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Intense Survey of Blast Disease in Rice Growing Areas of Bundi District of Rajasthan

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ABSTRACT: A crop failure for any reason, poses a real threat of starvation. One of the important constraints in achieving higher rice yield is, losses caused by abiotic and biotic factors. In the present study area work has been carried out specifically disease incidence of blast disease caused by *Pyricularia oryzae* at various localities of the study area. During survey period a total of 850 rice plant samples were collected from the seventeen different localities of Bundi district, Rajasthan, during growing period of rice. The results indicated that disease incidence in different agro-climatic regions ranged from 13.67% (Deikhera) to 50.67% (Keshavraipatan). The maximum disease incidence was noticed in Keshavraipatan locality (50.67%) followed by Bardha(43.90%) and Talera(40.33%). Least disease incidence was observed in Deikhera (13.67%).

KEYWORDS: disease incidence, survey, blast, crop, plants, food, world, cultivation, rice, survey

I. INTRODUCTION

Mother Nature has created thousands of diversified species of plants, which synthesize and provide food to living beings. Among those food sources rice plays a major role in our daily life starting from birth to death.

Rice cultivation is the principal activity and source of income for millions of household around the globe and several countries of Asia (Junaid *et al* 2009). Except of course, for Antarctica, every continent of the planet produces rice with over one hundred twenty two countries currently growing the crop (Kenmore 2003). Most of the world's rice is grown in tropics which include South Asia, South East Asia, West Africa and Central and South America. It is one of the leading food crops of the world.

India plays a dominant role in the production and consumption of rice as a food. It is the largest rice growing country accounting for about one-third of the world acreage under the crop. Rice (*Oryza sativa L.*) belonging to family graminiae (Poaceae) is the main source of food. It is one of the diverse crop grown in different agro-climatic conditions. It is cultivated in almost all the states of India, covering more than 30 percent of the total cultivated area. The major rice growing states in India are West Bengal, Bihar, Madhya Pradesh, Orissa, Andhra Pradesh and Uttar Pradesh, where 69.80 percent of the total area is covered under rice cultivation. In Rajasthan rice is grown largely under rain fed and irrigated conditions.

A crop failure for any reason, poses a real threat of starvation (Te Beest *et al* 2007). One of the important constraints in achieving higher rice yield is, losses caused by abiotic and biotic factors. Amongst the biotic factors plant disease are the most important factors which result in considerable and economical crop losses every year (Asghar *et al* 2007). The rice crop is subjected to more than forty diseases, which are responsible for low yield of rice in the world. The diseases may appear at any stage of development of plant, attacking the seed sown, root system, foliage, stalk, leaf sheath, inflorescence and even the developing grain (Shajia Iram *et al* 2003). The fungal diseases like blast, brown spot, sheath rot, false smut play remarkable role in damaging the crop. Among the fungal diseases of rice, rice blast is a devastating

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disease because of its wide distribution and its destructiveness under favourable conditions (Ou 1985; Pande 1997; Wilson *et al* 2009). It has been reported from eighty five rice growing countries (Sardaci 2003). The disease causes severe losses in yield (Rajarajeshwari and Muralidharan 2006).

The disease is found to be severe during kharif season. The disease is adaptable to adverse environmental conditions of widely fluctuating temperatures and relative humidity. Fungal diseases on rice and yield losses due to these diseases are equally common in Bundi district, Rajasthan.

In the present study area work has been carried out specifically disease incidence of blast disease caused by *Pyricularia oryzae* at various localities of the study area.

Feed -back took from farmers regarding the disease management strategies, already used by them for the control of blast disease to assess whether these practices are effective and sufficient for the control of the pathogen or not.

Therefore, this study is undertaken with the purpose of defining situation of rice diseases, in the rice fields of Bundi district. An understanding of the disease situation is essential for the successful implementation of disease management strategies.

