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EFFECT OF INSECTICIDES ON TRANSMISSION AND ACQUISITION OF 'KATTE' VIRUS OF SMALL CARDAMOM AND THEIR USE IN RELATION TO DISEASE SPREAD AND VECTOR CONTROL

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ABSTRACT

Thirty four insecticides were evaluated against nonpersistent aphid borne 'Katte' virus to determine their effect on transmission and acquisition under laboratory conditions. Transmission results showed that none of the insecticides tested was effective on acquisition and transmission of virus even on the day of spraying. Investigations were also carried to find out the feasibility of using systemic and contact insecticides for control of vector and disease. Regular application of insecticides such as Phosphamidon, Carbofuran and Phorate resulted in significantly more disease spread than control. But in the Methyl parathion, Dimethoate and Quinalphos treated plots the disease incidence was on par with control. However, suppression of aphid pupulation build up was significantly less in all insecticide treated plots.

INTRODUCTION

The 'Katte' or Mosaic disease is causing extensive losses in yield on small cardamom *Elettaria cardamomum* Maton. (Varma, 1962; Venugopal and Naidu, 1984). The first evidence of 'Katte' virus transmission by the banana aphid *Pentalonia nigronervosa* Coq. was reported by Uppal *et al.* (1945). Though extensive studies have been conducted on the virus-vector relationship (Varma and Capoor, 1958; Naidu *et al.*, 1982) and virus transmission by non-host vectors (Rao and Naidu, 1974) no approach was made to control the disease spread by controlling the vector. Therefore the following studies were undertaken to examine the efficacy of insecticides on aphid vector in various stages of virus acquisition, transmission and disease spread in the field.

MATERIALS AND METHODS

In a green house study, eighteen different contact and systemic insecticides were tested as foliar spray and soil treatment to find out their effectiveness on the process of virus acquisition by the aphid. The aqueous solutions of the test insecticides were sprayed on virus

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infected plants at 0.05% concentration. The granular insecticides tested viz. Carbofuran and Phorate were applied at 1 g a.i./earthern pot of 30 × 32 cm size. Insecticides treated plants were tested as source of virus inoculum starting from day of application to 30 days. Pre-starved apterate aphids were made viruliferous by allowing an acquisition access of 30 min. and released in groups of 10/plant. After 4 hours of transmission feeding aphids were killed mechanically. In each treatment 25-30 seedlings of Malabar type CV-Cl-37 at 5-6 leaf stage were maintained. Unsprayed virus infected plants served as control. Efficacy of insecticides was assessed on the basis of transmission percentage in test seedlings.

In a separate study thirty four insecticides were screened to study their effect on transmission under green house conditions. Healthy test seedlings of 5-6 leaf stage were sprayed with test chemicals at 0.05% (ai) concentration. The viruliferous apterate adult aphids were released in groups of 10/test seedling separately at different intervals starting from immediately to 30 days after insecticidal treatment. In case of granular insecticides, inoculation was done on 7th, 15th and 30th day after application. In each treatment 25-30 , seedlings of Malabar type CV-Cl-37 were maintained. The percentage of disease transmission was considered as the criteria to judge the effectiveness of insecticides.

To explore the possibility of disease control by suppressing vector population, a field trial with Malabar type was conducted for three years (1981-83). Two systemic, two contact and two granular insecticides along with one cultural practice (removal of old and partly dried pseudostems and leaf sheaths) were tested to control aphid population. In all, eight treatments were replicated thrice. The replicates were arranged in RBD. Each replicate per treatment consisted of 49 plants with one 'Katte' infected plant in the centre. The differential treatments were given at monthly intervals except during monsoon (June to September). The data on the aphid population were recorded after 15 and 30 days of spraying and disease incidence at quarterly interval.

RESULTS AND DISCUSSION

None of the insecticides tested was able to prevent the vector by acquiring the virus from infected plants (Table I). This study clearly suggests that it is impracticable to check the spread of 'Katte' disease by insecticidal treatment of the infected plants only.

