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## Isolate variations in *Colletotrichum gloeosporioides* infecting pomegranate

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### ABSTRACT

Eleven pomegranate varieties were tested against six isolates of *Colletotrichum gloeosporioides* under controlled conditions. Inoculated fruits were assessed on the basis of virulence of the isolates and reaction of a particular variety was expressed in Disease Reaction Index (DRI). There was considerable variation in virulence and susceptibility within isolates and varieties. Isolate Cg 86 was found to be virulent (DRI 7.2), Cg 81 as less virulent (DRI 2.87), and other isolates were moderately virulent irrespective of varieties. Fruit varieties Aarakta and Bhagwa were found to be highly susceptible as both displayed maximum mean DRI 10.38 and 8.56, respectively irrespective of isolates. Resistant varieties Yarcud local and Bedana thin skin showed uniform resistant reaction against six isolates of the pathogen. The interaction between isolates x varieties was also statistically significant. Highest DRI (15.22) was recorded in the interaction between Bhagwa x Cg 85 and it was on par with Ganesh x Cg 86, Aarakta x Cg 82, Aarakta x Cg 84, Ruby X Cg 86, Patna 5 X Cg 86 and Patna 5 X Cg 82.

**Keywords:** pomegranate, *Colletotrichum gloeosporioides*, disease reaction index, isolate, varieties

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### Introduction

Pomegranate is extensively cultivated around the Mediterranean and other parts of world including India. It is regarded as the fruit of paradise. India occupies first position in area and production of pomegranate in the world (Melgarejo 2012). Maharashtra ranks first sharing 66.21% production of pomegranate in India having an area of 0.82 lakh ha with production of 492,000 tons (Anonymous 2011). *Colletotrichum gloeosporioides* is responsible to cause localized epidemics in fruit plantations as well as it is the predominant post harvest pathogen of fruits worldwide. In India anthracnose caused by *C. gloeosporioides* is the second most important disease of pomegranate next to bacterial blight commonly re-

ferred as oily spot caused by *Xanthomonas auxonopodis* pv. *punicae*. The severity of anthracnose has also been reported by several workers (Nargund *et al.* 2012; Raghuvanshi *et al.* 2005; Mandhare *et al.* 1996). The average intensity of anthracnose and fruit rot of pomegranate under Rahuri (Maharashtra) conditions during 2006 was worked out to the tune of 20.78%. The disease is more severe in the fruiting stage of *Mrig bahar* cropping season (rainy season fruiting) which leads to post harvest rotting of fruits. Therefore the study was carried out to identify host resistance against the pathogen; fruits of eleven pomegranate varieties were tested against six isolates of *C. gloeosporioides* recovered from endemic area of Maharashtra.

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## Materials and Methods

Fruits showing typical anthracnose symptoms were collected from pomegranate gardens in different parts of the State for getting isolates of *C. gloeosporioides*. Monoconidial cultures of six distinct isolates were subjected to pathogenicity test separately for each isolate. Large, uniform sized healthy fruits of different varieties having uniform maturity were obtained from disease free garden of the University. Fruits were washed and then deposited in 0.1% HgCl<sub>2</sub> for 120 seconds for surface sterilization followed by washing with sterilized water and drying the surface with sterilized blotting paper. Such fruits were inoculated separately by following mycelial bit inoculation method (Rocha *et al.* 1998). Inoculated fruits were kept in the humid chamber for 10 days (28<sup>o</sup>C temperature and 90% RH). Six fruits of each variety were inoculated at three well isolated points. A set of uninoculated fruits of each variety was also maintained for comparison. Intensity of disease was recorded ten days after inoculation. The infectivity of each isolate on different varieties was confirmed upon re-isolation from each fruit inoculated after 10 days. The Disease Reaction Index (DRI) was calculated with following formula.

$$DRI = 3.14 \times A/2 \times L^{-1}$$

where A = Aggressiveness [lesion diam. in mm]

I = Invasion index [Degree of invasion in the fruit (0-4)]

L = Latent period in days [10]

3.14 = Area constant

The data obtained was subjected to statistical analysis by following factorial completely randomized design (FCRD). The varieties and isolates were rated respectively as resistant and avirulent (DRI < 2), moderately resistant and less virulent (DRI 2.1 – 4), moderately susceptible and moderately virulent (DRI 4.1 – 6), susceptible and virulent (DRI 6.1 – 8) and highly susceptible and highly virulent (DRI 8.1 and more).

## Results

Data presented in Table 1 reveals that there was significant difference within isolates with respect to their virulence, pomegranate varieties with respect to their susceptibility and their interactions. Out of six test isolates of *C. gloeosporioides*, isolate 'Cg 86' was found to be virulent (Mean DRI 7.2) irrespective of varieties and was statistically superior over other isolates. Cg 82, Cg 83, and Cg 85 were statistically not differentiated in their average virulence irrespective of varieties and were rated as moderately virulent. Isolate Cg 84 was also on par with Cg 83 and it was also rated as moderately virulent. Cg 81 was the only less virulent isolate with mean DRI of 2.87 (Fig 1).

