



INCIDENCE OF LEAF CRINKLE DISEASE ON GREENGRAM IN NORTHERN KARNATAKA

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Abstract

Greengram is rightly called the poor man's meat. It has high digestibility due to which it is fed to babies, convalescents and elders. Leaf crinkle is one among the viral diseases that infects this crop and reduces yield quantity and quality of the seed. The symptoms of disease appear in the form of extreme crinkling, curling, puckering and rugosity of leaves, stunting of plants, malformation of floral organs and pollen fertility and pod formation is also reduced severely in infected plants. An intensive roving survey was conducted in major greengram growing regions of northern Karnataka viz., Belagavi, Bidar, Dharwad, Gadag, Haveri, Kalaburgi, Koppal, Raichur, Uttar Kannada and Yadagir showed that the highest mean per cent disease incidence recorded was 45.20 per cent in Yadagir district while lowest recorded in Haveri (17.17%) district during 2011-12, while during 2012-13 survey also Yadagir district recorded the high of 42.50 per cent mean PDI and Haveri (16.89%) was recorded lowest mean PDI. All surveyed districts in northern Karnataka are coming under different agro climatic zones hence variation in PDI is may be due to variations in maximum and minimum temperature, relative humidity, rainfall, health of seed material, vector population and vector movement.

Key words: Greengram, Leaf crinkle, Survey, Karnataka, Per cent disease incidence (PDI)

Introduction

Greengram has many vernacular names viz., mung, moong, mungo, goldengram, chickasawpea and oreganpea. In India, the name greengram is more commonly used than mungbean. The mungbean is native to Indo-Burma region of South-East Asia and is cultivated extensively in the Indo-Burma-Thailand region of Asia (Chatterjee and Randhawa, 1952). It is highly relished pulse rich in proteins (23-24 %), carbohydrates (54-56 %), minerals and vitamins, particularly lysine which is deficit in cereals (www.dpd.gov.in). So, it is rightly called the poor man's meat. It has high digestibility due to which it is fed to babies, convalescents and elders. Unlike other pulses, it is free from flatulent effects in stomach. It also has medical properties and it is successfully tested and found to be the most suitable pulse for the preparation of pharmaceutically important molecules (Kumaraswamy and Ramesh, 2003).

Many plant pathogenic ailments like fungi, bacteria and viruses are known to causes many diseases in greengram. Leaf crinkle is one among the viral diseases that infects this crop and reduces yield quantity and quality of the seed. Leaf crinkle now a days become one of the major production constraint in greengram in both *kharif* and *rabi* seasons. Kadian (1980) reported the crop loss maximum up to an extent of 94 per cent depending on season and variety cultivated.

The symptoms of disease appear in the form of extreme crinkling, curling, puckering and rugosity of leaves, stunting of plants, malformation of floral organs and pollen fertility and pod formation is also reduced severely in infected plants (Nene, 1972). The disease is reported to be caused by *Urdbean leaf crinkle virus*, an unclassified seed borne, ssRNA virus with narrow host range and transmitted by aphid vector (Ashfaq *et al.*, 2008).

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Materials and Methods

An intensive roving survey was conducted in major greengram growing regions of northern Karnataka viz., Belagavi, Bidar, Dharwad, Gadag, Haveri, Kalaburgi, Koppal, Raichur, Uttar Kannada and Yadagir to know the incidence of leaf crinkle disease during *kharif* 2011-12 and 2012-13 and *rabi*/summer 2011-12 and 2012-13 seasons. The percentage of disease incidence (PDI) was assessed by recording the number of plants showing disease symptoms and the total number of plants examined by using the following formula.

$$\% \text{ disease incidence (PDI)} = \frac{\text{Number of diseased plants}}{\text{Total number of plants examined}} \times 100$$

During the survey information on total cropped area, cultivation under irrigation or rainfed conditions, stage of crop, types of symptoms produced and insect presence were recorded.

Results and discussion

Results obtained from roving survey on incidence of leaf crinkle disease conducted in major greengram growing regions of northern Karnataka during *kharif* and *rabi*/summer 2011-12 and 2012-13 seasons are presented in Table 1. In Belagavi district mean disease incidence recorded was 17.33 per cent. Highest PDI was recorded at Budarakatti (24.67 %) while lowest PDI of 11.33 at Nanagundikoppa village.

