International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 68-71

Received: 19-07-2019
Accepted: 21-08-2019

Pooja S Patel
Department of Plant Pathology, College of Agriculture (UAS-Bangalore), V.C. Farm Mandya, Karnataka, India

VB Sanath Kumar
Department of Plant Pathology, College of Agriculture (UAS-Bangalore), V.C. Farm Mandya, Karnataka, India

N Kiran Kumar
Department of Plant Pathology, College of Agriculture (UAS-Bangalore), V.C. Farm Mandya, Karnataka, India

KB Palanna
AICRP (Small Millets), GKVK, UAS-Bangalore, Karnataka, India

Chandrappa
Department of Horticulture, College of Agriculture (UAS-Bangalore), V.C. Farm Mandya, Karnataka, India

B Lingaraj
Department of Plant Pathology, College of Agriculture (UAS-Bangalore), V.C. Farm Mandya, Karnataka, India

Correspondence
VB Sanath Kumar
Department of Plant Pathology, College of Agriculture (UAS-Bangalore), V.C. Farm Mandya, Karnataka, India

Eco-friendly post-harvest management of papaya black spot disease caused by *Asperisporium caricae*

Pooja S Patel, VB Sanath Kumar, N Kiran Kumar, KB Palanna, Chandrappa and B Lingaraj

Abstract
Plant extracts for the control of plant diseases are emerging as an alternative to conventional fungicides as they are generally safe to humans and environment friendly. Seven plant extracts were tested for post-harvest management of papaya black spot disease caused by *Asperisporium caricae* under *in vivo* condition. Among all the seven plant extracts tested, *Allium sativum* was highly effective in maintaining lesser infection percentage (9.87%) at 40 per cent concentration for ten minutes dipping of fruits in the extract, which was significantly superior over of *Prosopis juliflora* (11.21%), *Vitex negunda* (12.06%), *Lawsonia inermis* (13.65%), *Ocimum sanctum* (15.62%) and *Lantana camara* (17.63%). *Azadirachta indica* (20.15%) was reported to be least effective in decreasing the infection percentage.

Keywords: Papaya, black spot disease, *Allium sativum*, plant extracts

Introduction
Papaya (*Carica papaya* L.) is very popular and a vital lozenge fruit of tropical and subtropical countries which grows up to 1,000 m above mean sea level. Papaya belongs to the family *Caricaceae* and it is native to Mexico and Central America (Aravind *et al*., 2013) [2]. The fruit is not just delicious and healthy, but whole plant parts like fruits, roots, bark, peel, seeds and pulp are also known to have a good medicinal property. The many benefits of papaya owe due to a good source of ascorbic acid, carotene, riboflavin (Saran and Choudhary, 2013) [10].

The major papaya producing countries in the world are India, Brazil, Indonesia, Nigeria, Mexico, Philippines and Thailand. In India, papaya is grown over an area of about 136,000 hectares, with annual production of 6,108,000 MT and productivity of 44.91 MT h $^{-1}$ a number that has been continuously increasing over the last few years. In Karnataka, it is grown over an area of about 7700 hectares with the annual production of 5,27,860 MT and average productivity is 68.55 MT ha^{-1}. India stands first in the production followed by Brazil and Indonesia. Major papaya growing States in India are Gujarat, Andhra Pradesh, Karnataka, Madhya Pradesh and Tamil Nadu. Karnataka stands third in the production (Annonymous, 2017) [1].

Of the biotic constraints low yield of papaya is mainly attributed to the prevalence of several diseases like, foot rot, anthracnose, powdery mildew, black spot, brown spot, papaya ring spot, mosaic and leaf curl diseases. Among them the emerging diseases in papaya is black spot disease caused by *Asperisporium caricae* is highly lethal which affects both leaves and fruits. The spots on the fruits are epidermal and do not reach the pulp of the fruit, causing only a hardening of the skin of the part affected which reduces the market value of the produce (Ventura, 2008) [12].

Though there is a large area under papaya cultivation in Karnataka, the productivity levels are low because of black spot infection. Although, the crop has been suffering a lot due to black spot disease, a limited work has been done on this aspect in Karnataka and less information is available about the disease and management strategies against it.

Therefore an investigation was carried out at College of Agriculture, Mandya during 2018 to find the effectiveness of the botanicals in post harvest management of the black spot disease as it is eco-friendliest, cost-effective and sustainable.

Material and Methods

Selection of medicinal plants

Medicinal plants mentioned in table 1 which were reported to contain some antimicrobial constituents and being used in Indian system of medicine (Kamala Ramachandran *et al*., 1986) [6] were selected for post harvest management of papaya black spot disease.

