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Protection of mungbean and urdbean crops against vector borne mungbean yellow mosaic virus through botanicals

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ABSTRACT

The mungbean and urdbean crops were found suffering from the infection of a vector borne virus which was characterized by severe yellowing of the leaves and extremely reduced growth of the plants. Such crops may be protected by the regular spraying either with the aqueous leaf extract of *Azadirachta indica, Clerodendrum aculeatum* or the root extract of the *Boerhaavia diffusa* separately. The maximum reduction in the incidence of mungbean yellow mosaic virus disease was observed in mungbean and urdbean when these crops were given six sprays of each botanical separately. In case of *C. aculeatum* treatments reduction in disease incidence in mungbean and urdbean was 53.76 and 48.22 per cent, respectively. Whereas, *B. diffusa* root extract could reduce the incidence by 42.48 and 40.55 per cent in mungbean and urdbean followed by 33.07and 28.55 per cent by *A. indica*. It has been observed that not only the incidence of disease was reduced but a significant increase in plant height, primary and secondary branches, nodulation, pods formation and grain yield was also recorded.

Introduction

Mungbean (*Vigna radiata* (L.) Wilczek) and urdbean (*V. mungo* (L.) Hepper) are the most important pulse crops in India. Besides India, these are widely cultivated throughout Southern Asia like Pakistan, Sri Lanka, Bangladesh, Thailand, Laos, Vietnam, Indonasia, China and Taiwan. In India, these crops are extensively grown in Uttar Pradesh, Madhya Pradesh, Rajasthan, Maharastha, Orissa, Karnataka, Andhra Pradesh, Gujarat, Bihar, Haryana and Delhi during *Kharif* and *Zaid* season. These crops suffer from a large number of biotic stresses. Among viral diseases, yellow mosaic disease caused by Mungbean yellow mosaic virus, a member of germinivirus group transmitted through whitefly (*Bemisia tabaci* Gen.), is a very severe disease. Yield losses due to this disease vary from 5 to 100 per cent depending upon disease severity, susceptibility of cultivars and population of whitefly (Nene, 1972, Singh, 1980, Rathi, 2002). The infection not only drastically reduces yield but also severely impairs the grain size and quality. The affected plant showed typical symptoms of mild scattered yellow spots on young leaves. The next trifoliate leaf emerging from the growing apex showed irregular alternating yellow and green patches. The leaves showed slight puckering with reduction in size. The size of yellowing areas increased further resulting with complete yellow of apical leaves. The infected plants usually mature late and bear very few flowers and pods. So far, no feasible measures are available to control this disease. Therefore keeping in view plant products (antiviral substances of plant origin), which have shown broad spectrum antiviral activity against many phytopathogenic viruses (Verma *et al.,* 1985 and Verma and Verma, 1993) were used to protect these crops under natural field conditions.

Materials and Methods

Healthy seeds of mungbean cultivar K-851 and urdbean cultivar Barabanki Local were directly sown in 3 x 2m plot accommodating ten rows with row to row distance of 30 cm and plant to plant 10 cm during *Kharif* season of 2004-05 and 2005-06 with 10th treatments and three replications under Randomized Block Design. The roots of *Boerhaavia diffusa* (B.D.) plants were collected from the field, washed with tap water and cut into small pieces. Green leaves of *Clerodendrum aculeatum* (C.A.) and *Azadirachta indica* (A.I.) were also collected from the field. The roots/green leaves were allowed to dry separately under shade at room temperature. Dried roots/leaves were ground to powder and stored at low temperature. The crude extract was prepared by making the suspension of roots/leaves powder in tap water (1 g/10 ml). The extract was strained through two folds of cheese cloth and homogenate was clarified by centrifugation at 3000 g for 15 min. The suspension was diluted to 1:20 with tap water and used for spray on experimental plots. The first spray of the antiviral substances (1:20) was done after 15 days of sowing and remaining sprays of same concentration of antiviral substances were done at weekly time interval following the first spraying. In control plots water alone was sprayed instead of antiviral substance. Observations were recorded on disease incidence, plant height, primary and secondary branches, nodulation, pod formation and seed yield per plant, from five plants selected randomly from each plot. Per cent diseases incidence and Per cent diseases control were calculated by the fallowing formula-

