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Radial force development during root growth measured by photoelasticity EVELYNE KOLB, PMMH-UMR 7636 ESPCI, 10 rue Vauquelin, 75231 Paris Cedex 5, France; Université Pierre et Marie Curie - Paris 6, 75230 Paris cedex 05, France, CHRISTIAN HARTMANN, IRD-UMR 211 "BIOEMCO," 46 rue d'Ulm, 75230 Paris cedex 05, France, PATRICIA GENET, CNRS-UMR 7618, 46 rue d'Ulm, 75230 Paris cedex 05, France; Université Paris Diderot - Paris 7, 75205 Paris cedex 13, France — The mechanical and topological properties of a soil like the global porosity and the distribution of void sizes greatly affect the development of a plant root, which in turn affects the shoot development. In particular, plant roots growing in heterogeneous medium like sandy soils or cracked substrates have to adapt their morphology and exert radial forces depending on the pore size in which they penetrate. We propose a model experiment in which a pivot root (chick-pea seeds) of millimetric diameter has to grow in a size-controlled gap δ (δ ranging 0.5-2.3 mm) between two photoelastic grains. By time-lapse imaging, we continuously monitored the root growth and the development of optical fringes in the photoelastic neighbouring grains when the root enters the gap. Thus we measured simultaneously and in situ the root morphological changes (length and diameter growth rates, circumnutation) as well as the radial forces the root exerts. Radial forces were increasing in relation with gap constriction and experiment duration but a levelling of the force was not observed, even after 5 days and for narrow gaps. The inferred mechanical stress was consistent with the turgor pressure of compressed cells. Therefore our set-up could be a basis for testing mechanical models of cellular growth.

Evelyne Kolb
PMMH, ESPCI

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