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## Incidence of viral diseases on capsicum (sweet pepper) under protected conditions in Karnataka

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**Abstract**

Capsicum a member of family *Solanaceae*, is commonly known as sweet pepper, bell pepper and Shimla mirchi. Under protected cultivation, capsicums are widely grown due to higher productivity and economic feasibility. However, diseases of viral nature affect production significantly, both in terms of yield and quality. To know the incidence of viral diseases and prevalence of vector populations, an extensive survey was conducted during *rabi* 2017 and 18 in major capsicum growing areas of Karnataka under protected cultivations. Virus infected capsicum plants exhibit symptoms of curling, cupping, puckering, mosaic, reduced plant growth and bushy appearance, chlorotic rings on leaves and fruits etc. Results of survey revealed that the highest mean incidence of leaf curl disease (27.92%) in Dharwad, mild mottle disease (27.61%) in Belagavi and mosaic disease (21.39%) in Chikkaballapur districts were recorded. Among the different crop growth stages, flowering stage recorded maximum mean incidences of leaf curl (20.32%), mild mottle (22.03%) and mosaic disease (18.16%). The highest mean incidence of 20.92 per cent leaf curl, 19.04 per cent mild mottle disease and 17.92 per cent mosaic diseases were observed under shade net condition. Among the different varieties/hybrids, hybrids from Namdhari seeds recorded highest mean incidence mild mottle disease (23.11%), leaf curl (21.85%) and mosaic disease (17.96%).

**Keywords:** Capsicum, leaf curl, mosaic, protected cultivation and incidence

**1. Introduction**

Capsicum (*Capsicum annuum* L. var. *grossum* Sendt.), is an important vegetable worldwide belonging to the solanaceous family (Alonso *et al.*, 1989) [1]. *Capsicum/Pepper fruits* have different names depending on place and type. Common names include chilli pepper, capsicum, red and green pepper. It consists of many varieties which include: green, red, yellow, orange and more rarely the white and the purple variety depending on when they are harvested and the specific cultivar. Pepper has both nutritional and medicinal values. When used as a primary ingredient it contributes to flavour texture and colour to dishes. It has vitamin A, C, B1 and B2. The crop contains appreciable amount of mineral such as iron, calcium, magnesium, phosphorus and sulphur.

In India, capsicum is extensively cultivated in states of Karnataka, Andhra Pradesh, Maharashtra, Tamil Nadu, hilly areas of Uttar Pradesh and Himachal Pradesh. In Karnataka capsicum is grown in an area of about 4.13 thousand ha with a production of about 81.67 thousand tons (Anon., 2018) [2]. However, Belagavi, Bengaluru Rural, Chikkaballapur, Dharwad, Haveri, and Kolar, districts are the major capsicum growing areas under protected conditions in Karnataka.

Capsicum is an important winter and summer season vegetable and spice crop in Karnataka both in open and protected cultivation it is grown as an off-season crop in summer and rainy seasons, which brings lucrative returns to the farmers. In recent years capsicum has become one of the premier crops under polyhouse condition. Capsicum has been attacked by number of fungi, bacteria and viruses. Besides *Phytophthora* fruit rot, Bacterial wilt and canker, viral diseases are the most common cause of losses to polyhouse grown capsicum as they affect both quantity and quality of the produce and are the most difficult to control. The viruses that infect capsicum are Alfalfa mosaic virus, Andean potato mottle virus, Beet curly top virus, Chili leaf curl virus, Chilli vein mottle virus, Cucumber mosaic virus, Pepper mild mottle virus, Pepper mottle virus, Pepper vein mottle virus, Potato virus Y, Tobacco etch virus, Tobacco mosaic virus, Tomato mosaic virus, Tomato spotted wilt virus (Wetter *et al.*, 1984

Sharma *et al.*, 1993 and Lima *et al.*, 2011)<sup>[8, 5, 4]</sup>.

In Karnataka, the viruses causing leaf curl and mosaic in capsicum are very common. The popularization of polyhouse venture and use of hybrid seeds has led to the escalated incidence of the viral diseases in the state. Surveys of the capsicum polyhouses in the state revealed that the major diseases symptoms were in the form of mosaic, mottle, chlorosis, upward or downward curling of the leaves, puckering, deformation and reduction of leaf lamina along with stunting of infected plants in some areas. It is necessity to have information about the prevalence of viral diseases in capsicum under polyhouse conditions in Karnataka. The present study was carried out to assess the prevalence of virus diseases in polyhouse cultivated capsicum.

