

## **Diversity analysis of leaf vein density of selected Sri Lankan rice varieties: an indicator of C<sub>3</sub> to C<sub>4</sub> photosynthesis pathway transition**

**E.M.T.P. Ekanayaka, D.V. Jayatilake and V. Herath\***

*Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya, Sri Lanka*

*\*venurah@pdn.ac.lk*

Out of the commonly cultivated cereals in the family *Poaceae*, maize and sorghum follow a C<sub>4</sub> photosynthetic pathway, while rice and wheat follow a C<sub>3</sub> pathway. Hence, carbon assimilation of C<sub>3</sub> is lower compared to C<sub>4</sub> plants. Studies revealing the evolution of these photosynthetic pathways indicate that C<sub>4</sub> plants evolved from C<sub>3</sub> plants. The transition is demarked by increased leaf vein density and subsequent cellular compartmentalization that facilitate efficient carbon fixation. In a leaf, photosynthates from nearby cells are collected by small longitudinal veins, transverse veins and large longitudinal veins, and are translocated out of the leaf *via* the phloem. Hence, with a denser leaf vein density, the translocation process is expected to be more efficient.

In the current study, longitudinal leaf vein (LV) density of 12 selected rice varieties was measured to assess their diversity with respect to collective assessment of both small and large LV density. The total LV length per unit area (TLV) and the average distance between LV (ADLV) were measured in a one-cm leaf sample fixed in a permanent slide, made from the widest middle portion of the first leaf of the main culm. The sections were imaged and the distances were measured using DinoCapture v2.0. The TLV and ADLV of the selected varieties were analysed using a one-way ANOVA with PROC GLM, and mean separation was carried out using Duncan's multiple range test in SAS v9.1.3.

A significant negative correlation was observed between TLV and ADLV ( $r = 0.969$ ,  $p < 0.05$ ). Among the selected rice varieties, *Dewareddhiri* and *Madayalvee* have the highest TLV ( $5.7 \pm 0.1$  and  $5.6 \pm 0.1$  mm/mm<sup>2</sup> respectively) and the lowest ADLV ( $159.6 \pm 1.2$  and  $160.8 \pm 3.3$   $\mu$ m, respectively). The variety *Moroberekan* shares the lowest TLV with *Pachchaperumal*, and *Sivappukuruvikkar* ( $4.8 \pm 0.1$ ,  $4.8 \pm 0.1$  and  $4.6 \pm 0.1$  mm/mm<sup>2</sup>, respectively) and *Moroberekan* has the highest ADLV ( $195.3 \pm 4.0$   $\mu$ m). The high TLV and low ADLV denote a high leaf vein density. Thus, the high vein densities of the varieties *Dewareddhiri* and *Madayalvee* could be a possible indicator of transition from C<sub>3</sub> to C<sub>4</sub> photosynthetic pathway. Further, analysis of these varieties with respect to leaf anatomy is underway.