

# Plant Protection & Biological Control of Viral Infection on Okra (*Abelmoschus esculentus*) by Root Extract of *Boerhaavia diffusa*

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**ABSTRACT:** Yellow vein mosaic disease on okra (*Abelmoschus esculentus*) under natural condition was suppressed by partially clarified aqueous root extract of *Boerhaavia diffusa*. Treatments were administered as foliar sprays at concentration of 4% at 7 days interval, commencing from the time when plants were at seedling stage. Regular sprays of root extract of *Boerhaavia diffusa* were highly effective in reducing okra yellow vein mosaic disease. Comparative data recorded with respect to infection, growth, flowering, fruiting, and yield revealed that extract from the roots of *Boerhaavia diffusa* reduced infection by about 80%. Flowering and consequent fruiting was observed in all treated beds, which showed high yield. Fruits were more in number, soft and green as compared to yellow and fibrous fruits in control beds.

**KEYWORDS:** Yellow Vein Mosaic, Aqueous Root Extract, Okra

## I. INTRODUCTION

Pesticides kill pests, but also pests' natural enemies, and their overuse can harm farmers, consumers and the environment. The first line of defense is a healthy agro-ecosystem. Integrated Pest Management (IPM) is an eco-friendly approach which aims at keeping pest below and disease infestation economic thresholds level by employing all available alternate pest control methods and techniques such as cultural, mechanical and biological control with greater emphasis on use of Bio-pesticides and pesticides of plant-origin like Neem formulations.

Okra (*Abelmoschus esculentus*) is an important vegetable crop of UP, Bihar, MP, Maharastra etc. It suffers from a very destructive disease, yellow vein mosaic (YVM) of okra spread by white fly, *Bemisia tabaci*. The YVM has been reported as a major disease of okra (Shivpuri *et al.* 2004), causing 25-35% mortality of plants every year in most of the okra growing areas of the country. The climatic condition of plateau region of UP generally favor disease development. In order to control the disease, the bioefficacy of conventional insecticides was tested against pests of okra (Patel *et al.* 1997, Mote *et al.* 1994, Bhagat *et al.* 1997). Induction and transfer resistance in okra was also tried (Fungra & Rajpoot 1993, 1999; Jambhale & Nerkar 1983). The main aim of the present work was to determine the efficiency of root extract of *Boerhaavia diffusa* in checking the disease under field conditions. The extract has earlier been reported as inducer of resistance in susceptible host plants against viruses showing mosaic type of symptoms (Awasthi *et al.*, 1984; Verma *et al.* 1979, 1985)

## II. MATERIALS & METHODS

The okra crop was sown in separate beds. Upon germination the seedlings were adjusted to approximately 500 plants/bed (Bed size = 10×7 meter<sup>2</sup>). Care was taken to avoid the growth of border weeds along the sides of the bed to facilitate the free flow of virus vectors. The sample of *Boerhaavia diffusa* roots was collected from fully mature plants in Kushinagar, UP. Roots after washed in running tap water, cut into small pieces, dried under natural sunlight and grounded to fine powder. The *Boerhaavia diffusa* powder was soaked in 0.2 M Sodium acetate (NaHCOOH) buffer

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Vol. 4, Issue 5, May 2015

(pH 5.2) in the ratio of 1:5. The pulp was squeezed through two folds of muslin cloth and filtrate was centrifuged at 8000 rpm for 15 minutes.

To the supernatant 60% ammonium sulphate was added and kept overnight. The precipitate formed was collected after centrifugation, dissolved in small amount of buffer and dialysed against Sodium acetate buffer (0.02 M, pH 5.2). The clear dialysate was diluted up to 1:5 with the help of distilled water. Sprays on test plants were done with the help of pneumatic hand sprayer, until drip off occurred. Observations on disease incidence were made at weekly intervals with respect to plant height, flowering and fruiting at the end of the experiment when the crop was mature. Final reading also included fruit length, number of fruits per plant and yield.

