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Prevalence of Emerging Disease of Macrophomina Stem Canker of Pigeonpea in North Eastern Karnataka, India

Swamy Chikkanna, M. K. Naik, Y. S. Amaresh, S. K. Jayalakshmi

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Abstract Pigeonpea [*Cajanus cajan* (L.) Mill spaugh] is one of the major legume crops grown in the tropics and sub tropics. Gulbarga is a very potential district in the country for extensive cultivation of pigeonpea. Macrophomina stem canker (MSC) caused by *Macrophomina phaseolina* (Tassi) Goid is an emerging disease of pigeonpea in North Eastern Karnataka causing considerable economic losses. An intensive roving survey was conducted during of *kharif* 2013 of pigeonpea crop in farmer's field at various districts of North Eastern Karnataka viz. Raichur, Yadgiri, Gulbarga and Bidar to know the status of MSC of pigeonpea. The MSC incidence ranged from 0.33 to 77.33%, Prevalence of MSC was highest in Gulbarga district (25.02%) followed by Bidar (18.11%), Raichur (3.49%) and the least in Yadgir (2.10%). In Gulbarga, the highest incidence (77.33%) was noticed in Gulbarga followed by Telakuni (40.0%) and Hudgi (40.0%). Least incidence was observed in Karigudda (0.33%) of Raichur district and Yargal (0.33%) of Yadgiri district. The highest average numner of lesions and lesion length per plant were recorded in ARS Gulbarga with 26.30 and 6.23 cm respectively and lesions were observed from basal stem to tip of the plant. Disease was more prominent in moisture stress and prolonged dry spell condition during the maturity stage of crop. During survey higher disease incidence of MSC was noticed in TS-3R grown areas compared to other cultivars.

Keywords Macrophomina stem canker, *Macrophomina phaseolina*, Pigeonpea, Roving survey.

Introduction

Pigeonpea [*Cajanus cajan* (L.) Mill spaugh] is one of the major legume crops grown in the tropics and sub tropics which accounts for about five percent of world legume production. India is largest producer of pigeonpea. It is mainly consumed as split pulse as 'dal' or fresh vegetable (de-hulled split peas) in some parts of India such as Gujrat, Maharashtra and Karnataka or as green vegetable in various states [1]. Gulbarga is a very potential district in the country for extensive cultivation of pigeonpea. It is also grown in Bidar, Bijapur, Dharwad, Bellary and Belgaum districts

S. Chikkanna*, M. K. Naik, Y. S. Amaresh
Department of Plant Pathology,
AC, Raichur, UAS, Raichur 584104,
Karnataka, India

S. K. Jayalakshmi
Department of Plant Pathology,
AC, Gulbarga, UAS, Raichur 584104,
Karnataka, India
e-mail : chikka8hbr@gmail.com
*Correspondence

of Northern Karnataka. Pigeonpea is affected by several abiotic (water-logging, drought, temperature, photoperiodisim, mineral deficing) and biotic stresses (fungal pathogens, insects and storage pests) that limit the realization of true potential of yield. The most idespread and destructive of which is *Fusarium* wilt (*Fusarium udum* Butler), sterility mosaic and *Phytophthora* blight (*Phytophthora drechsleri* f.sp. *cajani*) which are important in India and *Cercospora* leaf spot can cause serious losses under humid conditions in Asia and Africa [2]. Stem canker incited by *Macrophomina phaseolina* (Tassi) Goid has emerged as one of the very important diseases of pigeonpea.

Macrophomina stem canker of pigeonpea caused by *Macrophomina phaseolina* is primarily soil borne that incites disease by producing microsclerotia/pycnidia. It infects a wide host range of approximately 500 species from 75 plant families. It causes stem canker, seedling blight, charcoal rot, stem rot and root rot diseases in various crops. Hot (>30°C) and dry weather encourage disease development which is more prevalent on vertisols than alfisols. Rain after a prolonged dry spell pre-disposes plants to the disease. The pathogen poses a great problem in pigeonpea cultivation and causes considerable loss. The pathogen has a wide host range and survives in the form of microsclerotia in soil and pycnidia in plant debris. First report of Macrophomina Stem Canker occurrence was reported by Karmaiyan et al. [3] in the part of Eastern Uttar Pradesh (Varanasi and Mirzapur districts). The disease incidence varied from 2 to 70% in most fields and its severity ranged from 17 to 55% in the aforesaid regions of Eastern Uttar Pradesh [4]. In Northern Karnataka, there is no earlier report on Macrophomina Stem Canker of pigeonpea but recent year's disease was more sever in pigeonpea growing parts of Karnataka [5] and knowledge of their occurrence, distribution and environmental variables that affect the disease is lacking. Hence, a survey was undertaken to know the severity and distribution of stem canker disease of pigeonpea in North Eastern Karnataka region.

