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Variation in Virulence and Cross Infectivity Potential of *C. Gloeosporioides* Isolates Infecting Tropical Fruits

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ABSTRACT

Fruits of six different types *viz.* mango, pomegranate, mandarin, sweet orange, guava and custard apple were inoculated with 30 isolates of *Colletotrichum gloeosporioides* penz. Obtained from seven fruit hosts grown in four agro ecological zones of Maharashtra by following mycelial bit inoculation method by adopting FCRD analysis. Out of 126 possible interactions, 84 interactions exhibited compatible reactions with significant variation in virulence index and preference of host (fruit). Only one isolate Cg 68 (from mango) could able to infect all the six fruit types but with variable intensity and this isolate was identified as non- host specific. It was followed by Cg 71 from guava fruit which infected all fruit types except mango. Remaining isolates infected at least two fruit types. However, none of the isolates was found to be host specific. Twenty one isolates under study showed less specificity towards pomegranate and mango as compared to other fruit hosts. Isolate Cg 71 from guava recorded maximum mean disease reaction index of 6.76 irrespective of the hosts. Isolates Cg 64 and Cg 68 which were derived from mango were statistically un differentiable with respect to their mean disease reaction index. Isolates Cg 11, Cg 21 and Cg 61 from areca nut cashew, and mango respectively expressed very low degree of virulence and were rated as a virulent. Mandarin and mango were found to be more susceptible than other fruit hosts and were statistically on par. It was followed by pomegranate and sweet orange. This indicated that mango and mandarin fruits are more susceptible to post harvest fruit rot caused by *C. gloeosporioides.* Isolate Cg 82 which was basically obtained from pomegranate, showed greater infectivity on mango fruits than pomegranate.

Keywords: *Colletotrichum gloeosporioides*, Isolates, Disease reaction index, virulent, Infectivity.

INTRODUCTION

Colletotrichum capsici, *C. dematium*, *C. gloeosporioides* and *C. graminicola* are more common on many economically important crops in India (Mathur, 1979). Many tropical and

sub tropical fruit crops are the predominant hosts of *C. gloeosporioides* and are regularly damaged by the pathogen in one or the other stage of crop development. The ability of the fungus to cause quiescent infection made it as a more specialized and important post harvest pathogen of different tropical and subtropical fruits. Fruit crops have registered dramatic increase in acreage from 2.42 lakh ha to 13.66 lakh ha by the end of 2000 in Maharashtra (Anonymous, 2006). This includes mango, cashew nut, banana, grape, pomegranate, *Citrus* spp., guava custard apple and some minor fruits. The orchards of these crops are in close proximity and some of the fruit crops are even inter cultivated. Therefore, there is obvious chance of spread of inoculum from one host species to other. It has been reported that there is difference in virulence of *C. gloeosporioides* isolates when they are inoculated on some other host. (Freeman and Shaby, 1996; Quimio and Quimio, 1975). Freeman *et al*., (1998) have emphasized upon the investigations in complexity related to host range and specificity in the genus *Colletotrichum* for each host for every given location. This study was therefore undertaken to identify and quantify the cross infectivity potential of the *C. gloeosporioides* on different fruits which are regularly damaged by the pathogen in Maharashtra.

MATERIALS AND METHODS

Isolates of *C. gloeosporioides* were obtained from different fruit hosts *viz.* mango, pomegranate, custard apple, guava, cashew nut, arecanut and jamun cultivated in different agro ecological zones of Maharashtra. The pure colony obtained from mono conidial culture of each isolate was used for further study. The pathogenicity of all these isolates was confirmed on the same host on the respective plant part from where it was isolated.

