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Studies on M_2 Generation of Pollen Irradiated H.C. 1 Castor*

by

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Castor is an important oilseed crop in Andhra Pradesh occupying an area of 6.6 lakh acres. The average yield of this crop is 350 kg per acre and therefore is very low. With a view to improve the yielding ability of this crop several breeding techniques are adopted; mutuation breeding being one of them. Among the various methods employed for inducing mutations, emphasis is laid on pollen irradiation, as it is a simple and effective method. This paper presents an account of pollen irradiation studies on the M_2 generation of H.C. 1 castor.

Materials and Methods: The variety used is H.C. 1 castor, an improved variety evolved at Rajendranagar. This variety has several distinguishing characters viz., a green stem colour, non-spiny fruits and triple bloom which make it easily identifiable from the local and other improved strains such as, H.C. 2 to H.C. 7. Also the recessive characters viz., green stem colour and non-spiny nature of fruits were taken advantage in maintaining the varietal puriety resulting from natural crossing and mechanical mixture. Pollen grains of H.C. 1 castor were irradiated with X-rays at doses of 50r, 100r, 200r, 300r, 500r, 700r, 900r and 1,100r. The female flowers of the emasculated and protected spikes of H. C. 1 castor were pollinated by this pollen and the mature seeds were collected. The M_1 generation was grown during Kharif 1964 and the characters were studied by Ranga Rao (1965).

A total of 42 plants were selected from the M_1 generation for different characters. The character and the number of plants selected (given in parenthesis) are as follows :—

i) Red stem colour (11). ii) Spininess of fruit (7). iii) Vigour and yield (6). iv) Earliness (3). v) 100% pistillate nature (5). vi). Mostly femaleness (2). vii) Mostly male character (2). viii) Long spikes (4) and ix) Small seededness (2).

The plants selected were from the progenies covering all the dosages ranging from 50r to 1, 00r. M_2 generation was raised from the selfed seed collected from the selected M_1 plants. Plant to row progenies were grown during Kharif, 1965 and the segregation for the characters enumerated above were studied.

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Experimental Results: 1. *Red stem colour:* Eleven M_2 progenies were studied. Out of 873 M_3 plants, 650 had red stem indicating a monogenic segregation. All the eleven M_1 parents had red stem. The details of segregation are given in Table 1.

TABLE 1. *Segregation of stem colour in M_2*

M_1 Plants	Segregation in M_2		Total		
	Red	Green			
1 (50r)	79	9	88		
2 (50r)	60	30	90		
3 (100r)	71	5	76		
4 (300r)	142	27	169		
5 (300r)	40	24	64		
6 (500r)	65	19	14		
7 (700r)	36	24	60		
8 (700r)	45	47	92		
9 (900r)	12	12	25		
10 (1,100r)	65	26	91		
11 (1,100r)	35	—	35		
Total	660	223	873	X^2	'P' Value
Exp. on 3 : 1 ratio	654.75	218.25	873	0.137	0.80–0.70

2. *Spininess of capsules:* All the seven selections made in M_1 for spiny capsules segregated in M_2 as shown in Table 2. Out of 367 M_2 plants, 268 were with spiny fruits and 99 with non-spiny fruits, which indicated a monohybrid segregation for this character.

TABLE 2. *Segregation of spiny nature*

M_1 Plants	Segregation in M_2		Total		
	Spiny	Non-spiny			
1 (50r)	25	6	31		
2 (100r)	51	10	61		
3 (300r)	37	17	54		
4 (500r)	42	27	69		
5 (700r)	12	10	22		
6 (700r)	53	25	78		
7 (1,100r)	48	4	52		
Total	268	99	367	X^2	'P' Value
Exp. on 3 : 1 ratio	275.25	91.75	367	0.591	0.50–0.30

3. *Vigour and yield:* In M_1, six plants were selected for vigour and yield. This character was based upon the components like growth, number of spikes, sex-ratio, and average seed weight. Table 3 presents the data comparing the number of racemes with yield.

