



Research Article

STATUS OF MUNGBEAN YELLOW MOSAIC VIRUS (MYMV) ON FRENCHBEAN IN DIFFERENT AGRO-CLIMATIC ZONES OF KARNATAKA, INDIA

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Abstract- Mungbean Yellow Mosaic Virus(MYMV) is the most serious pathogen on french bean in Karnataka, where the crop is grown in *kharif* by making use of pre-monsoon showers. The survey was conducted to know the MYMV incidence in different agro-climatic zones of Karnataka during 2014-15. Results of the survey indicated that the disease incidence ranges from 5.88 to 28.54 per cent. The highest average incidence of 26.46% was recorded in Kolar district from Eastern dry zone followed by Chikkaballapur (26.21%), Bangalore Rural (25.19%), Ramanagara (23.58%). In the severely infected fields, the occurrence of whiteflies and large scale cultivation of susceptible varieties which is growing continuously in the same area were implicated as the reasons for increased incidence of MYMV. The variations in disease incidence might be due to the difference in temperature and relative humidity which may have a direct influence on vector population and its feeding behavior.

Keywords- Whitefly, MYMV, Agro-climatic zones, Survey, Per cent diseases incidence.

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Introduction

French bean (*Phaseolus vulgaris* L.) is also known as snap bean, kidney bean, haricot bean, garden bean or string bean. It is a diploid ($2n = 22$) plant with a relatively small genome of size 633 Mbp [1]. It is one of the most important legume vegetables grown for its green tender pods either for fresh consumption or for processing as canned, frozen or freeze dried products.

The crop is being affected by many diseases viz. leaf rust, yellow mosaic virus disease, anthracnose, bacterial blight, wilt etc. Among them, Mungbean Yellow Mosaic Virus (MYMV) disease is the most destructive disease in French bean, which causes severe yield loss. The MYMV disease was first reported in 1960 and now occurs throughout the country. The yield loss due to MYMV in French bean has not been systematically studied. However, the yield loss due to this virus in French bean has been reported from 10 to 100 per cent when the crop is infected at the seedling stage itself [2]. The disease is prevalent during all the three seasons in bean growing areas, but it is more severe during summer because of higher whitefly population. Mungbean yellow mosaic disease is caused by whitefly-transmitted *begomovirus*.

This virus causes Yellow Mosaic Diseases in a number of economically important edible grain legumes including mungbean, urdbean, French bean and soybean. The virus reported from India is not mechanically transmitted but has been transmitted by the whitefly vector (*Bemisia tabaci*), to several species in the leguminosae. The important begomo viruses infecting mungbean and other leguminosae are Mungbean yellow mosaic India virus(MYMIV), Mungbean yellow mosaic virus(MYMV), Dolichos yellow mosaic virus and Horsegram yellow mosaic virus. Though there is the large area under french bean cultivation in Karnataka but the production levels were low because of many factors, among them MYMV infections is one and moreover there are no commercially available resistant varieties in the state. Therefore, a study has been conducted to know the disease

incidence throughout all the agro-climatic zones of Karnataka.

Material and methods

A roving survey was carried out in major french bean growing districts, representing all the agro-climatic zones of Karnataka to record the incidence of Mungbean Yellow Mosaic Virus disease in the months of February -March 2015. Two taluks per district were considered for actual selections of villages and farmers plots. Two fields were selected randomly in each village and in the field five randomly selected lines were used for disease incidence analysis by counting a total number of plants and number of plants showing distinct disease symptoms of MYMV in french bean [Fig-1,2].





Fig-1, 2 Showing the typical symptoms of MYMV on french bean

$$\text{Per cent Diseases Incidence} = \frac{\text{Number of diseased plants}}{\text{Total number of plants observed}} \times 100$$

Average per cent incidence (PI) of every taluk was calculated by using the following formula

$$\text{Percent Diseases Incidence of a taluk} = \frac{\text{Sum of PI of fields surveyed in a taluk}}{\text{Number of fields surveyed in a taluk}}$$

Results and Discussion

The roving survey was undertaken to know the per cent diseases incidence of MYMV in different agro-climatic zones of Karnataka during 2014-15 when the crop was at different growth stages (vegetative growth, flowering, and pod bearing stages). Among all the ten agro-climatic zones the French bean was found to be cultivated majorly in seven agro-climatic zones. So, seven agro-climatic zones were considered for the survey. A total of 82 villages come under different agro-climatic zones of Karnataka were surveyed. Total plants in the randomly selected 5 rows in the fields were first counted and then the number of infected plants showing the symptoms of MYMV like general yellowing, mosaic pattern, stunted growth of the plant and curved pods were recorded. The survey results indicate that there is a significant difference in the per cent disease incidence of MYMV during 2014-15 in different agro-climatic zones of Karnataka ranging from 5.88 to 28.54 per cent [Table-1 and 2].

