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TILLER EMERGENCE IN RICE AND MUTATION FREQUENCY IN THE DIFFERENT EAR CATEGORIES

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Induced mutations are being used for the study of development patterns in higher plants. In short duration rice varieties, the tillering system comprises of the main shoot primaries and secondaries. The freqnencies of emergence and yield of mutations might differ in these different tiller categories. Studies on the pattern of tiller emergence and mutation frequency in the various ear categories have relevence to selection in the M_1 generation in mutation breeding programmes.

Meterials and Methods

Seeds of the rice variety 'Rohini' were treated with 2 doses each of gamma rays (15 and 25 krad) and ethyl methane sulphonate (1 and 2%). Large seeds of uniform size and maturity were selected for the treatment. Sprouted seeds were down on soil surface. Irrigation during the early stages was regulated to avoid water stagnation.

The tillers on M_1 plants were classified according to the system adopted by Jacobsen (1966) in barley. The main shoot was marked 'A' and the coleoptile 'C'. Primary and secondary tillers were marked according to their node position on the main and primary shoots respectively. The secondary tillers were marked separately in each of the primaries. The tillers were labelled with threads of different colours as and when they emerged. The threads were later replaced by paper labels. All the primary tillers and secondaries up to the fifth position in each of the primaries were labelled in all the surviving M_1 plants. The labels were transferred to the respective panicles after flowering. The ears on maturity were harvested separately. The M_2 generation was raised on ear progeny basis. The M_1 ears were sown separately and scored for cholrophyll mutations Normal seedlings and mutants in segregating progenies were separately counted and recorded. The data were tabulated and analysed.

Results and Discussion

The data on emergence of tillers are presented in Table 1. The frequencies of emergence for the various categories of tillers were different. The main shoot developed with the highest frequency followed by the primaries and the secondaries. Similar results were reported by Osone (1963) in rice.

Jacobsen (1966) in barley and Khan and Doll (1968) in wheat. Primary tillers showed variable degrees of emergence indicating that all the tillers of a plant did not develop equal frequency. Tillers in the axils of the coleoptile and the first primary leaf did not develop even under favourable conditions. Constantin and Mullenax (1966) reported that in rice a coleoptilar bud is neither present in the embryo nor appears throughout the development of the plant. The frequency of emergence of primary tillers increased upto the fourth and thereafter gradually decreased. Thus among the primary tillers of a rice plant, the fourth developed most frequently (9244%). Jacobsen (1966) on the other hand reported that the first primary had the highest frequency of emergence in barley. Early primaries developed more secondaries than later ones. Osone (1963) in rice and Jacobsen (1966) in barley also reported similar results. The first secondary of lower primaries rarely developed. Later secondaries regularly developed in early primaries but not in later ones.

Table 1 Frequency of emergence of primary and secondary tillers in rice

Category of tiller		No. of plants studied	No. of plants having the primary	Percentage of plants having the primary	No. of plants having the secondary	Percentage of plants having the secondary
Primary	Secondary					
1	2	3	4	5	6	7
C	—	450	0	0.0		—
1	—	450	1	0.22	—	—
2	—	450	151	33.56	—	—
,,	1	—	,,	—	0	0.0
,,	2	—	,,	—	53	35.0
,,	3	—	,,	—	61	40.4
,,	4	—	,,	—	67	44.4
,,	5	—	,,	—	35	23.2
3	—	450	377	83.78	—	—
,,	1	—	,,	—	0	0.0
,,	2	—	,,	—	133	35.3
,,	3	—	,,	—	136	36.1
,,	4	—	,,	—	151	40.1
,,	5	—	,,	—	83	22.0
4	—	450	416	92.44	—	—
,,	1	—	,,	—	0	0.0

Table 1 (Contd.)

1	2	3	4	5	6	7
,,	2	—	,,	—	150	36.1
,,	3		,,	—	158	38.0
,,	4		;,	—	118	28.4
,,	5		,,	—	115	27.6
5		450	318	70.67	—	—
,,	1	—	,,	—	3	0.9
,,	2	—	,,	—	87	27.3
,,	3	—	,,	—	87	27.3
,,	4	—	,,	—	98	30.8
,,	5	—	,,	—	80	25.1
6		450	196	43.56	—	—
,,	1	—	,,	—	0	0.0
,,	2	—	,,	—	51	26.0
,,	3	—	,,	—	77	39.3
,,	4	—	,,	—	48	24.5
,,	5	—	,,	—	10	5.1
7		450	129	28.67	—	—
,,	1		,,	—	4	3.1
,,	2	—	,,	—	51	39.5
,,	3	—	,,	—	27	20.9
,,	4	—	,,			0.8
,,	5	—	,,	—	0	0.0
8		450	131	29.11	—	—
,,	1	—	,,	—	14	10.7
,,	2	—	,,	—	28	21.4
,,	3	—	,,	...	4	3.0
,,	4	—	,,	...	0	0.0
,,	5	...	,,	...	0	0.0
9	...	450	165	36.67	...	...
,,	1	...	,,	...	2	1.2
,,	2	...	,,	...	2	1.2
,,	3	...	,,	...	0	0.0
,,	4	...	,,	...	0	0.0
,,	5	...	,,	...	0	0.0
10	...	450	124	27.56	...	...
11		450	12	2.67	...	...

