

A CASE STUDY

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Status of small millets diseases in Uttarakhand

■ BIJENDER KUMAR

Department of Plant Pathology, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar
UDHAM SINGH NAGAR (UTTARAKHAND) INDIA

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ABSTRACT

Although, small millets are known to cope up with abiotic and biotic stresses, nevertheless, under vulnerable conditions some of the diseases cause heavy losses and can damage entire crop. Therefore, the present investigation was planned with the objective to know the status of major diseases of small millets and also to observe occurrence of any new biotic problem with time in small millets. Based on the study conducted during 2007-2012, blast (*Pyricularia grisea*) and *Cercospora* leaf spot (*Cercospora eleusinis*) of finger millet, leaf blight (*Helminthosporium monoceros*) and grain smut (*Ustilago panici-frumentacei*) of barnyard millet, blast (*Pyricularia setariae*) and leaf blight (*Cochliobolus setariae*) of foxtail millet, leaf spot or blight (*Bipolaris panici-miliacei*) of proso millet diseases were found to be the major constraints in successful cultivation of small millets in Uttarakhand. However, in addition to these some of the diseases like; green ear or downy mildew (*Sclerophthora macrospora*) and foot rot or wilt (*Sclerotium rolfsii*) in finger millet, head smut (*Ustilago crugalli*) and sheath blight (*Rhizoctonia solani*) in barnyard millet, smut (*Ustilago crameri*) in foxtail millet and sheath blight (*R. solani*) in proso millet have been recorded for the first time in Uttarakhand.

Corresponding author:
Email: bij1005@yahoo.co.in

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INTRODUCTION

Among rainfed crops, small millets as a group figure prominently. India is largest producer of small millets, which are often referred to as coarse cereals. Realizing the nutritional superiority of these grains they are now considered as nutri-cereals (Nutritious grains). Small millets grown in India are finger millet (*Eleusine coracana*), kodo millet (*Paspalum scrobiculatum*), foxtail millet (*Setaria italica*), little millet (*Panicum*

sumatrense), proso millet (*Panicum miliaceum*) and barnyard millet (*Echinochloa crusgalli*), which account for about 2.7 million ha and their cultivation extending from sea level in coastal Andhra Pradesh to 8,000 feet above sea level in hills of Uttarakhand and North-Eastern states (Shanthakumar *et al.*, 2010). These crops are grown in diverse soils, varying rainfall regimes and in areas widely differing in thermo- and photo-periods. The resilience exhibited by these crops is helpful in their adjustment to different kinds of ecological niches and

have made them quite indispensable to rainfed, tribal and hill agriculture where crop substitution is difficult. These crops are cultivated in almost all the states of India in concentrated pockets and occupy unique position in hill agriculture. These crops are grown by small and marginal farmers in marginal and degraded soils with little cash input, where crop options are limited. Many of them are of short duration and are able to provide substantial yield in a short period of 60-65 days. Utilization of these crops is mainly as food for human consumption, but they also provide good quality fodder for cattle. Among the six small millets that are grown in India, finger millet and barnyard millet are the major crops grown extensively in Uttarakhand at present. Foxtail and proso millet though used to be grown earlier in some areas, are presently out of cultivation. Area and production wise small millets, mainly finger millet and barnyard millet, rank second only after rice among the *Kharif* crops and third among all the crops, occupying an area of about 1.96 lakh ha with a total production of 2.59 lakh tones (Anonymous, 2012). These crops are particularly valuable in the mountains where most of the population depends on vegetable proteins and carbohydrates as dietary staples. Small millets are poor-man's crop and unfortunately suffer from damages due to various diseases and insect pests.

Although, small millets are known to cope up with abiotic and biotic stresses, nevertheless, under vulnerable conditions some of the diseases cause heavy losses and can damage entire crop. However owing to their perceived lesser economic importance in past, very less information on the status of diseases of small millets, is available. Survey of the status of diseases in crops is essential to determine general levels of crop health, or the presence of particular diseases of quarantine significance, prioritization of problems to enable proper allocation of crop protection resources, and to assess the losses caused by crop diseases. Therefore, the present investigation was planned with the objective to know the status of major diseases of small millets and also to observe occurrence of any new biotic problem with time in small millets.

