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Research Article

Perpetuation of rice blast pathogen (*Magnaporthe grisea*) under temperate conditions of Kashmir, India

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Abstract: Investigations were carried out during the months of October to March on various common specimens viz, paddy straw, stubbles, weed straw, soil, rice residue (husk), seeds and undecomposed organic material to ascertain the perpetuation of blast pathogen (*M. grisea*) under temperate conditions. The results indicate that in all the samples collected, highest frequency (14.15%) of blast pathogen (*M. grisea*) was recorded in the month of October. However, month of March showed least occurrence (2.50%). Among collected samples, maximum perpetuation of blast pathogen (*M. grisea*) was exhibited by stubbles (14.35%) followed by paddy straw (12.37%) and the minimum were exhibited in undecomposed material (1.60%), followed by weed straw (3.40%) and soil (5.8%). It was concluded that these studied components are the possible sources of perpetuation for rice blast pathogen.

Keywords: *Magnaporthe grisea*, Perpetuation, Rice Blast, Temperate

Introduction

The cereals contribute tremendous and stupendous role in daily food requirement of the world. Among the cereals, rice (*Oryza sativa*) is an important food crop and it is the staple diet of over three billion people around the world, particularly in Asia (Abdull *et al.,* 2006; Skamnioti and Gurr 2009; Hosseyni Moghaddam and Soltani, 2013). In India, the productivity is less than those in agriculturally advanced countries because of poor agronomic practices followed in many remote areas and partially because a huge amount of crop being damaged by abiotic and biotic stresses (Garret, 1965). A major constrain in profitable rice production is the occurrence of the certain fungal diseases and paddy blast is one of the most important disease of rice worldwide. Paddy blast is generally considered as the principal disease of rice and is caused by a fungus belonging to the Ascomycete, *Pyricularia grisea* Sacc. (= *Pyricularia oryzae* Cavara (= teleomorph *Magnaporthe grisea* (Hebert) Barr Comb nov.) (Bussaban, *et al.* 2005). *M. grisea* has received considerable attention as the causal agent of rice blast disease (Dean R *et al.* 2012), which leads to 10−30 % loss per year (Talbot *et al.,* 2003). Total destruction of the crop over large areas has been reported from Jammu and Kashmir (Padmanabhan, 1963). This disease is one of the most widely distributed plant diseases. The Commonwealth Mycological Institute has recorded some 85 countries throughout the world that have reported its presence (CMI Distribution Maps of Plant Diseases, 51, ed.6, 1981). In India, the disease was first recorded in 1913 and a devastating epidemic occurred in 1919 in Tanjore delta area of Tamil Nadu (Padmanabhan, 1965b). It is mainly a foliar disease but it occurs in seedlings as the pathogen perpetuates through seeds and become epidemic from the primary source of seed under temperate conditions (Ali and Bhat 2003). *Magnaporthe grisea* infects the aerial parts of the rice plant including leaves, nodes, stems and panicles – at all stages of development (Wilson and Talbot 2009). In temperate regions were rice is not cultivated for several months each year, little is known about the initial onset of the disease in the field. The main overwintering and primary inoculum sources reported are infested residues and seeds, but the subsequent steps of disease cycle are largely unknown, even though a systemic infection has been proposed but not demonstrated (O. Faivre-Rampant *et al.,* 2013). Overwintering of mycelium and conidia on straw has been proposed, but these inocula do not survive under moist conditions (Ou, 1985). The ultimate aim of this research work is to ascertain the study of mode of perpetuation and possible sources of primary inoculum of rice blast pathogen under temperate conditions of Kashmir.

Materials and Methods

Paddy crop is being cultivated during April to September in Kharif season in Kashmir valley, where ambient and conducive atmosphere is prevalent for outbreak of the disease. After harvesting the crop, temperature and humidity descends and reaches for snowfall in the months of January to March every year, therefore pathogen needs over wintering. During the post- harvest of

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the crop in the months of October to March, the specimens of paddy straw, stubbles, weed straw, soil, rice residues (husk), seeds and undecomposed organic material from the farmer's field were collected and brought to the laboratory for processing and then ascertained the perpetuation of blast pathogen *(M.grisea*) on different and common components during the chilly months which carries to the next season of the crop. In order to break the possible dormancy of the pathogen and to get the fungus sporulated, the collected specimens were first incubated under humid and medium temperature (28± 2^0 C) for a period of 5-7 days. The bits of the specimens were then put on oat meal agar (OMA) medium in 90mm petriplates with 20 replications of each sample and incubated for 7 days at (28± 2^0 C). The fungal colonies of *M.grisea* were counted and its frequency calculated. From the composite samples, 1 gm of soil was taken and with the help of spatula spread over the oat meal agar medium already contained in 90mm petriplates with 20 replications and rotated to spread uniformly. Thus the colonies of *M.grisea* were counted and its frequency calculated.

