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EFFECT OF SELECTED PLANT EXTRACTS AND CHEMICALS AGAINST SOUR ROT (*Geotrichum candidum*) OF TOMATO (*Lycopersicon esclentum).*

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ABSTRACT
Sour rot caused by *Geotrichum candidum* is one of the most important disease affecting tomato. $CaCl_2$ (5.73 cm) and papaya (6.68 cm) significantly inhibited the radial mycelial growth of the pathogen as compared to control (9.05 cm), physiological loss in weight was minimum in acetic acid (36.61%) and eucalyptus extract (39.01%) as compared to control (58.23%). Higher lycopene content of tomato was obtained in $CaCl_2$ (4.57mg/100g) followed by aleovera (4.54mg/100g), papaya (4.51mg/100g) as compared to control (4.57 mg/100g). Higher ascorbic acid content of tomato was obtained from $CaCl_2$ (20.1mg /100g), papaya leaf extract (19.8mg/100g) as compared to control (16.2 mg/100g). Total soluble solids (ºBrix) of tomato was highest in $CaCl_2$ (5.2%) followed by papaya (4.42%) as compared to control (4.1%). Calcium chloride and papaya leaf extract treated fruits showed significant levels of delay in weight loss, firmness, total soluble solids, vitamin C and lycopene content, so they can be used as a potent natural antifungal agent.

INTRODUCTION

Tomato (*Lycopersicon esculetum* L.) is one of the most important vegetable crops grown in both temperate and tropical regions of the world (Akhtar *et al.,* 2016). The crop is attacked by number of diseases caused by fungi, bacteria, virus, mycoplasma, nematodes, etc and cause huge loss across the world (Mishra *et al.,*2016) The disease sour rot is caused by the common soil-borne fungus *Geotrichum candidum*. Greasy water-soaked lesions begin at wounds or at the edge of the stem scar. On mature-green fruit the lesions appear pale and dull, and have a definite sour odor. On ripe fruits, infected tissue is dark, soft, and watery. If the skin splits then a creamy white mold develops on the exposed flesh, producing sticky spores in ripe fruit the disease progresses rapidly, particularly under warm conditions. The epidermis covering the lesions usually cracks, allowing the watery contents to spill out. Fruit may become contaminated with sour rot through contact with fruit flies and other insects, splashing rainfall, decaying vegetation, and pickers. The sour-rot fungi are considered wound pathogens and cannot penetrate the fruit epidermis directly (Bartz *et al*., 2001). The fruits of tomato are highly perishable and cannot be stored or transported for longer period under room temperature. Therefore, in order to have an excellent return on its production and make supply in the market every time and throughout the year, it is inevitable to store the fruit for a considerably longer period. During transport and storage loss of fruit weight is rapid due to postharvest disease among which the most important is sour rot by *G. candidum*. Yield loss due to sour rot fungi may reach 100% under insufficient conditions of storage facility (Arsenijevic and Obradovic, 1996). This has huge impact on farmers and vendors leading to reduced quantities for sale, a reduction in quality, and an increase in expense. The aim of study is to evaluate the efficacy of different chemicals and phytoextracts against sour rot of tomato caused by *G. candidum*.

MATERIALS AND METHODS

Isolation of pathogen: The fungus was maintained on potato dextrose agar (PDA) plates at 5ºC, with periodic transfers through citrus fruit to maintain its aggressiveness. The pathogen inoculum consisted of aqueous arthrospores suspensions obtained from seven-day old culture plates incubated at 25ºC. Arthrospores were harvested by flooding plates with five ml of sterile distilled water containing 0.05% (v/v) passing the suspension through two layers of sterile cheesecloth to remove hyphal fragments. The arthrospore concentration was determined with the aid of a heamocytometer and adjusted to 10^6 arthrospores ml^{-1} with sterile distilled water (Karim *et al.*, 2016). Fresh tomato fruits were artificially wounded using sterilized scalpel and were inoculated with the spore suspension of the pathogen (Kouame *et al.*,2010). The fruits were left for 3 hours and after that the fruits were dipped in the leaf extracts and chemicals for five minutes as per the treatments (Gharezi *et al.*, 2012).