MATERIAL AND METHODS

Major small millets growing areas in Uttarakhand as well as various trials conducted under All India Co-ordinated Research Projects (AICRP) at Ranichauri (hill campus of G.B. Pant University of Agriculture and

Technology, Pantnagar now under Uttarakhand University of Horticulture and Forestry, Bharsar) were surveyed consecutively for six crop seasons during 2007 to 2012 at different stages of the crop to ascertain the status of diseases associated with the small millet crops (Tables 1, 2, 3 and 4).

Diseases were recorded in each field in each of five quadrates. One quadrate was situated in each of four corners and one in the centre of the field. During surveys, plants showing symptoms such as leaf spots, leaf blight and lesions on stem, smuts and stunting were collected, bagged separately in paper bags and brought to the laboratory for microscopic examination, isolation and identification of pathogens associated with the diseased plant samples. Potato Dextrose Agar (PDA) medium was used for the isolation of the pathogens. Identities of the diseases were confirmed using standard references (Nagaraja *et al.*, 2007; Pal *et al.*, 1980 and Dube, 2012). The incidences of various diseases were recorded at seedling stage, between flowering to grain filling stage and at dough stage.

Data collection for diseases of small millets :

Foliar diseases like; leaf blast, *Cercospora* leaf spot diseases of finger millet, leaf blight of barnyard millet, foxtail millet and proso millet and blast of foxtail millet were scored using modified 0-5 rating scale (Nagaraja *et al.*, 2007) where 0 = absolutely free from disease, 1 = 1 per cent plants infected, 2= 1.1 to 5 per cent plants infected, 3= 5.1 to 25 per cent plants infected, 4= 25.1 to 50 per cent plants infected and 5= more than 50 per cent plants infected.

The data on neck and finger blast were recorded at dough stage of the crop. Neck blast was recorded as the percentage of ears showing infection on the peduncle/ neck and finger blast as the percentage of fingers affected (Nagaraja *et al.*, 2007), in following ways:

Neck blast (%) = (Number infected ears/ Total number of ears in each plot (1m²)) x 100

Finger blast (%) = (Number of infected fingers x total number of fingers in each plot) x 100

However, smuts and sheath blight were recorded as percentage of ears and plants showing typical smut and sheath blight symptoms in each plot at maturity (Nagaraja *et al.*, 2007).

Foxtail millet and proso millet diseases were recorded only in experimental trials conducted at

Ranichauri because these crops earlier in cultivation are not grown as soul crop in Uttarakhand, now days.

RESULTS AND DISCUSSION

Majority of farmers in the district are small farmers having <0.25 ha land holding. It was observed that all the farmers were growing finger millet and barnyard millet but none of them were growing foxtail millet and proso millet as soul crop. Conditions of the fields varied from well maintained to poorly maintained. The agronomic condition of the crops also varied but in most cases was poor. It was difficult to determine, however, whether this reflected poor crop management or limitations in edaphic factors. More than seventy five per cent of the fields sampled were planted to local landraces. Of the farmers interviewed, nearly all identified the blast, *Cercospora* leaf spot as a serious problem in finger millet, grain smut and leaf blight in barnyard millet, leaf blight in foxtail millet and proso millet. Farmers were able to identify blast and smut as disease, but did not recognize other foliar diseases and in a few cases mistakenly associated severe leaf disease symptoms with natural signs of crop maturity.

