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GENETICS OF COLOUR CHANGES IN RICE LEAVES DUE TO PHOSPHATE STARVATION

Y.C. Aluwihare[1], R. Lelwala[1], M. Ishan[1], D.N. Sirisena[2], W.L.G. Samarasinghe[2] and S.D.S.S. Sooriyapathirana[1]*

[1]Department of Molecular Biology and Biotechnology, Faculty of Science, University of Peradeniya, Sri Lanka
[2]Rice Research and Development Institute, Bathalagoda, Sri Lanka
**sunethss09@gmail.com*

Rice plant leaves developed prominent dark green colouration under phosphate starved conditions. This is due to the production of higher amount of chlorophylls under P deficiency. P deficiency in rice is associated with red and purple color development in leaves if the variety has a tendency to produce anthocyanin. The genetics of color changes in rice leaves due to phosphate starvation has not been studied in Sri Lankan rice germplasm. The phenotypes associated with the Anthocyanin pathway in plants shows 9:7 ratio in F2 progeny and the present study was conducted to find out whether the color changes in rice leaves due to phosphate starvation follow a similar pattern.

The tolerant and sensitive rice cultivars were identified in a previous study and were used to generate three F2 populations. A landrace Murungakayan and cultivars Mas and and H4 were tolerant and BG 357 was sensitive for phosphate deficiency. Two hundred F2 individuals of each Murungakayan* Bg 357, Mas*Bg 357, H4*Bg 357 populations were screened under greenhouse condition. Nitrogen, potassium and zinc fertilizer were applied at recommended level, without applying phosphorous fertilizer. Leaf colour measurement of four leaves (L*,a* and b*) of each individual plant were taken at three months after planting by using colorimeter (Konica-Minolta-Japan). Average L* (lightness/darkness), a* (redness/greenness) and b* (yellowness/blueness) values of single F2 plants were analyzed by K means clustering of Minitab 14 software and number of individuals per cluster were used to check the goodness of fit for standard 9:7 dihybrid ratio.

The frequency distribution curves and normality tests depicted that the leaf color changes due to phosphate starvation were not a continuous (quantitative) trait and indicated the nature of a classical qualitative trait.

The grouping by K means clustering was tried for various possible segregation ratios and then chisquare goodness of fit test was conducted. The phenotypic ratios 1:1 and 9:7 that are specific for monohybrid and dihybrid crosses, respectively showed the significant goodness of fit ($P < 0.05$). However, the dihybrid ratio 9:7 showed the higher significance indicating the presence of two interactive loci for the control of leaf color changes due to phosphate starvation in rice.

It can be concluded that two genes are involved in the specific pathway of leaf colour development under phosphate deficiency. To express phenotype and functional products there should be at least one dominant allele in each pair of alleles to occur complementary gene interaction.

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