Effect of application of selected medicinal plant extracts on the incidence of pumpkin mosaic virus

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ABSTRACT: The five medicinal plant extracts tested showed more virus-inhibitory activity when applied before virus inoculation than applied after inoculation. Pre-inoculation application of the medicinal plant extracts at different time intervals revealed that virus-inhibitory effect of Basella alba and Glycyrrhiza glabra decreased gradually, whereas that of Phyllanthus fraternus and Thespesia populnea reached a maximum after some time gap.

Keywords : Botanicals, plant extracts, pumpkin mosaic

Medicinal plant extracts have been reported to possess antiviral effect against many plant viruses (Verma et al., 1979, 1995). Pre-inoculation spray of Boerhaavia diffusa extract was found to be effective against TMV in tobacco, cucumber mosaic virus and TMV in tomato, cucumber green mottle mosaic virus in melon, sunnhemp rosette virus in Crotalaria juncea and Gomphrena globosa (Awasthi et al., 1984). Pandey and Bhargava (1984) reported the effectiveness of Ampelopteris prolifera leaf extract against TMV and CMV. Vimi Louis and Balakrishnan (1995) reported that five medicinal plants, namely, Basella alba, Glycyrrhiza glabra, Phyllanthus fraternus, Plumbago rosea and Thespesia populnea decreased pumpkin mosaic virus (PMV) by about 80%.

In the present investigation, the different aspects of the selected medicinal plants against PMV have been studied.

MATERIALS AND METHODS

(i) Comparative efficacy of two concentrations of medicinal plant extracts

Extracts of five selected medicinal plants, viz., B. alba (leaf), G. glabra (root), P. fraternus (whole plant), P. rosea (tuber) and T. populnea (leaf) were prepared by triturating the plant using sterilized mortar and pestle. For each gram of plant part, one ml of distilled water was added, triturated into a pulp and filtered through muslin cloth. The crude sap was then centrifuged at 3000 g for 20 min and the supernatant was used for the study.

Virus inoculum was prepared by triturating young infected leaves of pumpkin in chilled sterilized mortar by adding on ml of sterile distilled water for the each gram of plant tissue. The extract was then filtered through muslin cloth, centrifuged at 3000 g for 20 min and the supernatant used as inoculum.

Two dilutions of the medicinal plant extracts, i.e., 5 and 10 per cent, were prepared and sprayed on pumpkin seedlings at the two-leaf stage. After 24 h, virus inoculation was done on the treated
plants. Equal number of plants previously sprayed with distilled water and inoculated as above were kept as control.

(ii) Effect of pre- and post- inoculation application of plant extracts

Extracts of five species of medicinal plants at 10 per cent concentration were prepared as above and sprayed on pumpkin seedlings at the two-leaf stage as given below:

a) One day prior to the inoculation with the virus (pre-inoculation application)

b) One day after inoculation with the virus (post- inoculation application)

The plants were kept under observation in an insect proof net house.

(iii) Effect of pre-inoculation application of plant extracts at different time intervals

Extracts of the medicinal plants were prepared at 10 per cent concentration and sprayed on six groups of test plants and seventh group of plants was kept as control.

Immediately after spraying plant extract (zero hour), the first set of plants and the control plants were inoculated with the virus inoculum. The other five sets of plants were inoculated at intervals of 6 h, one day, two days, four days and six days. The test plants were kept under insect proof net house and observed for the appearance of disease symptoms.

RESULTS

i) Efficacy of two concentrations of plant extracts

The inhibitory property of the plant extracts against PMV infection did not vary significantly with the different concentrations of the extracts used (Table 1). There was an increase in the inhibitory action with the decrease in concentration (5%) in the case of extracts of two plants, namely, B. alba and P. rosea. But P. fraternus and T. populnea extracts were more inhibitory at ten per cent than at five per cent. G. glabra showed equal effectiveness at both the concentrations (Table 1).