Table 1: List of medicinal plant used in post harvest management of papaya black spot disease

Sl. No.	Botanical name	Common name	Family	Parts used	Concentrations (%)
1.	*Prosopis juliflora*	Ironwood	Fabaceae	Leaves	20, 30, 40
2.	*Azadirachta indica*	Neem	Meliaceae	Leaves	20, 30, 40
3.	*Lawsonia inermis*	Henna	Lythraceae	Leaves	20, 30, 40
4.	*Ocimum sanctum*	Tulsi	Lamiaceae	Leaves	20, 30, 40
5.	*Allium sativum*	Garlic	Amaryllidaceae	Bulbs	20, 30, 40
6.	*Vitex negunda*	Chinese Chaste tree	Lamiaceae	Leaves	20, 30, 40
7.	*Lantana camara*	Wild sage	Verbanaceae	Leaves	20, 30, 40

Preparation of botanicals

The botanicals used in the experiment were prepared following the standard procedure (Kiran Kumar *et al.*, 2017) [7]. Fresh leaves of each plant were washed with tap water or bulb as the case may be were taken and cut into small pieces under aseptic condition. The plant material (250g) was put into mixer containing 250ml sterilized distilled water at a ratio 1:1. The sample was spun at low speed for 10-15 minutes till the material formed to fine texture. The blended material was then squeezed through a sterilized muslin cloth so as to get a crude liquid extract. The crude extract was filtered through Whatman no 1 filter paper followed by sterilized Seitz filter. The sterilized filtrate was mixed with sterile water to prepare desired concentrations.

Evaluation of botanicals against post harvest papaya black spot disease

Diseased papaya fruits of pale green or yellowish in colour with minimum number of spots on its surface of the variety Red Lady which is of uniform in shape, size and age were collected directly from the farmer's field and kept in the laboratory for a while to mitigate the field heat. Then the mud or filth and latex adhered on the fruit surface was cleaned. Then, randomly selected three papaya fruits were dipped in respective concentration of seven botanicals for two different timings *viz*., 5 and 10 minutes. The excess extract was drained off and treated papayas were air dried. Papaya fruits dipped in water (untreated papaya) served as control. Later the papaya fruits were rapped using paper. Three fruits (i.e. replications) for each concentration of the plant extracts were used and arranged in factorial CRD. Seven and ten days after treatment, rotted area covered by the infection due to *A. caricae* was measured in order to find out the disease severity.

Infection percentage was measured according to Corikidi *et al*. (2006). [4]

$$\text{Infection (\%)} = \frac{\text{Area covered by infection}}{\text{Total surface area of the papaya}} \text{X100}$$

Before treating the papaya fruits, surface area (S_a) of fruits were computed (Topuz *et al*., 2005). [11]

$$S_a = \pi D_e^2$$

Where, S_a = Surface area, m^2

D_e = Geometric mean diameter, cm

The geometric mean dimension (D_e) of the fruits was found using the formula (Mohsenin, 1980) [9] as given below:

$$D_e = (abc)^{1/3}$$

Where, De = Geometric mean diameter

a = Length of the fruit, cm

b = Width of the fruit, cm (Longest diameter)

c = Thickness of the fruit, cm (Shorter diameter)

Results and Discussion

There was a significant difference observed among different plant extracts, concentrations, timings and their interactions for post-harvest management of papaya black spot disease in terms of infection percentage over control at 1% level of significance (Table 2).

Among the seven botanicals evaluated, *Allium sativum* (9.87%) was highly effective in reducing the infection percentage seven days after treatment, which was significantly superior over *Prosopis juliflora* (11.21%), *Vitex nigunda* (12.06%), *Lawsonia inermis* (13.65%), *Ocimum sanctum* (15.62%) and *Lantana camara* (17.63%) which were moderately effective in reducing the infection percentage whereas, *Azadirachta indica* (20.15%) was found to be least effective in reducing the infection percentage on papaya (Fig. 1). However, fruits dipped with water recorded highest infection percentage (35.36%).

A significant effect was noticed with the treatment of different concentrations of plant extracts on the infection percentage over control at 1% level of significance. With an increase in the concentration of plant extract, infection percentage was found to be reduced. Among the different concentrations tested, dipping of fruits in 40% concentrations of plant extracts was significantly superior in reducing the mean infection percentage (13.03%) on papaya caused by *A. caricae* followed by 30 per cent and 20 per cent concentrations of plant extracts showed the mean infection percentage of 17.83 per cent and 19.72 per cent respectively. Significantly lowest infection percentage was observed in *A. sativum* bulb extract (3.85%) at 40 per cent when compared to 30 per cent (10.21%) and 20 per cent (15.55%) concentrations followed by *P. juliflora* with infection percentage of for 4.58 per cent, 12.86 per cent and 16.19 per cent at 40, 30 and 20 percent concentrations respectively.

