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# Nutritional spoilage of tomato and brinjal fruits due to post-harvest fungi

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**Abstract**

In the present investigation spore suspension of previously isolated *Alternaria solani, Colletotrichum sp., Fusarium solani, Phoma sp., Phomopsis vexans, Phytophthora sp., Phytophthora parasitica* and *Rhizopus stolonifer* from tomato and brinjal were separately inoculated by sterilized disposable syringe in same aged tomato and brinjal fruits in aseptic condition. After seven days, biochemical parameters like change in dry weight, changes in protein content, changes in total sugar content and changes in vitamin C (Ascorbic acid) content from tomato and brinjal were estimated. *Alternaria solani* showed maximum decrease in dry weight of tomato fruit. *Phytophthora parasitica* showed maximum decrease in protein contents, total sugar contents and ascorbic acid contents of tomato fruit. Maximum decrease in dry weight contents of brinjal was due to *Phomopsis vexans*. Protein content of brinjal was found to be reduced due to all fungi, but *Rhizopus stolonifer* and *Rhizoctonia solani* showed maximum reduction in protein content of brinjal. Maximum decrease in total sugar content of tomato was observed due to *Rhizopus stolonifer*. Ascorbic acid content in brinjal was drastically decreased due to *Rhizoctonia solani.*

**Keywords:** Tomato and brinjal fruit, dry weight, protein content, total sugar content and vitamin C (Ascorbic acid)

## INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) belongs to the family solanaceae and is one of the most remunerable and widely grown vegetables in the world. Among the vegetables tomato ranks next to potato in world acreage and ranks first among the processing crops. Tomato is grown for its edible fruits, which can be consumed either fresh or in processed form and is a very good source of vitamins A, B, C and minerals. In nutritional point of view, 100g of tomato contains, protein 0.9 g, Sugar 2.6g, Vitamin C 13mg, total fat 0.2g and dietary fibers 1.2g . Tomato cultivation has become more popular since mid nineteenth century because of its varied climatic adaptability and high nutritive value. Tomato is being exported in the form of whole fruits, paste and in canned form to West Asian countries, U.K., Canada and USA. The world annual production of tomato during 2003 was 113.3 million tonnes covering an area of 4.3 million hectare with the productivity of 26.34 tonnes per hectare and the Indian contribution to the world's production was 7.42 million tonnes. Tomato crop was grown in area of 0.52 million hectare with a productivity of 14.2 tonnes per hectare [1].

Brinjal is an important solanaceous crop of sub-tropics and tropics. Brinjal plants are grown throughout India, including West Bengal, Maharashtra, Bihar. The other main states growing brinjal are Karnataka, Maharashtra, Gujarat, Andhra Pradesh, Assam and Madhya Pradesh. The name brinjal is popular in Indian subcontinents and is derived from Arabic and Sanskrit whereas the name eggplant has been derived from the shape of the fruit of some varieties, which are white and resemble in shape to chicken eggs. As most of the population of India is vegetarian, the consumption of various vegetables is enormous here. India rank second in the world in terms of vegetable production. Brinjal plays an important role in vegetable production, grown in India and other parts of the world. India contributes 8703.8 million tones to the global production of brinjal and ranks second to China. After harvest tomato and brinjal fruits stores at different storage conditions. If storage conditions are not proper various fungi causes fruit rot and brings spoilage of nutritional value of tomato and brinjal fruits. Considering this fact present investigation has been carried out.

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## MATERIALS AND METHODS

Spore suspension of *Alternaria solani, Colletotrichum sp., Fusarium solani, Phoma sp., Phomopsis vexans, Phytophthora sp., Phytophthora parasitica* and *Rhizopus stolonifer* were separately inoculated by sterilized disposable syringe in same aged tomato and brinjal fruits in aseptic condition. Fruits of tomato and brinjal without inoculation were kept as control. After seven days of incubation following biochemical changes were estimated.

### Changes in dry matter (DM) content

Dry matter (DM) was calculated by weighing the sample after drying to a constant weight in an oven at 95 ± 5°C. For this purpose, l00 gm of sample was taken in a clean dry pre-weighed tray and is kept in oven for 48 hours or more, till constant weight. Weight of the dried sample was reported as percent dry matter (DM).

### Changes in protein content

Reagents: A. 2% $Na_2CO_3$ in 0.1 N NaOH; B. 1% NaK Tartrate in $H_2O$; C. 0.5% $CuSO_4.5\ H_2O$ in $H_2O$; D. 48 mL of A, 1 mL of B, 1

mL C; E. Phenol Reagent - 1 part Folin-Phenol [2 N] : 1 part water; BSA Standard – 50mg BSA in 50ml D.W.

0.2, 0.4, 0.6, 0.8 and 1 ml of working standard BSA was pipetted out in a series of test tubes. 0.1 ml of sample extract was pipetted out in another test tube. In all test tubes volume of 1 ml was made and tube with 1 ml of water served as a control. Then 5 ml of reagent C was added in all the test tubes including blank. It was then mixed well and incubate for 10 minutes at room temperature. 0.5 mL of dilute Folin-phenol solution was added to each tube. Each tube was vortexed immediately and incubated at room temperature for 30 minutes. Blue colour was appared and at 660 nm readings were taken. Absorbance *vs* mg protein graph was plotted to obtain standard curve.