Table 1. Comparative efficacy of selected medicinal plant extracts against PMV infection

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of plant</th>
<th>5 per cent</th>
<th>10 per cent</th>
<th>Change in per cent inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number of plants infected out of 20</td>
<td>Per cent inhibition over control</td>
<td>Number of plants infected out of 20</td>
</tr>
<tr>
<td>1</td>
<td><em>Basella alba</em></td>
<td>1</td>
<td>93.75</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td><em>Glycyrrhiza glabra</em></td>
<td>2</td>
<td>87.50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td><em>Phyllanthus fraternus</em></td>
<td>4</td>
<td>75.00</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td><em>Plumbago rosea</em></td>
<td>2</td>
<td>87.50</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td><em>Thebesia populnea</em></td>
<td>4</td>
<td>75.00</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Friedman test: NS, NS

NS - Not significant.
Table 2. Effect of pre- and post- inoculation application of selected medicinal plants against PMV infection

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of plant</th>
<th>Pre inoculation application</th>
<th>Post inoculation application</th>
<th>Reduction in per cent inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number of plants infected</td>
<td>Per cent inhibition over control</td>
<td>Number of plants infected</td>
</tr>
<tr>
<td>1</td>
<td><em>Basella alba</em></td>
<td>2</td>
<td>86.67</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td><em>Glycyrrhiza glabra</em></td>
<td>3</td>
<td>80.00</td>
<td>6</td>
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<td>3</td>
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<td>73.33</td>
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<tr>
<td>4</td>
<td><em>Plumbago rosea</em></td>
<td>2</td>
<td>86.67</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td><em>Thespesia populnea</em></td>
<td>3</td>
<td>80.00</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Friedman test

S - Significant.

pre-inoculation application of plant extracts was far better than post-inoculation application in inhibiting PMV infection (Table 2). Post-inoculation application reduced the inhibitory property of the plant extracts. When pre- and post-inoculation applications were considered together, it was found that *P. rosea* was the best followed by *T. populnea*.

iii) Effect of pre-inoculation application of plant extracts at different time intervals

When PMV was inoculated at different intervals after the application of plant extracts, there was significant variation in the inhibitory effect between the different times of inoculation as well as between plant extracts (Table 3, Fig. 1).

In case of *B. alba* and *G. glabra* extracts, inhibition decreased gradually as the time interval between application of plant extract and virus inoculation increased. There was a decrease in the inhibitory effect after two days of application of *P. fraternus* extract, but the inhibitory effect showed an increase when inoculation of PMV was done four days after application of the extract. In case of *P. rosea*, maximum inhibition was observed when PMV was inoculated immediately after and six hours after application of plant extract. The reduction in the inhibitory effect with the increase in the time interval was not uniform and a slight increase in the inhibitory activity was observed at 2 d and 6 d after application of the extract. The virus-inhibitory property of *T. populnea* leaf extract remained more or less constant up to four days after treatment.

**DISCUSSION**

Most of the earlier reports on antiviral properties of plant extracts indicate that the inhibitory effect of the extract decreases with an increase in the dilution of the extract. For example, Saigopal *et al.* (1986) reported that the inhibitory activity of *Phyllanthus fraternus* against TMV, peanut green mosaic virus and tobacco ring spot virus decreased with the increase in dilution. Unlike that found in earlier reports, in the present study, the lower concentrations (5%) of *B. alba* and *P. rosea* were more effective than the higher concentrations. At lower concentration, the suppressive effect of other plant constituents might have been reduced, allowing the antiviral effect to be expressed properly.
Pre-inoculation applications were found to be better than post-inoculation applications. Similar observations were made by many other workers also. Verma and Mukerjee (1979) found that inhibition of TMV infection was highly significant when *Datura metel* leaf extract was applied 24 h before virus inoculation. Rao and Shukla (1985) reported that aqueous extracts of dry coconut showed significant antiviral activity against PVY when applied 24 h before virus inoculation and no such inhibition was observed when extract was applied 24 h after virus inoculation.

In case of extracts of *P. fraternus* and *T. populnea*, a time gap was required between application and virus inoculation for the development of maximum inhibition. Verma and Srivastava (1985) reported a high degree of resistance (80-100 per cent reduction) when *Cyamopsis tetragonoloba* and *Datura stramonium* plants were mechanically inoculated with sunnhemp rosette virus and TMV one to seven days after application of *Aerva sanguinolenta* extracts. In the case of *P. rosea* extract, there was no considerable change in the inhibitory effect as the time gap increased between its application and virus inoculation. Therefore, the inhibitory effect of *P. rosea* extract on PMV may be a combination of the direct as well as indirect effect on the virus.

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**REFERENCES**


