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Survey of Incidence of Pigeonpea Cyst Nematode (*Heterodera cajani*) and Wilt Complex of Pigeonpea in parts of North Eastern Karnataka

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ABSTRACT

Pigeonpea (Cajanus cajan) is an important crop being cultivated in semiarid tropics particularly in Indian subcontinents, Southern and Eastern Africa. A roving survey for incidence of cyst nematode and wilt complex in pigeonpea was taken up during 2015 at different places of North Eastern Karnataka. Soil and roots were collected from the rhizosphere of infested pigeonpea plants. Randomly 10 plants selected in different locations in a field and numbers of plants wilted were counted and the mean wilt incidence was expressed in percentage. The soil was mixed thoroughly and 250 g of soil was processed following Cobb's sieving and decanting method where cyst and J_2's were separated in separate mesh size sieves. The survey results revealed that in Raichur district, maximum disease incidence was observed in Shaktinagar village of Raichur taluk (12%) followed by Gabbur of Deodurg taluk (10.5%) and lowest was in UAS campus Raichur (7%). In Yadgir district, maximum disease incidence was observed in Alishnagar village of Shahapur taluk (16.5%) followed by Gurmitkal village of Yadgir taluk and lowest was in Doranhalli village of Shahapur taluk (8.5%). In Kalaburgi district, maximum disease incidence was observed in Kanadal village of Kalaburgi taluk (20%) followed by Neelalli village of Sedam taluk (16.5%) and lowest was in ARS, Kalaburgi (5%). In Bidar district, maximum disease incidence was observed in Hallikheda (B) village of Humnabad taluk (13.5%) followed by Janawad village of Bidar taluk (13%) and lowest was in Chitguppa village of Humnabad taluk (7%).

Key words: *Cajanus cajan, cyst, Fusarium udum, Heterodera cajani, Wilt complex.*

INTRODUCTION

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is major pulse crop of India providing for much of the protein supplement to vegetarian population[14]. Pigeonpea is a very drought resistant, so can be grown in areas with less than 650 mm annual rainfall. In India, it is one of the very important grain legumes and occupies second position in area and production next to chickpea. It is mainly grown in the states of Maharashtra, Karnataka, Uttar Pradesh, Madhya Pradesh and Gujarat.

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In India, pigeonpea is cultivated in an area of about 36.3 lakh ha with an annual production of 27.6 lakh tonnes averaging a productivity of 760.33 kg/ha[2]. India accounts for 72 per cent of global output of pigeon pea with 3.15 million tons production from 3.53 m ha area[1] and productivity 697 kg/ha. There are several constraints for the production of pulses, among them plant parasitic nematodes associated with wilt causing fungi is one of the major factors affecting the productivity of pulses. Among the nematodes pigeon pea cyst nematode, *Heterodera cajani* Koshy, is the most important nematode pest of pigeonpea in India which cause pearly root disease on affected hosts, where 90 per cent of worlds pigeonpea is cultivated[10]. The crop suffers 13.2 per cent worldwide loss due to plant parasitic nematodes[8]. Among the diseases, wilt caused by *Fusarium udum* is the most important soil borne disease. The disease appears on young seedlings but the highest mortality occurs during flowering and podding stage[5]. The disease is reported to cause 30-100 per cent loss in grain yield[7] and may cause 100 per cent yield losses in susceptible genotypes. The annual losses due to wilt have been estimated at $71 million in India and $5 million in eastern Africa. The survey on complex disease involving nematode and fungus is very rare and inadequate so to know the present status of pigeonpea cyst nematode and wilt complex, survey has been carried out. A roving survey for incidence of cyst nematode and wilt complex in pigeonpea was taken up during 2015 at different places of North Eastern Karnataka (Kalaburgi, Bidar, Raichur and Yadgir).

MATERIAL AND METHODS

A roving (random) survey for incidence of pigeonpea cyst nematode and *Fusarium* wilt complex in pigeonpea was taken up during September-October in 2015 at different places of North Eastern Karnataka. Infected samples and roots were collected from the rhizospheres of pigeonpea plants. In the similar manner, totally 10 spots were selected randomly for taking infected soil and plant samples representing the whole field. Later from this, a composite sample of 250 g of soil was formed. For survey randomly 100 plants were selected in different locations in a field and number of plants wilted was counted and the mean wilt incidence was expressed in percentage. The per cent disease incidence was calculated by using the formula:

$$\textbf{Per cent disease incidence} = \frac{\text{Number of plants affected}}{\text{Total number of plants observed}} \times 100$$

Each sample was taken separately in polythene bags and tied with a rubber band and labeled immediately. Information pertaining to the locality, crop history, stage of the crop *etc.* was also noted along with the samples. Samples of soil and roots were analyzed on the same day of collection or after keeping for a few days under refrigerated conditions. The soil was mixed thoroughly and 200 cc of soil was processed following Cobb's sieving and decanting method[3] followed by modified Baermann's funnel method[9].

