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In vivo Inhibition of Cowpea Banding Mosaic Virus by Some Phenols

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In vivo inhibitory activity of *p*-cresol, catechol and pyrogallol against cowpea banding mosaic virus was evaluated by foliar spraying and rootdip treatments. Maximum inhibition of the viral infectivity and maximum increase in incubation period was obtained with six post-inoculation pyrogallol sprays and six pre-inoculation *p*-cresol sprays respectively, with the increase in number of -OH groups attached to the benzene nucleus the antiviral potency of the chemicals decreased when administered as pre-inoculation foliar spray. However, reverse trend was evidenced when post-inoculation rootdip and foliar treatments were given. Mild symptoms were accompanied with pre- and post-inoculation sprays of *p*-cresol and pyrogallol.

Key Words: CPMV, Phenols, Viral infectivity, Rootdip treatment, Foliar Spray

Introduction

The widening gap between the rapid addition of new virus diseases the literature and slow rate of exploration of chemicals for their control without impairing normal growth of host plants contributes greatly to the well-documented fact that unlike bacteria, fungi, nematodes and mycoplasma-like organisms, viruses lack in energy-yielding enzyme systems, and hence their multiplication is in many ways closely dependent on the metabolism of host cells. Certain electron microscopic, biochemical and immunological observations have revealed that a multiplying virus cannot reasonably be considered as something separate from the host cells; rather, it would appear to be very much part of the host cell (Tamm 1958).

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Effect of inhibitors when they were mixed with virus prior to inoculation was studied by several workers. Such type of virus inhibitors are mainly considered to interfere with the establishment of the infection. However, effect of inhibitors on virus after infection has taken place in the systemic hosts, has not been properly elucidated. In an *in vitro* study at 1000 ppm concentration, p-cresol, catechol and pyrogallol inhibited the infectivity of cowpea banding mosaic virus (Sharma & Varma 1975) by 53.70, 75.75 and 66.74% respectively (Prakash 1978). The present investigation was aimed to know the *in vitro* effect of these chemicals against cowpea banding mosaic virus.

Materials and Methods

The Virus on host Vigna sinensis (L.) Savi ex Hassk was identified in this laboratory as cowpea banding mosaic virus (CpBMV) and since then it is maintained in the Virus Culture Collection Laboratory of this Department. Cowpea cv. Pusa Dophasli was used as the test plant for foliar spray and root-dip experiments.

Foliar spraying of chemicals: The chemicals of 400 ppm concentration were used, since at this concentration none of the chemicals was phytotoxic. Seeds of cowpea cv. Pusa Dophasli were sown in 40 cm earthen pots. Thinning of seedlings was done leaving 10 seedlings in each pot. Pre- and post-inoculation sprays were made on four sets of plants with different durations of application as given below; in set I plants were sprayed daily for 6 days whereas set II of plants were sprayed on 1st, 3rd and 5th day and inoculated on 7th day from the date of first spray in both the cases. The plants of set III were sprayed on 1st and 3rd day while those of set IV only once before inoculation, i.e. plants were inoculated on the 7th day of first and last spray. In case of post-inoculation spray of chemicals set I was sprayed daily for a period of 6 days; set II on 2nd and 6th day, set III only on 2nd and 6th day, and set IV only on 6th day after inoculation. Observations were recorded regarding % infectivity inhibition, % increase in incubation period and symptom expression.

Root-dip treatment of chemicals: For pre-inoculation root-dip treatments, seedlings of test plant were uprooted gently at first trifoliate stage with the help of sterilized spatulas. Roots were washed in slow running tap water. Attached soil particles were removed with the help of camel hair brush. Precautions were taken to avoid mechanical injury to roots. Roots of 20 plants were allowed to stand in 400 ppm solution of the chemicals for 6,12, 18 and 24 hr. A group of 20 plants having their roots dipped in demineralized water served as control. After desired hours of root-dip treatments, the plants were repotted and inoculated with the virus after 24 hr of treatment. For post-inoculation root-dip treatments, the test plants were first inoculated at first trifoliate stage and thereafter 24 hr of inoculation root-dip treatments were given as described above. Observations were recorded regarding % inhibition infection and % increase in incubation period.

All the experiments were carried out in an insect-proof glasshouse which was regularly fumigated with 0.06% Folidol E-605.