II. STUDY AREA

The present surveyed area is situated in Rajasthan state. Bundi district ranks twenty second among the existing 33 districts of Rajasthan from the point of view of area and account for 1.62% of the state. The land is drained by the Mangali, Ghoda Pachad and Taleda rivers and its tributaries. The district is surrounded by the Aravali ranges. In Bundi, rice is an important source of earning because of existence of many rice industries and export of rice. Since the climatic conditions are congenial for the growth and spread of diverse fungal flora on various crops in the region, therefore present area has been chosen for the present investigation.

III. MATERIAL AND METHOD

Different localities of Bundi district were surveyed with the objective to know different fungal pathogens associated with rice crop. In the present investigation an intensive survey of the fungal pathogens with special reference to *Pyricularia*, associated with *Oryza sativa L.* was conducted at various localities *viz.* Ajjanda, Arnetha, Radi, Kapren, keshavraipatan, Gandoli (Tehsil-Keshavraipatan), Laban, Deikhera (Tehsil Indragarh), Gardara, Hattipura, Bardha, Dolara, Matunda, Namana, Talera (Tehsil Bundi), Satoor (Tehsil Hindoli) and Karwar (Tehsil Nainwan) covering the major rice growing areas of the Tehsils of Bundi district, during Kharif season. The survey covered the full cropping period i.e. from nursery beds to harvest stage.

1. Plant Sampling Technique and Storage Of Samples:

Each surveyed locality of rice growing area was divided into different zones of approximately the same area, by grouping. In each zone, five rice fields were selected, randomly. In each field, ten sampling units of 3x3 feet area were laid. A total of 50 plant samples (healthy and infected) were selected from 10 sampling units (5 plants from each unit), kept in sterilized plastic bags and brought to the laboratory. Plant tillers of each hill at each sample spot were closely examined for the presence of the diseases. On the basis of morphological symptoms healthy and infected plants were separated. Plant samples were washed thoroughly under tap water. The plants were kept in refrigerator at 4 degree Celsius temperature for further processing.

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Vol. 7, Issue 7, July 2018

2. Identification of Fungal disease on Rice

For the identification of fungal pathogen on *Oryza sativa*, the plant samples were collected from rice fields of the above said localities of the study area. The fungal pathogens from the field collected rice plant samples were identified on the basis of different morphological symptoms and using standard journals, manuals and keys (Subramaniam 1956 and Barnett 1972). Detailed morphological studies of both host and fungal pathogens were made. For the identification of different diseases the plant samples were keenly observed using hand lenses and disease symptoms were assessed on the basis of shape, size and colour of the spots on leaf, neck, panicle and seed of the plant. Microscopic preparations i. e. stained leaf sections, mycelia and spores from infected plant parts were made and observed under the light microscope for the identification of different pathogenic fungi. For this purpose infected plant parts were taken, thoroughly washed and finely sectioned. The sectioned pieces were stained with cotton blue and mounted in lactophenol and then observed under microscope for further confirmation of the pathogens on rice.

3. Blast Disease Incidence

For identification of blast disease, rice plants in the nursery beds were examined 3 weeks after sowing, at maximum tillering (40 days after transplanting) and also at a week before the harvest of crop at each location, for visual score of incidence of the disease. The occurrence and incidence of blast disease was calculated on rice plant samples by using the disease rating scale of 0-5 developed for foliar diseases (IRRI 1996).

0 = no symptoms.

1 = 1 – 5 % (Few) spots on <50% of leaves

2 = 5 – 20% spots on <50% of leaves

3 = 5 – 20% spots on >50% of leaves

4 = 20 – 50% spots on <50% leaves

5 = >50% spots on >50% leaves

The formula used for calculation of Percent disease incidence is as follows: Percent disease Incidence (PDI) =

IV. OBSERVATION

During survey period a total of 850 rice plant samples were collected from the seventeen different localities of Bundi district, Rajasthan, during growing period of rice as shown in table. During survey it was observed that many fungal diseases were spread around the surveyed area causing considerable yield losses to the crop. Disease occurrence arising from natural infection in the rice fields varied markedly among the different rice growing areas in the district. The prevalence and distribution of rice diseases in the surveyed area are summarized in Table. The *Pyricularia oryzae* was found to be highly pathogenic and occurred at all the seventeen localities of the five Tehsils of Bundi district and caused severe losses to the crop.

