Int.J.Curr.Microbiol.App.Sci (2017) *6*(9): 3768-3776

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 9 (2017) pp. 3768-3776**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.609.465

Global Positioning System Based Spatial Distribution of Yellow Mosaic Disease of Greengram in North Eastern Karnataka, India

H. Deepa[1*], M. R. Govindappa[1], S. A. Kulkarni[2], M. Kenganal[1] and S. A. Biradar[3]

[1]Department of Plant Pathology, College of Agriculture, Raichur, Karnataka, India
[2]Agricultutral Research Station, Bidar, Karnataka, India
[3]All India Co-ordinated Research Project on Linseed, Main Agricultutral Research Station, University of Agricultutral Sciences, Raichur, Karnataka, India
**Corresponding author*

Keywords

MYMV, GPS, Spatial variation, begomovirus

Article Info

Accepted:
31 July 2017
Available Online:
10 September 2017

A B S T R A C T

Global positioning system survey map is an indicator to locate the nature of disease spread so as to conclude the hotspot areas. Yellow mosaic disease on greengram caused by begomovirus genus of the family geminiviridae. Present investigations on field survey for disease incidence, diagnostic symptoms and its spatial distribution in major greengram growing parts of North Eastern Karnataka through Global positioning system (GPS) system during *kharif* 2015, revealed that the disease was found to occur at all the stages of under field condition and cause 100 per cent yield loss when it infects at seedling stage. Global positioning system based survey indicated that the per cent disease incidence varied from location to location (spatial variation). The highest average incidence was recorded in Koppal (76.70%) followed by Bidar (70.48%), Yadgir (66.70%), Kalburgi (54.15%) and Raichur (51.49%) districts. In Koppal district, Yelburga taluk has shown the highest (78.40%) disease incidence followed by Kustagi (75.00%). While, in Bidar and Yadgir districts, Humanabad and Yadgir taluks have recorded maximum incidence of 70.16 per cent and 64.80 per cent, respectively. The crop infected at early stages suffered more severe symptoms with almost all the leaves exhibiting yellow mosaic, complete yellowing and puckering with severe stunting of plants. Invariably, whiteflies were found feeding in most of the fields surveyed.

Introduction

Greengram [*Vigna radiata* (L.) Wilczek] is one among thirteen food legumes grown in India and ranks third in production after chickpea and pigeonpea. Greengram is native to Indian subcontinent, Burma and Thailand regions of Asia. India is the largest producer of greengram and accounts for 54 per cent of the world production and covers 65 per cent of the world acreage. Currently, in India greengram is grown in an area of 34.4 lakh ha with production of 15 lakh tonnes and productivity of 407 kg ha^{-1}. Important greengram growing states are Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, Odisha, Tamil Nadu and Uttar Pradesh. In Karnataka, it occupies an area of 5.28 lakh ha with production of 1.08 lakh tonnes and productivity of 205 kg ha^{-1} (Anon, 2014). Major greengram growing districts of Karnataka *viz*., Koppal, Kalburgi, Bidar,

Dharwad, Gadag, Belgaum, Chitradurga, Haveri, Shivamogga, Vijayapura, Bellary and Davangere.

Yellow mosaic disease affects many legumes in India and other South Asian countries and is transmitted by whitefly (*Bemisia tabaci* Genn.) caused by Mungbean Yellow Mosaic Virus (MYMV). On greengram, it is one of the most destructive and serious disease in South Asia. It was first reported by Nariani (1960) at Indian Agricultural Research Institute (IARI), New Delhi with 20 to 30 per cent disease incidence. In Durgapura, Pathak and Jhamaria (2004) reported 100 per cent disease incidence in the check variety K-8512. In India sub-continent disease incidence as high as 100 per cent in farmers' fields is common and often results in considerable yield losses (Varma *et al.,* 1992). Soybean, blackgram, mothbean, cowpea and few other leguminous species have also been reported as hosts of this virus.

For the past several decades, research has been conducted on biological characterization of the virus, virus-vector relationship, epidemiology and disease management by pesticides and resistance breeding (Varma *et al.,* 1992 and Malik, 1992). The present study was carried out to know the extent of mungbean yellow mosaic virus disease incidence in major greengram growing districts of Northern Karnataka.

