

- Lacey, John Wiley, New York, 1985, p. 33.
5. Rosett, T., Sankhala, R. H., Stickings, C. E., Taylor, M. E. O. and Thomas, R., *Biochem. J.*, 1957, **67**, 390.
  6. Brian, P. W., Curtis, P. J., Hemming, H. G., Jefferys, E. G., Unwin, C. H. and Wright, J. M., *J. Gen. Microbiol.*, 1951, **5**, 619.
  7. Meronuck, R. A., Steele, J. A., Mirocha, C. J. and Christensen, C. M., *Appl. Microbiol.*, 1972, **23**, 613.
  8. Scott, P. M., In: *Thin layer chromatography: Quantitative, environmental and clinical applications*, (eds) J. C. Touchstone and D. Rogers, Wiley Interscience, New York, 1980, p. 251.
  9. Scott, P. M. and Kanhere, S. R., *J. Assoc. Off. Anal. Chem.*, 1980, **63**, 612.
  10. Stickings, C. E., *Biochem. J.*, 1959, **72**, 332.
  11. Mikami, Y., Nishijima, Y., Iimura, H., Suzuki, A. and Tamura, S., *Agr. Biol. Chem.*, 1971, **35**, 611.
  12. King, Jr. A. D. and Schade, J. E., *J. Food Protection*, 1984, **47**, 886.
  13. *Registry of toxic effects of chemical substances*, NIOSH, Cincinnati O. H., 1980, Vol. 2.
  14. Umetsu, N., Kaji, J. and Tamari, K., *Agr. Biol. Chem.*, 1973, **37**, 451.

## INHIBITION OF SPINACH MOSAIC VIRUS BY EXTRACTS OF SOME MEDICINAL PLANTS

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It was found earlier<sup>1-7</sup> that the extracts of different parts from a number of higher plants have antiviral properties. However, nothing is known about the antiviral properties of *Aconitum heterophyllum* Wall., *Anagallis arvensis* L., *Azadirachta indica* A. Juss., *Catharanthus roseus* (Linn.) G. Don, *Digitalis purpurea* L., *Glycyrrhiza glabra* L., *Hyoscyamus niger* L., *Ocimum sanctum* L., *Rauvolfia serpentina* Benth. ex Kurz. and *Withania somnifera* Dun. Hence, an attempt was made to determine the inhibitory effects of extracts of these plants on spinach mosaic virus<sup>8</sup> (SMV).

The culture of SMV was maintained on *Nicotiana glutinosa* L. by periodic inoculation inside the insect-proof glass-house. The crude suspension of

the virus was prepared by macerating 5 g leaves of *N. glutinosa*, infected with SMV 8-10 days earlier, with 5 ml distilled water and squeezing through two layers of muslin cloth. The sap thus obtained was centrifuged at 10,000 rpm for 10 min. The pellet was discarded and the supernatant was taken as the standard virus solution. A standard solution of extracts of different parts of the plants was prepared by macerating 5 g of plant material with 5 ml of distilled water and squeezing later through two layers of muslin cloth. The extract thus obtained was centrifuged at 10,000 rpm for 10 min. The standard extracts of SMV and plant-parts were mixed in the ratio of 1:0.5 and 1:1. After 30 min the plants of *Chenopodium amaranticolor* Coste & Reyn., an indicator host for SMV, were inoculated separately with the mixtures of virus and plant extracts. In each case, five plants having six leaves of approximately the same leaf area were inoculated. Plants inoculated with distilled water in the ratio of 1:0.5 and 1:1 served as control. The number of local lesions evoked after 5-7 days of inoculation was counted. The percentage of inhibition was calculated as:  $[(A-B)/A] \times 100$  (where *A* is the number of lesions in plants inoculated with virus solution diluted in distilled water and *B* the number of lesions in plants inoculated with virus solution treated with plant extract).

The results presented in table 1 indicate that extracts of all medicinal plants inhibited the spinach mosaic virus to a varying degree. The inhibition effect of plant extracts was directly correlated with increase in the concentration. Highest inhibition of SMV was achieved in the extracts of leaves of *O. sanctum* L., followed by the roots of *G. glabra* L., leaves of *A. arvensis* L., roots of *A. heterophyllum* Wall., leaves of *A. indica* A. Juss., leaves of *C. roseus* (Linn.) G. Don and roots of *R. serpentina* Benth. ex Kurz.

Fukushi<sup>9</sup> demonstrated that digitalin, a glycoside, destroyed the virulence of tobacco mosaic virus (TMV), while Kalichave *et al*<sup>10</sup> reported that quinine reduced the multiplication of TMV. Others<sup>11,12</sup> reported that tannin present in the plant extract was responsible for virus inhibition. It is likely that extracts of plant-parts tested might contain certain compounds which bring about inhibitory effects. This aspect needs further investigation.

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Table I Inhibition of spinach mosaic virus by extracts of some medicinal plants

Species	Part used	Local lesions formed					
		Ratio of viral sap with distilled water (as control)		Ratio of viral sap with plant extract		Percentage inhibition	
		1:0.5	1:1	1:0.5	1:1	1:0.5	1:1
<b>Apocynaceae</b>							
<i>R. serpentina</i> Benth. ex. Kurz	Roots	82	62	58	31	29.2	50.0
<i>C. roseus</i> (Linn.) G. Don	Leaves	75	60	30	21	60.0	65.0
<b>Lamiaceae</b>							
<i>O. sanctum</i> L.	Leaves	98	80	46	18	53.1	77.5
<b>Papilionaceae</b>							
<i>G. glabra</i> L.	Roots	72	57	52	13	27.7	77.1
<b>Meliaceae</b>							
<i>A. indica</i> A. Juss.	Leaves	78	61	36	20	53.8	67.2
<b>Primulaceae</b>							
<i>A. arvensis</i> L.	Leaves	75	57	51	16	32.0	71.9
<b>Solanaceae</b>							
<i>H. niger</i> L.	Leaves	64	52	40	27	37.5	48.1
<i>W. somnifera</i> Dun.	Roots	90	71	63	38	30.0	49.3
<b>Ranunculaceae</b>							
<i>A. heterophyllum</i> Wall	Roots	75	59	32	19	57.3	67.7
<b>Scrophulariaceae</b>							
<i>D. purpurea</i> L.	Leaves	67	53	52	35	22.4	33.9

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- Duggar, B. M. and Armstrong, J. K., *Ann. Mo. Bot.*, 1925, **12**, 359.
- Johnson, J., *Phytopathology*, 1941, **31**, 679.
- Pandey, A. K. and Bhargava, K. S., *Indian Phytopathol.*, 1984, **37**, 271.
- Raychaudhari, S. P. and Prasad, H. C., *Indian J. Microbiol.*, 1965, **5**, 13.
- Roychaudhury, R., *Indian Phytopathol.*, 1984, **37**, 665.
- Sill, W. H. Jr. and Walker, J. C., *Phytopathology*, 1952, **42**, 349.
- Tiwari, J. P., *Curr. Sci.*, 1976, **45**, 696.
- Naqvi, Q. A. and Mahmood, K., *Indian Phyto-*

*pathol.*, 1975, **28**, 268.

- Fukushi, T., *Trans. Sapporo. Nat. Hist. Soc.*, 1930, **11**, 59.
- Kalichave, G. S., Longinova, L. N. and Saldan, L. N., *Soobshch. Akad. Nauk. Gruz. SSR.*, 1966, **41**, 431.
- Cadman, C. H., *J. Gen. Microbiol.*, 1958, **20**, 113.
- Cheo, P. C. and Linder, R. S., *Virology*, 1964, **24**, 414.