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Occurrence and Distribution of Cluster Bean Diseases in Grid Region of Madhya Pradesh

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ABSTRACT

Background: Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] has a special contribution among the pulse crops and recognized as one of the important commercial crop of arid and semi-arid region. Being a leguminous crop it is a source to replenish nutrients especially nitrogen of the low fertility soils and enhances the soil fertility and also can withstand moisture stress. Various biotic and abiotic constrains in cluster bean were responsible for lowering average yield of crop as compared to its potential yield. Thus, it becomes imperative to sustain the productivity of clusterbean by gathering the information and behavior of disease distribution pattern in the zone. The current study therefore greatly emphasized to find out the occurrence and distribution pattern of diseases in major cluster bean growing areas grid region of northern Madhya Pradesh.

Methods: An intensive survey was conducted with an objective to access the prevalence and intensity of diseases of cluster bean in sixteen village of three district of grid region of Madhya Pradesh between 2018-19 and 2019-20.

Result: Investigation in respect of survey conducted concludes that alternaria leaf blight, dry root rot and bacterial leaf blight are the major concern diseases of cluster bean which directly affect the yield (Chand and Gandhi, 1978). Alternaria leaf blight (19.90%) and Bacterial leaf blight (11.60%) disease intensity was maximum in Gwalior district while maximum dry root rot (4.25%) incidence was recorded in Morena district.

Key words: Alternaria leaf blight, Bacterial leaf blight, Cluster bean, Dry root rot, Survey.

INTRODUCTION

Cluster bean [*Cyamopsis tertragonoloba* (L.) Taub] is an important leguminous crop of *Kharif* season in arid and semi-arid region of India (Kumar, 2005). In India cluster bean cultivation is accounted for about 75% of global trade and 80% of total guar production in the world (Swamy and Naveena, 2015). In M.P. cluster bean is cultivated as pure crop in 75, 280 hectare and as mixed crop in 54,782 hectare area. Despite the highest total production, yield of cluster bean is very low due to many biotic and abiotic constraints. Among the biotic constraints, alternaria leaf blight, anthracnose, dry root rot, bacterial leaf blight, YVMV (Moshe *et al.,* 1991; Gillaspie *et al.,* 1998) are important in respect of yield reduction factors. Bacterial blight (Kaur *et al.,* 2006, Jain and Agrawal, 2011), Alternaria leaf spot and Powdery mildew are the important diseases that threaten guar production areas were it is grown (Shivanna and Shetty, 1988a,b; Undersander *et al.,* 1991; Mathur and Sinha, 1993; Lodha *et al,* 2002; Deore *et al.*, 2004; Jaiman and Jain, 2004; Saharan and Saharan, 2004; Jatav and Mathur, 2005; Singh *et al*, 2005; Wijesekara *et al.*, 2005; Mohamed *et al.*, 2006; Purkayastha *et al.*, 2006 and Awurum and Uwajimgba, 2013). Tolerant varieties with developed inbuilt resistance are the best alternative against these disease to prevent the crop from heavy economical yield losses. Lodha (1984) reported that GAUG63 had some tolerance to powdery mildew. Whereas HG75, G102 and G225 were sources of bacterial leaf blight resistance (Kumar 2005; Sharma *et al.* 1999). Resistance to blight and leaf spot were reported to governed by recessive or dominant genes respectively (Singh *et al.* 1995; Vig, 1965). These diseases have become more important in recent years due to drastic climatic change make the crop more susceptible. A comprehensive survey of cluster bean diseases in gird region of Northern Madhya Pradesh was conducted in 2018-19 and 2019-2020. The objectives of the survey were to find out the occurrence and distribution of cluster bean diseases and also, to assess the level of resistance and susceptibility of the cultivators grown in farmers field.

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MATERIALS AND METHODS

The cultivator field survey was carried out in major cluster bean growing districts of Madhya Pradesh, namely, Morena, Gwalior and Shivpuri. To find out the intensity of alternaria blight, bacterial leaf blight and incidence of dry root rot disease of cluster bean.

Area surveyed

Survey was conducted between July and October 2018-19 to 2019-20 in the three major cluster bean growing districts grid region of Northern Madhya Pradesh (Gwalior, Morena and Shivpuri). The villages in each district were selected randomly. A total of five fields covering sixteen villages were surveyed.

Data analysis

Three (1×1 m) quadret were randomly selected in each field in the entire three district surveyed and infected plants were counted in each quadret. Based on infected and total number of plants disease incidence was calculated. Disease incidence of individual fields was used for calculating the mean incidence of each district and the district average was used to calculate the mean incidence of the northern state of M.P. These averages indicate relative prevalence of cluster bean diseases in the surveyed areas. Data recorded were averaged to obtained mean of the respective diseases. The weather data of Gwalior district is also collected from the metrological department (Fig 1 and 2).

