

Inhibition of Bhendi (Okra) Yellow Vein Mosaic Virus (BYVMV) by different plant extracts

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Inhibition of Bhendi Yellow Vein Mosaic Virus (BYVMV) infection by different plant extracts was studied under field conditions. Superiority of alcohol extracts was proved over water extracts. Extract from bottlebrush, datura, agave and ginger gave a good degree of suppression of field symptoms. A lower rate of disease dissemination was recorded in extract treated plants than in untreated control. Mortality of whitefly ranged from 20-80% when they were confined in a cage with plants treated with extracts for a period of 30 minutes.

Key words : Inhibition, Plant extract, Bhendi, Yellow Vein Mosaic Virus, Whitefly, mortality

Bhendi (*Abelmoschus esculentus*) is one of the most important vegetables in India grown almost round the year. In spite of available good number of high yielding varieties total production and quality of fruits are gradually decreasing, primarily due to whitefly (*Bemisia tabaci*) transmitted yellow vein mosaic virus (BYVMV). Most of the bhendi cultivars are susceptible to this virus and the only suggested control practice is to frequent use of different insecticides which may lead to residual toxicity problem or enhances the resistance to the vector.

Induction of resistance in susceptible host either by living organisms or by chemical agents is known since a long time in various host-pathogen combinations (Loebenstein, 1972; Gupta *et al.*, 1974; Chowdhury and Saha, 1985). Many plant extracts have the property to induce resistance against some virus diseases and such resistance have been found in both local and systemic infection by viruses (Smookler, 1971; Verma *et al.*, 1979). Extracts from few

host plants have antiviral properties which inhibit the development of systemic infection by inducing resistance in susceptible host and some of them are protein and polysaccharide in nature (Zaitlin and Singh, 1963; Sing and Verma, 1981; Dannio and Ford, 1971). They have indicated that these chemical substances are responsible for either inducing resistance or may act directly on the virus *in vivo* or *in vitro* conditions as a result virus failed to establish in the host for the manifestation of disease syndrom. Considering the economic importance of the disease we attempted to screen some of the plant extracts against BYVMV with an object to find out an alternative methods to control this important disease.

MATERIALS AND METHODS

Leaves of *Callistemon lanceolus* DC (bottlebrush), *Datura metel* L (datura), *Eucalyptus polyanthemos* Schaver (eucalptus), *Azadirachata indica* A. JUSS (margo), *Agave americana* L (sisal), *Vinca rosea* L (vinca), fruits of *Capsicum annum* L (chilli), bulb of *Allium sativum* L (garlic) and rhizome of *Curcuma longa* L (turmeric) and *Zingiber officinale* Roscor (ginger) were selected to test the presense of antiviral substance in their extracts. Some of these plants listed are known for their medicinal value and few are use in prevention of viral diseases in human being.

Fresh material including leaves, fruits or rhizome were collected seperately and chopped into small pieces and extracted the sap with distilled water and absolute alcohol. For making extract in water, chopped, pieces were grinded in a pestle and mortar with water in the ratio of 1 : 1 (wt/vol). Extracted sap was filtered through a mushlin cloth and used for experiment in diluted and undiluted conditions. Dilution (50%) were made in distilled water. For extraction in alcohol, freshly collected plant materials were chopped and placed in absolute alcohol for 15 days, thereafter it was filtered and alcohol remained with the host extract was removed by evaporation at room temperature. Residue left after evaporation was diluted 50% with water and used to test the antiviral activity. Extracts prepared by the above methods were sprayed on the bhendi plants, planted in the fields. Spraying was done at 15 days interval and intensity of BYVMV infection was determined by counting the number of infected plants. Control plants was sprayed with water only.

Survival period or the mortality of whitefly vectors on different extracts was tested by releasing 50 whiteflies on extract treated plants using a suitably designed cage. Toxicity of these extracts on treated bhendi plants was also recorded by observing the scorching or any other abnormal symptoms on leaves.