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected plants per plots}}{\text{Total number of plants per plots}} \times 100$$

$$\text{Per cent disease control} = \frac{C - T}{C} \times 100$$

T = Per cent disease incidence in treated plot
C = Per cent disease incidence in control plot

Result

The evaluation of botanicals against mungbean yellow mosaic virus disease in mungbean and urdbean crops exhibited reduction in the disease incidence and significant increase in plant height, primary and secondary branches, nodulation, pods formation and yield. In case of mungbean, minimum disease incidence of 41.40 per cent was recorded in T_7 (six sprays of C.A.) followed by 48.90,54.70 ,56.50 ,60.00 ,65.60 ,67.10 ,70.30 and72.60 per cent disease incidence in T_4 (six sprays of B.D.), T_6 (four sprays of C.A.), T_{10} (six sprays of A.I), T_3 (four sprays of B.D.), T_5 (two sprays of C.A.), T_9 (four sprays of A.I.), T_2 (two sprays of B.D.) and T_8 (two sprays of A.I.) respectively. On the other hand, control plot (T_1) showed severe infection with higher disease incidence (80.80 per cent). Maximum reduction (53.76%) in disease incidence was found in T_7 followed by T_4 (42.48%), T_6 (35.30%), T_{10} (33.07%), T_3 (28.74), T_9 (22.03%), T_5 (18.21%), T_8 (16.96 %) and T_2 (13.00%). Maximum plant height of 68.65 cm was recorded in T_7 which was at par with T_4 (65.33 cm), T_6 (64.56) and significantly superior over rest of the treatment. Maximum primary branches of 6.36 per plant were found in T_7 which was at par with T_4 and statistically significant over rest all the treatments. Same trend was also found in secondary branches, more secondary branches (11.58 $plant^{-1}$) were recorded in T_7, which was significantly superior over rest of the treatments. Maximum nodules (25.44 $plant^{-1}$) were recorded in T_7 followed by T_4 (23.86),T_6 (23.10),T_{10} (22.36),T_3 (22.25),T_5 (21.29),T_9 (21.00),T_2 (20.60),T_8 (19.87) and T_1(19.37). Maximum pods of 15.87 $plant^{-1}$ was found in T_7 treatment followed by T_4 (13.95 $plant^{-1}$), T_6 (13.34 $plant^{-1}$), T_{1o} (13.10$plant^{-1}$), T_3 (11.84 $plant^{-1}$), T_5 (11.75 $plant^{-1}$), T_9 (11.20 $plant^{-1}$), T_2 (10.48 $plant^{-1}$), T_8 (10.00) and T_1 (9.89 $plant^{-1}$). Seed yield also increased by spraying of botanicals. The most effective treatment was T_7 with maximum seed yield of 4.10 g $plant^{-1}$ followed by T_4, T_6, T_{1o}, T_3, T_5, T_9, T_2, and T_8 with 3.86, 3.48, 3.42, 3.25, 3.08, 3.00, 2.94 and 2.76 g $plant^1$, respectively, whereas in untreated plot exhibited minimum 2.63 g $plant^{-1}$ seed yield (Table 1).

Table 1: Effect of graded dose of botanicals on the incidence of yellow mosaic disease, plant growth parameter and yield of mungbean (Mean data Kharif , 2004-05 and 2005-6)