Large, uniform sized healthy fruits of mango, pomegranate, sweet orange, Nagpur mandarin, guava and custard apple having uniform maturity were obtained as per their seasonal availability from disease free garden of the University. Fruits were washed and then deposited in 0.1% $HgCl_2$ for 60-120 sec. for surface sterilization followed by washing them thoroughly with sterilized water and drying the surface with sterilized blotting paper. Such fruits were inoculated separately by following mycelial bit inoculation method (Swart, 1999). Every time controlled and uniform conditions (28^0C temperature and 90 per cent RH). were maintained during incubation (10 days). Six fruits of each variety were inoculated at three well isolated points. The infectivity of each isolate on different hosts was confirmed upon re isolation from each fruit inoculated after 10 days. Intensity of disease was recorded ten days after inoculation. The interaction of virulence index of isolates and host susceptibility was collectively referred as disease reaction (DRI) and was quantified with the formula derived by giving due consideration to the lateral and vertical development of the lesion on fruit.

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

Where:

A = Aggressiveness [lesion diameter 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 isolates were rated as a virulent (DRI < 2), less virulent (DRI 2.1 – 4), moderately virulent (DRI 4.1 – 6), virulent (DRI 6.1 – 8) and highly virulent (DRI 8.1 and more).

RESULTS AND DISCUSSION

Isolate Infectivity Potential

The perusal of the Table 1 revealed *C. gloeosporioides* isolates varied significantly in their infectivity irrespective of hosts. Isolate Cg 71 from guava recorded maximum mean virulence index of 6.76 and it infected all the fruit hosts except mango with varied infectivity. Isolates Cg 64 and Cg 68 (both from mango) were on par with mean virulence index of 6.03 and 6.12 respectively. Although, Cg 68 infected all the six fruit types tested, Cg 64 could not able to initiate infection on sweet orange fruits. These three isolate were referred as virulent isolates. It was followed by Cg 65 from mango with mean DRI 4.6 and infected five out of six hosts inoculated (except sweet orange) and rated as moderately virulent. Wahid (2001) reported that five isolates of *C. Gloeosporioides* from guava showed different pathogenic potentialities towards the four tested fruit types. This supports the current findings. It was further stated that the pathogen successfully invaded mango, pear and apple fruits. However, in present study single guava isolate failed to infect mango fruits upon repeated inoculations. This difference may be due to strain variation in the isolate.

Table 1: Variation in virulence index of *C. gloeosporioides* isolates and its cross infectivity potential on different fruits

Isolates	Host	Mango*	Pomegranate*	Mandarin*	S. orange*	Guava*	C. apple*	Mean
Cg 11	Areca nut	5.65	3.61	0	0	0	0	1.54
Cg 21	Cashew nut	5.18	3.3	0	0	0	0	1.41
Cg 31	C. apple	4.71	0	3.3	0	0	6.59	2.43
Cg 32	C. apple	4.95	2.2	2.35	1.96	0	6.59	3.01
Cg 33	C. apple	0	0.47	3.14	2.83	3.3	12.08	3.63
Cg 61	Mango	2.12	0.31	0	0	0	0	0.4
Cg 62	Mango	4.4	2.75	4.71	2.36	0	0	2.37
Cg 63	Mango	4.32	4.4	4.08	0	3.3	0	2.68
Cg 64	Mango	12.6	0.86	8.79	7.7	6.26	0	6.03
Cg 65	Mango	7.69	3.62	6.28	0	2.67	7.37	4.6
Cg 66	Mango	7.22	0.63	2.59	0	3.45	5.8	3.28
Cg 67	Mango	7.22	3.93	0	4.24	0	3.14	3.09
Cg 68	Mango	12.95	4.22	7.06	5.81	3.85	2.82	6.12
Cg 71	Guava	0	2.83	6.28	10.6	14.6	6.28	6.76
Cg 81	Pomegranate	4.04	4.71	4.39	0	5.5	0	3.1
Cg 82	Pomegranate	9.89	7.3	1.88	0	2.04	2.35	3.91
Cg 83	Pomegranate	2.35	3.93	2.51	0	0	4.22	2.17
Cg 84	Pomegranate	0	10.99	6.28	0	1.73	0	3.17
Cg 85	Pomegranate	7.53	9.89	2.67	3.53	0	0	3.94
Cg 86	Pomegranate	4.71	12.09	1.73	0	0	4.08	3.77
Cg 91	Jamun	2.35	3.84	0	6.67	0	0	2.14
Mean		4.4	3.56	4.34	3.58	2.24	3.02	3.52