## 2. Material and Methods

Based on the availability of protected structures and standing crop, survey was conducted during *rabi* 2017-18 to know the incidence of viral diseases and prevalence of vector populations in major capsicum growing areas of Karnataka under protected cultivations like Bagalkote, Belagavi, Bengaluru Rural, Chikkaballapur, Dharwad, Haveri and Kolar districts. Observations were recorded for the incidence of viral diseases by recording the number of plants showing disease symptoms and the total number of plants examined. Later, the per cent disease incidence was calculated by using following formula given by Wheeler (1969)<sup>[9]</sup>.

$$\text{Per cent disease incidence} = \frac{\text{Number of diseased plants}}{\text{Total number of plants examined}} \times 100$$

## 3. Results and Discussion

A survey for the disease incidence of capsicum viral diseases under protected condition was undertaken during *rabi* 2017 and 2018 in major capsicum growing areas of Karnataka like Belagavi, Bagalkote, Bengaluru Rural, Chikkaballapur, Dharwad, Kolar and Haveri districts. Information regarding places visited, disease incidence, stage of the crop, varieties grown, type of protected structure, prevalence of pests and weeds were recorded. During survey, the capsicum plants showed typical symptoms of different viral diseases (leaf curl, cucumber mosaic and pepper mild mottle).

### 3.1 Symptomatology

Common symptoms observed during the survey include mosaic, green blisters or islands on leaves, yellowing, curling and crumpling of leaves. Infected capsicum plants showed mixed symptoms of Pepper mild mottle virus (PMMoV) and Cucumber mosaic virus (CMV) such as mosaic, mottling, greening, yellowing, dark green blisters on leaves and stunted growth of plant, chlorotic rings (Plate 1) and colour variation on fruits. Mosaic, yellowing of leaves and stunted growth were most confusing symptoms on capsicum. Various symptoms like, vein clearing, mosaic, mottling, vein banding and inter veinal chlorosis were observed on different weed

species in polyhouses during survey *viz.*, *Amaranthus viridis* L., *Ageratum conyzoides* L., *Alternanthera sessilis* L. and *Solanum esculantum* L. etc. which may serve as source of infection (Plate 1e,f). Whiteflies, aphids, mites, leaf minor and fruit borers were also observed in the places surveyed.

Mean incidence of viral diseases of capsicum during 2017-18 is presented in Table 1. Mean incidence of leaf curl disease during *rabi* 2017 and 2018 was 16.91 and 18.45 per cent respectively. Highest mean incidence leaf curl disease was observed in Dharwad (27.92 %) followed by Belagavi district (22.40 %) whereas, Haveri district recorded lowest incidence of 10.04 per cent. Over all mean incidence of leaf curl in all the surveyed areas was 18.76 per cent.

Maximum mean disease incidence of mild mottle disease was in Belagavi district (27.61 %) followed by Dharwad (25.91 %) and Chikkaballapur district (23.37 %). Mean incidence of disease during *rabi* 2017 and 2018 was 18.25 and 17.09 per cent respectively. However, overall mean incidence of 19.27 per cent was recorded in all districts surveyed in Karnataka.

The highest mean mosaic disease incidence of 21.39 per cent was recorded in Chikkaballapur district followed by Dharwad (18.70 %) and Kolar (17.85 %). The least incidence of 10.84 per cent was noticed in Bagalkot district. Mean incidence of mosaic disease was 16.31 and 15.04 per cent was during *rabi* 2017 and 2018 respectively. However, during 2017-18 Maximum mosaic disease incidence of 15.71 per cent was recorded in different districts of Karnataka.

