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SCREENING OF BANANA CULTIVARS AGAINST ANTHRACNOSE DISEASE CAUSED BY *COLLETOTRICHUM GLOEOSPORIOIDES*

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ABSTRACT

Anthracnose of banana caused by *Colletotrichum gloeosporioides* is the most serious disease of banana throughout the world. No banana cultivars reported showing resistance against this pathogen. Nine banana cultivars were screened against anthracnose disease of banana under lab and field conditions with the objective of identifying sources of resistance for the disease. 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. Incubation period and per cent disease index (PDI) were calculated at three developmental stage (25%, 50% and 100% rotting). The reaction of different cultivars was classified into resistant, moderately resistant, susceptible and highly susceptible according to the PDI. Chenia (AAB), Nepali Chenia (AAB) and Poovan (AAB 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, banana, cultivar screening.*

The banana which cultivated, are namely *Musa acuminata, Musa balbisiana.* The genus Musa is in the family *Musaceae*. Banana considered "queen of tropical fruit" and one of the oldest fruit known to mankind. Banana is the second largest fruit crop, is an important staple food commodity around the world. Banana is consumed as a staple food, fresh fruit or for processing. It also serves as a boost to farm income for millions of people in the tropical region. It is an important source of high-calorie energy and contributes about a quarter of the energy requirement of almost 70 million people in the West and Central African sub-region. It is also the fourth most important commodity at global level next to rice, wheat and dairy products (Hays 1966).

In Bihar, the production areas are broadly grouped in two zones. They are Vaishali and Koshi. About 40% areas lies in Vaishali belt (Zone I) and the rest 60 per cent area is in Koshi belt (Zone II), Production has been seriously decreased and threatened by diseases and pests and soil fertility problems. The diseases are a major constrains of banana production both in field and also at post harvest. Several postharvest diseases of banana had been reported worldwide but fruit rot /anthracnose diseases had been reported as being the most prominent (Chadha 2001).

Differences in resistance among banana cultivars against *Colletotrichum gloeosporioides* have been reported for several other crops including rubber, eggplant, cashew, water yam, papaya, avocado, and mango (Jeffries *et. al.,* 1990). However, there is no evidence for the fruits of banana having temporary resistance against anthracnose disease at any developmental stage. According to Duran *et al.* 1999, it was suggested that all stages of banana fruits were susceptible to anthracnose disease. Although no known cultivars of banana offer complete resistance to anthracnose, the Chenia (AAB)' has found less susceptible to infection by *C. gloeosporioides* (Nakasone and Aragaki 1892). In view of the above, the current study was undertaken to screen different cultivars of banana against *C. gloeosporioides* for anthracnose disease resistance.

MATERIALS AND METHODS

All field and laboratory experiments were conducted at Rajendra Agricultural University, Pusa, Samastipur, Bihar during the year 2004. Banana fruits of different cultivars were harvested at ripening stage and were

brought to the laboratory for screening against anthracnose disease. Same sizes of banana fruits of the following cultivars in the age between 3-4 months old, were screened in the experiment.

Banana varieties used for screening against anthracnose disease :

1. Robusta (AAA)
2. Chenia & AAB
3. Fhia 1 (AAAB)
4. Fhia 3 (AABB)
5. Poovan (AAB)
6. Alpan (AAB)
7. Basari (AAA)
8. Fhia 23-1 (AAAA)
9. Nepali Chenia (AAB)

A seven days old monoconidial culture *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 10^6spores/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 (Sangeetha 2003). In addition, number of days taken for the appearance of fist symptom was also recorded.

Scale/rating Description of symptoms

0 Fruits free from infection

1 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.

$$PDI = \frac{\text{Sum of all disease ratings}}{\text{Total number of plants observed} \times \text{maximum rating value}} \times 100$$

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.

RESULTS AND DISCUSSION

Nine cultivars of banana 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 and developed initial symptoms from 4 - 9 days after inoculation.

