IMPROVEMENT OF RICE THROUGH INDUCED MUTATIONS "A FINE GRAIN RECOMBINANT OF JHONA-349"

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In the era of high yielding dwarf varieties of rice, a general complaint is that most of the dwarf ones suffer from one or the other drawback pertaining to their grain qualities. This problem is likely to get aggravated with the extensive use of exotic lines of varied quality features in the breeding programme for the improvement in yield. Hence it becomes essential to improve and retain with ease the desirable quality norms present in indigenous germ plasm. Induction of mutations is a proven supplement to conventional breeding to confer specific improvement in a variety without significantly altering its otherwise acceptable phenotype[1,2]. Mutants playing the role similar to potential parents preferred for hybridization back-crossing and selection widen the prospects of substantial improvement in several traits[3].

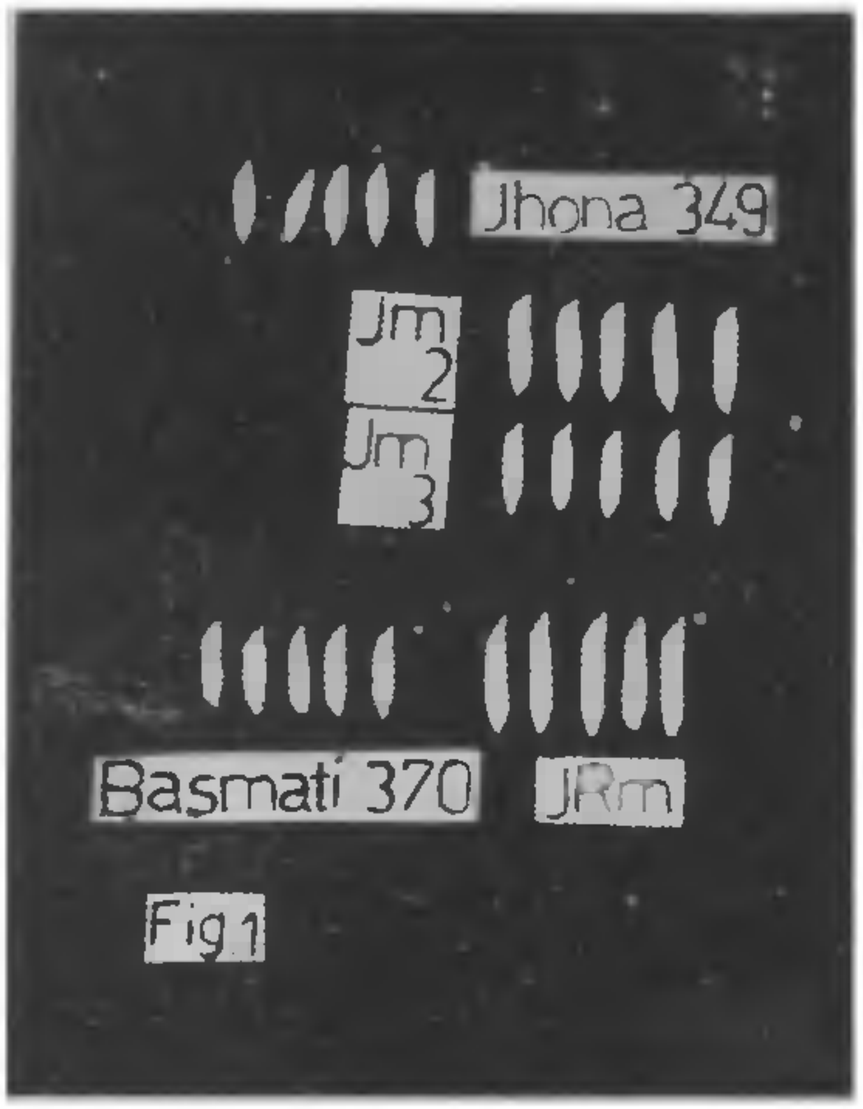

FIG. 1. Grains of Jhona-349, its mutants (Jm_2, Jm_3) recombinant (JRm) and variety Basmati-370.

Jhona-349, a tall, thin and weak culmed rice variety having grains coarser than Basmati-370, however, yields better and matures earlier; and is therefore still commonly cultivated in rice growing regions of North India. Mutations were induced using physical (gamma-rays) and chemical (DES, EMS) mutagens, singly and in combination with a view to remove some of the genetic defects in this variety. Initially, 13 desirable mutants isolated from M_2 population were studied through M_3 and M_4 generations[4]. Later, 5 mutants selected in M_4 generation were studied through M_5–M_7 generations. Out of these two

TABLE I

Performance of initial line, mutants, recombinant and Basmati-370

(Mean values of 360 observations, except for JRm)

