BREEDING CARDAMOM FOR 'KATTE' DISEASE RESISTANCE

G SUBBARAO AND R NAIDU

Central Plantation Crops Research Institute, Mercara 571 201
Coorg Dist., Karnataka

ABSTRACT

'Katte' or Mosaic disease of small cardamom (*E. cardamomum* Maton) is an important virus disease transmitted by an aphid (*Pentalonia nigronerusa* f. *caladii* Vander Goot). In order to obtain resistant lines, various breeding programmes were initiated at this Research Centre. Evaluation of existing germplasm including high yielders, morphological variants occurring in nature like pinkstemmed, terminal panicle, male sterile and chlorophyll variegants through insect vector has not revealed any resistant types. Seedlings raised after exposing the seeds to physical mutagens at 5, 10, 15 KR of gamma rays and seeds treated with chemical mutagens like Ethyl methane sulphonate (EMS) and Diethyl sulphate (DES) with different concentrations and treatments has also not yielded positive results in getting a resistant type. Even species of allied genera like *Aframomum*, *Amomum Alpinia* have also taken infection. So far the screened material was found to be susceptible.

INTRODUCTION

Small cardamom *Elettaria cardamomum* Maton known as 'Queen of spices' is an important spice crop grown in the evergreen forests of Kerala, Karnataka and Tamil Nadu in south India. During the past several decades, cardamom cultivation in India has been threatened by a serious malady locally known as 'Katte' disease. The disease is caused by a non-persistent aphid-borne virus, and is being spread in nature by *Pentalonia nigronervosa* f. *caladii* van der Goot, and also through the diseased rhizomes and seedlings (Uppal *et al.*, 1945; Varma and Capoor, 1958; Rao and Naidu, 1973). Widespread occurrence of this disease was observed in all the cardamom growing tracts in India (Mayne, 1951; Anonymous, 1980). Losses in yield due to 'Katte' disease amount to 10-68% in the first year, 26-92% in the second year and 82-98% in the third

year after getting the infection (Varma, 1962; Anonymous, 1980). Insecticidal application may reduce the vector population but not the disease, since the virus transmission takes place in few seconds (Anonymous, 1980). In the absence of suitable control measures, growing resistant cultivars is the most effective, economic and safe method of combating losses due to this disease. Hence, attempts were made to breed a cultivar (s) resistant to 'Katte' disease. The present paper summarises the results of these attempts obtained from 1979 onwards at this Research Centre.

Materials and Methods

Three commercial cardamom types, Malabar, Mysore and Vazhukka were used for physical and chemical mutagen treatments. One thousand seeds for each treatment and equal number of untreated seeds as control were used in the experiments. After the treatment, seeds were sown in galvanised iron trays of $70 \times 40 \times 10$ cm size and maintained in the green house. Seedlings were subjected to mass screening when they were at third leaf stage. Seeds of the three varieties were treated with 0.25%, 0.50% and 1.00% (EMS) at pH 7 for 24 hours and 48 hours respectively. In the physical mutagen experiment seeds were irradiated with gamma rays of 4, 8, 12 and 16 KR at the Sugarcane Breeding Institute, Coimbatore. Seedlings of M_1, M_2 and early mutants (M_2) of the Malabar type were obtained from the seeds irradiated at the Indian Institute of Horticultural Research, Bangalore with gamma rays of 5 and 10 KR.

Eighteen progenies raised from the entries of Initial Evaluation Trial, natural variants like pink stemmed, narrow leaf, terminal panicle, male sterile Malabar, chlorophyll variegants and 18 accessions from the allied genera viz., *Aframomum*, *Alpinia*, *Amomum*, *Costus*, *Curcuma*, *Hedychium* and *Schumannianthus* were also screened to locate sources of resistance.