Materials and Methods

A roving survey was conducted to understand spatial variation of yellow mosaic virus disease on greengram incidence between first fortnight of July to August during *kharif* 2015 in areas of North Eastern Karnataka (NEK) *viz*., Koppal, Raichur, Kalburgi, Bidar and Yadgir. During the study, two taluks, minimum two villages and two locations were selected from each district, taluk and in village were surveyed, respectively for disease incidence. Each surveyed fields were geo referenced in the Universal Transverse Mercator (UTM) co-ordinate system with a Global Positioning System (GPS). By using GPS (Trimble MAK – Juno SB), where they co-ordinates (latitudes and longitudes) were collected at each sampling point to map the spatial variation of yellow mosaic disease on greengram. In addition, other observations such as stage of the crop, varieties grown and type of symptoms, type of weeds in and around plots and farmer interventions in disease management were also recorded.

The per cent disease incidence was calculated based on the number of plants infected out of total number of plants observed.

GPS data import

The collected data from each location using GPS were imported using path finder software. Since, the projection system of collected locations were pre-defined in the GPS, the imported sample points were found within the respective village administrative boundary (having similar projection and datum *i.e*., UTM, WGS 84), when imported in the GIS environment.

Data attachment and mapping

The field observations on yellow mosaic disease incidence of the respective sampling point were fed in excel sheet with proper labeling for each observations. The unique ID was added and the physical ID was created along with the sample locations imported in the ArcGIS environment. Further, the collected field data were attached to the respective GPS location points using unique ID 1:1 relationship in ArcGIS 2010. The disease incidence was displayed through unique symbols to understand the spatial variability of yellow mosaic disease.

Computer software

ArcGIS 10.4 software from College of Agriculture, Raichur was used for the processing and analysis of the data.

Results and Discussion

The investigations on yellow mosaic disease of greengram with respect to GPS based spatial variability in major greengram growing areas of Northern Eastern Karnataka were carried out. It was noticed that the crop infected at early stages, all the leaves exhibited yellow mosaic and complete yellowing with puckering symptoms (Salam, 2005). Similar type of infection was found on reservoir hosts of MYMV *viz*., *Vigna radiata, V. mungo, V. acontifolia, Glycine max, Phaseolus lathyroides* and *Dolichos biflorus* (Nariani, 1960) and Dolichos and *Canava liagladiatus, Phaseolus lunatus, P. vulgaris* (Yaraguntaiah and Govindu 1964).

Survey revealed that, the presence of MYMV disease in all the greengram growing areas of North Eastern Karnataka with the mean incidence ranging from 51.49 to 76.70 per cent. Among the five districts, highest incidence of 76.70 per cent was recorded in Koppal district followed by Bidar, Yadgir, Kalburagi and Raichur with 70.48, 66.70, 54.15 and 51.49 per cent, respectively.

In Koppal district, the highest incidence of MYMV disease of greengram was recorded in Konasagra village (88.50%) of Yelburga taluk followed by Gumageri village (85.40%) of Kustagi taluk and lowest disease incidence was noticed in Navalahalli village (65.80%) of Kustagi taluk followed by Bandi village (67.20%) of Yelburga taluk. While in Raichur district, highest MYMV disease incidence was recorded in MARS Farm (65.30%) followed by Udamakal village (61.00%) of Raichur taluk and lowest disease incidence was observed in Adavibavi village (40.00%) of Lingsugur taluk. In Bidar district, highest MYMV disease incidence was recorded in Dublegundi village (81.00%) of Humnabad taluk followed by Halladkeri village (79.00%) of Bidar taluk and lowest disease incidence was noticed in Chitaguppa village (59.7%) of Bidar taluk. In Kalburgi district, the highest incidence of MYMV (68.40%) was noticed in Kamalapur village of Kalburagi taluk, followed by Madki village (65.20%) of Aland taluk and lowest disease incidence of 38.50 per cent was noticed in Nagoor village followed by Kusnoor village (44.00%) of Kalburagi taluk. In Yadgir district, MYMV disease incidence was highest in Khanapur village (78.10%) of Shahapur taluk followed by Konkal village (72.30%) of Yadgir taluk and lowest incidence of 53.20 per cent was noticed in Haiyyal village of Bidar taluk (Table 1).

