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Biopreservation of Guava By Plant Extracts

M. Ashwini* and Nikhita Desai

AICRP on EAAI (Bioconversion Technology), Main Agriculture Research Station, University of Agricultural Sciences, Dharwad-580 005, Karnataka, India.

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An investigation was undertaken to study effect of medicinal plant extracts/ bulb extracts *viz* bael (50 and 70%), tulsi (50 and 100%), Garlic (5 and 10%) on shelf life of guava. The Physiological loss of weight in guava fruits showed an increasing trend in all the treatments. Contrary to this acidity decreased with storage. However, there was an increase in pH with extension of storage period. The total soluble solids of fruits first increased upto a certain period and there after decreased .Bulb extracts of garlic @ 10 per cent were most effective of all the treatments with minimum spoilage percentage followed by garlic extracts @ 5 per cent concentration and tulsi extracts at 100 per cent concentration. In the present study bael extracts (50 and 100 per cent concentrations) were not effective in extending the shelf life guava (Cv Allahabad Safeda).The investigation concludes that the shelf life of guava fruits Cv Allahabad Safeda can be extended from 4 to 7 days by treating the fruits with 10 per cent garlic extract.

Keywords: Guava fruits, Tulsi ,Garlic ,Bael extract.

Guava *(Psidium guajava L.)*, is one of the most important fruit crops in the world, belonging to the family Myrtaceae, also commonly known as poor man's Apple due to its low price and it is also a most of the legendary fruits due to its hardy and prolific bearing nature[1.] Fruits are the source for human health they are rich in carbohydrates, vitamins and minerals with sweet taste, aroma and nutritive value. Fruits are poor in protein content with high level water quantity and the pH ranges from 7 to slightly acidic, these characteristics make a good platform for the growth of various microorganisms such as bacteria, molds and yeasts[2].

Plants are the richest resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs. The major part of traditional therapy involves the use of plant extract and their active constituents[3].

Guava fruits are severely affected by wilt disease leading to substantial loss in the crop production. *Fusarium solani* is the most predominant pathogen causing wilt of guava. To control these pathogens, chemical or synthetic compounds were used, it resulted in environmental contamination as chemical compounds are non-degradable in nature, causes side effects on beneficial organisms of the earth, stays on earth for very long duration and developed new physiological races in the pathogens[4]. These situations lead to the finding of alternative way for biopreservation, where the biologically synthesized chemicals are used which are ecofriendly and easily degradable. There is a widespread belief that green medicines are healthier and more harmless or safer than synthetic ones Medicinal plants have been used to cure a number

* To whom all correspondence should be addressed.
Tel: +91 08362744447
E-mail: ashwinim21@gmail.com

of diseases. Though the recovery is slow, the therapeutic use of medicinal plant is becoming popular because of its inability to cause side effects and antibiotic resistant microorganisms[5].

In the present study, biopreservation of guava fruits by using different concentration of Bael extract, garlic extract and tulsi extract was carried out *in vivo* to evaluate the effect of plant extract on preserving the guava fruits.

MATERIALS AND METHODS

LifeStudies of Guava Fruits

Matured, uniform sized, undamaged healthy fruits guava (Cv Allahabad safeda) were randomly selected after harvest and subjected to various treatments. There were seven treatments and three replications in each treatment. Aqueous extracts of efficient medicinal plants leaf/bulb extracts as obtained from screening for their antimicrobial properties *in vitro* from our previous studies were used.

Method of treatment

The fruits were dipped in the extracts for five minutes and then air dried. The untreated and treated fruits were bagged in new ventilated polythene covers and kept at room temperature. Observations were taken on the 3 rd,6th ,9 th and 12th day for guava.

Observations recorded

The observations recorded for shelf life studies were:

Spoilage Per Cent

The number of spoiled fruits were counted in each treatment. They were expressed as per cent of spoiled fruits.