The samples collected during surveys were examined under laboratory conditions. Based on the characteristic symptoms, morphological and microscopic characteristics of the pathogen the diseases were identified as blast (*Pyricularia grisea*) and *Cercospora* leaf spot (*Cercospora eleusinis*) of finger millet, leaf blight (*Helminthosporium monoceros*), grain smut (*Ustilago panici-frumentacei*), head smut (*Ustilago crugalli*) and sheath blight (*Rhizoctonia solani*) of barnyard millet, blast (*Pyricularia setariae*), smut (*Ustilago crameri*) and leaf blight (*Cochliobolus setariae*) of foxtail millet, leaf spot or blight (*Bipolaris panici-miliacei*) and sheath blight (*Rhizoctonia solani*) of proso millet. Identification of the diseases was confirmed using standard reference (Nagaraja *et al.*, 2007; Pall *et al.*, 1980 and Dube, 2012).

The data pertaining to prevalence, incidence and severity of finger millet, barnyard millet, foxtail millet and proso millet diseases are presented in Tables (1, 2, 3 and 4).

Diseases of finger millet :

During surveys, it was observed that blast and *Cercospora* leaf spot were prevalent in all areas

surveyed. Leaf blast grade ranged from 0.00 to 3.00 however, highest grade 3.0 was recorded in experimental trials of plant pathology at Ranichauri in and at village Gaind in Narendra Nagar tehsil. Neck blast incidence ranged from 0.00 to 14.71 per cent, highest at Tikhon and Kotdwara villages in Tehri tehsil. However, the incidence of finger blast ranged from 0.00 to 34.28 per cent, highest in variety PRM 2 in plant breeding experimental trial. *Cercospora* leaf spot disease was recorded at all the places and in all the varieties. The disease grade ranged from 1.0 to 5.0 none of the variety was free from disease and at most of the places maximum 5.0 disease grade was recorded.

The incidence of blast and *Cercospora* leaf spot diseases varied at different places. This may be attributed due to varied climatic conditions as these villages and experimental fields are located at different altitudes. *Cercospora* leaf spot disease has been noticed at all the places in all the varieties under cultivation. The results are in accordance with the work of Kumar *et al.* (2007a) who reported that the most of the germplasm screened at Ranichauri since the inception of AICRP project (1987) were susceptible to *Cercospora* leaf spot. It was found to be a serious problem in mid and high hills in Uttarakhand and is known to occur from 850 m to >1900 m altitude. The intensity of the disease was low in lower hills (Kumar *et al.*, 2007a).

In addition to the above mentioned diseases, sporadic occurrence of green ear or downy mildew (Kumar *et al.*, 2007b) and foot rot or wilt (Kumar and Prasad, 2010) diseases have also been recorded in experimental trails on finger millet for the first time in Uttarakhand.

Diseases of barnyard millet :

During surveys, it was observed that the two species of barnyard millet *i.e.* *E. frumentacea* and *Echinochloa crugalli* ssp. *utilis* are grown by the farmers but *E. frumentacea* is more common. The diseases like; Grain smut, head smut, leaf blight and sheath blight were encountered during surveys. It was interesting to note that head smut was confined only in experimental trails of plant pathology and sheath blight was limited only to variety PRJ 1. Head smut and sheath blight diseases were observed for the first time in Uttarakhand in 2008 (Kumar *et al.*, 2008) and 2009 (Kumar and Prasad, 2009), respectively. Grain smut and leaf blight were very common diseases at most of the places. The data

Table 1 : Prevalence, incidence and severity of finger millet diseases in different varieties at different places in Uttarakhand (highest of the six seasons 2007-2012)