Treatments	Disease incidence (%)	Disease control (%)	Plant height (cm)	Primary branches/ plant	Secondary branches/ plant	Nodules/ plant	Pods/ plant	Seed yield/ plant (g)
T_1 = Untreated (water alone)	80.80 (64.01)*	0.00	54.92	4.65	7.50	19.36	9.89	2.63
T_2 = Two sprays of B.D.	70.30 (56.98)	13.00	60.25	5.00	8.15	20.60	10.48	2.94
T_3 = Four sprays of B.D.	60.00 (50.77)	28.74	62.10	5.36	8.95	22.25	11.84	3.25
T_4 = Six sprays of B.D.	48.90 (44.37)	42.48	65.33	5.78	10.00	23.86	13.95	3.86
T_5 = Two sprays of C.A.	65.60 (54.09)	18.21	61.29	5.20	8.49	21.29	11.75	3.08
T_6 = Four sprays of C.A.	54.70 (47.64)	35.30	64.56	5.57	9.20	23.10	13.34	3.48
T_7 = Six sprays of C.A.	41.40 (40.05)	53.76	68.65	6.36	11.58	25.44	15.87	4.10
T_8= Two sprays of A.I.	72.60 (58.44)	16.96	59.85	4.82	7.80	19.87	10.00	2.76
T_9= Four sprays of A.I.	67.10 (55.00)	22.03	61.95	5.15	8.23	21.00	11.20	3.00
T_{10}= Six sprays of A.I.	56.50 (48.73)	33.07	63.00	5.48	9.00	22.36	13.10	3.42
Sem $\pm$	3.07	1.24	2.05	0.22	.40	0.87	0.51	0.13
CD at 5%	9.15	3.69	6.11	0.66	1.20	2.59	1.54	0.40

***** Figures in parentheses are angular transformed values

Table 2: Effect of graded dose of botanicals on the incidence of yellow mosaic disease, plant growth parameter and yield of urdbean (Mean data Kharif , 2004-05 and 2005-6)

Treatments	Disease incidence (%)	Disease control (%)	Plant height (cm)	Primary branches/ plant	Secondary branches/ plant	Nodules/ plant	Pods/ plant	Seed yield/ plant (g)
T_1 = Untreated (water alone)	73.50* (59.02)	00.00	44.82	4.11	6.52	27.38	14.57	2.10
T_2 = Two sprays of B.D.	65.40 (53.97)	11.00	49.69	4.67	7.18	29.76	15.26	2.29
T_3 = Four sprays of B.D.	57.10 (49.08)	24.14	50.95	5.00	8.00	31.46	16.49	2.55
T_4 = Six sprays of B.D.	45.90 (42.65)	40.55	52.56	5.32	8.94	33.90	18.95	3.10
T_5 = Two sprays of C.A.	60.70 (51.18)	17.41	50.38	4.89	7.65	31.25	16.29	2.36

T_6 = Four sprays of C.A.	54.40 (47.52)	28.99	51.65	5.06	8.85	33.35	18.20	2.67
T_7 = Six sprays of C.A.	41.00 (39.82)	48.22	54.00	5.60	9.70	35.13	20.40	3.55
T_8= Two sprays of A.I.	67.70 (55.37)	7.89	48.45	4.30	6.87	28.84	15.00	2.13
T_9= Four sprays of A.I.	61.00 (51.35)	21.00	49.78	4.70	7.27	30.14	16.95	2.31
T_{10}= Six sprays of A.I.	55.30 (48.04)	28.55	51.00	5.06	8.48	32.00	18.87	2.87
Sem $\pm$	2.11	1.10	1.49	0.19	0.33	1.26	0.71	0.09
CD at 5%	6.26	3.26	4.43	0.56	0.98	3.75	2.12	0.27

