



## Research Article

# SCREENING OF SWEET PEPPER GENOTYPES FOR VIRAL DISEASES UNDER PROTECTED CULTIVATION IN DHARWAD, KARNATAKA, INDIA

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**Abstract:** Sweet pepper is commonly known as capsicum, bell pepper and Shimla mirchi. Under protected cultivation widely grown due to higher productivity and economic feasibility. Diseases of viral nature affect the crop production significantly both in terms of yield and quality. To know the incidence of viral diseases and prevalence of vector population fourteen capsicum hybrids were screened during *kharif* 2018 and *rabi* 2018-19. None of the hybrids were found to be resistant during the both the seasons. However, During *kharif* 2018, six hybrids viz., Maxibell, Shristika, SV1865PB, Asha, Arka Gaurav and Arka Basanti were found to be moderately susceptible for leaf curl disease and for mild mottle disease, hybrids Arka Gaurav and Arka Basanti recorded moderately resistant reaction. Results of *rabi* 2018-19 season revealed that, hybrids Shristika, SV1865PB, Asha, Indra, Arka Gaurav, Arka Basanti, 35-160-R2 and NSX 8 found to be moderately susceptible for mosaic disease. The symptoms observed during screening included mosaic and mottling, yellow discoloration, vein clearing, leaf deformation and narrowing, stunted plant growth, reduced fruit setting and light green colour mottling symptoms on fruits.

**Keywords:** *Capsicum hybrids, Protected cultivation, Leaf curl, Mild mottle and Mosaic diseases*

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## Introduction

Production of vegetables under protected cultivation system results in effective use of the land resources, besides being able to increase the production of quality vegetables both for the export and domestic markets by offsetting biotic and abiotic stresses to a great extent that otherwise is prevalent in open cultivation. Under protected cultivation, capsicums are widely grown due to higher productivity and economic feasibility [1].

Capsicum (*Capsicum annuum* L. var. *grossum* Sendt.) a member of family Solanaceae, is commonly known as sweet pepper, bell pepper, Shimla mirchi and green pepper. Although this genus includes 25 species, most of them are cultivated in temperate and tropical areas. In India, capsicum is extensively cultivated in states of Karnataka, Andhra Pradesh, Maharashtra, Tamil Nadu, hilly areas of Uttar Pradesh and Himachal Pradesh. Area under capsicum in Karnataka is about 37 thousand ha with production of about 563 metric tons [2].

About sixty eight viruses has been reported to be infecting capsicum from different parts of the world in terms of host range, frequency of distribution and damage [3, 4]. Viruses and their vectors are the major bottleneck for successful cultivation capsicum in the world [5, 6, 7]. Diseased samples of indexed through DAS ELISA showed the presence of eight different viruses viz, Cucumber mosaic virus, Pepper mild mottle virus, Tobacco mosaic virus, Tomato spotted wilt virus, Tomato yellow leaf curl virus, Potato virus Y, Pepper mottle virus, Pepper vein mottle virus on capsicum during 2013 and 2014 in low and high hills of Himachal Pradesh [8].

Diseases of viral nature affect production significantly, both in terms of yield and quality for export and domestic market [9]. Leaf curl incidence of 30 per cent was recorded on capsicum under protected cultivation in Himachal Pradesh [10]. Majority of pepper viruses are reported to be transmitted by aphids, thrips,

leafhoppers, beetles and fungi or by contact and through the soil and some are transmitted by nematodes [11]. Observation showed that the production of this crop has been banned with viral infection. The viruses causing leaf curl and mosaic in capsicum are very common in Karnataka, because of popularization of polyhouse venture and use of hybrids has led to the increased incidence of viral diseases [12].

In Karnataka, capsicum cultivation under protected conditions drawing more attention towards farmers in peri-urban production system, because of easy access to the market. The popularization of polyhouse venture and use of hybrid seeds has led to the escalated incidence of the viral disease in the state. Hence, host plant resistance is considered as most practicable, feasible and an economical method of plant disease management. So, there is a need to identify resistant source in capsicum through screening of available hybrids against viral disease under protected cultivation.

In view of the above facts the present study was conducted to investigate the severity of viral diseases of capsicum in mostly cultivated hybrids in Karnataka under protected conditions and to know the resistant nature against viral diseases. To achieve these goals, fourteen different hybrids were selected which are cultivated year around under protected conditions.

