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Axial variation of xylem conduits in giant cacti

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Axial variation of xylem conduits in giant cacti UNIVERSITY OF CAMBRIDGE Giacomo Mozzi, Kevin R. Hultine, Tommaso Anfodillo, Alan Crivellaro DESERT Conduit diameter (Cd) essels widening in CaC Distance from top of plant (L) $Cd = aL^b$ with b = 0.20odillo et al. 2013) Plant picture Genus species Echinopsis Carnegea gigantea Pachvcereus tetetza weberi Echinopsis Pachycereu: pringlei Stenocereus Stetsoni Pachycereu schotti thurheri terscheckii coryne T = Vessel diameter at plant top B = Vessel diameter at plant base 10000 Log Vessel density (vessels/mm²) Log Hydraulic diameter (µm) 10 10 (m Log (t/b)² 0.1 100 $b = -0.37 R^2 = 0.69$ p < 0.02 $b = 0.25 R^2 = 0.68 p < 0.01$ b = -0.73 R² = 0.73 p < 0.01 1 1 0.01 100 10 100 10 100 10 1 Log Distance from plant top (cm) Log Distance from plant top (cm) Log Distance from plant top (cm)

Hydraulic diameter increases basipetally maintaining water flow hydraulic resistance constant Thickness of the conduits double wall (t) and its span (b) interplay decreasing risk of cell collapse

References: Terrazas & Mauseth 2002, Univ. Cal. Press - Anfodillo et al. 2013, IAWA Journal - Olson et al. 2015, Ecology letters - Olson et al. 2018 PNAS

Vessel density decreases

basipetally to compensate for

smaller vessels at the top