

CROP DISEASE SITUATION AND SOME NEW RECORDS IN INDIAN ARID ZONE

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ABSTRACT

Surveys of plant diseases were undertaken during 1977-1984 in the arid zones of Rajasthan. A comprehensive plant-wise list of commonly occurring fungi, bacteria and viruses is given and includes 28 new host records. Root rots, wilts, ergot, blight, and powdery and downy mildews were the most frequent and severe diseases on different hosts. Maximum yield loss (75.36%) was recorded due to yellow mosaic virus on moth bean, followed by downy mildew of pearl millet (50.15%) and bacterial blight of clusterbean (50%). Agroclimatic factors influencing root rots, ergot and mildews development are also indicated.

INTRODUCTION

Crop production in arid zone of Rajasthan is problematic owing to low and erratic rainfall, high evapo-transpiration, low fertility and poor moisture retention of sandy soils and ravages of insect pests and diseases. So far very little information is available pertaining to plant diseases of important crops of Indian desert, their severity, extent of losses and associated pathogens. In this paper, we report these aspects of plant diseases alongwith some new host records.

MATERIAL AND METHODS

Surveys of important districts of arid areas of Rajasthan State viz., Jodhpur, Jaisalmer, Bikaner, Barmer, Pali and Nagaur were conducted during the year 1977 to 1984 to record prevalence and severity of diseases on important crops grown under different seasons at farmers fields. Disease samples and seeds were collected and inoculations were done on potato Dextrose Agar and Nutrient Agar for fungi and bacteria, respectively. Associated organisms were identified at the Plant Pathology Laboratory, Central Arid Zone Research Institute, Jodhpur or sent to the Commonwealth Mycological Institute, London. Pathogenicity of the fungal pathogens isolated from the plants was established on their respective hosts by standard techniques.

Intensity and losses due to more prevalent diseases of important crops were studied by conducting experiments at Central Research Farm of the Institute on suscep-

tible commercial/local varieties (Table 2) of Pearl millet [*Pennisetum typhoides* Burm. f. Stapf. and Hubb.], Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.), Moth bean [*Vigna aconitifolia* (L.) Walp.] and Sesame (*Sesamum indicum* L.) in rainy season and on cumin (*Cuminum cyminum* L.) in winter season from 1980 to 1983. These crops were grown in separate plots of 4m x 3m size (6 rows, 50 cm apart) with three replications. Artificial epiphytotic conditions were created for each disease as per recommended procedures.

Disease intensities were recorded as per cent mortality, or the per cent disease index as per standard ratings suggested for downy mildew, ergot and smut of pearl millet (Williams *et al.*, 1976), bacterial blight of cluster bean (Gandhi *et al.*, 1978), dry root rot of cowpea, cluster bean and sesame (Kataria and Grover, 1976), yellow mosaic of moth bean (Nene, 1972), Powdery mildew (Singh and Gupta, 1976), blight (Gemawat and Prasad, 1969) and wilt (Mathur and Prasad, 1964) of cumin.

RESULTS AND DISCUSSION

The diseases recorded and their intensity, hosts and affected plant parts, causal organisms, seed mycoflora and accession number of identified fungal cultures are listed in Table 1. A total of 102 fungi, bacteria and viruses were recorded on various hosts during the eight years of study. Out of 92 fungal hosts records (representing 35 genera), 64 are earlier reported (Bilgrami *et al.*, 1979, 1981) and 28 not so far reported on the observed hosts are new host records.

Maximum severity and yield losses by important diseases of some arid region field crops on susceptible varieties are presented in Table 2. All the diseases caused appreciable yield losses. Loss in yield as high as 75.36% by yellow mosaic virus in moth bean, 50.15% by downy mildew in pearl millet and 50% by bacterial blight in cluster bean has been estimated. Root rots, wilts, ergot, powdery and downy mildews occur more frequently than other diseases over a wide range of hosts. Agro-climatic factors conducive to their occurrence and spread are discussed hereinafter.

Root rots and wilts : (*Ganoderma lucidum*, *Macrophomina phaseolina* and *Fusarium* sp.) : These soil borne pathogens occur under conditions of moisture stress and, in older plants, possibly loss of root vigour favours infection (Lodha, 1983). Severity of *M. phaseolina* in sandy soils, owing to poor moisture retention, low organic matter low microbial population and high summer temperature, is well documented (Hsi, 1961 ; Edmunds *et al.*, 1964; Dhingra and Sinclair, 1978). Post flowering moisture stress also encourages *M. phaseolina* development in arid region (Lodha and Singh, 1984).

