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Biochemical changes in Sapota Pulp (*Achrassapota*L.) Due to Post Harvest Fungi

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ABSTRACT

In this present investigation, three dominant post-harvest sapota fungi were chosen for artificial infection to the three varieties of sapota fruits i.e. Kalipatti, Kutchh and Cricket ball which are normally cultivated in Thane district was studied in detail for the biochemical changes via post-harvest fungi. When pathogen interacts with the fruits either in the field or in storage, this interaction is responsible for qualitative and quantitative biodeterioration of fruits. *In vivo* studies of biochemical changes revealed increase or decrease in organic components of sapota fruits. Study in relation with the predominant three post-harvest fungi viz. *Aspergillusniger, Geotrichumcandidum* and *Rhizoctoniasolani* were used. The quantitative losses of biochemical changes in fruit pulp studied for ten different parameters. It is observed that there was considerable loss in biochemicals in some extent fruits of all three varieties due to the fungi.

Key words: Sapota, Varieties, post-harvest fungi, biochemicals

INTRODUCTION

Sapota (*Achrassapota*L.) belongs to the family sapotaceae and is an economically important edible fruit crop cultivated in tropical and subtropical regions of the world. Fruits are the essential requirement of human diet. Being soft textured sapota fruits are highly sensitive to exogenous agencies specially fungi, that affects physiology, morphology and biochemistry of fruits and thus ultimately causes loss to the fruit seller. And exposure on consumption of these spoiled fruits may be responsible for serious health hazards. It is native of Southern Mexico and Central America (Popenoe, 1974). In India it ranks 5thposition in production and consumption next to mango, banana,

citrus and grapes. India is the largest producer of sapota in the world, with an area of 160 million hectare with production of 1363 million tons.

Maharashtra, Gujarat, Andra Pradesh, Tamil Nadu, Karnataka, W. Bengal, Kerala, Uttar Pradesh, Punjab, Assam and Haryana states were produced major fruit crops. In India the first commercial sapota cultivation from Maharashtra was taken up in Gholwad area in1898 (Sulladmath and Readdy, 1990). Sapota fruit is rich source of sugar, protein, ascorbic acid, phenols, carotenoids and minerals like Fe, Cu, Zn, Ca and K (Kulkarni et al., 2007). Sapota pulp is used for making sweets, halwas, salads and milk shakes. It is also used for manufacture of industrial glucose and pectin. Seeds can be used to prepare different kind of beverages (Toral- Jarquin, 1988). The post-harvest losses are high in tropical countries particularly in India and it ranges between 25-30% (Sudha et al., 2007). The fruits are very susceptible to diseases caused by many microorganisms especially fungi as they are rich in moisture and nutrients (Sankat and Maharaj, 1997). At postharvest stage, many diseases greatly reduce the storage life, fruit contents and quality of sapota. Postharvest diseases of fruits represent a very important source of wastage andmainly economic losses.

Chaudhary et al. (1980) reported that the considerable decrease in total sugar and an increase in reducing sugars of both healthy and infected tissues of apple. The decrease was more pronounced in non-reducing sugars as compared to reducing and total sugars in peach and plum fruits infected with *Rhizopusstolonifer* (Singh and Prashar, 1981). Majumdar and Pathak (1989) reported that contents of ascorbic acid, sugars and proteins declined in the fruits of guava infected by fungi.Several reports have been reported that fungal diseases cause changes in biochemical composition of sapota pulp (Srivastava, 1969; Gadgile et al., 2010).

MATERIALS AND METHODS

Biochemical studies

Fungi were isolated from fruits of three varieties (cultivars) of chikoo collected from different regions of Thane District of Maharashtra state. Spore (0.01 ml) suspension of *Aspergillusniger, Geotrichum candidum* and *Rhizoctonia solani* isolates were separately inoculated in same aged sapota fruits of three varieties i.e. Kalipatti, Cricket ball and Kutch in aseptic condition. After 8 days of incubation of fruit,100g pulps from each variety were collected in aseptic container. Pulp without inoculation served as control and biochemical changes were estimated by standard biochemical methods (AOAC, 1970, Mungikar, 1999; Sadasivam and Manickam, 1992). Estimation of dry matter (DM) (Mungikar, 1999), total sugar, reducing and non-reducing sugar (Miller,1959), total soluble solids (TSS) (Rangana, 1979). Ash, ascorbic acid (Sadasivam and Theymoli, 1987), protein (Lowry et al., 1951), phenols and Tannin (Malick and Singh, 1980; Schanderi, 1970).

