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CHLOROPHYLL MUTATIONS INDUCED IN RICE BY CHEMICAL MUTAGENS

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Abstract

Chlorophyll mutants were isolated in the traditional rice variety namely, jerraga samba by ethyl methane sulphonate (EMS) and colchicine. Chlorophyll mutant spectrum includes albino, xantha, chlorina and variegate. EMS produced the higher frequency and spectrum of chlorophyll mutants in comparison to colchicine. Based on the effectiveness, EMS was found to be more efficient as compared to colchicine.

Key words : Chlorophyll mutations, chemical mutagens, jeeraga samba.

Introduction

Mutation breeding has been widely used for the improvement of various plant characters from time to time. Various methods have been made to determine the most effective and efficient mutagens and treatments for the induction of beneficial mutations in rice (Singh and Singh, 2003).

The chlorophyll mutation frequency is useful in assessing the potency of a mutagen. Hence, scoring of chlorophyll mutations has proved to be much dependable index for evaluating the genetic effects of the mutagenic treatments.

In this paper, the frequency and spectrum of chlorophyll mutants and the effectiveness and efficiency of chemical mutagens in rice is reported.

Materials and Methods

Three sets of 200 healthy seeds of the rice variety, jeera samba were presoaked in distilled water for twelve hours and then treated with 0.4, 0.6 and 0.8 per cent concentration of EMS and colchicine for four hours. The seeds were given intermittent shaking through out the period of treatment to maintain uniformity. Immediately after treatment the seeds were thoroughly washed in running water and sown directly in the field along with untreated controls to raise M_1 generation. Seeds of M_1 plants along with the control were harvested separately and sown in plant progeny rows to raise M_2.

In M_2 generation, four mutant populations *viz*, 0.6% colchine (Population 1), 0.8% Colchicine (Population 2), 0.6% EMS (Population 3) and 0.8% EMS (Population 4) were used for taking observations. Chlorophyll mutations were scored in M_2 when seedlings were 8-15 days old. They were identified and classified according to gustofsson (1940). Formula suggested by Konzak *et al*. (1965) were used to evaluate mutagenic effectiveness and efficiency of the mutagens used.

Results and Discussion

Frequency and spectrum of chlorophyll mutations: The Spectrum of different M_2 chlrophyll mutants included albino, xantha, chlorina and variegate were recorded at the seedling stage. Brief description of different chlorophyll mutants identified is given below:

Albina – White leaves without chlorophyll . It is a lethal mutation.

Xantha – Leaves were complete yellow in colour. Seedlings survived for 8 – 12 days only.

Chlorina - Leaves were light green in colour (viable).

Variegata – Leaves with longitudinal stripes of yellow on green or white on green (viable).

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Table 1 : Frequency and Spectrum of Chrolophyll mutants in M_2 Generation.

Population	No. of M_2 plants	Chlorophyll mutant type				Total	Frequency (%)
		Albina	Xantha	Chlorina	Variegata		
Control	340	-	-	-	-	-	-
1	360	20	17	5	8	50	4.44
2	372	11	8	4	5	28	4.30
3	400	8	14	3	2	27	6.00
4	356	14	10	2	6	32	5.62

Table 2 : Effectiveness and efficiency of different mutagens in M_2 generation.

Population	Percentage of height reduction (injury)	Percentage of survival reduction (lethality)	Mutation for 100 Plants (M)	Effectiveness $\frac{M \times 100}{C \times t}$	Efficiency	
					M × 100 I	M × 100 L
1	16.41	52.31	4.44	185.00	27.05	8.48
2	16.44	55.31	4.30	134.37	26.15	7.76
3	17.27	49.69	6.00	250.00	34.74	12.07
4	16.44	55.31	5.62	175.62	34.18	10.16

Maximum frequency of chlorophyll mutants were obtained in population 3. Mutant like albino was occurred in higher frequency than xantha, chlorine or variegate mutants, confirming the earlier reports (Swaminathan *et al*., 1970 and Singh *et al*., 1998). The Chlorophyll development seems to be controlled by many genes located on different chromosomes which could be adjacent to the centromere and proximal segments of chromosomes (Swaminathan, 1964 and Gouth, 1967).

A perusual of the table 1 revealed that population 3 (0.6% EMS) induced the higher frequency of chlorophyll mutations and was followed by population 4.

Mutagenic effectiveness and efficiency

Data on effectiveness and efficiency of different mutagenic treatments is presented in table 2. Among the populations (06% EMS) Gaul (1964) stated that the mutagenic effectiveness have theoretical importance and does not have any immediate practical significance. Hence, the aim is to derive more efficiency with optimum concentration of mutagen.

The efficiency was calculated on the basis of inhibition in seed germination and seedling injury. On the basis of injury and lethality, population 3 recorded the maximum mutagenic efficiency.

According to Konzak *et al*. (1965) the greater efficiency of lower concentration of mutagen appeared in relation to the fact that injury and lethality increases with increase in concentration at faster rate than mutations.

The results indicate that the efficiency calculated on the basis of injury and lethality, 0.6% EMS was found to be most efficient among the treatments studied.

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