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## The Environmental Variation of Traits for Interpreting Genotypic Characterisation in Broad-Adapted Populations of Tamarind

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### Abstract

Environmental variation limits genetic gain to identify superior genotypes for quantitative traits such as plant biomass or biomass variables. Characterisation of the environmental variance is an important step in understanding heritability of traits. A modelling approach is proposed here to genotypically characterise broad-adapted populations of tamarind from different continents to provide breeders to analyse their target trials in a breeding program. Open-pollinated seeds were chosen from three broad-adapted populations to indicate environmental variance of traits such as total plant mass (TPM), leaf mass (LM), stem mass (SM), root mass (RM), hypocotyl (Hyp.), epicotyl (Ep.) and leaf chlorophyll a (Cha), chlorophyll b (Chb), total carotenoids (Caro) in non-inbred families. In each provenance, one population was sampled as a family and three seed classes were grouped within family. Seed groups and populations were established in a two level nested design I. Simulates of variance components ( $s^2$ ), phenotypic variance ( $\delta^2p$ ), genotypic variance ( $\delta^2g$ ) and environment variance ( $\delta^2e$ ) are given for each trait. The ranking of ten trials for broad-sense heritability varied substantially between traits ( $h^2=0.48\%-81\%$ ). Leaf chlorophyll a and total plant mass were more heritable (81.01 % and 80.71 % respectively). The average plant biomass increased considerably among populations, while the environmental variance was less than the genotype variance ( $\delta^2e=5.11$  and  $\delta^2g=13.38$ ) and environment variance was less for most of the other trials as well. Moreover the ranking of the environmental variance varied considerably between trials. The presence of genotypic variance component indicated that in the genotype performance of these populations, genetic variance is more important than the environment variance to predict the variation of trials. The incorporation aids interpretation of the relative effect of environment variables, and helps to identify opportunities to improve breeding and germplasm-testing strategies for these populations.

**Keywords:** Broad-sense heritability, environment variance, tamarind, variance component