RESULTS AND DISCUSSION

The quantitative loss in fruit pulp contents studied for ten parameters in detail (Table 1).

Dry weight

Three dominant post-harvest sapota fungi were chosen for artificial infection to the three varieties of sapota fruits i.e. Kalipatti, Kutchh and Cricket ball separately which were incubated for a period of 7 days at room temperature, a loss in dry weight was calculated by comparing with healthy fruits. It is observed that there was considerable loss in dry weight of fruits of all three varieties due to the fungi. In Kutchh variety maximum loss in dry weight was found due to *Geotrichumcandidum* (11.5gm⁄100ml) while in case of Kalipatti it was found due to *Aspergillusniger* (12.9gm⁄100ml) and *Rhizoctoniasolani* deteriorated maximum dry weight in Cricket ball (11.6gm⁄100ml) variety.

Total sugar content

It was found that all fungi reduced the total sugar in all varieties. It was also observed from the result that maximum of total sugar of Kalipatti variety was reduced due to *Aspergillusniger* (12.0gm⁄100gm pulp). While in case of Cricket ball maximum loss of total sugar was observed due to *Rhizoctoniasolani* (12.1 gm⁄100gm pulp) and *Aspergillusniger* (12.0 gm⁄100gm

Table 1: Biochemical changes in sapota due to post harvest fungi.

Sr. No	Parameters	Variety / Fungi											
		Kalipatti				Cricket ball				Kutch			
		An	Gc	Rs	C	An	Gc	Rs	C	An	Gc	Rs	C
1	Dry weight (g/100ml)	12.09	14.2	13.4	14.1	12.8	12.2	11.6	12.8	14.3	11.5	12.6	15.1
2	Total sugar (g/100g)	12.0	13.2	12.4	13.5	12.0	12.8	12.1	13.2	11.8	12.9	12.2	13.1
3	Reducing sugar(g/100gm)	11.2	12.4	11.3	12.6	11.2	11.9	11.0	12.0	10.3	12.1	11.0	12.2
4	Non reducing sugar(g/100gm)	0.8	0.8	1.1	0.9	0.8	0.9	1.1	1.2	1.5	0.8	1.2	0.9
5	TSS (g/100g)	11°	15.4°	15.4°	16.5°	12.2°	11.2°	15.7°	16°	14°	14.8°	13.4°	16.4°
6	Ash (mg/100ml)	298	317	299	336	245	293	310	345	243	340	295	366
7	Asorbic acid(mg/100ml)	9.5	8.8	8.9	10.8	8.1	9.7	8.2	10.1	5.8	9.2	8.1	10.4
8	Protein(mg/100ml)	42.8	51.23	52.3	59.2	48.9	56.8	56.1	60	43.1	43.3	53.3	58.8
9	Phenol (mg/100ml)	120.5	125.8	125.8	135.2	122.7	118.1	121.5	134.6	124.5	125.5	120.2	136.6
10	Tannin (mg/100ml)	0.14	0.18	0.18	0.2	0.13	0.17	0.15	0.19	0.15	0.12	0.13	0.18

Legends:An-*Aspergillusniger*Gc- *Geotrichumcandidum*Rs – *Rhizopussolani* C – Control

pulp). *Aspergillusniger* reduced maximum total sugar in Kutchh variety (11.8 gm/100gm pulp).

Reducing sugar content

It was found that all fungi reduced the reducing sugar in all varieties of sapota fruits. It is also found that in Kalipatti, Cricket ball, Kutchh varieties showed maximum depletion of reducing sugar due to *Aspergillusniger.*

Non-reducing sugar content

Three selected post-harvest fungi were selected for artificial infection to the three varieties of sapota fruits separately which were incubated for a period of 7 days at room temperature, loss in non-reducing sugar was calculated by comparing with non-infected fruits and the results are summarized in the table 1. It was noticed that all fungi reduced the non-reducing sugar in all varieties of sapota fruits. It was observed from the results that in Kalipatti variety, non-reducing sugar was declined more due to *Aspergillusniger* (0.8gm/100gm pulp) and *Geotrichumcandidum* (0.8 gm/100gm pulp) while in case of Cricket ball maximum loss of non-reducing sugar was caused by *Geotrichumcandidum* (0.9gm/100gm pulp). It was also found that in Kutchh variety maximum loss of non-reducing sugar was caused by *Geotrichumcandidum* (0.8 gm/100gm pulp).