In Bidar district highest PDI of 35.33 was recorded at Barur and lowest incidence of 28.67 per cent at Tadapalli village. Mean PDI recorded in district was 32.60. In Dharwad district the highest disease incidence of 29.33 per cent was at Hebasur village followed by 27.00 per cent at Yettinagudda village. The lowest incidence recorded was 12.67 per cent at Nulvi village. The mean PDI recorded in the district was 20.29.

In Gadag district highest disease incidence of 31.33 per cent was at Bentur village and lowest incidence of 23.00 per cent at Lakkundi village. The district mean incidence was 27.73 per cent. In Haveri district mean leaf crinkle disease incidence was 17.17 per cent. This was the lowest PDI recorded among the entire surveyed district during 2011-12 and PDI in Haveri ranged from 24.00 per cent higher at Karur village to 11.67 per cent lower at Gudagur village.

Kalaburgi district mean per cent disease incidence was 38.93 with highest incidence of 41.33 per cent recorded at Andola village and lowest of 36.33 per cent at Channur village. In Koppal district the mean per cent disease incidence recorded was 35.33, which ranged from

37.33 per cent at Itagi village to 33.33 per cent at Bannikoppa. While in Raichur district the mean disease incidence recorded was 28.07 per cent, which was contributed by highest PDI of 30.67 at Rampura village and lowest PDI of 25.33 at Machlapur village.

In Uttar Kannada district where greengram is grown in *rabi* season, mean per cent disease incidence recorded was 30.47 per cent. The highest incidence of 35.67 per cent was recorded at Saalgaon and lowest incidence of 25.00 per cent at Mundagod. In Yadagir district the highest per cent disease incidence was 45.20 among the entire district surveyed during 2011-12 season. Mailapur village in Yadagir district recorded the highest disease incidence of 50.67 per cent while the lowest incidence of 39.67 per cent was observed at Bheemarayana Gudi.

During 2012-13, leaf crinkle disease incidence in greengram (Table 2) showed that the highest disease incidence of 24.00 per cent was recorded at Belavadi village of Belagavi district and the lowest of 13.67 per cent at Udikeri village. The district mean incidence was 18.33 per cent.

In Bidar district mean PDI recorded was 29.47 and the highest disease incidence of 35.33 per cent was at Janawada village and lowest of 23.00 per cent was at Yakatpura village. In Dharwad district mean disease incidence recorded was 21.71 per cent. The highest PDI of 29.00 was recorded at Narendra village, while lowest of 15.33 at Kavalageri village.

In Gadag district the mean per cent disease incidence recorded was 22.87, where in PDI of 26.67 was the highest at Hombala village and the lowest of 17.67 at Venkatapur village. In Haveri district the mean PDI was 16.89 and it is lowest among the entire surveyed districts during the season. PDI in Haveri district ranged from 23.33 at Bankapur village to 11.33 per cent at Kundur village.

In Kalaburgi district the mean per cent disease incidence recorded was 36.80. Yalawar village recorded the highest disease incidence of 39.33 per cent and the lowest of 33.67 per cent was at Kellur village. While in Koppal district mean disease incidence recorded was 29.00 per cent, which was accounted by the highest PDI of 31.67 at Katrahalli village and the lowest PDI of 26.33 at Vadaganahalli village.

In Raichur district mean per cent disease incidence recorded was 29.40 and the highest of 33.33 per cent was at Neermanvi village and the lowest was 26.33 per cent at UAS Raichur campus. During *rabi* in Uttar Kannada district mean per cent disease incidence recorded was 25.40 and the highest disease incidence of

Table 1: Survey for leaf crinkle disease infecting greengram in selected district of northern Karnataka for 2011-12