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Vol. 7, Issue 7, July 2018

Table:– Disease incidence and rice crop losses due to blast disease (*Pyricularia oryzae* cav.) at different localities of Bundi district. (observations are mean of 5 replicates).

S N.	Tehsil	Location	No. of Sampling Unit	No. of Plant Samples Studied	No. of Infected Plant	PDI in %	Decrease in yield per plant (seed weight) mg.	
							Healthy (H)	Infected (I)
1	K. Patan	Ajjanda	10	50	17	16.00	75.6	57.2
2		Arnetha	10	50	14	14.23	79.9	69.3
3		Radi	10	50	25	35.00	80.5	67.7
4		Kapren	10	50	21	22.67	78.5	65.0
5		K. Patan	10	50	43	50.67	78.2	42.6
6		Gandoli	10	50	27	36.00	76.0	50.2
7	Indargarh	Laban	10	50	18	17.33	79.6	67.5
8		Deikhera	10	50	19	13.67	80.5	60.2
9	Bundi	Gardara	10	50	14	14.82	80.0	62.2
10		Hattipura	10	50	23	29.20	82.5	67.3
11		Bardha	10	50	34	43.90	78.5	52.0
12		Dolara	10	50	13	18.82	75.2	59.5
13		Matunda	10	50	26	28.20	79.6	54.6
14		Namana	10	50	22	25.22	74.6	56.5
15		Talera	10	50	30	40.33	74.9	59.6
16	Hindoli	Satoor	10	50	16	15.92	76.9	67.2
17	Nainwan	Karwar	10	50	18	17.78	80.1	64.9

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Vol. 7, Issue 7, July 2018

Table -List of Fungicides used commonly in surveyed area for the control of Blast disease of rice.

S.N.	Commercial Name	Chemical Name	Dose in Amount	Time of Spray
1	Silicon Plus	Hexaconazole 5% EC	35ml/l/ha	After 45 days of transplantation
2	Cypra Plus	Gypermethrin 25% EC	20ml/16l/ha	90 days after transplantations
3	Mantra	Imidacloprid 17.8% SL	5ml/16l/ha	120 days after transplantations
4	Combi Plus	Carbendazim 12% + Mancozeb 63% WP	50gm/16l/ha	At emergence of neck for neck blast
5	Machete	Carbendazim 50WP	2.5g/kg seed	For seed treatment
6	Netiva	Propinazole 25EC	16ml/16l/ha	At ear emergence
7	Dupond	Hexaconazole 5EC	32ml/l/ha	At foliar stage for leaf blast

Blast Disease (*Pyricularia oryzae*)

In Blast disease the fungus attacked the rice crop at all stages from seedling to heading in the surveyed fields. The typical symptoms appeared on leaves, leaf sheath, rachis, nodes and even the glumes. The first symptoms of *Pyricularia oryzae* infection, appeared on the leaves as whitish or green-greyish spots with darker greenish edges, when they were in the mid tillering stage. As the damage developed, the spots gradually became whitish-greenish in colour with brown-reddish necrotic edges. The spots were of oval-elliptic shape with the extremes more or less pointed and facing the same way as the veins. When sporulation occurred, the centre of the spots turned ash grey due to the presence of conidia and hyphae. On average, the lesions were less than 1 cm long when the crop was in the plantlet stage, and reached 3 or 4 cm by the jointing stage. In the culm (nodes and internodes) and panicle (base, axis, branches and glumes), necrotic dark brown lesions appeared that sometimes reduced or cut off the circulation of the sap. Node damage was much more common and harmful than at the internodes; this sometimes broke the culm either partially or completely. The damage caused by *P. oryzae* was frequently occasioned by dewdrops carrying the fungus sliding down the flag leaf and collecting at the collar and affecting the ligule.