Tehsil	Place/Village	Variety	Crop stage	Leaf blast (G)	Neck blast (%)	Finger blast (%)	CLS (G)	Green ear (%)*	Foot rot (%)**
Tehri	Hill Campus, Ranichauri, Plant Pathology	PRM 1	Vegetative phase	3.00	0.00	-	2.00	-	-
			Ear head emergence	0.00	4.96	16.66	5.00	-	-
			Dough stage	0.00	6.89	26.66	5.00	-	6.66
		VL 149	Vegetative phase	1.00	0.00	-	3.00	-	-
			Dough stage	0.00	0.00	0.00	5.00	-	-
		PR 202	Vegetative phase	0.00	0.00	0.00	5.00	-	-
			Dough stage					35.55	-
	Gaja Research Station	PRM 1	Dough stage	1.00	3.33	12.00	5.00	-	-
		PRM 2	Dough stage	0.00	0.00	10.00	4.00	-	-
	Hill Campus, Ranichauri, Plant Breeding	PRM 1	Vegetative phase	1.00	0.00	-	5.00	-	-
			Ear head emergence	0.00	0.00	26.66	5.00	-	-
			Dough stage	0.00	0.00	25.00	5.00	-	-
		PRM 2	Vegetative phase	0.00	0.00	-	5.00	-	-
			Ear head emergence	0.00	0.00	6.66	5.00	-	-
			Dough stage	0.00	0.00	34.28	5.00	-	-
		VL 149	Vegetative phase	0.00	0.00	-	5.00	-	-
			Ear head emergence	0.00	0.00	0.00	5.00	-	-
			Dough stage	0.00	0.00	6.66	5.00	-	-
	VL 315	Vegetative phase	0.00	0.00	-	5.00	-	-	
		Ear head emergence	0.00	0.00	6.66	5.00	-	-	
		Dough stage	0.00	0.00	25.71	5.00	-	-	
	Jagdhari	VL 149	Maturity	0.00	0.00	6.66	5.00	-	-
		Local	Maturity	0.00	3.40	20.00	5.00	-	-
	Nakot	Local	Maturity	0.00	5.80	23.33	5.00	-	-
	Neri	Local	Maturity	0.00	12.66	25.74	5.00	-	-
	Tikhon	Local	Maturity	0.00	14.71	23.33	5.00	-	-
	Bhans Koti	Local	Maturity	0.00	14.28	33.33	5.00	-	-
	Bamrari	Local	Maturity	0.00	12.33	26.66	5.00	-	-
	Kamand	Local	Maturity	0.00	6.66	25.16	5.00	-	-
	Majholi	Local	Maturity	0.00	0.00	25.71	5.00	-	-
	Sankari	Local	Maturity	1.00	2.33	16.66	5.00	-	-
	Thouldhar	Local	Maturity	0.00	0.00	23.33	5.00	-	-
	Kyulagi	Local	Maturity	0.00	0.00	25.71	5.00	-	-
	Kandikhal	Local	Dough stage	0.00	6.66	16.66	5.00	-	-
	Sunar gaon	Local	Dough stage	0.00	10.00	23.33	5.00	-	-
	Dobari	Local	Maturity	0.00	12.66	25.74	5.00	-	-
	Kotdwara	Local	Maturity	0.00	14.71	23.33	5.00	-	-
	Kainchhu	Local	Maturity	0.00	14.28	33.33	5.00	-	-
	Dargi	Local	Maturity	0.00	12.33	26.66	5.00	-	-
	Dharkot	Local	Dough stage	0.00	7.94	16.66	5.00	-	-
Deoprayarg	Chaka	Local	Maturity	0.00	10.00	26.66	5.00	-	-
	Amni	Local	Maturity	0.00	13.33	33.33	5.00	-	-
	Bharpur	Local	Maturity	0.00	10.00	25.00	5.00	-	-
	Jogad gaon	Local	Maturity	0.00	10.00	26.66	5.00	-	-
	Dandeli	Local	Maturity	0.00	10.00	33.33	5.00	-	-

Contd... Table 1

Table 1 contd..

