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EFFECT OF NEEM OIL ON RICE TUNGRO VIRUS INFECTION IN RICE VARIETIES WITH DIFFERENT LEVELS OF RESISTANCE

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The effect of neem oil application on rice tungro infection in susceptible (S), moderately resistant (MR) and resistant (R) varieties which were inoculated by using 1, 3 and 5 viruliferous *Nephotettix virescens* per plant was studied. Neem oil [5%] was applied as both pre-inoculation and post-inoculation sprays. The varieties used were ADT 31 [S], ACM 9 [MR], IR 50 (MR) and TNAU 831520 (R).

The results indicated that increasing the number of insects used for inoculation increased the per cent infection from 50 to 95 in susceptible ADT 31, from 20 to 60 in moderately resistant ACM 9 and IR 50 and from 0 to 35 in resistant TNAU 831520. In the case of susceptible ADT 31, pre inoculation application of neem oil reduced the infection significantly from 50 to 15 per cent when one green leaf hopper [GLH] was used for inoculation. Similar reduction in the percent infection was observed when 3 or 5 GLH per plant were used for inoculation. In the moderately resistant ACM 9 and IR 50 the reduction in infection was respectively from 20 to 5 percent and from 25 to 10 per cent when one GLH was used for inoculation. When the number of insects used for inoculation increased to 3 or 5, the reduction in infection per cent was significant. In the resistant culture TNAU 831520, all the treated plants were free from

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infection when one GLH was used for inoculation. The infection was reduced to 10 per cent in treated resistant plants inoculated using 3 or 5 insects as against 25 and 35 per cent respectively in the controls.

The post-inoculation spray of neem oil also generally showed reduction in the infection but it was not found to be appreciable as in pre-inoculation treatment in the case of all varieties with different levels of resistance. The present study shows that pre-inoculation application of neem oil reduces the rice tungro infection remarkably in susceptible, modrately resistant and resistant varieties.

The use of plant products to reduce virus infection of crops is considered as an effective approach for their management because of the possibility of avoiding chemical pollution, development of resistance to chemicals in pathogens and vectors and phytotoxicity due to chemicals. In the present study, the effect of neem oil application on rice tungro virus infection of susceptible, moderately resistant and resistant varieties was evaluated and the results are presented in this communication.

MATERIALS AND METHODS

The effect of neem oil on RTV infection was tested using twenty day old susceptible ADT 31, moderately resistant IR 50 and ACM 9 and resistant TNAU 831520 genotypes which were Inoculated using 1, 3 and 5 green leafhoppers (GLH) per plant.

The GLH had an acquisition and inoculation feeding period of 24 hours each. Neem oil 5 per cent (V/V) in water with 0.1 per cent Teepol liquid detergent was applied both as pre-inoculation and post-inoculation sprays. The control plants were sprayed with

RESULTS AND DISCUSSION

The results (Table 1 and 3) indicated that increasing the number of insects used for inoculation increased the per cent infection from 50 to 95 in susceptible ADT 31, from 20 to 60 in moderately resistant ACM 9 and IR 50 and from 0 to 35 in resistant TNAU 831520. In the case of susceptible ADT 31, pre-inoculation (Table 1) application of neem oil reduced the infection significantly from 50 to 15 per cent when one GLH was used for inoculation. Similar reduction in the per cent infection of 85 to 30 and 95 to 70 respectively was observed when 3 or 5 GLH per plant were used for inoculation. In the moderately resistant ACM 9 and IR 50 the reduction in infection was respectively from 20 to 5 per cent and from 25 to 10 per cent when one GLH was used for inoculation. When the number of insects used for inoculation was increased to 3 or 5 the infection per cent was reduced from 40 to 20 and from 50 to 35 in the case of ACM 9, and from 40 to 25 and from 60 to 35 in the case of IR 50. In the resistant culture.

Table 1. Effect of Pre-Inoculation Application of Neem oil on RTV Infection in Rice Varie with Different Levels of Resistance.

Variety	Treatment	Percentage of infection			
		Number of insects used for inoculation			
		1	3	5	Mean
ADT 31	Control	50.00	85.00	95.00	76.66[d]
		(45.00)	(76.08)	(82.40)	(67.83)
	Neem oil	15.00	30.00	70.00	38.33[c]
		(20.24)	(32.90)	(57.11)	(36.75)
	Per cent decrease over control	70.00	64.71	26.32	50.00
ACM 9	Control	20.00	40.00	50.00	36.66[c]
		(23.41)	(38.95)	(45.00)	(35.79)
	Neem oil	5.00	20.00	35.00	20.00[b]
		(7.6)	(23.41)	(36.06)	(22.36)
	Per cent decrease over control	75.00	50.00	30.00	45.44
IR 50	Control	25.00	40.00	60.00	41.66[c]
		(29.73)	(38.95)	(51.05)	(39.91)
	Neem oil	10.00	25.00	35.00	23.33[b]
		(13.92)	(29.73)	(36.06)	(26.57)
	Per cent decrease over control	60.00	37.50	41.66	43.99
TNAU 831520	Control	5.00	25.00	35.00	21.66[b]
		(7.6)	(29.73)	(36.06)	(24.46)
	Neem oil	0.00	10.00	10.00	6.66[a]
		(1.28)	(13.92)	(13.92)	(9.71)
	Per cent decrease over control	100.00	60.00	71.43	69.25

