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Research Article

Severity of bacterial blight (*Xanthomonas axonopodis* pv. *vignicola*) of Cowpea in northern regions of Karnataka.

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Abstract

The survey investigation reveals that the bacterial blight disease of Cowpea during *Kharif* 2011-12 was present in all the districts surveyed and the disease intensity ranged from 2.52 to 28.47 per cent. The maximum per cent disease index was recorded in Belgaum district (14.32 PDI) followed by Gadag (13.11 PDI) and Dharwad district (11.36 PDI) due to heavy rainfall and susceptible cultivars used in these regions whereas; the least per cent disease index of 9.58 PDI was recorded in Haveri district of Karnataka.

Key Words: Survey, bacterial blight, cowpea.

INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp.] (2n=22) commonly called as Lobia, is one of the most ancient human food sources and short duration multipurpose pulse crop grown extensively in tropical and subtropical countries. It has been estimated that the total world pulse requirement for consumption is around 23 million tonnes and cowpea is grown in 10.73 million hectares with the productivity of 387 kg /ha and production of 3.84 million tonnes. In India, cowpea is grown in an area of about 1.5 million hectares with productivity of 567 kg per ha and production of 0.5 million tonnes. The productivity potential of the crop in Karnataka is 420 kg per ha (Anon, 2011). In Karnataka, cowpea varieties such as C-152 and TVX- 1839-9E are mainly grown for seed purpose while S-488, Pusa- Barsathi for vegetable purpose. Among these several constraints, losses due to pests and diseases are very high. Although, 25 to 30 per cent of total cost of production is being spent on plant protection especially pesticides, the biotic constraints could not be managed effectively. Among the diseases infecting cowpea, the bacterial disease popularly known as 'bacterial blight' caused by *Xanthomonas axonopodis* pv. *vignicola* (Burkholder,1944) Vauterin *et al.*, 1995 formerly *X. campestris* pv. *vignicola* (Burkholder, 1944) Dye is a major production constraint. The first symptoms appear on cotyledons of seedlings emerging from infected seed and look reddish and wrinkled. First necrotic lesions are formed on leaves and later the stem is attacked. The pathogen reaches vascular bundles and the disease becomes systemic. The growing tip of the infected plant is killed and the plant ultimately dies. Cankers are often developed on the stem near the union of cotyledons and first leaves (Plate 1). Such stems are unable to bear the load of the plant and easily break in strong winds.

Secondary infection on leaves appeared as light yellow circular spots which are 4 to 10 mm in diameter and scattered on the lamina. The centre of these spots is necrotic and brown. The veins are red in color. On pods, deep green or water-soaked streaks are formed. Such pods become yellow, shrivel and die. The diseased pods produce smaller, wrinkled and infected seeds (Plate 1). These infected seeds serve as the source of primary inoculum. Secondary spread is by rains, insects and implements. The disease is serious in soils with poor drainage. It causes yield loss of 2.7 - 92.2 per cent depending on susceptibility of the variety (Kishun, 1989). Even though a lot information available pertaining to incidence, disease cycle and management of bacterial blight of cowpea, the generating data that to in terms of amount and level

of incidence in various locations helps in come out with tremendous report of this disease in surmounted areas.

MATERIAL AND METHOD

To assess the extent of bacterial blight of cowpea disease severity, an intensive roving survey was conducted in major cowpea growing areas of Belgaum, Dharwad, Gadag and Haveri (Fig 1) districts of northern Karnataka during *Kharif* 2011. Then fields were assessed for bacterial blight severity by recording the disease on 0-5 disease ratings scale as furnished below (Shah *et al.*, 1991). Further PDI was calculated by using the following formula (Wheeler, 1969).

$$\text{Per cent Disease Index} = \frac{\text{Sum of individual disease ratings}}{\text{Total No. of leaves observed x Maximum grade}} \times 100$$