Materials and Methods

An intensive roving survey was conducted during 2013 near maturity stage of crop in the farmer's field at Raichur, Yadgir, Gulbarga and Bidar districts. In each district, a minimum of three taluks and four villages in each taluks and three fields per villages were randomly selected at the interval of 5–10 km along the roadside, number of diseased and healthy plants were counted and incidence of disease was calculated. The per cent disease prevalence was calculated using following fromula:

$$\text{Percent disease incidence} = \frac{\text{Number of plants infected}}{\text{Total number of plants examined}} \times 100$$

Plants showing typical symptoms of stem canker with spindle shaped lesion on stems with numerous pycnidial bodies. From the surveyed area were collected for disease diagnosis and confirmation of the pathogen. A fungus was isolated aseptically from diseased parts on potato dextrose agar medium. The plates were incubated at 30 ± 1°C for growth and development of fungus. Koch's postulate was proved by cellophane tape method and stem detached technique [6, 7] and the identity was also confirmed by amplification and sequencing of ITS rDNA by NCBI, BLAST. Meteorological data for the year 2013-14 were obtained from the ARS, Gulbarga, University of agricultural science, Raichur.

Results and Discussion

The survey conducted during *kharif* season of 2013, Macrophomina Stem Canker varied from locality to locality, obviously due to different soil conditions, cultivars used, cultivation practices and environmental conditions prevailing over these tracts. The mean maximum Macrophomina Stem Canker incidence was observed in Gulbarga district (25.02%) followed by Bidar (18.11%), Raichur (3.49%) and the least (2.10%) was in Yadgir (Table 1). In Gulbarga, the highest incidence (77.33%) was noticed in Agriculture Research Station (ARS), Gulbarga and the least (10.67%) was in Handarki village. However, in Bidar district, the maximum incidence was noticed in Hudgi (48.00%) and the least was (0.6%) in Hankuni village. The maximum incidence in Raichur was in Yergera (10.30%) and least was in Karigudda (0.33%). However, in Yadgir district lowest incidence was recorded in Yargal

Table 1. Incidence and PDI of Macrophomina Stem Canker (MSC) of pigeonpea in North Eastern Karnataka during *kharif*.