RESULTS AND DISCUSSION

In the area surveyed, 80 farmers fields were inspected from all field visited the plants showing symptoms characteristics of cluster bean disease were observed and recorded (Plate 2). During *Kharif* 2018-19 and 2019-20 it was observed that alternaria leaf blight, dry root rot and bacterial leaf blight on cluster bean were important diseases in these three district of Northern M.P. Three major cluster bean growing districts of M.P. *viz.,* Gwalior, Morena and Shivpuri were surveyed to find out the status of cluster bean in grid region of Madhya Pradesh. The data summarized (Table 1 and Plate 1) reveals that the disease has become a major biotic constraint in the cultivation of cluster bean particularly in Gwalior, Morena and Shivpuri districts.

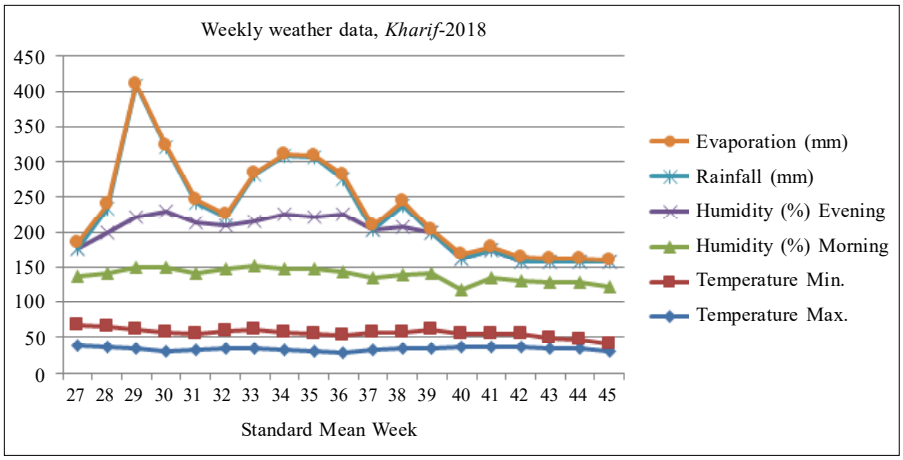

Fig 1: Metrological data during *kharif*-2018.

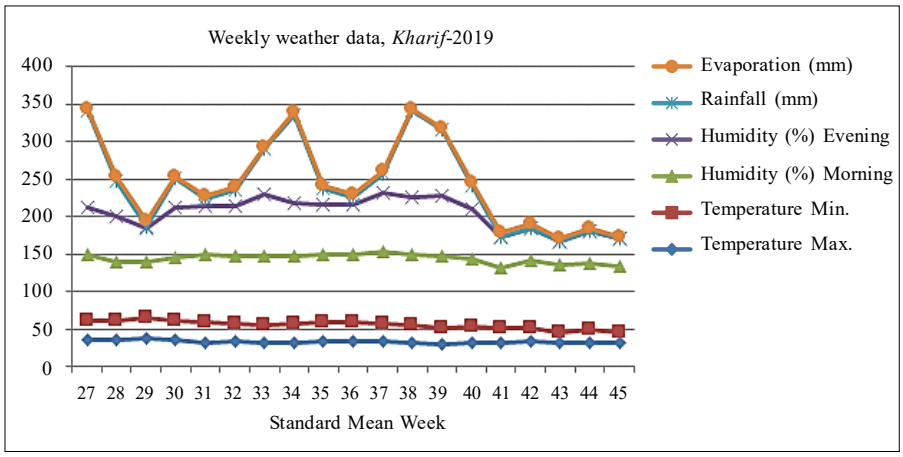

Fig 2: Metrological data during *kharif*-2019.

Intensity of foliar diseases (Alternaria leaf blight, bacterial leaf blight)

During the year 2018-19 the disease intensity of alternaria leaf blight in Gwalior district was in the range of 16.00% (shakhani) to 23.00% (Raichura). In Morena district it was in ranged from 4.00% (Arahakapura) to 10.00% (Kailaras). In Shivpuri it was in the range of 0.00% (Khadi) to 4.00% (Aadoli). The pressure of disease in 2019-20 was low as compared to 2018-19.

