

イネの雄性不稔突然変異

Male-sterile Mutants of Rice

自殖性作物の戻し交雑法による育種では、交配と選抜とを繰返して雑種集団の遺伝変異を制御し、望ましい遺伝子型の頻度を高めることが必須で、効率を上げるためには雑種集団の規模をある程度大きくする必要がある。また、遺伝的組換えを促進し、好ましくない遺伝的連鎖を打ち破る方法として、ソルガムやダイズにおいても雄性不稔遺伝子利用による循環選抜法が提案されている。

イネは自殖性作物であるため、自然交雑率がきわめて低く、自然交雑を利用した戻し交雑法や循環選抜法を適用することは不可能であるが、核遺伝子型雄性不稔突然変異を誘起し、これを利用すれば雑種集団中の自然交雑率が高まるので、これら育種法を適用しうる可能性が考えられる。

このような背景から、雄性不稔突然変異を誘起する目的でイネ種子に対してガンマー線照射と化学薬品による浸漬処理を行ったところ、ガンマー線 20 kR 照射および

エチレンイミン 0.2% 液浸漬処理後代からそれぞれ 1 系統の核遺伝子型雄性不稔系統が得られたので報告する。

水稻品種ニホンマサリの M_2 系統, 1,592 の中から、不稔株がほぼ単因子性分離をしていると見られる 45 系統を選抜し、 M_3 世代において、これら系統群の不稔株の分離状況、袋かけ試験および花粉の稔性を調査し、雄性不稔株を含む系統を探索した。

その結果、ガンマー線照射によって誘起された系統 56—160 とエチレンイミン処理によって誘起された系統 347—88 の 2 系統を有用雄性不稔系統として選抜した。これら系統の不稔株では、葯内に花粉の形成が全く認められなかった。(図-1) また、系統 56—160 の不稔株は、正常稔性株と比較してやや生育量が小さかったが、系統 347—88 の不稔株は、正常稔性株と同様な生育を示した。(図-2, 図-3)

誘起された不稔系統は、袋かけによる自殖では 1 粒も



図-1 雄性不稔突然変異系統 No. 56—160 (左) と No. 347—88 (中央) の花粉形成がみられない葯および原品種ニホンマサリの正常葯 (右)

Fig. 1. Empty anthers of male-sterile mutants of lines No. 56—160 (left), No. 347—88 (center) and a normal anther of original variety "Nihonmasari" (right)



図-2 系統 No. 56—160 の正常稔性株 (左) と雄性不稔株 (中央) および原品種ニホンマサリの草型 (右)

Fig. 2. Plant type of fertile plant (left) and male-sterile plant (center) of the line No. 56-160 and that of original plant "Nihonmasari" (right)

結実しないが、放任受粉により数パーセント結実するので、これら雄性不稔遺伝子を利用すれば交配操作を行うことなく、イネに循環選抜法を適用したり、戻し交雑育



図-3 系統 No. 347—88 の正常稔性株 (左) と雄性不稔株 (中央) および原品種ニホンマサリの草型 (右)

Fig. 3. Plant type of fertile plant (left) and male-sterile plant (center) of the line No. 347-88 and that of original plant "Nihonmasari" (right)

種法を効率的に進めることが可能と考えられ、その成果が期待される。

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In backcross breeding procedures of self-pollinated crops such as soybean, sorghum and rice, it is essential to control the genetic variabilities of hybrid population by increasing the proportion of desirable genotypes in the population through continuously repeated crossings and selections. In addition, it is necessary to enlarge the size of hybrid population to raise efficiency of backcross breeding method. For these reasons, it has been proposed to use a male-sterile gene for the purposes of promoting recombination of genes and/or breaking a link of undesirable genes with desirable ones which should be recomposed into a new variety of self-pollinated crops.

As it is hardly expected to obtain spontaneous hybrids of rice because of its low frequency of outcrossing under natural conditions, the authors intended to obtain genic male-sterile mutants which might greatly contribute to a backcross breeding system in rice. The present study has been carried out in order to obtain male-sterile mutants of rice by the treatments of gamma-rays from ^{60}Co source and chemical mutagens. As the results, two male-sterile mutant lines have been isolated by the treatments of 20 kR of gamma-rays and 0.2% aqueous solution of ethyleneimine. Their selection procedures were as follows:

Forty-five M_2 lines which seemed to follow monogenic inheritance in sterility were screened out of 1,592 M_2 panicle progenies of a paddy rice cultivar "Nihonmasari". Segregating ratios for sterility were confirmed in their M_3 families derived from the 45 M_2 lines. Bagging experiment on sterile mutants and microscopic inspection of pollen grains on sterile plants in the M_3 families were made as the check. The line No. 56—160 induced by gamma-rays and the line No. 347—88 induced by ethyleneimine were isolated as useful male-sterile mutants. No pollen grains were observed in the anthers of these male-sterile mutants as shown in Fig. 1. The morphological appearances of the male-sterile plants of the line No. 56—160 and No. 347—88 are shown in Fig. 2 and Fig. 3, respectively. Male-sterile plants of the line No. 56—160 were slightly less vigorous than fertile plants, while sterile plants of the line No. 347—88 were as vigorous as fertile plants. No seeds were borne on bagged panicles of sterile plant in both the mutant lines, but a small number of seeds were produced on unbagged panicles of the sterile plants in the mutants.

The male-sterile mutants obtained in the present study are considered to play an important role to raise the efficiency of rice improvement through backcross techniques.

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