Estimation of incubation period and post harvest losses on fruits of germplasms/cultivars against *Colletotrichum gloeosporioides:* The mean maximum number of days (17) was required for complete rotting (100%) found in cultivar namely Fhia 3 (AABB) and Fhia 23-1 (AAAA) which was followed by Fhia 1 (AAAB) and Basari (AAA) whereas mean minimum days (12.8) required to complete was found in cultivar Chenia (AAB) indicated in Table 2. Data revealed that, there was no variety found in the category of resistant or moderately resistant response with regards to the PDI.

Reaction of different germplasms/cultivars against *Colletotrichum gloeosporioides* : The reaction of different cultivars against anthracnose disease was found only in the categories of susceptible and highly

Table-1 : Performance indicators of banana 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

Table-2 : Estimation of incubation period and post harvest losses on fruits of germplasms/cultivars against Colletotrichum gloeosporioides.

Sl. No.	Germplasms/ cultivars	Incubation period	No. of days required		
			Different level of fruit rotting		
			25%	50%	100%
1.	Robusta (AAA)	7	9.5	11.5	14.1
2.	Chenia & AAB	6	7.8	9.8	12.8
3.	Fhia 1 (AAAB)	9	11.7	13.7	16.7
4.	Fhia 3 (AABB)	9	12.0	14.0	17.0
5.	Poovan (AAB)	4	8.3	10.4	13.4
6.	Alpan (AAB)	5	9.0	11.0	14.0
7.	Basari (AAA)	5	11.1	12.8	15.8
8.	Fhia 23-1 (AAAA)	9	12.0	15.0	17.0
9.	Nepali Chenia (AAB)	6	6.5	8.5	11.5
	S. Em. +		0.7	0.8	0.7
	CD at 5%		2.2	2.4	2.1

Table-3 : Reactions of different germplasms/cultivars against *Colletotrichum gloeosporioides.*

Sl. No.	Germplasms/cultivars	PDI	Reaction
1.	Robusta (AAA)	56	HS
2.	Chenia & AAB	45	S
3.	Fhia 1 (AAAB)	67	HS
4.	Fhia 3 (AABB)	68	HS
5.	Poovan (AAB)	49	S
6.	Alpan (AAB)	56	HS
7.	Basari (AAA)	63	HS
8.	Fhia 23-1 (AAAA)	68	HS
9.	Nepali Chenia (AAB)	46	S
	S. Em. +	3.0	
	CD at 5%	8.1	

S = Susceptible, HS = Highly susceptible

susceptible. Chenia (AAB), Poovan (AAB) and Nepali Chenia (AAB) cultivars found to have a susceptible reaction while all the other cultivars tested were highly susceptible. Among highly susceptible cultivars, Fhia 3 (AABB) and Fhia 23-1 (AAAA) had higher PDI (68) while Chenia (AAB) had the lowest PDI (45) which was followed by PDI (46) in Nepali Chenia (AAB) and PDI (49) in Poovan (AAB) indicated in Table 3.

Current study indicates that none of the tested varieties had resistance reaction with this pathogen. Conducting a similar experiment, Nakasone and Aragaki 1892 reported that no known cultivars of banana offered complete resistance to anthracnose. In the present study, Chenia (AAB), Poovan (AAB) and Nepali Chenia (AAB) and in agreement with the above results. Thakur and Misra 1960 also studied of varietal reaction showed that all the six varieties *viz.*, Harchhal, Malbhog, Champa Chenia, Alpan, Martban, were susceptible to the anthracnose disease of banana, whereas, cultivar Kothia and Muthia were fairly resistant. Alpan and Martban cultivars were comparatively less susceptible while Harichhal and Malbhog were worst affected.

This resistance (or less susceptibility) could be sufficient to preclude spraying for this disease except in wetted areas (Nakasone and Aragaki 1892) 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 reasons 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 banana 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 banana. All the cultivars tested showed either a susceptible or highly susceptible disease reaction to *C. gloeosporioides.* Chenia (AAB), Poovan (AAB) and Nepali Chenia (AAB) cultivars found susceptible (S) while all the other cultivars tested were highly susceptible (HS) to the disease.

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