District	Villages	Latitude	Longitude	Area (acre)	Variety	Crop stage	R/I	Incidence (%)	Symptom recorded	Insects observed
Belagavi	Belligatti	15.631060	74.952651	7.0	Shining moong	Pre flowering	R	14.67	Cr, Pu, Cu	A
	Budarkatti	15.662646	74.922689	8.0	Shining moong	Pre flowering	R	24.67	Cr, Pu, Cu	A, Wf
	Doddavada	15.684659	74.978918	10.0	Shining moong	Pre flowering	R	14.67	Cr, Pu, Cu	A, Wf
	Govinakoppa	15.635363	74.936088	4.5	Shining moong Local	Pre flowering	R	17.00	Cr, Pu, Ru, Cu	A
	Gudakatti	15.630206	74.932322	5.0	Shining moong	Pre flowering	R	21.67	Cr, Pu, Cu	A
	Nanagundikoppa	15.658967	74.978912	6.0	Shining moong	Pre flowering	R	11.33	Cr, Pu, Ru, Cu	A, Th3
					Mean			17.33		
Bidar	Barur	17.451152	77.321897	11.5	Shining moong	Flowering	R	35.33	Cr, Pu, Cu	A
	Kamatana	17.855847	77.447946	7.5	Shining moong	Flowering	R	31.33	Cr, Pu, Cu	A, Th
	Rajagira	17.717950	77.453060	5.0	Shining moong	Pod formation	R	32.67	Cr, Pu, Cu, Rpf	A, Th, Pb
	Sindhol	17.718806	77.427694	9.0	Shining moong	Flowering	R	35.00	Cr, Pu, Cu	A
	Tadapalli	17.745425	77.445813	7.0	Shining moong	Flowering	R	28.67	Cr, Ru, Cu	A, Pb
					Mean			32.60		
Dharwad	Byahatti	15.442698	75.206109	8.5	Local, Shining moong	Pre flowering	R	21.67	Cr, Pu, Cu	A, Wf
	Hebasur	15.453967	75.293543	10.0	Shining moong	Pod formation	R	29.33	Cr, Pu, Cu, Rpf	A, Wf
	Mishrikoti	15.242923	75.055183	9.0	Shining moong	Pod formation	R	14.33	Cr, Pu, Cu, Rpf	A, Wf
	Narendra	15.514360	74.978427	7.0	Shining moong	Pre formation	R	17.33	Cr, Ru, Cu	A, Th, Pb
	Nulvi	15.266845	75.166309	11.5	Local	Flowering	R	12.67	Cr, Pu, Cu	A, Th
	UAS Dharwad	15.493923	74.987338	2.0	Shining moong, Selection -4	Pre flowering	I	19.67	Cr, Pu, Cu	A, Wf
	Yattinagudda	15.481825	74.993511	12.0	Shining moong	Pod formation	R	27.00	Cr, Pu, Ru, Cu, Rpf	A, Pb, Wf
					Mean			20.29		
Gadag	Bentur	15.355778	75.472375	9.0	Local	Pre flowering	R	31.33	Cr, Pu, Cu	A
	Hombal	15.515876	75.559786	8.0	Local	Flowering	R	30.67	Cr, Pu, Ru, Cu	A, Wf
	Hulakoti	15.418456	75.54.1634	15.0	Shining moong	Pre flowering	R	25.67	Cr, Pu, Cu	A
	Lakkundi	15.390476	75.718342	13.0	Local	Pre flowering	R	23.00	Cr, Ru, Cu	A, Wf

