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EARLY DIAGNOSIS OF DISEASE IN ORANGE FRUITS BY USING REFLECTANCE SPECTROSCOPY

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Post-harvest decay is the most important factor limiting shelf-life of fruits. About 30% of the economic loss in harvested fruits is caused by pathogens. Among the post-harvest diseases of the orange fruits *Phytophthora citrophthora* (browning rot fruits) and *Penicillium italicum* (blue mold fruit) are the most common. These pathogens attack the host by means of pectic enzymes and they are responsible for metabolic changes as well as the alteration of pigments like chlorophylls, carotenoids and anthocyanins. Since the spectral properties of pigments change in function of the physiological state of the fruits, the study of the changes of the spectral properties of these pigments allow to detect the health and the physiological status of the fruits. The reflectance spectroscopy is a useful tool for studying pigment composition and content in plants *in vivo*. The technique is non-invasive and can be performed in a real-time mode. The reflectance values in the visible range (Vis, from 400-700 nm), where the pigments absorb light, give information on the principal pigment composition and content. Moreover, in Vis range it is possible to identify the pigment and plant tissue degradation and the appearance of necrotic zones as a response to biotic and abiotic stress. The internal structure of epidermal layer can be monitored in the near-infrared region (NIR, 700-2500 nm). All these characteristics allow an early diagnosis already at the first stages of the disease. The aim of this work was to monitor and estimate the development of specific diseases on cultivar of blood orange in post-harvest by using reflectance spectroscopy. The blood orange cultivars Tarocco, Moro, Sanguinello have been inoculated with *Penicillium italicum* and *Phytophthora citrophthora*. Reflectance measurements have been performed on fruits after 24, 48 and 72 h from the inoculation. The range of wavelengths used was 400 nm to 1100 nm (Perkin Elmer Lambda 25 spectrophotometer). A Cary E spectrophotometer was used for the reflectance measurements in NIR until 2500 nm. Both instruments are equipped with the integrating sphere and certified reflectance standards. The results evidence the different infection modality between the two pathogens in both time of appearance of symptoms and reflectance spectra. Peaks corresponding to 6,7-dimethoxycoumarin (scoparone) were detected by second derivate of the reflectance spectra. This substance is involved in the host-pathogenic interaction. The investigation on the fruits inoculated after 24 and 72 h by means of gas-chromatography/mass spectrometry has been performed. The results confirm that the degradation of pigments and the cell damages of flavedo in response to infestation can be monitored by using reflectance measurements at the early stages of the disease. The changes in reflectance spectra of the orange peel caused by *P. italicum* and *P. citrophthora*, pathogens can be seen already 24 h after inoculation, when the damage is still not visible. The reflectance spectra of fruits infested by *P. italicum* diverge from that of *P. citrophthora*. The differences among the various cultivars in response to the pathogens have been related with the areas of the necrosis.