The hydraulic conductivity of wounded xylem

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The xylem specific hydraulic conductivity ($k_s$) is a key trait for the description of the plant's ability to sustain the long-distance water transport required for transpiration. In this work, we systematically analyze xylem flow in several woody plants with contrasting anatomical traits combining flow experiments under different hydraulic pressure gradients. Results show a time and pressure dependence of $k_s$ similar to observations made a century ago by Dixon (1914). We mainly attribute the persistent drop in $k_s$, accentuated with higher-pressure gradients, to a wounding response of the xylem tissues. Evidence suggests that wounded xylem tissue releases polysaccharides (prominently pectin) that gradually occlude xylem conduits. The macroscopic definition of $K$ is further affected by complex microscopic xylem dynamics, with a key role of the xylem network topology, interconduit pit membrane flexibility, and redundancy of flow paths. These findings validate the picture of a complex and delicate conductive system whose hydraulic behavior goes beyond that of passive and inert deadwood. Notable implications for xylem conceptualization, measurements protocols, as well as ecosystem modeling applications are discussed.