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Genetic Behaviour of Awning Character in Rice (*Oryza sativa* L.)

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A B S T R A C T

The study of genetic behaviour of awning character in Rice genotypes on the basis of morphological characteristics was carried out at Instructional cum Research farm of IGKV, Raipur. Expression of long and fully awned trait suggested the presence of two independent genes, one dominant and another one recessive in the accession of wild species *O. officinalis*. Partially awned character was governed by trigenic gene interaction where two dominant genes, either of which being capable to complement with another dominant gene, to produce partial awns in the variety Chiko, whereas in another variety Dokara-dokari partially awned trait was imparted by three genes, but their genetic behaviour was complementary.

Introduction

Rice (*Oryza sativa* L.) is considered as one of the most important cereal crops and the staple food for more than half of the world's population (Jiang *et al.*, 2013). Due to the importance of rice as one of the major world food crops, its genetic diversity has attracted great interest of researchers.

The genetic diversity of rice has been used effectively to increase the productivity. One of the specific traits of rice is the presence of awns at the tip of lemma. The presence of awns influences the physical and morphological characteristics of the grains. Awns tend to cling to each other, bridge-over and cause seed to adhere in a mass. Morphological evaluation is a preliminary step to estimate the variability and relationship among cultivars although several other tools are also used extensively (Smith *et al.*, 1991). The present investigation was carried out to study the genetic behavior of awning characters in indigenous rice genotypes.

Materials and Methods

The experimental materials consisted of five rice genotypes *viz.* Chiko, R304-34, Dokara-dokari, R714-2-9-3-2-2-2 and R710-4-37-1-1-1-1 and one wild rice species *O. officinalis* with distinguishable traits for the inheritance study of awning character.

Table.1 Mode of segregation of long and fully awned character in the wild accession *Oryza officinalis*

Name of cross	F_1 reaction	F_2 reaction								F_3 reaction										
		No. of plants			Ratio			χ^2 value	P value	Number of progenies				Ratio					χ^2 value	P value
		Long & fully awn	Awnless	Total	Long & fully awn	:	Awnless			Long & fully awn	Segregation	Awnless	Total	Long & fully awn	:	Segregation	:	Awnless		
R710-4-37-1-1-1-1 x *O. officinalis* (Awnless) (Long and fully awn)	Long and fully awn	273	68	341	13	:	3	0.32	0.70-0.50	56	42	2	100	7	:	8	:	1	3.80	0.20-0.10

Table.2 Mode of segregation of partially awned character in the varieties Chiko and Dokara-dokari

Name of cross	F_1 reaction	F_2 reaction							
		No. of plants			Ratio			χ^2 value	P value
		Partly awned	Awnless	Total	Partly awned	:	Awnless		
R304-34 x Chiko (Awnless) (Partly awned)	Partly awn	492	215	707	45	:	19	0.176	0.70-0.50
R714-2-9-3-2-2-2 x Dokara-dokari (Awnless) (Partly awned)	Partly awn	342	410	752	27	:	37	3.338	0.10-0.05

The long and fully or partially awned parents were crossed with the awnless parents. The F_1, F_2 and F_3 plant populations were scored for awned, awnless and their segregating type. The observations of the parents and F_1 were recorded on row basis, while F_2 population on individual plant basis. The data were analyzed for studied trait to determine the fitness with diverse segregation ratios to study the mode of inheritance using Chi square test as given by Fisher (1936).

Results and Discussion

For the inheritance study of long and fully awned character *O. officinalis* was crossed with awnless parent R710-4-37-1-1-1-1. The F_1 plants were observed to be long and fully awned. In the F_2 population, segregation ratio closely fitted to 13 long and fully awned : 3 awnless, indicating that two independent genes, independently governed long and fully awned character in the accession of wild species *O. officinalis* (Table 1). Cunha-Filho and Nascimento (1995) reported 3:13 ratio of awn to awnless in the cross of IR8 and Sagrimao and suggested that awns were controlled by two independently segregating genes (one dominant gene A for awns and an awn inhibitor). Tomar *et al.,* (2000) reported that presence of awns was controlled by single dominant gene. Saxena *et al.,* (2014) has done genetic diversity analysis of long and fully awned rice varieties like Danwar, Suldhan, ChiniKapoor and Chinnor using molecular markers like ISSR, SSR and Morphological markers.

Partially awned character was studied in the crosses of Chiko (partially awned) with R304-34 (awnless) and Dokara-dokari (partially awned) with R714-2-9-3-2-2-2 (awnless). The F_1 plants of the former cross were observed to have partial awns, indicating dominant nature of trait over awnless. The F_2 population of the cross Chiko (partially awned) with R304-34 (awnless) segregated into ratio of 45 partially awned: 19 awnless suggesting that partially awned trait imparted trigenically involving two dominant genes (designated as *An-a* and *An-b*) either of them complementing with another dominant gene (designated as *An-c*). Result is presented in Table 2. In the other cross Dokara-dokari x R714-2-9-3-2-2-2, the F_1 plants were found partly awned indicating dominant nature of awned character over awnless and the ratio of partly awned and awnless plants in F_2 population was most closely fitted with the ratio 27: 37. This study indicates that three complementary genes (designated as *An-a*, *An-b* and *An-c*) were responsible for expression of partially awned trait in the variety Dokara-dokari (Table 2). Shukla (1999) also reported similar gene interaction for expression of awn character in their study, whereas earlier workers reported different gene action for the partially awned trait in their studies. Rao and Misro (1986) reported similar trigenic gene action for the trait. Shobha Rani *et al.,* (2005) reported involvement of complementary genes with a dihybrid segregation ratio of 9:7 (awned: awnless) in F_2 generation for expression of this trait.

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