

Original Research Article

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Host Range and Cross Infectivity of the Genus *Magnaporthe grisea*

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ABSTRACT

Keywords

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Blast (*Magnaporthe grisea*) is an economically important disease of finger millet in India. The cross infectivity of *M. grisea* isolates of leaf, neck and finger blast from finger millet can infect weed host viz., *Pennisetum cenchroides*, *Pennisetum pureum* and *Cynodon dactylon* but not the rice, foxtail millet and little millet. The *vice versa* pattern of cross infection were observed between the leaf, neck and finger blast pathogens. This shows that the weed management is more important in finger millet fields to manage the blast disease and growing of finger millet adjacent to weed host is dangerous for blast epidemics in finger millet since weed host viz., *P. cenchroides*, *P. pureum* and *C. dactylon* serves as the source of inoculums.

Introduction

Blast disease caused by *Magnaporthe grisea* is an economically important disease of finger millet which causes significant losses in yield. Various weed hosts growing near cultivated plants might serve as potential sources of inoculums for the disease and thus provide alternate means of survival for the fungus. Since collateral and alternate hosts are the most important sources of inoculums which are present throughout the year. Study of the host range has become an important aspect of the disease management. Finger millet blast caused by *Magnaporthe grisea* (Hebert) Barr. (anamorph *Pyricularia grisea* (Cooke) Sacc. is a heterothallic, filamentous fungus, one of

the major destructive disease causing excessive damage to this crop from seedling to ear head forming stages.

The disease occurs during all growing seasons and on almost all finger millet varieties cultivated. *M. grisea* parasitizes over 50 grasses, including economically important crops like wheat, rice, barley and millet (Ou, 1985). Yield loss due to blast can be as high as 50% when the disease occurs in epidemic proportions. The fungus appears to overwinter as mycelia in the infected living leaves or dead plant debris in the soil (Uddin, 2000). Thomas (1941) reported that the blast disease on finger millet caused by *M. grisea* fails to infect the rice and ginger but does infect the wheat,

barley and oats. He also found that strains from rice and *Panicum repens* would infect only its own host and the strains from finger millet and *Setaria italica* were capable of infecting wounded leaves of each other but would not infect rice or *P. repens*. Todman *et al.*, (1994) reported that *Magnaporthe* isolates from *E. coracana* failed to infect rice and *vice versa*. Similar results were reported by Viji *et al.*, (2000) stated that ten isolates of *M. grisea* from rice did not infect the finger millet and *vice versa* under laboratory conditions. This research aimed at estimating the possibility of the genotype alteration in *P. grisea* dc4 isolated from *Digitaria ciliaris*, following cross infection to either rice cv. *Kencana bali*, Cisokan and IR64 or *Panicum repens*, *Cynodon dactylon*, *Digitaria* sp. and *Ottochloa nodosa*. Khadka *et al.*, (2012) showed that the *M. grisea* isolates from rice were able to infect all the plant species *viz.*, rice, finger millet, *Panicum* sp., *E. indica* and *Setaria* sp. while isolates from finger millet were only able to infect three plant species *viz.*, *E. coracana*, *Setaria* sp. and *E. indica*.

Materials and Methods

Collection and isolation of pathogen

In major finger millets growing regions of Tamil Nadu and from the All India Coordinated Small Millet Improvement Project (AICSMIP) centers, the blast infected finger millet plant parts *viz.*, leaf or neck or finger blast infected samples were taken at the time of survey. The collected samples were air dried, separately bagged and stored under refrigerated condition at 4°C for the isolation of the pathogen. The pathogen (*M. grisea*) of different samples collected during survey was isolated by using the standard tissue isolation method (Tuite, 1969). Blast infected plant tissues were cut into small pieces and washed in sterile water twice and surface sterilized with 0.1 per cent mercuric chloride solution

for 30 sec. followed by rinsing in sterilized water twice and transferred to plates containing Oat Meal Agar Medium (OMA). After 4 days for obtaining monoconidial isolate, a dilute spore suspension was prepared in sterilized distilled water and plated onto 0.8% water agar in Petri plates. After 15 days of incubation at 26 ± 1 °C, single germinating conidium was marked under a microscope and transferred to fresh Petri dish containing OMA medium and then the plates were incubated at 26 ± 1 °C for 10 days to get monoconidial isolates (Ou, 1985).

Cross-infectivity test

For cross infectivity test the pathogen from finger millet to foxtail millet (*Setaria italica*), little millet (*Panicum sumatrense*), pearl millet (*Pennisetum glaucum*), rice (*Orizea sataiva*), kollukattai grass (*Pennisetum cenchroides*), elephant grass (*Pennisetum pureum*), dub grass (*Cynodon dactylon*) and *vice versa* were tested. Seeds of finger millet (KM 252), foxtail millet var, little millet var, pearl millet var and rice (IR 50) were sown in earthen pots containing potting medium (Red soil- sand-FYM at 2:1:1).

