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Short communication

Effect of post-harvest fungal pathogens on fruit quality in guava cv. Allahabad Safeda

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ABSTRACT

Fruits of guava cultivar '*Allahabad Safeda*' at mature yellowish-green stage were collected from Allahabad fruit market. Nine post-harvest fungal pathogens were isolated from these fruits. Of these, two isolates with highest incidence, namely, *Pestalosia psidii* (fruit canker causing pathogen) and *Gloeosporium psidii* (anthracnose causing pathogen) were used in the study. Fruits inoculated with the pathogens and Control (a lot of fruits with no treatment) were stored at ambient temperature. The fruits were analyzed for various quality attributes at different storage intervals for upto 15 days. Data revealed that fruits in all the treatments showed a lower fruit-weight loss compared to the untreated fruits. TSS, acidity (%) and ascorbic acid content (mg/100g) were also found to decrease in relation to the Control at 5, 10 or 15 days of storage. The least PLW was recorded in *Gloeosporium psidii*-treated fruits, followed by those treated with *Pestalosia psidii*. But for the bio-chemical changes (also due to post-harvest fungi) *Gloeosporium psidii*-treated fruits had higher TSS, acidity (%) and ascorbic acid content (mg/100g) than *Pestalosia psidii*-treated fruits.

Key words: Guava, Allahabad Safeda, fungal pathogens, post-harvest, fruit quality

Guava (*Psidium guajava* L.) is one of the most common and major fruit crops of India. It is the fourth most important fruit crop in terms of area and production after mango, banana and citrus. In India, it occupies nearly 2.68 lakh ha, with a production of 36.68 lakh tonnes and a productivity of 13.7 t/ha fruit per year (NHB, 2015). The fruit is rich in minerals like phosphorus (23-37mg/100g), calcium (14-30mg/100g), iron (0.6-1.4mg/100g) and vitamins like ascorbic acid, niacin, pathotenic acid, thiamine, riboflavin and Vitamin A (Bose *et al*, 1999). It is a climacteric fruit which ripens rapidly after harvest and, therefore, has a short shelf-life. Guava fruit is highly perishable and loses its texture and quality within 3-4 days of harvest, at ambient temperature. Post-harvest diseases develop during handling and grading. Packing and transportation adversely affect fruit quality. Deterioration in quality caused by fungal pathogens may include a wide range of symptoms of spoilage. In tropical and subtropical regions of India, about 25-40% of fruits harvested are damaged from faulty post-harvest handling and infection with fungal diseases. With this backdrop, the present study was undertaken to investigate fruit quality in guava cv. Allahabad Safeda as affected by post-harvest fungal pathogens.

The diseased parts from infected fruits were cut into small pieces (2-3mm) and surface-sterilized with 0.1% mercuric chloride solution for 30 seconds. These pieces were then washed three times in sterilized distilled water and aseptically transferred onto clean, sterilized petri-dishes containing solidified potato dextrose agar medium. The petri-dishes were incubated in an inverted position at 28±1°C and observed after 3-4 days. Fungal hyphae growing out from the infected fruit pieces associated with post-harvest disease in guava were identified using a microscope, as per Biligrami *et al* (1981 and 1991), Burnett and Hunter (1999) and Subramanian (1971), followed by purification on PDA slants. Pure culture was maintained by periodic subculture as per Aneja (2003). All the nine post-harvest fungal pathogens, viz., *Pestalotia psidii*, *Gloeosporium psidii*, *Rhizoctonia solani*, *Fusarium* sp., *Alternaria alternata*, *Cladosporium* sp., *Geotrichum candidum*, *Mucor* sp. and *Trichothecium* sp., were isolated from the guava fruit. Of the nine pathogens, the two most-frequently detected pathogens, *Pestalotia psidii*, the fruit-canker causing fungal pathogen (Fig. 1a, 1b and 1c) and *Gloeosporium psidii*, and anthracnose causing fungal pathogen (Fig. 1d, 1e and 1f) were used for further study.

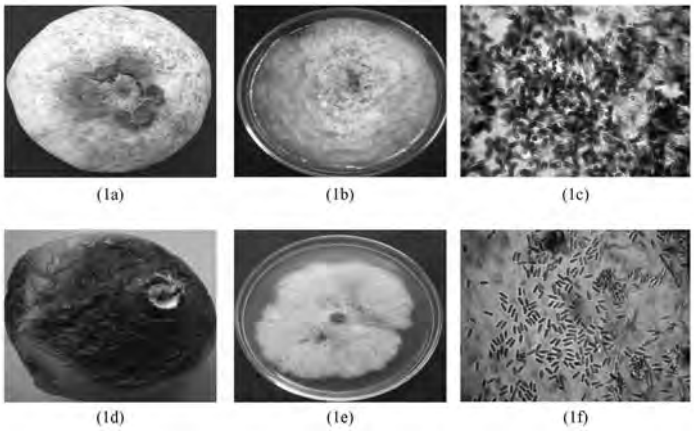

Fig 1. Post-harvest diseases of guava: 1a and 1b. Fruit canker of guava and pure culture of the pathogen, 1c. Conidia of *Pestalotia psidii*; 1d and 1e. Anthracnose of guava and pure culture of the pathogen, 1f. Conidia of *Gloesporium psidii*