The post harvest treatments imposed were as follows:

Treatments	
T1	CONTROL
T2	BAEL EXTRACT @50%
T3	BAEL EXTRACT @75%
T4	GARLIC EXTRACT @5%
T5	GARLIC EXTRACT @10%
T6	TULSI EXTRACT @50%
T7	TULSI EXTRACT @100%

Spoilage per cent = $\frac{\text{Number of fruits spoiled}}{\text{Total number of fruits}}$ x 100

Physiological Loss of Weight (PLW)

The fruits were weighed at regular intervals i.e, on the 3 rd,6th ,9 th and 12th day after treatment for guava. The loss in weight of fruits due to spoilage was calculated as per cent loss of weight.

Titrable Acidity (Citric Acid %)

Total titrable acidity was determined by the method, described by Ranganna (1977)[6]. Five g of pulp was blended with 40 ml water and volume was made upto 50ml with distilled water. Five ml of this was taken and titrated against 0.1N NaOH solution using phenolphthalein. The acidity was expressed as citric acid per cent.

Total Soluble Solids (TSS)

Pulp from randomly selected fruit was taken and macerated for juice extraction and TSS of the juice was determined using hand refractrometer (Erma Japan) of 0-30 per cent range. The values were expressed as per cent total soluble solids of the fruits.

pH

Fifty grams of the pulp were macerated with fifty ml of distilled water. The pH was read using a Digital (Hanna) pH metre[6].

Statistical Analysis

The data was statistically analyzed by adopting the analysis of variance technique appropriate to the levels of treatment [7].

RESULTS AND DISCUSSION

Shelf Life Studies of Guava

There was no significant difference between treatments on the 6th day (Table 1). Fruits treated with bael extracts @ 50 per cent concentration had a mean spoilage percentage of 6.67 as compared to that of control which had a mean spoilage percentage of 13.3 per cent . The fruits subjected to the rest of the treatments still remained healthy with no disease symptoms. There was significant difference among treatments on the 9th day after treatment. The fruits treated with garlic @ 10 per cent differed significantly with fruits treated with bael extracts @ 100 per cent

which had a mean spoilage percentage of 53.33 per cent .

Spoilage percentage was up to 66.67 per cent with garlic (10 per cent) and tulsi (100 per cent) on 12th day of storage. Misra and Dixit (1976)[8] reported that the extracts of garlic completely checked the growth of *Pestalotia* and *Phomopsis*. These two fungi cause severe post harvest losses in guava[9]. Srivastava and Bihari Lal (1997)[10] stated that the leaf extracts of tulsi protected fruit rot of

Table 1. Post Harvest shelf life of guava fruits treated with medicinal plant extracts

Treatment	Spoilage days after harvest			
	3 Days	6 Days	9 Days	12 Days
T1 Control	0.00(12.92)	13.33(21.39)	80.00(63.44)	100.00(93.24)
T2 Bael Extract @50%	0.00(12.92)	6.67(14.89)	60.00(50.77)	100.00(93.24)
T3Bael extract @75%	0.00(12.92)	0.00(12.92)	53.33(46.89)	100.00(93.24)
T4 Garlic extract @5%	0.00(12.92)	0.00(12.92)	40.00(39.23)	86.67(68.53)
T5 Garlic extract 10%	0.00(12.92)	0.00(12.92)	26.67(31.05)	66.67(54.70)
T6 Tulsi Extract 50%	0.00(12.92)	0.00(12.92)	46.67(43.05)	93.33(75.00)
T7 Tulsi Extract 100%	0.00(12.92)	0.00(12.92)	33.33(35.24)	66.67(54.70)
CD@5%	-	-	15.73	15.61

Note: Spoilage is expressed as % of fruits spoiled

Table 2. Post harvest physiological loss of weight (PLW) of guava fruits treated with medicinal plants extracts

