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AGROSAVIA

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GOBIERNO DE COLOMBIA MINAGRICULTURA

Phenotyping tools to dissect morphological diversity in sweet potato *Ipomoea batatas* (L.) Lam

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INTRODUCTION

Sweetpotato (*Ipomoea batatas* (L.) Lam.) is an hexaploid specie (2n=6x=90) with high levels of heterozygosity, it is an important tropical American crop belonging to the family Convolvulaceae (Austin and Huaman, 1996), which has wide variations in botanical characteristics and are readily distinguished on the basis of morphological traits, yield potential, size, shape, flesh and skin colour of roots, as well as sizes, colours and shapes of leaves and branches (Acheampong, 2012; Zhang et al., 2000).Morphological characterization has been used as a first step in assessment plant diversity for both plant genetic resources conservation and utilization (Mwanga et al., 2017). In thi study, new phenomic approaches were used to increase the efficiency discriminating different phenotypes not detected by conventional morphological descriptors.

MATERIAL AND METHODS

Seventy accessions of sweet potato collected in north-coast of Colombia were characterized by forty-nine parameters from conventional sweet potato descriptor and data obtained by RGB imaging and colorimetry. Field description, RGB imaging-colorimetry and both joined-databases were analysed using Gower general similarity coefficient for clustering in R.

RESULTS AND DISCUSSION

Constraints of phenotypical diversity estimation by morphological characters from sweet potato descriptor

Two main clusters were found, thesetwo groups were differentiated mainlydue tuberous root formation (Fig. 1).