Screening procedure. The aphid *Pentalonia nigronervosa* f. *caladii* was reared on healthy cardamom leaf funnels in the laboratory through single apterous aphid. The source of virus was a naturally affected cardamom plant and its culture was maintained in the glass house on cardamom by repeated transfers through aphid. Adults

of alate and apterous aphids were collected in glass vials by means of camel hair brush. The aphids were given the following treatments for efficient transmission (i) pre-acquisition fasting 2 hours, (ii) acquisition feeding 12-20 minutes, (iii) inoculation feeding 12 hours. The method of inoculation followed was that of Varma and Capoor (1958). In these experiments, 3 mass screenings at an interval of 30 days, and 3 individual screenings at an interval of 45 days were given. The seedlings which remained tolerant after 3rd individual screening were planted in the field for multiplication.

Results and Discussion

Out of 18 seedlings which showed tolerance after 2nd individual screening, only one was obtained after 3rd screening in the chemical mutagen experiment (Table 1). In the physical mutagen experiment among the 3 varieties tested tolerant seedlings could not

Table 1. Performance of seedlings obtained after different inoculations following EMS treatment of seeds

Variety	Treatment	Duration in hours	No. of seedlings tolerant after screening			
			3 Mass	1st individual	2nd individual	3rd individual
Malabar	0.25%	48	163	39	8	..
,,	0.50%	24	115	17	2	..
,,	1.00%	24	210	40	1	..
,,	Control	..	224	100	..	1
Mysore	0.25%	48	231	37	1	..
,,	Control	..	288	7	..	..
Vazhukka	0.50%	24	144	74	3	..
,,	1.00%	24	137	17	3	..
,,	Control	..	154	57	..	..

be obtained with 4KR. In Malabar, 8 and 12 KR; Mysore, 12 and 16 KR; and in Vazhukka, 8 KR has given tolerant seedlings even after 6 inoculations. This indicates that 8-12 KR with very large populations may result in getting substantial success. Out of 693 seedlings obtained after 3 mass scale screenings of M_2 progenies

only 3 plants were tolerant after third screening (Table 2). All the seedlings which showed resistance even after 6 inoculations were planted in the field for multiplication.

Success was obtained by using gamma irradiation in rice against tungro virus when susceptible and moderately resistant varieties were exposed to 15 KR. Symptomless seedlings were obtained after individual inoculation technique to an extent of 0.12% in M_2 and 2.7% in M_3 generations (Mathur, 1979). This supports our view that resistance can be obtained by using mutation breeding technique.

Table 2. Performance of seedlings obtained following different inoculations after gamma irradiation of seeds

Variety	Treatment	No. of seedlings tolerant after screening			
		3 Mass	1st individual	2nd individual	3rd individual
Malabar	4 KR	44	17	..	..
,,	8 KR	71	31	4	1
,,	12 KR	24	12	5	3
,,	16 KR	40	19	4	..
,,	Control	224	100	..	..
Mysore	4 KR	57	23	..	..
,,	8 KR	68	25	4	..
,,	12 KR	68	12	3	2
,,	16 KR	120	23	1	1
,,	Control	288	7	..	..
Vazhukka	4 KR	69	16	..	..
,,	8 KR	124	51	6	2
,,	12 KR	79	18	..	..
,,	16 KR	159	35	2	..
,,	Control	154	57	..	..
Malabar	5 KR	218	102	15	..
,, M_2 (early)	5 KR	81	34	..	..
,, M_2	10 KR	693	231	44	3

Progenies from 18 selections from the Initial Evaluation Trial were screened and found to be susceptible. Natural variants such as pink stemmed narrow leaf terminal panicle male sterile Malabar and chlorophyll variegants were also found to be susceptible. Similar observations were also reported when 12 cultivars of 3 types were tested (Rao and Naidu 1973). Out of 18 accessions from the allied genera tested so far *Aframomum Alpinia* and *Amomum* have taken infection in the 1st screening. The remaining ones were subjected to 2nd screening. This confirms the earlier reports of the susceptibility of allied genera to 'Katte' disease (Varma and Capoor 1958; Rao and Naidu 1973; Viswanath *et al.* 1973; Viswanath and Siddaramaiah 1974; Yaraguntaiah 1979).

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