RESULTS AND DISCUSSION

The survey results revealed the distribution of pigeonpea cyst nematode and wilt complex (N+F) in pigeonpea growing districts of North Eastern Karnataka. In Raichur district, maximum disease incidence was observed in Shaktinagar village of Raichur taluk (12.0%) followed by Gabbur of Deodurga taluk (10.5%) and lowest was in UAS campus, Raichur (7.0%). In Yadgir district, maximum disease incidence was observed in Alishnagar village of Shahapur taluk (16.5%) followed by Gurmitkal village of Yadgir taluk and lowest was in Doranahalli village of Shahapur taluk (8.5%). In Kalaburgi district, maximum disease incidence was observed in Kanadal village of Kalaburgi taluk (20.0%) followed by Neelalli village of Sedam taluk (16.5%) and lowest was in ARS, Kalaburgi

(5.0%). In Bidar district, maximum disease incidence was observed in Hallikheda (B) village of Humnabad taluk (13.5%) followed by Janawad village of Bidar taluk (13.0%) and lowest was in Chitguppa village of Humnabad taluk (5.0%).

In results, many of the areas were affected by only *Fusarium* wilt where cyst nematodes were absent. Here, highest wilt incidence was observed in Boral (12.0%), Aurad (11.5%) and Manthal (9.0%) villages of Bidar district followed by Sathmail (10.5%), Masarkal and Deodurga (8.5%) villages of Raichur district and least in Bhimarayanagudi (9.5%) and Yargal (9.0%) villages of Yadagir district.

Among the districts surveyed, more incidence of *H. cajani* was observed in Kalaburgi district followed by Bidar and least by Raichur. The population density revealed that, Kanadal village of Kalaburgi district recorded high density of *H. cajani* (28 cysts per 250 g of soil) followed by Keribhosaga. All the villages of Kalaburgi, Chittapur, Sedam and Aland taluk of Kalaburgi district recorded medium density of cyst population except Dannur (5 cysts per 250 g of soil) village of Aland taluk which recorded low. Janawad, Hallikheda and Chitguppa villages of Bidar district recorded medium density of cysts and remaining villages having low density of cysts. Ramsamudra, Gurmitkal, Doranhalli and Alishnagar villages of Yadgir district were recorded low density of cysts. In case of Raichur district MARS farm, Shaktinagar and Gabbur villages from Raichur district recorded low density of cyst (Table 1).

Overall maximum wilt complex incidence was observed in Kalaburgi (13.04%) followed by Yadgir (7.91%), Bidar (6.82%) and least in Raichur district (4.91%) and also varied from village to village, field to field. It might be due to variety of pigeonpea, type of soil, moisture content, previous crop grown and management practices followed in the field which influences the variation in disease incidence. The population density revealed that Kanadal village of Kalaburgi district recorded high density of *H. cajani* (28 cysts per 250 g of soil) followed by Keribhosaga (18.0). Maximum cyst density was recorded in Kalaburgi and lowest in the Raichur district.

The present results are in conformity with the report of survey done by earlier workers in Karnataka and India. Infestation of pigeonpea cyst nematode, *H. cajani* in all pulse growing areas of Northern Karnataka[11] and distribution of *H. cajani* in all pulse growing districts of Northern Karnataka[4] have been reported. Shekhappa *et al*.[12] also reported *H. cajani* associated with pigeonpea in three districts *viz.* Bidar, Kalaburgi and Raichur in North Eastern Karnataka. Association of pigeonpea cyst nematode along with wilt causing fungus *Fusarium* in farmer's field at different localities in Agra, Aligarh, Bulandshahr, Hathras and Mathura districts of Uttar Pradesh have been reported by Shukla and Haseeb[13].

Wilt disease complex (*F. udum* and *H. cajani*) was most severe problem in pigeonpea cultivation. Severity of stunting, yellowing and wilting of plants appeared directly proportional to the population of pigeonpea cyst nematode, *H. cajani*. The cyst nematode was found in those fields where there was high incidence of wilt, this is due to cyst nematodes assist in development of disease by paving the way to the fungus. The reason behind the association of pigeonpea cyst nematode, *H. cajani* may be due to continuous monocropping or intercropping of pigeonpea with other pulse crops every year. Monocropping facilitates continuous availability of host to pigeonpea cyst nematode, *H. cajani* for its development and multiplication[4]. Mixed cropping with other leguminous crops provide variety of collateral host and makes them predominant thus results in increase in highest cyst population and attributing to multiplicity of the pathogenic threshold by manifolds causing heavy losses to the crops[6].