The GPS based survey of MYMV disease on greengram indicated that, the per cent disease incidence varied from location to location (Figure 1). Further, this result shows the various steps towards pin-pointing the location specific disease incidence or hot-spot analysis from overall scenario of disease.

The variability of association is due to various environmental factors and biotic factors *viz*., sources of disease inoculum, temperature, rainfall, relative humidity, host susceptibility, etc. and their spatial heterogeneity affect the viral disease incidence and epidemic development.

Comparatively the disease incidence was more in Koppal district followed by Bidar, Yadgir, Kalburgi and Raichur district. Among the varieties grown, Chinamung (Local cultivar), which occupied 95 per cent of area and remaining area was under Selection- 4 and BGS-9, were found susceptible to MYMV infection.

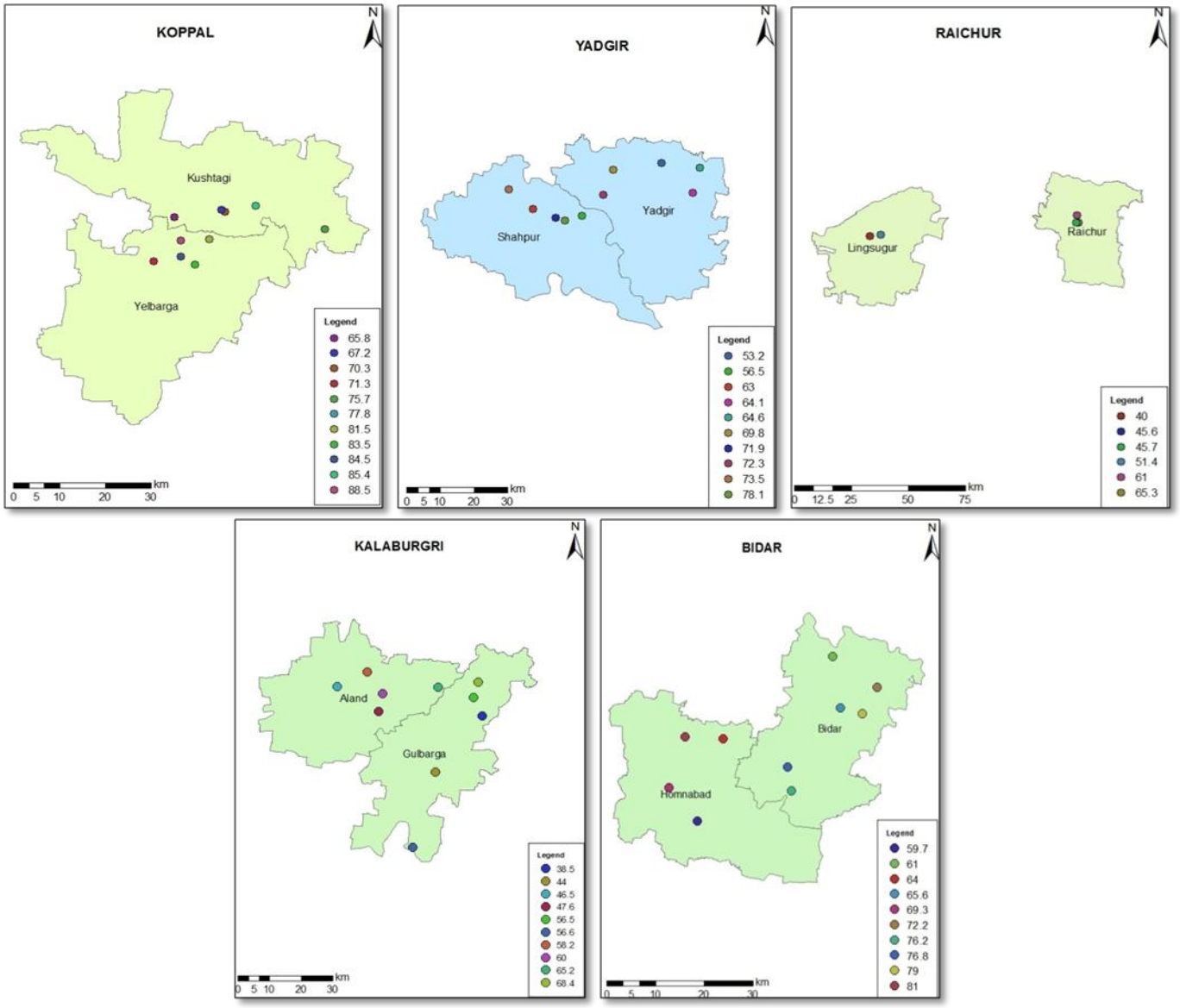
Table.1 Survey for the incidence of MYMV during *kharif* 2015 in North Eastern Karnataka