Table-1 Survey for Mungbean yellow mosaic virus (MYMV) disease incidence in different agro-climatic zones of Karnataka during 2014 - 15

Sl. No.	Agro-climatic zone	District	Taluk	Village	GPS coordinates	Pole/ Bush type	PDI (%)	Insects observed	Stage of the crop
1.	Northern Dry Zone	Dharwad	Dharwad	Dharwad local	15° 28' 33.1356"N 75° 2' 26.9376" E	Pole	6.35	Whitefly, Thrips	Flowering
				Hebbali	15° 28' 55.3188"N 75° 8' 11.9256" E	Pole	5.88	Whitefly, Pod borer	Vegetative
			Hubli taluk	Unkal	15° 22' 27.2892"N 75° 7' 21.8676" E	Pole	8.28	Whitefly, blister beetle	Flowering
				Bairidevarakoppa	15° 23' 42.8100"N 74° 55' 47.2584" E	Pole	8.69	Whitefly, Thrips	Flowering
			Kalaghatagi	Aulakoppa	15° 10' 47.7156"N 74° 57' 46.0656" E	Pole	9.42	Whitefly, Pod borer	Fruiting
				Honalli	15° 10' 44.8824"N 74° 58' 40.2168" E	Pole	8.14	Whitefly, Stem fly, Thrips	Flowering
		Belgaum	Belgaum	Yaragatti	15° 58' 25.3452"N 75° 1' 44.5296" E	Pole	7.82	Whitefly, Thrips, Aphids	Vegetative
				Kakati	15° 55' 45.9192"N 74° 31' 32.9556" E	Pole	9.16	Whitefly, Aphids, Thrips, Pod borer	Flowering
				Samb	15° 52' 10.8768"N 74° 36' 26.3808" E	Pole	9.42	Whitefly, Thrips	Flowering
		Bagalkot	Bagalkot	Haveli farm	16° 8' 22.8192"N 75° 44' 6.4680" E	Bush	8.88	Whitefly, Thrips, Pod borer, Aphids	Vegetative
				Anedinni	16° 12' 39.2904"N 75° 37' 18.9372" E	pole	9.14	Whitefly, Pod borer	Flowering
		Gadag	Naragund	Shirol	15° 49' 29.1036"N 75° 32' 8.2680" E	Pole	8.69	Whitefly, Stem fly	Flowering
				Chikkanaragund	15° 43' 36.7392"N 75° 23' 34.3392" E	Pole	9.29	Whitefly, Blister beetle	Vegetative
				Kulageri	16° 45' 2.2032"N 76° 26' 53.5308" E	Pole	8.35	Whitefly, Pod borer	Flowering
			Navalagund	Annigeri	15° 25' 33.7692"N 75° 26' 29.8860" E	Pole	6.98	Whitefly, Thrips	Vegetative
2.	Central Dry Zone	Davangere	Harihara	Bevinahalli	13° 53' 39.2028"N 76° 50' 8.6244" E	Pole	12.32	Whitefly, Thrips	Flowering
				Byladahalli	12° 55' 43.2228"N 77° 49' 8.5728" E	Pole	15.44	Whitefly, Thrips	Flowering
			Davanagere	Agasanakatte	14° 28' 19.7184"N 75° 49' 28.6392" E	Pole	14.82	Whitefly, Stem fly	Vegetative
				Annapura	14° 19' 49.7424"N 76° 4' 6.8664" E	Pole	15.84	Whitefly, Stem fly, Thrips	Flowering
		Tumkur	Sira taluk	Tarur	13° 43' 52.2948"N 76° 54' 46.2528" E	Pole	16.42	Whitefly, Pod borer	Vegetative
				Yaliyuru	13° 41' 28.5828"N	Pole	19.86	Whitefly, Stem fly	Vegetative

