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INTERRELATION OF INDUCED CHLOROPHYLL AND VIABLE MUTATIONS IN RICE

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The frequency of chlorophyll mutations serves as the criterion for the assessment of mutagenic efficiency in most of the induced mutation studies. Viable mutations are not always scored because of the difficulty involved in raising a large population. However, in a mutation breeding programme, preliminary screening of material can be effectively made on the basis of chlorophyll mutation studies if information on the interrelation of chlorophyll and viable mutations is availabe. The present study was undertaken to examine whether such an interrelation exists or not.

Materials and Methods

Seeds of the rice variety Co.29 were treated with gamma rays, fast neutrons, nitroso methyl urea (NMH) and ethyl methane sulphonate (EMS), each employed over a wide range of doses. The main ears of all surviving M_2 plants were collected separately and the M, generation was grown on M_2 ear progeny basis. Chlorophyll, viable and total mutations were scored in the M_2 generation and their frequencies were estimated as the number of mutations per 100 M_1 ears.

Results and Discussion

The chlorophyll, viable and total mutation frequencies estimated in the M_2 generation as the number of mutations per 100 M_1 ears are presented in Table 1. The frequencies of chlorophyll and viable mutations induced by the same does of fast neutrons, NMH and EMS are almost similar. Such a high correlation between the frequencies of chlorophyll and viable mutations was previously reported in rice by Matsuo and Onozawa (1961) and Sato (1966), in barley by Nilan 1961, Rao and Natarajan 1965 and Doll and Sandfaer (1969) and in durum wheat by Chopera (1966). On the other hand, gamma rays induced viable mutations, at a higher rate than chlorophyll mutations. This indicates that the proportion of viable to chlorophyll mutations depends on the mutagen.

In treatments with gamma rays, fast neutrons and NMH, the total mutation frequency was the sum of chlorophyll and viable mutation frequencies. This was also the case in teatment with the lower doses of EMS, whereas at higher doses of EMS the total mutation frequencies were less than the sum of chlorophyll and viable mutation frequencies.

Table 1

Frequencies of different types of mutations in the M_2 generation

Mutagen and dose	No. of mutations per 100 VI , ears		
	Chlorophyll	Viable	Total
1) Gamma rays			
10 krad	11.3	11.5	21.2
20 krad	8.0	29.4	35.3
30 krad	6.8	36.3	44.0
40 krad	24.3	49.2	63,1
50 krad	5.6	47.2	50.0
2) Fast neutrons			
705 rad	10.1	6.7	16.8
968 rad	8.8	12.6	20.2
1170 rad	12,5	133	24.2
1408 rad	13.8	13.3	27.7
1570 rad	12.1	18.5	26.1
1710rad)	14.2	16.5	32.2
1880 rad	35.8	25.0	36.2
2100 rad	12,7	13.2	23.7
3) NMH			
0.97 mM;	10.7	11.0	19.5
1.94 mM	13.3	150	26.7
2.91 mM	14.1	11.0	22.9
3.88 mM	13.1	15.4	26.5
4.85 mM	10.8	12.6	23.5
5.82 mM	18.9	24.2	43.3
7.76 mM	29.5	16.8	42.5
9.70 mM	22.6	32.1	49.1
4) EMS			
38 *mm*	6.7	3.4	11.0
77 mM	9.0	6.8	17.8
115 mM	11.2	14.3	26.1
154 mM	20.3	20.3	33.1
192 mM	22.8	25.0	45.0
240 mM	22.3	31.3	43.2
288 mM	32.5 -	34.7	51.7

The interrelation of M_1 ear progenies segregating for chlorophyll and viable mutations is shown in Table 2. The expected frequencies of double (chlorophyll and viable) mutations were calculated on the assumption that chlorophyll nd viable mutations appeared independently in each ear. These estimated values vere the same as the observed frequencies of ears with double mutations in treatments with gamma rays, fast neutrons and NMH. On the other hand in treatments vith EMS, the oberved frequencies of double mutations were much higher than he expected ones indicating that EMS induced both types of mutations simultaeously at least in certain of the ear primordia. The incidence of chlorophyll nd viable mutations in the same primordium was more common at the higher doses. Simultaneous incidence of chloropyll and viable mutations has been reported in rice by Matsuo and Onozawa (1961) and in *Phalaris* by Bremer Reinders (1965). Since progenies segregating for chlorophyll mutations in the