Infection percentage was gradually decreased with the increasing dipping timing of fruits in plant extracts. Dipping of fruits for ten minutes in plant extracts was found to be effective in reducing the infection percentage (16.94%) when compared to five minutes (19.93%). The results of effect of plant extracts on post-harvest management of papaya black spot disease revealed that *Allium sativum* bulb extract at 40 per cent concentration was effective in decreasing the infection percentage by dipping the papaya fruits for ten minutes in the extract.

From the results it is evident that, though complete reduction in the infection percentage was not observed in any of the

plant extracts tested, but considerable amount of reduction was noticed. *A. sativum* and *P. juliflora* was effective in reducing the infection percentage due its antimicrobial property which was significantly superior to all other plant extracts. These results were in confirmation with the findings of Bazie *et al*. (2014) [3] in reducing the severity of post-harvest anthracnose of banana by treating the fruits with *P. juliflora* leaf extract. Similar results were also obtained by Marpudi *et al*. (2011) [8] who reported effective management of post-harvest anthracnose of papaya by treating with various plant extracts at 1:1 dilution and also extended the shelf life of the fruit. Cruz *et al.* (2013) [5] reported plant extracts were effective in suppressing post harvest anthracnose of banana in which citric extract was most effective and neem extract was least effective.

Table 2: Efficacy of plant extracts on infection percentage at 7 days after treatment

Sl. No	Plant extracts	Per cent infection							
		Concentrations (%)						Mean	Mean
		20%		30%		40%			
		Timings (Minutes)							
		5m	10m	5m	10m	5m	10m	5m	10m
1.	*Prosopis juliflora*	18.00 (25.12)	16.19 (22.14)	16.00 (23.59)	12.86 (21.03)	6.85 (15.18)	4.58 (12.36)	13.62 (21.30)	11.21 (19.04)
2.	*Azadirachta indica*	27.58 (31.70)	20.98 (27.27)	25.02 (30.03)	20.65 (27.04)	18.63 (25.58)	18.81 (25.72)	23.74 (29.10)	20.15 (26.68)
3.	*Lawsonia inermis*	19.12 (25.94)	18.38 (25.40)	17.58 (24.80)	14.75 (22.60)	12.60 (20.80)	7.83 (16.26)	16.43 (23.85)	13.65 (21.42)
4.	*Ocimum sanctum*	26.78 (31.18)	24.96 (29.99)	23.30 (28.88)	17.06 (24.41)	5.2 (13.19)	4.85 (12.73)	18.43 (24.41)	15.62 (22.38)
5.	*Allium sativum*	19.58 (26.28)	15.55 (23.24)	13.25 (21.36)	10.21 (18.64)	6.24 (14.47)	3.85 (11.32)	13.02 (20.70)	9.87 (17.73)
6.	*Vitex negunda*	23.86 (29.25)	16.33 (23.85)	18.60 (25.56)	9.12 (17.59)	12.52 (20.73)	10.72 (19.12)	18.33 (25.18)	12.06 (20.19)
7.	*Lantana camara*	15.94 (23.54)	12.04 (20.31)	24.59 (29.74)	22.60 (28.40)	21.08 (27.34)	18.24 (25.30)	20.54 (26.88)	17.63 (24.67)
8.	Control (Water)	35.36 (36.51)	35.36 (36.51)	35.36 (36.51)	35.36 (36.51)	35.36 (36.51)	35.36 (36.51)	35.36 (36.48)	35.36 (36.48)
Mean		23.28 (28.69)	19.72 (26.09)	21.71 (27.56)	17.83 (24.53)	14.81 (21.73)	13.03 (19.91)	19.93 (25.99)	16.94 (23.58)
		Plant extracts	Concent-rations	Timings	P x C	P x T	C x T	P x C x T	
SE m±		0.20	0.33	0.40	0.11	0.14	0.23	0.08	
CD @ P=0.01		0.123	0.077	0.063	0.217	0.177	0.109	0.307	

