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Inactivation of Groundnut (*Arachis hypogaea* L.) Mosaic virus by ultraviolet light

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Abstract

In the present investigation, experiments were conducted *in vitro* as well as *in vivo*. *In vitro* treatment of ultraviolet light clearly indicated that 10 minutes exposure to UV rays had no inhibitory effect on the virus but with an increase in the time of exposure, there was a steady increase in the inhibition of the virus till 55 minutes. At 55 minutes 100% inhibition was noted. In the present study with *in vivo* treatment, it was observed that except one hour pre-inoculation treatments (inhibition 12.5%), *in vivo* treatment was not effective. Post-inoculation treatments, in general were more destructive in terms of virus infectivity. Maximum reduction in infectivity was observed in immediate one hour post-inoculation treatment *i.e.*, 87.5% but as the time interval between inoculation and UV exposure increased, there was gradual decrease in virus inhibition.

Plant viruses are inactivated by exposure to Ultraviolet light (UV) light. Mulvania[5] was the first to work on the inactivation of plant viruses by ultraviolet light and reported that exposure to sunlight to tobacco mosaic virus for 3-6 hrs reduced the infectivity by 90%, while ultraviolet light from a Cooper-Hewett mercury vapour lamp at a distance of 6" inactivated the virus in one hour.

Raychaudhuri *et. al.*;[9] observed that after the 90 minutes exposure to ultraviolet (120 m.u.d.) cucumis virus 2C started to get inactivated and complete inactivation of the same was noticed after 120 minutes. Siegel and Wildman[10] found reduction in local lesion numbers of TMV on Nicotiana glutinosa and postulated that three phases of sensitivity to ultraviolet light viz; (i) period during which the infection had the same sensitivity as the virus *in vitro*, (ii) a period during which resistance to ultraviolet-light increased and (iii) a period during which a secondary level of resistance was maintained.

Nariani and Pingley[6] reported complete inactivation of the soyabean mosaic virus in leaf extract when exposed to ultraviolet rays (160 m.u.d.) for two hrs. Cowpea mosaic virus in undiluted leaf extract was not completely

Table-1. Exposure of virus extract to different lengths of time of UV-irradiation (120W Phillips lamp at a distance of 30 cm) *in vitro*.

S. No.	Length of UV-exposure in minutes	Number of Plants		% Inhibition	Incubation period (days)
		Inoculated	Infected		
1.	1	40	40	Nil	8 - 10
2.	5	40	40	Nil	9 - 11
3.	10	40	40	Nil	9 - 11
4.	15	40	35	12.5	10 - 12
5.	20	40	30	25.0	11 - 13
6.	25	40	27	32.5	12 - 14
7.	30	40	23	42.5	15 - 17
8.	35	40	21	47.5	17 - 19
9.	40	40	18	55.0	18 - 20
10.	45	40	10	75.0	20 - 22
11.	50	40	3	92.5	21 - 23
12.	55	40	Nil	100.0	—
13.	60	40	Nil	100.0	—
14.	65	40	Nil	100.0	—
15.	70	40	Nil	100.0	—
16.	75	40	Nil	100.0	—
17.	Control	40	40	Nil	7 - 9

inactivated even after exposure for 3 hrs. (240 m.u.d.) to ultraviolet light[7]. Nariani and Paliwal[8] reported complete inhibition of sunhemp mosaic virus in sap by ultraviolet light (160 m.u.d.) for two hrs.

Blaszczak and Weber[1] observed that under U.V. light potato viruses X and Y, tobacco mosaic virus and cabbage black ring virus lost infectivity. *Gomphrena globosa, Physalis floridana* and *Nicotiana glutinosa,* treated with U.V. light exposure immediately before infection showed decrease in susceptibility to these viruses. Levy *et. al.*;[3] studied that shortwave U.V. (2540A^{o}) significantly enhanced cucumber mosaic virus multiplication in cotyledons of a resistant cucumber Cv. when applied 1-3 days after inoculation.

Chessin[2] observed that U.V. irradiation 24 hrs. after inoculation with tobacco mosaic virus had increased the size of local lesions

Table-2: Effect of UV-rays (55 minutes, 120W phillips lamp from a distance of 30 cm) before and after inoculation *in vivo*

Time before inoculation in hours.	Number of plants		% Inhibition	Incubation period (days)
	Inoculated	Infected		
1	40	35	12.5	9 - 11
8	40	40	Nil	8 - 10
16	40	40	Nil	7 - 9
24	40	40	Nil	7 - 9
48	40	40	Nil	7 - 9
Time after Inoculation in hours.				
1	40	5	87.5	17 - 19
8	40	14	65.0	16 - 18
16	40	25	37.5	15 - 17
24	40	31	22.5	13 - 15
48	40	37	7.5	9 - 11

produced on leaves of pinto beans (*Phaseolus vulgaris*). Soliman[11] studied that U.V. irradiation to squash cotyledonary leaves before inoculation with alfa alfa mosaic virus induced the formation of necrotic local lesions in plants which would otherwise have produced a few chlorotic lesions followed by systemic infection. Lu *et. al*.;[4] reported that UV exposure caused a drastic change in the circular dichraism of Chinese cabbage virus in saline within the pH range of 3.1-4.8.

To study the effect of ultraviolet light on the disease development, experiments were conducted *in vitro* as well as *in vivo*. The effect of UV-rays *in vitro* was studied by exposing the standard inoculum to UV-light exposure for different lengths of time ranging from per minute to 75 minutes. The exposures were given at room temperature using 120 watt phillips UV-lamp keeping the material at 30 cm. distance. Two sets of experiments were conducted to study the effect of UV-rays on the disease development *in vivo*. In the first set, plants were irradiated 1, 8, 16, 24, 48 hrs. before inoculation at 55 minutes exposure. While in the second set, plants were irradiated 1, 8, 16, 24, 48 hrs. after inoculation at 55 minutes exposure. These experiments were performed at room temperature 25ºC (±2ºC). Corresponding controls were also maintained.

Results are presented in Table 1 & 2.

Results presented in table-1 indicate that 10 minutes exposure to UV-rays had no inhibitory effect on the virus but with an increase in the time of exposure, there was a steady increase in the inhibition of the virus till 55 minutes. At 55 minutes 100% inhibition was noted. The perusal of the data presented in table-2 indicates that pre-inoculation treatments could not inhibit the virus. However, one hour pre-inoculation treatments, in general were more destructive in terms of virus infectivity. Maximum reduction in infectivity was observed in immediate one hour post inoculation treatment *i.e.*, 87.5% but as the time intervals between inoculation and UV-exposures increased, there was gradual decrease in virus inhibition as much as that 48 hours post inoculation treatment could inhibit virus activity by 7.5% only.

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