Registration of Four Indica Rice Genetic Stock Mutants

The USDA-ARS released four indica rice genetic stocks (Oryza sativa L.): Early Plant Death, sometimes known as Apoptosis; Narrow Leaf, sometimes known as “Chives”; Extreme Dwarf; and Gold Leaf, Reg. no. GS-3 to GS-6, and PI 643128 to 643131, respectively, in May, 2006. These specialized seed stocks are expected to be useful to scientists conducting basic genetic studies in germplasm adapted to the U.S., and in some cases may be useful to breeders for identifying lines in breeding programs.

As part of the Genetic Stocks–Oryza (GSOR) Collection, four genetic stocks were selected from a gamma-ray mutagenized indica (300 Gy) M2 population grown at Stuttgart in 2003. The mutagenized line was an 8-d-earlier sib to the previously released germplasm line indica-9 (PI 634583) derived from the cross Zhe733/IR64 (Rutger et al., 2005). The earlier-maturing sib was chosen for mutagenesis in an effort to induce mutants that were even earlier in maturity; this effort was inconclusive. About 10,000 seeds were mutagenized in late 2002 at each of two dosages, 250 and 300 Gy. The M1 generation was grown in the 2002/03 Puerto Rico nursery. Reduced seed set, an indication that mutagenesis had occurred, was observed in the 300 Gy treatment, so approximately 1000 M1 panicles were taken from that dosage. Twenty seeds from each M1 panicle were planted at Stuttgart panicle-to-row in the M2 generation in 2003, at a single seed per hill, in hills spaced 30 cm apart, in 30 cm wide rows.

The Early Plant Death mutant (GSOR 21) was observed in five out of 12 plants in a single M2 row. In subsequent tests, plant death began about 50 d after planting and concluded about 20 d later, with individual plants dying rather suddenly. Progeny testing in 2004 of the seven surviving M2 plants produced three segregating rows. In limited 2004/05 greenhouse progeny tests of normal M3 plants from a segregating row, one M3 plant that M4 progeny tests revealed to be heterozygous for the mutant phenotype was selected for further study. The progeny of this plant segregated 22 normal:13 dead, a satisfactory fit to a single recessive gene ratio (0.05 < P < 0.10). In 2005, progeny tests of 21 of the normal M4 plants revealed that seven were normal and 14 segregated for early death, a perfect fit to the expected 1 homozygous normal:2 heterozygous normal ratio. Also in 2005, further progeny tests of the original heterozygous normal M3 plant produced a segregation of 572 normal:190 dead, a near-perfect fit to a 3:1 ratio (0.95 < P < 0.975). In a sample of 100 or more grains, brown rice length, width and weight, from the surviving plants were 6.5 mm, 2.3 mm, and 20 mg, compared to 6.8 mm, 2.4 mm, and 22 mg for the parent genotype. Before the onset of the early death phenomenon, no phenotypic differences were evident between the mutant and the parent line. Residual material from the mutant was used to produce five green and two Gold Leaf plants, six of which remained at harvest time. In progeny tests of these six remaining M3 plants in 2005, four segregated and two gave all green progenies, indicating that one green plant had been misclassified as gold in 2004 and another gold plant had been lost before harvest. The composite segregation ratio within the four segregating plants was 217 normal:70 Gold Leaf, a satisfactory fit to a single recessive gene ratio (0.75 < P < 0.80). In a sample of 100 or more grains, brown rice length, width and kernel weight from the mutant plants were 6.7 mm, 2.4 mm, and 21 mg, compared to 6.8 mm, 2.4 mm, and 22 mg for the parent genotype. Otherwise, mutant and normal plants were phenotypically similar. Seeds of the Gold Leaf plants were composited to form a genetic stock that is true breeding for the extreme dwarf mutant phenotype.

The Gold Leaf mutant (GSOR 24) was observed in two out of seven plants in a single M2 row in 2003. In subsequent tests, the gold, or bright yellow, leaf color appeared about 80 d after planting in the upper leaves and remained in the leaf material through harvest. In 2004 and 2005 progeny tests of the two original Gold Leaf plants, all the progeny were Gold Leaf. In 2004 progeny tests of four normal M2 plants, one was noted to produce five green and two Gold Leaf plants, six of which remained at harvest time. In progeny tests of these six remaining M3 plants in 2005, four segregated and two gave all green progenies, indicating that one green plant had been misclassified as gold in 2004 and another gold plant had been lost before harvest. The composite segregation ratio within the four segregating plants was 217 normal:70 Gold Leaf, a satisfactory fit to a single recessive gene ratio (0.75 < P < 0.80). In a sample of 100 or more grains, brown rice length, width and kernel weight from the mutant plants were 6.7 mm, 2.4 mm, and 21 mg, compared to 6.8 mm, 2.4 mm, and 22 mg for the parent genotype. Otherwise, mutant and normal plants were phenotypically similar. Seeds of the Gold Leaf plants were composited to form a genetic stock true breeding for the gold leaf trait.

Seeds of these genetic stocks have been placed in the Genetic Stocks–Oryza Collection and are available for distribution in 1/2 gram (about 20 seeds) amounts to geneticists, breeders and other research personnel on written request to: J. Neel Rutger, Dale Bumpers National Rice Research Center, USDA-ARS, and P.O. Box 1090, Stuttgart, AR 72160. Emailed requests may be sent directly to gisor@ars-grin.gov. Requests

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