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Quantitative analysis variables Maguey Mezcalero (A. *cupreata*) in four environments

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Resumen

Este trabajo se realizó con el propósito de analizar las variables cuantitativas del maguey mezcalero,*Agave cupreata*Trel& Berger, especie endémica de la cuenca del Rio Balsas de Guerrero y Michoacán, se muestrearon 100 plantas en cuatro ambientes; se usaron los descriptores requeridos en la Guía técnica para la descripción varietal de agave (*Agave spp.)*, SAGARPA-SNICS-CCVP (2014). Las localidades y/o ambientes georreferenciados fueron: Amatitlán, Axaxacualco, Chilapa y Mazatlán; se realizaron análisis de varianza entre localidades.

Contribución. El resultado fue que de las ocho variables cuantitativas medidas, siete presentan variación significativa entre ambientes.

***Agave cupreata*, Variables cuantitativas, Ambientes.**

Abstract

This work was performed in order to analyze the quantitative variables of mezcal maguey, *Agave cupreata*Trel& Berger, endemic to the Balsas River basin of Guerrero and Michoacan, 100 plants were sampled in four environments; descriptors required by the Technical Guide for the varietal description used agave (*Agave spp.*), SAGARPA-SNICS-CCVP (2014). Localities and/or georeferenced environments were: Amatitlan, Axaxacualco, Chilapa and Mazatlan; analysis of variance among localities were performed.

Contribution. The result was that of the eight measures seven quantitative variables presented significant variation between environments.

***Agave cupreata*, quantitative variables, environments.**

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Introduction

Agave cupreatapertenece the subgenus Agave, Crenatae group (Gentry, 1982). The Crenatae group is distinguished by margins crenate leaves, with varying teeth and deep and narrow panicles, but the flowers are structurally homogeneous, so the distinction of species within the group is based on leaf characters. The plants are light green to yellow-green and younger leaves are covered by a glaucous hair that is accentuated with printed patterns spines previous sheets. A. cupreata, named after a copper color of their spines, it is also distinguished by its clear, very jagged and very distinct impressions of thorns on shoots green broad leaves. Like other species of the genus in their respective habitats, A. cupreataconstituye a key to providing food and lodging to multiple organisms, especially during the dry season in which flowers and produces lots of nectar consumed by insects and birds species. This is a species that is distributed narrowly in isolated populations, forests of pine and pine / oak, and has been reported by Gentry (1982) as endemic to the Balsas River basin, in the northern state of Michoacan and the center of the state of Guerrero, between 1220 and 1800 meters.

This species has been used for centuries in the production of "mezcal", a local distilled and traditional alcoholic beverage in the state of Guerrero, whose traditional manufacturing currently represents an economical alternative to high potential for communities in this area of influence. However, as more than 90% of the raw material is of wild origin, there is little clarity and control of genotypic and phenotypic variants used, or even more, if the material used by the producers of the drink is a single taxon (Martin , et al, 2011;. Martinez, et al, 2011)..

Mature individuals in natural populations are harvested just before flowering to produce mezcal (Colunga-Garcia & Zizumbo-Villareal, 2007). The harvest prevents the reproduction of the plant, as A. cupreata is played once in its life cycle (semelparous) and not reproduced vegetatively. The effect of the crop in the demographics of populations is exacerbated because the plants need between seven and 15 years to reach sexual maturity (Illsleyet al., 2007). Therefore the aim of this paper is to analyze the variability of its quantitative descriptors for conservation, improvement and more efficient use. It is understand the variation that exists in their germplasm in terms of morphological and phenological high heritability (Hinthum van, 1995; FAO, 1996) ie characteristics whose expression is little influenced by the environment (Franco and Hidalgo, 2003, Laguna , et al., 2006)