Table 1: Incidence of pigeonpea cyst nematode and wilt complex in parts of North Eastern Karnataka

District	Taluk	Village/Place	Variety	Disease incidence (%)	*H. cajani* (N)	*F. udum* (F)	N+F	Cysts	
								No. of cysts/ 250 g of soil	Density
Raichur	Raichur	MARS Farm	TS-3R	7.0	+	+	+	3.0	Low
		Sathmail	TS-3R	10.5	-	+	-	0	-
		Shaktinagar	Gulyal local	12.0	+	+	+	4.0	Low
	Mean			**9.83**				**2.33**	
	Deodurga	Gabbur	TS-3R	10.5	+	+	+	5.0	Low
		Masarkal	Local	8.5	-	+	-	0	-
		Deodurga	Maruti	8.5	-	+	-	0	-
Mean				**9.16**				**1.66**	
Yadgir	Yadgir	Ramasamudra	TS-3R	9.5	+	+	+	3.0	Low
		Gurmitkal	Karitogari	13.0	+	+	+	5.0	Low
		Yargal	TS-3R	9.0	-	+	-	0	-
	Mean			**10.5**				**2.66**	
	Shahapur	Bhimarayangudi	TS-3R	9.5	-	+	-	0	-
		Doranahalli	Katti beeja	8.5	+	+	+	2.0	Low
		Alishnagar	Gulyal local	16.5	+	+	+	5.0	Low
Mean				**11.5**				**2.33**	
Kalaburgi	Kalaburgi	ARS Farm, Kalaburgi	TS-3R	5.0	+	+	+	9.0	Medium
		Kanadal	Local	20.0	+	+	+	28.0	High
		Karibhosaga	TS-3R	17.0	+	+	+	18.0	Medium
	Mean			**14.0**				**18.33**	
	Chittapur	Sannur	TS-3R	12.0	+	+	+	12.0	Medium
		Gundagurthi	Katti beeja	16.0	+	+	+	11.0	Medium
		Ivani	Double moong	9.5	+	+	+	8.0	Medium
	Mean			**12.5**				**10.33**	
	Sedam	Malakhed	Katti beeja	15.0	+	+	+	9.0	Medium
		Huda	TS-3R	8.5	+	+	+	8.0	Medium
		Neelalli	Gulyal local	16.5	+	+	+	12.0	Medium
	Mean			**13.33**				**9.66**	
	Aland	Bhusnoor	Gulyal local	11.5	+	+	+	6.0	Medium
		Pattan	TS-3R	13.5	+	+	+	7.0	Medium
		Dannur	TS-3R	12.0	+	+	+	5.0	Low
	Mean			**12.33**				**6.0**	
Bidar	Bidar	Janawad	BSMR-736	13.0	+	+	+	13.0	Medium
		Chikpet	Maruti	10.0	+	+	+	4.0	Low
		KVK Farm, Bidar	BSMR-736	7.5	+	+	+	4.0	Low
	Mean			**10.16**				**7.0**	
	Aurad	Aurad	Gulyal local	11.5	-	+	-	0	-
		Boral	BSMR-736	12.0	-	+	-	0	-
		Koutha	TS-3R	12.0	+	+	+	3.0	Low
	Mean			**11.83**				**1.0**	
	Basavkalyan	Muchlamb	Maruti	8.0	+	+	+	5.0	Low
		Manthal	TS-3R	9.0	-	+	-	0	-
		Bettadkund	TS-3R	11.0	+	+	+	3.0	Low
	Mean			**9.33**				**2.66**	
	Humnabad	Hallikheda	Pink variety	13.5	+	+	+	8.0	Medium
		Chitguppa	BSMR-736	7.0	+	+	+	12.0	Medium
		Kudambal	TS-3R	8.5	-	+	-	0	-
	Mean			**9.66**				**6.66**	

Low : 1-5 cysts per 250 g soil, **Medium** : 6-20 cysts per 250 g soil, **High** : >20 cysts per 250 g soil

CONCLUSION

From this it could be concluded that plant parasitic nematodes and wilt causing fungi on pigeonpea constitute a very important and significant part of the soil fauna of pulse growing areas and cause a serious problem to the pigeonpea and other leguminous crops.

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