The weeds species were collected from field as a clump collected from disease free area in the vicinity of the crop. The pure culture of the blast pathogen from finger millet, foxtail millet, little millet, pearl millet, rice, *P. cenchroides*, *P. pureum* and *C. dactylon*, were isolated and pathogenicity for respective host was confirmed. The cross inoculation from finger millet pathogen to rice and other weeds were done by spraying with the spore suspension from finger millet to other hosts and *vice versa*. All the inoculated seedlings were kept in glass house at 23 ± 1 °C with more than 95 per cent RH and leaf wetness for 12 hr photoperiod for 10 days. Observation for the presence or absence of disease symptoms was made after 10 days.

Cross infectivity of leaf blast, neck blast and finger blast within the finger millet

Leaf blast isolates inoculation

The experiment was carried out in glass house using 30 cm in diameter earthen pots containing ten seedlings to each pot as described earlier by injecting of spore suspension of 1×10^5 per ml^{-1} in the top most leaf sheath and observed for symptom appearance by keeping the inoculated pots at 23°C with more than 95% RH and leaf wetness for 12 h photoperiod for 10 days. Three replicates with control were maintained. The observation on presence of neck and finger blast infection was recorded.

Neck and finger blast inoculation

The isolates of neck and finger blast were inoculated to 15 days old finger millet seedlings separately and labeled by spraying the spore suspension containing 1×10^5 conidia per ml with 1 ml of teepol. Three replicates with control were maintained. The observation was made for the presence or absence of leaf blast infection.

Result and Discussion

Testing the cross infectivity of *M. grisea* blast pathogen from different hosts

For cross infectivity test the isolates of *M. grisea* from finger millet was inoculated to other minor millets viz., *P. sumatrense*, *P. glaucum* and *S. italica*, rice (IR50) and other weed crops viz., *P. cenchroides*, *P. pureum* and *C. dactylon*, and vice versa to find out the host range. The results revealed that the isolates of *M. grisea* from finger millet can infect only weed host viz., *P. cenchroides*, *P. pureum* and *C. dactylon* but not the other minor millets viz., *P. sumatrense*, *P. glaucum* and *S. italica* including rice and vice versa. The cross infectivity test from finger millet

leaf blast to infect the neck and finger revealed that the isolates of the leaf blast can cause neck and finger blast infection and the isolates of neck and finger blast can cause leaf infection (Table 1, Plate 1). The results of the present study was in agreement with the work of various workers viz., Ramakrishnan (1948), Kato *et al.*, (1977) and Todman *et al.*, (1994). Todman *et al.*, (1994) reported that the pathogenicity of the blast fungus is largely restricted to its host species of origin, although successful infection of a host by an isolate from a different species has been reported under experimental conditions. Similar results were also obtained by Viji *et al.*, (2000) who found that *M. grisea* isolates from *E. coracana* failed to infect rice and vice versa. Cross inoculation tests carried out with *M. grisea* isolates from *Eleusine* and *Oryza sativa* show that the isolates are host-specific. This result agrees with those of Kato *et al.*, (1977) and Todman *et al.*, (1994), who also found that *Magnaporthe* isolates from *E. coracana* failed to infect rice and vice versa. Kumar and Singh (1995) have reported contradictory results regarding the ability of the pathogens from rice and finger millet to cross-infect. The reasons for this variation appear to be the environmental conditions provided during experimentation in addition to the nutritional status of soil (Ou, 1985). Khadka *et al.*, (2012) showed that the *M. grisea* isolates from rice were able to infect all the plant species viz., rice, finger millet, *Panicum* sp., *Eleusine indica* and *Setaria* sp. while isolates from finger millet were only able to infect three plant species viz., *E. coracana*, *Setaria* sp. and *E. indica*. In the present study also the cross infectivity was observed within the plant, this was agreed with the earlier work of Smita Puri and Kumar (2012) found that leaf, finger and neck derived *M. grisea* isolates had the ability to cross infect all the three plant parts of *Eleusine coracana* and could not be separately categorized on their pathogenicity on leaf, neck and panicles.