Ghansali	Jyundana	Local	Maturity	0.00	6.66	26.66	5.00	-	-
	Silyara	Local	Maturity	0.00	10.00	23.33	5.00	-	-
	Srikot	Local	Maturity	0.00	13.33	33.33	5.00	-	-
Narendra	Gaind	Local	Vegetative phase	3.00	-	-	3.00	-	-
Nagar		Local	Maturity	0.00	6.66	33.33	5.00	-	-
	Pali	Local	Vegetative phase	2.00	-	-	2.00	-	-
		Local	Maturity	0.00	5.66	25.00	5.00	-	-
	Pokhari	Local	Vegetative phase	3.00	-	-	3.00	-	-
Dhanaulti		Local	Maturity	0.00	10.00	26.66	5.00	-	-
	Almas	Local	Maturity	0.00	10.00	33.33	5.00	-	-
	Rautu ki beli	Local	Maturity	0.00	10.00	26.66	5.00	-	-
	Jaunpur	Local	Maturity	0.00	6.66	13.33	5.00	-	-
	Thatyur	Local	Maturity	0.00	10.00	13.33	5.00	-	-
Jakhnidhar	Marara	Local	Maturity	0.00	10.00	16.66	5.00	-	-
	Kot	Local	Maturity	0.00	6.66	16.66	5.00	-	-
	Koti	Local	Maturity	0.00	13.33	33.33	5.00	-	-
	Barkot	Local	Maturity	0.00	6.66	26.66	5.00	-	-
	Garakot	Local	Maturity	0.00	16.66	33.33	4.00	-	-
Pratap Nagar	Madan negi	Local	Maturity	0.00	6.66	26.66	5.00	-	-
	Rindol	Local	Maturity	0.00	10.00	33.33	5.00	-	-
	Rajakhet	Local	Maturity	0.00	10.00	26.66	5.00	-	-
	Manjkhet	Local	Maturity	0.00	6.66	16.66	5.00	-	-

* Recorded for first time in Uttarakhand (Kumar *et al.*, 2007)

** Recorded for the first time in Uttarakhand (Kumar and Prasad, 2010.)

presented in Table 2 revealed that the variety PRJ 1 is free from grain smut disease and highly resistant to other diseases. The incidence of grain smut ranged from 0.00 to 53.33 per cent however, highest 53.33 per cent was recorded at Bhanskoti and Kyulagi villages in tehri tehsil. Present findings on grain smut are in conformity with the work of Pawar *et al.* (1982) who reported that in nature, grain smut incidence has been found to range from 0 - 75 per cent on different species of barnyard millet.

Head smut was noticed only in experimental trials at Gaja (3.33%) and Ranichauri (6.66%), in variety VL 207. The leaf blight grade ranged between 1.00 and 5.0, however, at most of the places 5.0 disease grade was recorded. The incidence of sheath blight ranged from 0.00 to 7.39 per cent being highest in experimental trial of plant breeding in variety PRJ 1. As mentioned earlier that the disease was noticed for the first time in 2009. Search for the literature revealed that the disease has not been recorded in barnyard anywhere across the world. Therefore, it should be considered as a first record in this crop.

The differences in disease incidence were noticed

at different place and in different varieties. Interestingly sheath blight was noticed only in variety PRJ 1. The variety PRJ 1 belongs to species, *Echinochloa crusgalli* ssp. *utilis*, which is different from the commonly grown species *E. frumentacea*. PRJ 1 is selection from germplasm, IEC 542 maintained at ICRISAT India and is a medium duration variety suitable for mid hill conditions. Due to its thermo-sensitive nature the variety does not perform well in southern plains and in low hills or valleys (Yadav *et al.*, 2010). This may be because of the resistance in *crusgalli* type of variety that is absent in *frumentacea* types. The results are in conformity with the Yadav *et al.* (2010) who reported high resistance in PRJ 1 to brown spot or blight, grain smut and head smut under various AICRP trials.

Head smut was confined only to experimental fields may be because that the disease is seed borne and the germplasm sent by the co-ordinating unit for evaluation under AICRP trial might carried the pathogen with seed.