Sl. No.	District	Villages	Variety	(Percent incidence) MSC	PDI of MSC	Average No. of lesions/plant	Average lesion length/plant (cm)
1.	Raichur	UAS, Raichur	TS-JR	6.30	12.88	3.30	2.3
		Yergera	Gulyal red	10.30	14.46	4.30	2.63
		Chickasugar	Local	3.30	12.88	3.30	2.63
		Jambaladinni	Kari togari	4.60	13.77	2.60	1.26
		Kavithal	Kari togari	3.30	13.77	3.00	2.06
		Mallat	Kari togari	2.60	12.00	2.30	1.76
		Kallur	TS-3R	1.30	13.77	2.60	1.46
		Kurdi	TS-3R	3.00	12.00	1.30	1.76
		Jakkaldinni	TS-3R	4.60	13.77	2.00	2.13
		Karigudda	Local	0.33	12.00	1.30	0.93
		Jalahalli	Kari togari	1.30	13.77	2.30	1.8
		Alkoda	Local	1.00	12.00	1.00	1.46
		Mean		3.52	13.08	2.44	1.84
2.	Yadgir	Yargal	Local	0.33	12.00	0.60	0.63
		Gunjanaru	Local	3.00	12.00	1.30	1.63
		Konapal	Kari togari	5.00	13.77	2.00	1.86
		Gajarkote	Local	3.30	12.00	2.30	1.36
		B. Gudi	TS-3R	2.00	12.00	3.60	2.13
		Mudabala	Local	1.60	13.70	2.30	2.56
		Gogi	TS-3R	2.60	12.00	1.30	2.46
		Madaraki	Kattibeeja	2.00	12.00	2.30	2.93
		Shorapur	TS-3R	0.60	13.77	1.30	2.73
		Mallaburjaka	Local	2.00	12.00	2.30	2.46
		Yalagi	Kari togari	1.60	12.00	1.30	3.30
		Chamanahala	Kattibeeja	1.30	12.00	2.00	2.30
		Mean		2.13	12.43	1.88	2.19
3.	Gulbarga	ARS, Gulbarga	TS-3R	77.33	55.55	26.30	6.23
		Shirasigi	TS-3R	12.67	17.77	4.60	3.30
		Bimalli	TS-3R	28.67	27.55	6.30	3.7
		Hirapur	TS-3R	12.67	18.22	5.00	2.63
		Kadaganchi	TS-3R	13.33	20.00	7.60	2.10
		Telakarni	TS-3R	48.00	52.00	17.30	1.90
		Honnahalli	TS-3R	22.67	20.00	10.00	3.16
		Padavasavali	Gulyal red	18.00	13.77	2.00	2.60
		Ramateerta	TS-3R	46.00	52.00	5.00	3.30
		Diggao	TS-3R	28.00	27.12	6.00	3.43
		Dandoti	TS-3R	19.67	18.22	4.60	3.06
		Halakatti	Local	20.67	27.55	5.30	3.86
		Kodla	TS-3R	13.00	18.22	2.30	3.03
		Adaki	Kari togari	15.00	16.44	3.00	2.40
		Handarki	TS-3R	10.67	14.66	3.00	2.40
		Neelhalli	TS-3R	14.00	16.64	3.00	2.30
		Mean		25.02	26.38	7.22	3.14

(0.33%) village and highest was found in Konapal with 5% incidence. The overall incidence of MSC ranged from 0.33 to 77.33% across the districts and taluks.

The highest average number of lesions and lesion length were recorded in ARS Gulbarga with 26.30 and 6.23 cm respectively (Table 1). In ARS, Gulbarga two years old perennial plant produced 89 lesions on a single plant with maximum lesion length of 13.60 cm with splitting of most of basal stem of lesions. During

survey higher disease incidence of MSC was noticed in TS-3R grown areas compared to other cultivars (Table 1).

Highest incidence of Macrophomina Stem Canker was noticed in Gulbarga district mainly enhanced by moisture stress and prolonged dry spell during the maturity stage (November to December). The pigeonpea crop entirely depends upon the rainfall. Since 2011, there has been prolonged dry spell during the maturity and variation in weather parameters which affected growth and development of disease. The average temperature of 30.04°C and prolonged dry spell (19.20 mm rainfall) from flowering to harvesting stage in Gulbarga during November 2013 to February 2014 (data collected from ARS, Gulbarga, UASR) might have led to enhanced disease during maturity stage. Present investigation corroborate the results of earlier presenting authors [8—10]. Monocropping with closer spacing and also drought and high temperature increased the vulnerability of the crop and enhanced the aggressiveness of the pathogen [10, 11]. Interestingly, more number lesions were observed in a closer cropping system with higher incidence of drying of branches but few lesions with increased of lesion length was common in wider spaced crop.

During the survey of the fields, most of the fields were having mono cropped pigeonpea which might have led to the increase in pathogen population of *M. phaseolina*. In addition heaping of uprooted stem in around the bunds of farmers field during the summer is another reason for activating the pycnidia during rainy season. Thus the infection progressed during early planted crop during favorable condition. Hence, higher incidence of MSC was noticed in Gulbarga and particularly ARS, Gulbarga is one of the "hot spot" for recurrence of Macrophomina Stem Canker. That would be the reason for increases severity.

The Macrophomina Stem Canker which has increased gradually in recent years to reach an alarming proportion. This has increased the responsibilities of the scientific communities in agriculture to come forward for rescue of the farmers and sincere efforts are needed to elucidate the impact of different weather parameters on the epidemic of the pathogen.

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