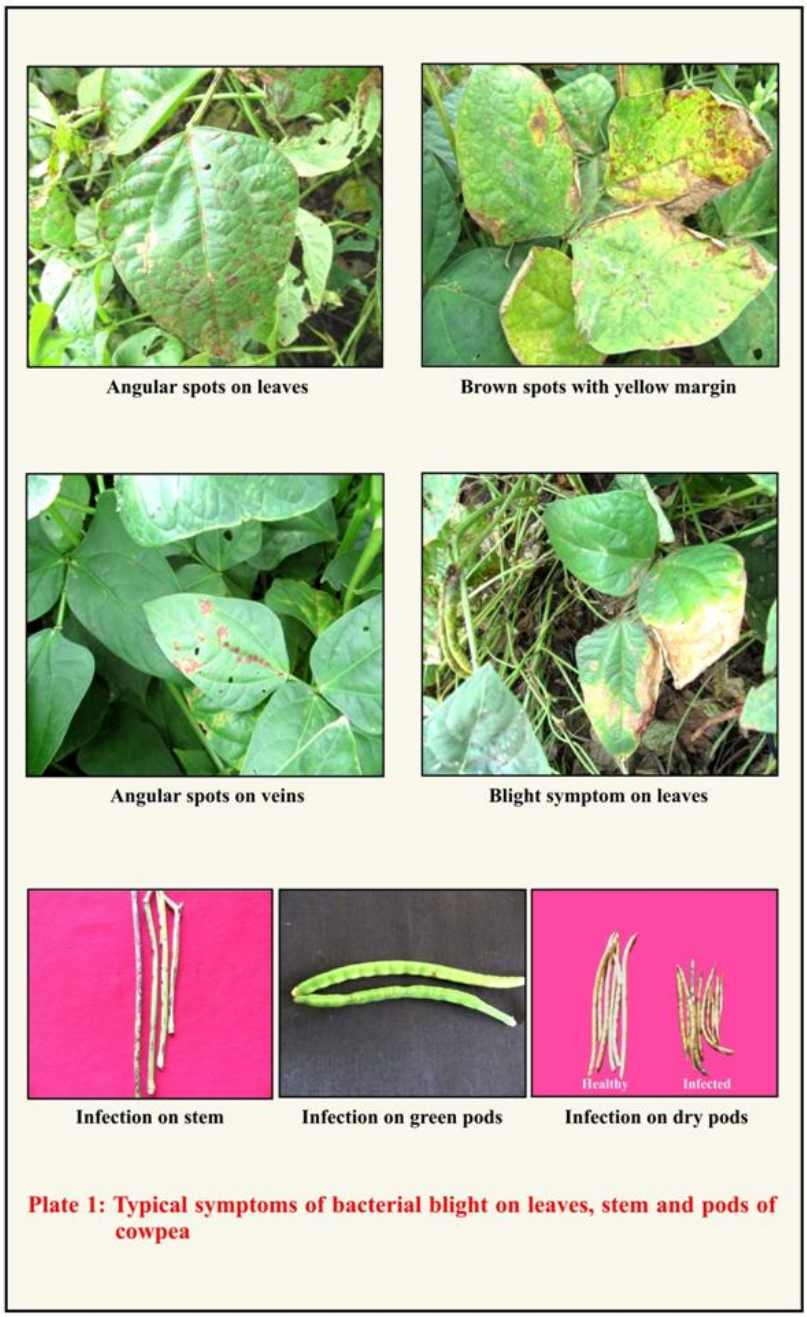

Plate 1: Typical symptoms of bacterial blight on leaves, stem and pods of cowpea

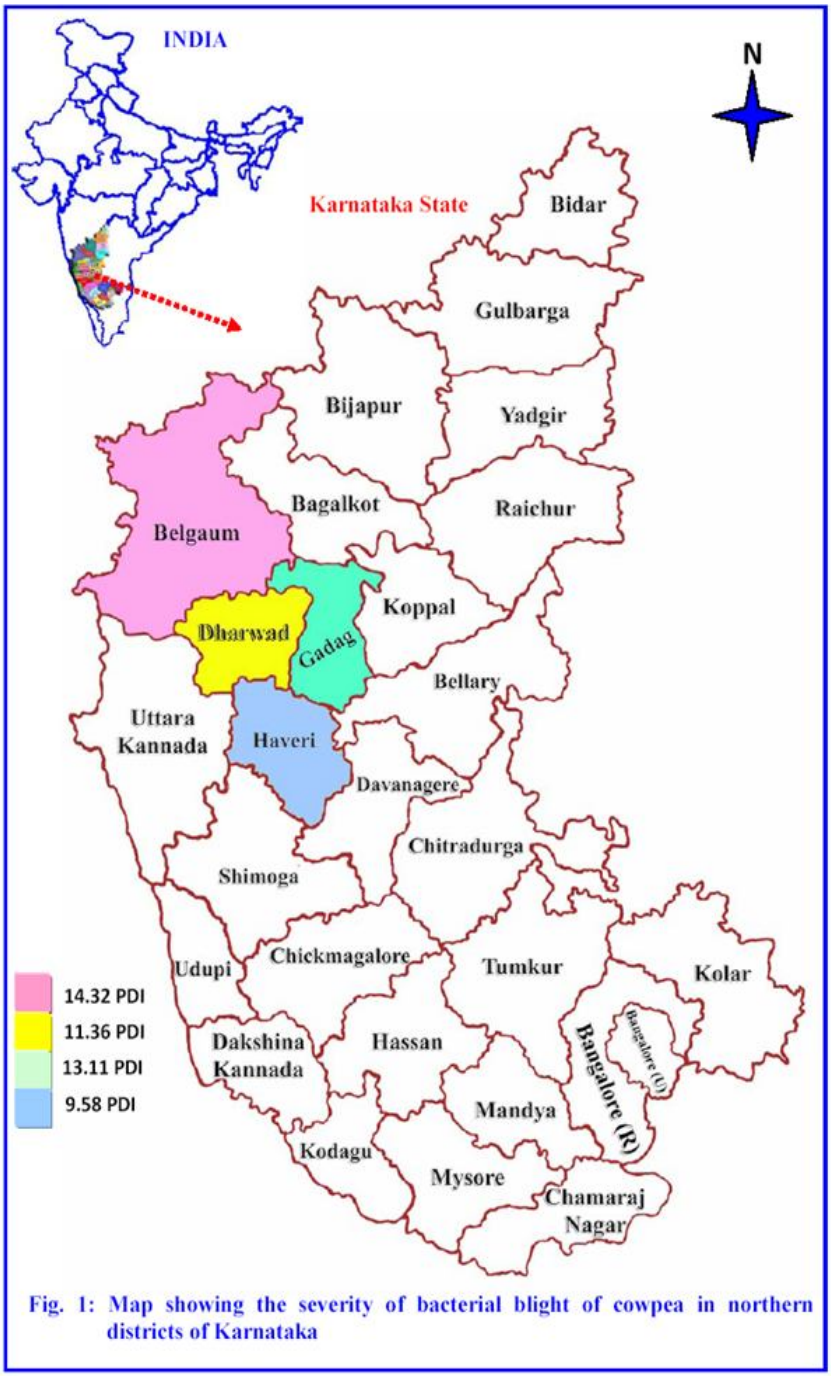

Fig. 1: Map showing the severity of bacterial blight of cowpea in northern districts of Karnataka

Grade	Per cent of leaf area infected	Reaction
0	No visible infection	Immune (I)
1	1 – 5% infection	Resistant (R)
2	6 – 15% infection	Moderately resistant (MR)
3	16 – 30% infection	Moderately susceptible (MS)
4	31 – 50% infection	Susceptible (S)
5	>50% infections	Highly susceptible (HS)

RESULTS AND DISCUSIION

An intensive survey to record the disease severity was conducted in major cowpea growing areas of Belgaum, Dharwad, Haveri and Gadag districts during *kharif* 2011. The details of locations and number of fields visited are tabulated (Table 1).