Methodology to develop

Vegetal material. Comes from four wild populations of Agave cupreata, its geographical coordinates are: Mazatlan, MA, (17 ° 27.3 'LN 99 ° 27.5' LO), Ahuacotzintla, Chilapa, CH, (17 ° 35.8 'LN 99 ° 05.3' LO), Axaxacualco, AX, (17 ° 43.9 'LN 99 ° 25.7' LO) and Amatitlan, AM, (17 ° 51.9 'LN 99 ° 45.4' LO). These areas have a SemicálidoSemiseco climate and an altitude of 1200-1850 m, the agaves are mainly associated with trees and shrubs that make up the subtropical scrub. The soils are calcareous and contain poor levels of nitrogen, phosphorus, potassium and organic matter (Barrios et al., 2006).
Sample size. It was determined based on the statistical technique used to make inferences population values from a sample (Pita F., 1996), where:

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$$n = \frac{Z\alpha^2 * p * q}{d^2} = 96$$

n = Individuals sampled

$Z\alpha^2$ = 1.962 (sure 95 %)

p = expected proportion of variability (in this case 50% = 0.50 maximizes the sample size, if you have no idea of this data)

q = 1 – p (1-p=0.50)

d = Accuracy (in this case it is desired that the error probability is 10%).

Variables. Plant height (AP), diameter rosette (DR), number of leaves (NH), number of leaves per filotaxia (NHF) Blade Length (LH), leaf width (AH), length ratio of width sheet (RLAH) and terminal spine length (LET).

Variance analysis. This analysis was performed to quantitative variables already identified through environments (Crivisqui, 1998).

Results and discussion

The result for sample size was 96 plants, so for practical purposes we chose to use 25 plants per room to have a sample size of 100. The results of analysis of variance across locations of the eight quantitative variables and test (Tukey 0.05) are presented in Table 2 indicate that there are significant differences across locations in seven of these variables, except the length of the spinal terminal (LET) not varied. In this sense Mazzaniet al., 2007, states that the descriptors or variables of one variety or species are listed a series of characters that a priori known to have internal variability and it is preferred that most of the characters used are qualitative and easy measurement to avoid the complication that has environmental influence on quantitative characters.

In some locations the environment conducive greater growth than others (AP and DR) indicating that may be operable so as to promote increased production of biomass. Also NH, RLAH and AH, the latter varies with the environment in inverse relation to the previous two, this is that plants some rooms have more leaves, NH and RLAH but with lower AH, these variables give us an idea of the shape and / or structure of the plant and the environment influences this regard, the sampled site Mazatlan and Chilapa have similarities to these variables; so, Axaxacualco and Amatitlan tend to be larger maguey, also they appear to be more consistent in having larger plant and Chilapa presents homogeneity with smaller plants. General plants sampled in Mazatlan are heterogeneous in size and shape, Chilapa is heterogeneous in form or structure.

Anexxes

Table 1.

Gratitude

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Conclusions

The variance analysis indicates that the environments influenced seven of the eight variables and relative to its size, is Axaxacualco Amatitlan and localities with larger maguey (AP and DR), Chilapa and Mazatlan were on average smaller. The same happened with NH, LH AH. LET unchanged.

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References

Barrios A. A., R. Ariza F., J. M. Molina M., H. Espinosa P. y E. Bravo M. 2006. Manejo de la fertilización en magueyes cultivados (Agave *spp*.) de Guerrero. Iguala, Guerrero. México. INIFAP. Campo Experimental Iguala. Folleto Técnico No. 13. México. 44 p.

Colunga-García Marín, P., &Zizumbo Villarreal, D., 2007. El tequila y otros mezcales del centro-occidente de México: Domesticación, diversidad y conservación de germoplasma. In P. Colunga-García Marín, L. Eguiarte, A. Larqué, & D. Zizumbo-Villarreal (Eds.), En lo ancestral hay fututo: Del tequila, los mezcales y otros agaves (pp. 113-131). México D.F: CICY-CONACYTCONABIO-SEMARNAT-INE.

Crivisqui, E. 1998. Presentación de los métodos de clasificación. En: Seminario de métodos estadísticos multivariados. Valdivia, Chile. 5-16 de enero de 1998. 56 p.

