Diversity index of Arbuscular Mycorrhizal Fungi in Colombian Andean transect

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INTRODUCTION

There are some biotic and abiotic factors that can affect positive or negatively the structure and diversity of Arbuscular Mycorrhizal Fungi communities, such as the interaction with other soil microorganisms, and agricultural practices including cutting down, burning, fertilization and tillage. Also the Arbuscular Mycorrhizal Fungi population could be modulated indirectly by microclimate aspects, topography and plant species (Schenck, *et al*., 1975; Matsubara y Harada, 1996; Augé, 2000; Entry, *et al*., 2002; Jansa, *et al*., 2003; Kernaghan, 2005).

Key words: Diversity, Functional diversity, Arbuscular Mycorrhizal Fungi (AMF)

MATERIALS AND METHODS

This work was focused in the evaluation of AMF biodiversity in an altitudinal transect (1500 to 3000 masl) cultivated with cape gooseberry (*Physalis peruviana*) in the Colombian Andean Mountains. Samples were collected in two seasonal periods: wet (150 – 300 mm.month^{-1}) and dry (0 - 20 mm.month^{-1}). We evaluated the Arbuscular Mycorrhizal Fungi communities based on species diversity (Table 1).

Table 1. Sampling places, altitude ,soil taxonomy, soil pH, for Cundinamarca (C) and Boyacá (B), locations in Colombian Andean mountains

Location	Nomenclature	Taxonomic Classification	Altitude masl	pH
Zipacón (C)	Z1	Andic Dystrudepts	2675	5,10
	Z2	Andic Dystrudepts	2627	5,10
Granada (C)	G1	Andic Dystrudepts	2380	5,18
	G2	Dystric Eutrudepts	2302	5,18
	G3	Dystric Eutrudepts	2250	5,15
	G4	Dystric Eutrudepts	2000	5,00
Mosquera (C)	M1	Aeric Epiaquents	2560	5,10
Albán (C)	A1	Dystric Eutrudepts	1636	5,14
Cómbita (B)	C1	Typic Humitropept	2869	5,30
	C2	Typic Humitropept	2930	5,21
	C3	Typic Humitropept	2750	5,20
Arcabuco (B)	Ar1	Oxic Humitropept	2572	5,07
	Ar2	Oxic Humitropept	2636	5,11

DENSITY (DE): DE = No. spores g^{-1} soil

RICHNESS: R= No. Species g^{-1}; R = (S^{-1}) / ln *N Where*: S= No. Species y *N* No. Species Total

***RELATIVE ABUNDANCE(RA):* RA** = No. simple species / No.Total Species X 100

***ISOLATION FREQUENCY (IF):* IF**= No. of samples with a specifique specie / No. samples total x 100

Dominance of specie: Abundance > 3 % and Isolation Frequency > 40 % (Zhao y Zhao, 2007)

Dominance of specie IF > 50 %; Commun species IF: 30-50 % and rare species < 10 % (Zhang, et al., 2004)

SHANON –WIENER DIVERSITY INDEX (H´): Where S = No. species or R; p_i = % *individuals of the specie i/total of individuals (RA)*; n_i /*N* (n_i No. *individuals of the specie*; N (No. Total individuals-, Range: 1 to 5.

$$H' = \sum_{I=1}^{S} p_i \ ln \ p_i$$

UNIFORMITY INDEX (E): E = H´ / H´max Where: H´: Diversity index and H´max :ln S (S=No. species)

RESULTS

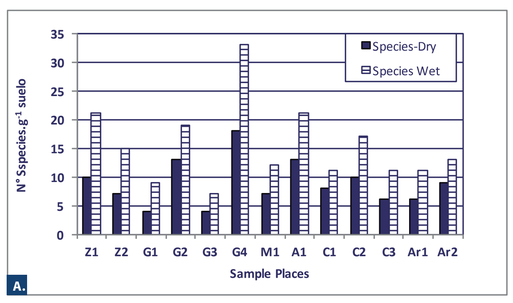

Figure 1. A. Number-Richness B. Relative abudance C. Shannon Index of AMF species (RSA) in cape gooseberry crops in dry and wet season

