

Research Note

New genotypes with multiple pistils and inheritance pattern of this trait in rice

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Abstract

Present study investigated genetic basis of multiple pistil. The experimental material consisted of Ram Laxman and Dodana indigenous varieties with distinguishable multiple pistil trait were used as male parents, while R710-4-37-1-1-1 with single grain trait were used as female parents. Two segregating F₂ populations for target trait were developed. The segregating ratio revealed that multiple pistils trait was governed by single recessive gene in the varieties Ram Laxman and Dodana and it is revealed that normally only one grain is set in each of the spikelet.

Key words

Multiple pistil, germplasm, inheritance, genetics

Oryza sativa L. the most essential food crop of the World, is popularly known as “Global Grain” (Subramaniam *et al* 2006). It belongs to family Poaceae (Gramineae) and spread in many countries of the globe. These represent greater gene pool for rice ecosystem indicating high genetic variability associated with different climatic zone in all areas. In Chhattisgarh state of India, Indira Gandhi Agricultural University, Raipur conserves over 23,250 accessions of rice germplasm. This germplasm with wide variability is the wealth of the county because of its valuable gene system. Out of these large indigenous rice accessions Ram Laxman and Do Dana are found with two grains per spikelet (Multiple pistil). Very little information is available on genetics of such unique trait of rice. Therefore present study taken with the objective of inheritance of double grain character and its utilization in rice breeding.

The experimental materials were consisted of two indigenous rice accessions Ram Laxman, it was collected from block Gharghoda, Raigarh district (Chhattisgarh) and Do Dana, it was collected from block Bilaspur, Bilaspur district (Chhattisgarh), collection was done at Raipur, Chhattisgarh during 1972-81. The crosses were made during kharif 2010 by involving Ram Laxman and Dodana indigenous varieties with distinguishable multiple pistil trait, were used as male parents while R710-4-37-1-1-1 with single grain trait were used as female parents. A minimum of 40 F₁ seeds were produced for each cross combination. Seeds were individually hand-threshed and kept in paper envelopes. For advancing of generation of from F₁ to F₂ during kharif 2011, the F₁ seeds were treated with Bavistin @ 0.25%, and rinsed thoroughly with distilled water. Disinfected seeds were placed in petridishes lined with moist filter paper and kept

in a germinator at 30°C for 48 hours. The germinated seeds were first placed in wooden seed boxes, filled with soil to raise seedlings. At the age of 21 days, F₁ seedlings were transplanted in the field. Seedlings were transplanted at the rate of single seedling per hill, spaced 15 cm between hills in single row distance between F₁ were maintained 25 cm. The F₁ plants were examined regularly during different stages of growth and off types and selfed plants were eliminated. In the F₁ observation of traits under study were recorded on whole population. At maturity the F₁ plants were harvested individually and hand threshed to obtain F₂ seeds and seeds were sun dried. A total of 700-1000 F₂ plants of cross combination were transplanted in 20 rows and at last row other parent was transplanted during kharif 2012. The observations on various traits were recorded on individual plant basis. The data were analyzed independently for trait to determine the fitness with diverse segregation ratios to determine mode of inheritance by χ^2 (Chi-square) test as suggested by Fisher (1936).

Ram Laxman (R: 358): Multiple pistils observed in the range of 2 to 3 grains per spikelet however frequency of single grain spikelet found higher (51.55 %) followed by double grain (45.17 %) and triple grain (3.29 %) based on three year data a average of 1066.33 spikelets were observed (Table 2).

Do Dana (D: 612), IC 390777: Multiple pistils observed in the range of 2 to 3 grains per spikelet however frequency of single grain spikelet found higher (50.37%) followed by double grain (46.04%) and triple grain (3.59 %) based on three year data a average of 1074 spikelets were observed (Table 2).

The F₁ progenies of both crosses were found with single grain (normal type). The proportion of plants possessing double and single grain in F₂ population was closely fitted in the ratio of 1:3 indicating that a single recessive gene (designated as *mp*) governed double grain (multiple pistil) trait in both varieties Ram-laxaman and Dodana (Table 1). On the basis of this analysis it is found the inheritance of multiple pistil revealed that normally only one grain is set in each of the spikelet. However a tendency seen in some of the cultivars to set two or more grains per spikelet arising because of more than one pistil within the spikelet. In addition to this pattern, very few spikelets also having four pistils per spikelet and mature into four grains per spikelet. The proportion of plants possessing tendency to have double grains to those having single grain plants in the F₂ populations of these crosses were closely fitted in the ratio of 1 double grain: 3 single grained types, indicated that single recessive gene (earlier designated as *mp*) was responsible for expression of the double grain trait. Similar results were reported by several early workers such as Parthasarthy (1935), Morinaga and Tajiri (1941), Chakravorty (1948), Ghose and Butany (1952) and Tomar *et al.* (2000), but contrary to the findings of present investigation, result of Rao and Rao (1986) showed 3:13 ratio of multiple pistil to normal in F₂ in some of the crosses. Butany and Bhattacharya (1962) obtained 10:54 ratio of multiple pistil to single pistil segregation and reported that the character appeared to be under the control of three recessive genes *mpa*, *mpb*, *mpc*, any two of which produced multiple pistils. Since majority of workers have reported only one recessive gene, the present results seems to be matching with this and can be considered adequate to explain the inheritance.

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Table 1. Mode of segregation of double grain (multiple pistil) in the varieties Ram-laxaman and Dodana

Name of cross		F ₁ reaction	F ₂ reaction						χ ² value	P value
			No. of plants			Ratio				
			Double grain	Single grain	Total	Double grain	:	Single grain		
R710-4-37-1-1-1 x (Single grain) (Normal type)	Ram-laxaman (Double grain)	Single grain (Normal)	139	473	612	1	:	3	1.70	0.20-0.10
R710-4-37-1-1-1 x (Single grain) (Normal type)	Dodana (Double grain)	Single grain (Normal)	177	515	692	1	:	3	0.12	0.80-0.70

Table 2. Frequency of double, triple, single grained spikiests observing 10 randomly selected panicle of rice genotypes Ram luxman and Do Dana

Genotypes	Characteristics	First Year 2010		Second Year 2011		Third Year 2012		Avrage	%
		Total	%	Total	%	Total	%		
Ram Luxman	No of single grained spiklets	471	54.96	467	54.62	670	45.06	536.00	51.55
	No of double grained spiklets	363	42.36	360	42.11	759	51.04	494.00	45.17
	No of triple grained spiklets	23	2.68	28	3.27	58	3.90	36.33	3.29
	Total no of spiklets	857		855		1487		1066.33	
Do Dana	No of single grained spiklets	471	55.41	488	56.42	592	39.28	517.00	50.37
	No of double grained spiklets	356	41.88	352	40.69	837	55.54	515.00	46.04
	No of triple grained spiklets	23	2.71	25	2.89	78	5.18	42.00	3.59
	Total no of spiklets	850		865		1507		1074.00	