The bacterial blight severity was noticed in all the locations surveyed ranging from 2.52 to 28.47 per cent. The mean maximum severity (14.32 PDI) was observed in Belgaum district, followed by Gadag district (13.11 PDI) and Dharwad district (11.36 PDI) whereas, the least PDI (9.58 PDI) was observed in Haveri district (Table 2, and Fig. 2).

Belgaum district

Four talukas were surveyed in Belgaum district *viz.*, Belgaum, Gokak, Raibag and Bailhongal. The disease was observed in all the surveyed area and ranged from 4.34 to 28.47 PDI. The mean maximum Per cent Disease Index (19.43) was observed in Bailhongal taluka followed by Belgaum taluka (14.29 PDI) and Gokak taluka (12.22 PDI). The least PDI was observed in Raibag taluka (11.36 PDI). In Belgaum taluka, five villages were surveyed. The disease index ranged from 4.34 to 24.03 PDI. The maximum disease index of 24.03 PDI was observed in Hirebagevadi village with a PDI range of 22-50 followed by Kitturu (21.21 PDI with 20-25 PDI range) and the least index was observed in Hulli (4.34 PDI with a range of 0-12 PDI). In Gokak taluka, five villages were surveyed. The disease index ranged from 8.63 to 16.36 PDI. In Rajapur village, maximum disease index (16.36 PDI) was observed with a PDI range of 15-30 followed by Ghataprabha (14.11 PDI with 10-20 PDI range) and the least disease index was observed in Kalolli (8.63 PDI with 5-15 PDI range). In Raibag taluka, three villages were surveyed and the disease index ranged from 9.74 to 13.48 PDI. The maximum disease index (13.48 PDI) was observed in Chinchali village with a PDI range of 10-20 followed by Kudachi (10.87 PDI with 5-15 PDI range) and the least disease index was observed in Kakanavadi (9.74 PDI with 0-15 PDI range).

Four villages were surveyed in Bailhongal taluka where, the disease index ranged from 9.40 to 28.47 PDI. The maximum disease index (28.47 PDI) was observed in Pattihala village with a PDI range of 15-50 followed by Vaderatti (23.56 PDI with 10-40 PDI range) and the least disease index was observed in Gudsa (9.40 PDI with a range of 5-15 PDI).

Dharwad district

Three talukas were surveyed in Dharwad district *viz.*, Dharwad, Kalghatki and Kundagol talukas. The disease index observed in all the surveyed area ranged from 2.52 to 21.33 PDI. The mean maximum disease index (17.87 PDI) was observed in Kalghatki taluka, followed by Dharwad taluka (12.90 PDI) and the least index was observed in Kundagol taluka (4.38 PDI).

In Dharwad taluka, five villages were surveyed. The disease index ranged from 6.67 to 18.78 PDI. The maximum disease index (18.78 PDI) was observed in Narendra village with a PDI range of 15-30, followed by Marewad village (14.00 PDI with a range of 5-20 PDI) and the least disease index was observed in Madihala (6.67 PDI with a range of 3-8 PDI). Three villages were surveyed in Kalghatki taluka where the disease index ranged from 13.82 to 21.33 PDI. The maximum disease index (21.33 PDI) was observed in Kalghatki village with a PDI range of 10-30, followed by Kanavihonnapur village (18.46 PDI with a range of 10-25 PDI) and the least disease index was observed in Hirehonnalli (13.82 PDI with a range of 5-15 PDI). In Kundagol taluka, four villages were surveyed and the disease index ranged from 2.52 to 6.29 PDI. In Devikoppa village, maximum disease index (6.29 PDI) was observed with a PDI range of 0-10, followed by Thimmapur village (5.46 PDI with a range of 0-7 PDI) and the least disease index was observed in Dummawada (2.52 PDI with a range of 0-5 PDI).

Haveri district

Three talukas were surveyed in Haveri district *viz.*, Byadgi, Shiggaon and Haveri. The disease index observed in all the surveyed areas ranged from 4.68 to 14.23 PDI. The mean maximum disease index (10.46 PDI) was observed in Haveri taluka, followed by Shiggaon taluka (10.07 PDI) and the least index was observed in Byadgi taluka (8.21 PDI).

