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Status of Root Rot Disease (*Fusarium solani f. sp. phaseoli*) of Beans at Gurez in Jammu and Kashmir.

Z. A. Badri	Department of Plant Pathology, Faculty of Agriculture, Sher-e-Kashmir University of Agriculture Science and Technology of Kashmir, Shalimar campus-191121, Jammu & Kashmir, India.
Nazir A. Bhat	Department of Plant Pathology, Faculty of Agriculture, Sher-e-Kashmir University of Agriculture Science and Technology of Kashmir, Shalimar campus-191121, Jammu & Kashmir, India.
F.A. Raina	KVK Kupwara, Sher-e-Kashmir University of Agriculture Science and Technology of Kashmir, Shalimar campus-191121, Jammu & Kashmir, India.

ABSTRACT

Root rot (Fusarium solani), was found prevalent in all the villages of Gurez with incidence 7.99 to 30.33 % and 9.77 to 36.77 % and intensity 4.61 to 25.03 % and 4.71 to 28.75 % in 2011 and 2012, respectively. The maximum mean disease incidence (17.94 % in 2011 & 33.55 % in 2012) and intensity (13.46 in 2011 & 26.89 % in 2012) was recorded in village Wanpora of lower Gurez and minimum mean disease incidence (8.88 & 14.38 % include similarly) and intensity (4.66 & 11.67 %) was recorded in village Gujran of upper Gurez. Both the root rot incidence and intensity increased with crop growth stage in both the years.

KEYWORDS : Beans, incidence, intensity, pulses, root rot, Fusarium solani

Gurez in Jammu and Kashmir is a mid–high altitude valley with temperate climate. The area remains under snow for about 6 months (From November to April) due to which there is large variation in the weather conditions during the months of April and May when the agriculture activities are to be undertaken. Nearly 1100 ha are under cultivation out of which 10 % is under rajmash, which is cultivated as sole or mixed crop with maize.

Pulses are major sources of proteins among the vegetarians in India, and complement of staple cereals in the diets with proteins, essential amino acids, vitamins and minerals. In India, these are being considered as the poor man's only source of protein (Jukanti et al, 2012). Pulses are grown on 22-23 million hectares of area with an annual production of 13-15 million tonnes (mt), and India accounts for 33% of the world area and 22% of the world production of pulses (Joshi, 2009).

French bean also known as rajmash is valued for its protein rich (23%) seeds. In India, both bushy and trailing types rajmash are found. Major rajmash producing areas are located in tropical and temperate regions with a temperature around 21°C (Saxena et al, 2011). Soil-borne diseases can be devastating in bean production areas, especially if they are grown repeatedly in the same ground. Beans prefer a growing environment where temperatures are between 15°C and 30°C. Germination is reduced when soil temperatures are below 15°C. Optimum vigour at germination is desirable to reduce the effects of soil-borne diseases which may infect slowly germinating plants (Watson, 2009). Yield losses range from a trace to 100 percent, especially when adverse environmental conditions persist after planting and through flowering. Production of major pulses is constrained by both biotic and abiotic stresses. The richness of legumes in N and P makes them attractive for insect pests and diseases (Sinclair and Vadez, 2012). The most common diseases and their pathogens are Fusarium root rot or dry rot (Fusarium solani f. sp. phaseoli), Fusarium wilt or yellows (Fusarium oxysporum f. sp. phaseoli), Rhizoctonia root and pod rots (Rhizoctonia solani), and Pythium damping off . Among these, Fusarium root rot (FRR), also referred to as Fusarium foot rot or dry rot, occurs throughout the world wherever beans are grown. It does not always cause damage unless plants are subjected to some form of stress. However, under severe or drastic environmental stresses, the disease can be very destructive (Harveson, R. M. 2011).

The disease is one of the major yield-limiting diseases of bean (Phaseolus vulgaris L.) in Gurez area of Jammu & Kashmir and economic losses were reported in past few years due to its occurrence . Therefore, the objective of the present investigation was to undertake surveys of major bean growing villages of Gurez valley to record incidence and intensity of Fusarium root rot.

MATERIALS AND METHODS

Survey

A systematic survey was conducted in major rajmash growing villages viz., Tarbal, Baktore, Izmarg, Korakbal, Nyle, Badwan, Wanpora, Khandyal and Markoot of lower Gurez and Barnaye, Kashpat, Purana Tulail, Neeru, Badugam, Sardaab, Hossangam, Malangam and Gujran of upper Gurez during 2011 and 2012 cropping seasons. At each village, three fields were randomly selected for recording observations on root rot incidence and intensity. The data was recorded on unsprayed crop as whole area of Gurez is organic by default.

Disease incidence

Bean plants were randomly observed at 10 different places in the field for recording the total number of diseased and healthy plants at 30 and 60 days after sowing (DAS) of the crop. Mathematically, root rot incidence (%) = n / N x 100

Where n is the number of plants showing root rot symptoms and N is the total number of plants examined. An average of the ten assessments in the fields represented the average disease incidence of the field.