Sl. No.	District	Taluk	Cultivar	Stage of crop	Per cent incidence	Mean incidence (Taluk wise)	Mean incidence (District wise)	Surrounding crops/ weed hosts around field surveyed	Symptoms on weeds
1.	Koppal	**Kustagi Taluk**					76.70		
		Kustagi	Chinamung	Vegetative Stage	70.30	**75.00**		*Croton*, *Malvestrum*, Greengram	Mosaic, yellowing
		Gumageri	Chinamung	Vegetative Stage	85.40			*Malvestrum*, Cotton, *Parthenium*	Mosaic, vein clearing
		Navalahalli	Selection-4	Vegetative and Reproductive Stage	65.80			*Croton*, *Euphorbia*, Greengram	Slight curling, yellowing
		Hirebannigol	Chinamung	Vegetative Stage	77.80			*Cassia*, *Parthenium*, Greengram	Mosaic, yellowing
		Menedal	Selection-4	Vegetative Stage	75.70			*Malvestrum*, *Croton*, Greengram	Mosaic, vein clearing
		Yelburga taluk							
		Konasagar	Chinamung	Vegetative Stage	88.50	**78.40**		*Croton*, *Euphorbia*, Greengram	Slight curling, Yellowing
		Vajrabandi	Chinamung	Vegetative Stage	84.50			*Croton*, *Malvestrum*, Greengram	Mosaic, yellowing
		Chikka-bannikola	Chinamung	Vegetative and Reproductive Stage	81.50			*Cassia*, *Parthenium*, Greengram	Mosaic, vein clearing
		Bandi	Chinamung	Vegetative Stage	67.20			*Croton*, *Euphorbia*, Greengram	Slight curling Yellowing
		Bellutagi	Chinamung	Vegetative and Reproductive Stage	71.30			*Acalypha*, *Alternenthera*, Blackgram	Mosaic, yellowing
2.	Yadgir	**Yadgir Taluk**							
		Hattikuni	Chinamung	Vegetative And Reproductive Stage	69.80	64.80	66.70	*Croton*, *Malvestrum*, Greengram	Slight curling, yellowing
		Yadhalli	Chinamung	Vegetative Stage	64.60			*Cassia*, *Parthenium*, Greengram	Mosaic, yellowing
		Haiyyal	Chinamung	Vegetative And Reproductive Stage	53.20			*Croton*, *Euphorbia*, Greengram	Mosaic, vein Clearing
		Konkal	Chinamung	Vegetative Stage	72.30			*Phyllanthus*, *Croton*,	Slight curling,

								Blackgram	yellowing
		Chinakar	Chinamung	Vegetative Stage	64.10			*Croton*, *Malvestrum*, Greengram	Yellowing, mosaic
		Shahapur Taluk							
		Khanapur	Chinamung	Vegetative Stage	78.10	68.60		*Cassia*, Greengram *Parthenium*,	Slight curling yellowing
		Manginhall	Chinamung	Vegetative Stage	73.50			*Croton*, *Euphorbia*, Greengram	Mosaic, vein clearing
		Doranahalli	Chinamung	Vegetative Stage	63.00			*Croton*, Greengram *Malvestrum*,	Mosaic, vein clearing
		Naikal	Chinamung	Vegetative Stage	56.50			*Cassia*, Greengram *Parthenium*	Slight curling yellowing
		Gundalli	Chinamung	Vegetative Stage	71.90			*Croton*, *Euphorbia*, Greengram	Mosaic, yellowing
3.	**Raichur**	**Raichur Taluk**							
		MARS, Raichur	Chinamung	Vegetative Stage	65.30	57.33	51.49	*Croton*, *Malvestrum*, Greengram	Slight curling, yellowing
		Udamakal	Chinamung	Vegetative Stage	61.00			*Cassia*, Greengram *Parthenium*,	Mosaic, yellowing
		Askiyal	Chinamung	Vegetative Stage	45.70			*Croton*, *Euphorbia*, Greengram	Mosaic, vein clearing
		Lingasgur Taluk				45.66			
		Kasaba Lingasgur	Chinamung	Vegetative And Reproductive Stage	45.60			*Phyllanthus*, *Croton*, Blackgram	Slight curling, yellowing
		Lingasgur	Chinamung	Vegetative Stage	51.40			*Cassia*, Greengram *Parthenium*,	Mosaic, vein Clearing
		Adavibavi	Chinamung	Vegetative Stage	40.00			*Croton*, Greengram *Malvestrum*,	Mosaic, vein clearing
4.	**Kalaburgi**	**Kalburgi Taluk**				52.80	54.15		
		Kamalapur	Chinamung	Vegetative and Reproductive Stage	68.40			*Phyllanthus*, *Croton*, Blackgram	Slight curling, yellowing
		Gabbur	Chinamung	Vegetative And Reproductive Stage	56.50			*Croton*, *Malvestrum*, Greengram	Mosaic, yellowing,
		Kusnoor	Selection-4	Vegetative Stage	44.00			*Cassia*, Greengram *Parthenium*,	Vein clearing Mosaic
		Nagoor	Chinamung	Vegetative Stage	38.50			*Croton*, *Euphorbia*, Greengram	Slight curling yellowing