The two years mean data also summarized in (Table 1) which reveal that in Gwalior district the maximum intensity of alternaria leaf blight was recorded in Masoriya block (24.00%) followed by Raichura (22.50%), Basodi (21.50%) and Kadaiya (17.00%), while the minimum disease intensity was recorded in shakhani village (14.50%). In Morena district the maximum disease intensity was recorded in Kailaras (9.50%) followed by Noorabaad, Mitawaligoan (7.00%), (7.00%), Arahakpura (6.00%) and Padawali (5.50%), while

Table 1: Survey and monitoring of arid legume in gwalior, Morena and shivpuri district of northern M.P. during kharif 2018-19 and 2019-20.

Village	Cluster bean								
	Alternaria leaf blight (PDI)			Dry root rot (PDI)			Bacterial leaf blight (PDI)		
	2018-19	2019-20	Mean	2018-19	2019-20	Mean	2018-19	2019-20	Mean
Gwalior district									
Shakhani	16.00	13.00	14.50	7.00	5.00	6.00	16.00	4.00	10.00
Basodi	22.00	21.00	21.50	4.00	4.00	4.00	26.00	9.00	17.50
Masoriya	25.00	23.00	24.00	3.00	7.00	5.00	15.00	5.00	10.00
Kadaiya	17.00	17.00	17.00	4.00	3.00	3.50	15.00	8.00	11.50
Raichura	23.00	22.00	22.50	3.00	1.00	2.00	12.00	6.00	9.00
Mean	20.60	19.20	19.90	4.20	4.00	4.10	16.80	6.40	11.60
Morena district									
Arahakapura	4.00	8.00	6.00	3.00	6.00	4.50	10.00	2.00	6.00
Noorabaad	7.00	7.00	7.00	3.00	4.00	3.50	12.00	5.00	8.50
Mitawaligoan	8.00	6.00	7.00	5.00	2.00	3.50	7.00	3.00	5.00
Padawali	7.00	4.00	5.50	6.00	3.00	4.50	6.00	2.00	4.00
Joura	5.00	5.00	5.00	6.00	1.00	3.50	4.00	4.00	4.00
Kailaras	10.00	9.00	9.50	7.00	5.00	6.00	4.00	3.00	3.50
Mean	6.83	6.50	6.66	5.00	3.50	4.25	7.17	3.16	5.16
Shivpuri district									
Khadi	0.00	1.00	0.50	4.00	5.00	4.50	0.00	1.00	0.50
Dhumapura	3.00	3.00	3.00	6.00	4.00	5.00	6.00	3.00	4.50
Karyawati	0.00	0.00	0.00	3.00	2.00	2.50	7.00	5.00	6.00
Aadoli	4.00	5.00	4.50	4.00	3.00	3.50	6.00	6.00	6.00
Mohana	3.00	4.00	3.50	2.00	1.00	1.50	5.00	2.00	3.50
Mean	2.00	2.60	2.30	3.80	3.00	3.40	4.80	4.80	10.25

Plate 1: Major cluster bean growing areas of Northern Madhya Pradesh.

minimum disease intensity was recorded in Joura block (5.00%) of the district. In Shivpuri district the maximum disease intensity was recorded in Aadoli (4.50%) followed by Mohana (4.00%), Dhumapura (3.00%) and Khadi (0.50 %), while karyawati village are free from Alternaria leaf blight that is (0.00%) of the district.

In the year 2018-19 the intensity of Alternaria leaf blight in Gwalior, Morena and Shivpuri was 20.60%, 6.83% and 2.00% respectively. While, in 2019-20 the disease observed in Gwalior, Morena and Shivpuri district was 19.20%, 6.50% and 2.60% respectively. As per the two year mean data presented in (Table 1) reveals that the maximum disease intensity was recorded in Gwalior (19.90%) followed by Morena (6.60%), while minimum disease intensity was recorded in Shivpuri district which is 2.30%.

In the year 2018-19 the disease intensity of bacterial leaf blight disease in Gwalior district was in the range of 12.00% (Raichura) to 26.00% (Basodi). In Morena district it was in ranged from 4.00% (Kailaras) to 12.00% (Noorabaad). In Shivpuri it was in the range of 0.00% (Khadi) to 7.00% (Karyawati). The pressure of disease in 2019-20 was low as compared to 2018-19.