Pomegranate varieties expressed considerable variation (Fig. 2) in their susceptibility to *C. gloeosporioides* irrespective of isolates (Table 1). The variety Arakta recorded highest mean DRI (10.38) followed by Bhagwa (DRI 8.56). Both these varieties were rated as highly susceptible. Patna-5, Ruby and Mrudula were at par with mean DRI of 7.73, 7.04 and 6.38,

respectively and these varieties were rated as susceptible. Pomegranate variety 'Ganesh' was rated as moderately susceptible with mean DRI of 5.94 while GKVK Jyoti as moderately resistant (DRI 3.05). This study indicated that all leading and accepted varieties of pomegranate are susceptible due to variation in virulence of *C. gloeosporioides* isolates.

It was observed that the interaction between varieties and isolates was statistically significant ( $P \geq 0.05$ ). The highest DRI (15.22) was recorded in the interaction between Bhagwa x Cg 85 and it was on par with Ganesh x Cg 86, Aarakta x Cg 82, Aarakta x Cg 84, Ruby X Cg 86, Patna 5 X Cg 86 and Patna 5 x Cg 82. These were followed by Aarakta x Cg 81 and Bhagwa x Cg 82, Ruby x Cg 85 and Bhagwa x Cg 86. This indicated that different isolates have specific varietal preference.

## Discussion

As the disease is more severe during fruiting at different growth stages right from fruit inception to harvesting and also as a post harvest disease, the varietal susceptibility was investigated on fruits instead of leaves. Jayalakshmi (2010) screened 19 genotypes of pomegranate by detached leaf technique against only one isolate of *C. gloeosporioides* and reported that genotypes viz., Ganesh, Arakta and Kesar (Bhagwa) were susceptible and remaining genotypes were moderately susceptible. The present findings partially agree with this earlier report. Further, Verma *et al.* (1982) reported that variety 'Jel icote local' as susceptible and 'Muscat white' was

highly susceptible to pomegranate fruit rot caused by *C. gloeosporioides*. In present study, variety 'Ganesh' was moderately susceptible and 'GKVK Jyoti' was found to be moderately resistance to anthracnose (c.o. *C. gloeosporioides*). These results were in partial agreement with Bhat (1991) who reported Ganesh variety as more susceptible to fruit rot of pomegranate caused by *C. gloeosporioides* and *Aspergillus niger*. There was significant difference in the interaction between the *C. gloeosporioides* isolates and pomegranate varieties. Similar results in other hosts support our findings. Smith (1990) reported highly significant variable interaction between 15 cultivars of strawberry and 13 isolates of *C. fragari*, two isolates of *C. gloeosporioides* and five of *C. accutatum* isolates. Similar type of significant interaction between *C. gloeosporioides* isolates and custard apple varieties has been recorded (Gaikwad 2002). Abnang *et al.* (2006) while studying the virulence of *C. gloeosporioides* isolates from *D. alata* reported that all cultivars showed resistance to some isolates and no cultivar could be considered as susceptible. However Mackenzie and Legard (2006) studied the interaction between 12 distinct *C. gloeosporioides* isolates and 10 strawberry cultivars and noted difference in disease resistance among cultivars and difference in aggressiveness among isolates but failed to identify interactions between cultivar and isolate.

The 'Bhagwa' is a leading commercial variety of pomegranate in Maharashtra and Karnataka and this variety is coming up in the

newly established orchards. Due to high susceptibility level of this variety to *C. gloeosporioides*, adequate attention must be given for timely management of the disease. Two varieties 'Yarcud local' and 'Bedana' thin skin showed uniform resistance against six isolates of the pathogen. Although, these varieties possess resistance against *C. gloeosporioides*, both varieties are poor in fruit quality with hard arials. However, they can be used as a good genetic material for resistance source in the breeding programme. Further, the bio-chemical contents of the fruit rind of pomegranate varieties may analyzed to understand this resistance response.