			Tiptur		76° 54' 59.7708" E				
				Aladahalli	13° 15' 25.8372"N 76° 29' 3.3864" E	Pole	14.45	Whitefly, Pod borer, Thrips	Flowering
				Agrahara	13° 16' 6.9636"N 76° 28' 8.2308" E	Pole	16.53	Whitefly, Stem fly	Fruiting
		Chikkamagaluru	Kadur	Chatnalli	13° 23' 3.6168"N 76° 2' 25.0548" E	Pole	15.89	Whitefly, Pod borer	Flowering
				Nidaghatta	13° 23' 0.8736"N 76° 2' 32.6040" E	Pole	17.52	Whitefly, Pod borer, Thrips	Flowering
				Tippanalli	13° 23' 13.1604"N 76° 1' 54.2316" E	Pole	17.84	Whitefly, Pod borer	Fruiting
		Hassan	Arasikere	Salagame	13° 4' 47.3268"N 76° 5' 25.3500" E	Pole	21.25	Whitefly, Thrips	Fruiting
				Basavaghatta	12° 36' 50.0904"N 76° 6' 50.8644" E	Pole	20.86	Whitefly, Thrips	Fruiting
				Haranahalli	13° 0' 49.5612"N 76° 15' 47.4048" E	Pole	17.12	Whitefly, Thrips	Fruiting
		Bangalore urban	Yelahanka	Sadenahalli	13° 11' 43.6236"N 77° 34' 19.8408" E	Pole	20.42	Whitefly, Pod borer, Thrips	Fruiting
Rajanakunte	13° 11' 7.5984"N 77° 33' 7.7868" E			Pole	24.50	Whitefly, Pod borer	Flowering		

3.	Eastern Dry Zone	Ramanagar	Ramanagar	Vaderahalli	12°44'35.3"N 77°28'41.2"E	Pole	22.85	Whitefly, Pod borer	Fruiting
				Gopalapura	12°44'14.1"N 77°18'42.3"E	Pole	24.62	Whitefly	Fruiting
		Channapattana	Vanniganahalli	-	Pole	23.25	Whitefly, Stem fly	Fruiting	
			Doddamallur	12°38'56.9"N 77°11'08.5"E	Pole	23.64	Whitefly	Fruiting	
		Bangalore Rural	Nelamangal	T B Cross	13° 7' 51.5028"N 77° 29' 22.3584" E	Pole	25.86	Whitefly, Thrips, Blister beetle	Fruiting
				Byrashettihalli	13° 15' 48.0168"N 77° 32' 36.9060" E	Pole	26.21	Whitefly	Fruiting
			Devanahalli	Boodhihal	13° 8' 0.9816"N 77° 21' 39.6468" E	Pole	24.38	Whitefly, Pod borer	Fruiting
				Muddenahalli	13° 13' 11.2368"N 77° 45' 24.4008" E	Pole	26.24	Whitefly	Flowering
			Doddaballappu r	Bashettihalli	13° 15' 12.4524"N 77° 33' 27.7740" E	Pole	26.38	Whitefly	Fruiting
				Bisuvanahalli	13° 6' 35.2548"N 77° 23' 11.3964" E	Pole	25.31	Whitefly, Pod borer	Fruiting
			Hoskote	Dasarahalli	13° 5' 57.1488"N 77° 50' 19.8744" E	Pole	24.34	Whitefly	Fruiting
				Chikkahulluru	13° 4' 12.5616"N 77° 48' 4.3020" E	Pole	22.86	Whitefly, Pod borer	Flowering
		Kolar	Kolar	Tamaka	13° 8' 17.0052"N 78° 8' 36.0168" E	Pole	26.78	Whitefly, Aphids, Thrips	Flowering
				Vadaguru	13° 8' 4.5168"N 78° 12' 7.5204" E	Pole	27.62	Whitefly, thrips, Blister beetle	Fruiting
				Veerapura	13° 15' 4.9068"N 77° 32' 4.9668" E	Pole	24.88	Whitefly	Fruiting
			Malur	Bellavi	13° 1' 31.7460"N 77° 54' 42.0516" E	Pole	24.82	Whitefly, Thrips,	Fruiting
				Jadigenahalli	13° 3' 15.2244"N 77° 51' 9.7740" E	Pole	28.54	Whitefly	Flowering
		Chikkaballpur	Chikkaballapur	Arasanahalli	14° 48' 4.0572"N 75° 58' 42.5820" E	Pole	26.98	Whitefly	Fruiting
				Nandi	13° 22' 49.7892"N 77° 40' 39.1260" E	Pole	26.54	Whitefly, Pod borer	Fruiting
			Shidlaghatta	Kothanur	13° 23' 20.9760"N 77° 51' 30.8628" E	Pole	27.92	Whitefly	Flowering
				Devaramallur	13° 25' 11.7372"N 77° 53' 54.7764" E	Pole	25.54	Whitefly	Flowering
			Chintamani	Kaiwara	13° 21' 3.8196"N 77° 59' 3.4584" E	Pole	26.41	Whitefly, Thrips, Pod borer	Fruiting
				Kendanahalli	13° 21' 7.8048"N 78° 1' 36.5628" E	Pole	23.89	Whitefly	Flowering

