Title Calcium oxalate crystal distribution in rose peduncles: Non-invasive analysis by synchrotron X-ray micro-tomography

Author Uzuki Matsushima, André Hilger, Wolfgang Graf, Simon Zabler, Ingo Manke, Martin Dawson, Gerard Choinka and Werner B. Herppich

Citation Postharvest Biology and Technology. Volume 72, October 2012, Pages 27–34

Keywords Druse; Bent-neck; Edge-enhancement; Functional plant anatomy; Mechanical strength; Cut flower

Abstract

Comprehensive knowledge of plant microstructures and their variations is essential to understanding the mechanisms underlying postharvest quality changes of horticultural products. In cut roses, bent-neck syndrome is a widespread problem damaging millions of flowers well before the end of inherent vase life. Besides water status, structure and function of peduncles, and as a result, tissue strength, may determine bent-neck susceptibility. In this study, phase-contrast X-ray computed microtomography (sXMT) was applied to investigate non-invasively the inner structure of peduncles of samples of three rose cultivars that have been shown to differ greatly in their bent-neck susceptibility. Due to its high resolution, sXMT can be used to three-dimensionally study tissues, and even individual cells, without physically interfering with the product. In 3D sXMT images of peduncle samples of all cultivars, spherical, crystalline, biomineral, high X-ray attenuation particles were observed. These calcium oxalate (CaOx) druses, as clearly identified due to their shape and sizes by microscopic evaluation of concomitantly prepared fresh-cut slices, were mainly scattered in the cortex tissue but were also present less abundantly between vascular bundles. Because CaOx crystals are assumed to serve as structural support, high crystal densities may increase tissue strength. Although the CaOx crystal distribution pattern, the relative radial druse density and the CaOx crystal size differed greatly between samples of the three rose cultivars, these variations do not match the mechanical tissue strength, and hence the bent-neck susceptibility of cultivars as determined in earlier experiments. To the best of our knowledge, this is the first report on the in situ distribution of calcium oxalate crystals in rose peduncles.