Ergot (*Claviceps fusiformis*) : Under congenial environmental conditions this disease has full potential to pose a major threat to pearl millet cultivation (Joshi *et al.*, 1984). Epidemiological studies have revealed that under arid conditions, daily rainfall

Table 1. Pathogens recorded on different plants in arid zones of Rajasthan

Host	Disease and plant parts infected	Pathogen	*Disease intensity	CMI accession No.
Agave (<i>Agave americana</i> L.)	Leaf spot	** <i>Hendersonula toruloides</i> Nattrass.	m	IMI 268124
Capparis [<i>Capparis decidua</i> (Forsk) Edgew.]	Stem spot	** <i>Sphaeropsis capparis</i> Ahmed.	mM	IMI 253171
Cassia (<i>Cassia angustifolia</i> Vahl.)	Root rot	** <i>Macrophomina phaseolina</i> (Tassi) Goid	mM	IMI 265456
	Leaf spot	<i>Alternaria alternata</i> (Fr.) Keissler	m	IMI 263122
Chickpea (<i>Cicer arietinum</i> L.)	Wilt	<i>Fusarium orthoceros</i> f. <i>ciceri</i> Padwick	m	
	Blight (Above-ground parts)	<i>Ascochyta rabiei</i> (Pass.) Labr.	MS	
	Leaf rust	<i>Uromyces ciceris arietini</i> (Grog.)	m	
	Root and stem rot	Jacz and Bover <i>Macrophomina phaseolina</i> (Tassi) Goid.	mM	
	"	<i>Sclerotinia sclerotiorum</i> (Lib.) Mass	mM	
Clerodendrum sp,	Root rot	<i>Ganoderma lucidum</i> (Leys.) Karst.	MS	
Clusterbean	Blight	<i>Xanthomonas campestris</i> pv	MS	
[<i>Cyamopsis tetragonoloba</i> (L.) Tanb.]	(Above-ground parts)	<i>cyamopsidis</i> (Patel, Dhande and Kulka [†] ni) Dye.	MS	
	Charcoal (root, stem)	<i>Macrophomina phaseolina</i> (Tassi) Goid.	S	
	Leaf spot	<i>Alternaria cyamopsidis</i> Ranga & Rao	m	
	"	** <i>Alternaria alternata</i> (Fr.) Keissler	m	IMI 265455
	"	<i>Fusarium equiseti</i> (Corda) Sacc.	T	
	"	<i>Myrothecium roridum</i> Tode ex fr.	T	
	Blight (Above-ground parts)	<i>Colletotrichum capsici</i> f. sp. <i>cyamopsicola</i> Desai and Prasad		
	Powdery mildew (Leaf, pod)	<i>Leveillula taurica</i> (Lev.) Arnaud	M	
	Slow wilt	<i>Neocosmospora vasinfecta</i> Smith	T	
	Root rot	** <i>Fusarium equiseti</i> (Corda) Sacc.	T	
	Seed Mycoflora	** <i>Alternaria alternata</i> (Fr.) Keissler	-	

1	2	3	4	5
	Seed Mycoflora	<i>Drechslera spicifera</i> (Bainier) Von Arx.	—	
	”	** <i>Syncephalastrum racemosum</i> Cohn ex Schroter.	—	IMI 257231b
Cowpea (<i>Vigna unguiculata</i> (L.) Walp.)	Leaf blight	<i>Xanthomonas campestris</i> pv. <i>vignicola</i> (Burk.) Dye.	M	
	Leaf spot	<i>Cercospora cruenta</i> Sacc.	M	
	”	<i>Cercospora canescens</i> Ell & Mart	M	
	”	<i>Fusarium equiseti</i> (Corda) Sacc.	m	
	”	** <i>Alternaria alternata</i> (Fr.) Keissler	m	IMI 265461
	”	** <i>Coleophoma empetri</i> (Rostrup.) Petrak	T	IMI 265466
	Charcoal rot (Stem, root)	<i>Macrophomina phaseolina</i> (Tassi) Goid.	S	
	Leaf mosaic	Cowpea mosaic virus	mM	
Cumin (<i>Cuminum cyminum</i> L.)	Wilt	<i>Fusarium oxysporum</i> f. <i>cumini</i> Prasad and Patel	S	
	Blight (Leaf, floral parts)	<i>Alternaria brunsi</i> Uppal, Patel and Kamat	S	
	Powdery mildew (Above-ground parts)	<i>Erysiphe polygoni</i> DC	S	
Date-palm (<i>Phoenix dactylifera</i> L.)	False smut (leaf)	<i>Graphiola phoenicis</i> Poit.	S	
	Stem rot	** <i>Diplodia</i> spp.	m	
	Black scorch (Leaf rachis)	** <i>Thielaviopsis</i> spp.	M	
Euphorbia (<i>Euphorbia antisiphilitica</i> Zucc.)	Stem rot	<i>Macrophomina phaseolina</i> (Tassi) Goid.	M	
Jujube [<i>Simmondsia chinensis</i> (Link) Schneider]	Root rot	<i>Rhizoctonia solani</i> Kuhen.	m	
	”	<i>Fusarium solani</i> (Mart.) Sacc.	m	
	”	** <i>Fusarium acuminatum</i> Ell. & EV.	m	IMI 257228
Jujube (<i>Ziziphus mauritiana</i> Lamk.)	Wilt	<i>Fusarium equiseti</i> (Corda) Sacc.	m	IMI 255351