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**Table 1.**  
Differences in Disease reaction index of *C. gloeosporioides* isolates from pomegranate as influenced by varieties

<i>C. gloeosporioides</i> Isolates	Pomegranate varieties ( DRI)											Mean DRI
	Ganesh*	Bhagwa*	Aarakta*	Mrudula*	GKVK Jyoti*	Bedana thin skin*	Ruby*	Yarcud Local*	Muscat*	P-23*	Patana - 5*	
Cg 81	1.25	1.2	11.51	6.85	0.93	0.78	1.3	0.78	1.44	0.78	4.81	2.87
Cg 82	3.92	10.46	12.55	8.11	1.88	0.99	6.89	2.14	3.4	1.83	13.49	5.97
Cg 83	5.83	6.69	9.57	5.54	3.19	0.41	9.72	1.14	1.67	6.59	4.71	5.0
Cg 84	8.38	7.84	12.56	6.07	0.88	1.22	0.83	2.24	3.03	1.04	4.29	4.4
Cg 85	3.76	15.22	7.53	5.96	6.01	0.88	10.35	2.82	1.77	2.56	6.07	5.72
Cg 86	12.55	9.94	8.57	5.75	5.44	2.9	13.18	2.14	2.77	3.13	13.02	7.22
Mean	5.94	8.56	10.38	6.38	3.05	1.19	7.04	1.87	2.34	2.65	7.73	5.19
S.E. ± Isolates						0.37	C.D. 1% Isolates					1.16
S.E. ± Varieties						0.50	C.D. 1% Varieties					1.48
S.E. ± Isolates X Varieties						1.23	C.D. 1% Isolates X Varieties					3.71

\* Means of six replications

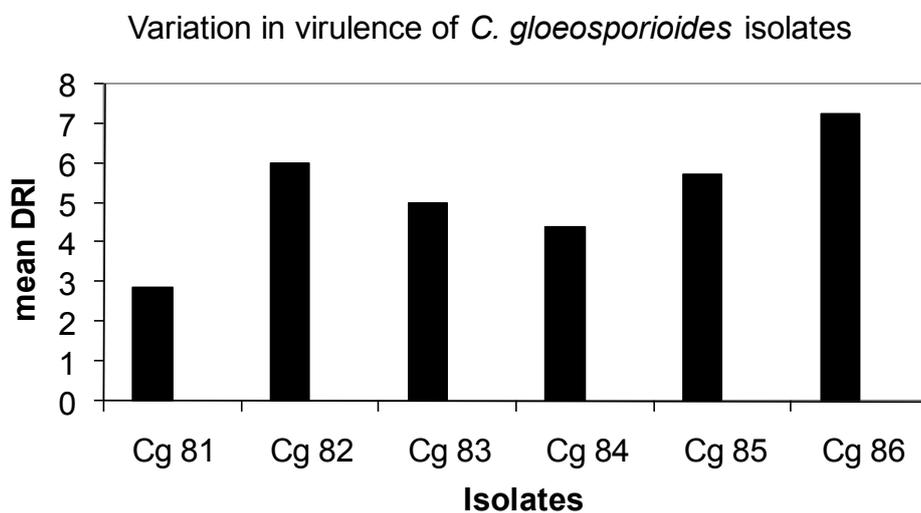


Fig.1. Variation in virulence of *C. gloeosporioides* isolates infecting pomegranate

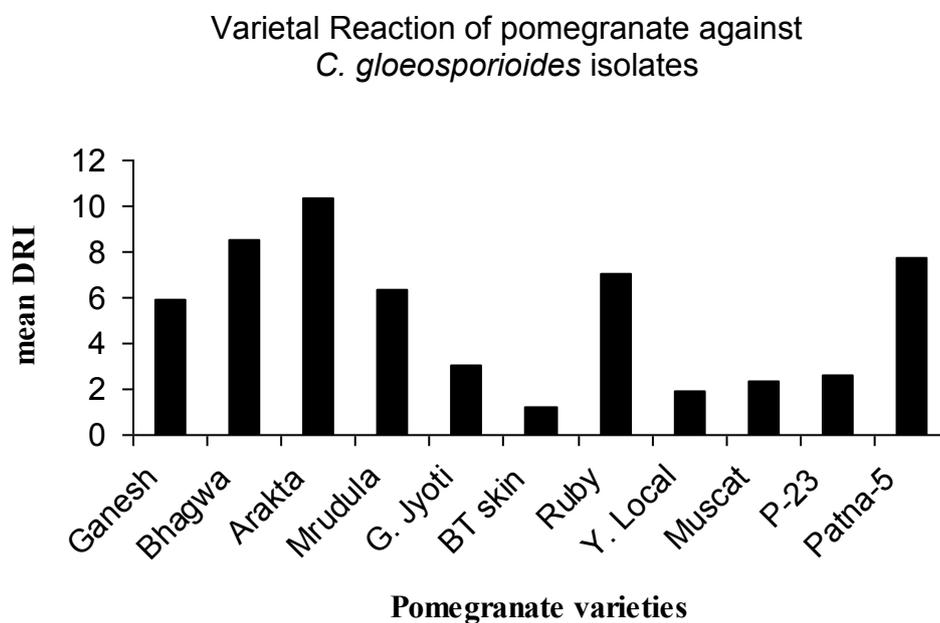


Fig. 2. Variation in varietal susceptibility of pomegranate to *C. gloeosporioides* isolates