TABLE 3. *Average number of racemes and yield per plant in M_1 and M_2 generation*

M_1 Plants	Average number of racemes per plant		Average yield per plant in gr.	
	M_2	M_1	M_2	M_1
1 (100r)	5.9	10.0	96.4	350 0
2 (500r)	4.2	25.0	72.3	366.0
3 (700r)	6.3	22.0	106.7	358.0
4 (700r)	6.7	14.0	110.8	258.0
5 (1,100r)	4.1	25.0	71.6	288.0
Control	3.4	4.3	43.7	104.2

The data show that there was a steep decline in the yield and average number of racemes per plant in M_2 as compared to M_1.

4. *Earliness:* Three plants in M_1, that flowered between 48 and 51 days after sowing were selected. The progenies of these plants in M_2 had taken the normal period of 73 to 75 days for the first flowering, and therefore were not early in nature.

5. *Small seededness:* Two plants with small fruits and seeds were selected in M_1 and their progenies were studied. The population presented an array with regard to seed size. There were seven plants in the first progeny and six in the second with seeds smaller than the parents. The segregation was indicative of quantitative inheritance of this character.

6. *Long spikes:* Four plants were selected for long-spike nature in M_1 and their M_2 progenies were studied separately. The length of spikes in M_1 measured 50.2 cm to 54.6 cm. Although the spike length during M_2 was some what less than the M_1 generation, it was longer than the control (20 cm).

7. *100% pistillate character:* Five plants having 100% pistillate spikes were selected during the M_1 generation and the seed obtained after pollination with the mostly pistillate spikes was sown and the progenies were studied for this character. A total of 252 plants were raised of which only 52 were 100% pistillate. The remaining 200 plants had varying percentage of pistillate flowers. 150 plants had spikes with less than 70% pistillate flowers, which 50 plants possessed spikes with pistillate flowers ranging from 70 to 99%.

8. *Mostly female characters:* Two M_2 plants from the M_1 plants having 90 to 98% pistillate spikes were studied for the inheritance of mostly pistillate character. Out of 59 plants studied in the first progeny, 9 plants had 100% pistillate inflorescence while remaining fifty plants had varying proportions of pistillate flowers. All the 29 plants in the second progeny had spikes with less than 70% pistillate flowers.

9. *Mostly Male Character;* Two selections were made in M_1 generation for mostly male character (over 70% flowers male) and their progenies were studied. Most of the progeny plants of these two selections possessed less than 30% female flowers in their spikes. In any case, the female flowers did not exceed 50%, thereby indicating the true breeding nature of this character.

Discussion: The genetic basis of each of these nine characters is discussed below individually.

1. *Inheritance of Red Stem Colour;* In contrast to the green stem colour of the parent (H.C.1), the selected M_1 mutants had red coloured stem. Obviously the mutation for the red stem colour has occurred in the irradiated pollen. Segregation of M_2 progeny into 3 Red to 1 Green indicates a monogenic control of this character. It is also evident that the red colour is dominant over green. Patwardhan (1931) and Kulkarni (1959) reported that the Red stem colour is dominant over Green and is controlled by a single pair of genes. On the contrary Harland (1920) and Peat (1928) reported that 2 or more independent factor pairs were involved in the determination of stem colour. The results of the present investigation support the earlier view that the stem colour of castor is controlled by a single pair of genes.

2. *Inheritance of Spiny Nature of Fruits;* The fruits of H.C.1 Castor were typically non-spiny while the selected M_1 plants had spiny fruits. The mutation for spiny nature of fruits must have occurred in the irradiated pollen, which on pollination produced plants exhibiting this character. Since the M_2 segregated into 3 spiny to 1 non-spiny, it is obvious that the spiny nature is dominant and controlled by a single pair of genes. Harland (1920), Peat (1928), Patwarahan (1931), and Kulkarni (1959) reported the dominance of spiny character and its segregation into a monogenic ratio. The results reported herein are in perfect agreement with the report of these workers. It is possible that the recessive gene "s" for non-spiny nature of fruit had mutated into its dominant allele "S" in the irradiated pollen, which produced plants heterozygous for this factor pair during M_1 generation.