Table 2 Chlorophyll mutation frequency and segregation ratio in the different ear categories of rice

Ear category	Mutation frequency			Segregation ratio		
	No. of M_1 ear progenies scored	No. of progeniesse-gregating	Mutations per 100 M_1 ears	No. of M_2 Plants in segregating ear progenies	No. of mutants in segregating ear progenies	Percentage of mutants
Apical (Main)	240	33	13.75	1323	185	13.95
Primary—1	1	0	...	...	...	...
Primary—2	104	8	7.69	299	52	17.39
Primary—3	182	22	12.09	821	81	7.87
Primary—4	220	21	9.55	673	117	17.38
Primary—5	145	18	12.41	646	96	14.86
Primary—6	95	10	10.53	228	42	17.98
Primary—7	56	13	23.21	464	65	14.04
Primary—8	80	11	13.75	395	58	14.68
Primary—9	101	13	12.87	391	64	16.75
Primary—10	83	11	13.25	419	56	13.36
Primary—11	8	3	37.50	79	15	19.00
All primaries	1075	130	12.09	4415	646	14.63
Secondary (1)*	0	...	...	...	...	...
Secondary (2)	98	10	10.20	344	62	18.02
Secondary (3)	221	22	9.75	578	132	22.84
Secondary (4)	231	51	22.08	1418	272	19.18
Secondary (5)	158	32	20.25	936	162	17.31
Secondary (6)	104	12	11.54	273	48	17.58
Secondary (7)	49	8	16.33	332	72	21.69
Secondary (8)	30	4	13.33	95	10	10.53
Secondary (9)	4	3	75.00	84	12	14.29
Secondary (10)	0	...	—	...	...	...
All secondaries	895	142	15.87	4060	770	18.97

* All secondary ears in a primary group.

Mutation frequencies estimated as number of mutations per 100M_1 ears for the main ear, primary ears and secondary ears are presented in Table 2. The frequency for the main ear did not differ appreciably from that of primary. Karunakaran and Varkey (1977) reported that the first 3 ears on M_1 plants did not show any significant difference in M_2 chlorophyll mutation yields Khan and Doll (1968) reported similar results in wheat. On the other hand Osone (1963) observed that later tillers in rice showed a decrease in the M_2 mutant frequency. Mutation frequencies of secondary groups (4) and (5) were higher than those of the respective primaries. Frydenberg and Jacobsen (1966) in barley reported that all primaries except the third mutated more frequently than their corresponding secondaries

The M_2 segregation ratios of the various ear categories are presented in Table 2. The ratios for the main ear in primaries were mostly similar but that of the secondaries was higher. This high segregation ratio indicates that secondary ears are derived from smaller number of initial cells. Osone (1963) reporting high segregation ratios for later tillers in rice has stated that the initial cells leading to the formation of secondary tillers consist of a part of the cells leading to the formation of the primary ones.

Summary

Rice seeds were treated with two doses each of gamma rays and EMS. The tillers on M_1 plants were classified according to their node positions. The frequencies of emergence for the various tiller categories were estimated. The M_2 generation was raised as M_1 ear progenies. Chlorophyll mutation frequency and segregation ratio were estimated in the different ear categories. The frequencies of emergence for the various categories of tillers were different. The main shoot developed with the highest frequency followed by the primaries and the secondaries. Tillers in the axils of the coleoptile and the first primary leaf did not normally develop. The frequency of emergence of primary tillers increased upto the fourth and thereafter gradually decreased. Early primaries developed more secondaries than later ones.

Mutation frequency of the main ear did not differ appreciably from that of primary ears Secondary groups (4) and *(5)* mutated more frequently than the respective primaries. The segregation ratios for the main ear and primaries were mostly similar. The ratios for the secondaries were higher. This high segregation ratio indicates that secondary ears are derived from smaller number of initial cells.

സംഗ്രഹം

M_1 ചെടികളിൽ വിവിധതരം ചിനപ്പുകൾ പൊട്ടുന്നതിന്റെ ആവൃത്തി വ്യത്യസ്ഥമായികണ്ടു. പ്രാധമിക ചിനപ്പുകളുടെ ആവൃത്തി ദ്വിതീയചിനപ്പുകളുടേതിനേക്കാൾ അധിക

മാണു്. കോളിയോപ്റ്റെറായിൽ, ആദ്യപ്രാധമികപത്രം എന്നിവയുടെ കാര്യത്തിൽ rolorra" ചിനപ്പുകൾ വികാസം പ്രാപിക്കുന്നില്ല. ചിനപ്പു പൊട്ടലിന്റെ ആവൃത്തി ഏറ്റവും അധികമായി കണ്ടതു് നാലാമത്തെ പ്രാധമികത്തിനാണു്. rei^s^ajoej പ്രാധമികങ്ങളിൽ ദ്വിതീയ ചിനപ്പുകൾ കൂടുതലായി കാണുന്നു. മുഖ്യം, പ്രാധമികം എന്നീ കതിരുകളിൽ ഉൽപരിവർത്തന ആവൃത്തി ഏകദേശം തുല്യമായിരുന്നു. എന്നാൽ നാലും അഞ്ചും ദ്വിതീയ ഗ്രൂപ്പുകളിൽ ആവൃത്തി അധികമായി കണ്ടു. മുഖ്യം, പ്രാധമികം എന്നീ കതിരുകളിൽ ഉൽപരിവർത്തിത ആപേക്ഷിക ശതമാനം തുല്യമായിരിക്കുമ്പോൾ ദ്വിതീയങ്ങളിൽ ഈ ശതമാനം കൂടുതലായിരുന്നു.

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