		Ferojbad	Chinamung	Vegetative Reproductive	56.60			*Acalypha,* Blackgram	Mosaic, yellowing
		Aland Taluk							
		Aland	Chinamung	Vegetative Stage	46.50	55.50		*Croton*, *Malvestrum*, Greengram	Vein clearing, mosaic
		Madki	Selection-4	Vegetative and Reproductive Stage	65.20			*Cassia*, *Parthenium*, Greengram	Slight curling, yellowing
		Tadkal	Chinamung	Vegetative and Reproductive Stage	58.20			*Croton*, *Euphorbia*, Greengram	Mosaic, yellowing
		Belamagi	Chinamung	Vegetative Stage	60.00			*Acalypha*, *Alternenthera*, Blackgram	Mosaic, vein clearing
		Vaijapur	Chinamung	Vegetative and Reproductive Stage	47.60			*Croton*, *Malvestrum*, Greengram	Slight curling, yellowing
		Humnabad Taluk				70.16			
		Hudagi	Chinamung	Vegetative and Reproductive Stage	69.30			*Cassia*, *Parthenium*, Greengram	Slight curling, yellowing
		Humnabad	Selection-4	Vegetative Stage	76.80			*Croton*, *Euphorbia*, Greengram	Mosaic, yellowing
		Chitaguppa	Chinamung	Vegetative and Reproductive Stage	59.70			*Croton*, *Malvestrum*, Greengram	Vein clearing, mosaic
		Halliked B.	Chinamung	Vegetative Stage	64.00			*Cassia*, *Parthenium*, Greengram	Slight curling, yellowing
		Dublegundi	Chinamung	Vegetative and Reproductive Stage	81.00			*Croton*, *Euphorbia*, Greengram	Mosaic, yellowing,
5.	**Bidar**	**Bidar Taluk**					70.48		
		Chidri	Selection-4	Vegetative Stage	65.60	70.80		Croton, Malvestrum, Greengram, Blackgram	Slight curling, yellowing
		Bagadal	Chinamung	Vegetative and Reproductive Stage	76.20			*Cassia*, Greengram *Parthenium*,	Mosaic, yellowing
		Gumma	Chinamung	Vegetative Stage	72.20			*Croton*, *Euphorbia*, Greengram	Mosaic, vein clearing,
		Janwada	Chinamung	Vegetative and Reproductive Stage	61.00			*Phyllanthus*, *Croton*, Blackgram	Slight curling, Yellowing
		Halladkeri	Selection-4	Vegetative Stage	79.00			*Croton*, Greengram, *Malvestrum*, Blackgram	Mosaic, yellowing

Fig.1 GIS Map showing spatial variation of yellow mosaic disease of greengram during *Kharif* 2015 in North Eastern Karnataka



During the survey, it was observed that, farmers were not practicing plant protection measures *viz*., seed treatment, spraying of insecticides during onset of disease, removal of alternate hosts and growing resistant varieties. In these locations, MYMV incidence were found on other leguminous crops *viz*., soybean, blackgram, horsegram and volunteer greengram crop besides potential off season weed hosts *viz*., *Croton bonplandianum, Malvastrum coromandelianum, Euphorbia geniculata* and others. Similarly, cotton plants surrounding surveyed fields might have also influenced as the source of whitefly population.