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Infection of the panicle base was the most destructive form of infection. As with node damage, this caused a reduction in the weight of grain and led to white, erect panicles with empty grains during the early and severe attack. Infection of the panicle base and branches (axis, primary and secondary branches) and damage to the pedicels holding the spikelets appeared later, during the ripening phase.

The mycelium of *Pyricularia oryzae* was septate and having branched hyphae. Conidiophores were arose singly from mycelium and were un branched. Conidia were present at the tip of the conidiophores. The shape of conidia was pyriform to obclavate, narrowed towards tip and rounded at the base. The conidia were 2- septate, both the septa were transverse forming 3- celled conodia. The conidia were measured about 14-40x6-13µm. the systematic position of the fungus *Pyricularia oryzae cav.* is as follows:-

Kingdom – Fungi

Phylum – Deuteromycota

Class –Deuteromycetes

Order - –Moniliales

Family - Dematiaceae

Genus – Pyricularia

Species – Pyricularia oryzae

Blast disease caused by *Pyricularia oryzae cav.* found to be the predominant and major disease of the study area. A fixed plot survey was carried out to know the incidence of blast disease. The data pertaining to this study are presented in Table. The table showed that maximum disease incidence of 50.67% was observed in the Keshavraipatan locality of Tehsil Keshavraipatan and minimum disease incidence of 13.67% was observed from Deikhera locality of Indragarh Tehsil. The results indicated that disease incidence in different agro-climatic regions ranged from 13.67% (Deikhera) to 50.67% (Keshavraipatan).The maximum disease incidence was noticed in KeshavraiPatan locality (50.67%) followed by Bardha(43.90%) and Talera(40.33%). Least disease incidence was observed in Deikhera (13.67%).

V.RESULT AND DISCUSSION

The present investigation was aimed to find out the occurrence and distribution of fungal diseases of rice and specially blast disease on rice plant in all the seventeen localities of Bundi district, during Kharif season. The observations from the table revealed that fungal diseases are fairly present in the area in the prevalence of blast. The occurrence of the diseases in the study area may be due to the favourable climatic conditions, amount of rainfall in the area, moderate temperature, relative high humidity and suitable soil conditions. The results obtained in the present work coincided with the findings of many previous workers such as Subramaniam *et al* (1986), Patel *et al* (1988), Biswas (2003) who suggested that above said climatic conditions were much favourable for the occurrence of fungal diseases on rice crop. The above findings were also in accordance with a national level survey conducted in India (AICRIP 2010).

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Vol. 7, Issue 7, July 2018

The report of highest PDI in KeshavraiPatan locality is supported by the fact that in this area rice fields are in abundance, adjoining to each other, providing heavy crop canopy and the availability of favorable micro climate in the area, for the spread of the fungus. Common occurrence of blast disease at all the localities may be due to susceptibility of the most commonly grown variety of rice Pusa basmati -1121 in the study area. These all factors might be responsible for the highest PDI and disease outcome in this area.

For the management of different fungal diseases prevailing in the area, chemical methods were preferably applied by the farmers (Table). They use different fungicides having main formulation of maneozeb, carbendazim and hexconazole.

The survey study enabled us to locate the hot spots for disease in study area. In addition, it also helped us to know their characteristic symptoms. The present investigation gave us a clear picture of morphological characters of fungal pathogen and it also helped us to develop integrated management practices by using botanicals and fungicides. Thus with the help of these strategies we can reduce the losses caused in rice due to blast disease and grow rice successfully. The survey study thus gives advance knowledge of disease infestations in the area and this could help to plan cropping patterns and to get best advantage of control measures.

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