Environment Conservation Journal 11(3) 33-36, 2010
(ISSN 0972-3099) Abstracted and Indexed

Changes in ascorbic acid content of fresh apricot fruits under fungal pathogenesis

J. Bhadwal and Y.P. Sharma ✉

Received: 30-07-2010 **Accepted: 20-10-2010**

Abstract

The degradation of ascorbic acid content of fresh apricot fruits infected with *Rhizopus stolonifer*, *Aspergillus japonicus*, *A. niger* and *Penicillium citrinum* was studied. The experimental results revealed that there was decrease in vitamin C content of both healthy and infected fruits with an increase in incubation period. Fruits infected with *R. stolonifer*, *A. japonicus*, *A. niger* and *P. citrinum* had lost Vitamin C by 85%± 4.08, 78.3%± 2.36, 60%± 4.08 and 34.97%± 4.08 respectively after 6 days of pathogenesis whereas the healthy fruits still had 90%± 0.19 of vitamin C after same period of incubation. The degradation of ascorbic acid was more in infected fruits in comparison to healthy fruits and this may be either due to the production of ascorbic acid degrading enzymes or due to increased respiration rate which may induce rapid oxidation of ascorbic acid in the fruit tissue.

Keywords: *Rhizopus stolonifer*, *Aspergillus japonicus*, *A. niger*, *Penicillium citrinum*, *apricot*, *ascorbic acid*

Introduction

Ascorbic acid is widely distributed in fresh fruits and green leafy vegetables. While fruits also contain some dietary fibres, simple sugars, vitamins and minerals, they ought to be consumed fresh to derive maximum benefits as prolonged storage and careless handling can destroy their nutrient content and also affect the texture, colour and flavour (Serrano *et al.*, 2006).

Apricot is one of the most delicious and highly nutritive fruits rich in sugars, minerals and vitamins including ascorbic acid. Ascorbic acid (also known as vitamin C) is an antioxidant and along with other antioxidants, is known for inhibiting reactive oxygen species and their harmful effects (Knekt *et al*., 1991; Minnunni *et al*., 1992; Ferraroni *et al*., 1994). Apricot fruits, fresh as well as dried and their seed kernels serve as dessert and have immense medicinal properties. They are anti-inflammatory, anti-diarrhoeal, antipyretic, emetic, cardiotonic and antiseptic, besides being used in the treatment of respiratory and digestive ailments (Nyugen and Doan, 1989). However, the fresh apricot fruits, on account of their high moisture content, provide conditions conducive for the growth and multiplication of fungal organisms on the surface that may affect their nutritive value. In view of this, an investigation was undertaken to analyze the changes in ascorbic acid content of apricot fruits under the impact of its 4 most frequently occurring mycopathogens *viz*., *Rhizopus stolonifer*, *Aspergillus japonicus*, *A. niger* and *Penicillium citrinum.*

Author's Address
Department of Botany, University of Jammu, Jammu.
E-mail address: yashdbm3@ yahoo.co.in ✉

Materials and Method

Fully mature, ripe and healthy apricot fruits were collected from the various fruit markets of Jammu, brought to the laboratory in polythene bags and washed thoroughly with sterilized distilled water. These fruits were then artificially inoculated with five days old pure cultures of *Rhizopus stolonifer*, *Aspergillus japonicus*, *A. niger* and *Penicillium citrinum* by pin-prick method and incubated at 25±2°C. The inoculated fruits were then analyzed

for ascorbic acid content after 2, 4 and 6 days of incubation. Healthy uninoculated fruits were kept as control. The ascorbic acid content was estimated titrimetrically using the indicator dye, 2,6-dichlorophenol indophenol (DCPIP) as followed by Sharma and Sumbali (2000). The dye was first standardized for calculating the quantity of ascorbic acid reacting with 1 ml of dye. For this, 5 mg of standard ascorbic acid was dissolved in 100 ml of 5% metaphosphoric acid. 10 ml of this solution was taken in a beaker and titrated against 0.025% DCPIP solution filled in a microburette. The amount of dye used was recorded when a pink end point persisted for atleast 30 seconds. From this, the quantity of ascorbic acid (in mg) reacting with 1ml of dye was calculated. Thereafter, fruit tissue of healthy fruits and those inoculated with test pathogens was cut into pieces (5 gm each) and crushed in mortar by adding 25 ml of 5% metaphosphoric acid solution to it. In each case, the solution was then filtered through Whatman No.42 filter paper using suction pump and the residue was washed 2-3 times with 5% metaphosphoric acid until the total volume of the filtrate reached 50ml. The filtrate was centrifuged at 4000 rpm for 15 minutes to obtain clear solution. 10 ml of each of this solution was separately titrated against previously standardized DCPIP solution. The volume (in ml) of indophenol solution required for each titration was noted on the basis of three readings. In all cases, a blank correction of the titration value was made as suggested by Frank (1955). The amount of ascorbic acid in mg/100 gm of fruit tissue was calculated using the following formula:

$$\text{Amount of ascorbic acid} = \frac{A \times I \times V}{v \times W} \times 100$$