Results and Discussion

The three phenols, viz., p-cresol, catechol and pyrogallol have one, two and there hydroxyl groups attached to the benzene nucleus respectively. In case of pre-inoculation foliar spray of chemicals each treatment of p-cresol increased the incubation period, the maximum being 85.71% when six sprays were made. This treatment was also accompanied with the maximum inhibition of viral infectivity by 88% and mild symptom production (table 1). None of the

Table 1 *Effect of pre- and post-inoculation spray of phenols on cowpea cv. Pusa Dophasli for the virus infectivity*

Chemical	Number of sprays scheduled	Mean percentage of virus inhibition		Percentage increase in incubation period		Infectivity as per 100 plants of control		Symptom expression	
		Before inoculation	After inoculation	Before inoculation	After inoculation	Before inoculation	After inoculation	Before inoculation	After inoculation
p-Cresol	1 spray	19.25	66.25	14.29	—	80.75	33.75	S	Md
	2 sprays	29.75	71.75	42.86	—	70.25	28.25	S	Md
	3 sprays	32.00	74.75	42.86	14.29	68.00	25.25	Md	Md
	6 sprays	88.00	80.00	85.71	28.57	12.00	20.00	Md	Ml
	C.D. 1%					5.71	7.13		
Catechol	1 spray	49.25	45.00	—	—	50.75	55.00	Md	Md
	2 sprays	51.25	62.00	—	—	48.75	38.00	Md	Md
	3 sprays	55.00	64.00	—	21.43	45.00	36.00	Md	Md
	6 sprays	74.50	84.25	—	28.57	25.00	15.75	Ml	Ml
	C.D. 1%					2.93	5.37		
Pyrogallol	1 spray	39.25	53.25	14.29	—	60.75	46.75	Md	Md
	2 sprays	47.75	56.00	14.29	—	52.25	44.00	Md	Md
	3 sprays	60.00	70.00	28.57	—	40.00	30.00	Md	Md
	6 sprays	62.25	90.75	32.14	—	37.75	9.25	Md	Ml
	C.D. 1%					5.93	7.30		

S=Severe; Ml=Mild; Md=Moderate

treatments of catechol could alter the incubation period However, each treatment of pyrogallol affected the incubation period. Six sprays of catechol and pyrogallol inhibited the viral infectivity by 74.50 and 62.25% respectively, suggesting thereby that with increase in number of -OH groups attached to the benzene nucleus the antiviral potency of the chemicals against CpBMV decreased when administered as pre-inoculation foliar spray. However, this trend was not evidenced in case of pre-inoculation root-dip treatment as p-cresol catechol and pyrogallol resulted in 57, 34.33 and 47.33% inhibition of the viral infectivity respectively (table 2). It was interesting to note that none of the chemicals could alter the incubation period when applied as pre-inoculation root-dip treatment.

In case of post-inoculation foliar spray of chemicals, the maximum increase in incubation period was obtained with six sprays of p-cresol and catechol. These treatments resulted in mild symptom expression. p-Cresol, catechol and pyrogallol resulted in 80, 84.25 and 90.75% (table 1) inhibition of the infectivity respectively when sprayed six times after virus inoculation. When post-inoculation root-dip treatments were made, the three chemicals in order of their performance were pyrogallol, catechol and p-cresol (table 2). This suggested that when applied after virus inoculation and with increase in number of -OH groups of

Table 2 *Effect of pre- and post-inoculation root-dip treatment of phenols on the virus infectivity*

Chemical	Time in hrs for which roots were dipped in chemicals before/after virus inoculation	Mean percentage of virus inhibition		Percentage-crease in incubation period		Infectivity as per 100 plants of control	
		Before inoculation	After inoculation	Before inoculation	After inoculation	Before inoculation	After inoculation
p-Cresol	6	1.67	28.67	—	—	98.33	71.33
	12	3.33	36.00	—	—	96.67	64.00
	18	19.00	48.00	—	—	81.00	52.00
	24	57.00	51.57	—	—	43.00	48.33
	C.D.1%					5.25	2.76
Catechol	6	7.33	14.67	—	—	92.67	85.33
	12	26.00	19.67	—	—	74.00	80.33
	18	29.67	43.17	—	—	70.33	56.83
	24	34.33	51.83	—	—	65.67	48.17
	C.D.1%					5.15	2.74
Pyrogallol	6	22.00	33.67	—	—	78.00	66.33
	12	27.67	45.34	—	14.29	72.33	54.66
	18	39.33	54.67	—	14.29	60.67	45.33
	24	47.33	68.00	—	85.71	52.67	32.00
	C.D.1%					3.46	2.36

the benzene nucleus the antiviral activity of the compound increased irrespective of the method of their treatment. Gupta and Raychauduri (1971) have also recorded 91% inhibition of potato virus Y infectivity by 2000 ppm catechol.

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