Diseases of foxtail millet :

In Uttarakhand, the cultivation of foxtail millet as soul crop is very rare. The variety PRK 1 is the only

Table 2 : Prevalence, incidence and severity of barnyard millet diseases in different varieties at different places in Uttarakhand (highest of six seasons 2007-2012)

Tehsils	Place/village	Variety	Crop stage	Grain smut (%)	Head smut (%)	Leaf blight (G)	Sheath blight (%)	
Tehri	Gaja Research Station	PRJ 1	Maturity	0.00	0.00	3.00	6.66**	
		VL 207	Maturity	26.66	3.33	5.00	0.00	
	Hill Campus, Ranichauri, Plant Pathology	VL 207	Vegetative phase	0.00	0.00	3.00	0.00	
		VL 207	Maturity	36.66	6.66*	5.00	0.00	
	Hill Campus, Ranichauri, Plant Breeding	VL 224	Maturity	13.88	0.00	5.00	0.00	
		VL 172	Maturity	17.78	0.00	4.00	0.00	
		VL 207	Maturity	26.66	0.00	5.00	0.00	
		PRB 903	Maturity	0.00	0.00	2.00	0.00	
		VL 228	Maturity	23.33	0.00	4.00	0.00	
		PRJ 1	Maturity	0.00	0.00	3.00	7.39	
		VL 223	Maturity	10.00	0.00	5.00	0.00	
		PRB 905	Maturity	0.00	0.00	1.00	0.00	
		PRB 904	Maturity	0.00	0.00	1.00	0.00	
		VL 229	Maturity	15.00	0.00	0.00	0.00	
		Gaind	PRJ 1	Maturity	0.00	0.00	2.00	0.03
			Local	Maturity	33.33	0.00	4.00	0.00
		Jagdhari	PRJ 1	Maturity	0.00	0.00	1.00	0.00
			Local	Maturity	13.33	0.00	1.00	0.00
		Nakot	Local	Maturity	26.66	0.00	4.00	0.00
		Neri	Local	Maturity	33.33	0.00	5.00	0.00
		Tikhon	Local	Maturity	36.66	0.00	5.00	0.00
		Bhainskoti	Local	Maturity	53.33	0.00	5.00	0.00
		Bamrarhi	Local	Maturity	23.33	0.00	5.00	0.00
		Kamand	Local	Maturity	43.66	0.00	5.00	0.00
		Manjoli	Local	Maturity	46.66	0.00	5.00	0.00
		Sankari	Local	Maturity	36.66	0.00	5.00	0.00
		Thouldhar	Local	Maturity	33.33	0.00	5.00	0.00
		Kyulagi	Local	Maturity	53.33	0.00	5.00	0.00
		Ovary	Local	Maturity	23.33	0.00	5.00	0.00
		Kotdwara	Local	Maturity	26.66	0.00	5.00	0.00
		Kainchu	Local	Maturity	16.66	0.00	5.00	0.00
		Dargi	PRJ 1	Maturity	0.00	0.00	2.00	0.00
		Dharkot	Local	Maturity	26.66	0.00	4.00	0.00
	Ratnagarh	Local	Maturity	16.66	0.00	4.00	0.00	
	Kamand	Local	Maturity	23.66	0.00	5.00	0.00	
	Kandikhal	Local	Maturity	33.33	0.00	5.00	0.00	
	Sunar gaon	Local	Maturity	26.66	0.00	5.00	0.00	
Jakhnidhar	Kot	Local	Maturity	26.66	0.00	5.00	0.00	
	Koti	Local	Maturity	26.66	0.00	5.00	0.00	
	Barkot	Local	Maturity	26.66	0.00	5.00	0.00	
	Garakot	Local	Maturity	10.00	0.00	4.00	0.00	
Deoprayag	Chaka	Local	Maturity	26.66	0.00	5.00	0.00	
	Amni	Local	Maturity	25.00	0.00	4.00	0.00	
	Bharpur	Local	Maturity	33.33	0.00	4.00	0.00	
	Jogad gaon	Local	Maturity	25.00	0.00	5.00	0.00	
	Dandeli	Local	Maturity	33.33	0.00	5.00	0.00	

Contd....Table 2

Table 2 contd...