Further, it was observed that the crop infected at early stage suffered more severe symptoms with almost all leaves exhibited mosaic and complete yellowing and reduced leaf size. Severely infected leaves shows puckering symptoms with green areas became thick, leathery and raised. The plants matured lately produced few flowers with very much condensed stalk and yellow coloured pods turned upwards containing few underdeveloped and immature seeds with reduced size. During survey whiteflies were found invariably feeding in most of the fields.

Salam *et al.,* (2011) reported more YMD incidence in Bidar and Gulbarga districts followed by Haveri, Dharwad and Gadag with an average incidence of 22.64, 17.60, 9.52, 7.05 and 2.61 per cent, respectively. Panduranga *et al.,* (2012) reported MYMV incidence of 49.60 and 57.70 per cent during vegetative and flowering stages, respectively in Warangal district. While in Khammam district, incidence of 42.20 per cent and 50.62 per cent recorded during vegetative and flowering stages, respectively. Manjunath *et al.,* (2013) also reported 31.49 to 100 per cent disease incidence in Southern Karnataka.

Present investigations on yellow mosaic disease of greengram caused by begomovirus revealed that the disease was found to occur at all the stages of greengram under field condition across the locations surveyed. GPS based survey indicated that the per cent disease incidence varied from location to location (spatial variation). However, Koppal district regarded to be the hot spot for yellow mosaic disease of greengram.

References

Anonymous, 2014, *www. Indiastat.com*.

Malik, I. A., 1992. Breeding for resistance to MYMV and its vector in Pakistan. In: Green, S. K. and Kim, D. I. L., (Ed.). Mungbean yellow mosaic disease; Proceedings of an International Workshop, 2-3 July 1991, Bangkok, Thailand. AVRDC, Shanhua, Tainan, Taiwan. p. 641-650.

Manjunath, B., Jayaram, N., Muniyappa, V. and Prameela, H. A., 2013. Status of yellow mosaic virus and whitefly *Bemisia tabaci* biotypes on mungbean in Southern Karnataka. *Legume Research - An International J.*, 36(1): 62-66.

Nariani, T. K., 1960. Yellow mosaic of Mung (*Phaseolus aureus* L.). *Indian Phytopath*, 13: 24-29.

Panduranga, G. S., Reddy, P. K. and Rajashekara H., 2012. Survey for incidence of mungbean yellow mosaic virus (MYMV) in mungbean *Vigna radiata* (L.) Wilczek. *Environment and Ecology*, 30(3): 1030-1033.

Pathak, A. K., and Jhamaria, S. L., 2004. Evaluation of Mungbean (*Vigna radiata* L.) varieties to yellow mosaic virus. *J. Mycol. Pl. Path*., 34(1): 64-65.

Salam, S. A., 2005. Studies on Mungbean yellow mosaic virus disease on greengram. *M. Sc (Agri) Thesis*, Univ. Agril. Sci., Dharwad, Karnataka, India.

Salam, S. A., Patil, M. S. and Byadgi, A. S., 2011. Status of mungbean yellow

mosaic virus disease incidence on green gram. *Karnataka J. Agric. Sci*., 24(2): 247-248.

Varma, A., Dhar, A. K., Mandal, B., Gocen, S. K. and Kim, D., 1992. MYMV transmission and control in India. Mungbean yellow mosaic disease: *Proceeding of International Workshop*, Bangkok. 8-27: 92-373.

Yaraguntaiah, R. C., and Govindu, H. C., 1964. Virus disease of *Dolichos lablab* var. *Typcum* from Mysore. *Curr. Sci*., 33: 721-722.

How to cite this article:

Deepa H., M. R. Govindappa, S. A. Kulkarni, M. Kenganal and Biradar S. A. 2017. Global Positioning System Based Spatial Distribution of Yellow Mosaic Disease of Greengram in North Eastern Karnataka. *Int.J.Curr.Microbiol.App.Sci.* 6(9): 3768-3776.
doi: https://doi.org/10.20546/ijcmas.2017.609.465