### III. RESULTS

Plants showing viral symptoms on a & b -tobacco, c- Lagenaria and d-sun hemp Fig-1 is expressed in the experiment. The disease was apparent from the first week onwards in all the beds of okra, however in the third week disease spread stabilized in the treated beds. Between 4<sup>th</sup> and 5<sup>th</sup> week control beds exhibited a steep rise in disease and number of plants infected shot up from 20% to 35%-40%, indicating perhaps a fresh vector attack which had no effect on the treated beds Fig-2.



Fig.2 Plants showing viral symptoms:  
a: Systemic symptoms of TMV on *Nicotiana tabacum* cv. NP-31;  
b: Localized symptoms of TMV on *Nicotiana glutinosa*;  
c: Systemic symptoms of CMV on *Lagenaria*  
d: Systemic symptoms of SRV on *Crotalaria juncea*

Fig-1

The percent protection afforded by *B. diffusa* extract initially was 85%. Treated okra displayed a better response in the initial phase but exhibited a sudden rise in disease incidence between the third and fourth weeks before stabilizing again from fifth week onwards. There was however, a corresponding increase in the control bed as well

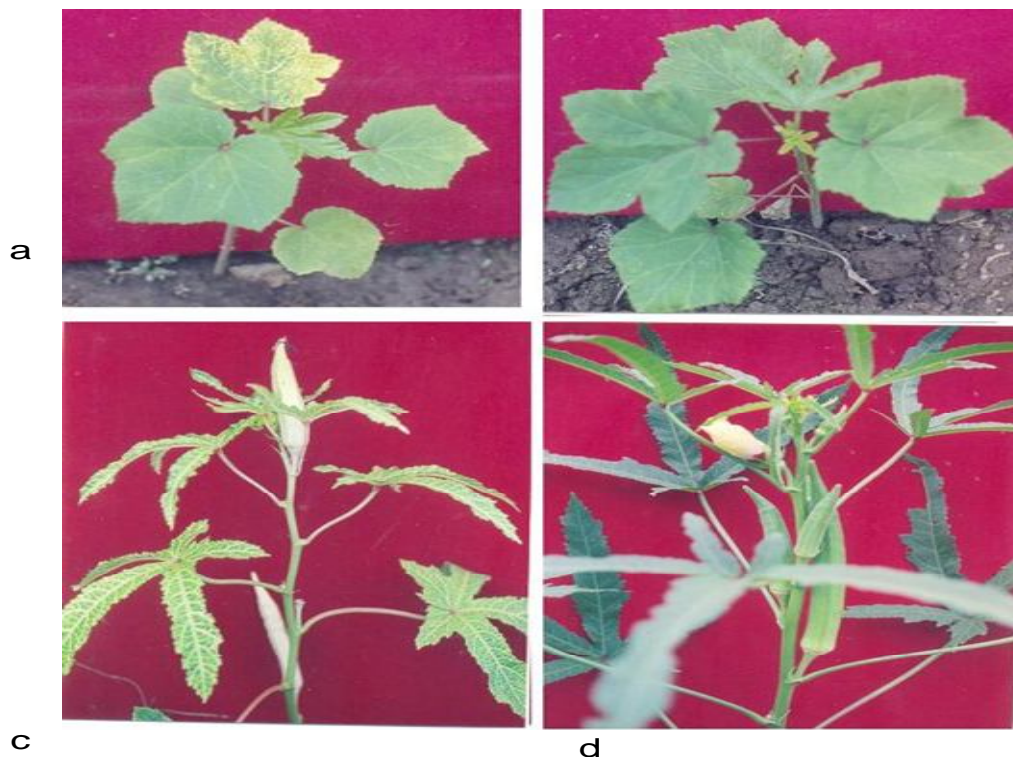
The final figures showed 35% decrease in number of diseased plants in beds treated with *B. diffusa* extracts. Disease suppression due to *B. diffusa* extract treatment resulted in better growth, flowering and yield of plants. Enhancement of

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(An ISO 3297: 2007 Certified Organization)

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final yield was notable in *B. diffusa* extract treated beds. Total crop yield was 68.5 kg in treated beds in contrast to 37.75 kg in control beds.