## Material and Methods

In the present study fourteen capsicum hybrids [Table-1] from different private companies collected and used for screening against viral diseases under protected structures at Hi-tech Horticulture Unit, Saidapur farm, UAS, Dharwad during *kharif* 2018 under polyhouse and *rabi* 2018-19 under shade net [Fig-1,2]. The seeds were sown in the nursery by covering nylon mesh to the trays and normal agronomic practices were followed to ensure proper plant growth.



Kharif 2018 field view

Rabi 2018-19 field view

Fig.1.2 Field view of screening plots during kharif-2018 and rabi 2018-19 at Hi-Tech Horticulture unit, UAS, Dharwad.



Curling and interveinal chlorosis

Yellowing and mottling

Fig-3 Viral symptoms of capsicum a. upward and downward curling, vein thickening and vein banding and b. yellowing and mottling

Table-1 Capsicum genotypes used for screening against viral diseases under protected condition

SN	Capsicum Hybrids	Colour	Source
1	Maxibell	Red	United Genetics Pvt. Ltd.
2	Shristika	Green	Chia Tai Seeds Pvt. Ltd.
3	SV1865PB	Green	Seminis Seeds Pvt. Ltd.
4	Asha	Green	Clause India Pvt Ltd.
5	Indra	Green	Syngenta India Ltd.
6	Arka Gaurav	Yellow	IIHR, Hesarghatta, Bengaluru
7	Arka Basanti	White	Rijk Zwaan India Seeds Pvt. Ltd.
8	Rithal	Yellow	
9	Sympathy	Red	
10	35-160-R2	Red	Namdhari Seeds Pvt. Ltd.
11	NSX 8	Red	
12	SPH-20	Red	
13	SPH-82	Red	
14	NS-292	Red	

Forty-five days old seedlings were transplanted in the polyhouse and shade net in the respective years. Indra cultivar was used as susceptible check. Each entry was sown in two rows of 6 m length with a spacing of 45 cm from plant to plant and 60 cm between rows. Regular package of practices was carried out until harvest of the crop.

Disease rating scale used to determine the level of resistance or susceptibility of capsicum hybrids against viral diseases as given by [13].

Disease severity Index	Percentage of infection	Host reaction
0	Free from infection	HR (Highly resistant)
1	1-10% infection	R (Resistant)
2	11-20% infection	MR (Moderately resistant)
3	21-30% infection	MS (Moderately susceptible)
4	30-50% infection	S (Susceptible)
5	More than 50% infection	HS (Highly susceptible)

## Results and Discussion

Symptoms like stunted growth of plants followed by upward curling of marginal leaves, interveinal chlorosis, yellowing, netting, mild mottling and blisters on

leaves was noticed on capsicum hybrids. Mild mottle virus infected plants showed mild mottling, deformed leaves, yellow or green mosaic and chlorosis of leaves. Mosaic virus infected sweet pepper plants showed mixed symptoms of mosaic, mottling, yellow discoloration, vein clearing, leaf deformation and narrowing of petiole, stunted growth, reduced fruit setting and light green colour, mottling, chlorotic rings on fruits [Fig-3].

**Screening during kharif 2018:** The disease severity of viral diseases of capsicum was recorded at 30, 60, 90, 120 and 150 days after transplanting (DAT). There was no disease at 30 DAT in any of the genotypes. However, disease severity increased with increase in age of the crop from 30-150 DAT. Screening results of fourteen capsicum hybrids showed various reaction to viral diseases. Hybrids viz., Maxibell, Shristika, SV1865PB, Asha, Arka Gaurav and Arka Basanti were moderately resistant to leaf curl virus followed by Indra, Rithal, and Sympathy hybrids showed considerable reaction to virus with mild symptoms. For mild mottle disease, hybrids Arka Gaurav and Arka Basanti recorded moderately resistant reaction. Whereas, Maxibell, Shristika, SV1865PB, Asha, Indra, Rithal and Sympathy showed moderately susceptible reaction. Hybrids 35-160-R2, NSX 8 and SPH-20 were found to be susceptible. Hybrids, SPH-82 and NS-292 recorded highly susceptible reaction to the virus.