Disease intensity

Bean genotypes were assessed for root rot severity in the field. On 1st week of August, ten plants from each plot were dug, roots were washed to remove soil, and roots were rated for root rot severity using a 1 to 7 scale (Schneider and Kelly, 2000), where: 1 = healthy roots with no discoloration of root and no reduction in root mass; 2 = 0.1 to 0.2 cm small reddish brown lesions with normal root mass and size; 3 = increase in intensity and size and coalescing of localized root lesions approximately 180° around the stem, with lesions from 0.5 to 1 cm and 10 to 20% root discoloration but no reduction in root mass size; 4 = increase in intensity of discoloration and size of lesions, with lesions extending and completely encircling the stem, 5 to 10% root mass reduction, and 95% of the roots discolored; 5 = increasingly discolored and extended root lesions, with 100% of the roots intensely reddish-brown and 20 to 50% root mass reduction; 6 = root lesions encircling the stem extending up to 2 cm, intense root mass discoloration, and 50 to 80% root mass reduction; and 7 = pithy or hollow root with very extended lesions, 80 to 100% root mass reduction, and functionally dead.

The disease intensity was calculated by using the following formula

$$\text{Root rot intensity (\%)} = \frac{\text{Summation of numerical rating}}{\text{No. of plants examined} \times \text{Maximum disease Score}} \times 100$$

RESULTS AND DISCUSSION

The data presented in Table-1 reveals prevalence of the disease in all the locations surveyed with varying degrees of incidence. Fields in village Wanpora exhibited the maximum root rot incidence (33.55%) followed by Korakbal (31.60%), whereas , Gujran fields displayed lesser root rot incidence (14.38%) at 60 DAS. Villages of upper Gurez also exhibited lesser mean disease incidence as compared to villages of lower Gurez. The villages where more than 25 per cent root rot incidence was recorded were Badwan, Khandyal and Markoot in lower Gurez, whereas a root rot incidence of less than 20 per cent was recorded in villages Sardaab, Hossangam, Malangam and Gujran of upper Gurez at the same crop stage. The root rot incidence increased with advancement in crop growth stage.

The data (Table-2) reveals varying degrees of root rot intensity throughout the area. Fields in village Wanpora exhibited the maximum root rot intensity (26.89) per cent followed by those in Korakbal (25.03%) , whereas Tarbal, Baktore, Izmarg, Badwan, Nyle, Khandyal and Markoot fields displayed root rot intensity in the range of 17.95 to 21.35 per cent only at 60 DAS. The villages where less than 15 per cent root rot intensity was recorded were Budogam,Sardaab, Hossangam, Malangam and Gujran.

The lesser root rot incidence and intensity was recorded in 2011 compared to those in 2012, seems to be owing to the pre-disposing environmental conditions which prevailed during 2012 and led to increased disease development and spread. The role of environmental factors such as temperature, topographical features and high relative humidity in the development of Fusarium root rot has been well documented (Cichy et. al., 2007). In general, the fields in village Wanpora exhibited the maximum disease incidence and intensity at both the stages. The Fusarium root rot fungus occurs in most cultivated soils of the region where dry beans have been grown previously and most plants grown in these soils will become infected to some degree before they mature. Root rot severity depends on factors such as cropping history, plant spacing, moisture and temperature stresses, and soil compaction. Early planting in cool, moist soil favors the disease, as does soil compaction in the form of tillage or harden layers. In dry land production areas the disease can be more serious, especially in years of drought. The effect of Fusarium root rot is most apparent during blossoming and early pod set when the plant and its productivity are more sensitive to stress. Yield losses associated with Fusarium root rot are difficult to assess, but may exceed 50 to 75% in severe cases (Schwartz, et. al., 2007). Then findings may contribute to the future estimation of bean yield losses to root rots and selection for resistant cultivars. The varying levels of disease intensity and the inflicting losses recorded at different villages seem largely due to the topographical differences between locations which reflect in the form of different environmental factors. Thus the losses due to the disease seem to vary from region to region and location to location depending on the prevailing environmental conditions and the vulnerability of the crop variety under plantation.

These findings may be supported by the fact that the incidence and intensity in upper Gurez is less as compared to lower Gurez. Root rot of beans (Fusarium solani f. sp. phaseoli) is prevalent in almost every pulse field of Gurez with varied incidence and intensity from place to place. The blight incidence was minimum at 30 DAS and reached maximum at 60 DAS during both the cropping seasons at all the surveyed villages.