Where,

A= Quantity of ascorbic acid (in mg) reacting with 1 ml of indophenol reagent
I= Volume of indophenol solution (in ml) required for the completion of the titration with the extract
V= Total volume of extract (50 ml)
v= Volume of extract for each titration (10 ml)
W= Weight of the fruit tissue (5 gm)

Results and Discussion

The average ascorbic acid content of healthy and ripened apricot fruits was observed to be 13.5 mg/100 gm of the fruit tissue. The average ascorbic acid content of the apricot fruits under pathogenesis of various test pathogens *viz. Rhizopus stolonifer*, *Aspergillus japonicus*, *A. niger* and *Penicillium citrinum* showed gradual decline and the results have been summarized in Table 1 and depicted in Fig. 1.

The extent of decline, however, varied with the test pathogen. Out of the four test pathogens, the apricots inoculated with *Rhizopus stolonifer* showed a maximum percentage loss (85.00 %± 4.08) in ascorbic acid content after 6 days of pathogenesis.

Similarly, the percentage loss of ascorbic acid in *Aspergillus japonicus* and *A. niger* inoculated fruits was 78.3 %± 2.36 and 60 %±4.08 respectively after the same duration. On the other hand, loss of ascorbic acid content by *Penicillium citrinum* was comparatively low (34.97 %±4.08) after 6 days of pathogenesis. In the same way, other investigators have also observed rapid decline in ascorbic acid content in other fruits during fungal pathogenesis. Prasad and Bilgrami (1979) showed that with an increase in the incubation period, there was decline in the ascorbic acid content of litchi fruits infected with *Aspergillus flavus*, *A. niger*, *A. variecolor*, *A. nidulans* and *A. quadrilineatus*. According to Prasad (1980), the percentage loss of ascorbic acid in plum fruits infected with *Helminthosporium spiciferum* was 92.0%.

The healthy apricot fruits kept as control for 6 days also showed a loss of 10%±0.81 ascorbic acid content. However, this loss was minimal comparatively. A gradual loss in ascorbic acid content of healthy fruits over a period of time may be due to the fact that the ascorbic acid stability in fruits and vegetables is affected by a variety of factors including temperature, light, oxygen, enzymes and pH.

In general, ascorbic acid degradation is very rapid both after harvest and as the storage time increases (Morris, 1947). Similarly, Nunes *et al*. (1998) also noticed a loss of 55-70% of the ascorbic acid content in only 4 days in several uninfected strawberry varieties. Moreover, ascorbic acid is

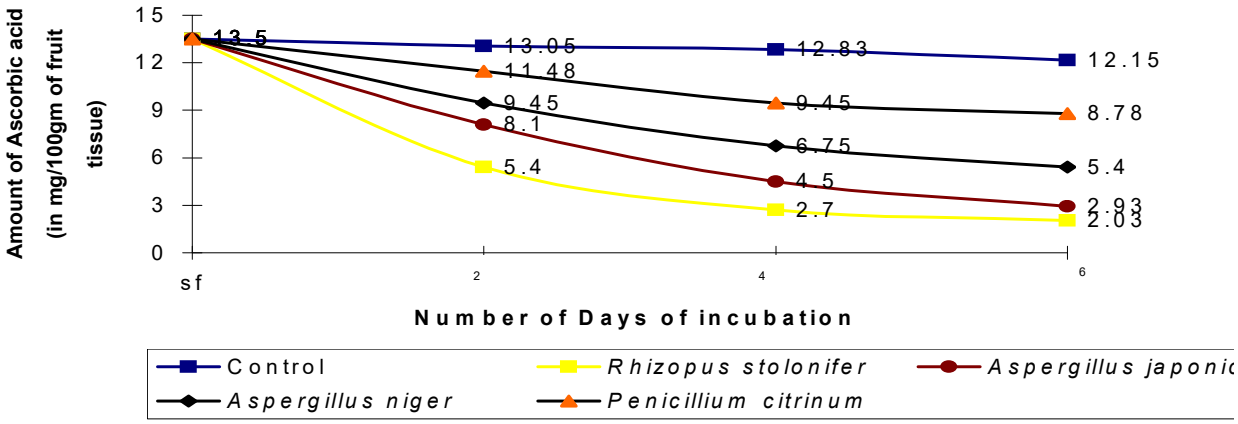
also known to act as a precursor of tartarate and oxalate in several fruits (Gander, 1982) which may explain its slow but gradual reduction in the healthy fruits over a period.

