

Screening of papaya cultivars against anthracnose disease caused by *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc.

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Abstract

Anthracnose caused by Colletotrichum gloeosporioides (Penz.) Penz. and Sacc. is the most serious disease of papaya throughout the world. No papaya cultivars reported showing resistance against this pathogen. Seventeen papaya (*Carica papaya* L.) cultivars were screened against anthracnose disease of papaya under laboratory conditions with the objective of identifying sources of resistance for the disease. Ten papaya fruits of each cultivar were inoculated with a spore suspension of *C. gloeosporioides* (10^6 spores/ml) and incubated for disease development under room temperature (28 ± 1 °C) for one weeks. Disease severity and the per cent disease index (PDI) were calculated one week after the treatment. The reaction of different cultivars was classified into resistant, moderately resistant, susceptible and highly susceptible according to the PDII. Shillong, Pusa Dwarf, Solo and Washington cultivars showed susceptible to anthracnose, while all the other cultivars tested were highly susceptible. Data revealed that, there was no cultivar found resistant or moderately resistant to anthracnose disease caused by *Colletotrichum gloeosporioides*.

Key words: Anthracnose, *Colletotrichum gloeosporioides*, Papaya, Cultivar screening

INTRODUCTION

Papaya (*Carica papaya* L.) is one of the most popular fruit plant grown widely under tropical and sub-tropical climatic conditions. It is the most important fruit plant in the home gardens, and green papaya is also used as a vegetable [1]. It is one of the few fruit plants which yields throughout the year, gives quick returns and adopts itself to various soil and climatic conditions [2].

Papaya fruit has a very thin skin and thus rough handling leads to heavy losses due to a number of rots caused by fungi and bacteria. Commercial papaya production has been hampered worldwide due to the high susceptibility of the crop to various diseases among which the anthracnose caused by *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. is the most serious disease that affects the ripened fruit. The disease is prevalent wherever papaya is grown and becomes more prominent during marketing and at consumer level [3].

Differences in resistance among cultivars against *Colletotrichum gloeosporioides* have been reported for several other crops including rubber, eggplant, cashew, water yam, banana, avocado, and mango [4]. However, there is no evidence for the fruits of papaya having temporary resistance against anthracnose disease at any developmental stage. According to Duran *et al.* [5], it was suggested that all stages of papaya fruits were susceptible to anthracnose disease. Although no known cultivars of papaya offer complete resistance to anthracnose, the Hawaiian cultivar 'Sunrise Solo' has found less susceptible to infection by *C. gloeosporioides* [6].

In view of the above, the current study was undertaken to screen different cultivars of papaya against *C. gloeosporioides* for anthracnose disease resistance.

MATERIALS AND METHODS

All field and laboratory experiments were conducted at Indian Institute of Horticultural Research (IIHR), Hessaraghatta, Bangalore during June 2002 to February 2004.

Papaya fruits of different cultivars were harvested at ripening stage and were brought to the laboratory for screening against anthracnose disease. Same sizes of papaya fruits of the following cultivars in the age between 3-4 months old, were screened in the experiment.

Papaya varieties used for screening against anthracnose disease:

- | | |
|-----------------------------|---------------------------|
| 1. Pink Fleshed Sweet (PFS) | 10. CO-4 |
| 2. Pusa Nanha (PN) | 11. CO-5 |
| 3. Tainung-1 (TN-1) | 12. Coorg Honey Dew (CHD) |
| 4. Tainung-2 (TN-2) | 13. Sunrise Solo |
| 5. Shillong | 14. Surya |
| 6. Pusa Dwarf (PD) | 15. Thailand |
| 7. AC 119 | 16. Washington |
| 8. CO-1 | 17. Mauritius |
| 9. CO-2 | |

A ten-day old monoconidial cultures of *Colletotrichum gloeosporioides* grown on potato dextrose agar (PDA) were scrapped with a sterilized scalpel and transferred into a conical flask containing 50 ml of sterilized distilled water under aseptic conditions. A uniform, homogenized spore suspension was obtained by agitating on a rotary shaker for 15 minutes. The spore concentration was adjusted to 10^6 spores/ml after counting the number of spores in haemocytometer with the aid of 10x binocular microscope.

Ten fruits from each cultivar were used to screen for resistance against anthracnose disease. Fruits were washed with tap water and dipped in a spore suspension of *C. gloeosporioides* for ten minutes. Fruits were kept in a humid chamber for 48 hours and then transferred into plastic crates and kept in room temperature of 28 ± 1 °C.

A six-day after inoculation, the disease development and its severity was recorded using a 0-5 scale as described below [7]. In addition, number of days taken for the appearance of fist symptom was also recorded.