4.	Southern Dry Zone	Mysore	K R Nagar	Doranahalli	12° 23' 15.4428"N 76° 58' 0.0660" E	Pole	21.85	Whitefly	Flowering
				Hampapura	12° 29' 16.6236"N 76° 23' 47.5980" E	Pole	20.80	Whitefly	Fruiting
				Kumbara koppalu	12° 24' 6.3684"N 76° 23' 38.0940" E	Pole	22.54	Whitefly	Fruiting
			Nanjanagudu	Kadakola	12° 11' 43.0188"N 76° 39' 59.1408" E	Pole	23.62	Whitefly	Flowering
				Basavanapura	12° 7' 34.8780"N 76° 40' 39.4644" E	Pole	22.98	Whitefly	Flowering

		Mandya	Madduru	Belakere	12° 37' 44.2884"N 77° 6' 48.5172" E	Pole	23.62	Whitefly, Thrips	Fruiting
				Somanahalli	12° 37' 2.6040"N 77° 3' 41.0364" E	Pole	25.6	Whitefly	Flowering
			Mandya	Budanoor	9° 18' 21.4848"N 76° 33' 53.3736" E	Pole	21.32	Whitefly	Fruiting
				Ragimuddanahalli	13° 13' 9.2064"N 77° 45' 27.7992" E	Pole	23.52	Whitefly	Flowering
5.	Southern Transition Zone	Hassan	H.N.Pura	Nagalapura	14° 18' 14.9868"N 77° 15' 35.2692" E	Pole	21.45	Whitefly	Fruiting
			Alur	Yaduru	14° 40' 40.6056" N 80° 2' 50.7372" E	Pole	20.54	Whitefly	Fruiting
				Mavanoor	12° 58' 48.0468" N 76° 1' 49.7532" E	Pole	18.35	Whitefly, Pod borer	Vegetative
			Belur	Adagooru	12° 51' 46.7100" N 76° 23' 46.8240" E	Pole	17.56	Whitefly	Fruiting
				Hagare	13° 8' 6.2484" N 75° 58' 45.0552" E	Pole	16.54	Whitefly	Fruiting
			Channarayapat tana	Hirisave	12° 57' 23.7312" N 76° 35' 9.7692" E	Pole	16.82	Whitefly	Fruiting
				Baraguru	13° 51' 46.3392" N 76° 58' 58.7748" E	Pole	14.38	Whitefly	Vegetative
		Mysore	Hunsur	Somanahalli	12° 46' 0.2964" N 77° 29' 20.5044" E	Pole	16.98	Whitefly	Fruiting
				Hunsur	12° 18' 28.8432" N 76° 17' 54.7296" E	Pole	18.24	Whitefly	Fruiting
		Davanagere	Honnali	Kadadakatte	14° 12' 26.7696" N 75° 36' 33.3036" E	Pole	19.52	Whitefly	Fruiting
				Arakere	12° 48' 40.5252" N 76° 53' 51.7920" E	Bush	18.62	Whitefly	Fruiting
6.	Northern Transition Zone	Haveri	Haveri	Devihosur	14° 48' 52.6032" N 75° 21' 0.0756" E	Pole	20.62	Whitefly	Fruiting
				Kurabagunda	14° 48' 44.8344" N 75° 23' 23.1396" E	Pole	21.50	Whitefly	Fruiting
			Bydagi	Motebennur	14° 42' 58.5396" N 75° 29' 3.1056" E	Pole	19.65	Whitefly	Fruiting
				Gundenahalli	14° 44' 28.7124" N 75° 27' 51.0336" E	Pole	20.85	Whitefly	Flowering
			Ranebennuru	Hulihalli	14° 37' 0.1200" N 75° 37' 0.1200" E	Pole	18.65	Whitefly	Fruiting
				Chalageri	14° 33' 54.8640" N 75° 42' 59.6520" E	Pole	14.28	Whitefly	Vegetative
7.	Hilly Zone	Chikkamagalur	Mudigere	COH, Mudigere	13° 6' 53.6508"N 75° 37' 49.7208" E	Bush	8.12	Whitefly, Stem fly	Fruiting

Table-2 Average MYMV incidence in various taluk surveyed in Karnataka during 2014-15