Dillon, W. R. y Goldsten, M. 1984. Multivariate analysis: Methods and applications. Wiley, Nueva York. 587 p.

FAO, 1996. Plan de Acción Mundial para la Conservación y la utilización sostenible de los recursos Fitogenéticos para la alimentación y la agricultura. Leipzig, Alemania.

Franco, T. L. e Hidalgo, R. (eds.). 2003. Análisis Estadístico de Datos de Caracterización Morfológica de Recursos Fitogenéticos. Boletín técnico no. 8, Instituto Internacional de Recursos Fitogenéticos (IPGRI), Cali, Colombia. 89 p.
Gentry H.S., 1982.Agaves of continental North America.The University of Arizona Press.

Hintum, TJL van., 1995. Hierarchical approaches to the analysis of genetic diversity in crop plants IN Hodgkin, T, Brown, AHD, Hintum, TJL van, Morales, EAV (eds) Core Collections of plant genetic resources pp23-34. John Wiley and sons, New York.

Illsley, C., Vega, E., Pisanty, I., Tlacotempa, A., García, P., Morales, P., Calzada, M., 2007.Maguey papalote: Hacia el manejo campesino de un recurso colectivo en el trópico seco de Guerrero, México. In P. Colunga-García Marín, L. Eguiarte, A. Larqué, & D. Zizumbo-Villarreal (Eds.), En lo ancestral hay futuro: Del tequila, los mezcales y otros agaves (pp. 19-338). México D.F.: CICY-CONACYT-CONABIO-SEMARNAT-INE.

Laguna C. A., Guadarrama-Guadarrama M. E., Arenas-Julio Y. R., Delgado M. R., 2006. Aplicación de la guía de descripción varietal de dalia (Dahliaspp) en la caracterización de clones seleccionados. Ciencias Agrícolas Informa; 4: 24-29.

Martin, M. P., Peters, C. M., Palmer, M. I., &Illsley, C., 2011. Effect of habitat and grazing on the regeneration of wild Agave cupreata in Guerrero, México.ForestEcology and Management, 262(8), 1443-1451. doi: 10.1016/j.foreco.2011.06.045

Martínez-Palacios, A., Gómez-Sierra, J. M., Sáenz-Romero, C., Pérez-Nasser, N., & Sánchez-Vargas, N. M., 2011. Genetic diversity of *Agave cupreata*Trel.& Berger.Considerations for its conservation.Revista Fitotecnia Mexicana, 34(3), 159-165.

Mazzani, E.; C. Marín; J. Romero. 2007. Clasificación del banco de germoplasma de ajonjolí de Venezuela basada en escalas cualitativas. Agronomía Trop. 57: 15-24.

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Pita Fernández, S., 1996. Unidad de Epidemiología Clínica y Bioestadística. Centro Hospitalario Universitario de A Coruña. CAD ATEN PRIMARIA, 3: 138-14

AMB	AP	DR	NH	NHF	LH	AH	RLAH	LET	

AM	1.1732 a	1.78600 a	60.600 ab		4.640 a	0.7452 a	0.2880 a	2.6036 a	4.744 a
AX	1.1032 a	1.71680 a	68.920 a		4.640 a	0.7148 a	0.2732 a	2.6460 a	5.028 a
CH	0.7512 c	1.29840 b	54.560 b		4.040 b	0.5316 b	0.2460 b	2.1828 b	4.528 a
MA	0.9040 b	1.67560 a	53.000 b		4.880 a	0.7020 a	0.2656 ab	2.6600 a	4.848 a
					--------				
Media	**0.9829**	**1.6192**	**59.270**		**4.550**	**0.6734**	**0.2682**	**2.5231**	**4.7870**
C.V.	**16.0373**	**19.78906**	**20.2946**		**14.7296**	**17.6918**	**13.39820**	**17.2077**	**22.0011**

Table 1 Results of analysis of variance across eight locations quantitative variables A. cupreat

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