In Byadgi taluka, five villages were surveyed. The disease index was ranged from 4.68 to 11.32 PDI. The maximum disease index (11.32 PDI) was observed in Dummihala with a PDI range of 5-20, followed by Kummur (10.57 PDI with 5-15 PDI range) and the least index was observed in Anuru (4.68 PDI with 0-5 PDI range). The disease index ranged from 9.75 to 10.38 PDI in Shiggaon taluka where only two villages were surveyed. The maximum disease index (10.38 PDI) was observed in Hanumaralli with a PDI range of 5-15 and the least disease index was observed in Bankapura (9.75 PDI with a PDI range of 3-12). Among four villages surveyed in Haveri taluka, the disease index ranged from 6.38 to 14.23 PDI. The maximum disease index (14.23 PDI) was observed in Haveri with a PDI range of 10-25, followed by Devagiri (12.67 PDI with a range of 9-20 PDI) and the least index was observed in Hosalli (6.38 PDI with a PDI range of 3-10).

Gadag district

Two talukas were surveyed in Gadag district *viz.*, Gadag and Shirahatti. The disease index observed in all the surveyed areas ranged between 10.45 to 17.17 PDI. The mean maximum disease index (13.56 PDI) was observed in Gadag taluka and the least disease index was observed in Shiratti taluka (12.67 PDI).

The disease incidence varied from locality to locality, because of cropping pattern, environmental conditions, use of different varieties and build up of inoculum load. The higher disease severity may be attributed to heavy rainfall and high temperature which favoured the bacterial blight disease. Further, negligence of crop as it is hardy crop and growing in marginal lands without proper management practices also aggravated the disease. It was observed during the survey that incidence of disease was negligible up to July. This clearly indicated that the disease intensity depends on factors like location, cultural practices followed by use of infected seeds of susceptible variety, improper drainage and meteorological factors like temperature, relative humidity and rainfall. In general, it was observed that disease incidence was maximum during July-August which coincides with heavy rains and cool weather. In Karnataka, cowpea has been grown in marginal lands which have poor physical characteristics with low productivity which impose stress on the plant and favours the activities of the pathogens. During survey it has been observed that Bacterial blight incidence was more in *Kharif* season *i.e.*, wherever rainfall was more during the season. The disease incidence was more because of suitable environmental parameters for development of the pathogen. Incidence of the disease was less wherever improved varieties were used and early sowing has been practiced indicating the importance of proper selection of cropping season and disease free seeds helping in managing bacterial blight disease of cowpea.

Similar observations were made by Preston (1948) who reported the bacterial canker of cowpea caused by *Xanthomonas vignicola* from Oklahoma and opined that the pathogen was carried within the seed and spreads in the field by moisture propelled wind. Kishun (1989) observed losses ranging from 2.66 to 92.24 per cent at various stages of infection in different cowpea cultivars substantiating the results of the present survey wherein incidence varied from genotype to genotype. Moretti *et al.* (2007) reported the occurrence of leaf spot on cowpea (*Vigna unguiculata*) caused by *Xanthomonas axonopodis* pv. *vignicola* in Mozambique for the first time on June 2004 *i.e.*, during *Kharif* season as angular, necrotic, pustuliform leaf spots, surrounded by a thin water-soaked hallow on cowpea plants with an incidence of 70 - 90 per cent.

From survey, the studies revealed that the bacterial blight incidence was present in almost all districts wherever the cowpea was cultivated. The incidence of bacterial blight varied from place to place with a range of 2.52 to 28.47 per cent. Survey also revealed that Belgaum and Gadag districts as hot spots for the bacterial blight disease of cowpea (Table 1 and Fig.2).

