Anatomical, Biochemical, and Physiological Traits Associated with Drought Tolerance in Wild Rice *Oryza rhizomatis* Vaughan

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Water scarcity remains a key limitation in rice cultivation, underscoring the need for drought-resilient rice varieties. *Oryza rhizomatis*, an endemic wild rice species, represents a valuable genetic resource for enhancing drought tolerance in cultivated rice. This study investigated anatomical, biochemical, and physiological traits in two contrasting *O. rhizomatis* accessions, namely drought-tolerant accession-1 and drought-susceptible accession-21, collected from Puttalam and Hambantota, respectively. Sixty-five days after planting, plants were subjected to progressive drought stress in a completely randomized design until completely dry. Sets of plants were maintained as a control. Leaf rolling, a key drought-responsive indicator, was assessed using the Standard Evaluation System developed by International Rice Research Institute, and total phenolic content (TPC) was measured using Folin–Ciocalteu method. Leaf and floret anatomy was studied using a light microscope. Accession-21 exhibited a higher early-stage TPC (32.22±1.77 mg GAE/g) than accession-1, likely reflecting an early oxidative defense, whereas low TPC in accession-1 indicated the tendency of conserving energy for survival by limiting phenolic synthesis. Leaf rolling differentiated drought sensitivity, with delayed rolling (11%) in accession-1 versus complete rolling (100%) in accession-21 after 29 days. Anatomically, accession-1 possessed larger bulliform cells (113.00±26.70 µm height; 215.67±49.07 µm width) and thicker lower epidermis (32.37±1.60 µm; $P<0.05$), reducing transpirational water loss. Although anther height did not differ significantly, accession-21 showed a taller stigma (5379.2±195.6 µm) than accession-1 (4415.1±227.9 µm), suggesting a potential reproductive advantage under stress. Overall, drought tolerance in *O. rhizomatis* is mainly associated with structural and physiological adaptations in accession-1, while accession-21 exhibits rapid phenolic accumulation and accelerated leaf rolling. These observations underscored the potential of the species for developing drought-tolerant rice.

Keywords: Climate change, Drought-tolerance, Leaf anatomy, Polyphenols, Sri Lanka

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