Allozyme Variation and Ecogeographical Variation Correlation in Cowpea *(Vigna unguiculata* (L.) *Walp)* Accessions

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Abstract

Allozymic-ecogeographical correlation was studied in the cowpea to find out whether cowpea allozyme distribution pattern favours the selectionist theory of selection. The study was based on 22 loci and geographical, temperature and moisture parameters. The cowpea accessions were collections from three agroecological zones of Ghana, namely semi-deciduous forest, Guinea savanna and Sudan savanna. The enzymes were adenylate kinase, fumarate hydratase, hexokinase, isocitrate dehydrogenase, malate dehydrogenase, malic enzyme, 6-phosphogluconate dehydrogenase and phosphoglucoisomerase (glucose-1-phosphate). A total of 110 different alleles were observed; an average of 5.00 alleles per locus. The most polymorphic locus was the *Mdh2* enzyme locus with nine different alleles. The *Pgi1* locus was monomorphic in all the nine accessions. The highest allele frequency of 0.905 occurred in the Sudan savanna zone. The alleles *Ak1-3, Mdh3-6, Mdh4-3, Mdh4-3* and *Pgm1-3* showed clinal effects with allele frequencies increasing from the semi-deciduous forest zone to the Sudan savanna zone. Frequencies for the alleles *Me2-1, Pgdh1-5* and *Pgi2-5* increased from the Sudan savanna zone to the semi-deciduous forest zone. Allozyme frequencies were significantly correlated with geographical, temperature and moisture factors. Therefore, allozyme polymorphism in the nine cowpea accessions studied were partly adaptive. Allozyme frequency distribution appears to be primarily affected by environmental variables such as monthly cloudiness, minimum temperature, mean monthly rainfall and longitude. The findings of the study do not favour the neutralist theory of selection.

Introduction

Cowpea is cultivated in all the six agroecological zones of Ghana. The greatest production occurs in the savanna zones and the margins of the semi-deciduous forest zone (GGDP, 1990). Constraints in cowpea production, among other factors, include drought and heat (Singh *et al.*, 1992). Sub-characters of cowpea yield components are affected by diverse environmental conditions. For instance, reproductive development, yield potential and seed yield in cowpeas are sensitive to the weather (Marfo & Hall, 1992). It has been documented that warmer temperatures can hasten the appearance of flowers on both photoperiod-sensitive and insensitive genotype (Singh & Rachie, 1985). Percentage pod set per plant and number of days to pod maturation in cowpea have been found to decrease from the semi-deciduous forest zone to the savanna zone and might be selected for by the climatic factors mean monthly, total cloud and number of rain days per year (Asante, 1998).

Some workers believe that most molecular variation will prove to be physiologically meaningful and, hence, under selective control and important in adaptation; but others regard it as evolutionary "noise" without phenotypic effect and thus selectively neutral (Ayala, 1976). Kimura & Ohta (1971) proposed that isozyme variability polymorphisms are selectively neutral and they would all thus function equally well. However, evidence of the frequency and the patterns of the polymorphism have failed to correspond with the predictions of the neutralist theory. It now