Among five villages surveyed in Gadag taluka, disease index ranged from 10.45 to 17.17 PDI. The maximum disease index (17.17 PDI) was observed in Beldadi village with a PDI range of 15-30, followed by Mulgund village (15.61 PDI with a range of 10-25 PDI) and the least disease index was observed in Harti village (10.45 PDI with a PDI range of 5-15).

In Shirahatti taluka, three villages were surveyed and the disease index ranged from 11.62 to 14.05 PDI. The maximum disease index (14.05 PDI) was observed in Magadi village with a PDI range of 11-21, followed by Shirahatti village (12.33 PDI with a range of 6-24 PDI) and the least disease index was observed in Lakshmeshwara village (11.62 PDI with a PDI range of 5-20).

Table 1: Survey to assess the disease severity of bacterial blight of cowpea in northern Karnataka

Name of the district	Name of the taluka	Name of the village	Cultivars grown	Stage of the crop	No. of fields visited	Per cent Disease Index
Belgaum	Belgaum	Kitturu	Bailhongal local	Flowering stage	3	21.21
		Hirebagevadi	Bailhongal local	Flowering stage	4	24.03
		M.K. Hubli	Bailhongal local	Grand growth stage	3	12.29
		Benduru	C-152	Pod formation stage	2	9.56
		Hulli	C-152	Pod formation stage	1	4.34
		Mean				**14.29**
	Gokak	Ghataprbha	C-152	Pod formation stage	4	14.11
		Tukkanatti	C-152	Pod formation stage	2	10.27
		Rajapur	Bailhongal local	Grand growth stage	4	16.36
		Mudalgi	Bailhongal local	Pod formation stage	3	11.72
		Kalloli	Bailhongal local	Grand growth stage	2	8.63
		Mean				**12.22**
	Raibag	Kakanavadi	C-152	Flowering stage	2	9.74
		Chinchali	Bailhongal local	Grand growth stage	4	13.48
		Kudachi	Bailhongal local	Grand growth stage	3	10.87
		Mean				**11.36**
	Bailhongal	Vaderatti	Bailhongal local	Flowering stage	4	23.56
		Pattihala	Bailhongal local	Flowering stage	5	28.47
		Tigadi	Bailhongal local	Pod formation stage	3	16.29
		Gudsa	Bailhongal local	Grand growth stage	2	9.4
		Mean				**19.43**
Dharwad	Dharwad	Madihala	C-152	Pod formation	2	6.67
		Aminabhavi	C-152	stage	3	8.13
		Narendra	C-152	Maturity stage	5	18.78
		Garag	C-152	Flowering	3	11.55
		Marewada	C-152	stage	4	14
				Grand growth stage		
				Flowering stage		
		Mean				**11.83**
	Kalghatgi	Kalghtagi	C-152	Flowering	6	21.33
		Kanavihonnapur	V-118	stage	4	18.46
		Hirehonnalli	C-152	Grand growth stage	3	13.82
				Grand growth stage		
		Mean				**17.87**
	Kundagol	Thimmapur	C-152	Maturity stage	2	5.46
		Ramapur	C-152	Pod formation	1	3.24
		Dummawada	C-152	stage	1	2.52
		Devikoppa	V-118	Grand growth stage	3	6.29
				Pod formation stage		
		Mean				**4.38**

Cont…

Name of the district	Name of the taluka	Name of the village	Cultivars grown	Stage of the crop	No. of fields visited	Per cent Disease Index
Haveri	Byadgi	Dummihala	C-152	Pod formation stage	3	11.32
		Kummur	C-152	Grand growth stage	3	10.57
		Masanagi	C-152	Flowering stage	1	5.11
		Anuru	V-118	Pod formation stage	2	4.68
		Kagenali	C-152	Maturity stage	3	9.36
		Mean				**8.21**
	Shiggaon	Bankapura	C-152	Grand growth stage	2	9.75
		Hanumaralli	C-152	Pod formation stage	3	10.38
		Mean				**10.07**
	Haveri	Haveri	C-152	Flowering stage	3	14.23
		Devagiri	C-152		2	12.67
		Gourapura	V-118	Flowering stage	1	8.55
		Hosalli	C-152	Flowering stage Pod formation stage	1	6.38
		Mean				**10.46**
Gadag	Gadag	Harti	C-152	Pod formation stage	2	10.45
		Mulgund	C-152		5	15.61
		Nagavi	C-152	Maturity stage	3	11.04
		Lakkundi	C-152	Pod formation stage	4	13.53
		Beldadi	C-152	Maturity stage Flowering stage	3	17.17
		Mean				**13.56**
	Shirahatti	Shirahatti	C-152	Flowering stage	2	12.33
		Lakshmeshwara	C-152	Maturity stage	2	11.62
		Magadi	C-152	Grand growth stage	3	14.05
		Mean				**12.67**