Sl. No.	Place		No. of fields surveyed	PDI range	Average PDI
	District	Taluk			
1	Dharwad	Dharwad	3	5.88 – 6.35	6.11
		Hubli	2	8.28-8.69	8.48
		Kalaghatagi	1	8.14-9.42	8.78
2	Belgaum	Belagum	5	7.82-9.42	8.80
3	Bagalkot	Bagalkot	6	8.88-9.4	9.14
4	Gadag	Naragund	3	8.35-9.29	8.77
		Navalagund	2	5.95-6.98	6.46
5	Davangere	Harihara	3	12.32-15.44	13.88
		Davanagere	5	14.82-15.84	15.33
		Honnali	6	18.62-19.52	19.07
6	Tumkur	Sira	2	16.42-19.86	18.14
		Tiptur	6	14.45-16.53	15.49
7	Chikkamagaluru	Kadur	8	17.52-21.25	19.38
		Mudigere	1	8.12	8.12
8	Hassan	Arasikere	6	17.12-21.25	19.18
9	Bangalore Rural	Nelamangal	10	25.86-26.21	26.03
		Doddaballappur	8	25.31-26.38	25.84
		Devanahalli	10	24.38-26.24	25.31
		Hoskote	4	22.86-24.34	23.60
10	Bangalore Urban	Yelahanka	10	20.42-24.5	22.46
11	Ramanagar	Ramanagar	4	22.85-24.62	23.73
		Channapattana	3	23.25-23.64	23.44
12	Kolar	Kolar	6	24.88-27.62	26.25
		Malur	3	24.82-28.54	26.68
13	Chikkaballpur	Chikkaballapur	12	26.54-26.98	26.76
		Shidlaghatta	6	25.54-27.92	26.73
		Chintamani	6	23.89-26.41	25.15

14	Mysore	K R Nagar	3	20.8-22.54	21.67
		Najanagudu	2	22.98-23.62	23.30
		Hunsur	2	16.98-18.24	17.61
15	Mandya	Madduru	3	23.62-25.6	24.61
		Mandya	2	21.32-23.52	22.42
16	Hassan	H.N.Pura	3	21.45	21.45
		Alur	2	18.35-20.54	19.44
		Belur	6	16.54-18.24	17.39
		Channarayapattana	8	14.38-16.8	15.6
17	Haveri	Haveri	2	20.62-21.5	21.06
		Bydagi	2	19.65-20.85	20.25
		Ranebennuru	2	14.28-18.65	16.46

Survey for Mungbean Yellow Mosaic Virus (MYMV) incidence indicated that maximum incidence of MYMV was recorded in Jagidenahalli village (28.54) in Kolar which comes under Eastern dry zone and Kothanur village (27.92) in Chikkaballapur districts of the same zone. This was followed by 27.62 per cent in Vadaguru village of Kolar district. The lowest incidence was recorded in Hebbali (5.88%) of Dharwad which is Northern dry zone and Shalavad of Navalagund (5.95%) followed by 7.82 per cent incidence in Yeragatti of Belagavi district. Among the surveyed taluqs, highest average per cent disease incidence was noticed in Chikkaballapur taluk recorded 26.76 per cent and lowest average per cent incidence was recorded in Dharwad (6.11%). The results were in accordance with [3], who conducted similar survey work on MYMV incidence in green gram. The variation in disease incidence might be due to the difference in temperature and relative humidity that may have a direct influence on vector population and its feeding behavior. A similar effect of climate on vector population was earlier reported by [4-5].

It was noticed that the crop infected at early stage showed more severe symptoms, almost all the leaves exhibited mosaic, complete yellowing, reduction in leaf size and higher percent disease incidence. In the severely infected leaves, the green areas become thick, leathery and showed puckering. The plants showed late maturity giving few flowers and pods. The flower stalk and pods were reduced in size; pods were yellowish in color, turned upwards and produced under developed, immature seeds. Invariably whiteflies were found feeding in most of the fields surveyed in different agro-climatic zones of Karnataka along with other insects like jassids, thrips, pod borers and pod bugs in some of the fields. These symptoms are in conformity with those described by [6]. In severely infected fields the occurrence of whiteflies and large scale cultivation of susceptible varieties growing continuously in the same area are implicated as the reason for increased incidence of MYMV in these areas.

Conclusion

Mungbean yellow mosaic virus disease incidence on French bean was observed in all the surveyed agroclimatic zones of Karnataka. The variations in the incidence of MYMV infection is favored by the susceptible variety and whitefly insect vector, which is most influenced by temperature.

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Author contributions

1. Archith T C: overall conception, framing of experiment, data collection, analysis and article drafting
2. V Devappa: conception and work design, corresponding author
3. Prashant: conducting of survey, data analysis and article drafting
4. Priya I Nagnur: analysis of data

Abbreviations

MYMV: Mungbean yellow mosaic virus
PI: Per cent incidence

Conflict of Interest: None declared

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