Treatment	PLW%- days after harvest			
	3 Days	6 Days	9 Days	12 Days
T1 Control	1.01(5.74)	4.07(11.54)	9.21(17.66)	12.72(20.88)
T2 Bael Extract @50%	1.00(5.74)	4.18(11.68)	7.49(15.79)	11.23(19.55)
T3Bael extract @75%	1.00(5.74)	4.04(11.54)	7.87(16.22)	10.05(18.44)
T4 Garlic extract @5%	1.00(5.74)	4.00(11.54)	7.00(15.34)	8.62(17.05)
T5 Garlic extract 10%	1.00(5.74)	4.00(11.54)	6.66(24.89)	8.05(16.43)
T6 Tulsi Extract 50%	1.11(6.02)	4.33(11.97)	7.26(15.56)	11.11(19.46)
T7 Tulsi Extract 100%	1.00(5.74)	4.15()11.68	6.58(14.77)	9.98(18.34)
CD@5%	-	-	-	1.85

Note: Weight loss is expressed as % of weight loss

Table 3. Post harvest changes in titrable acidity (citric acid %) of guava fruits treated with medicinal plants extracts

Treatment	Titrable Acidity days after harvest			
	3 Days	6 Days	9 Days	12 Days
T1 Control	0.54	0.47	0.41	0.27
T2 Bael Extract @50%	0.52	0.46	0.39	0.29
T3Bael extract @75%	0.56	0.51	0.41	0.27
T4 Garlic extract @5%	0.55	0.52	0.46	0.35
T5 Garlic extract 10%	0.56	0.50	0.44	0.33
T6 Tulsi Extract 50%	0.54	0.46	0.38	0.26
T7 Tulsi Extract 100%	0.60	0.52	0.43	0.31

Note: Titrable Acidity expressed as citric acid %

Table 4. Post Harvest changes in total soluble solids (TSS) of guava fruits treated with medicinal plants extracts

Treatment	Total soluble solids days after harvest			
	3 Days	6 Days	9 Days	12 Days
T1 Control	8.0	9.4	11.0	9.8
T2 Bael Extract @50%	8.2	9.2	11.4	9.6
T3Bael extract @75%	7.8	9.0	11.2	10.0
T4 Garlic extract @5%	7.6	8.8	11.6	10.2
T5 Garlic extract 10%	8.0	9.6	11.4	10.4
T6 Tulsi Extract 50%	8.0	9.4	11.6	10.0
T7 Tulsi Extract 100%	8.2	9.8	11.4	10.2

Note: The values are expressed as per cent total soluble solids of the fruits

Table 5. Post-Harvest changes in pH of guava fruits treated with medicinal plants extracts

Treatment	pH-Days after harvest			
	3 Days	6 Days	9 Days	12 Days
T1 Control	3.9	4.1	4.4	4.9
T2 Bael Extract @50%	3.8	4.4	4.5	5.0
T3Bael extract @75%	4.0	4.1	4.3	5.1
T4 Garlic extract @5%	3.9	4.1	4.1	4.7
T5 Garlic extract 10%	3.8	4.1	4.3	4.8
T6 Tulsi Extract 50%	3.9	4.1	4.2	4.7
T7 Tulsi Extract 100%	4.1	4.2	4.2	4.9

pear and pomegranate due to *Alternaria alternata* by 82 and 85 per cent respectively. Effective control of banana anthracnose was brought about by extracts of tulsi[11].

The investigation was carried by G. S. Shinde *et. al.*[12] 2010 to study the retardation of ripening process and to minimize the post harvest losses in mango fruit under the influence of various plant extract treatments *viz.*, neem leaf extract, bael leaf extract, neem oil and sesame oil.

Physiological loss of weight (PLW)

The PLW was measured at regular intervals upto 12 days after treatment. The treatments were on par with each other after 3 days(Table 2). There was no significant difference in physiological loss of weight in the fruits subjected to all the six treatments and control on the 6th day after treatment the fruits treated with tulsi extract at 50 per cent concentration showed maximum mean weight loss of 4.33 per cent. In rest of the treatment mean weight loss between 4.00 to 4.18 per cent. (Table 2).On 9th day all the treatments and control were on par with each other.