Total soluble solids content

Total soluble solids (TSS) content of the pulp was determined and found that all fungi reduced the TSS in all varieties of fruits. It was observed from the results that in Kalipatti variety TSS was found more decreased due to *Aspergillusniger* (11°) while in case of Cricket ball maximum loss of TSS was caused by *Geotrichumcandidum* (11.2°). It was also found that *Rhizoctoniasolani* (13.4°) reduced more TSS in Kutchh variety as compared with control (healthy).

Ash content

It was observed, that all fungi reduced the ash contents in all varieties as compared with control. It was found that *Aspergillusniger* (298mg/100ml) depleted maximum ash contents in Kalipatti variety while *Geotrichumcandidum* caused maximum loss of ash contents in Cricket ball (293 mg/100ml) variety. It was also reported that in Kutchh variety,

Rhizoctoniasolani was responsible for maximum depletion of ash contents (295 mg/100ml).

Ascorbic acid content

It was found that all fungi were responsible to reduce the ascorbic acid contents in all varieties of fruits as compared with control. It was found that *Geotrichumcandidum* (8.8 mg/100ml) deteriorated maximum ascorbic acid in Kalipati variety while *Aspergillusniger* (8.1 mg/100ml) and *Rhizoctoiasolani* (8.1 mg/100ml) depleted maximum ascorbic acid content in Cricket ball and Kutchh variety respectively.

Protein content

It was found that all fungi reduced the protein contents in all varieties of fruits. It was found that *Aspergillusniger* (42.8,8.9 & 43.1mg/100ml) and *Rhizoctoiasolani* (52.3, 56.1 & 53.3mg/100ml) depleted maximum protein content in Kalipatti, Cricket ball and Kutchh variety respectively as compared to control**.**

Phenol content

It was observed that all the tested fungi reduced the phenol contents in all varieties as compared with control. It was found that *Aspergillusniger* depleted maximum phenol contents in Kalipatti (120.5 mg/100ml) variety while *Geotrichumcandidum* caused loss of maximum phenol content in Cricket ball (118.1 mg/100ml) variety. *Rhizoctoniasolani* caused loss of maximum phenol content in Kutchh variety (120.2mg/100ml).

Tannin content

It was observed that all the tested fungi reduced the tannin contents in all varieties as compared to control. It was found that *Aspergillusniger*caused maximum loss of tannin in Kalipatti (0.14 mg/100ml) and Cricket ball varieties (0.13mg/100ml) while *Geotrichum candidum* (0.12 mg/100ml) and *Rhizoctonia solani* (0.13 mg/100ml) caused maximum loss of tannin in Kutchhvariety.

Sawant and Gawai (2011) reported that the nutritional content of healthy fruit was found to be significantly higher than the infected fruits. *Sapotemamey* is high in vitamin and mineral content, compared to other tropical fruit such as papaya and jobo or red mombin (Alia et al., 2007). Kulkarni et al. (2007) reported chemical constituents of sapota as: - Total sugar (%) - 11.06 -1.9, Protein (mg/100 g)-312.5 - 5.6, Ascorbic acid (mg/100 g) - 10.52 - 1.2, Carotenoids

(mg/100 g) - 0.92- 0.06, Totalphenolics (mg/100 g) - 134.6- 4.5, Iron (ppm) - 0.11- 0.01, Copper (ppm) - 0.09 -0.01. Khillare et al. (2006) reported total sugars, total amino acids, crude protein DNA and RNA contents increased in their quantity due to infection by both the isolates of fruit rot of grape. Schovánková and Opatová (2011) reported that the apples inoculated with *Moniliniafructigena* demonstrated higher concentration of total phenols in the healthy pulp than in the area surrounding the rotten part. Ruth et al. (2009) reported that *A. niger* GH1 degraded 90% of tannin content of "creosotebush" after 72 h. and there was a considerable increase in the total protein content during this period. Mahattanatawee et al. (2006) reported that the phenolic composition of mango, sapodilla and longan pulp have been previously reported to contain hydrolysable tannins and conjugated hydroxycinnamic, allagic and other phenolic.

CONCLUSION:

Sapota is a climacteric fruit that requires careful handling after harvest in order to maintain quality, extend shelf life and allow transport to markets outside the area of production.Therefore it is concluded that fungalinfection ofsapota pulp decreases biochemical contents. Biochemical changes showed that there was significant variation between artificially inoculated sapota and healthy sapota fruit which served as control.

Conflicts of interest: The authors stated that no conflicts of interest.

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