Results and Discussion

The frequency percentage of blast fungus (*M. grisea*) was observed during the months from October-March. The data annexed in **Table 1, Figure 1(a, b)** revealed that the month of October was found to be the most suitable season for the highest frequency (14.15%) of blast pathogen *M. grisea* in all the samples collected which declined with the onset of winter in all the specimens. The minimum survival of pathogen was found in the months of January to March. Moreover, the month of March showed least occurrence (2.50%) because of the sub-zero temperature prevalent. It may be due to the fact that the fungus of blast disease is one of the most sensitive plant pathogens to temperature changes. (Singh, 1997). Similar trend was reported by (Padmanabhan, 1974) who reported that the survival of the pathogen through summer is most probably through an ascomycetous stage, with the ascospore discharge taking place under conditions favorable to infection just after the cessation of the monsoon. Similar observations and data by (Harmon *et al.*, 2005) suggest that when winter temperatures are low, disease outbreaks are less common the following summer and are consistent with the hypothesis that pathogen populations reduced by low winter temperatures, limit disease development in north central Indiana. Among the collected samples, stubbles exhibited maximum perpetuation in the form of (14.35%) frequency survival of blast pathogen *M. grisea* followed by Paddy straw (12.37%), seeds (7.70%) and rice husk (6.27%), while, the minimum was recorded in undecomposed material (1.60%) followed by weed straw (3.40%) and soil (5.08%).These findings are also in line with (Trimurthy and Devadath,1984) who have implicated infested rice seed, rice straw and rice residue as important overwintering sources of primary inoculum, although their impact on initial disease development and the spatial distribution of rice blast is not fully understood. (Suzuki, 1930) have also attributed that the fungus may be found within the embryo, endosperm and glumes of the seed and sometimes between the glumes and the kernel. Several other workers reported that the frequency of infection per transmission from seed to seedling was gradually low; however, seedling infection was greater when seeds were not covered with soil. (Long *et al.*, 2001) showed that *M.grisea* could sporulate for several weeks on inoculated seeds, previously autoclaved when placed on the soil surface and could initiate epidemics in the field. The results therefore indicate that the seed, crop residue and secondary hosts are the possible sources of *M. grisea* primary inoculum and the fungus survives on harvested seeds and several other components until the next growing season.

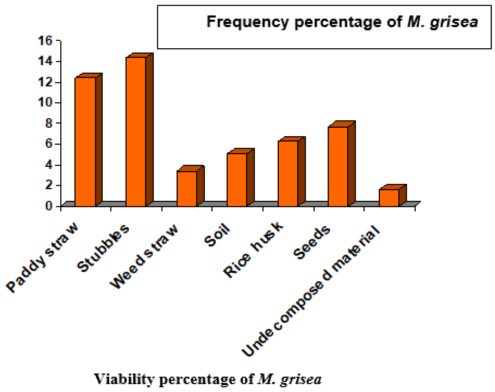

Figure.1 (a): Perpetuation of blast pathogen, *M. grisea* from different components.

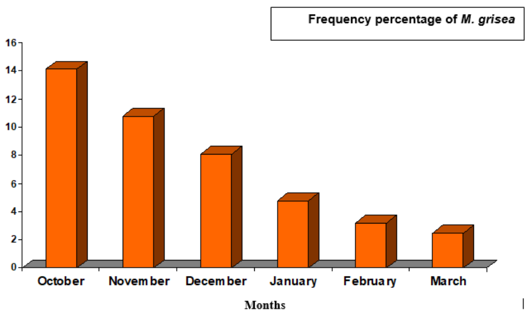

Figure.1 (b): Perpetuation of blast pathogen, *M. grisea* from October to March.

Table 1. Perpetuation of blast Pathogen, *Magnaporthe grisea* under temperate conditions of Kashmir.