The two years mean data also summarized in (Table 1) which reveal that in Gwalior district the maximum disease intensity of bacterial leaf blight was recorded in Basodi block (17.50%) followed by Kadaiya (11.50%), Masoriya (10.00%) and Shakhani (10.50%), while the minimum disease intensity was recorded in Raichura village (9.00%) (Fig 3). In Morena district the maximum disease incidence was recorded in Noorabaad, Kailaras (8.50%) followed by Arahakpura (6.00%), Mitawaligoan (5.00%) and Padawali, Joura (4.00%) respectively, while the minimum disease intensity was recorded in Kailaras village (3.50%) (Fig 4). In Shivpuri district the maximum disease intensity was recorded in Aadoli and Karyawati (6.00%) followed by Dhumapura (4.50%) and Mohana (3.50 %), while the minimum disease incidence was recorded in khadi village (0.50%) of Shivpuri district (Fig 5). During 2018-19 the incidence of bacterial leaf blight in Gwalior (16.80%) followed by Morena (7.17%) and Shivpuri was 4.80%. While, in 2019-20 the disease was observed in Gwalior district 6.40%, Morena 3.16%, while in Shivpuri intensity was 4.80%. The two year mean data represented in (Table 1) revealed that the maximum disease incidence was recorded in Gwalior (11.60%) followed by

Plate 2: Survey and symptoms diagnosis of cluster bean diseases.

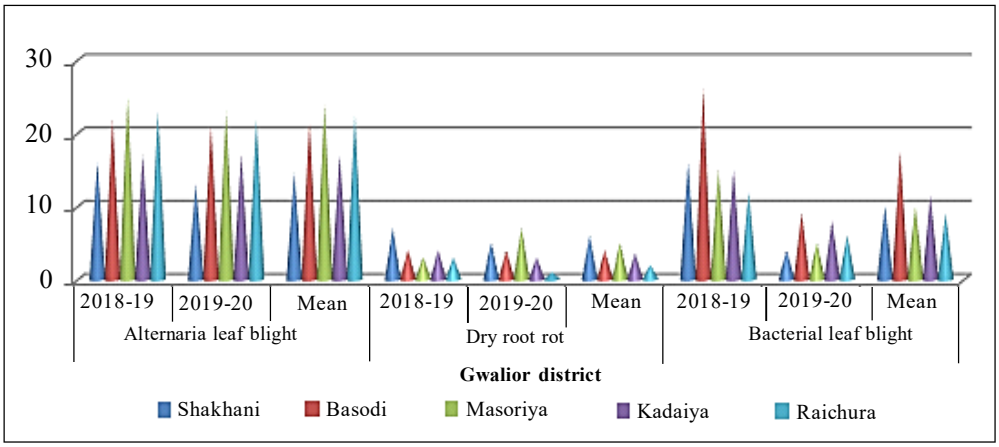

Fig 3: Prevalence of foliar and soil borne diseases of cluster bean in Gwalior districts.

Shivpuri (10.25%), while in minimum disease intensity was recorded in Morena district is 5.16%.

Incidence of soil borne disease (Dry root rot)

Dry root rot incidence in 2018-19 at Gwalior district was in the range of 3.00% (Raichura) to 7.00% (Shakhani). In Morena district it was in ranged from 3.00% (Arahakapura) to 7.00% (Kailaras). In Shivpuri it was in the range of 2.00% (Mohana) to 6.00% (Dhumapura). The pressure of disease in 2019-20 was low as compared to 2018-19. Also, the two years mean data summarized in (Table 1) reveals that in Gwalior district the maximum disease incidence of dry root rot was recorded in Shakhani block (6.00%) followed by Masoriya (5.00%), Basodi (4.00%) and kadaiya (3.50%), while the minimum disease incidence was recorded in Raichura village (2.00%) (Fig 3). In Morena district the maximum disease incidence was recorded in Kailaras (6.00%) followed by Arahakpura, Padawali (4.50%) and Noorabaad, Mitawaligoan, Joura (3.50%) respectively (Fig 4). In Shivpuri district the maximum disease incidence was recorded in Dhumapura (5.00%) followed by Khadi (4.50%), Aadoli (3.50%) and karyawati (2.50%), while the minimum disease incidence was recorded in Mohana village (1.50%) of Shivpuri district (Fig 5). As per survey data recorded in 2018-19 the incidence of dry root rot in Gwalior, Morena and Shivpuri was 4.20%, 5.00% and 3.80% respectively. While in 2019-20 it was observed that in Gwalior district the mean diseases intensity was 4.00% followed by Morena 3.50%, while in Shivpuri it was 3.00%. The two year mean data presented in (Table 1) reveals that the maximum disease incidence was in Morena (4.20%) followed by Gwalior (4.10%), while minimum disease incidence was recorded in Shivpuri district is 3.40%.