**Changes in total sugar content**

The sugar content in the plant material was estimated [2]. 500mg of seed powder was taken in 50ml distilled water and boiled, then filtered. Further filtrate was diluted up to 100ml. Three Folin-wu tubes were taken and to it following content were added

(1) Blank tube - D. W. 2ml (2) 2ml glucose 'C' solution. (3) 2ml filtrate. In each tube 3ml alkaline solution of copper was added. Then tube was boiled in boiling water bath for 8 minutes. The tubes were cooled under tap water and 2ml of phosphomolybdic acid solution was added which gave blue colour. Then this solution was diluted up to 25ml distilled water and optical density was determined at 420nm and the amount of reducing sugar present in seed powder was calculated. Percent total sugar were calculated by following formula:

$$\text{Mg sugars/100mg samples} = \frac{\text{O.D. of unknown X 100 X 0.4}}{\text{Conc. from graph X 2 X W}}$$

Where, V = volume of the filtrate
W = weight of the sample taken

**Changes in vitamin C content**

Vitamin C content was estimated by standard titration method. 5 ml of standard solution of standard ascorbic acid (100mg /ml) was pipette out into a conical flask, then 10ml of 0.4 % oxalic acid was taken and it was titrated with dye solution. After that 2gm sample was extracted in 0.4% oxalic acid and volume was made up to 100ml by 0.4% oxalic acid. From that solution 5ml of sample was pipette out into conical flask and titrated with dye solution. End point was pink colour. Finally amount of ascorbic acid in mg / 100ml pulp was estimated by using following formula.

$$\frac{\text{Amount of ascorbic acid mg}}{\text{100ml pulp}} = \text{0.5mg/V}_1\text{ ml X V}_2\text{ml/5ml X 100ml/wt. of sample X 100}$$

Where, V1 ml = volume of Standard Ascorbic acid.
V2ml = volume of sample's Ascorbic acid.

## RESULTS AND DISCUSSION

**Biochemical changes in tomato due to post harvest fungi**

*Alternaria solani* showed maximum decrease in dry weight of tomato fruit, while *Rhizopus stolonifer* showed minimum decrease in dry weight. Protein content in tomato was found to be hampered due to *Phytophthora parasitica* while *Rhizopus stolonifer* showed minimum decrease in protein content of tomato. Total sugar content in tomato was reduced due to all post harvest fungi, but *Phytophthora parasitica* showed maximum decrease in total sugar contents of tomato. All fungi showed decrease in ascorbic acid contents, but among all these fungi *Phytophthora parasitica* maximum decrease in ascorbic acid contents (Table 1).

**Biochemical changes in brinjal due to post harvest fungi**

Maximum decrease in dry weight contents of brinjal was observed to decrease due to *Phomopsis vexans*. Protein content of brinjal was found to be reduced due to all fungi, but *Rhizopus stolonifer* and *Rhizoctonia solani* showed maximum reduction in protein content of brinjal. Maximum decrease in total sugar content of tomato was observed due to *Rhizopus stolonifer*. Ascorbic acid content in brinjal was drastically decreased due to *Rhizoctonia solani* (Table 2).

From results it is clear that, *Phytophthora parasitica* showed maximum decrease in total sugar content, protein content and ascorbic acid content of tomato fruit. While in case of brinjal, maximum decrease in total sugar content, protein content and ascorbic acid content was observed due to *Rhizopus stolonifer* and *Rhizoctonia solani.*

*Aspergillus niger, Aspergillus flavus, Alternaria alternata, Alternaria solani and Fusarium oxysporium* hampered the vitamin C contents in tomato fruit [3]. *Phoma destructiva* depleted the vitamin C and carbohydrate contents in tomato fruit [4]. Loss in amount of glucose in fruits have been reported for tomato-*Drechslera australiense* [5] tomato-*Alternaria solani* [6]; banana- *Gloeosporium musarum* [7].

It is therefore advocated that tomato and brinjal fruits be utilized within the two to three weeks after harvest. This will not only prevent excessive infection of the pulp by fungal pathogens but will also eliminate the possibilities of contamination with mycotoxins and other related metabolites of infecting pathogens that might be hazardous to human health.

Table 1. Biochemical changes in tomato fruit due to post harvest fungi

| Fungi | Dry weight (g) | Protein (g) | Total sugar (g) | Ascorbic acid |
|---|---|---|---|---|
| *Alternaria solani* | 3.8 | 1.3 | 2.7 | 12.5 |
| *Aspergillus niger* | 3.5 | 1.4 | 2.1 | 13.2 |
| *Phytophthora parasitica* | 3.7 | 1.1 | 1.8 | 12.4 |
| *Colletotrichum sp.* | 4.8 | 1.7 | 2.5 | 14.1 |
| *Rhizopus stolonifer* | 5.1 | 1.8 | 2.7 | 14.2 |
| Control | 5.5 | 1.9 | 3 | 15 |

Table 2. Biochemical changes in brinjal fruit due to post harvest fungi

| Fungi | Dry weight (g) | Protein (g) | Total sugar (g) | Ascorbic acid |
|---|---|---|---|---|
| *Alternaria solani* | 5.1 | 1.2 | 2.9 | 9.1 |
| *Phomopsis vexans* | 4.4 | 1.4 | 3.8 | 11.1 |
| *Rhizopus stolonifer* | 6.7 | 1.0 | 3.1 | 12.3 |
| *Fusarium solani* | 5.7 | 1.2 | 3.6 | 12.1 |
| *Rhizoctonia solani* | 4.8 | 1.0 | 3.2 | 8.9 |
| Control | 7.3 | 1.7 | 5.0 | 13 |

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