(Data in parentheses are transformed values)

		SE_d	CD (P=0.05)		SE_d	CD (P=0.05)
Varieity	(V)	3.08	6.14	V × T	4.35	8.67
Treatment	(T)	2.18	4.34	V × I	5.33	N. S
Insects	(I)	2.67	5.32	T × I	3.77	N. S
				V×T×I	7.54	N. S

infection was reduced to 10 per cent in treated and inoculated resistant plants using 3 or 5 insects as against 25 and 35 per cent respectively in

Pre-inoculation application neem oil significantly reduced the p cent infection in susceptible ADT to a level comparable to

Table 2. Effect of Pre-Inoculation Application of neem oil on Incuoation Period of RTV in Varieties with Different levels of Resistance

Variety	Treatment	Incubation period (days) Number of insects used for inoculation 1	3	5	Mean
ADT 31	Control	11.25	10.73	10.63	10.87[f]
		(3.50)	(3.43)	(3.40)	(3.44)
	Neem oil	12.33	11.50	11.44	11.76[e]
		(3.65)	(3.54)	(3.53)	(3.57)
	Per cent increase over control	9.60	7.18	7.62	8.19
ACM 9	Countrol	14.00	13.88	13.73	13.87[d]
		(3.87)	(3.86)	(3.84)	(3.86)
	Neem oil	16.00	14.83	14.50	15.11[c]
		(4.12)	(3.97)	(3.93)	(4.01)
	Per cent increase over control	14.28	6.84	5.60	8.94
IR 50	Control	13.88	13.79	13.48	13.72[e]
		(3.86)	(3.85)	(3.81)	(3.84)
	Neem oil	16.00	15.38	15.13	15.50[b]
		(4.12)	(4.05)	(4.01)	(4.06)
	Per cent increase over control	15.27	11.53	12.24	12.97
TNAU 831520	Control	18.00	17.13	16.88	17.34[a]
		(4.36)	(4.26)	(4.23)	(4.28)
	Neem oil	—	18.00	17.00	17.50[a]
			(4.36)	(4.24)	(4.30)
	Per cent increase over control	—	5.08	0.71	0.92

(Data in parentheses are transformed values)

		SE_d	CD(P= 0.05)		SE_d	CD(P=0.05)
Variety	(V)	0.0076	0.0151	V × T	0.0107	0.0214
Treatment	(T)	0.0054	0.0107	V × I	0.0131	0.0262
Insects	(I)	0.0066	0.0131	T × I	0.0093	0.0185
				V × T × I	0.0186	0.0370

moderately resistant varieties was on in the susceptible variety than

Table 3. Effect of Post-Inoculation Application of Neem oil on RTV Infection in Rice Varieties Different Levels of Resistance

Variety	Treatment	Percentage of infection: Number of insects used for inoculation 1	3	5	Mean
ADT 31	Control	55.00	85.00	95.00	78.33
		(47.86)	(69.76)	(82.40)	(66.68)
	Neem oil	30.00	70.00	85.00	61.66
		(32.90)	(57.11)	(69.76)	(53.25)
	Per cent decrease over control	45.45	17.65	10.53	21.28
ACM 9	Control	20.00	45.00	55.00	40.00
		(23.40)	(42.12)	(47.89)	(37.80)
	Neem oil	15.00	35.00	50.00	33.33
		(20.24)	(27.06)	(45.00)	(30.77)
	Per cent decrease over control	25.00	22.22	9.09	16.68
IR 50	Control	20.00	45.00	60.00	41.66
		(23.40)	(42.12)	(51.05)	(38.86)
	Neem oil	15.00	40.00	50.00	35.00
		(20.24)	(39.23)	(45.00)	(34.82)
	Per cent decrease over control	25.00	11.11	16.66	15.99
TNAU 831520	Control	0.00	25.00	30.00	18.33
		(1.28)	(29.73)	(32.90)	(21.30)
	Neem oil	0.00	15.00	20.00	11.67
		(1.28)	(20.24)	(23.40)	(14.98)
	Per cent decrease over control	—	40.00	33.33	36.33

(Data in parentheses are transformed values)

		SE_d	CD (P=0.05)		SE_d	CD (P=0.05)
Variety	(V)	2.96	5.89	V×T	4.19	N. S
Treatment	(T)	2.09	4.17	V×I	5.13	N. S
Insects	(I)	2.57	5.12	T×I	3.63	N. S
				V×T×I	7.25	N. S

The post-inoculation application of neem oil also generally

(Table 3) ADT 31 when one GLH per plant w used for inoculation but only margina

when 3 or 5 insects were used for inoculation. In the moderately resistant ACM 9 and IR 50 varieties also the reduction was not appreciable. In the resistant culture TNAU 831520, none of the treated and untreated plants were infected when one GLH was used for inoculation. The i tion was reduced to 15 and 20 cent due to post-inoculation t of resistant plants inoculated u 3 or 5 insects as against 25 an per cent respectively in the contr