Table 1 continued

Table 1 continued

District	Villages	Latitude	Longitude	Area (acre)	Variety	Crop stage	R/I	Incidence (%)	Symptom recorded	Insects observed
	Papanashi	15.367230	75.679762	5.0	Shining moong, Local	Pre flowering	R	28.00	Cr, Pu, Cu.	A
					Mean			27.73		
Haveri	Gudagur	14.424816	75.385974	6.0	Shining moong	Flowering	R	11.67	Cr, Pu, Ru, Cu	A,Th
	Halagi	14.561109	75.364107	4.5	Local	Pod formation	I	14.33	Cr, Pu, Cu, Rpf	A,Wf,Th
	Itagi	14.330938	75.400188	8.0	Shining moong	Pre flowering	R	16.67	Cr, Pu, Cu	A,Th
	Karur	14.332217	75.435787	12.0	Shining moong	Pod formation	R	24.00	Cr, Pu, Cu, Rpf	A,Th
	Motebennur	14.423072	75.290749	10.0	Selection-4	Pre flowering	R	14.33	Cr, Pu, Cu	A, Wf
	Nelogal	14.454698	75.261579	6.0	Shining moong	Pre flowering	R	22.00	Cr, Pu, Cu	A, Wf
					Mean			17.17		
Kalaburgi	Andola	16.571022	76.503187	6.0	Shining moong	Flowering	R	41.33	Cr, Pu, Cu	A, Wf
	Aurad	16.580020	76.462466	4.0	Local	Flowering	R	40.00	Cr, Pu, Cu	A
	Butanal	17.003944	76.480129	5.0	Shining moong	Flowering	R	39.33	Cr, Pu, Cu	A,Th
	Channur	16.585087	76.483213	5.5	Shining moong	Pod formation	R	36.33	Cr, Pu, Cu, Rpf	A
	Raddewadgi	17.021102	76.474998	5.5	Shining	Flowering moong	R	37.67	Cr, Pu, Cu	A, Wf
					Mean			38.93		
Koppal	Bannikoppa	15.232331	75.561898	5.0	Local	Pre flowering	R	33.33	Cr, Pu, Cu	A, Wf
	Bhanapur	15.231565	76.021573	8.0	Shining moong	Pre flowering	R	36.33	Cr, Pu, Cu	A
	Binnala	15.292186	75.522202	7.5	Local	Pod formation	R	34.00	Cr, Pu, Cu, Rpf	A,Wf,Th
	Itagi	15.261865	75.575661	9.0	Shining moong Local	Flowering	R	37.33	Cr, Pu, Cu	A
	Yerehanchinal	15.281494	75.505265	7.0	Local	Pod formation	R	35.67	Cr, Pu, Cu	A,Wf,
					Mean			35.33		
Raichur	Eklaspur	16.133675	77.185232	7.0	Local	Flowering	R	29.00	Cr, Pu, Ru, Cu	A,Pb
	Hospet	16.164052	77.164465	8.5	Shining Moong, Local	Pre flowering	R	28.33	Cr, Pu, Cu	A,Pb,Ja
	Kalamala	16.115016	77.124496	5.0	Local	Flowering	R	27.00	Cr, Pu, Cu	A, Th
	Manchlapur	16.131547	77.204536	4.0	Local	Flowering	R	25.33	Cr, Pu, Cu	A,Th,Pb
	Ramapur	16.112302	77.200130	5.5	Selection-4	Flowering	R	30.67	Cr, Pu, Ru, Cu	A,Pb
					Mean			28.07		

Table 1 continued

Table 1 continued

District	Villages	Latitude	Longitude	Area (acre)	Variety	Crop stage	R/I	Incidence (%)	Symptom recorded	Insects observed
Uttara Kannada	Hirehalli	14.903793	75.034896	2.5	Karihesaru	Flowering	R	33.67	Cr, Ru, Cu	A
	Kavalhalli	14.913377	75.039856	3.0	Karihesaru	Flowering	R	29.33	Cr, Pu, Cu	A, Wf
	Koppa	15.009054	75.022249	3.5	Karihesaru	Pod formation	R	28.67	Cr, Pu, Ru, f Cu, Rp	A,Th,Ja
	Mundgod	14.975978	75.035931	2.0	Karihesaru	Flowering	I	25.00	Cr, Pu, Cu	A,Th
	Saalgaon	14.945094	75.034326	5.0	Karihesaru	Flowering	I	35.67	Cr, Ru, Cu	A
					Mean			30.47		
Yadagiri	Bheemarayana Gudi	16.434674	76.473794	7.0	Selection-4, Shining moong	Flowering	I	39.67	Cr, Pu, Ru, Cu	A, Wf
	Doranahalli	16.442035	76.555278	11.0	Shining moong	Flowering	R	44.00	Cr, Pu, Cu	A
	Gundahalli	16.432823	76.572008	9.0	Shining moong	Flowering	R	44.33	Cr, Ru, Cu	A
	Mailapur	16.441490	77.141495	12.5	Local	Pod formation	R	50.67	Cr, Pu, Ru, Cu, Rpf	A,Pb, Ja
	Ram Samudra	16.460640	77.142315	7.0	Local	Pod formation	R	47.33	Cr, Pu, Ru, Cu, Rpf.	A, Ja
					Mean			45.20		

