Why fruit cracking differs among sweet cherry varieties

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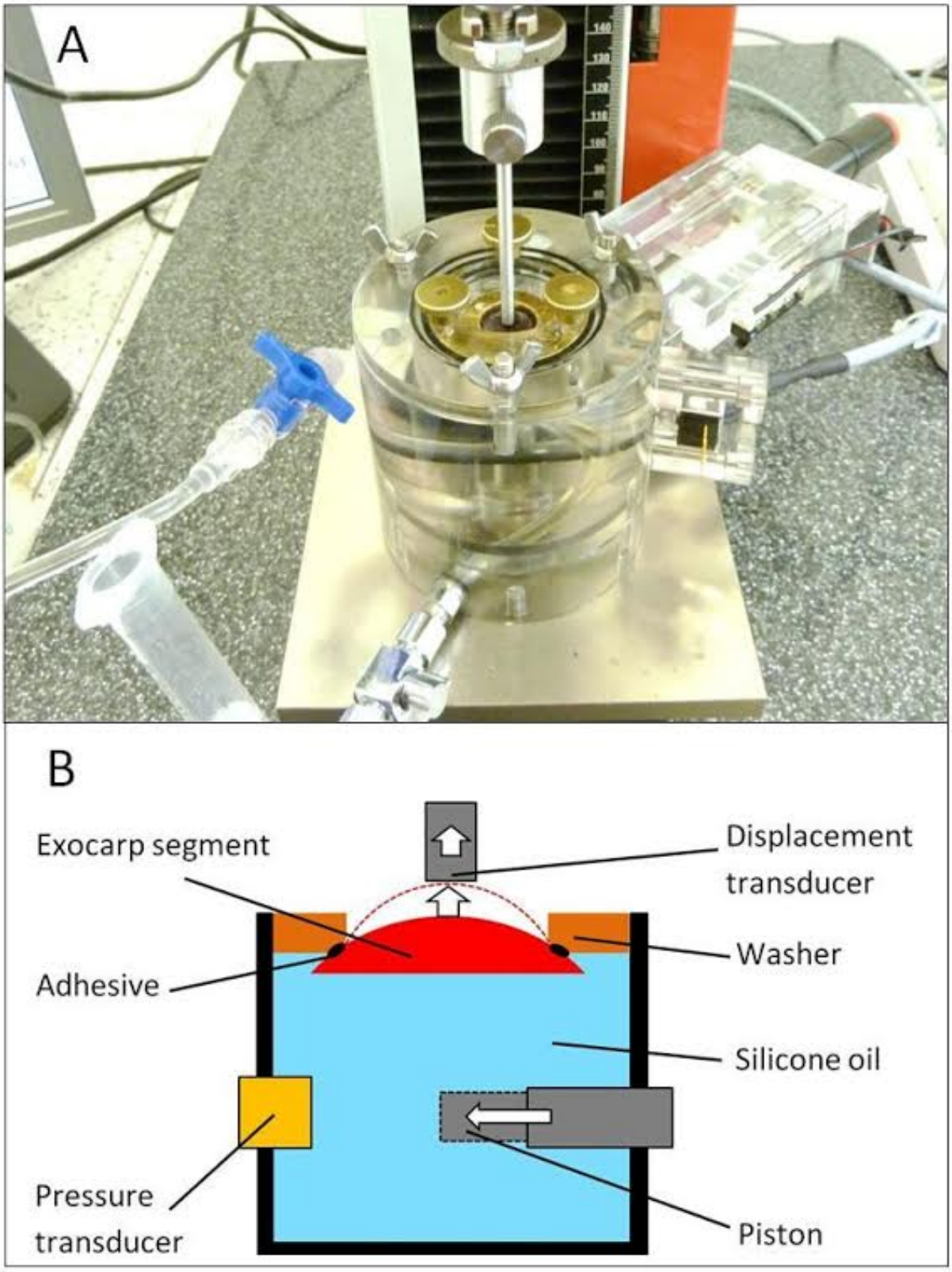
A
B
Exocarp segment
Displacement transducer
Adhesive
Washer
Silicone oil
Pressure transducer
Piston

Researchers used an elastometer, in which hydrostatic pressure is generated by displacing the silicone oil in the lucite chamber using a piston, to increase pressure and cause cherry fruit skin to bulge outwards. During bulging the skin is subjected to biaxial tension, causing strain. Pressure in the system and height of the bulging skin segment are measured using electronic pressure and displacement transducers. Credit: Moritz Knoche.

Sweet cherries are susceptible to a condition called "cracking", in which the skin of the fruit is strained, causing fractures or "cracks". The condition, which limits marketability of the fruit, may be a result of factors such as excessive water uptake or weak fruit skins. In a new study published in the *Journal of the American Society for Horticultural Science* (March 2016) researchers examined the mechanical properties of different cherry cultivars to determine how these properties impact skin cracking.

"Rain-induced cracking imposes a major limitation to (sweet cherry) production," said Moritz Knoche, corresponding author of the study. "Susceptibility to rain cracking differs among cultivars, but the mechanistic basis of differential cracking susceptibility among cultivars is not clear," Knoche said, adding that cracking is likely related to water uptake into the fruit. "Water uptake leads to an increase in volume, causing the fruit surface area to increase. When the limits of extensibility are exceeded, the fruit is expected to crack," Knoche explained.

To determine why sweet cherry varieties have differing levels of susceptibility to cracking, Knoche and co-author Martin Brüggenwirth tested two sweet cherry cultivars using a biaxial tensile test to quantify key mechanical properties, and then investigated the mechanistic basis of differences between the two cultivars. The researchers designed

experiments using 'Regina' (a cultivar less-susceptible to cracking) and 'Burlat' (a more-susceptible cultivar). "Because the fruits vary diurnally in diameter, and hence surface area, and because this may cause the skin to fatigue, we also investigated the effects of repeated loading and unloading cycles on the mechanical properties of the fruit skin of the two cultivars," the authors explained.

The results of tensile tests showed that the mechanical properties of the skins of 'Regina' and 'Burlat' fruit differed: the skin of the less cracking-susceptible variety 'Regina' was stiffer and had a higher fracture pressure than that of the more cracking-susceptible 'Burlat'.

Tests also revealed that repeated loading and unloading cycles did not cause the skin to fatigue in either cultivar. "The pressures at fracture were of a similar order of magnitude to those reported previously for both cell and fruit turgor. However, the strains at fracture, resulting from surface area increase following water uptake (0.3% to 1.1%), were markedly lower in the cracking assay than in the biaxial tensile tests," the authors said. They noted that the reason for this discrepancy is unknown and should be studied further.

"These results suggest that cell wall physical (and possibly also chemical) properties account for the cultivar differences in skin mechanical properties, and hence in cracking susceptibility," the authors said.

More information: The complete study and abstract are available on the ASHS *J. Amer. Soc. Hort. Sci.* electronic journal web site: journal.ashspublications.org/c … t/141/2/162.abstract

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