The fruits were are dried and kept at room temperature (25-30ºC)

Preparation of plant extracts and chemicals

T_0- Control distilled water, T_1-Aleo vera @ 10% , T_2-Basil @ 10%, T_3-Guava @ 10%, T_4-Eucalyptus @ 10%, T_5 –Papaya @ 10%, T_6- $CaCl_2$ @ 5 %, T_7- Acetic acid @ 5% (Marcel and Alina, 2011; Tanackov *et al*., 2012; Neela *et al*., 2014; Mahmoud, 2012; Gharezi *et al.,* 2012; Gharezi *et al.,* 2012).

Preparation of plant extracts: Fresh plant leaves were collected from Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad campus and surrounding area of the campus. (*Aleovera*, *Ocimum basilicum*, *Psidium guajava*, *Eucalyptus obliqua*, and *Carica papaya*).

In vitro evaluation: In this study, phytoextracts of five botanicals and two chemicals were evaluated in the laboratory against *Geotrichum candidum*. The phytoextracts and chemicals were evaluated *in vitro* through food poison technique (Nene and Thapliyal, 2000).

RESULTS AND DISCUSSION

After 3 days the lowest radial mycelial growth was observed in $CaCl_2$ (2.38 cm), followed by acetic acid (2.76 cm), papaya (3.05cm), eucalyptus (3.05), guava (3.2cm), basil (3.25cm), aloe vera (3.43cm), and highest in control (3.51cm) as presented in table and figure 1. After 6 days, the lowest radial mycelial growth was observed in $CaCl_2$ (3.85cm), followed by acetic acid (3.97cm), papaya (4.55cm), eucalyptus (4.68cm), basil (4.98cm), aloe vera (5.03cm), guava (5.48cm) and highest in control (5.73cm). After 9 days, the lowest radial mycelial growth was observed in $CaCl_2$ (5.73cm) followed by acetic acid (6.35cm), papaya (6.68 cm), eucalyptus (6.91cm), basil (7.18cm), aloe vera (7.35cm), guava (8.16cm), and the highest in control (9.05cm).

The data on ascorbic acid content presented in table and figure 1 indicated significant differences in ascorbic acid content among the post-harvest treatments at 9 days of ambient temperatures (0.05). The maximum ascorbic acid was recorded with $CaCl_2$ (20.1mg/100g) followed by acetic acid (19.24mg/100g), papaya (19.08mg/100g), eucalyptus (19.05 mg/100g), basil (19mg/100g), aloe vera (18.67mg/100g), guava (16.49mg/100g) and lowest was control (16.29mg/100g). After 9 days the highest lycopene content was recorded with $CaCl_2$ (4.57mg/100g) and control (4.57mg/100g) followed by acetic acid (4.54mg/100g), aloe vera (4,54mg/100g), papaya (4.51mg/100g), eucalyptus (4.49mg/100g), basil (4.45mg/100g), and lowest was guava (4.37gm /100g). In case of total soluble solids the maximum total soluble solids was recorded with $CaCl_2$ (5.2%), followed by acetic acid (4.86%), papaya (4.42%), eucalyptus (4.4%), basil (4.4%), guava (4.29%), aloe vera (4.24%), and the lowest was control (4.1%). Whereas the physiological loss in weight after 9 days was lowest in acetic acid (36.61%) , followed by eucalyptus (39.01%), $CaCl_2$ (44%), aloe vera (46.76%), guava (53.98%), tulsi (56.85%), papaya (57.22%), and the highest was control (58.23%).

Table 1 : Radial mycelial growth of *Geotrichum candidum* as affected by different treatments

7S/N.	Treatments	Radial mycelial growth (cm)		
		3 days	6 days	9 days
T_0	Control (untreated check)	3.51	5.73	9.05
T_1	Aloe-vera	3.43	5.03	7.35
T_2	Basil	3.25	4.98	7.18
T_3	Guava	3.2	5.48	8.16
T_4	Eucalyptus	3.05	4.68	6.91
T_5	Papaya	3.05	4.55	6.68
T_6	Ca Cl_2	2.38	3.85	5.73
T_7	Acetic acid	2.76	3.97	6.35
F-test		S	S	S
S E m±		0.416	0.417	0.419
CD (5%)		0.515	0.517	0.517

Table 2 : Effect of different treatments against sour rot (*Geotrichum candidum*) of tomato (*Lycopersicon esculentum)* on ascorbic acid content, lycopene content (mg/100 g fr.wt), loss in weight (g) and total soluble solids (ºBrix).