RESULTS AND DISCUSSIONS

It appears from the results (Table 1) that the plant extracts significantly reduced the BYVMV infection ranging from 35 to 88% irrespective of concentration and method of extraction. Prevention of infection was highest by alcohol extract than by water extract excepting chilli. Rate of inhibition

Table 1. Effect of different plant extracts on the inhibition of bhendi yellow vein mosaic virus (BYVMV) on bhendi

Plant	% inhibition		
	Water extract		Alcohol extract*
	Diluted	Undiluted	Diluted
<i>C. lanceolatus</i>	75	56	80
<i>C. annum</i>	80	80	64
<i>D. metel</i>	70	35	80
<i>E. polyanthemos</i>	62	56	78
<i>A. sativum</i>	70	50	76
<i>A. indica</i>	75	84	75
<i>A. americana</i>	75	80	88
<i>C. longa</i>	50	65	78
<i>V. rosea</i>	76	66	78
<i>Z. officinale</i>	75	56	82

* Diluted with water

among the diluted and undiluted form of water extract had the minimum difference. However extracts of bottlebrush, datura, eucalyptus, garlic, vinca and ginger gave better results when sprayed in diluted form. Rate of spread of the disease in the field was recorded at 15 to 20 days after each spray. It was found that in most of the cases treated plants were free from disease upto 15 days, after which the disease appeared in different intensity. A minimum infection of 16% was observed after third spray when plants were treated with undiluted water extract of *A. indica* while highest of 65% was observed in plants treated with undiluted extract of *D. metel* (Table 2). In control where the plants were treated only with water plants gave highest infection of BYVMV.

Mortality of whitefly varied from 20-80% when caged with extract treated leaves separately for a period of 30 minutes (Table 3). A mortality upto 80% was observed when exposed to plants treated with garlic extract and lowest upto

Table 2. Effect of plant extracts on development of bhendi yellow vein mosaic virus at different time interval in field conditions

Plant	Type of extract (diluted or undiluted)	Infection percentage		
		15 days after 1st spray	20 days after 2nd spray	15 days after 3rd spray
<i>C. lanceolatus</i>	Dil	0	0	25
	Undil	0	33	44
<i>C. annum</i>	Dil	0	14	20
	Undil	0	14	20
<i>D. metel</i>	Dil.	10	15	30
	Undil	30	60	65
<i>E. polyanthemus</i>	Dil.	0	25	38
	Undil.	0	33	44
<i>A. sativum</i>	Dil.	10	30	30
	Undil.	0	10	50
<i>A. indica</i>	Dil.	0	15	25
	Undil.	0	10	16
<i>A. americana</i>	Dil.	0	0	25
	Undil.	0	0	20
<i>C. longa</i>	Dil.	25	50	50
	Undil.	0	25	35
<i>V. rosea</i>	Dil.	0	20	24
	Undil.	0	22	34
<i>Z. officinale</i>	Dil.	10	25	25
	Undil.	10	28	44
Control (water)		30	60	65

Table 3. Efficacy of some plant extracts on the normality of whitefly and their field toxicity on bhendi plants

Plant	Percentage of whitefly mortality (30 min)	Toxicity of the extracts	
		Diluted	Undiluted
<i>C. lanceolatus</i>	30	—	—
<i>C. annum</i>	20	+	++
<i>D. metel</i>	20	+	+
<i>E. polyanthemus</i>	60	—	+
<i>A. sativum</i>	80	+	+++
<i>A. indica</i>	75	—	+
<i>A. americana</i>	50	—	++
<i>C. longa</i>	20	+	+++
<i>V. rosea</i>	65	+	+
<i>Z. officinale</i>	20	+	+
Control (water)		0	—

— no toxicity ; + mild toxicity ; ++ moderate toxicity ; +++ severe toxicity.

20% was recorded with the extract of chilli, datura, turmeric and ginger. In control plants all the insects survived upto 30 minutes observation period. Few of the extracts treated leaves showed scorching type of symptoms which indicated the toxic reaction and which persisted for a longer period in the leaves and it was more pronounced with garlic and turmeric.

All the plant extracts could prevent infection of BYVMV to varied degrees. Inhibition of plant virus *in vivo* and *in vitro* using plant extracts has been reported by Singh and Gupta (1970), Verma *et al.*, (1979) and Verma and Mukherjee (1979). Possibly some kind of protective substances are formed within the extract treated plants which prevent the infection or some inhibitory substance present in the extracts may act directly on virus particles present in the host or the extract may induced host resistance. Sing and Verma (1981) screened extracts of 20 plant spp. and obtained 100% and 87.5% inhibition of tobacco mosaic virus using *D. metel* and *A. indica* leaf extract respectively.

Besides direct inhibition or inducing of resistance, most of the plant extracts had repellent and insecticidal effect when spread on bhendi plants. Insecticidal property of few plant spp. like tobacco, black pepper, *Euphorbia* sp., *Lantana camera* against aphids, thrips and jassids have been reported (Pandey *et al.*, 1977; Scott and McKibben, 1978). Chemical nature of substances present in plant extracts which are responsible for inhibition of infection needs further studies as such they can be used more efficiently with minimum cost to control one of the most important virus disease of bhendi.

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