Cr- Crinkling, Pu-Puckering, Ru-Rugosity, Cu-Curling, Rpf-Reduced pod formation, A- Aphids, Wf- Whiteflies, Th- Thrips, Pb- Pod borer, Ja- Jassids, R-Rainfed, I- Irrigated

Table 2: Survey for leaf crinkle disease infecting greengram in selected district of northern Karnataka for 2012-13

District	Villages	Latitude	Longitude	Area (acre)	Variety	Crop stage	R/I	Incidence (%)	Symptom recorded	Insects observed
Belagavi	Asundi	15.750058	75.024760	9.0	Shining moong	Flowering	I	19.33	Cr, Pu, Ru, Cu	A
	Belavadi	15.713173	74.913413	5.5	Shining moong	Pre flowering	R	24.00	Cr, Pu, Cu	A, Wf
	Budarakatti	15.686897	74.914807	7.0	Shining moong	Pre flowering	R	17.33	Cr, Pu, Ru, Cu	A, Wf, Th
	Karikatti	15.737910	75.024016	7.5	Shining moong	Flowering	I	20.67	Cr, Ru, Cu	A, Th
	Savadatti	15.764238	75.167211	12.0	Shining moong	Flowering	I	15.00	Cr, Pu, Cu	A
	Udikeri	15.719699	74.942481	4.0	Shining moong	Pre flowering	R	13.67	Cr, Pu, Cu	A, Th, Pb
					Mean			18.33		
Bidar	Barur	17.453598	77.323217	14.50	Shining moong	Flowering	R	26.33	Cr, Pu, Cu	A
	Chintalgeri	17.755875	77.502869	9.0	Shining moong	Pod formation	R	28.67	Cr, Pu, Ru, Cu, Rpf	A, Wf, Pb
	Janawada	18.005274	77.479051	11.5	Shining moong	Flowering	R	35.33	Cr, Pu, Cu	A, Th,
	Kamatana	17.856935	77.447478	12.5	Shining moong	Flowering	R	34.00	Cr, Pu, Ru, Cu	A, Ja