Treatments		Ascorbic acid (mg/100 g. fr.wt)	Lycopene content (mg/100 g. fr.wt)	Physiological loss in weight (%)	Total soluble solids (ºbrix) (%)
T_0	Control (untreated check)	16.29	4.57	58.235	4.1
T_1	Aloe-vera	18.67	4.54	46.765	4.24
T_2	Basil	19	4.45	56.85	4.4
T_3	Guava	16.49	4.375	53.985	4.29
T_4	Eucalyptus	19.05	4.49	39.015	4.4
T_5	Papaya	19.08	4.51	57.225	4.42
T_6	Ca Cl_2	20.1	4.57	44	5.2
T_7	Acetic acid	19.24	4.54	36.61	4.86
F-test		S	S	S	S
S E m±		0.058	0.039	8.12	0.139
CD (5%)		0.058	0.074	9.959	0.164

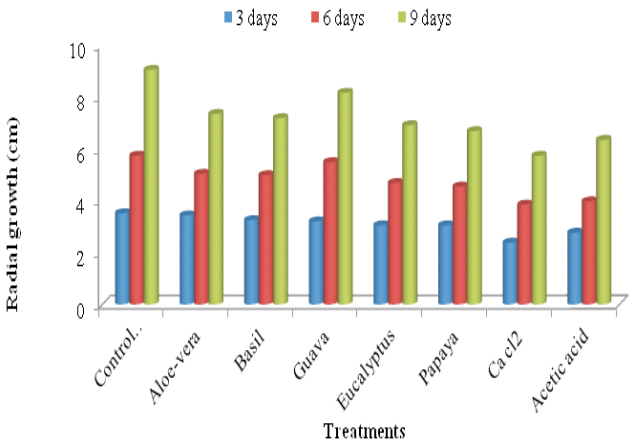

Figure 1 : Radial mycelial growth (cm) of *Geotrichum candidum* as affected by different treatments

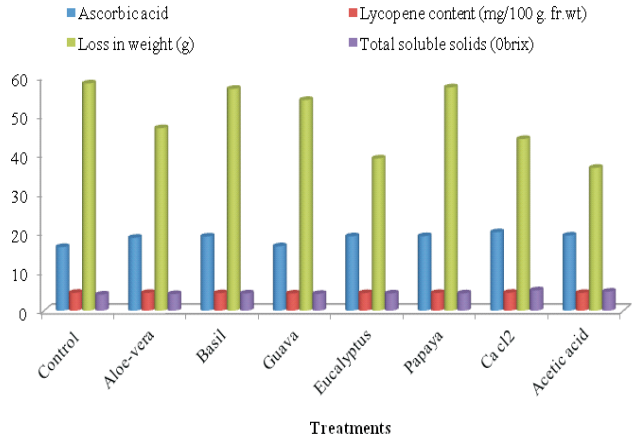

Figure 2 : Effect of different treatments against sour rot (*Geotrichum candidum*) of tomato (*Lycopersicon esculentum)* on ascorbic acid content, lycopene content (mg/100 g fr.wt), loss in weight (g) and total soluble solids (ºBrix).

The results of the present study are similar to the findings of Bartz *et al.* (2001), Faten (2010) and Karim *et al.* (2016). They reported that $CaCl_2$ treated fruits had highest ascorbic acid, lycopene content and had lowest PLW and moisture content. $CaCl_2$ was found highly effective in controlling sour rot as well as in maintaining the quality of the fruits during storage. Similar findings have also been reported by Arsenijevic and Obradovic (1996), Nguyen (1999), Causse *et al.* (2002), Raffo *et al.* (2002),Enrique and Eduardo (2006) , Lai *et al.* (2011), Okolie and Sanni (2012) and Gharezi *et al.*(2012).

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