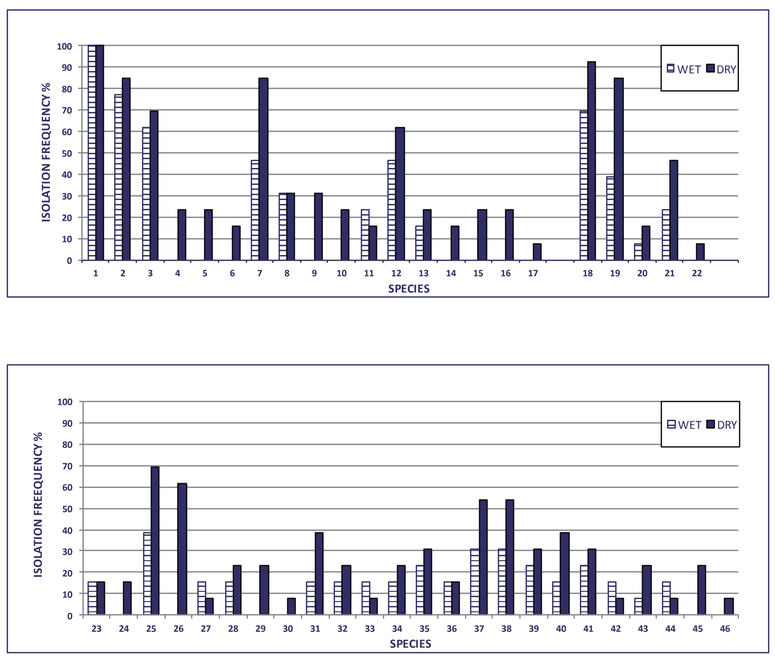

Figure 2. Isolation frequency % of AMF species (RSA) in cape gooseberry crops in dry and wet season.

AMF taxonomic classification of isolated was made at the species level based on spore morphology from assemblies with PVLG and Melzer's reagent (Schenck and Perez, 1988, Morton and Redecker; 2001, Schüssler *et al*., 2001; Oehl and Sieverding, 2004; Walker and Schüssler, 2004; Blaskowski *et al*., 2006, 2008; Oehl Sieverding, 2006; Palenzuela *et al*., 2008; Alves Da Silva *et al* ., 2009; Oehl *et al*., 2008, 2010 , 2011a , b, c , d; Goto *et al*., 2011; Redecker *et al*., 2013.

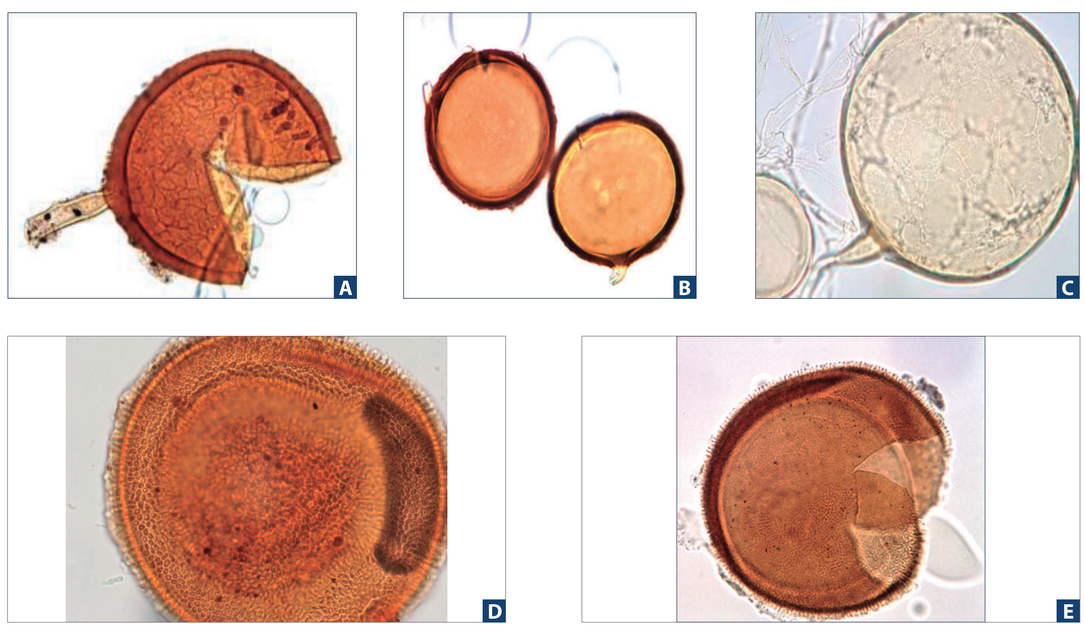

Figure 3. AMF; (A) *Glomus macrocarpum*; (B) *Claroideoglomus* sp., (C) *Funneliformis mosseae* (D y E) *Entrophospora infrequens*

CONCLUSION

The estimated diversity indexes corroborate the hypothesis that mycorrhizal communities in this systems are highly heterogeneous with a low/average uniformity levels within and between samples.

We found that in the altitudinal gradient, Arbuscular Mycorrhizal Fungi communities showed high diversity, expressed by the number, richness and relative abundance of spores genus and species. This high diversity level founded in cultivate soils at different altitudes with *P. peruviana*, show that andean ecosystem has higher diversity compared with other reports for tropical and temperate soils.

ACKNOWLEDGMENT

Authors would like to thank Dr. Fritz Oehl for his invaluable support in the taxonomic identification of AMF spores

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