* Figures in parentheses are angular transformed values

In case of urdbean, most effective treatment found was T_7 (six sprays of C.A.). It exhibited minimum (41.00 %) disease incidence followed by T_4, T_6, T_{10}, T_3, T_5, T_9, T_2, and T_8 which exhibited disease incidences of 45.90, 54.40, 55.30, 57.10, 60.70, 61.00, 65.40 and 67.70 per cent, respectively, while in untreated plot disease incidence was recorded maximum 73.50 per cent. On the other hand most effective treatments was T_7 which reduced the disease incidence by 48.22% followed by T_4, T_6, T_{10}, T_3, T_9, T_5, T_2, and T_8 40.55,28.99,28.55,24.14,21.0,17.41, 11.0 and 7.89 per cent disease- incidence respectively. Maximum plant height of 54.00 cm was recorded in T_7 which was at par with T_4 (52.56 cm), T_6 (51.65 cm), T_{10} (51.00 cm), T_3 (50.95 cm), T_5 (50.38 cm), T_9 (49.78 cm), and T_2 (49.69cm) significantly superior over rest of the treatments. Same trend was found in all the parameters. Maximum primary and secondary branches of 5.60 and 9.70 per plant, respectively was found in T_7 followed by T_4, T_6, T_{10}, T_3, T_5, T_9, T_2, T_8 , and T_1 . Maximum nodules of 35.13 per plant was recorded in treatment T_7 which was at par with treatments T_4, T_6, T_{10} and T_3 and significantly superior over rest of the treatments. Maximum pods (20.40 $plant^{-1}$) was recorded in treatment T_7 which was at par with T_4, T_{10} and significantly superior over rest of the treatments. The most effective treatment was T_7 which exhibited maximum (3.55 g $plant^{-1}$) seed yield followed by T_4 (3.10 g $plant^{-1}$), T_{10} (2.87 g $plant^{-1}$), T_6 (2.67 g $plant^{-1}$), T_3 (2.55 g $plant^{-1}$), T_5 (2.36 g $plant^{-1}$), T_9(2.31 g $plant^{-1}$), T_2 (2.29 g $plant^{-1}$) and T_8 (2.13 g $plant^{1}$). However, minimum seed yield of 2.10 g $plant^{-1}$ was recorded in untreated plots (Table 2).

Discussion

The antiviral activity of extract from a few plants were reported earlier due to the presence of a protein in leaf extract of *Azadirachta indica* and *Clerodendrum aculeatum* and a glycoprotein in *Boerhaaavia diffusa* roots (Verma *et al., 1979*). These important glycoprotein act as resistance inducer on treated as well as non-treated site of host plants, that confers antiviral activity and makes a plants resistant to virus infection (Awasthi andVerma , 2006). Similar results were obtained by Verma *et al.* (1985) and Singh *et al.* (2004) on mungbean and urdbean through leaf extract of *Clerodendrum aculeatum* and root extract of *B. diffusa*. *Boerhaavia diffusa* induces strong systemic resistance against several viruses in hypersensitive as well as systemic hosts (Awasthi *et al*., 1984). It is presumed that the inhibitors in *B. diffusa* root and *C. aculeatum* leaf which applied before virus inoculation induces synthesis of some translocatable virus inhibitory or protective substances in the hosts plants (Verma and Awasthi, 1979, and Verma *et al*., 1985). Awasthi *et al.* (1987) attributed mechanism of virus inhibition that the physiology of host is altered and cells no longer supports virus multiplication. It also acts as a repellent as well as antifeadent for vectors (Awasthi and Rizvi, 1999). Verma and Verma (1993) reported, that spraying with leaf extract of *Clerodendrum aculeatum* alongwith soil amendment with dry leaf powder and they found two folds increase in nodulation and grain yield with 50% reduction in incidence of mungbean yellow mosaic virus disease. Verma and Singh (1994) reported that inhibition of natural mungbean yellow mosaic virus infection by spraying with leaf extract of *Clerodendrum aculeatum,* together with soil amendment with dry leaf powder or fresh extract.

Suvendran *et al.* (1999) observed the antiviral activity of plants extract, against brinjal mosaic virus and reported that pre-inoculation sprays of 10% leaf extract or oil formulation of *Azadirachta indica* were effective against virus infection under field conditions. Rajappan *et al.* (2000) also reported the reduction in transmission of rice tungro virus under field conditions by *Azadirachta indica*.