S. No	Perpetuated on	Frequency percentage of *Magnaporthe grisea*						
		October	November	December	January	February	March	Average
1	Paddy straw	27.0	20.0	13.0	7.2	4.0	3.0	12.37
2	Stubbles	29.0	23.0	17.0	8.0	5.0	4.1	14.35
3	Weed straw	8.0	6.0	4.2	2.2	0.0	0.0	3.40
4	Soil	10.0	7.0	5.0	3.0	3.0	2.5	5.08
5	Rice husk	10.0	8.5	7.0	5.0	4.1	3.0	6.27
6	Seeds	12.0	9.0	8.7	6.8	5.4	4.3	7.7
7	Undecomposed material	3.0	2.0	1.9	1.2	0.8	0.5	1.60
	Mean	14.15	10.80	8.11	4.80	3.20	2.50	------

References

1. Abdullah AB, Ito S and Adhana K. "Estimate of rice consumption in Asian countries and the world towards 2050." In proceedings for workshop and conference on rice in the world at stake 2 Chiang Mai. (2006): 28 -43.
2. Anwar A and Bhat MS. "National seminar on recent advances in plant science research." (2003): 12-14 Oct. University of Kashmir.
3. Bussaban B, Lumyong S. Lumyong P. Seelanan T, Park D and Mckenzie *et al.*, "Molecular and morphological characterization of *Pyricularia* and allies genera." *Mycologia* 97 (2005): 1002-1011. http://dx.doi : 10.3852/mycologia.97.5.1002.
4. Dean R, Van K, Pretorius ZA, Hammond Kosack KE, Di Pietro A and Spanu PD *et al.*, "The top 10 fungal pathogens." *Mol plant pathol* 13 (2012): 414-430.
5. Garrett SD. "Towards biological control of soil borne plant pathogens." p. 4-17. In: Ecology of soil borne pathogens, 1965, (Eds. K.F. Buker and W.C. Syndes) California Univ. Press, Barkley, Los Angeles.
6. Harmon PF and Latin R. "Winter survival of the perennial ryegrass pathogen *Magnaporthe oryzae* in North Central Indiana." *Plant Disease* 89 (2005): 412-418.
7. Hosseyni−Moghaddam M and Soltani J. "An investigation on the effects of photoperiod, aging and culture media on vegetative growth and sporulation of rice blast pathogen *Pyricularia oryzae.*" *Prog Biol Sci* 3 (2013): 135−143.
8. Long DH, Correll JC, Lee FN and TeBeest DO. "Rice blast epidemics initiated by infested rice grain on the soil surface." *Plant Disease* 85 (2001): 612-6.
9. Manandhar HK, Jorgensen HJL, Smedegaard Petersen V and Mathur SB. "Seed borne infection of rice by *Pyricularia oryzae* and its transmission to seedlings." *Plant Disease* 82 (1998): 1093-1099.
10. O. Faivre-Rampant, Genies L, Piffanelli P and Tharreau D. "Transmission of rice blast from seeds to adult plants in a non- systemic way." *Plant Pathol* 62 (2013): 879−887.
11. Ou SH. "Rice Diseases. (1985): Kew, UK: Commonwealth Mycological Institute.
12. Padmanabhan SY. "Estimating losses from rice blast in India." In the rice blast diseases, (1965b): 203-221 Baltimore, Maryland, Johns Hopkins Press.
13. Padmanabhan SY. "Control of rice disease in India." *Indian Phytopath* 27 (1974): 1-28.
14. Padmanabhan SY. "The role of therapeutic treatments in plant disease control with special reference to root diseases." (Abs). *Indian Phytopath* 16 (1963): 109.
15. Singh RA. "Current status of rice blast in India and challenges ahead." *Indian Phytopath* 50 (1997): 186-191.
16. Skamnioti P and Gurr SJ. "Against the grain: safeguarding rice from rice blast disease." *Trends Biotechnol* 27 (2009): 141-150. http://dx.doi: 10.1016/j.tibtech.2008.12.002.
17. Suzuki H. "Experimental studies on the possibility of primary infection of *P. oryzae* and *Ophibolus miyabeanus* internal of rice seeds." *Ann Phytopath Soci Japan* 2 (1930): 245-275.
18. Talbot NJ. "On the trait of acereal killer. Exploring the biology of *Magnaporthe grisea.*" *Ann Rev Microbiol* 57 (2003): 177-202.
19. Thrimurthy VS and Devadath S. "Role of seed in survival and transmission of *X.compestris* Pv. *oryzae* causing bacterial blight of rice." *Phytopath* Z. 110 (1984): 15-19.
20. Wilson RA and Talbot NJ. "Under pressure: investigating the biology of plant infection by *Magnaporthe grisea.*" Nat *Rev Microbiol* 7 (2009): 185−195.

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