It is evident from Table-II that all the thirty four insecticides were not effective in killing the vector before transmission of the virus. Insecticides rarely kill rapidly enough to prevent the probing behaviour of vector. Being non-persistent virus (Rao, 1977; Naidu *et al.*, 1982) 'Katte' virus can be acquired with short probes and can be transmitted within short periods. This may be the reason for the ineffecitveness of insecticides. These results indicate that prophylactic treatment with insecticides may not help in preventing infection from the viruliferous aphids migrating from nearby plantations.

The vector population build up was significantly lower in all the sprayed plots

Table I. *Effect of different insecticides on 'Katte' virus acquisition by the aphids under laboratory condition.*

Sl. No.	Insecticides screened	% of transmission obtained					Mean
		acquisition after spraying					
		1 day	2 days	7 days	15 days	30 days	
Contact insecticides:							
1.	Primophos Methyl 0.05% (a.i.)	20	28	64	76	80	53.6
2.	Nicotine sulphate "	24	36	52	76	88	55.2
3.	Permithrin "	28	32	56	76	84	55.2
4.	Quinalphos "	12	20	16	16	28	18.4
5.	Methyl parathion "	25	25	20	24	28	24.4
6.	Chlorophyriphos "	24	28	48	56	80	47.2
7.	Fenlorate "	12	20	32	36	48	28.6
8.	Fenthion "	16	12	12	28	40	21.6
9.	Dichlorovos "	20	28	28	36	48	39.4
10.	Malathion "	32	20	28	36	56	34.4
11.	B.H.C. "	16	20	16	28	36	23.2
12.	Pyrethrum "	28	20	24	40	48	32
Systemic insecticides:							
13.	Dimethoate "	4	4	20	24	24	15.2
14.	Phosphamidon "	4	4	20	24	28	16
15.	Monocrotophos "	12	16	20	24	32	20.8
16.	Ethiofencarb "	40	40	80	76	76	62.4
17.	Formothion "	8	28	40	36	44	31.2
Granular insecticides:							
18.	Carbofuran (5g ai/plant)	–	–	20	28	36	28
19.	Phorate (1.0g ai/plant)	–	–	16	24	40	26.7
20.	Control	78	78	82	86	92	83.2

than unsprayed plots (Table III). Contrary to the expectations, the disease incidence was significantly higher in the treatment plots where phorate, phosphamidon and carbofuran were applied than unsprayed control. There was no significant difference among quinalphos, methyl parathion, dimethoate and unsprayed control. In the case of non-persistent viruses, for example, Potato virus 'Y' insecticides could neither protect the entry nor stop its spread (*Burt et al.*, 1964, Patkar *et al.*, 1969; Nirula and Kumar, 1967). The cardamom aphid *P. nigronervosa* f. *caladii* is photophobic and it is found in colonies of 30-50 comprising nymphs, alate and apterate adults. These colonies are formed in between the pseudostems and loose leaf sheaths especially of old, partly dried or damaged parts. Occasionally, the colonies are found on the leaf spindles, young suckers and panicles. Because of their concealed placement in the older parts, the possibilities of direct access to contact insecticides and indirect contact

Table - II. *Effect of different insecticides on transmission of 'Katte' agent under laboratory condition*

