EFFECT OF MUTAGENS ON GERMINATION IN CARDAMOM

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ABSTRACT

Response of cardamom (*Elettaria cardamomum* Maton) to ionising radiations and chemical mutagens with special reference to the effect of germination are presented in this paper. In the seed treatment no germination was noticed above 30 KR whereas in capsule treatment a few sprouts were noticed at 40 KR, but germination was not noticed above 40 KR. The percentage of germination was observed to be inversely proportional to the dose of gamma rays indicating the lethality of high doses in the life process of the seedlings. The percentage ofiger-mination is highly influenced by moisture content of the seed. The LD-50 appears to be around 10 KR.

INTRODUCTION

In recent years, mutation breeding has been used as a valuable supplement to other methods of plant breeding for developing better varieties with new plant architecture, superior biochemical constitution and suitable growth. Induced mutations offer a source of new variability (Siddiq, 1969). The realisation of the potential of induced mutations in vegetatively propagated crop plants is rather limited, the reasons being (1) difficulty in producing large populations of mutagen treated plants, (2) lack of efficient evaluation techniques applicable in early developmental stages and (3) the long time required to assess clearly the superiority of a selected genotype under field conditions. Response of cardamom to ionising radiations and chemical mutagens with special reference to the effect on germination are presented in this paper.

MATERIALS AND METHODS

The seeds of cultivar 'Manjerabad' of the Malabar variety were treated in the Gamma shine unit at the Department of Botany,

University Centre, Trivandrum. Freshly extracted cardamom seeds of ripe capsules were used in all the experiments. The seeds were washed thoroughly in cold water till the mucilage was completely removed. After draining of the water the seeds were air dried for 24 hours. Germination counts were taken at 15 days intervals up to 120 days.

For comparative study of seed and capsule treatment, cardamom capsules (50) as well as seeds (1000) with normal moisture content (19.2%) were treated with gamma rays. The following doses were given: 5, 10, 20, 30, 40, 50, 60, 70, and 80 KR.

The moisture content of the seeds (1000 for each treatment) was reduced from 19 to 14% after desiccation over P_2O_5 for 24 hours. The following doses were given : 5, 10, 20, 30, 40, 50 and 60 KR.

Cardamom capsules were sun dried for four days. Seeds were extracted and after keeping for three months, seeds (10,000 for each treatment) were treated with gamma rays. The moisture content of the seed was 15.2% and the following doses were given : 5, 10, 15 and 20 KR.

To enhance the radiosensitivity, seeds (500 for each treatment) were soaked in water for 2 hours at 23°C and then exposed to different doses: 5, 10, 20 and 30 KR of gamma rays. Unsoaked seeds (500 for each treatment) were also exposed to gamma rays of 5, 10, 20 and 30 KR.

Rhizomes of cardamom were exposed to 5 KR Co^{60} gamma rays at the Gamma cell unit, Indian Institute of Horticultural Research, Bangalore.

In order to study the mutagenic effect of Methyl methane sulphonate (MMS) on germination, seeds (1000 for each treatment) of Malabar, Mysore and Vazhukka were treated with 0.1%, 0.3%, 0.5%, 0.8% and 1.0% MMS for 4, 6, 8, 10, 12 and 15 hours. The treated seeds after thorough washing were sown in galvanised iron trays of $70 \times 40 \times 10$ cm size along with control and maintained in the green house.

Results and Discussion

In seed treatment no germination was noticed beyond 30 KR whereas in capsule treatment a few (0.2%) sprouts were noticed at 40 KR but germination was not noticed beyond 40 KR. A slight increase in germination was noticed in all the capsule treated material (Table 1).

Reduction in moisture content of the seed from 19 to 14% affected the germination both in control as well as in treated material adversely. Germination started from 30 days onwards and continued up to 90 days. Afterwards germination was not noticed.

Table 1. Comparative study of seed and capsule treatment

S. No.	Treatment	Germination %	
		Seed treatment	Capsule treatment
1.	Control	50.0	56.1
2.	5 KR	34.5	37.5
3.	10 KR	25.5	27.5
4.	20 KR	2.0	3.2
5.	30 KR	0.1	0.5
6.	40 KR	..	0.2

Table 2. Effect of irradiation on germination under reduced moisture content, sun dried seeds and pre-soaked seeds

S. No.	Treatment	Percentage of germination			
		Reduced moisture content	Sun-dried seeds	Soaked seeds	Unsoaked seeds
1.	Control	19.6	8.2	56.6	50.0
2.	5 KR	13.0	8.0	29.0	28.0
3.	10 KR	11.0	4.0	17.0	15.0
4.	15 KR	..	1.6	..	..
5.	20 KR	0.4	0.3	..	2.0
6.	30 KR	..	..	..	0.2

Table 3. Effect of Methyl methane sulphonate (MMS) on germination

Concentration	Duration in hours	Germination percentage		
		Malabar	Mysore	Vazhukka
Control		43.6	62.0	56.4
0.1%	4	22.0	63.3	39.3
	6	6.6	42.0	19.3
	8	5.3	47.3	15.3
	10	4.0	36.6	34.6
	12	12.0	34.0	10.0
	15	2.6	85.5	11.3
0.3%	4	16.6	50.0	27.3
	6	26.6	57.3	25.3
	8	10.6	34.0	15.3
	10	12.0	28.0	38.0
	12	8.6	37.3	29.3
	15	29.3	80.6	52.6
0.5%	4	12.0	47.3	24.0
	6	16.6	41.3	7.2
	8	14.0	38.6	19.3
	10	2.6	35.3	34.6
	12	2.6	25.3	17.3
	15	26.6	50.0	27.3
0.8%	4	25.3	61.3	20.0
	6	2.6	52.5	1.3
	8	19.3	36.6	26.5
	10	10.0	38.6	23.0
	12	6.0	29.3	14.0
	15	11.3	78.0	17.3
1.0%	4	20.0	58.6	10.6
	6	2.6	52.0	2.6
	8	5.3	36.6	20.0
	10	7.3	53.3	10.0
	12	8.0	26.6	19.3
	15	16.6	86.6	30.0

In sun-dried seeds, germination of both the treated and control lots was poor. Germination started only after 60 days and continued up to 120 days. In the experiment on soaking of seeds before irradiation, it was observed that though the soaked seeds gave slightly better germination in lower doses (5 KR and 10 KR), sharp reduction in the percentage of germination was noticed at higher doses (20 and 30 KR).

On perusal of data (Table 2) it is evident that, germination of cardamom is highly influenced by moisture content of seed. An important physiological factor which controls the germinability of seeds is the moisture content. The percentage of germination was observed to be inversely proportional to the dose of gamma rays indicating the lethality of high doses. From the above studies LD-50 appears to be around 10 KR. The failure of rhizomes to sprout may be attributed to higher dose of gamma irradiation used.

It is clear from the data (Table 3) that there is no relationship between (i) duration of treatment (ii) difference in concentration and the percentage of germination in different cultivars. Cardamom seeds take a long time to germinate due to the hard seed coat. The chemical mutagen might not have penetrated properly owing to the hard seed coat. This may be the reason for the insignificant effect on germination. The efficiency of chemical mutagen depends on various factors like seed coat, permeability, type of mutagen and stage of treatment (Siddiq, 1969).

REFERENCES

SIDDIQ, E. A. 1969. *In* Symp. Radiation and radiomimictic substances in mutation breeding, BARC, Bombay.