**Screening during rabi 2018-19:** Eight hybrids viz., Maxibell, Shristika, SV1865PB, Asha, Indra, Arka Gaurav, Arka Basanti and Rithal showed susceptible reaction. Whereas, six hybrids i.e., Sympathy, 35-160-R2, NSX 8, SPH-20, SPH-82 and NS-292 were found to be highly susceptible to the leaf curl disease. Whereas, eight hybrids viz., Shristika, SV1865PB, Asha, Indra, Arka Gaurav, Arka Basanti, 35-160-R2 and NSX 8 recorded moderately susceptible reaction with disease severity index of 3. Hybrids, Maxibell, Rithal, Sympathy, SPH-20, SPH-82 and NS-292 were found to be susceptible to the mosaic disease. All the 14 capsicum hybrids were further categorized into different groups based on the type of disease reaction [Table-2]. Screening results of capsicum hybrids during kharif 2018 and rabi 2018-19 for viral diseases under protected cultivation deciphered, all fourteen hybrids showed varied degrees of resistance and susceptibility to both leaf curl and mild mottle viruses respectively.



Table-2 Disease reaction of capsicum hybrids screened against viral diseases under protected condition

SN	Disease severity index	Percentage of infection	Disease reaction	Kharif 2018		Rabi 2018-19	
				Leaf curl disease	Mild mottle disease	Leaf curl disease	Mosaic disease
1	0	Free from infection	HR (Highly resistant)	-	-	-	-
2	1	1-10% infection	R (Resistant)	-	-	-	-
3	2	11-20% infection	MR (Moderately resistant)	-	Arka Gaurav, Arka Basanti	-	-
4	3	21-30% infection	MS (Moderately susceptible)	Maxibell, Shristika, SV1865PB, Asha, Arka Gaurav, Arka Basanti	Maxibell, Shristika, SV1865PB, Asha, Indra, Rithal, Sympathy	-	Shristika, SV1865PB, Asha, Indra, Arka Gaurav, Arka Basanti, 35-160-R2, NSX 8
5	4	30-50% infection	S (Susceptible)	Indra, Rithal, Sympathy	35-160-R2, NSX 8, SPH-20	Maxibell, Shristika, SV1865PB, Asha, Indra, Arka Gaurav, Arka Basanti, Rithal, Sympathy, 35-160-R2, NSX 8, SPH-20, SPH-82, NS-292	Maxibell, Rithal, Sympathy, SPH-20, SPH-82, NS-292
6	5	More than 50% infection	HS (Highly susceptible)	35-160-R2, NSX 8, SPH-20, SPH-82, NS-292	SPH-82, NS-292	-	-

However, none of the hybrid showed resistant or immune reaction to the disease. Fifty pepper genotypes screened by [14] for chilli veinal mottle virus (ChiVMV) and cucumber mosaic virus (CMV) by mechanical sap inoculation. Symptoms of severe leaf distortion and chlorotic lesions were observed for CMV, among the genotypes eight genotypes showed immune and highly resistant, five were resistant and two showed moderately resistant reaction. Similarly [15] screened 50 tomato genotypes for the disease incidence of tomato leaf curl virus (ToLCV). Out of 50 genotypes, none of the tested lines were resistant; however, six genotypes showed mild infection and nine genotypes were found to be moderately resistant.

### Conclusion

The present study results revealed that, all fourteen capsicum hybrids showed varied degrees of resistance and susceptibility to the viral diseases. The plausible answer may be the warm humid conditions and, an excellent stable environment for pest development. The natural enemies that keep pests under control outside are not present under protected conditions.

**Application of research:** Viruses remain a primary constraint to production of high-quality capsicum world-wide especially in the developing countries like India. Prompt action against the damage caused by viruses is with the use of resistant varieties and ensuring adequate phyto-sanitary conditions within the field. Therefore, awareness of local farmers on the impact of field hygiene must be improved as adjunct to using tolerant varieties. Ultimately, development of ecofriendly ways of virus disease management will help to improve yield in the pepper industry.

**Research Category:** Plant Pathology, Virology

**Abbreviations:** ha-Hectare, cm-Centimetre, DAT- Days after transplanting

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**Cultivar / Variety / Breed name:** Capsicum (*Capsicum annuum* L. var. *grossum* Sendt.)

**Conflict of Interest:** None declared

**Ethical approval:** This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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