Sl. No.	Insecticide tested	Transmission in different treatments (%) spraying after					Mean
		1 hr.	24 hrs	48 hrs	7 days	15 days	
1	2	3	4	5	6	7	8
1.	Quinalphos	12.0	52.0	48.3	34.5	65.5	42.6
2.	Methyl parathion	30	27.6	46.1	50	53.3	41.4
3.	Phosalone	33.3	50	76.6	93.3	93.3	69.3
4.	Methamidophos	50	86.6	86.6	93.3	93.3	82
5.	Phosphamidon	16.6	23.3	30.0	46.6	56.6	35.3
6.	Dimethoate	16.6	23.3	33.3	46.6	56.6	35.3
7.	Monocrotophos	16.6	13.3	26.6	60	63.3	36
8.	Leybacid	30	36.6	56.6	63.3	63.3	49.9
9.	Fenitrothion	80	66.6	66.6	80	73.3	73.3
10.	Formothion	46.6	66.6	60	80	66.6	69
11.	Endosulfan	26.6	40.	50	63.3	66.6	49.3
12.	Permithrion	26.6	36.6	46.6	63.3	66.6	48.4
13.	Malathion	40	52	76	80	84	66.4
14.	Dichlorovos	34.6	55.1	72	66.6	66.6	59
15.	Ekatox	16.6	40	56.6	53.3	66.6	46.6
16.	Carbaryl (Sevimol)	23.3	36.6	63.3	66.6	70	52
17.	Ekatin	30	36.6	63.3	66.6	70	53
18.	Coroban	23.3	36.6	53.3	56.6	63.3	46.6
19.	Dipterex	33.3	40	50	53.3	56.6	46.6
20.	Birlane	23.3	36.6	56.6	66.6	70	50.6
21.	Phenthoate	16.6	30	33.3	46.6	43.3	34.9
22.	Metasystox	43.3	86.6	80	76	60	69.2
23.	Fenlorate	23.3	40	43.3	66.6	73.3	49.3
24.	Phosvel	66.6	63.3	50	64	52	59.2
25.	B.H.C.	60	64	72	72	72	68
26.	Carbaryl (Sevin)	26.6	50	53.3	83.3	86.6	60
27.	Disopropyl Benzyl thiosulphate (Kitazin)	82.5	75.9	82.2	85.8	92.4	83
28.	Primophos methyl	56	64	72	80	72	68.8
29.	Pyrethrum	33	50.4	80	68	92.4	66.6
30.	Ethiofencarb	64	52	64	68	92	68
31.	Nicotine sulphate	36	60	68	84	92.4	68.1
				7days	15days	30days	
32.	Phorate (10gm/pot)	–	–	68	24	24	38.7
33.	Carbofuran (30g/pot)	–	–	24	52	20	32
34.	Dasanit (15g/pot)	–	–	40	36	36	37.3
35.	Control	75	76	81	82	88	80.1

with systemic insecticides are less. As a result of insecticides treatment, the colony might have been disturbed and their hyperactivity, probing and intermittent migration in search of suitable host may be responsible for increased spread in some treatments. The increased spread of virus disease due to

Table III. *Effect of insecticide on 'Katte' disease and its vector (Mean of 3 replications)*

Sl.No.	Treatments	Progressive disease incidence (%)			Mean No. of aphids/clump		
		1981	1982	1983	1981	1982	1983
1.	Methyl parathion (0.05%)	2.78	8.33	9.72	0.90	0.19	1.16
2.	Quinalphos (0.05%)	3.47	8.33	9.72	1.09	0.15	1.55
3.	Dimethoate (0.05%)	4.86	9.02	10.41	0.65	0.42	2.61
4.	Phosphamidon (0.05%)	5.57	20.82	22.22	1.16	0.73	2.83
5.	Carbofuran (1.5 kg a.i./ha)	2.08	20.17	22.22	2.63	1.46	11.27
6.	Phorate (15 kg a.i./ha)	6.94	18.06	22.28	1.88	0.55	1.34
7.	Cultural operation Removal of breeding sites	8.78	7.64	9.02	4.47	1.68	9.88
8.	Control	1.72	10.42	10.42	9.54	5.09	37.33
	C.D. at 5%	N.S.	N.S.	3.83	1.31	3.83	4.08
	C.D. at 1%	N.S.	N.S.	5.30	1.82	4.30	5.65

insecticidal application has been reporded in other crops also. Broadbent *et al.* (1963) observed that more Narcissus plants became infected with yellow stripe virus in plots sprayed with DDT or a systemic organophosphorous insecticide than control.

Thus the insecticides are ineffective in preventing the entry of infection from other sources and secondary spread of virus within the crop. Deshpande *et al.* (1972) recommended application of dimethoate (0.05%) as one of the pretreatments in roguing operaton of 'Katte' virus infected plants. Since no added advantage was observed, this treatment may be avoided to reduce the cost of crop production.

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