Abstract:

The interest in alternative methods for postharvest decay control of horticultural crops has been continuously growing in order to minimise pre- or postharvest treatments with agrochemicals. This review is focused on reducing decay, chilling injury and enhancement of host resistance to pathogens through physical treatments of heat and UV-C, mainly in citrus fruits. Heat application markedly reduced decay incidence and the sensitivity of citrus and other fruits to chilling injury. Several methods of heat application have been successfully developed. Curing fruit for 72 hours at 36°C, or a short - duration hot water treatments gave favorable results with several citrus cultivars. Best results were obtained by hot water dip (HWD) for 2 min at 53°C, and by drenching the fruit on moving brushes exposing the fruit to heat for 10-30 sec at temperatures between 52-62°C. The hot water drench with or without moving brushes has the advantage of being the most suitable method for installing in the packinghouse conveyer line. Several types of machines for hot water treatments are already operating in Israel and several other countries for citrus and other fruits such as, bell pepper, corncob, litchi, mango, melon, nectarine and peach. Another important outcome of the heat treatment was the application of hot rather than cold fungicide for citrus fruits which enabled for example, the reduction of the dosage of imazalil from 1000 to 250ppm. The mode of action of the heat treatment in reducing decay was studied mainly with P. digitatum. Heat treatment arrested the growth of this pathogen for 24 to 48 h enabling the fruit to build up its mechanisms of resistance, if elicited by the pathogen. The following defense mechanisms of citrus fruits against pathogens were elicited by a combined inoculation with P. digitatum followed by heat treatments: production of passive barrier against the invasion of wound pathogens; production of the phytoalexins scoparone and scopoletin and enhancement of production of the PR proteins chitinase and β-1,3-glucanase as well as induction of several heat shock proteins. Additionally the heat melted portions of the epicuticular wax layer occluding existing cuticular fractures and micro wounds, thus protecting the fruit from wound pathogens. Some of the new findings in enzymology and molecular biology related to the reduction in chilling injury are described. UV, unlike heat treatments, acted by itself as an abiotic physical elicitor of resistance mechanisms. Irradiation with UV inhibited decay of inoculated citrus fruits and elicited the synthesis of the phytoalexins - scoparone and scopoletin. However, this treatment was also phytotoxic. After optimization research, dosage and conditions of the irradiation were found that would reduce decay in kumquat, Valencia orange, Star Ruby grapefruit and pepper fruits without phytotoxicity. Large scale study of UV irradiation of ‘Star Ruby’ fruit is needed to determine whether the reduction of decay without damage could be applied commercially. However, both heat and UV cannot match the high efficiency of decay control achieved by present day fungicides.