Ghansali	Jyudana	Local	Maturity	25.00	0.00	4.00	0.00
	Silyara	Local	Maturity	26.66	0.00	5.00	0.00
	Srikot	Local	Maturity	33.33	0.00	5.00	0.00
Dhanulti	Rautu ki beli	Local	Maturity	26.66	0.00	5.00	0.00
	Jaunpur	Local	Maturity	16.66	0.00	5.00	0.00
	Thatyur	Local	Maturity	23.66	0.00	5.00	0.00
	Marara	Local	Maturity	33.33	0.00	5.00	0.00
Narendra Nagar	Gaind	PRJ 1	Maturity	0.00	0.00	1.50	3.33
		Local	Maturity	33.33	0.00	4.00	0.00
	Pali	PRJ 1	Maturity	0.00	0.00	1.00	1.66
		Local	Maturity	26.66	0.00	5.00	0.00
	Pokhari	PRJ 1	Maturity	0.00	0.00	1.00	1.66
		Local	Maturity	33.33	0.00	5.00	0.00
Pratap Nagar	Madan Negi	Local	Maturity	6.66	0.00	5.00	0.00
	Rindol	Local	Maturity	16.66	0.00	5.00	0.00
	Rajakhet	Local	Maturity	10.00	0.00	5.00	0.00
	Manjkhet	Local	Maturity	26.66	0.00	5.00	0.00

* Recorded for the first time in Uttarakhand (Kumar *et al.*, 2007)

** Recorded for the first time in Uttarakhand (Kumar and Prasad, 2009)

Table 3 : Incidence and severity of foxtail millet diseases at Ranichauri under AICRP experiments (highest of six seasons during 2007-2012)

Tehsil	Place	Variety	Crop stage	Blast (G)	Leaf blight (G)	Smut (%)
Tehri	Hill Campus,	PRK 1	Vegetative phase	2.0	3.0	0.0
	Ranichauri, Plant	PRK 1	Maturity	5.0	5.0	0.0
	Pathology	Unknown (FAVT trial)	Maturity	2.0	2.0-5.0	0.0-75.0*

* Recorded for the first time in Uttarakhand (Kumar, 2011)

Table 4 : Incidence and severity of proso millet diseases at Ranichauri under AICRP experiments (highest of six seasons during 2007-2012)

Tehsil	Place	Variety	Crop stage	Leaf blight (G)	Grain smut (%)	Sheath blight (%)
Tehri	Hill Campus, Ranichauri, Plant	PRC 1	Vegetative phase	2.00	0.00	6.66*
	Pathology	PRC 1	Maturity	5.00	0.00	13.33

* Recorded for the first time in Uttarakhand (Kumar and Prasad, 2010).

variety recommended for cultivation in the state. It is mostly grown around the borders of rice or other *Kharif* crops. Therefore, the survey was restricted only to the experimental fields at Ranichauri. During surveys, blast, leaf blight and smut diseases were noticed. The blast and leaf blight grades ranged between 0 and 5.0 being highest in variety PRK 1 in plant pathology experimental trials. However, the smut disease was recorded for the first time in Uttarakhand in experimental trails of plant pathology (Kumar, 2011). The smut incidence was ranged from 0 to 75.00 per cent in different varieties under foxtail millet advanced varietal trial (FAVT) during 2010. However, the disease did not appear in different crop

season during the study period may be because that the disease is seed borne and the germplasm sent by the coordinating unit for evaluation under AICRP trial in 2010 might carried the pathogen with seed.

Diseases of proso millet :

Proso millet was grown earlier as catch crop after wheat in Uttarakhand but now the cultivation of proso millet is almost abandoned in the state. The survey was confined to the experimental trials conducted at Ranichauri. PRC 1 is the only variety released for cultivation in Uttarakhand. During survey, leaf blight and grain smut were targeted as these diseases have been

noticed by earlier workers previously (Kumar *et al.*, 2007a). The leaf blight was recorded in the disease grade ranged between 1.0 and 5.0. However, the incidence of sheath blight in proso millet was also recorded for the first time in Uttarakhand (Kumar and Prasad, 2010) (Table 4).

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