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Effect of hot water treatment on papaya fruit peel infected with fruit rot (*Colletotrichum domatium*)

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Abstract

Papaya (*Carica papaya* L.) is a plant that produces fruits throughout the year. It needs a smaller area for the tree, comes to fruiting in 1 year, is easy to harvest, and next to banana it provides more income/ha. Papaya fruit is called as “common mans” which is for reasonable price and high nutritive value. All the hot water treatments and durations found significantly superior in reducing the *Colletotrichum* rot severity after eighth day of inoculation. Significantly lowest rot severity was found in treatment given at 54 °C for 2 and 4 min. with cent percent disease control over untreated check.

Keywords: *Colletotrichum domatium*, hot water treatment, post inoculation

Introduction

The papaya is (*Carica papaya* L.) the sole species in the genus *Carica* from the family *Caricaceae*. It is native from tropical America. The popularity of papaya has made it ubiquitous in tropical and subtropical regions of the world. It has made its way from kitchen gardens to the commercial orchards because of its highest production of fruits (75 to 100 tons ha⁻¹) and stood next to banana in relation to income (Thamaraikannan and Sengottuvel, 2012) [8]. Papaya may be consumed at ripe and unripe stages (Mendoza, 2007) [7]. It is rich in vitamins A, C and the presence of several polyphenols, making it a good source of antioxidants in diet (Lim *et al.* 2007; Adetuyi *et al.* 2008) [6, 1]. Papaya place first among the fruits for riboflavin, folate calcium, thiamine, iron, pantothenic acid, niacin, potassium and fiber. The comparative low calories content (32 Kcal/100 gm of ripe fruits) makes favorite fruit of obese people who are into weight reducing regime (Krishna *et al.*, 2008; Thamaraikannan and Sengottuvel, 2012) [4, 8]. Papaya is a rich source of the digestive enzyme papain, which is used as an industrial ingredient in brewing, meat tenderizing, pharmaceuticals, and cosmetics (Evans and Ballen, 2012) [3].

Materials and Methods

Papaya fruits exhibiting symptoms of *Colletotrichum* fruit rot were collected from local markets of Anand and the isolation was made by tissue isolation. The isolated pathogen was purified and artificially inoculated on healthy ripe papaya fruits following pin-prick method. The artificially inoculated fruits exhibited small well defined dried depressed pink lesions on the surface of ripe fruit. In Post inoculation Hot Water Treatment, matured healthy fruits were inoculated with pathogen (25µl of spore suspension) (10⁶ spores/ ml) and after 3 hours, the inoculated fruits were dipped in a hot water bath at 50 ± 2 °C for 3 and 4 minutes and 55 ± 2 °C for 2, 3 and 4 minutes then rinsed with distilled sterile water, air-dried and placed in sterilized plastic tray containing sterilized moist absorbent cotton at the bottom and covered with sterilized polythene transparent sheet. The fruits were kept at 25 ± 1 °C temperature. The observations on disease severity was recorded after 4th and 8th days of inoculation following standard assessment key.

Grade	Disease (%) on the fruit surface
0	No Disease
1	0.1- 5%
2	5.1-10%
3	10.1-25%
4	25.1-50%
5	>50%

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Results and Discussion

The results on effect of hot water treatment on management of Colletotrichum rot of papaya inoculated with *C. domatium* are presented in Table 1 and Fig 1. Total eight various temperatures and duration were studied for the management of Colletotrichum fruit rot of papaya.

All the hot water treatments and durations found significantly superior in reducing the Colletotrichum rot severity after 8th day of inoculation. The result revealed that significantly lowest rot severity was recorded in treatment T₁ and T₂ i.e. 54 °C for 2 and 4 min. with cent percent disease control over untreated check (26.66%). The next best treatment in order of merit was treatment T₄ (50 °C for 4 min.) with 3.90 percent rot severity and 85.37% overcontrol (85.37%) which is at par with treatment T₃ i.e. (50 °C for 2 min., 4.70%).