Table 4. Effect of Post-Inoculation Application of Neem Oil on Incubation Period of RTV in Varieties with Different levels of Resistance

Variety	Treatment	Incubation period (days) Number of insects used for inoculation			
		1	3	5	Mea
ADT 31	Control	11.37	10.64	10.64	10.88[b]
		(3.52)	(3.41)	(3.41)	(3.45
	Neem oil	12.25	11.83	11.30	11.79
		(3.64)	(3.58)	(3.52)	(3.58
	Per cent increase over control	3.41	11.18	6.20	8.3[6]
ACM 9	Control	14.00	13.88	13.79	13.89
		(3.87)	(3.86)	(3.85)	(3.86
	Neem oil	16 00	15.00	14.21	15.07
		(4.12)	(4.00)	(3.90)	(4.01)
	Per cent increase over control	14.28	8.07	3.05	8.49
IR 50	Control	13.83	13.75	13.64	13.74[d]
		(3.85)	(3.84)	(3.83)	(3.84)
	Neem oil	14.66	14.63	14.17	14.49[c]
		(3.96)	(3.95)	(3.89)	(3.93)
	Per cent increase over control	6.00	6.40	3.88	5 46
TNAU 831520	Control	—	17.63	17.17	17.40[a]
			(4.32)	(4.26)	(4.29)
	Neem oil	—	18.00	17.25	17.63[a]
			(4.36)	(4.27)	(4.31)
	Percent increase over control	—	2.09	0.46	1.32

(Data in parentheses are transformed values)

		SE_d	CD (P=0.05)		SE_d	CD (P=0.05)
Variety	(V)	0.0099	0.0198	V×T	0.0140	0.0280

The effect of pre- (Table 2) and post-inoculation (Table 4) application of neem oil on the incubation period was also studied. It was noticed that the incubation period was longer in resistant variety than in moderately resistant and susceptible varieties. The incubation period was 17 to 18 days in resistant TNAU 831520, 13 to 14 days in moderately resistant ACM 9 and IR 50 and 10 to 11 days in susceptible ADT 31. The neem oil application significantly increased the incubation period by 1 or 2 days in susceptible and moderately resistant varieties but in resistant varieties there was no change in the incubation period due to treatment with neem oil.

The present study indicated that increasing the number of insects from 1 to 5 used for inoculation increased the per cent infection in the susceptible, moderately resistant and resistant varieties. The changes in the level of resistance of rice varieties to RTV due to the number of insects used for inoculation has been observed by other workers also. When the number of GLH per seedling was increased from 1 to 5, the reaction of varieties IR 36 and IR 42 was altered from resistant to susceptible and IR 50 and 54 showed reduced level of resistance (Tiongco *et a*, 1983).

The neem oil treatment reduce the RTV infection in all the rice varieties with different levels of resistanc inoculated by different number insects. The reduction in RTV infectic of treated plants may be due to t following effects on the vector a reported by different researcher repellent or antifeedant, insecticid properties (Mariappan and Saxen 1983), reduced reproductive potentia physiological disturbances in paren persisting even in the succeedin generation, developmental abnorma lities and inhibition of ecdysis (Heyd *et al.*, 1984). These effects on th vectors may be useful either to avoi the RTV infection or to reduce t vector population. Saxena and Kha (1984, 1985) reported that the feedin site of *N. virescens* was altered frc phloem to xylem following neem oi application on rice plants. As th rice tungro virus is a phloem boun virus, the change in the feeding site of the vector could be expected to result in failure of or reduction in infection because the chances of introducing the virus in the pholem might be reduced.

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EFFECT OF SEED TREATMENT WITH PESTICIDES ON THE INCIDENCE SHOOTFLY ON PEARL MILLET

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Effect of seed treatment with insecticides, fungicides and their combinations on the occurrence of dead hearts due to shootfly *Atherigona approximata was studied*. Monocrotophos followed by chlorpyriphos and phosalone at 4 ml per kg of seed were effective in reducing dead hearts caused by *A. approximata*. The fungicides, thiram and carbendazim individually or in combination were ineffective in reducing dead hearts caused by shootfly.

Shoot cum earhead fly, *Atherigona approximata* Malloch is a very important pest which attacks pearl millet crop both in vegetative and earhead stages causing considerable loss. Jotwani *et al.* (1969) reported the infestation of *A. approximata* on pearl millet causing 47 per cent dead hearts in a plot in Coimbatore. The present study reports the effect of s ed treatment with insecticides and fungicides on the occurrence of dead hearts due shootfly.

MATERIALS AND METHODS

The pearl millet seeds were treat with three insecticides *viz.*, chlor riphos, phosalone and monocrotop at 4ml per kg, two fungicides carbendazim at 2g per kg and thiran 6 g per kg and also the combinatic of insecticides and fungicides.

* Part of rhe M. Sc. (Ag). thesis submitted by the senior author to the Tamil Nadu Agricult