Table. 1: Post- infection changes in ascorbic acid content (mg/100g of fruit tissue) of apricot fruit due to pathogenesis

Fungal pathogen	Ascorbic acid content (mg/100 g of fruit tissue)				Percent loss of ascorbic acid after 6 days
	Days of incubation				
	Initial	2 day	4 day	6 day	
Control	13.50 ± 1.10*	13.05 ± 0.07	12.83 ± 0.11	12.15 ±0.11	10.00 ± 0.81
Rhizopus stolonifer	13.50 ± 1.10	5.40 ± 0.55	2.70 ± 0.55	2.03 ± 0.55	85.00 ± 4.08
Aspergillus japonicus	13.50 ± 1.10	8.10 ± 1.10	4.50 ± 0.64	2.93 ± 0.32	78.30 ± 2.36
Aspergillus niger	13.50 ± 1.10	9.45 ± 0.55	6.75 ± 0.55	5.40 ± 0.55	60.00 ± 4.08
Penicillium citrinum	13.50 ± 1.10	11.48 ± 0.95	9.45 ± 0.55	8.78 ± 0.55	34.97 ± 4.08

* Each value denotes the mean, ± = S.D, n=3

Figure1: Changes in ascorbic acid content of test pathogen inoculated apricot fruits during incubation period.



The decline in ascorbic acid content in fruits under pathogenesis may be attributed to the production of certain ascorbic acid degrading enzymes either by the pathogen or by the host and pathogen interaction (Ghosh *et al*.,1965; Das, 2007]. In addition, the decline may also be due to increased respiration rate, which may induce rapid oxidation of ascorbic acid. Acceleration of the respiratory activity has also been found in infected climacteric fruits such as peaches infected with *Monilinia fructicola* (Hall, 1967). Furthermore, the fungal enzymes including polyphenol oxidases, peroxidases and cytochrome oxidases might have played significant role in ascorbic acid degeneration in infected fruit tissue due to the oxidation of ascorbic acid (Ghosh *et al*., 1966).

References

Das, R., 2007. Degradation of Vitamin C and capsaicin content of Infected chilli fruits by *Colletotrichum capsici* and *Aspergillus niger,* ***J. Mycol. Pl. Pathol.*** 37**:** 410-412.

Ferraroni, M., Heinonen, O.P., Albanes, D., Heinonen, M., Rikkala E., and Teppo, L., 1994. Selected micronutrients intake and the risk of colorectal cancer, ***Brit. J. Cancer*** 70: 1150-1155.

Frank, W., 1955. Ascarbinsaure. In: *Modern Methods of Plant Analysis*. (eds. K. K. Paech and M.V. Tracey) Vol. 11, Springer-Verlag, Berlin.

Gander, J.E., 1982. Polyhydroxy acids: Relation to hexose phosphate metabolism. In: *Encyclopedia of Plant Physiology*.(eds. A. Pirson and M.H. Zimmermann) New Series Vol. 13A**,** Springer-Verlag, Berlin, , pp. 77-102.

Ghosh, A.K., Bhargava, S.N. and Tandon, R.N., 1966. Studies on fungal diseases of some tropical fruits VI. Post-infection changes in ascorbic acid contents of mango and papaya**,** ***Indian Phytopath****.,* 19: 262-268.

Ghosh, A.K., Tandon, R.N., Bhargava, S.N. and Srivastava, M.P., 1965. Vitamin C content of guava fruits after fungal infection. ***Naturwissenschaften,*** 52: 478.

Hall, R., 1967. Effect of *Monilinia fructicola* on oxygen uptake of peach fruits, ***Phytopathology,*** 58: 131-136.

Knekt, P., Jarvinen, R., Seppanen, R., Rissanen, A. and Aromaa, A., 1991.Dietary antioxidant and the risk of lung cancer, ***Am. J. Epidemiol***. 1134: 471-479.

Minnunni, M., Wolleb, U., Mueller, O., Pfeifer, A. and Aeschbacher, H.U., 1992. Natural antioxidants as inhibitors of oxygen species induced mutagenecity, ***Mutat. Res.*** 269**:** 193-200.

Morris, L.L., 1947. A study of broccoli deterioration, ***Ice Refrig***. 113: 41-42.

Nunes, M.C.N., Brecht, J.K., Morais, A.M.M.B. and. Sargent, S.A., 1998. Controlling temperature and water loss to maintain ascorbic acid levels in strawberries during post-harvest handling, ***J. Food Sci****.,* 63**:**1033-1036.

Nyugen, V.D. and Doan, T.N., 1989. *Medicinal Plants in Vietnam.* World Health Organization ISBN 92 9061 101 4 .

Prasad, M.M., 1980. Vitamin C content of Indian plum fruits after fungal infection, ***Indian Phytopath****.,* 33: 117-118.

Prasad, S.S. and Bilgrami, R.S., 1979. Investigations on diseases of litchi- Vll. Changes in ascorbic acid content of fruits during pathogenesis of *Aspergillus*, ***Indian Phytopath.,*** 32: 300.

Serrano, M., Valverde, J.M., Guillen, F., Castillo, S., Martinez-Ronero, D. and Valero, D., 2006. Use of *Aloe vera* gel coating preserves the functional properties of table grapes, ***J. Agric. Food Chem***. 54**:** 3882-3888.

Sharma, Y.P. and Sumbali, G., 2000. Impact of different storage conditions, systems and associated mycoflora on the ascorbic acid content of dried fruit slices of quinces (*Cydonia oblonga* Mill.), ***J. Indian Bot. Soc.,*** 79: 201-203.