1	2	3	4	5
	Powdery mildew (Leaf, fruit)	<i>Oidium erysiphoides</i> f. <i>zizyphi</i> Yen and Wang.	M	
	Spot (Leaf, fruit)	<i>Alternaria alternata</i> (Fr.) Keissler	M	IMI 265463
Mung bean <i>Vigna [radiata</i> (L.) Wilczek]	Leaf spot & root rot	** <i>Macrophomina phaseolina</i> (Tassi) Goid.	m	IMI 255348
	Leaf spot	<i>Xanthomonas campestris</i> pv. <i>phaseoli</i> Dye	M	
	„	<i>Cercospora canescens</i> Ell & Mart.	M	
	„	** <i>Fusarium equiseti</i> (Corda) Sacc.	m	IMI 263174
	Powdery mildew (Above-ground parts)	<i>Erysiphe polygoni</i> DC	m	
	Leaf blight & Root rot	<i>Macrophomina phaseolina</i> (Tassi) Goid.	m	
Mustards (<i>Brassica</i> spp.)	Leaf mosaic	Yellow mosaic virus	M	
	Leaf blight	<i>Alternaria brassicae</i> (Berk.)	M	
	White rust (Above ground parts)	<i>Albugo candida</i> (Pers) Kuntz.	m	
	Downy mildew (Leaf, floral parts)	<i>Perenospora brassicae</i> Gaum.	M	
	Powdery mildew (Above ground parts)	<i>Erysiphe polygoni</i> DC.	MS	
	Rot (Above- ground parts)	<i>Xanthomonas campestris</i> pv. <i>brassicae</i> (Pammel) Dye	MS	
Pearl millet [<i>Pennisetum typhoides</i> (Burm.f.) Stap.f. & Hubb.]	Downy mildew & green ear (Above ground parts)	<i>Sclerospora graminicola</i> (Sacc.) Schroet.	S	
	Ergot (Ears)	<i>Claviceps fusiformis</i> Loveless	MS	
	Smut (Ears)	<i>Tolyposporium penicillariae</i> Bref.	mM	