Significant differences were observed in physiological loss of weight on 12th day after treatment. The fruits treated with garlic extracts at 5 per cent and 10 per cent concentration showed minimum mean loss of weight of 24.35 per cent and 23.89 per cent respectively. They differed significantly from the other treatments. The rest of the treatments were on par with each other. Hittalmani (1986)[13] reported that the decline in quality of stored fruits is due to build up of microbial populations.Similar results were obtained by Pandey *et al.* 1983[14] applied leaf extracts of Mentha and Melia to guava fruits and observed that these treatments were effective in retaining physical quality characteristics of fruits as they reduced moisture loss and storage rot symptoms.

Titrable acidity

On day 3, there was not much difference in the acidity among the treatments (Table 3). On

the 6th day, there was a decrease in acidity in all the treatments. After 9 days fruits dipped in garlic showed acidity of 0.46 percent. In rest of the treatments and control, the acidity was low ranging from 0.38 to 0.44 per cent. On day 12, there was a further decrease in acidity. Maximum acidity of 0.35 was recorded in fruits dipped with garlic extracts @ 5 per cent. In rest of the treatments, there was not much difference in the acidity percent.

These results are compatable with the several works of [15 16 17 18] .The decrease in acidity could be probably due to increased utilization of organic acids during respiration resulting in increased rate of ripening[19].

Total soluble solids (TSS)

After 3 days of treatment, the TSS of fruits did not vary much (Table 4). It ranged from 7.6 to 8.2 per cent. An increase in TSS content of fruits was noticed in all the treatments and control after 6 days. Fruits treated with tulsi extracts (100 per cent concentration) recorded maximum TSS of 9.8 per cent .Lowest TSS (8.8 per cent) was observed in fruits treated with garlic extracts (5 per cent concentration). On 9 th day, the control fruits recorded lowest TSS (11.0 per cent) .However in all the treatments and control the TSS increased to its maximum. After 12 days of treatment, there was a decline in the TSS of fruits. The fruits treated with bael extracts (50 per cent) recorded minimum TSS of 9.6 per cent whereas the fruits dipped in garlic extracts maintained TSS at 10.4 per cent.

Fruits dipped in garlic (5 and 10 per cent) and tulsi (50 and 100 per cent) maintained the TSS throughout the period .However, the control fruits and fruits dipped in bael extract (50 and 75 per cent) recorded low TSS value throughout the assessment period. *Aspergillus flavus* and *Aspergillus parasiticus* infected guava fruits showed a considerable loss in total, reducing and non reducing sugars[20]. Fungi are capable of synthesizing many of their requirements if simple sources of nutrient are available.

pH

The pH was recorded at different intervals for a period of 12 days (Table 5). On day 3, there was not much variation in the pH content among the treatments. On day 6 there was slight increase in pH among all treatments. Fruits treated with bael extracts @ 50 per cent concentration showed a maximum pH of 4.4, followed by fruits treated with tulsi extracts @ 100 per cent concentration (4.2). In rest of the treatments and control the pH (4.1) remained same. At 12 days after treatment, there was further increase in pH among all the treatments and control.

After 12 days of treatment, there was an increase in pH value of guava fruits. There was gradual increase in pH of fruits treated with bael extracts (75 per cent concentration) followed by bael extract (50 per cent) treated fruits. The mature guava fruits had a pH of around 5.0 which is suitable for the production of pectinolytic enzymes by *Gleosporium psidii* the causal organism of fruit rot of guava.

CONCLUSIONS

The investigation concludes that the shelf life of guava fruits Cv Allahabad Safeda can be extended from 4 to 7 days by treating the fruits with 10 per cent garlic extract.