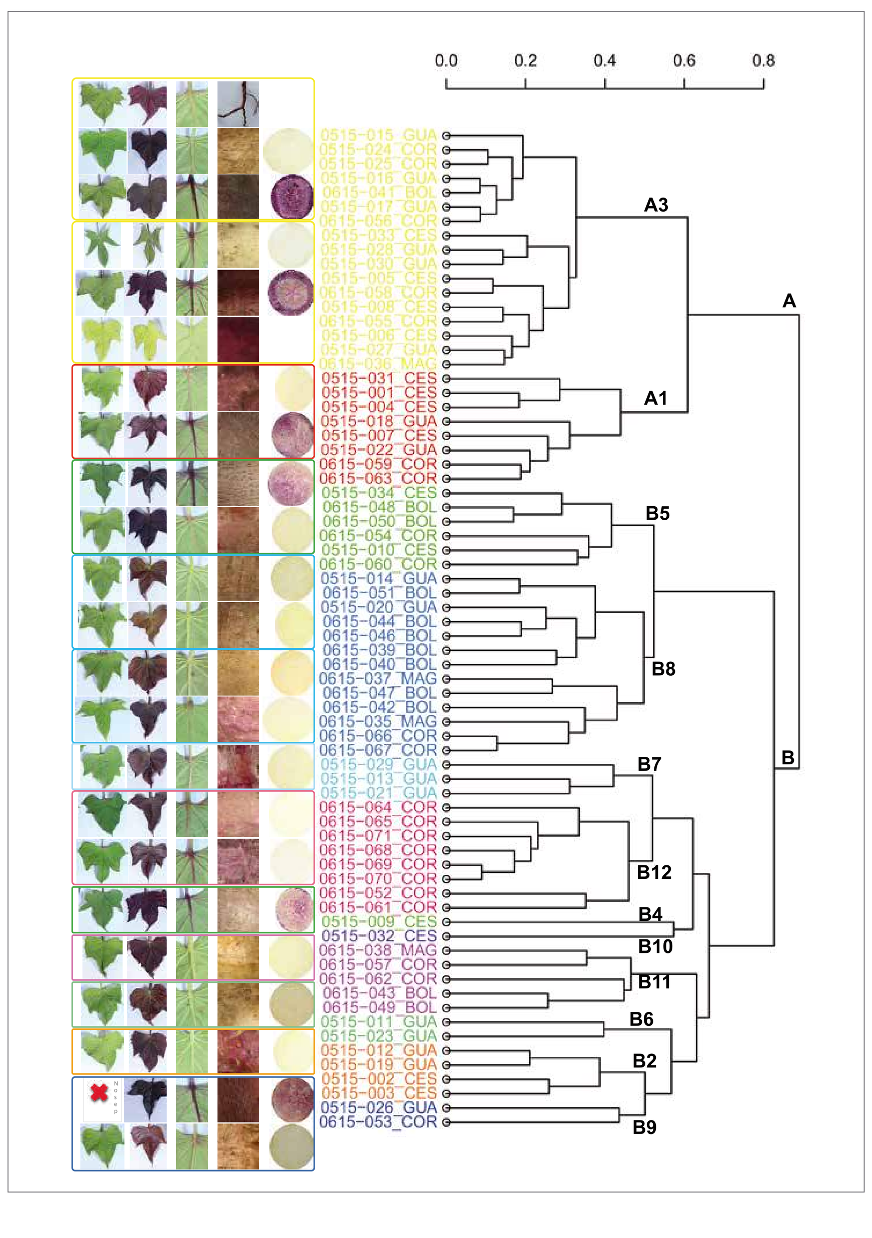

Figure 1. Cluster analysis to dissect phenotypic diversity using traditional morphological descriptor for sweet potato

New approaches introduced for morphological characterization

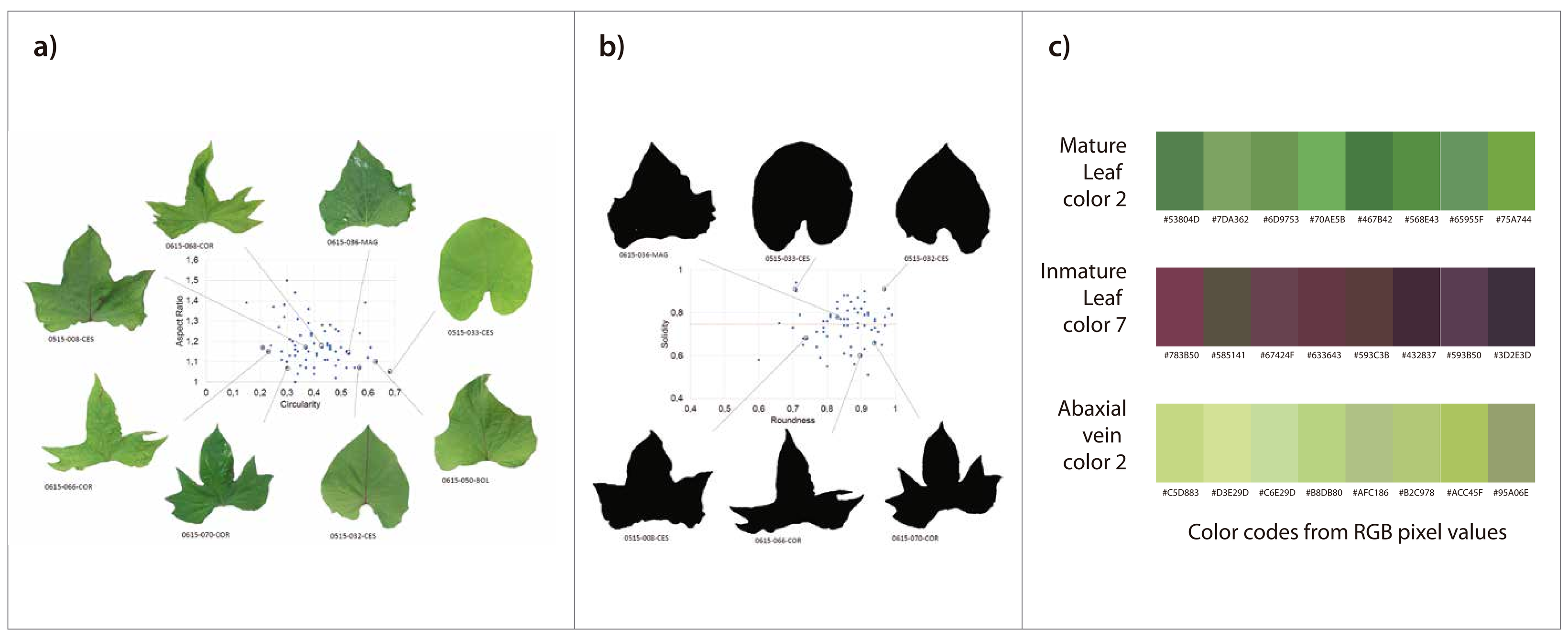

Figure 2. Morphometric and colorimetric measurements from RGB images. a) Thresholded image from leaves used to determine shape parameters. b) circularity, round and solidity values according to leaf type and age. c) color variation determined from RGB images in a selected color category from field descriptor