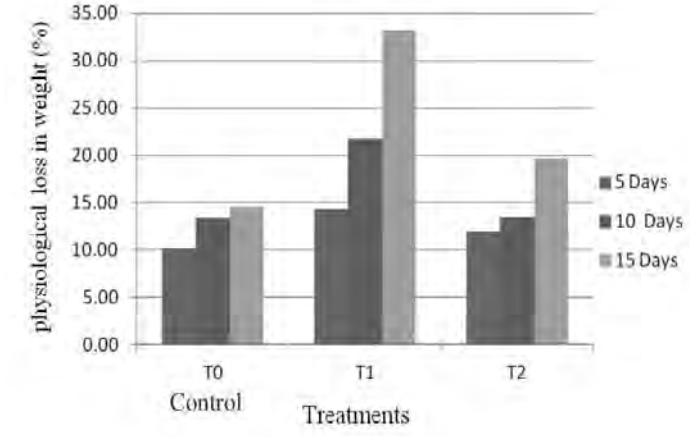

Fig. 2. Effect of inoculation of *Pestalotia psidii* (T1) and *Gloeosporium psidii* (T2) on physiological loss in weight (%) of guava fruit after 5, 10 and 15 days of storage.

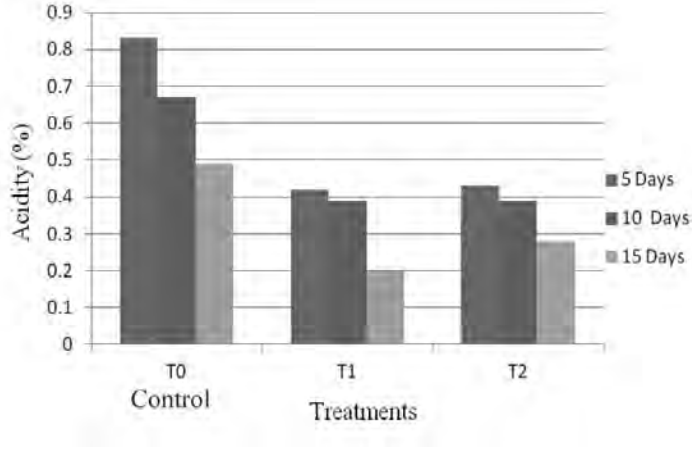

Fig. 3. Effect of inoculation of *Pestalotia psidii* (T1) and *Gloeosporium psidii* (T2) on acidity (%) of guava fruit after 5, 10 and 15 days of storage.

Fresh and mature, green coloured guava fruits of uniform size free of pests or mechanical injury were collected from the fruit market in Allahabad. The fruits were washed in distilled water, dried and surface-sterilized using 0.1% mercuric chloride for 30 sec. Wounds were made in guava fruits with the help of a sterilized cork-borer (6mm) and inoculated with pathogen *Pestalotia psidii* (T1) and *Gloeosporium psidii* (T2) containing a spore load of $1x10^4$ conidia/ml (Granger and Horne, 1924). The injured fruits were then wrapped in sterilized paper and stored at ambient temperature for 15 days. Observations were made regularly on various physico-chemical characters to assess storage quality as affected by the two pathogens, at intervals of 5 days. Physiological loss in weight (PLW) of the fruit was calculated on initial-weight basis and expressed as per cent. Total soluble solids (TSS) in the fruit were determined using a hand-held refractometer and, expressed as per cent. Acidity was determined by titrating guava fruit juice against 0.1N NaOH and expressed as per cent citric acid (Ranganna, 1977; Shankar, 1999). Ascorbic acid was determined using reduction of 2,6-dichlorophenol by ascorbic acid (Sadasivan and Manikan, 1996) and expressed in mg/100ml juice. The data was statistically analyzed through Analysis of Variance using CRD, as per Fisher and Yates (1968).

A perusal of the data indicates that physiological loss in weight (PLW) in guava fruit increased with advancement in storage period (Fig. 2). During different storage-interval periods, fruits treated with *Pestalotia psidii* (T1) showed maximum weight loss, i.e., 14.30% on the 5th day, 21.78% on the 10th day and 33.14% on the 15th day, followed by fruits infected with *Gloeosporium psidii* (T2), which ranged between 11.95 to 19.64% from 5 to 15 days of storage, respectively, compared to that in Control (where minimum physiological loss in weight was ranged between 10.21-14.51% during the same time interval). Difference in PLW may be due to the continuous moisture loss by evaporation and respiration in fruits. Infected guava fruits were associated with greater enzymatic activity by pathogens, thus resulting in higher PLW. These results are similar to findings of Chundawat *et al* (1976) and Mayer *et al* (1960). Acidity in guava fruits showed a linear decline during storage (Fig. 3).