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REFERENCES

1. Jana, B. R., Munsi, P. S. and Manna, D. C. Studies on Seasonal Variation of Some Important Characters of Guava Under Eastern Plateau and Hill Region. *International Journal of Development Research.* 2014; **4**: 2746-2749.
2. Debabandya Mohapatra, Sabyasachi Mishra, Saroj Giri and Abhijit Kar. Application of hurdles for extending the shelf life of fresh fruits. *J. Trends in Post Harvest Technology,* 2013; **1**: 37-54.
3. Rashmi Chandra, Vinay Dwivedi, Kumar Shivam, Abhimanyu Kumar Jha. Detection of Antimicrobial Activity of *Oscimum sanctum* (Tulsi) & *Trigonella foenum graecum* (Methi) against some selected bacterial & fungal strains. *Research Journal of Pharmaceutical, Biological and Chemical Sciences.* 2011; **2:** 809-813.
4. Dwivedi SK and Neetu Dwivedi . Antifungal activity of some plant extracts against guava wilt pathogen. *International Journal of Environmental Sciences*. 2012; **3**: 412-420.
5. Mukesh Pimpliskar, Pramod Shinde, Vijay Savakare, Vaishali Jadhav and Kaustubh Girkar.

Antibacterial screening of stem, fruit and leaves of *A. marmelos. European Journal of Zoological Research*, 2012, **2***:* 60-64.

6. Ranganna, S. Manual of analysis of fruits and vegetable products. Tata Mc. Graw Hill publishing Co. Ltd., New Delhi.
7. Snedecor, W.G. and Cochran, Statistical methods. Iowa state University press, USA. 1967**;** 328-329.
8. Misra, S.B. and Dixit, S.N. Screening of some medicinal plants for antifungal activity. 1977, Geobios, **4:** 129-132.
9. Arya, A. Control of phomopsis fruit rots by leaf extracts of certain medicina Plants. Indigenous Medicinal Plants Symp.1988, 41-46.
10. Srivatsava, A.B. and Bihari Lal, Studies on biofungicidal properties of leaf extracts of some plants. Indian Phytopath**.** 1997,**3**: 408-411.
11. Bagawan, N. B. Anthracnose of Banana fruits and its Management with plant extracts. *Curr. Res.*, 2001, **30**: 197-198.
12. G.S. Shinde, D.K. Kakade, P. B. Jadhav, K. M. Karetha, S. A. Aklade, Seema J. Sharma, N.A. Deshmukh and P.G. Memane. Studies of plant extracts and wrapping materials on total soluble solids (%), ascorbic Acid and acidity of mango (cv. KESAR) fruit during storage. *The Asian Journal of Horticulture,* 2010; **4**: 504-506.
13. Hittalmani, S.V. Investigations on standardization of maturity indices. Post Harvest physiology and post harvest technology of 'solo' papaya (Carica papaya L.) Fruits. PhD Thesis. University of Agricultural Sciences, Bangalore, 1986: **1**-240
14. Pandey RS, Bhargava SN, Shukla DN, Dwivedi KK. Control of pestololia fruit rot of Guava by leaf extracts of two medicinal plants. *Revists Mexic Fito*. 1983, 2: 15-16.
15. Kumar, D. Effect of post harvest treatments on shelf life and quality of mango. *Indian J. Hort.* 1998; **2**: 134-138
16. Kumar, R. and Nagapal, R. Effect of post harvest treatments on the storage behavior of mango cv. Dashehari. *Haryana J. of Hort. Sci.,* 1996; **3**: 101-108.
17. Kaushik, R.A. and Kumar, R, Physico chemical changes in different mango cultivars during storage. *Haryana J. Hort. Sci.* 1992, **3**: 166-173.
18. Rangavalli, K., Ravishankar, C., Hariprasad, P. Post harvest changes in Mango Cv Baneshan. S. *Indian J. Hort***.** 1993, 3: 169-170.
19. Subramanyam, H., Moorthy N.V.N., Subhadra, N. V. and Muthu, M., Control of spoilage and inhibition of ripening in Alphanso mangoes by fungicides. *Trop. Sci.* 1973;**11**:120
20. Singh, J.P. and Daulta, B.S, Factors affecting the development of anthracnose of Guava during storage. *Haryana J. Hort. Sci*. 1983; **12**: 41-43.