SHORT COMMUNICATION

Notes on numerical taxonomy in DUS (Distinctness, Uniformity and Stability) Testing under the Protection of Plant Variety and Farmers Right Authority (PPV FRA)

M. Anantha Lakshmi¹*, V. Sivakumar² and A. Nicodemus²
¹Botanical Survey of India, Southern Regional Centre, TNAU Campus, Coimbatore – 641 003, Tamil Nadu, India
²Institute of Forest Genetics and Tree Breeding, Department of Genetics and Tree Improvement, Lawley Road, Coimbatore–641 003, Tamil Nadu, India
Email: ananthi.lycopodium@gmail.com

ABSTRACT

It is compulsory to create effective system of Plant Variety Protection (PVP) not only to safeguard against illicit profitable exploitation of the new varieties but also stimulate the development of new varieties from both farmers and breeders for a specific duration. Registration and protection for 15 years for annuals and 18 years for vines and trees can be granted to a variety only if it conforms to the criteria of Distinctness, Uniformity and Stability (DUS). Now-a-days the examination of a variety for DUS generates a description of the Variety, based on its relevant characteristics (qualitative, pseudo-qualitative and quantitative) using three step Numerical Taxonomy. The first step is classification, second one is identification and last one is discrimination. Which utilize more number of characters, and provides the weightage/support in DUS Testing based on the Multi-variant analysis using SPSS, Pasta and Excel Stats.

KEYWORDS: Canonical discriminant analysis, Cluster Analysis, Discrimination, Identification, Principal Component Analysis

Introduction

Agriculture is the backbone of our country and Agroforestry is the backbone of marginal farming for a resourceful and sustainable agriculture, which also forms a strong realistic option to counter climate change. Simply it is defined as a land use system which integrates trees and shrubs on farmlands and rural landscapes to enhance productivity, profitability, diversity and ecosystem sustainability. It is a dynamic, ecologically based, natural resource management system that, through integration of woody perennials on farms and in the agricultural landscape, diversifies and sustains production and builds social institutions. General Agreement on Tariffs and Trade (GATT) recognized agriculture as an enterprise of investment and profit making and included it for the first time in the 1986–1994: Uruguay Round of negotiations. Having ratified, the agreement on trade made provisions for the new varieties but also stimulate the development of new varieties of plants. The production of plant varieties and farmers right act was passed by parliament in 2001; it will give recognition and help in finding high quality seed material and planting material for industries and other public. Implementation of this act will trigger agricultural development, protection against the plant breeder’s rights and farmers rights. Before claiming protection under PPV & FRA 2001, the breeder will have to characterize his materials as per DUS guidelines. The ability to discriminate germplasm is important for plant breeding as well as plant variety production.

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Numerical Taxonomy also known as taxometrics or adansonian taxonomy is the grouping of plants using numerical methods on the basis of both qualitative and quantitative morphological characters. Most of traits are recorded at several stages of plant growth from seedling, coppice shoot, mature leaf, flowering to fruiting. It requires the data of different characters to be converted into numerical quantities which can then be scrutinized by appropriate statistical tools. According to Sneath & Sokal (1973), the term broadly covers much of systematics, and includes the distinct activities of classification (ordering of plants into group) and identification assessment of additional plants to their correct groups. One of the key concepts of Numerical taxonomy is predictivity. Morphological descriptor would not only facilitate greater understanding of the genetic diversity in the clones but also provide useful means of characterizing them. The relationships between the plants are highly multivariate, because numerous characters are considered (polythetic). In plant breeding, the ability to discriminate germplasm and plant variety production is significant. Data were discriminated for the purpose of Individual identity employing multivariate analysis. Multivariate analyses have been aid in many countries for several crops such as wheat (Ajmal et al., 2013, Malik et al., 2014), sorghum (Ali et al., 2011) and maize (Lee et al., 2005; Babic et al., 2010; Azad et al., 2012), Eucalyptus (Lakshmi et al., 2019). According to Ajmal et al., 2013; Malik et al., 2014, it is the most common methodology for genetic variability guesstimate to know the arrays of variation and the genetic relationships among the germplasm collections. Based on Mohammadi & Prasanna (2003) and Peeters & Martinelli (1989), the standard statistical tools used were Principle Component Analysis and Cluster Analysis.

Canonical discriminant analysis (CDA) lessens a set of inter-correlated observations to a number of discrete features or magnitudes. For each of these magnitudes, a measure of its relative size of importance within the overall data set is given by the Eigen value of the relevant matrix, which represents the proportion of the multivariate dispersion explained. It is precisely this ability to overview the complete data set and expresses the variation across the wider data set in a reduced number of composite variables which allows CDA to make a quantitative determination of species associations within a set of botanical data. In developing classification models, it is the first best multivariate statistical classification method used for decades by researchers and practitioners. Principal Component Analysis (PCA) was used to classify individual genotypes and find its contribution to the character of individual genotype appearance. The scatter plots is a graphic biplot determined by the PC values that shows the highest contribution of characteristic traits towards the variability of a character. In view of Sharma (1996), Cluster analysis (CA) is a method used in grouping a set of characters into clusters. Genetic diversity and distance based on the similarity between plants under study were analysed using Cluster Analysis based on the Euclidian Coefficient. The result of a hierarchical clustering algorithm can be graphically displayed as tree, called a dendogram. For supporting clustering, dendogram provides a classified index (Jain & Dupes 1988, Kaufman & Rousseeuw 1990). Euclidian distance values in the range of 0–1 indicate, a small dissimilarity, whereas its value more than 1 indicates a large dissimilarity coefficient. For PCA Pasta software is used to make graphical representation i.e. Spread plot method. The XLSTAT 2012 computer software was used for CA. Therefore Numerical Taxonomy plays an important role in DUS Testing under PPVFRA to the DUS Centre to test the new variety and to develop the DUS Descriptor for Plants.

References