3. *Vigour and High Yield Potential:* There were considerable reduction in the average number of racemes and yield per plant in M_2 generation as compared to the M_1 plants, although they were superior for both the characters over the control. Ancel (1927) and Sax (1955) reported increased yield due to stimulus of irradiation. It is therefore likely that the M_1 plants gave increased yield due to greater stimulus which obviously was reduced in M_2 generation.

4. *Earliness:* The plants selected in M_1 generation had early flowering while their progeny in M_2 were more or less normal in the flower initiation.

As in the case of vigour and yield, in this case also the earliness during M_1 generation might have been induced due to stimulus of irradiation, which might have confined to only M_1 generation.

5. *Small Seededness:* The plants selected for small seed size. There was an array of segregation for seed size from bold to small, which indicates a quantitative inheritance of this character. It is likely that several genes for controlling the seed size have mutated in the irradiated pollen, which on pollination produced plants with small seeds. Reddy (1964) reported that the gene for small seed size is dominant over the bold seed. The present investigation agrees with this view.

6. *Sex Expression in Castor:* The breeding behaviour of 100% pistillate, mostly pistillate (90–98%) and mostly staminate plants (less than 50% pistillate flowers in the spike) was studied in M_2. The results indicated that the 100% pistillate and mostly pistillate character segregated into groups of plants ranging from 100% pistillate to less than 70% pistillate (*i.e.*, normal). No definite Mendelian ratio could be attributed to this character. The mostly staminate character bred true. Joshi (1926), Zimmerman and Parkey (1954), and Shiffris (1956) observed the extremes of sexuality ranging from 100% pistillate to mostly staminate nature in the natural populations of castor crop. Claussen and Hoffmann (1950) are of the view that the sex expression in castor is influenced by the modifying genes as well as environmental factors. It is likely that the segregation ranging between 100% pistillate and the normal condition observed in the present investigation is caused by the environmental factors and modifying genes.

Summary: Breeding behaviour of nine characters was studied in M_2 generation of the selected M_1 plants, following X-ray irradiated pollen. Red colour of stem and spiny nature of fruit segregated in a monohybrid ratio. The M_2 progenies were lacking in vigour, earliness and high yield potential as compared to their M_1 parents selected for these features and this is presumbly due to the stimulus cuased by irradiation in the M_1 generation. With regard to the seed size, the M_2 exhibited an array from bold to small seed attributing it to quantitative inheritance of this character. The sex-expression was irregular and no definite Mendelian ratio could be attributed for this character.

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Fungicidal Control of 'Tikka Leaf Spot' of Groundnut in Tamil Nadu.

by

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Introduction: Groundnut which is one of the most important oilseed crops is susceptible to some of the most serious diseases like 'tikka'-*Cercospora personata* (Berk. & Curt.) Ell. & Eve., *Cercospora arachidicola* Hori. and Root rot-*Rhizoctonia bataticola* (Taub.) Butl. The low yield of pods in India is to a great extent attributed to some of these diseases as well as pests. Reduction in yield from 20 to 50% due to severe cases of tikka alone has been reported from Uttar Pradesh by Mehta *et al.* (1954). Similarly Sulaiman (1965) has recorded a loss in yield upto 40% in the Maharashtra State.

Reduction in yield is largely due to the damage caused to the leaves as a result of intense spotting and the consequent loss in photo-synthetic tissue; 35% of the leaf area has been reported to be lost in parts of North America (Wolf, 1916). Spots on the pegs also tend to decrease yield by restricting translocation of food to the seeds (Reys *et al.*, 1940). Premature leaf fall, which is invariably associated with tikka incidence, is also a factor contributing to the low yield of groundnut.

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