AgriCos e-Newsletter
ISSN: 2582-7049 www.agricosemagazine.com
Volume: 01 Issue: 02 June 2020 Article No: 19

Viral Diseases in King Chilli: A Brief Report

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SUMMARY

King chilli is known to have a good potential of economic return to the growers. The various factors hindering the production of king chilli, biotic stress and virus diseases in particular has the utmost pressure on the growers. About 65 viruses are reported to infect and hinder the production of chili worldwide. However, most reviews of king chilli viruses focuses mainly on molecular indexing of Begomovirus, Cucumovirus, Potyvirus and Tospovirus only. Therefore, systematic investigations on molecular characterization and development of robust diagnostics of different viruses occurring in the region have not been done. To ameliorate the yield and quality loss of King chilli due to virus diseases, efforts has been made in detection and studies are being carried out to formulate packages of practices to manage the viral diseases of king chilli.

INTRODUCTION

Chili is an important and widely cultivated spice crop of North Eastern (NE) region of India. The north-eastern states of Manipur, Nagaland, Assam and Mizoram are known for the cultivation of one of the hottest chill known as King chili / Umorok / Naga chili (*Capsicum chinense* Jacq). The pungent flavor of chillies is mainly due to a compound called capsaicin.

Table 1: Pungency in SHU of chilli cultivars belonging to three species of Capsicum.

Chilli cultivar	Scientific Name	Pungency (SHU) (mean values)
Carolina Reaper	*Capsicum Chinense*	2,200,000
7 Pot Douglah	*Capsicum Chinense*	1,853,936
Trinidad Scorpion “Butch T”	*Capsicum Chinense*	1,463,700
Naga Viper	*Capsicum Chinense*	1,359,000
King Chilli (Bhut Jolokia)	*Capsicum Chinense*	1,041,427
‘Meiteimorok’	*Capsicum annuum L.*	39.100
‘Haomorok’	*Capsicum annuum L.*	26.600
‘Uchithi’	*Capsicum frutescens L.*	141.200
‘Mashingkha’	*Capsicum frutescens L.*	104.300
‘Umorok’	*Capsicum chinense Jacq.*	329.100
‘Chiengpi’	*Capsicum chinense Jacq.*	126.200

Chilli is the largest spice item exported from India it occupies first position in terms of value. During 2015-16, chilli exported 24.21 per cent by value of the total exports of spices from India. The average quantity of chilli exported was 300375 Metric tonnes with value of Rs 269101.50 lakhs. The major importers of Indian chillies are Malaysia, Sri Lanka, Indonesia, The Us, Bangladesh, Singapore, UK, Nepal and Mexico. Malaysia is the largest importer of Chilli from India (Sources: Spices Board Statistics Report, 2015-16).

Viruses of Chilli

Chili crop with its wide geographical distribution is exposed to many biotic stresses and viral diseases have been a major constriction to the flourishing production of king chili. Out of the various viruses, *Chilli veinal mottle virus* (ChiVMV) belonging to the Potyvirus genus, *Cucumber mosaic virus* (CMV) of the Cucumovirus genus, chilli infecting begomovirus which cause leaf curl diseases (referred to as ChiLCV) and *Groundnut bud necrosis virus* (GBNV) or *Peanut bud necrosis virus* (PBNV) of belonging to the genus Tospovirus are thought to be the most distressing (Reddy and Reddy, 2010). A Macluravirus, *Large cardamom chirke virus* (LCCV) was recently detected, infecting *C. annuum* (landrace Dalle Khursani) (Sharma et al, 2018). Other economically important viruses of chilli includes *Potato virus Y* (PVY), *Pepper mottle virus* (PepMoV), *Pepper severe mosaic virus* (PeSMV), *Pepper mild mottle virus* (PMMoV) belonging to the genus *Tobamovirus* is highly contagious and can survive for long period in soil, *Tomato yellow leaf curl virus* (TYLCV), *Pepper veinal mottle virus* (PVMV), *Tomato spotted wilt virus* (TSWV), *Tobacco mosaic virus (TMV), Pepper yellow mosaic virus* (PepYMV), *Tomato chlorotic spot virus* (TCSV), and *Pepper ring spot virus* (PepRSV) are known to infect chilli in different parts of the world (Gracia et al. 1968; Kang et al. 1973; Lockhart & Fischer 1974; Villalon 1975; Ong et al. 1980; Wetter et al. 1984; Sharma et al. 1993) causing both yield and quality losses.

They are naturally transmitted by the vector aphid, thrips, whitefly, mealybug in a non-persistent/ non-circulative manner. Once in a while, circulation is supported by seed transmission however it is extremely uncommon. The subtropical climatic conditions prevailing in the north-eastern region is favorable for the elevated occurrence of the vector i,e aphid and increases the biological diversity of the plant virus and thus results in higher crop loss. Normally, CMV and ChiVMV regularly co-infect the chilli crop. Because these viruses have broad host range and are transmitted by several aphid species, complete control is extremely difficult, and inherent genetic resistance in host plants is the best strategy to combat these viruses (Chaim et al. 2001).

Detection

Reported methods for the detection of the viruses include isolation and purification of the virus, reverse transcription polymerase chain reaction (RT-PCR), enzyme-linked immunosorbent assay (ELISA) and western blotting. PCR-based methods for the detection and identification are primarily based on the use of degenerate primers to conserved sequences in the viral genomes. The vast majority of these primers have been designed to sequences viz, CP- and NIb-coding region. The use of degenerate primers has not only facilitated the rapid detection of many potyviruses but has also enabled partial genomic sequencing for taxonomic purposes.

A highly specific conventional duplex PCR to detect the occurrence of *chilli leaf curl virus* (ChiLCV) and *Chilli vein mottle virus* (ChiVMV) by using the specific primer Pot 1 and Pot 2 for ChiVMV and AVF28 and AV29R for ChiLCV was developed by Sahu *et al.*, (2015). A Luminex xTAG-based assay for plant-infecting tospoviruses was developed by Niklas *et al.*, (2017). The test enables the detection of tospoviruses in general and the differentiation of the four important member species of this genus: Tomato spotted wilt virus, Impatiens necrotic spot virus, the proposed 'Capsicum chlorosis virus' and Watermelon silver mottle virus. The generic tospovirus primers used in this method are also applicable for detection of tospoviruses by basic RT-PCR. The sophisticated Luminex xTAG technology allows the simultaneous detection of various targets. Although commercially available ELISA kits can be used for the diagnosis of ChiVMV, the kits are expensive and less sensitive than molecular diagnostic methods. Conventional RT-PCR techniques are time-consuming and require expensive equipment, a sophisticated laboratory setup and highly skilled personnel.

CONCLUSION

Various viruses belonging to different family has been detected and identified to cause disease in King chilli and thereby reductions of crop yield. There are various commercial kits for detection of the plant viruses causing diseases in chilli. There are many sophisticated technology that allows the simultaneous detection of various targets. Although commercially available kits can be used for the diagnosis, the kits are expensive and less sensitive than molecular diagnostic methods. Conventional PCR and RT-PCR techniques are time-consuming and require expensive equipment, a sophisticated laboratory setup and highly skilled personnel. Thus, more studies and research in this field shall help in exploring ways and techniques favorable with regards to expense and result outcome.

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