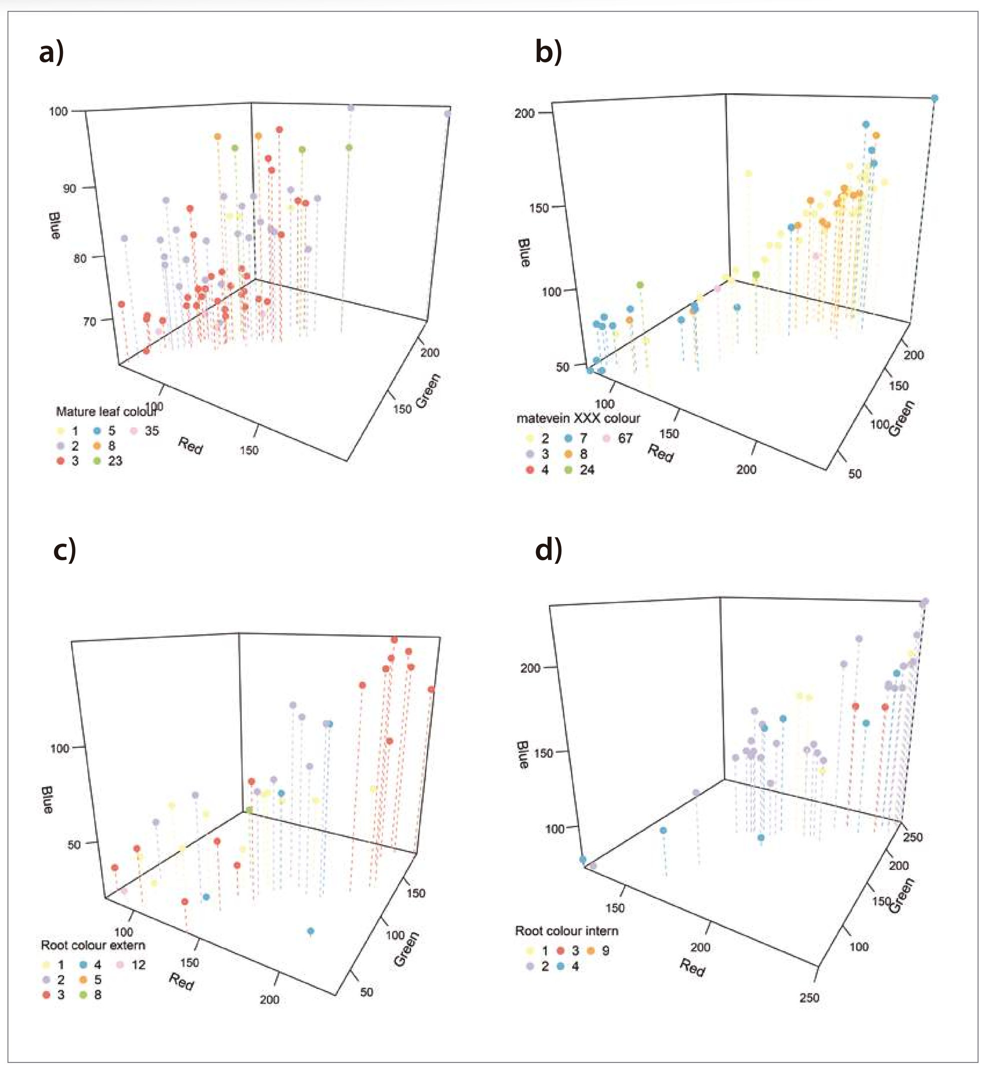

Figure 3. Colorimetric measurements from RGB images and its relation with field descriptor. Red, green and blue pixel values variation according to visual description of mature leaf colour (a), main abaxial vein (b), external root color (c) and root flesh (d) color categories

Table 1. Spearman correlation between morphometric parameters measured by Image J and field descriptor

Morphometric parameter	Central lobe shape	Lobe number	Lobe type	Mature leaf size
Circularity of 10th leaf lamina	-0,569**	-0,472**	-0,417**	-0,31*
Solidity of 10th leaf lamina	-0,618**	-0,428**	-0,435**	-0,275*
Roudness of 10th leaf lamina	-0,379*	ns	ns	0,244*
Area of 10th leaf lamina	-0,237*	ns	ns	0,33**

**p<0.001, *p<0.05

Potential of morphometric and colorimetric evaluation to dissect phenotypic polymorphisms

Field description, RGB imaging-colorimetry and both joined-databases were analysed using Gower general similarity coefficient for clustering in R. Estimation of genotype similarity was significantly improved when quantitative data obtained by RGB imaging and colorimetry analysis was included (Fig. 4).