Loss in acidity during storage was more rapid in fruits artificially inoculated with pathogens, compared to that in the non-inoculated ones. At 15th day of storage, acidity in guava under the two treatments was significantly different. Acidity of 0.49% was recorded in the Control, followed by T2 (0.28%) and T1 (0.20%).

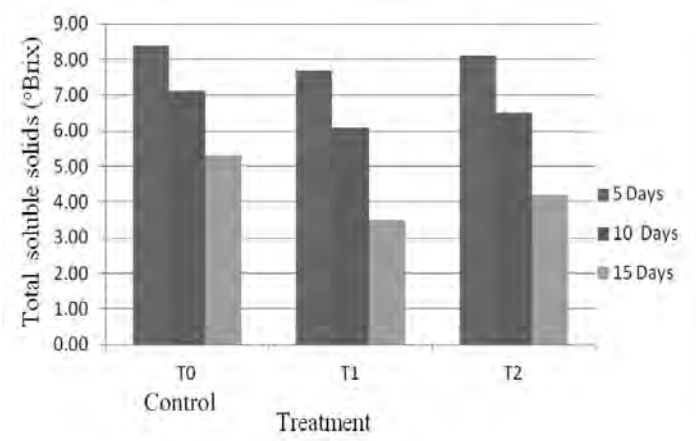

Fig. 4. Effect of inoculation of *Pestalotia psidii* (T1) and *Gloeosporium psidii* (T2) on Total Soluble Solids in guava fruit at 5, 10 and 15 days of storage

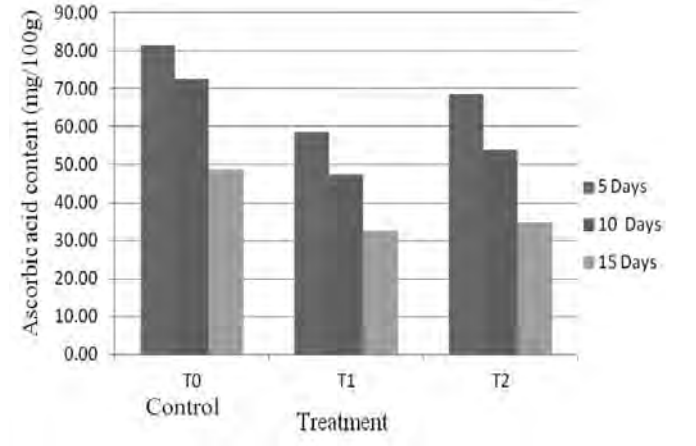

Fig. 5. Effect of inoculation of *Pestalotia psidii* (T1) and *Gloeosporium psidii* (T2) on ascorbic acid content (mg/100g) in guava fruit at 5, 10 and 15 days of storage

TSS of fruits inoculated with *Pestalotia psidii* and *Gloeosporium psidii* during storage was significantly reduced at 5th, 10th and 15th day of storage compared to the Control (Fig. 4). TSS in *Gloeosporium psidii* (T2) infected fruits was found to be 8.10, 6.50 and 4.20% at 5th, 10th and 15th day of storage, respectively; whereas, *Pestalotia psidii* (T1) treated fruits showed TSS values of 7.70, 6.10 and 3.50% at the same intervals of storage, respectively. Maximum TSS was recorded in the non-inoculated fruit (8.40%, 7.10% and 5.30% at 5th, 10th and 15th day of storage, respectively). During storage, TSS in both inoculated and un-inoculated fruits showed a decreasing trend; however, the rate of decline was faster in the infected fruits compared to the Control. This may be attributed to a higher degradation of metabolites by the fungal pathogens. This result is in agreement with Singh *et al* (1981). As with TSS, ascorbic acid content (mg/100g) in the fruit also decreased with advancement in storage period (Fig. 5). Ascorbic acid content in the fruit during storage at ambient temperature varied significantly at all the storage periods studied. *Gloeosporium psidii* (T2) had a detrimental effect on ascorbic acid content in guava fruit (68.75, 53.90 and 34.86 mg/100g at the 5th, 10th and 15th day of storage, respectively) compared to *Pestalotia psidii* (T1) inoculated fruits (58.76, 47.25 and 32.74 mg/100g, respectively) and in the Control (81.50, 72.47 and 48.80mg/100g, respectively) at the same interval of storage. Our results clearly show that the rate of consumption of ascorbic acid varies with the two fungi in the inoculated fruits. This may be due to the oxidation of ascorbic acid by ascorbic acid oxidase enzyme, or, by some other oxidative enzymes like polyphenol oxidase, cytochrome oxidase or peroxidase as reported by Siddiqui *et al* (1991).

It may be concluded that *Pestalotia psidii*, the fruit-canker causing fungal pathogen, and *Gloeosporium psidii*, the anthracnose-causing fungal pathogen, adversely affect the quality of guava fruit during storage. Information obtained in this study can be effectively utilized to develop suitable post-harvest management practices for minimizing deterioration in fruit quality and post-harvest loss in guava.

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