

Identification of susceptible stage of fruit and role of biochemical constituents in fruit rot of chilli

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ABSTRACT

An experiment was conducted to know the susceptible stage of chilli fruit at which it is prone to infection and role of different biochemical constituents of fruit in imparting resistance against fruit rot caused by *Colletotrichum capsici*. Three different stages viz green fruits, green fruits turning red and red fruits were evaluated. The red fruits recorded 150 per cent more fruit infection and 128 per cent more per cent area of fruit infection than green fruits. The stage at which chilli fruits turn from green to red is prone to infection. The infection continued severely when fruit turned red. Paprika fruits were more susceptible than Guntur and Byadgi fruits. The resistance observed in green chillies is due to the presence of higher phenol and wax content than in green fruits turning red and red fruits. The depletion of nitrogen and sugar content in chilli fruit is also observed as a result of pathogenesis to the tune of 45, 50 and 89 percents in Byadgi, Guntur and Paprika varieties.

Key words : Chilli, Anthracnose, Fruit rot, Biochemical resistance, Susceptible stage, *Colletotrichum capsici*.

INTRODUCTION

The chilli (*Capsicum* spp.) is a member of solanaceae family is mainly cultivated as a vegetable in many countries including India. In Karnataka the chillies grown are even exported to western countries. Chillies suffer from many diseases like damping off, fruit rot (anthracnose), murda complex, leaf spots, powdery mildew and wilt. Among them the fruit rot caused by *Colletotrichum capsici* (Sydew). Butler and Bisby is becoming more serious in chilli growing areas of India. Ahmed (1982) reported that *C. capsici* can infect chilli fruits in all stages of growth. Asuti and Suhardi (1986) reported that green or young chillies were more susceptible than half matured fruits. Adikaram *et al* (1983) noticed appressoria are not developed infection hyphae and remained quiescent on immature fruits. Basak *et al* (1994) noticed *C. capsici* infection on young, mature and ripened chilli fruits but maximum was at ripened stage. Some biochemical constituents of chilli are known to be reduced by the infection. Prakasam and Jeyarajan (1989) concluded that amount of wax was higher in resistant green fruits than in susceptible ripe fruits. Azad (1991) found phenolic compounds decreased with increasing fruit maturity. He also found decreased nitrogen content in diseased fruits. In this context the present study was conducted to know the susceptible stage of fruit for infection and role of different biochemical constituents in imparting resistance.

MATERIALS AND METHODS

One hundred chilli fruits each of different growth stage viz., green fruit, green fruit turning to red and red fruits sterilized by 0.1% mercuric chloride were inoculated by the pin prick method in 4 replications. Then they were incubated for 15 days. Observations on per cent fruit infection and percent area of infection on fruit were recorded after incubation. Estimation of nitrogen was done by mikrokjeldhal method (Jackson, 1967) sugars by Nelson, (1944) method, phenol by (Bray and Thorpe, 1954) and wax by Ebercon *et*

al. (1977).

RESULTS AND DISCUSSION

Table 1 indicated that number of fruits infected did not differ significantly between red stage (42.60 per cent) and green to red stage (37.90 per cent). These two stages recorded highly significant percentage of fruits infected compared to green stage (7.90 per cent) in all the varieties. In all there is increase of 150 per cent fruit infection from green to red stage. Among varieties Paprika fruits (34.16) recorded significantly superior per cent fruit infection than Guntur (25.05) and Byadgi (24.00) which are at par.

There was significant difference between the growth stages, varieties and interactions with respect to per cent area of infection on fruit (Table 2). Highest percentage area of infection was observed at ripe red stage (25.25 per cent) and is at par with fruits turning from green to red stage (23.50 percent). Least area of infection was seen at green stage (5.20 percent). Over all there is increase of 128 per cent area on red fruits compared to green fruits. Paprika (20.85 per cent) and Guntur (16.20 per cent) recorded highest fruit infection and they were at par.

Phenol and wax content varied significantly with respect to different stages of fruit growth (Table 3). Green fruits (0.0006 mg/100 g) recorded significantly higher phenol content than fruits turning green to red (0.00025 mg/100g) red fruit (0.00007 mg/ 100g). Wax content also followed similar trend. Green fruits (25.80 mg/100 g) recorded significantly higher wax content than fruits turning green to red (18.05 mg/100g) and red fruit (16.30 mg/ 100g). Both the phenol and wax content depleted as the fruits matured from green to red.