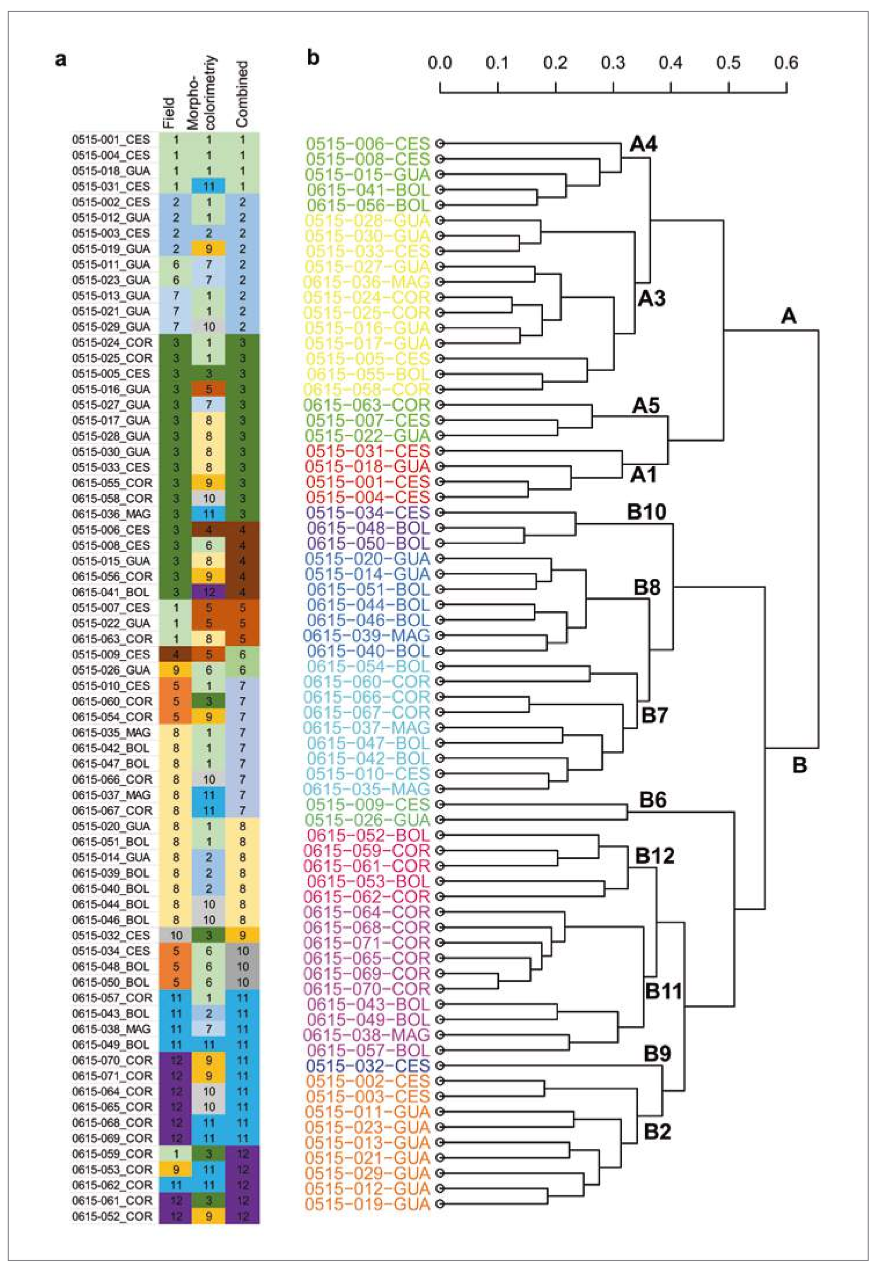

Figure 4. Phenotypic diversity estimation obtained by traditional morphological descriptor and improved by morphometric and colorimetric approaches for sweet potato

Conclusions

Conventional description using categorical parameters faced a constraint dissecting sweet potato diversity in terms of plant pigmentation, organ shapes and efficiency of vegetative growth, the inclusion of color pixel values or indexes, morphometric parameters and coverage area estimated by morphometric-colorimetric tools improved the phenotypic characterization in sweet potato and allowed to found differences that were not previously detected.