The mungbean and urdbean plants may be protected against infection and spread of mungbean yellow mosaic virus by aqueous extracts of *B. diffusa* roots, *C. aculeatum* and *A. indica* leaves. If strategies are developed to prolong the effect of this inhibitor, it may prove as a source of possible prophylactic substance against the yellow mosaic disease of mungbean and urdbean at commercial levels. Since, the antiviral substance present in these plants are of the same origin like many other common constituents of a majority of plant systems, it may be easily absorbed into the leaves and translocated systemically to induce the production/synthesis of some protein (s) which are actually antiviral and defends the plants against infection. Besides their antiviral effect these phytochemicals, induces plant height , primary and secondary branches, nodulation, pods formation and grain yield. It also have many other advantages over chemicals like easily biodegradable, does not leave any residual effect, nonphytotoxic and easily absorbed by the plants and are very cheap.

References

Awasthi, L.P. and Rizvi, S.M.A. 1999. Effect of *Baerhaavia diffusa* glycoprotein on the transmission of *Tomato leaf curl virus* by *Bamisis tabaci* Gen. *Proceedings of the National Symposium on Vectors of Plant Diseases.* Nov. 11-13, 1999, N.D.U.A.&T., Kumarganj, Faizabad p. 56.

Awasthi, L.P.; Chowdhary, B. and Verma, H.N. 1984. Prevention of plant virus diseases by *Baerhaavia diffusa* inhibitor. *Int. J. Trop. Plant Dis.* **2**: 41-44.

Awasthi, L.P.; Kluge, S. and Verma, H.N. 1987. Characteristics of an antiviral agent induced by *Baerhaavia diffusa* glycoprotein in host plants. *Indian J. Virol* **3**: 156-169.

Awasthi, L.P. and Verma, H.N. (2006). Boerhaavia diffusa-A wild herb with potent biological and antimicrobial properties. *Asian Agri History,* **10** (1) : 55-68.

Nene, Y.L. 1972. A survey of viral diseases of pulse crops in Uttar Pradesh. *Final Tech. Report. Res. Bull.* No. 4, U.P. Agricultural University, Pantnagar, pp. 1-91.

Rajappan, K.; Ushamalini, C. Subramanian, N.; Narasimhan, V. and Kareem, A.A. 2000. Effect of botanicals on the population dynamics of *Nephotettix virescens,* rice tungro disease incidence and yield of rice. *Phytoparasitica* **28** (2): 109-113.

Rathi, Y.P.S. 2002. Epidemiology, yield losses and management of major diseases of *Kharif* pulses in India. *Plant Pathology and Asian Congress of Mycology and Plant Pathology,* Oct.-1-4, 2002. University of Mysore, Mysore.

Singh, J.P. 1980. Effect of virus diseases on growth component and yield of mungbean and urdbean. *Indian Phytopath.* **8**: 405-408.

Singh, S.; Awasthi, L.P. and Verma, H.N. 2004. Prevention and control of yellow mosaic disease of mungbean by application of aqueous root extract of *Baerhaavia diffusa*. *Indian Phytopath.* **57** (3): 303-307.

Surendran, M.; Shunmugam, V.; Rajagopalan, B. and Ramanlan, N. 1999. Efficacy of botanicals on *Brinjal Mosaic Virus. Plant Dis. Res.* **14** (1): 63-66.

Verma, H.N. ,Awasthi, L.P. and Saxena. K.C. 1979.Isolation of the virus inhibitor from root extract of *Baerhaavia diffusa* inducing systemic resistance in plant.,*Can. J. Bot.* **57**: 1214-1218.

Verma, A. and Singh, R.B. 1994. *Clerodendrum aculeatum* a possible prophylactic agent against natural viral infection in mungbean. *Annals of Plant Protection Science,* **2** (2): 60-63.

Verma, A. and Verma, H.N. 1993. Management of viral disease of mungbean by *Clerodendrum* leaf extract. *Indian J. Plant Pathology,* **11** (1&2): 63-65.

Verma, H.N. and Awasthi, L.P. 1979. Antiviral activity of *Baerhaavia diffusa* root extract and the physical properties of the virus inhibitor. *Can. J. Bot.* **57**: 926-932.

Verma, H.N.; Rastogi, P.; Prasad, V. and Srivastava, S. 1985. A possible control of natural virus infection of *Vigna radiata* and *V. mungo* by plant extracts. *Indian J. Plant Pathology,* **3**(1):21-24

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