**Fig.5** Effect of spray of BD root protein on growth and disease incidence on *Abolmoschus esculentus* plants  
**a** Untreated control plant in early stages  
**b** Treated healthy plant in early stages  
**c** Untreated plant showing high infection and low fruiting in late stages  
**d** Treated plant showing good growth and high fruiting in later stages

Fig-2

As a whole, the root extract of *Boerhaavia diffusa* was found to be most effective in all observations recorded. As compared to control, yellow vein mosaic disease characterized by, bright yellow areas alternating with green and occasional leaf turning fully yellow was checked to a considerable extent in *B. diffusa* treated plants (Verma et al.1979, 1985). Previous reports of *Boerhaavia diffusa* was as inducer of resistance against virus infections (Awasthi et al. 1984 and Verma et al. 1984). Root extract has been claimed to provide protection in a wide variety of vegetable crops. Data recorded here suggested the use of *Boerhaavia diffusa* as a source of possible prophylactic agent against the yellow vein mosaic disease of okra. Effect of treatment of BD root extract on protection of okra crop from diseases and crop yield is tabulated in the table -1 and plotted in the diagramme-1.

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2015

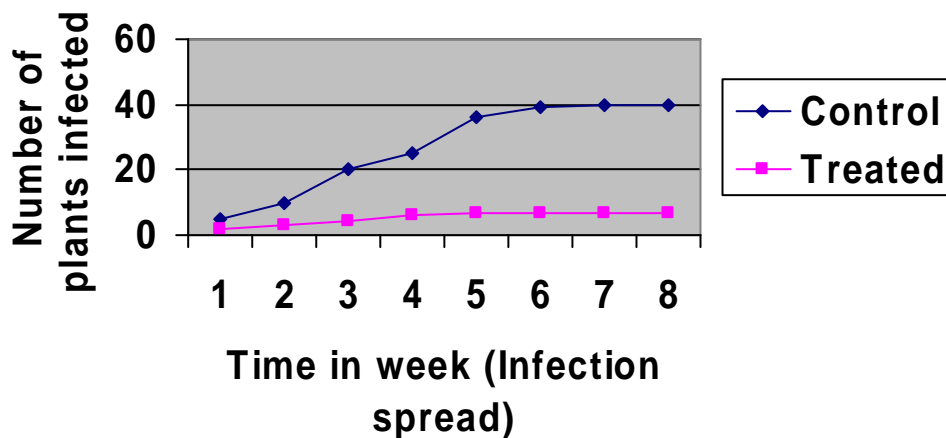
**Table-1:**Effect of treatment of BD root extract on protection of okra crop from diseases and crop yield.

S. No.	Aspect	BD root extract treated				Control			
		I	II	III	IV	I	II	III	IV
1	Number of plants	500	500	500	500	500	500	500	500
2	Number of diseased plants	65	68	57	72	152	161	143	149
3	Disease severity	++	++	+	++	++++	++++	+++	++++
4	Number of fruits per plant	8±1	9±0.5	10±1	9±0.25	5±0.1	6±0.2	8±0.3	6±0.3
5	Fruit length (cm)	11±2	12±1	12±1.5	12±1.75	8±0.5	8±1.5	10±1.0	9±0.5
6	Plant height (cm)	75±5	80±5	85±3	80±2.5	65±3.5	35±2.9	40±4	35±3.0
7	Total crop yield (kg)	66±3	69±2.5	72±1.9	67±2.6	35±4	38±4.5	42±5.2	36±2.3

**Diagramme-1.** Effect of treatment of BD root extract on protection of okra crop from diseases and crop yield.

### IV. DISCUSSION

#### Effect of BD root extract on disease incidence on okra crop under field conditions



Plant Protection strategy and activities have significant importance in the overall crop production programmes for sustainable agriculture. Plant protection efforts aim at minimizing crop losses due to ravages of insect pests, diseases, weeds, nematodes, rodents, etc. Enforcement of Destructive Insects & Pests Act (1914) for prevention of exotic pests, promotion of Integrated Pest Management (IPM), Implementation of Insecticides Act, 1968 for regulating production

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and use of pesticides, monitoring and control. Plant Protection and through biological control it is expected that the yield losses could be minimized and the quality of crop be improved

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