Table 1. Incidence of root rot of beans at various locations of Gurez during 2011-2012, cropping season

Tehsil	Area	Village	Root rot incidence (%)					
			2011		2012		Mean 2011-12	
			I	II	I	II	I	II
Gurez	Lower Gurez	Tarbal	10.33	21.66	11.25	23.77	10.79	22.71
		Baktore	11.11	22.99	13.77	24.22	12.44	23.60
		Izmarg	10.27	21.33	11.22	22.11	10.74	21.72
		Korakbal	14.99	28.66	15.44	34.55	15.21	31.60
		Nyle	10.66	22.18	12.51	23.51	11.58	22.84
		Badwan	12.77	24.33	14.15	26.22	13.46	25.27
		Wanpora	16.44	30.33	19.44	36.77	17.94	33.55
		Khandyal	11.55	23.46	13.22	26.99	12.38	25.22
		Markoot	13.51	24.14	15.71	27.66	14.61	25.90
	Upper Gurez	Barnaye	12.99	23.66	14.22	26.66	13.60	25.16
		Kashpat	12.33	23.46	14.22	25.99	13.27	24.72
		Purana Tulail	11.80	22.99	13.99	25.77	12.89	24.38
		Neeru	11.07	22.66	13.33	24.99	12.20	23.82
		Badogam	10.66	20.99	12.66	24.00	11.66	22.49
		Sardaab	10.03	18.66	11.76	19.66	10.89	19.16
		Hossangam	10.00	17.33	11.66	19.00	10.83	18.16
		Malangam	9.11	17.33	11.00	18.33	10.05	17.83
		Gujran	7.99	13.66	9.77	15.11	8.88	14.38
Mean			11.53	22.21	13.29	24.74	12.41	23.47

Data presented as average of 20 observation across the village; data recorded at 30 DAS (1) and 60 DAS (11) during the cropping season.

Table 2. Intensity of root rot of beans at various locations of Gurez during 2011-2012, cropping season

Tehsil	Area	Village	Root rot intensity (%)					
			2011		2012		Mean 2011-2012	
			I	II	I	II	I	II
Gurez	Lower Gurez	Tarbal	8.00	18.33	9.33	19.33	8.66	18.83
		Baktore	8.88	17.30	8.66	20.03	8.77	18.66
		Izmarg	7.71	16.66	8.70	19.24	8.20	17.95
		Korakbal	11.33	23.55	12.30	26.51	11.81	25.03
		Nyle	6.66	17.01	7.90	20.43	7.28	18.72
		Badwan	9.07	20.71	10.70	22.00	9.88	21.35
		Wanpora	12.61	25.03	14.31	28.75	13.46	26.89
		Khandyal	10.99	20.06	12.11	22.30	11.55	21.18
		Markoot	10.50	19.58	11.20	21.91	10.85	20.74
	Upper Gurez	Barnaye	9.71	18.33	9.99	20.66	9.85	19.49
		Kashpat	7.08	16.33	9.07	19.94	8.07	18.13
		Purana Tulail	7.72	16.04	8.32	19.12	8.02	17.58
		Neeru	6.33	15.90	7.06	17.55	6.69	16.72
		Badogam	6.67	13.33	7.11	16.24	6.89	14.78
		Sardaab	5.97	12.33	6.54	15.66	6.25	13.99
		Hossangam	5.75	12.11	6.33	14.05	6.04	13.08
		Malangam	5.10	11.33	6.66	13.44	5.88	12.38
		Gujran	4.61	11.01	4.71	12.33	4.66	11.67
Mean			8.04	16.94	8.94	19.41	8.49	18.17

Data presented as average of 20 observation across the village; data recorded at 30 DAS (1) and 60 DAS (11) during the cropping season.

REFERENCES

Cichy, A. K., Snapp, S. S. and Blair, M. W. (2007). Fusarium root rot incidence and root system architecture in grafted common bean lines. Plant and Soil. 300 (1-2) : 233-244. | Harveson, R. M. (2011). Soil borne Root and Stem Diseases of Dry Beans in Nebraska. The Board of Regents of the University of Nebraska on behalf of the University of Nebraska–Lincoln Extension. PP-10. | Joshi, P K. (2009). "Prices and Market Intervention in Pulses", paper presented in Brainstorming workshop on Issues and Strategies for Increasing Productivity and Production of Pulses in India, organised by the Indian Council of Agricultural Research and Ministry of Agriculture, Government of India, New Delhi, 9-10 June. | Jukanti, A. K., Gaur, P. M., Gowda, C. L. L and Chibbar, R. N. (2012). Nutritional quality and health benefits of chickpea (Cicer arietinum L.): a review. British Journal of Nutrition 108: S11-S26. | Saxena, K. B., Singh, G., Gupta, H. S., Mahajan, V., Kumar, R. V., Singh, B., Vales, M. I. and Sultana, R. (2011). Enhancing the livelihoods of Uttarakhand farmers by introducing pigeonpea cultivation in hilly areas. Journal of Food Legumes. 24: 128-132. | Schneider, K. A. and Kelly, J. D. (2000). A greenhouse screening protocol for Fusarium root rot in bean. Hort. Science. 35: 1095-1098. | Schwartz, H. F., Gent, D. H., Franc, G. D. and Harveson, R. M. (2007). Dry Bean- Fusarium Root Rot. High Plains IPM Guide, a cooperative effort of the University of Wyoming, University of Nebraska, Colorado State University and Montana State University. PP-3. | Sinclair, T. R. and Vadez, V. (2012). The future of grain legumes in cropping systems. Crop and Pasture Science. 63 (6). pp. 501-512. | Watson, A. (2009). Soil-borne diseases of beans. Primefacts- for Profitable, Adaptive and Sustainable primary industries. Science and Research, Yanco.PRIMEFACT 586. |