Sources	±S. E.M	C.D. at 1%
Isolates	0.18	0.67
Hosts	0.08	0.3
Isolates X Hosts	0.45	1.63

* Mean of six replications

Isolates with mean DRI ranging between 2.1 – 4 were grouped as less virulent isolates. This includes all isolates from custard apple (Cg 31 Cg 32 and Cg 33), Cg 62 Cg 63 Cg 66 and Cg 67 from mango, all isolates from pomegranate (Cg 81, Cg 82, Cg 83, Cg 84, Cg 85 and Cg 86) and Cg 91 from jamun. The isolates having extremely low virulence include Cg

11, Cg 21 and Cg 61. It is concluded that most of the isolates of *C. gloeosporioides* infected other fruit hosts with reduced virulence. These results are supported by the findings of Abnang *et al.,* (2006) during study of cross infectivity of *C. gloeosporioides* isolates from yam on other hosts. Moderate symptoms were observed upon inoculation of papaya, avocado and mango fruits. Yam isolates failed to infect citrus and the citrus isolate did not infected yam. Mango isolates caused mostly moderate disease reactions on yam and avocado. Similar trend in variation in the cross infectivity was also reported earlier by Xiao *et al.,* (2004) during study of cross infectivity of *C. gloeosporioides* on strawberry.

Variation in the Host Susceptibility

Out of six fruit types, orange and mango were found to be more susceptible than other fruit types and both were on par with respect to disease reaction index. These were followed by pomegranate and sweet orange (mean DRI 3.56 and 3.32, respectively) and were statistically un differentiable. Guava and custard apple were found to be less susceptible as compared to mango, orange, pomegranate and sweet orange in cross inoculation test. Twenty one isolates under study showed less specificity towards pomegranate and mango as compared to other fruit hosts.

Twenty isolates (except Cg 31) could able to infect pomegranate with varied virulence. Similarly, 18 isolates (except Cg 33, Cg 71 and Cg 84) could able to infect mango with varied intensity. All Pomegranate and custard apple isolates and six mango isolates infected mandarin while maximum twelve isolates failed to infect sweet orange. Isolates Cg 71 from guava and Cg 91 from jam uninfected sweet orange fruits with higher virulence.

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The interaction between Cg 71 and guava fruits yielded the maximum DRI of 14.60 followed by Cg 68 and Cg 86 from mango and pomegranate respectively. These later two interactions were on par with each other. Out of 126 possible interactions 42 interactions were statistically incompatible. Swart (1999) while summarizing the infectivity of mango and avocado isolates stated that isolates were able to produce symptoms on their original host but not always on others.

When twenty one isolates of *C. gloeosporioides* from seven hosts were inoculated on six different fruit hosts it was observed that there was maximum diversity with respect to host preference and the degree of infection to a particular fruit type. Cg 68 from mango could able to infect all the fruit hosts inoculated but with varied degree of infectivity. This isolates can be considered as non host specific isolates. Remaining isolates could able to infect two or more fruit types and therefore, referred as less host specific. However, none of the isolates was found to be host specific. These findings are in agreement with Freeman *et al.,* (1998) studied the cross inoculation of *C. gloeosporioides* and *C. acutatum*on different tropical and temperate fruits. *C. gloeosporioides* isolates from almond, apple, avocado and mango and *C.*

acutatum isolates from anemone, apple and peach developed infection on detached fruits of apple, avocado and mango in all possible combinations indicating non host specificity in both the species.

CONCLUSION

In general isolates expressed higher virulence on their original hosts from where they were isolated. Similar trend in infectivity of *C. gloeosporioides* in relation to host is earlier reported by Hayden *et al*. (1994). However, two isolates expressed greater virulence on other fruit hosts than their original host. Isolate Cg 82which was basically obtained from pomegranate, showed greater infectivity on mango fruits than pomegranate. It infected the pomegranate with 7.30 DRI while the same isolate infected mango with 9.89 DRI. Cg 62 from mango infected mandarin with slight higher infectivity (DRI 4.71) than mango (DRI 4.4).

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