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REVIEW ARTICLE

BUD NECROSIS DISEASE- A DETAILED STUDY ON HOST RANGE, SERODIAGNOSIS AND VARIETAL EVALUATION

***Aswathi, K. K., Preethy, T. T., Dr. Asha, V. Pillai and Mannambeth Renisha Jayarajan**

India

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ABSTRACT

In India, tospoviruses are arising as serious pathogens and affecting the cultivation of variety of crops. Five *Tospovirus* species, viz., Groundnut bud *necrosis virus* (GBNV) (Reddy *et al*., 1992) and *Groundnut yellow spot virus (*GYSV) (Satyanarayana *et al.,* 1998) from groundnut, *Watermelon bud necrosis virus* (WBNV) from watermelon (Singh and Krishnareddy, 1996), *Iris yellow spot virus* (IYSV) from onion (Ravi *et al.,* 2005) and *Capsicum chlorosis virus* (CaCV) from tomato (Kunkalikar *et al.,* 2007) have been identified on the basis of host range, vector specificity, serological properties and amino acid sequence identity of NP gene. Among them bud necrosis disease has emerged as a serious threat to watermelon and groundnut cultivation in India.

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INTRODUCTION

Host range

Collateral hosts play an important role in the perpetuation of the pathogen and the vectors. The knowledge on this aspect is very useful for the successful management of viral diseases. Among the plant infecting viruses, *Tospoviruses* have a very broad host range that spans more than 1100 different species from within more than 80 families, which include both monocots as well as dicots. Many of these plants serve as reservoirs of infection that contribute to epidemics on crop plants (Cho *et al*., 1986). Moyer *et al*. (1999) reported that *Tospoviruses* belonging to family *Bunyaviridae* were causing substantial losses worldwide to crops such as groundnut, potato, tobacco, vegetables and ornamental plants. *Tospovirus* infect important vegetables and other crops in tropical, subtropical and temperate regions worldwide (Whitfield *et al*., 2005). Ghotbi and Shahraeen (2005) reported the occurrence of *Tospoviruses* in many ornamentals and weed species. Singh and Krishnareddy (1996) reported that *Tospovirus* isolate from India systemically infected watermelon, muskmelon and other cucurbits. Thirty three plant species belonging to seven families were evaluated for the host range studies of WBNV.

Corresponding author: Aswathi, K. K.,
India

Among them only 17 produced different type of symptoms. Chlorotic local lesions were observed on *V.unguiculata* cv. C-152, *Vigna mungo* and *Sesamum indicum*, where as chlorotic or necrotic spots followed by systemic infection was observed on *Citrullus lanatus* cv. Arka Manik, *Citrullus lanatus* cv.Madhu, *Cucumis melo*, *Cucumis sativus*, *Lagenaria sciceraria*, *Arachis hypogaea* cv. JL-24,*Cassia tora*, *Dolichos lablab*, *Nicotiana rustica*, *Nicotiana tabaccum* and *Gomphrena globosa*. Mandal *et al*. (2003) reported the natural infection of WBNV in *Luffa acutangula* for the first time in India. The characteristic symptoms noticed were yellowing of leaves. Jain *et al*., (2006) reported natural infection of *Tospoviruses* on three cucurbitaceous (*C.sativus*, *L.acutangula*, *and C.lanatus*) and three fabaceous (*V.unguiculata*, *Phaseolus vulgaris* and *D.lablab*) vegetable crops in India. Experimental host range studies of WBNV isolate was done on 21 host plants belonging to six families, out of which 13 hosts were successfully infected. Out of thirteen, eight hosts exhibited local chlorotic or necrotic lesions, while four hosts, viz., *N.rustica*, *N.glutinosa, D.stramonium and C.lanatus* showed systemic infection (Bhanupriya, 2006). Krishnaveni *et al*. (2004) tested 31 plant species by mechanical inoculations with six different PBNV isolates collected from different crop species, *viz.,* tomato, groundnut, blackgram, peas, chilli and brinjal. Out of them, visible symptoms were expressed by all the six isolates on nine plant species such as lima bean, green gram, groundnut, tomato, brinjal, chilli and tobacco. A study was

conducted to determine the host range of PBNV in Bhapatla, Andrapradesh. Fourteen various crops and weed species belonging to different families were tested by mechanical inoculation for their susceptibility to PBNV. Among these selected hosts *C.amaranticolor*, *V.radiata*, *V.mungo*, *V.unguiculata*, *A.hypogaea*, *P.vulgaris*, *D.lablab*, *S.lycopersicon*, *C.annum*, *D.stramonium*, *P.minima*, *N.glutinosa* and *N.tabaccum* showed different types of symptoms after sap inoculation (Kumar *et al*., 2006).