<u>Scale/rating</u>	<u>Description of symptoms</u>
0	Fruits free from infection
1	Spots covering less than 5 percent of total fruit surface
2	Spots covering over 5-10 percent fruit surface
3	Spots covering over 10-25 percent fruit surface
4	Spots covering over 25-50 percent fruit surface
5	Spots covering more than 50 percent fruit surface

The percent disease index (PDI) for each variety was calculated using the following formulae.

$$\text{PDI} = \frac{\text{* Sum of all numerical ratings}}{\text{Total number of observations}} \times \frac{100}{\text{Maximum rating observed}}$$

*Sum of all numerical ratings was calculated as summation of scale given to each fruit

Total number of fruits observed for each variety was 10.

The cultivars were then classified into different reactions [7] based on PDI as described below.

Table 1. Performance indicators of papaya with reference to PDI

Reaction	Percent disease index (PDI)
Resistant	0-10
Moderately resistant	10.1-25
Susceptible	25.1-50
Highly susceptible	50.1 and above

RESULTS AND DISCUSSION

Seventeen cultivars of papaya which were screened against anthracnose disease were categorized using Table 1. There was little variation observed among tested varieties when screened against anthracnose disease. All varieties that were screened, developed initial symptoms in 3 days except CO-5 which showed symptoms 4 days after inoculation. Data revealed that, there was no variety found in the category of resistant or moderately resistant response with regards to the PDI. The reaction of different cultivars against anthracnose disease was found only in the categories of susceptible and highly susceptible. Shillong, Pusa Dwarf, Sunrise Solo and Washington cultivars found to have a susceptible reaction while all the other cultivars tested were highly susceptible (Table 2). Among highly susceptible cultivars, AC 119 and Shantha had higher PDI (79 and 70) while CO-2.

Table 2 : Reaction of different papaya cultivars against anthracnose disease

Cultivar/germplasm	Average number of days taken to appear first symptom	PDI	Reaction [#]
Pusa Fleshed Sweet (PFS)	03	60	HS
Tainung-2 (TN-2)	03	52	HS
Shillong	03	49	S
Pusa Dwarf	03	45	S
AC 119	03	79	HS
CO-5	04	68	HS
Shantha	03	70	HS
Coorg Honey Dew (CHD)	03	64	HS
Tainung-1 (TN-1)	03	58	HS
Sunrise Solo	03	42	S
Surya	03	64	HS
Thailand	03	53	HS
Washington	03	49	S
CO-1	03	67	HS
CO-2	03	51	HS
CO-4	03	60	HS
Mauritius	03	53	HS

[#] S=susceptible HS = highly susceptible

Mauritius, Thailand and Tainung-2 had lower PDI. Cultivar Solo had the lowest PDI (42) among all the cultivars tested. Shillong and Washington cultivars had the highest PDI among susceptible cultivars.

Current study indicates that none of the tested varieties had resistance reaction with this pathogen. Conducting a similar experiment, Nakasone and Aragaki [6], reported that no known cultivars of papaya offered complete resistance to anthracnose but, the Hawaiian cultivar ‘Sunrise Solo’ had some resistance to infection by *C. gloeosporioides* than ‘Kapoho Solo’. In the present study, sunrise solo offered only susceptible reaction (S) along with Shillong, Pusa Dwarf, and Washington and in agreement with the above results. This resistance (or less susceptibility) could be sufficient to preclude spraying for this disease except in wetted areas [6].

According to Stanghellini and Aragaki [8], nonwounded field fruits, inoculated when green and harvested at varying intervals up to and including full maturity, failed to show any sign of infection although the fungus had formed appressoria and was in a viable state. They have suggested that certain metabolites normally supplied by the leaves and present only in low concentrations in fruits were not available or have been inhibited once the fruit has been detached. This could be one of the reason we found only susceptible or highly susceptible reaction on detached fruits of all cultivars tested. It is therefore, important to study the response of different cultivars on attached fruits under field conditions.

An intensive search will be necessary to identify cultivars with resistance, but this will be a long-term process. Selections must also take place in the environment where the crop is to be grown because varieties imported from elsewhere are often agronomically unsuitable. Since many papaya growing countries have very little material from which to select, the first priority will be to establish germplasm collections for initial evaluation.

CONCLUSION

No sources of resistance were identified during screening of germplasms against anthracnose disease of papaya. All the cultivars tested showed either a susceptible or highly susceptible disease reaction to *C. gloeosporioides*. Shillong, Pusa Dwarf, Solo and Washington cultivars found susceptible (S) while all the other cultivars tested were highly susceptible (HS) to the disease.

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