WORLD CARROT MUSEUM

Disease Response Mechanism in Carrots or How a carrot looks after itself

Not all of the chemical constituents of carrots are for our health; some appear to be there for the health of the carrot itself. One reason that the carrot can be stored for long periods of time, such as over winter in a root cellar, is that the carrot has a mechanism to guard against microbial decomposition (rot).

There are three enemies of carrot storage: wilt, re-growth and rot. The first of these is no problem if the carrot is stored where the humidity is high. The second is of little consequence if the carrot is stored at 0 to 5°C.

The carrot itself contributes much toward conquering the last enemy, rot. At the present time, scientists are busy determining how the disease response mechanism of the carrot operates. There appear to be three lines of resistance.

The skin - The first line of resistance is the outer membrane or skin of the carrot and chemical compounds that are normally present there. Two antifungal polyacetylenes, falcarinol and falcarindiol, and an isocoumarin, 6-methoxymellein, are present in small amounts in a normal carrot and present the first barrier in undamaged carrots.

Post Harvest - If during harvest or post harvest handling this barrier is broken, the surface is punctured, scraped or sliced, microorganisms may begin to grow. The carrot at this point begins a wound healing process by accumulating suberin, a complex polysaccharide, at the wound site. Along with suberin, lignin is also accumulated.

Suberisation is complete within 48 hours after wounding, and lignification is complete within 168 hours of wounding..

Phytoalexin barrier - The last and most important line of resistance is the phytoalexin barrier. Phytoalexins are chemicals produced by plants that impart disease resistance in response to mechanical injury, physiological stimuli or infection. Scopoletin, a coumarin,and para-hydroxy benzoic acid, a phenol, are apparently early arrivals on the scene but later disappear.

The isocoumarin 6-hydroxy mellein and the closely related 6-methoxy mullein are major components of the phytoalexin complex. Also the polyacetylenes, falcarinol and falcarindiol, which are present in approximately 30 and 60 parts per million respectively in normal carrots, are transported to the wound site. Perhaps this wide array of phytoalexins is present because a variety of micro organisms must be stopped.

Some of the economically important pathogens of cold-stored carrots are:*Botrytis cinerea Pers ex Pers, Sclerotinia sclerotiorum (Lib.)de Bary, Mycocentrospora acerina and Rhizopus sp.* Other polyacetylenes are known to occur in carrots, although in very small concentrations. In any one infection, production of one or more of these acetylenes could be activated. Susceptibility to rot during storage increases on length of storage, severity of the wound, and age of the root at harvest indicate that the DRM begins to decline after the carrot reaches an age of 176 days.