Table.1 Cross infectivity of finger millet blast pathogen with different hosts

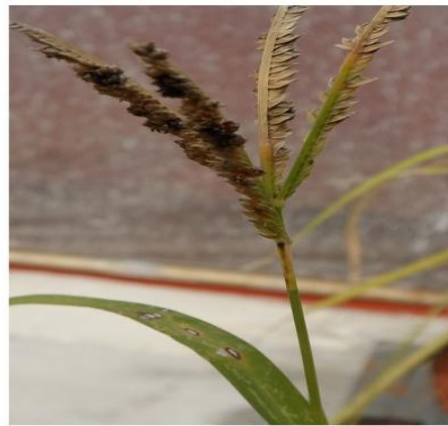
Millets				Rice (IR 50)			Weeds			
<i>Eleusine coracana</i> Finger millet (KM252)				<i>Panicum sumatrense</i> (Little millet)	<i>Pennisetum glaucum</i> (Pearl millet)	<i>Setaria italic</i> (Foxtail millet)	<i>Oryza sativa</i>	<i>Pennisetum cenchroides</i> (Kollukattai grass)	<i>Pennisetum pureum</i> (Elephant grass)	<i>Cynodon dactylon</i> (Dub grass)
	Leaf	Finger	Neck	Leaf	Leaf	Leaf	Leaf	Leaf	Leaf	Leaf
Leaf blast	+	+	+	-	-	-	-	+	+	+
Neck blast	+	+	+	-	-	-	-	+	+	+
Finger blast	+	+	+	-	-	-	-	+	+	+

(+) – Positive; (-) – Negative

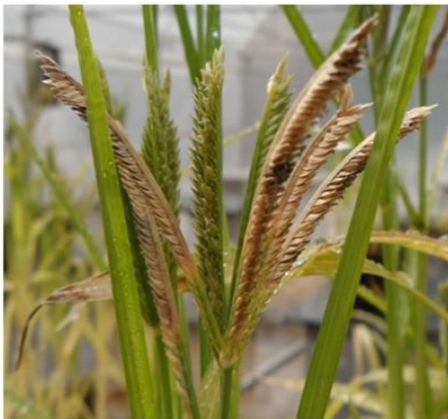
Plate.1 Cross infectivity of leaf, neck and finger blast pathogen from finger millet



Neck and Finger isolates express symptom on Leaves



Leaf and Finger isolates express symptom on Neck



Leaf and Neck isolates express symptom on Finger

But differing with Silva *et al.*, (2009) who observed low frequency of 15 rare pathotype among panicle blast isolates of rice cv. Bonaca that was not present in the leaf and which may have occurred due to change in the pathotype pattern at adult plant stage before heading and resulted into differential pathogenic behavior.

References

- Kato, H., Yamaguchi, T. and Nishihara, N. 1977. Seed transmission, pathogenicity and control of ragi blast fungus and susceptibility of ragi to *Pyricularia* spp. from grasses, cereals and mioga. *Ann. Phytopath. Soc. Japan*, 43(4): 392-401.
- Khadka, R.B., Shrestha, S.M., Manandhar, H.K. and Gopal, B.K.C. 2012. Study on differential response of *Pyricularia grisea* isolates from rice, finger millet and *Panicum* sp. with local and alien media and their host range. *NJST.*, 13(2): 7-14.
- Kumar, A. and Singh, R.A. 1995. Differential response of *Pyricularia grisea* isolates from rice, finger millet and pearl millet to media, temperature, pH and light. *Indian J. Mycol. Plant Pathol.*, 25(3): 238-242.
- Ou, S. H. 1985. *Rice Diseases*. Commonwealth Mycological Institute, Kew, Surrey, England.
- Ramakrishnan, C.V. 1948. Studies on the morphology, physiology and parasitism of the genus *Pyricularia* in Madras. *Rev. App. Mycol.*, 46: 668.
- Silva, G.B., Prabhu, A.S., Filippi, M.C.C., Trindade, M.G., Araujo, L.G. and Zambolim, L. 2009. Genetic and phenotypic diversity of *Magnaporthe oryzae* from leaves and panicles of rice in commercial fields in the state of Goias, Brazil. *Trop. Plant Pathol.*, 34: 71-76.
- Smita Puri and Kumar, J. 2012. Characterization of leaf, neck and finger blast pathogen populations from *Elusine coracana* and elucidating their interrelationships in *Elusine-Magnaporthe* pathosystem. *Indian Phytopath.*, 65(2): 133-141.
- Thomas, K.M. 1941. Detailed. Adm. Rep. Govt. *Mycol.*, Madras, 1940-41.
- Todman, A.K., Pawar, D.R. and Joshi, M.H. 1994. Host reactions to finger millet blast (*Pyricularia grisea* Sacc.). *Mysore J. Agr. Sci.*, 28: 45-46.
- Tuite, J. 1969. Plant pathological methods, fungi and bacteria. Burges Publishing Company, USA, p. 239.
- Uddin, W. 2000. Gray leaf spot comes on strong. [Online] available: [http://groundsmag. Com/ar/grounds_maintenance_gray_leaf_spot/](http://groundsmag.Com/ar/grounds_maintenance_gray_leaf_spot/) (09 Oct. 2008).
- Viji, G., Gnanamanickam, S.S. and Levy, M. 2000. DNA polymorphism of isolates of *Magnaporthe grisea* from India that is pathogenic to finger millet and rice. *Mycol. Res.*, 104: 161-167.

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