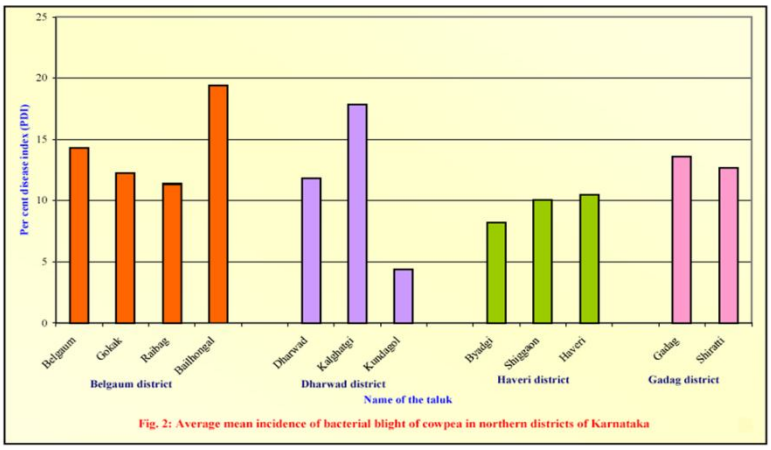

Fig. 2: Average mean incidence of bacterial blight of cowpea in northern districts of Karnataka

Table 2: Severity of bacterial blight of cowpea in northern Karnataka

District	Taluk	Per cent Disease Index
Belgaum	Belgaum	14.29
	Gokak	12.22
	Raibag	11.36
	Bailhongal	19.43
	Mean	**14.32**
Dharwad	Dharwad	11.83
	Kalghatgi	17.87
	Kundagol	4.38
	Mean	**11.36**
Haveri	Byadgi	8.21
	Shiggaon	10.07
	Haveri	10.46
	Mean	**9.58**
Gadag	Gadag	13.56
	Shirahatti	12.67
	Mean	**13.11**

REFERENCES

1. FAO 2011, http//www. fao. stat. fao. org.
2. Burkholder, W. H., 1944, Xanthomonas vignicola sp. nov. pathogenic on cowpea and beans, Phytopathol., 34 : 430-432.
3. Kishun, R., 1989, Appraisal of loss in yield of cowpea due to Xanthomonas campestris pv. vignicola. Indian Phytopathol., 42 : 241–246.
4. Moretti, C., Mondjana, A. M., Zazzerini, A. and Buonaurio, R., 2007, Occurrence of leaf spot on cowpea (Vigna unguiculata) caused by Xanthomanas axonopodis pv. vignicola in Mozambique. Pl. Pathol., 56(2) : 347.
5. Preston, D. A., 1948, Bacterial canker of cowpeas in Oklahoma (Abstr.), Phytopathol., 38 : 572.
6. Shah, R., Bhatnagar, M. K., Mali, B. L. and Dashora, P. K., 1991, Control of bacterial blight of cowpea, Indian J. Mycol. Pl. Pathol., 21 (3) : 251-254.
7. Vauterin L., Hoste B., Kersters K. and Swings J., 1995 Reclassification of Xanthomonas. Int. J. System. Bacteriol., 45 : 472-489.
8. Wheeler, B. E. J., 1969, An introduction to plant disease, John Wiley Publishers, Phytopathol., 22 : 837-845.