Genotypes/ Traits	Plant height (cm)	Tiller number	Maturity (days)	Total grains (fertile)	1000 grain weight (g)	Grain yield (g)	Grain length L (mm)	Grain breadth B (mm)	Grain fineness L/B
Jhona-349	130·5 ±0·5	7·3 ±0·3	125·2 ±0·7	104 ±3·8	20·7 ±0·3	21·6 ±0·6	6·9 ±0 0	2·2 ±0 0	3·0 ±0·0
Jm_2	126·8 ±0·6	6·4 ±0·2	124·7 ±0·8	760 ±2·9	28·3 ±0·4	21·2 ±0·6	8·1 ±0·0	2·3 ±0·0	3·5 ±0·0
Jm_3	134·7 ±0·3	6·9 ±0·1	123·2 ±0·8	103 ±2 8	20·1 ±0·3	20·9 ±0·6	7·0 ±0·0	2·0 ±0·0	3·5 ±0·0
JRm	132·4	7·0	124·8	825·0	26·2	21·5	9·0	2 0	4·5
Basmati-370	146·5 ±0·6	6·4 ±0·2	149·0 ±0·9	783·0 ±2·4	20·6 ±0·2	16·1 ±0·4	7·1 ±0·0	2·0 ±0·0	3·6 ±0·0

± represents the standard error values.

(Jm_2 and Jm_3) were found to be the most promising with improved traits particularly for grain fineness. These were crossed together and out of the promising recombinants isolated from F_3 families, one (JRm) seemed to be the most promising because of overall better agronomic performance coupled with grains even finer than those of Basmati-370 (Fig. 1). Data recorded for various metric traits (Table I) revealed that while plant height, panicle bearing tillers, grain yield and maturity period of this recombinant are nearly equal to those of parents and initial line, it is superior to Basmati-370 in these aspects. Its total fertile grains are more than those of Basmati and Jm_2, being heavier than those of initial line, Basmati and Jm_3. Furthermore, dehusked grains of this recombinant are longest amongst all these genotypes, their breadth being similar to that of Basmati and Jm_3 resulting in enhanced L/B ratio and hence the finest grains. This Jhona-349 recombinant has a high breeding value and economic return. Further studies regarding the stability and other selection parameters are in progress.

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SEED STERILITY IN *DACTYLOCTENIUM SINDICUM* BOISS. (POACEAE)

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Dactyloctenium Willd. is a genus of annual and perennial grasses belonging to the tribe Eragrosteae of the sub-family Pooideae. It comprises of 17 species distributed in India and Africa[1]. In India, the genus is represented by a total of 5 species[2]. *Dactyloctenium sindicum* Boiss. is a perennial desert grass with woody stolons. It inhabits drier localities in the plains of North-West India and is a very good soil binder. A casual examination of the mature panicles during the cytological studies in *D. sindicum* revealed a poor seed set which initiated the present study in this grass. The populations of this species growing in the Punjab plains are diploid with $2n = 20$[3].

The material was fixed in FAA from the natural populations growing around Bhatinda (Punjab) on dry sandy soil and the customary embryological methods were followed[4].

The anthers in *D. sindicum* are tetrasporangiate. The development of the anther wall conforms to the Monocotyledonous type[5]. The mature anther wall comprises of the epidermis, fibrous endothecium, a single ephemeral middle layer and a uniseriate secretory tapetum with binucleate cells. A similar feature has also been reported by Chandra[6] in *D. aegyptium* and *Eleusine indica*. The meiosis is normal and successive cytokinesis leads to the formation of isobilateral tetrads as has also been reported in *D. aegyptium* and *Eleusine indica*[6], and *E. compressa*[7], whereas T-shaped and linear tetrads have also been reported to occur in addition to the isobilateral tetrads in *E. coracana*[8]. The pollen grains are 3-nucleate at the time of shedding.

The ovary encloses a bitegmic, tenuinucellate and hemianatropous ovule. The inner integument is formed first and is two-celled in thickness. After fertilization, the cells of the inner layer of the inner integument show deposition of a darkly staining material. The outer integument is composed of 2–3 layers of cells but is slightly shorter than the inner integument, which forms the micropyle. The outer integument is ephemeral in nature. The periclinal divisions in the nucellar epidermis in the micropylar region are lacking.

There is a hypodermal archesporial cell in the nucellus which increases in size and behaves as the megaspore mother cell. In some ovules, the archesporial cell undergoes degeneration. The megaspore mother cell divides meiotically to form a linear or T-shaped tetrad of megaspores. Although it is the chalazal megaspore which functions and forms a Polygonum type of embryo sac, in some instances all the four megaspores of the tetrad showed signs of disorganization. Occasionally, degeneration was also observed during the development of the embryo sac. The organized embryo sac has an egg, 2 synergids, a central cell with its 2 polar nuclei and 3 antipodal cells. The 3 antipodal cells undergo secondary multiplication resulting in upto 12 cells. After fertilization, the antipodal cells become hypertrophied and get displaced to a lateral position, a feature frequently noticed in members of the sub-family Pooideae[6,7,9,10,11].

About 100 ovules were examined to study the process of fertilization and post-fertilization development. The formation of embryo and endosperm was, however, noticed in only 8 ovules. The process of fertilization was not observed. In all the embryo sacs which were apparently mature, there was no trace of the pollen tube at the micropylar end of the ovule or inside the embryo sac. Such embryo sacs and ovules eventually undergo disintegration. The endosperm is of the Nuclear type. An examination of