### 3.2 Distribution of viral disease incidence on capsicum under different crop stage, protected conditions and varieties during *rabi* 2017-18

During survey the viral diseases were recorded on capsicum under protected condition irrespective of stage of the crop. However, highest mean incidence of leaf curl (20.32 %), mild mottle (22.03 %) and mosaic disease (18.16 %) were recorded in flowering stage followed by fruiting stage (18.80 %), (18.84 %) and (16.30 %) respectively. Whereas, lowest incidence of 17.25 per cent leaf curl, 8.87 per cent mild mottle disease and 12.25 per cent mosaic disease was recorded when the crop was in vegetative stage (Table 2). The highest mean incidence of 20.92 per cent leaf curl, 19.04 per cent mild mottle disease and 17.92 per cent mosaic diseases were observed under shade net. While, 18.11, 18.94 and 15.63 per cent disease incidence of leaf curl, mild mottle disease and mosaic disease were recorded under polyhouse respectively (Table 3).

Among the different varieties/hybrids, hybrids from Namdhari seeds recorded highest mean incidence mild mottle disease (23.11 %), leaf curl (21.85 %) and mosaic disease (17.96 %), followed by Oroballa hybrid (20.44, 19.42 and 17.26 %) respectively. Similarly Indra hybrid showed (18.24 %) leaf curl, (17.77 %) mild mottle disease and (15.39 %) mosaic disease incidence. Indus hybrid recorded lowest mean disease incidence (13.00 %) leaf curl and mild mottle disease, (7.50 %) mosaic disease (Table 4).

**Table 1:** District wise mean incidence of viral diseases on capsicum under protected cultivations during *rabi* 2017 and 2018

Districts	Disease incidence (%)						Mean incidence (%)		
	<i>Rabi</i> 2017			<i>Rabi</i> 2018			Leaf curl disease	Mild mottle disease	Mosaic disease
	Leaf curl disease	Mild mottle disease	Mosaic disease	Leaf curl disease	Mild mottle disease	Mosaic disease			
Bagalkote	10.00	8.20	9.75	10.21	8.20	11.93	10.10	8.20	10.84
Belagavi	17.16	22.83	12.25	10.17	9.56	13.25	22.4	27.61	12.75
Bengaluru	14.39	20.86	19.27	21.57	22.50	14.88	17.98	21.68	17.07

Rural									
Chikkaballapur	24.00	23.57	21.57	22.63	23.18	21.22	22.31	23.37	21.39
Dharwad	21.00	25.40	20.00	34.84	26.42	17.40	27.92	25.91	18.70
Kolar	22.36	20.20	20.80	19.15	18.45	14.90	20.75	19.32	17.85
Haveri	9.50	6.75	11.00	10.58	11.08	11.75	10.04	8.66	11.37
Mean	16.91	18.25	16.31	18.45	17.09	15.04	18.76	19.27	15.71

**Table 2:** Incidence of viral diseases at different stage during survey

Sl. No.	Stage of the crop	Disease incidence (%)						Mean incidence (%)		
		Rabi 2017			Rabi 2018			Leaf curl disease	Mild mottle disease	Mosaic disease
		Leaf curl disease	Mild mottle disease	Mosaic disease	Leaf curl disease	Mild mottle disease	Mosaic disease			
1	Vegetative	26.50	11.75	15.50	8.00	6.00	9.00	17.25	8.87	12.25
2	Flowering	19.58	20.17	17.71	21.06	23.89	18.61	20.32	22.03	18.16
3	Fruiting	18.94	20.40	17.78	18.67	17.29	14.83	18.80	18.84	16.30
	Mean	21.67	17.44	17.78	15.91	15.73	14.15	18.79	16.58	15.57

**Table 3:** Incidence of viral diseases on capsicum under protected cultivation system

Sl. No.	Type of protected cultivation	Disease incidence (%)						Mean incidence (%)		
		Rabi 2017			Rabi 2018			Leaf curl disease	Mild mottle disease	Mosaic disease
		Leaf curl disease	Mild mottle disease	Mosaic disease	Leaf curl disease	Mild mottle disease	Mosaic disease			
1	Polyhouse	17.93	20.17	16.33	18.29	17.71	14.94	18.11	18.94	15.63
2	Shade net	21.17	18.61	19.39	20.68	19.48	16.46	20.92	19.04	17.92