Table 4 indicated that sugars and nitrogen content were reduced as a result of pathogenesis. In Byadgi fruits nitrogen content reduced from 0.055% (healthy) to 0.041% (diseased); in Guntur from 0.032% (healthy) to 0.028% (diseased) and in Paprika from 0.040% (healthy) to 0.021%

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Table 1 : Percent fruit infection at different stages fruit of development.

S. No.	Stage	Chilli varieties			Mean
		Byadgi	Guntur	Paprika	
1.	Green	13.58 (05.50)*	16.43 (08.00)	18.90 (10.50)	16.30 (07.90)
2.	Turning from green to red	36.58 (35.50)	34.75 (32.50)	42.71 (46.00)	38.01 (37.90)
3.	Red	37.78 (37.50)	38.93 (39.50)	45.57 (51.00)	40.76 (42.60)
	Mean	29.31 (24.00)	30.03 (25.05)	35.72 (34.16)	

* Figures in parenthesis are original values

	Stages	Varieties	Stages x varieties
S.Em±	1.81	0.71	1.34
CD at 1%	6.17	2.49	5.48

Table 2 : Percent area of infection on fruit at different stages of its development

S. No.	Stage	Chilli varieties			Mean
		Byadgi	Guntur	Paprika	
1.	Green	13.44 (05.42)	11.39 (03.90)	14.77 (06.50)	13.20 (05.20)
2.	Turning from green to red	26.93 (20.50)	27.52 (21.35)	32.55 (28.95)	29.60 (23.50)
3.	Red	23.99 (16.50)	32.30 (28.55)	34.18 (31.35)	30.16 (25.25)
	Mean	21.45 (13.40)	23.74 (16.20)	27.17 (20.85)	

* Figures in parenthesis indicate original percentages

	Stages	Varieties	Stages x varieties
SE m±	1.76	1.71	1.17
CD at 1%	5.76	5.73	4.79

Table 3 : Phenol and Wax content of the chilli fruits at different stages of development

S. No.	Stages of growth	Phenol content mg/ 100g	Wax content mg/100 g
1.	Green	0.18 (0.0006)*	30.56 (25.80)
2.	Turning from green to red	0.090 (0.00025)	25.13 (18.05)
3.	Red	0.030 (0.00007)	23.82 (16.30)
	SE m±	0.01	0.54
	CD at 1%	0.04	2.33

* Figures in parenthesis are original percentages.

(diseased). Both non reducing and reducing sugar percentage decreased in diseased fruits. As a result decrease in total sugar content from healthy to diseased

fruits of Byadgi, Guntur and Paprika was to the extent of 45, 50 and 89 per cent respectively.

Per cent fruit infection and percentage of area infected

Table 4 : Nitrogen and Sugar content in chilli fruits.

S. No.	Chilli varieties	Condition of fruit	Nitrogen (%)	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)
1.	Byadgi	Healthy	0.055	1.10	0.71	1.81
		Infected	0.041	0.83	0.42	1.25
2.	Guntur	Healthy	0.032	1.21	0.62	1.83
		Infected	0.028	0.71	0.51	1.22
3.	Paprika	Healthy	0.040	1.59	0.91	2.50
		Infected	0.021	0.90	0.42	1.32

on fruit were maximum in ripe red stage of the fruit. These were prone to infection when fruits were turning from green to red. Thus the resistance mechanism operated in green chillies can well be explained by the fact that they are containing more phenols and waxes. As the maturity progressed these biochemical constituents are depleted in their concentrations making the fruit susceptible for the pathogen activity. Cutin forms the frame work of cuticular membrane which carries the wax on its surface and embedded within it. (Baker *et al*, 1964). Royle (1976) suggested that there was some evidence that cuticle provided protection against pathogen. The present studies are in agreement with Prakasam and Jeyarajan (1989) who reported that amount of wax is higher in resistant green fruits than in susceptible red fruits. Decrease in phenolic compounds with the maturity of chilli fruits have direct correlation with the severity of disease (Azad, 1991). Resistance to fruit rot in green chillies was earlier reported by Narain and Das 1970.

During the infection and rotting of plant tissues the metabolic changes were found to be different and distinct from those of healthy tissues (Wood and Singh, 1956). In the present studies nitrogen content and the total sugars content (reducing and non reducing) were found to be decreased in diseased fruits than in healthy fruits as a result of disease. This decrease in nitrogen content of chilli fruits as a result of fruit rot was earlier observed by Pillayar Swamy *et al.* (1973) and Azad (1991). Decrease in total sugar content was observed by Narain and Das (1970), Awasthi and Singh (1974) and Azad (1991).

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