

## THE INHIBITORY ACTIVITY OF SOME PLANT JUICES ON THE INFECTIVITY OF WATERMELON MOSAIC VIRUS\*

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*Summary.* — The infectivity of watermelon mosaic virus (WMV) was inhibited by juices of sixteen plants. The crude juices of *Chenopodium album*, *C. amaranticolor*, *Dahlia rosea* and *Spinacia oleracea* totally inhibited the activity of virus, while others did so partially. The activity of inhibitors was wholly or partially destroyed by heating the juices at 100° C for 10 minutes. Juices of *Chenopodium* and *D. rosea* retained their full inhibitory action for 7 days at 10° C. Extracts of four plants prevented transmission of WMV, when sprayed on the leaves of host plants prior to inoculation.

A large number of plant juices are known to lower the relative infectivity of plant virus inocula. This study deals with the inhibitory properties of several plant extracts on the infectivity of WMV.

Plant extracts used as inhibitors were obtained from young leaves of 30—40 days old healthy plants by crushing them to fine pulp and squeezing out the juice through muslin cloth. *Cucurbita pepo* cv. Caserta was used as a host plant of WMV, originally obtained from *Bennincasa hispida* (Singh and Bhargava, 1962). Leaf tissues of infected host plant were macerated in mortar and the crude juice served as virus inoculum. Mechanical inoculations were made by gently rubbing the carborundum dusted leaves of *C. pepo* cv. Caserta plants with fore-finger dipped in virus inoculum.

In a preliminary test, the virus inoculum was mixed 1 : 1 with the crude, heated (at 40° C for 10 minutes) and diluted (1 : 10 with distilled water) plant extracts. All dilutions were mixed well for 10 minutes before inoculation. Percentage of inhibition was measured by the difference between the number of plants infected by a test inoculum and number of plants infected by control inoculum (virus inoculum diluted 1 : 1 with distilled water). In each case 100% infection was obtained by control inoculum.

Data in Tables 1 and 2 indicate that crude juices from all healthy plants tested were inhibitory to WMV. Dilution of juices (1 : 10) with distilled water and heating of crude juices at 40° C for 10 minutes removed the inhibitory activity partially. As crude juices of *Chenopodium*, *Dahlia rosea* and *Spinacia oleracea* showed 100% inhibition of WMV in the preliminary test they were further studied.

Dilution of the test juices with distilled water lowered their inhibitory activity. Dilution of plant juices 1 : 1000 with distilled water resulted in activity losses of 60% in *C. album*, 70% in *C. amaranticolor*, 50% in *D. rosea* and 80% in *S. oleracea* (Table 2).

\* Based on a thesis submitted by the author for the degree of Doctor of Philosophy, University of Gorakhpur.

Table 1. Inhibition of watermelon mosaic virus by plant juices

Plant species	Inhibition per cent		
	Crude juice	Juices diluted 1 : 10	Juices heated for 10 min at 40° C
<i>Antirrhinum majus</i> L.	90	80	60
<i>Capsicum annuum</i> L.	80	70	50
<i>Cucumis sativus</i> L.	70	70	70
<i>Datura stramonium</i> L.	90	70	80
<i>Lycopersicon esculentum</i> Mill.	70	70	50
<i>Nicotiana glutinosa</i> L.	60	70	50
<i>Nicandra physaloides</i> Gaertn.	80	70	70
<i>Phaseolus vulgaris</i> L.	80	70	80
<i>Petunia hybrida</i> Vilm.	90	70	80
<i>Solanum tuberosum</i> L.	80	70	80
<i>Vicia faba</i> L.	70	60	50
<i>Vigna sinensis</i> Endl.	80	70	80

Values based on results obtained in 10 plants.

Two ml of each test juice were heated in thin walled glass test tubes for 10 minutes in a water bath at various temperatures. No significant reduction in effectiveness of the inhibitors resulted from heating the sap of *Chenopodium* and *D. rosea* at 60 and 80° C, but heating at 100° C removed the inhibitory activity considerably in *Chenopodium* sap and little in *D. rosea* sap (Table 2).

Table 2. Inhibition of watermelon mosaic virus by plant juices

Plant species	Inhibition per cent							
	Crude juice	Diluted juices			Juices heated for 10 min at °C			
		1:10	1:100	1:1000	40	60	80	100
<i>Chenopodium album</i> L.	100	80	60	40	100	70	60	50
<i>C. amaranticolor</i> Coste et Reyn.	100	90	70	30	100	100	90	70
<i>Dahlia rosea</i> Cav.	100	100	60	50	100	100	100	80
<i>Spinacia oleracea</i> L.	100	70	50	20	70	60	40	20

Values based on results obtained in 10 plants.

The *Chenopodium* and *D. rosea* saps could be stored at 10° C for 7 days without loss of inhibitory activity, while at the same conditions *S. oleracea* sap lost its activity up to 20%.

Extract of *Chenopodium*, *D. rosea* and *S. oleracea* were examined as a spray to control the transmission of WMV. Host plant leaves were sprayed with sap and at intervals the plants were inoculated with WMV. The juices of test plants were inhibitory up to 7 days, the longest period tested.

The extracts of a number of plant species used in this study have not been tested before as WMV inhibitors. Dilution and heat treatments were effective in removing the inhibitory activity of test juices. The inhibitors present in the juices of *Chenopodium* and *D. rosea* appeared to be more potent than the others. Kuntz and Walker (1947) showed that inhibitory effect of spinach juice to tobacco mosaic virus was reduced by dilution and heat treatments. Several workers (Blaszczak *et al.*, 1959; Thomson and Peddie, 1965; Yoshizaki and Murayama, 1966; Yoshii and Sako, 1967) reported decrease and removal of inhibitory activity of *Chenopodium* sap at different dilutions and temperatures. The sharp decrease of inhibition with dilution and heat treatments in one case and gradual decrease in the other case may indicate the presence of different inhibitory substances in the test juices.

The plant extracts mentioned retained the inhibitory activity for a week at 10° C. Kuntz and Walker (1947) noted that spinach juice remained inhibitory to cucumber mosaic virus up to 15 months at room temperature. Blaszczak *et al.* (1959) showed that *Chenopodium* sap could be stored at 4° C for 77 days without loss of activity.

The present results on the sprayed juices agree with observations of Blaszczak *et al.* (1959) who showed that juice of *C. album* and *S. oleracea* sprayed on the assay host remained inhibitory up to 20 days. Thomson and Peddie (1965) found that when *Nicotiana glutinosa* leaves were sprayed with *C. album* juice, no infection by tobacco mosaic virus occurred for three days.

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