PHENOTYPIC CHARACTERIZATION OF KENYAN AND SOUTH AFRICAN SPIDER PLANT (*Cleome gynandra* L.) ECOTYPES

BY

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DECLARATION

This thesis is my original work and it has not been presented for a degree in any other university.

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ABSTRACT

Spider plant (*Cleome gynandra* L.) is an important leafy vegetable that has been used by local African communities as a source of nutrition in their diets for many years. The plant has recently attracted an increasing demand since it is highly nutritive and contains health promoting bioactive compounds important in combating malnutrition and reducing human degenerative diseases. Despite the great value of spider plant, there are limited efforts towards its improvement especially in the area of phenotypic diversity. Spider plant has a rich genetic resource base in Kenya and South Africa and knowledge of its phenotypic diversity in these countries will aid on selection of accessions with desirable traits for breeding and conservation purposes. The aim of this study was to determine the extent of phenotypic variation among selected spider plant accessions from Kenya and South Africa and select those with desirable qualitative and quantitative characters for future improvement. Field and greenhouse experiments were conducted in 2013 and 2014 at the University of Nairobi’s Kabete field station, Kenya. A total of 32 spider plant accessions, 23 sourced from Kenyan genebank and nine from South African genebank were used in characterization and evaluation. Both field and greenhouse experiments were laid out as a randomized complete block design with three replications. Eleven qualitative and quantitative traits based on modified FAO (1995) spider plant descriptors were used in characterization. Qualitative characters evaluated included growth habit, flower colour, stem colour, stem hairiness, petiole colour, petiole hairiness, leaf colour, leaf pubescence, leaf shape, leaf blade tip shape, and number of leaflets per leaf. Quantitative characters evaluated were days to 50% flowering, soil plant analysis development values, plant height, stem girth, number of primary branches, leaf length, leaf width, single leaf area, number of leaves per plant, number of pods per plant and seed yield per plant. The qualitative and quantitative data were analyzed using DARwin software version 5.0 and Genstat version 14. Shannon diversity index (*H’*), multivariate methods of principal coordinate analysis, principal component analysis and hierarchical clustering analyses of unweighted pair group method of arithmetic averaging were assessed for all the qualitative traits. Analysis of variance was performed at 5% level of significance for the quantitative data and variability calculated using statistical measures of mean, standard deviation and coefficient of variation. Correlation was also performed to estimate quantitative relationships among the traits.
Estimates of Shannon-Weaver diversity index (H’) for the qualitative characters assessed in the field and glasshouse were generally high (H’>0.500). The H' index indicated inter-country diversity to be greater than the intra-country diversity. The second plane of principal coordinate analysis separated the two groups of accessions (Kenyan and South African) clearly. Principal component analysis identified seven important qualitative characters for characterizing spider plant accessions. These were stem colour, stem hairiness, petiole colour, petiole hairiness, leaf hairiness, leaf shape and number of leaflets per leaf. The hierarchical cluster analysis revealed two major clusters (Cluster I and II) for the thirty two accessions grown in the field, with clustering of accessions occurring along regional basis. Cluster I consisted of South African accessions only while cluster II had mainly Kenyan accessions and two South African accessions (accession numbers 1959 and 2289). The cluster phenogram grouped the glasshouse grown accessions into three major clusters (Cluster I, II and III). Cluster I had only one accession, GBK045436. Cluster II had two Kenyan accessions, GBK027195 and GBK027212. Cluster III consisted mainly of a mixture of the Kenyan and South African accessions with two sub-clusters (sub-cluster ‘a’ and ‘b’). Sub-cluster ‘a’ had six South African accessions and two Kenyan accessions. Sub-cluster ‘b’ had a total of 21 accessions most of which were Kenyan accessions.

The analysis of variance indicated significant differences (P<0.05) for most of the accessions grown in the field and glasshouse. Number of leaves per plant was significant (P<0.05) and positively correlated with SPAD values % (r = 0.34 and 0.03), stem girth % (r =0.59 and 0.29), number of pods per plant % (r = 0.69 and 0.57) and seed yield per plant % (r =0.21 and 0.03) for field and glasshouse grown accessions, respectively. However, number of leaves per plant correlated both positively and negatively with days to flowering % (r = -0.17 and 0.12), leaf area (r = -0.05 and 0.03), plant height % (r = 0.52 and -0.15) and number of branches per plant % (r = 0.35 and -0.09), respectively, for field and glasshouse grown accessions. Twelve accessions, namely 1959, 2000, 2279, 2289, GBK027195, GBK027212, GBK031990, GBK031996, GBK032302, GBK040606, GBK043261 and GBK045451 were found to be different from the other accessions for important characters such as late flowering, high SPAD content, large leaf area, high number of primary branches, high number of leaves per plant, high number of pods per plant and high seed yield per plant. These accessions can therefore be used for future spider plant improvement programmes through breeding in view of variety release.