The results revealed that the hot water treatment either at 54

°C for 4 min. or 54 °C for 2 min. found most effective in reducing the Colletotrichum rot severity in papaya fruits without hampering the quality of fruits. Hot water treated fruits may exhibit the resistance of papaya fruits to anthracnose and extend shelf life. The effect of hot water treatment on fruit firmness associates with the pectin and activity of critical enzymes related to cell wall degradation, like polygalacturonase (PG) and pectin methylesterase (PME). It is showed that along with the fruit turning yellow, the firmness rapidly decreased, the respiration rate and ethylene production greatly increased, quickly followed by increase in both enzyme activities. Appropriate hot water treatment might be reduce the respiration rate and ethylene production in fruit, and inhibit the activity of certain cell wall degradation enzymes.

Table 1: Impact of hot water treatment on severity of Colletotrichum rot of papaya *in vivo*

Sr. No.	Treatment	Colletotrichum Rot Severity (%)	% disease control over untreated check
T ₁	54 °C for 2 min.	0.00	100
T ₂	54 °C for 4 min.	0.00	100
T ₃	50 °C for 2 min.	4.70	82.37
T ₄	50 °C for 4 min.	3.90	85.37
T ₅	48 °C for 2 min.	5.87	77.98
T ₆	48 °C for 4 min.	5.90	77.86
T ₇	45 °C for 2 min.	21.80	18.22
T ₈	45 °C for 4 min.	17.13	35.74
T ₉	Untreated Control	26.66	--
	S.Em. ±	0.34	
	C.D. at 5%	1.02	
	C.V. %	6.22	

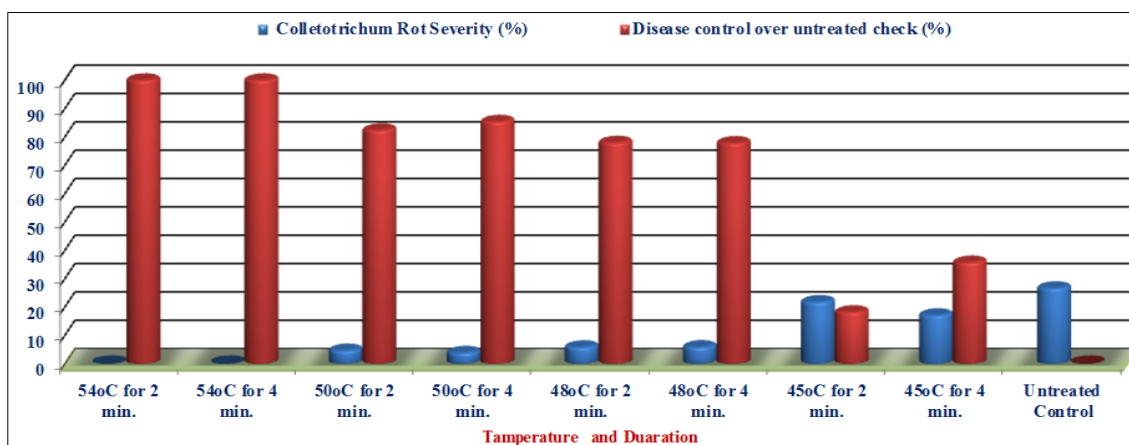


Fig 1: Role of hot water treatment on severity of Colletotrichum fruit rot of papaya *in vivo*

Amin and Hossain (2012) [2] observed that hot water treatment of banana fruits at 53 °C for 9 min. manage crown rot and also extended shelf life of BARI Kola 1 and Sabri Kola varieties by 26 and 27.5 percent, respectively compared to untreated fruits. Unripe injured papaya fruits inoculated with *Alternaria alternata*, *Fusarium solani*, *Aspergillus niger*, *Penicillium* sp., *Rhizopus nigricans*, *Stemphylium* sp. and *Phomopsis* when dipped in hot water bath at 50 °C for 5 minutes remained rotting free as compare to untreated fruits (Wagan *et al.* 2004) [9]. Le *et al.* (2010) [5] observed that the hot vapour treatment of mango fruits at 55 °C for 3 min decreased total numbers of spots (*C. gloeosporioides*) anthracnose for 6 days as compared to untreated check. The vapour heat treatment do not hampered firmness, peel color index and total soluble solids content in mango peel.

Conclusion

All the hot water treatments with various durations found significantly superior in reducing the Colletotrichum fruit rot of papaya severity after 8th day of inoculation. The results revealed that significantly lowest rot severity was recorded in treatment T₁ and T₂ i.e. 54 °C for 2 and 4 min. with cent percent disease control over untreated check (26.66%).

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