The comprehensive study through survey was the first to check out the relative importance of fungal and bacterial diseases of cluster bean in grid region of Northern M.P. Based on survey results alternaria leaf blight, intensity was ranked 1st out of the other two cluster bean disease. Thus alternaria leaf blight was found to be a relatively major disease of cluster bean in Northern M.P. During the survey results of the present study indicated that alternaria blight, dry root rot and bacterial leaf blight were restricted in local cultivars. There are several possibilities to explain the low prevalence and incidence of DRR in all cluster bean growing areas irrespective of cluster bean cultivars during the survey, including resistance, atmospheric conditions for disease infection and development and the use of seed treatment with fungicides. Widespread distribution of DRR, Alternaria

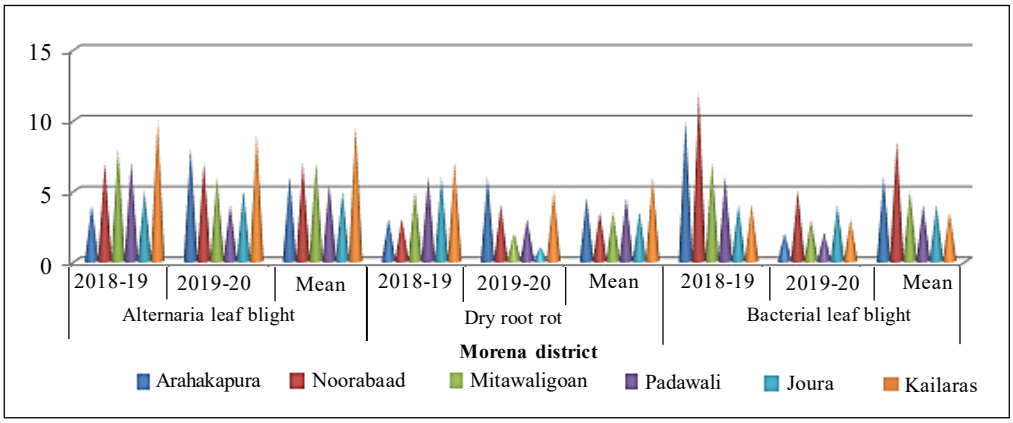

Fig 4: Prevalence of foliar and soil borne diseases of cluster bean in Morena districts.

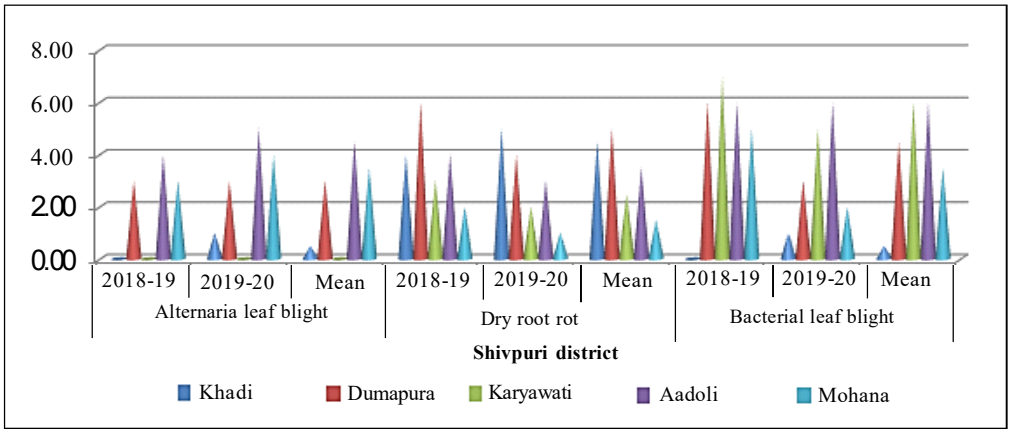

Fig 5: Prevalence of foliar and soil borne diseases of cluster bean in Shivpuri districts.

blight and Bacterial leaf blight in all cluster bean cultivars observed which were grown by the farmers and it is a matter of concern also. Average disease intensity of Alternaria blight and bacterial blight varied from 2.30%-19.90% and 5.16%-11.60% and disease incidence of DRR varied from 3.40%-4.25% on all the cultivars grown by the farmers. The random moisture stress and higher temperature in northern M.P. Probably predisposed the cluster bean crop to favourable condition for DRR development. Pande *et al*. (2010). Research done on *R. bataticola* showed that temperature and moister stress are important factor for its infection Pande *et al.,* (2004), Akram (2008).

CONCLUSION

The distribution and intensity of Alternaria blight, bacterial blight, incidence of soil borne disease of cluster bean varied in each district. These diseases are emerging as a potential threat to cluster bean production. Multiple disease resistant lines against, Alternaria leaf blight, Bacterial blight and DRR need to develop with combined resistance against these diseases. The detailed analysis of the factors responsible for wide spread emergence of the diseases need further investigations.

Conflict of interest: None.

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