Values in parenthesis are arcsine transformed values

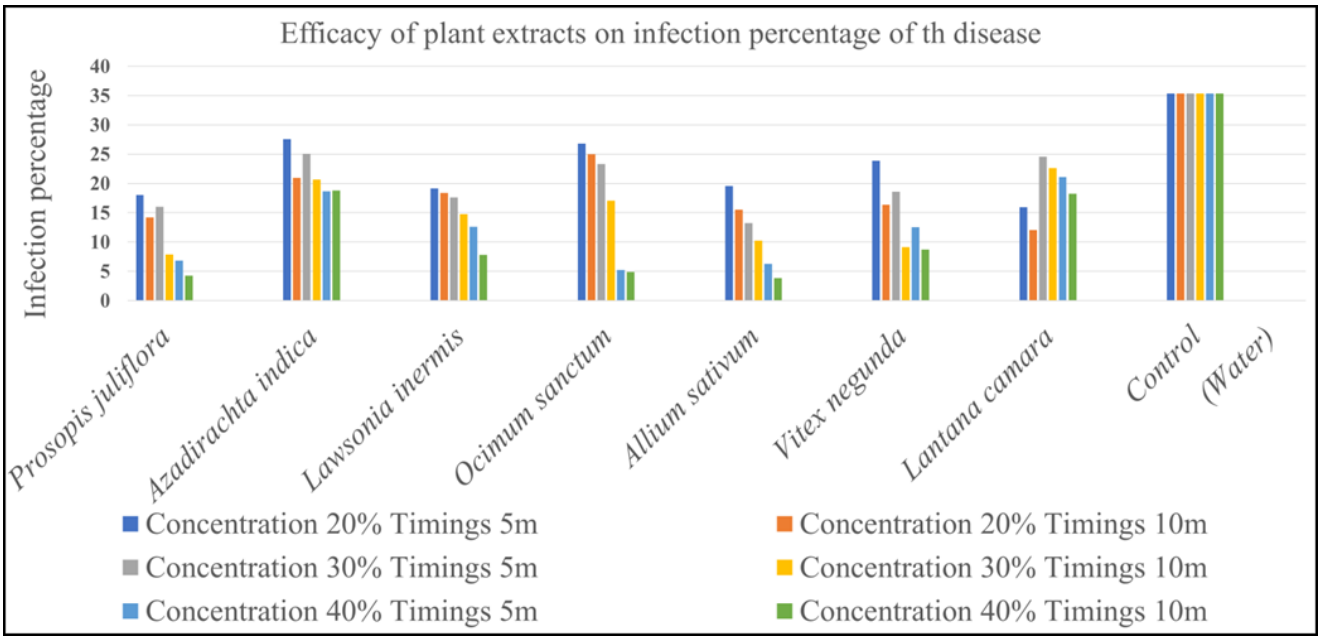

Fig 1: Efficacy of plant extracts on infection percentage of papaya black spot disease

Conclusion

The present investigation revealed that extracts of many medicinal plants were effective against papaya black spot disease. The use of fungicides to manage post harvest diseases may lead to the accumulation of fungicide residue on fruits. Hence these could be exploited as an alternate management strategy for chemical pesticides in the management of post harvest papaya black spot disease. The future studies should focus on identification and elucidation of the active principles present in medicinal plants having potential antimicrobial properties.

References

1. Annonymous. Horticulture statistics at a glance, Ministry of Agriculture and Farmers Welfare, Government of India. 2017; 481.
2. Aravind G, Bhowmik, D, Duraivel S, Harish G. Traditional and medicinal uses of *Carica papaya*. J Med. Plants Stud. 2013; 1(1):7-15.
3. Bazie S, Ayalew A, Woldetsadik K. Integrated management of postharvest banana anthracnose (*Colletotrichum musae*) through plant extracts and hot water treatment. Crop Prot. 2014; 66:14-18.
4. Corkidi G, Balderas-Ruiz KA, Taboada B, Carreon SL, Galindo E. Assessing mango anthracnose using a new three-dimensional image analysis technique to quantify lesions on fruit. Plant Patho. J. 2006; 55: 250-257.
5. Cruz MES, Schwan-E Strada KRF, Clemente E, Itako AT, Stangarlin JR, Cruz MJS. Plant extracts for controlling the post-harvest anthracnose of banana fruit. Rev. Bras. Pl. Med. 2013; 15(4):727-733.
6. Kamala Ramachandran, Kashyapa K, Ramesh Chand. The useful plants of India. Publication and Information Directorate, CSIR, New Delhi, 1986; 918.
7. Kiran Kumar N, Sanath Kumar VB, Manjunatha SE, Mallikarjuna N. Effect of botanicals on *Ralstonia solanacearum* and bacterial wilt incidence in tomato. Int. J. Chem. Stud. 2017; 5(6):737-740.
8. Marpudi L, Abirami LSS, Pushkala R, Srividya N. Enhancement of storage life and quality maintenance of papaya fruits using *Aloe vera* based antimicrobial agent. Indian J. Bitechnol. 2011; 10:83-89
9. Maublanc A. Disease of the leaves of papaya (*Carica papaya*). Socitey Mycologique de France. 1913; 29(1):353-358.
10. Mohsenin. Physical properties of plant and animal materials, 3rd Gordon and breach, Science Publishers, 1980.
11. Saran PL, Choudhary R. Drug bioavailability and traditional medicaments of commercially available papaya: A review. Afr. J Agric. Res. 2013; 8(25):3216-3223.
12. Topuz A, Topakci M, Canakci M, Akinci I, Ozdemir F. Physical and nutritional properties of four orange varieties. J Food Eng. 2005; 66:519-523.
13. Ventura JA. Management of diseases of papaya, In: The papaya. 2008, 231-310.