Table 2 continued

Table 2 continued

District	Villages	Latitude	Longitude	Area (acre)	Variety	Crop stage	R/I	Incidence (%)	Symptom recorded	Insects observed
	Yakatpura	17.785175	77.489132	6.0	Shining moong	Flowering	R	23.00	Cr, Ru, Cu	A, Wf
					Mean			29.47		
Dharwad	Amminabhavi	15.520983	75.044929	6.0	Shining moong	Pre Flowering	R	21.67	Cr, Pu, Cu	A
	Kavalageri	14.495770	75.067433	5.0	Shining moong	Pre Flowering	R	15.33	Cr, Ru, Cu	A, Th
	Narendra	15.785983	74.859776	10.0	Selection-4	Pre Flowering	R	29.00	Cr, Pu, Ru, Cu	A, Wf
	Nigadi	15.394955	74.941985	9.0	Selection-4	Pre Flowering	R	17.33	Cr, Ru, Cu	A
	Salakinkoppa	15.414750	74.955865	3.5	Shining moong	Pre Flowering	R	25.67	Cr, Pu, Ru, Cu	A, Wf
	UAS Dharwad	15.403611	74.697978	3.5	Shining moong, Selection-4	Pre Flowering	I	23.67	Cr, Pu, Cu	A, Wf, Th
	Yattinagudda	15.482083	74.994262	6.5	Shining moong	Pre Flowering	R	19.33	Cr, Pu, Ru, Cu	A, Wf
					Mean			21.71		
Gadag	Balaganur	15.596723	75.604093	7.0	Shining moong	Pre flowering	R	23.33	Cr, Pu, Cu	A, Wf
	Hombala	15.517939	75.564012	11.0	Local	Pre flowering	R	26.67	Cr, Ru, Cu	A, Wf
	Huyilgol	15.524565	75.634859	4.0	Local	Pre flowering	R	25.00	Cr, Pu, Cu	A
	Kadadi	15.584876	75.632670	6.5	Shining moong	Pre flowering	R	21.67	Cr, Pu, Ru, Cu	A
	Venkatapura	15.352354	75.857388	4.5	Shining moong	Pre flowering	R	17.67	Cr, Pu, Ru, Cu	A, Wf, Ja
					Mean			22.87		
Haveri	Bankapura	14.917485	75.248572	8.0	Shining moong	Pre flowering	R	23.33	Cr, Pu, Cu	A, Wf
	Chatra	14.701432	75.526028	4.0	Shining moong	Pre flowering	R	17.67	Cr, Ru, Cu	A, Th
	Guddadach-annapura	14.898771	75.248039	5.5	Shining moong	Pre flowering	R	19.67	Cr, Pu, Ru, Cu	A
	Kuni mallihalli	14.864378	75.319794	7.0	Shining moong	Pre flowering	I	16.33	Cr, Pu, Cu	A
	Kundur	14.898543	75.250794	7.5	Local	Pre flowering	R	11.33	Cr, Ru, Cu	A, Wf, Th
	Motebennur	14.717750	75.471342	7.5	Shining moong	Pre flowering	R	13.00	Cr, Ru, Cu	A, Th
					Mean			16.89		
Kalaburgi	Andola	16.574523	76.507211	4.0	Shining moong	Pod formation	R	37.33	Cr, Pu, Ru, Cu, Rpf	A, Wf, Th
	Chigarahalli	16.908030	76.780619	7.0	Shining moong	Flowering	R	36.00	Cr, Ru, Cu	A
	Ijjeri	16.904340	76.704504	7.5	Local	Flowering	R	37.67	Cr, Pu, Ru, Cu	A, Th
	Kellur	16.942715	76.781609	6.5	Shining	Flowering	R	33.67	Cr, Pu, Cu	A, Th

Table 2 continued

Table 2 continued

District	Villages	Latitude	Longitude	Area (acre)	Variety	Crop stage	R/I	Incidence (%)	Symptom recorded	Insects observed
					moong					
	Yalawar	16.894891	76.752068	4.5	Selection-4	Pre flowering	R	39.33	Cr, Pu, Cu	A
					Mean			36.80		
Koppal	Hiresindhogi	15.292565	76.094078	6.5	Shining moong	Flowering	R	31.33	Cr, Pu, Ru Cu	A, Wf
	Katrahalli	15.325053	76.084423	12.0	Shining moong Local	Flowering	R	31.67	Cr, Ru, Cu	A, Wf
	Vadaganahalli	15.346514	76.073603	5.0	Shining moong	Pod formation	R	26.33	Cr, Pu, Ru, Cu, Rpf	A, Wf
					Mean			29.00		
Raichur	Askihala	16.218795	77.305985	6.0	Shining moong	Flowering	R	29.67	Cr, Ru, Cu	A, Th, Pb
	Kalamala	16.115016	77.124496	10.5	Shining moong	Flowering	R	28.00	Cr, Pu, Cu	A, Th, Wf
	Neermanvi	16.059308	77.091387	7.5	Shining moong	Pre flowering	R	33.33	Cr, Pu, Cu	A, Th, Pb
	Sirwara	16.176247	77.011876	8.0	Shining moong	Pre flowering	R	29.67	Cr, Pu, Cu	A, Wf
	UAS Raichur Campus	16.201796	77.329877	3.5	Shining moong Selection-4	Flowering	I	26.33	Cr, Pu, Cu	A, Th
					Mean			29.40		
Uttara Kannada	Agadi	15.066378	74.997086	4.5	Karihesaru	Pre flowering	R	30.33	Cr, Pu, Cu	A, Wf
	Baachanaki	15.005698	75.054123	4.0	Karihesaru	Pre flowering	I	25.67	Cr, Pu, Ru, Cu	A, Th
	Chigali	14.907289	75.048015	5.0	Karihesaru	Pre flowering	R	27.33	Cr, Pu, Ru, Cu	A
	Koppa	15.008955	75.022340	6.5	Karihesaru	Pre flowering	R	22.67	Cr, Pu, Cu	A, Wf, Th
	Mundgod	14.975149	75.036321	4.0	Karihesaru	Pre flowering	I	21.00	Cr, Ru, Cu	A, Wf, Ja
					Mean			25.40		
Yadagiri	Bheemarayanagudi	16.461015	77.145254	7.5	Shining moong	Flowering	I	39.33	Cr, Pu, Cu	A, Ja
	Googi	16.736587	76.750686	6.0	Local	Flowering	R	39.67	Cr, Pu, Ru, Cu	A, Wf
	Halagera	16.723373	77.235354	6.0	Shining moong	Flowering	R	42.00	Cr, Ru, Cu	A, Wf
	Mailapur	16.441490	77.141495	9.0	Shining moong Selection-4	Pod formation	R	45.33	Cr, Pu, Ru Cu, Rpf	A, Wf, Th
	Ramasandra	16.436548	76.474244	10.5	Shining moong	Pod formation	R	46.67	Cr, Pu, Ru Cu, Rpf	A
					Mean			42.50		

