investigated how this species responded to fluctuating water supply, carrying out observations and measurements on potted plants grown under well-watered conditions, three weeks after suspending irrigation, and two weeks after regular re-watering. Measured parameters were leaf relative water content (RWC) of basal and apical leaves, stem hydraulic conductivity (k_{stem}) and percent loss of conductivity (PLC). Presence of mechanical obstructions in stem xylem was observed by light microscopy, while symplastic and apoplastic fluorescent tracers were used to follow water transport pathway between basal and apical leaves. Overall plant growth and new root formation were followed throughout the experimental period.

Leaf RWC decreased significantly three weeks after withholding water, and returned to control values two weeks after regular re-watering. RWC of apical leaves was always significantly lower than that of basal leaves, suggesting that there was no water shuttling between basal and apical leaves. Furthermore, neither apoplastic nor symplastic tracers supplied through basal leaves were evident in apical leaves.

Stems of well watered plants showed k_{stem} values around $1.5 \text{ E-7 Kg m MPa}^{-1} \text{ s}^{-1}$ and an average PLC of 5%, while water stressed plants showed a 30% decrease in k_{stem} and an average PLC of 40%. After two weeks of recovery from water stress, PLC was still around 40%, while k_{stem} showed a further decrease, suggesting that the stem xylem transport system had been irreversibly damaged.

Observation of stem cross sections confirmed a significantly higher presence of mechanical obstructions, gums and tyloses, in stem xylem conduits of plants after recovery from water stress, compared to those under well watered conditions. Furthermore, there was a higher presence of obstructions in the basal than in the apical part of the stems.

In *S. sediforme* during drought, water shuttling between older and younger leaves was not observed, and basal and apical leaves lost water to the same degree. The axial water transport system was impaired during water shortage periods, particularly in the basal part, due both to embolism and mechanical occlusions. Water content recovery after re-watering however was complete, suggesting that the remaining functional xylem was sufficient to provide water, once new roots had emerged (Nobel, 1998). Formation of adventitious roots at the base of the younger part of the stem allows plants to take up water after rain bypassing the older more damaged part of the stem and ensuring growth of the younger tissues from which flowering axes are formed.

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