Immunodetection and diagnosis

Plant viruses are immunogenic and were used as antigens for the production of antibodies and utilized in serological detection of viruses. The identification of the virus is best carried out by serological assays like immuno - diffusion and ELISA (Clark and Adams, 1977). Serological tests by ELISA and western blotting with polyclonal and monoclonal antibodies demonstrated that the virus infecting watermelon in Taiwan was serologically related to *Watermelon silver mottle virus* (Yeh *et al*., 1992; Adam *et al*., 1993). WBNV from India was detected by ELISA using PBNV or WSMoV specific antisera. According to the results, WBNV in India was found to be similar to watermelon *Tospovirus* from Japan and Taiwan and closely related to Indian PBNV (Singh and Krishnareddy, 1996). Pandey *et al*. (2004) raised polyclonal antiserum against N protein of WBNV and detected WBNV as well as PBNV isolates of wide range of hosts from different locations in India. According to the report of Jain *et al*. (2005) the antiserum to the N protein of PBNV at 1:4000 dilution successfully detected the natural infection of PBNV and WBNV in a wide range of cucurbitaceous, leguminous and solanaceous hosts from different locations in India. Reddy *et al*. (1992) reported that the virus causing peanut bud necrosis in India was found to be distinct and is restricted to Asia. Bhat *et al*. (2001) confirmed the association of PBNV with crops like black gram, cowpea, green gram and soyabean based on the DAC- ELISA. The weed plants *Achyranthes aspera*, *Acanthospermum hispidum*, *Commelina benghalensis*, *Ageratum conyzoides*, *Borreria hispida*, *Euphorbia geniculata* and Datura *stramonium* showed strong reaction to PBNV antisera in DAC- ELISA (Nagaraja and Murthy, 2005). Raja and Jain (2006) and Anjaneyareddy *et al*. (2008) diagnosed bud blight of tomato using polyclonal antiserum (N protein) of PBNV in DAC- ELISA and DIBA and suggested that the tomato samples were infected with Peanut *bud necrosis virus*.

Varietal evaluation

Limited progress has been made in breeding of crops for increased resistance to *Tospoviruses*. Polygenic nature of resistance in many cases makes incorporation of resistance a difficult task (Goldbach and Peters, 1996). A total of 16 watermelon hybrids and selection lines were screened for resistance against WBNV in a field experiment conducted in Uttar Pradesh, India during 1998. Among the hybrids and lines tested, four were moderately resistant (EC-393240, Durgapura Meetha, MHW-6 and Ashey Questo) and three were resistant (EC-393243, Durgapura selection and RHRWH -2) to the pathogen (Pandey and Pandey, 2001).

Among the interspecific cross (Arka Manik x *Citrullus colocynthis*) a total of 146 individual plants were raised and these plants were screened against WBNV under natural field condition. Of the germplasm screened, eight germplasm accessions namely, IIHR-81, IIHR-83, IIHR-85, IIHR-90, IIHR-102, IIHR-110, IIHR-114 and IIHR-118 were found free from watermelon bud necrosis disease under natural condition, whereas, Arka Manik susceptible check showed 85 per cent WBND incidence (IIHR, 2007). In India, despite intensive efforts over a number of years to find resistance, none of the 7000 groundnut (*A. hypogaea*) genotypes evaluated by researchers exhibited resistance against PBNV. However, tolerant lines with good agronomic characteristics included TCGV-86029, TCGV-86030, ICGV-86031, TCGV-86033 and ICGV-86538. But this has not been yet incorporated into commercially attractive groundnut cultivars (Reddy *et al*., 1983). Venkataramana *et al*. (2006) screened 63 tomato entries for resistance to PBNV under field condition during Kharif 2003. Among them only one entry EC5888 showed highly resistant reaction while EC 8630 and EC 2652 were resistant. Pusa Uphar, EC 251709, EC 165700, LE 23, IIHR 2187, IIHR 2272, IIHR 2273 and IIHR 2274 were moderately resistant. These field promising genotypes were further tested by sap inoculation for confirmation of resistance. Two genotypes, *viz*., EC 8630 and EC 5888 were highly resistant, LE 23 and EC 526512 were resistant and EC 165700 displayed a moderately resistant reaction. Field experiments were conducted in 2007 and 2008 at AVRDC in Hyderabad, India to evaluate 30 improved lines of tomato for yield performance and field tolerance against *tomato leaf curl virus* and *peanut bud necrosis virus*. Peanut bud necrosis disease severity recorded was minimum in lines DR2-1 and NC 3220 (Sain and Chadha, 2012). The review of literature on host range, serodiagnosis and varietal evaluation will be helpful for future research works and developing proper management practices in near future.

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