Cr- Crinkling, Pu-Puckering, Ru-Rugosity, Cu-Curling, Rpf-Reduced pod formation, A- Aphids, Wf- Whiteflies, Th- Thrips, Pb- Pod borer, Ja- Jassids, R-Rainfed, I- Irrigated

Table 3: Leaf crinkle disease of greengram in different districts of northern Karnataka during 2011-12 and 2012-13

S. No.	Districts	PDI (2011-12)	PDI (2012-13)
1	Belagavi	17.33	18.33
2	Bidar	32.60	29.47
3	Dharwad	20.29	21.71
4	Gadag	27.73	22.87
5	Haveri	17.17	16.89
6	Kalaburgi	38.93	36.80
7	Koppal	35.33	29.00
8	Raichur	28.07	29.40
9	Uttara Kannada	30.47	25.40
10	Yadagiri	45.20	42.50

30.33 per cent was recorded at Agadi and the lowest incidence of 21.00 per cent was at Mundagod of Uttar Kannada.

The highest incidence of 46.67 per cent was recorded at Ramasamudra village and the lowest incidence of 39.33 per cent at Bheemarayana Gudi in Yadagir district. The mean PDI recorded in the district was 42.50 and it was the highest incidence recorded among the entire surveyed districts.

Survey conducted during 1968 and 1969 by Nene and co-workers showed that prevalence of the leaf crinkle disease was only 1-5 per cent in Gorakhpur and Pratapgarh districts while 26-50 per cent in Almora, Meerut, Nainital and Bulandshahar districts of Uttar Pradesh and during 1989 and 1990 in Maharashtra 12 to 30 per cent of urdbean leaf crinkle disease incidence was recorded in 143 fields of blackgram and 78 fields of greengram areas surveyed by Mahajan and Joi (1999). In two districts of Andhra Pradesh leaf crinkle disease incidence reported was 5.28 and 5.87 per cent during *rabi* 1997-98 and 1998-99, respectively (Nageswara Rao, 2002). In Uttar Pradesh four districts were surveyed by Srivastava (2005) and reported the incidence of urdbean leaf crinkle disease vary from 28 to 85% under natural field conditions. Punith kumar (2012) reported that leaf crinkle disease of greengram in four districts of North Eastern Karnataka *viz.*, Raichur, Gulbarga, Yadagir and Bidar during *kharif* 2012 was highest of 31.21 per cent in Yadagir while lowest of 17.20 per cent in Bidar district.

Conclusion

All surveyed districts in northern Karnataka (Table

3) are coming under different agro climatic zones hence variation in PDI is may be due to variations in maximum and minimum temperature, relative humidity, rainfall, health of seed material, vector population and vector movement. Beniwal *et al.* (1979) was also reported similarity in the nature and rate of spread of urdbean leaf crinkle virus under field conditions.

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