Table 2

Interrelation of M_1 ear progenies segregating for chlorophyll and viable mutations

Mutagen	No. of M_1 ear progenies scored	No. of M_1 ear progenies segregating for: Chlorophyll mutations	Viable mutation	Chlorophyll or viable mutations	Both chlorophyll and viable mutations: Observed	Expected *
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Gamma rays	407	S3	125	159	19	16.3
2. Fait neutrons	941	127	140	243	24	18.9
3. NMH	878	145	142	267	20	23.5
4. EMS	829	162	161	270	53	31.5
EMS - doses						
38 mM	118	9	4	13	0	0.3
77 mM	118	15	8	21	2	1.0
115 mM	119	15	17	31	1	2.1
154 mM	118	21	24	39	6	4.3
192 mM	120	33	30	54	9	8.3
240 mM	118	27	37	51	13	8.5
288 mM	118	42	41	61	22	14.6

Expected on the assumption of independent occurrence of chlorophyll and viable mutations in ears

$$\text{Col. } 7 = \frac{\text{col. 3} \times \text{col. 4}}{\text{col. 2}}$$

M_2 generation yield viable mutations more often than non-segregating progenies, screening of M_2 seedlings based on chlorophyll mutation studies becomes possible in a mutation breeding programme.

Summary

Rice seeds were treated with radiations and chemical mutagens and mutation frequencies were estimated in the M, generation. The proportion of viable to chlorophyll mutations changes with the mutagen. The total mutation frequencies were less than the sum of chlorophyll and viable mutation frequencies at higher doses of EMS indicating that the incidence of chlorophyll and viable mutations in the same ear primordium was more frequent at these doses.

സംഗ്രഹം

വിവിധrairorannlejgg ഉൽപരിവർതിതങ്ങളുടെ അനുപാതക്രമം മനസ്സിലാക്കുന്നതിനു വേണ്ടി നെൽവിത്തുകളെ വികിരണത്തിനും roocrugKsSaJto ിവർത്തക പ്രയോഗത്തിനും വിധേയ മാക്കുകയും അവയുടെ പ്രവർത്തനം മൂലം ഉത്പാദിപ്പിച്ച ഉൽപരിവർത്തിതങ്ങളെ രണ്ടാം തലമുറയിൽ പാടിക്കുകയും ചെയ്തു. വർണ്ണഹരിതശൂന്യ ഉൽപരിവർത്തികങ്ങളും, ജീവനക്ഷമ ഉൽപരിവർതി തങ്ങളും തമ്മിലുള്ള rawnranjonno ഉൽപരിവർതികത്തിന്റെ തരം rararraaroro"l.g,j[0] വ്യത്യാസപ്പെ ടുന്നു. E M S എന്ന roooro ഉൽപരിവർത്തകം വർദ്ധിച്ച അളവിൽ ഉപയോഗിക്കുമ്പോൾ ഒരു ആദ്യകത്തിൽ ഒരേ സമയം വിവിധതരം ഉൽപരിവർതിതങ്ങളും ഉത്പവിക്കുന്നതായി കാണുകയു ണ്ടായി. വർണ്ണഹരിതശൂന്യമായ ഉൽപരിവർതിതങ്ങളും ഉൾക്കൊള്ളുന്ന സന്തതികളിൽ പിൽ ക്കാലത്തു് ജീവനക്ഷമ ഉൽപരിവർത്തിതങ്ങളും കൂടുതലായി ആവിർഭവിക്കാൻ സാദ്ധ്യതയുള്ള തായി ഇതിൽ നിന്നു് മനസ്സിലാക്കാം.

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