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Influence of environmental factors on the development of *Colletotrichum gloesporioides* rot (Anthracnose) of Mango Fruits

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Abstract

The present paper deals with the study of the impact of environmental factors like temperature and relative humidity (R.H.) on severity of disease, spore germination, cellulase and pectinase enzyme activity of *Colletotrichum gloesporioides*. Development of anthracnose (*Colletotrichum gloesporioides* rot) was found to be very less at low temperature (10^0 C) and low R.H. (30%) whereas; it was highest at 25 ^{0}C and at 100% R.H.

Keywords:- *Anthracnose, Cellulase activity, Disease severity, Mango fruits, Pectinase activity, Relative Humidity, Temperature*

Introduction

Anthracnose (*C.gloesporioides* rot) is presently recognized as the most important field and post harvest disease of mango worldwide. It is an important cause of loss in mangoes all over the world (Susamma, 2002). It is the major disease, limiting fruit production in all countries where mangoes are grown, especially where high humidity prevails during the cropping season. The post harvest phase is the most damaging and economically significant phase of the disease worldwide (Chrys, 2006).

Environmental factors such as temperature and relative humidity (R.H.) play an important role in the development and spread of post–harvest fungal diseases of fruits (Thakur, 1972; Gupta and Nema, 1979; Patel and Pathak, 1995; Mehrotra *et al.*, 1998; Bagwan and Yeole, 2003; Bagwan and Meshram; 2003; Chrys, 2006; Cherian and Mani, 2007). However, there is very less information about the effect of temperature and R.H. in respect to *Colletotrichum gloesporioides* rot of mango fruit. Hence attempts were made to determine the impact of these environmental factors on anthracnose of mango fruits.

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Materials and Method

Healthy mango fruits of Alphanso variety were collected from Aurangabad fruit market. Mango fruits were surface sterilized with 0.1 % $HgCl_2$, Pricked to a depth of 2mm and washed with sterile distilled water. The injured fruits were dipped in spore suspension (106 spore/ml) of *Colletotrichum gloesporioides* for 2min. Then the fruits were placed in sterilized polythene bags as on fruit per bags.

These polythene bags containing mango fruits were incubated to different level of temperature and RH percentage adjusted level were maintained by the method recommended by Buxton and Mellanby (1934). Severity of rot was recorded on 8th day of incubation on the basis of percent fruit area infected. Effect of temperature and R.H. on spore germination of *C.gloesporioides was* examined by placing spores on glass-slide placed to different levels of temperature and R.H. Effect of temperature and R.H. on action of cellulase and pectinase enzyme of the *C.gloesporioides* was investigated by incubating inoculated fruits at different temperature and R.H. at 25^{0}C. On 8th day of inoculation 5gm of rotted tissue was macerated with distilled water and 0.5N NaCl. The extract was filtered and filtrate was centrifuged at 4000 rpm for 25 min and the supernatant was used as enzyme sample. Pectinase was assayed gives in 2ml of enzyme sample, 5.00 ml of 1% pectin dissolved in buffer solution (pH- 4.5), 1.8 ml of phosphate citrate buffer solution (pH-4.0) and 1.5 ml of distilled water.

The cellulolytic were assayed using 2ml of enzyme sample, 5.00 ml of 1% CMC (Carboxy Methyl Cellulose), dissolved in buffer solution (pH-4.5), 1.8 ml of sodium citrate buffer (pH-4.8) and 1.8 ml of distilled water.

The enzyme action was assayed by determining loss in viscosity of the reaction mixture after 120 min at 30 ^{0}C following the method of Bell *et al.* (1955). The data were statistically analyzed for C.D. following Panse and Sukhatme (1978).

Results and Discussion

Anthracnose severity was highest at 25 ^{0}C and 100% R.H. severity was absent at 10 ^{0}C and at 30% R.H., so at this physical environment there is a very less rotting of mango fruits. Severity was increased from 30 to 100% R.H. (Table-1 and 2). The spore germination did not occur at 10 ^{0}C up to 24 hours of incubation. Cellulase and pectinase activities were highest at 25 ^{0}C and 100% R.H. and lowest at 10 ^{0}C and 30% R.H. (Table-1 and 2).

Chrys (2006) reported that at 95 % R.H. and 25-30 ^{0}C temperature was favorable for spore germination of *C.gloesporioides*. Fatima *et al.* (2006) found that the temperature between 20^{0}C-30^0 C and R.H. at 95-97% was favorable for *C. gloesporioides* rot. Prabakar *et al.* (2003) investigated that the optimum temperature for the anthracnose development was 25 ^{0}C and it was least at 13 ^{0}C. Sharma (2000) observed a temperature of 25 ^{0}C and R.H. more than 95 percent has been considered favorable for anthracnose development of post harvest mango fruits. Temperature between 25 to 30 ^{0}C and 90 percent R.H. was favorable for *C. gloesporioides* rot. Maximum (>32^{0}C) was found unfavorable for anthracnose disease (Patel and Rathod, 2005).

The present research findings reveals that optimum temperature and R.H. for *C. gloesporioides* rot was 30 ^{0}C and 100% respectively and the pathogen did not show any symptoms at 10 ^{0}C. Hence it can be concluded at low temperature (10 ^{0}C) and low humidity (30%), anthracnose is not developed in mango fruits. Whereas, at room temperature (25-30 ^{0}C) and high humidity (100%), *C. gloesporioides* rot is severe. It can be also concluded that diseases severity, spore germination cellulase and pectinase action of *C. gloesporioides* were directly proportional to the R.H. level.

The finding suggests that storage of mango fruits at low R.H. and low temperature will reduce the spoilage by anthracnose of mango fruit during harvesting, loading, transportation, unloading, storing etc. So, low temperature and low humidity storage conditions are recommended to avoid spoilage of mango fruits by *C. gloesporioides*.

Table-1: Influence of temperature on disease severity, spore germination, cellulase and pectinase enzyme activity of *C. gloesporioides* rot of mango fruits

Temp. (^{0}C)	Disease severity %	Spore germination % after 24 hours	Enzyme Activity	
			Cellulase	Pectinase
10	0.00	0.00	14.40	13.60
25	59.30	80.40	69.20	67.30
30	48.70	73.20	61.30	58.70
40	38.40	62.40	44.20	38.40
C.D. (p=0.05)	35.40	50.50	33.30	32.70

Note:- Enzyme activity values are expressed in viscosity loss % after 120 min.

Table-2: Influence of Relative humidity on disease severity, spore germination, cellulase and pectinase enzyme activity of *C. gloesporioides rot* of mango fruits

R.H. (%)	Disease severity %	Spore germination % after 24 hours	Enzyme Activity	
			Cellulase	Pectinase
30	22.40	19.50	15.40	14.30
50	26.70	42.80	18.30	16.90
80	54.20	73.20	57.20	48.70
100	65.40	78.70	70.40	65.60
C.D.(p=0.05)	28.80	37.80	38.00	34.30

Note:- Enzyme activity values are expressed in viscosity loss % after 120 min.

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