1	2	3	4	5
	Mould (Ears)	** <i>Aspergillus phoenicis</i> (Corda) Thom.	m	IMI 255353
	Leaf rust	<i>Puccinia penniseti</i> Zimm.	m	
	Leaf spot	<i>Pyricularia penniseti</i> Prasada & Prabhu	M	
	„	<i>Curvularia penniseti</i> (Mitra) Boedijn	m	
	„	<i>Helminthosporium australiensis</i> Berg.	m	
	„	** <i>Drechslera hawaiiensis</i> Ellis	mM	IMI 255355
	„	** <i>Drechslera colocasiae</i> Tandon & Bhargava	m	IMI 255352
	„	** <i>Drechslera spicifera</i> (Bainier) Von. Arx.	m	IMI 257233
	„	** <i>Chaetomium globosum</i> Kunze ex Stendel.	m	IMI 257234
	„	** <i>Acremonium strictum</i> Games	m	IMI 267201
	Root rot	** <i>Fusarium oxysporum</i> Schlecht.	m	IMI 267201
	„	** <i>Fusarium longipes</i> Wollenw. & Reink	m	IMI 267191
	„	** <i>Fusarium equiseti</i> (Corda) Sacc.	m	IMI 267196
	Seed mycoflora	<i>Drechslera australiensis</i> Bungnicourt	—	
		<i>Curvularia penniseti</i> (Mitra) Boedijn	—	IMI 265450
		<i>Fusarium moniliformae</i> Sheld.	—	
		** <i>Syncephalastrum racemosum</i>	—	IMI 259629
		Cohn ex Schroeter	—	
		** <i>Aspergillus terreus</i> Thom.	—	IMI 259629
		<i>Aspergillus flavus</i> Link ex fries.	—	IMI 259634
		** <i>Aspergillus phoenicis</i> (Corda) Thom.	—	IMI 259633
<i>Sesame</i> (<i>Sesamum indicum</i> L.)	Phyllody (Leaf & floral parts)	Mycoplasma	S	
	Leaf spot	<i>Alternaria sesami</i> (Kawam.) Mohanty & Behera.	m	
	Leaf blight	<i>Xanthomonas campestris</i> pv <i>sesami</i> (Sobet & Dowson) Dye.	MS	
	Charcoal rot (Stem, root)	<i>Macrophomina phaseolina</i> (Tassi.) Goid.	MS	
	Powdery mildew	<i>Leveillula taurica</i> (Lev.) Arnaud.	m	
White Popinac (<i>Leucaena leucocephala</i> (Lamk.) de wit.)	Root rot	** <i>Macrophomina phaseolina</i> (Tassi) Goid.	M	IMI 263183
B. TREES	Leaf spot	** <i>Curvularia clavata</i> Jain	T	IMI 265453

1	2	3	4	5
<i>Acacia catechu</i> (L.) Wild, <i>Acacia nilotica</i> (L.f.) Wild, <i>Acacia tortilis</i> (Forsk.) Hayne, <i>Albizzia lebbek</i> (L.) Benth, <i>Albizzia procera</i> (Roxb.) Beneth, <i>Azadirachta indica</i> Juss, <i>Butea monosperma</i> (Lamk.) Taubert, <i>Cassia auriculata</i> L., <i>Delonix regia</i> (Boj.) Rat., <i>Dalbergia sisso</i> Roxb., <i>Erythrina indica</i> Lamk. and <i>Eucalyptus</i> spp.]	Root rots	<i>Ganoderma lucidum</i> (Leys.) Karst.	MS	

*m=mild, M=moderate, mM=mild to moderate, S=severe, MS=moderate to severe, T=traces.

**New records

Table 2. Disease severity and yield losses due to important diseases of some arid land crops during 1977-84

Crop	Variety	Disease	Pathogen	Severity (%)	Yield losses (%)
Clusterbean	FS 277	Dry root rot	<i>Macrophomina phaseolina</i>	31.00a	32.11
	EC 248	Bacterial blight	<i>Xanthomonas campestris</i> pv. <i>cyamopsidis</i>	72.00	50.00
Cowpea	V-8	Dry root rot	<i>M. phaseolina</i>	64.50a	—
Cumin	Local	Powdery mildew	<i>Erysiphe polygoni</i>	19.37	15.98
	„	Blight	<i>Alternaria brunsii</i>	13.90	11.30
	„	Wilt	<i>Fusarium oxysporum</i> f. <i>cumini</i>	40.07a	36.35
Mothbean	T-23	Yellow mosaic	as per cent mortality	60.25	75.36
Pearl millet	HB 3	Downy mildew	<i>Sclerospora graminicola</i>	57.20	50.15
	BJ 104	Ergot	<i>Claviceps fusiformis</i>	29.33	—
	BJ 104	Smut	<i>Tolyposporium penicillariae</i>	18.00	—
Teasme	T-13	Dry root rot	<i>M. phaseolina</i>	43.89a	45.86

a severity expressed

able commercial/local varieties (Table 2) of Pearl millet [*Pennisetum typhoides* Burm. 12 mm, relative humidity 75 per cent, atmospheric temperature around 20°C and sunshine 6 hours from protogyny to early anthesis period, are optimum for the development of ergot (Gupta *et al.*, 1983).

Powdery mildews (*Leveillula taurica*, *Erysiphe polygoni* and *Oidium* sp.) : Warm temperatures (28°C–35°C), dry weather and moisture stress favour the severe development and rapid spread of disease particularly in the months of February, March and October. High water content of the fungal conidia enables them to withstand such conditions.

Downy mildews (*Sclerospora graminicola*, *Perenospora brassicae*) : Highly humid and cloudy weather with intermittent sunlight favour development of downy mildew. In pearl millet, sequential monocropping, which favours consistent inoculum build-up, augments the disease year after year.

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