**Table 4:** Distribution of viral diseases on capsicum on different varieties/hybrids

Season	Disease incidence (%)								Mean incidence (%)			
	Rabi 2017				Rabi 2018				Indra	Namdhari	Indus	Oroballa
	Genotypes/ hybrids	Indra	Namdhari	Indus	Oroballa	Indra	Namdhari	Oroballa				
Leaf curl disease	20.05	18.33	13.00	18.91	16.43	25.37	19.94	18.24	21.85	13.00	19.42	
Mild mottle disease	19.21	27.67	13.00	20.85	16.34	18.55	20.04	17.77	23.11	13.00	20.44	
Mosaic disease	18.41	17.00	7.50	17.35	12.38	18.92	17.18	15.39	17.96	7.50	17.26	

**Plate 1:** a) Upward curling, puckering and mottling b) Mosaic and mottling c) Conspicuous chlorotic rings on leaves d) Stunted growth e) and f) Viral symptoms on weeds: *Ageratum conyzoides*, *Alternanthera sessilis*.

Survey conducted in the present investigation showed that the per cent incidence of viral diseases varied from place to place, season to season, irrespective of crop stage and

varieties/hybrids. However, occurrence of all three viral diseases were more in *rabi* 2017. Among the three viral diseases, pepper mild mottle caused by *Pepper mild motle*



*virus* recorded maximum incidence followed by leaf curl disease caused by ToLCV and ChiLCV, and mosaic disease by *Cucumber mosaic virus*. Natural occurrence of viral diseases on Capsicum under protected cultivation system depends on the prevalence of vectors population.

The survey results of the present study on capsicum viral diseases are in accordance with the many research findings from different parts of the world. Wherein, an extensive survey was conducted by Sharma *et al.* (2016)<sup>[6]</sup> in different capsicum grown polyhouses of Himachal Pradesh during 2011 to 2014. The symptoms observed on diseased plants included upward and downward curling, mosaic and mottling, chlorosis, deformed leaves and fruits with stunted plant growth. The diseased samples were indexed through DAS-ELISA, and results revealed the presence of eight viruses namely CMV, PMMoV, TMV, TSWV, Tomato yellow leaf curl virus (TYLCV), PVY, PepMoV and PVMV during 2011, while in 2013 data indicated only four viruses *viz.*, CMV, TSSWV, PVY and PMMoV. Singh *et al.* (2004)<sup>[7]</sup> recorded incidence of fruit borer, mites, aphids and whitefly on hybrid sweet pepper under protected condition (Net house) in India. Incidence of Pepper yellow vein mosaic virus (PYVMV) vectored through aphids was seen on sweet pepper.

#### 4. References

1. Alonso EL, Gracia MT, Avila-rincon B, Wicke MT, Serra, Daiz JR. A tobamovirus causing heavy losses in protected pepper crops in Spain. *J Phytopathology*. 1989; 125:67-76.
2. Anonymous, Horticultural Statistics at a glance. Ministry of Agriculture and Farmers welfare, GOI, 2018, 514p.
3. Hartwell JL. Plants used against cancer. *A survey Liogdia*. 1971; 34:204-244.
4. Lima MF, Inoue-Nagata AK, Reifschneider FJB, Souza KRR, Ulhoa AB, Ferraz RM. Detection, occurrence and natural incidence of Pepper mild mottle virus (PMMoV) in hot peppers in Brazil. *Acta Horticulturae*. 2011; 917:269-273.
5. Sharma PN, Chowfla SC, Garg ID, Khurana SM. Properties of viruses associated with mosaic disease complex of bell pepper. *Indian Phytopath*. 1993; 46:347-353.
6. Sharma A, Kulshrestha S. Molecular characterization of tospoviruses associated with ring spot disease in bell pepper from different districts of Himachal Pradesh. *Virus Dis*. 2016; 27(2):188-192.
7. Singh D, Kaur S, Dhillon TS, Singh P, Hundal JS, Singh GJ. Protected cultivation of sweet pepper hybrids under net- house in Indian conditions. *Acta Hort*, 2004; 659:1583-1589.
8. Wetter C, Conti M, Altschuh D, Tabillion R, Regenmortel MHV. Pepper mild mottle virus, a *Tobamovirus* infecting pepper cultivar in Sicily. *American Phytopatholog Soci*. 1984; 74:405-410.
9. Wheeler BEJ. An introduction to plant diseases. John Wiley and Sons Ltd., London, United Kingdom. 1969, 80-82p.