

Arbuscular mycorrhizal colonization model in *Lotus tenuis* and dominant grasses of a natural grassland from Salado River Basin (Buenos Aires – Argentina)

[RODOLFO MENDOZA](#)* and ILEANA GARCÍA

MACN (Museo Argentino de Ciencias Naturales – CONICET). Av. Ángel Gallardo 470, C1405DJR. Ciudad de Buenos Aires, Argentina.

* Corresponding author

[click here for Spanish version](#)

We studied the dynamic of arbuscular mycorrhizal colonization in *Lotus tenuis* and dominant grasses roots of a natural grassland from the Salado River Basin along a topographic, hydric, saline and sodic gradient (pH: 9.4 – 6.9; EC: 9.3 – 1.7 dS/m; ESP: 77 – 28%; %C: 1.1 – 2.1%; N: 0.11 – 0.19%; P Bray: 8.7 – 3.9 ppm). The main objective was to relate the seasonal changes in the mycorrhizal colonization structure with the changes in growth of plant having different affinity for mycorrhizal colonization (*Lotus tenuis*, *Paspalum vaginatum*, *Distichlis spicata* and *Stenotaphrum secundatum*). Hence, to investigate if there is a key factor controlling the pattern of mycorrhizal colonization in roots. It was reported that the climate, associated with soil and plant are the factors that control mycorrhizal colonization, but it is not possible to identify which of these factors is more important (Johnson *et al.*, 1992; Entry *et al.*, 2002). In the present work, we have studied the same plant species at the same climate growing at different soil characteristics to investigate which factor can be more important influencing the colonization pattern.

The total mycorrhizal colonization was greater and seasonally different in *L. tenuis* roots comparing with the dominant grasses. However, this pattern was similar along the soil gradient. We do not necessarily expect a similar mycorrhizal between plant species since plants differ in root system, growing period, affinity and dependence for mycorrhizal to grow in nutrient deficient soils. Then, different in length and seasonal pattern of colonized root between plants species may be ascribed to the interactions among the growth rates of both the fungi within the roots and the roots within the soil.

The arbuscular colonization (AC) pattern was similar in roots of *L. tenuis* and the grasses. Larger AC were found at the beginning of the growing season in late winter at all the sites, and this might have been related to the period of active nutrient uptake by the host plant (García and Mendoza 2007). The seasonal pattern of vesicular colonization (VC) was similar in the roots of both *L. tenuis* and the grasses. Larger VC were found at all the sites and plant species in summer, when plant growth rate decreases because of the frequency of dry periods and high temperature spells. This fact suggests the presence of a seasonal effect on vesicle formation in roots. Vesicles produced by mycorrhizal fungi are considered to function as temporary storage organs (Hirsch and Kapulnik, 1998), and are signs that the fungi speed up their life cycles in annual plants towards the end of the growing season (Gavito and Varela, 1993). From the present work, maximum AC and VC took place at

different seasons. These seasonally related effects suggest the preferential production of one kind of morphological colonization forms by the fungus during a specific season.

The number of entry points (EP) per mm of colonized root was greater in *Lotus* than in grasses, showing the differential affinity between plant species. Increases in EP suggest increases in formation of colonization units (Fig. 1). *Lotus tenuis* is a dependant plant for arbuscular mycorrhiza (Mendoza and Pagani 1997), and presents high levels of colonization at early age. In *Lotus*, the changes observed in the colonization structure are mainly because of the seasonal production of AC, VC and intraradical hyphae (HO) fungal structures, rather than the formation of new colonization units by EP. This is because with increases in EP, AM did not change and still high even with changes in EP (Fig. 1). However, in *Paspalum vaginatum*, *Distichlis spicata* and *Stenotaphrum secundatum* roots, increases in EP are positively correlated with increases in AM (Figure 1). Hence, in the grasses the changes in the colonization structure are mainly dependent of the formation of new colonization units from the EP and then the development of the intraradical mycelium within the root (HO).

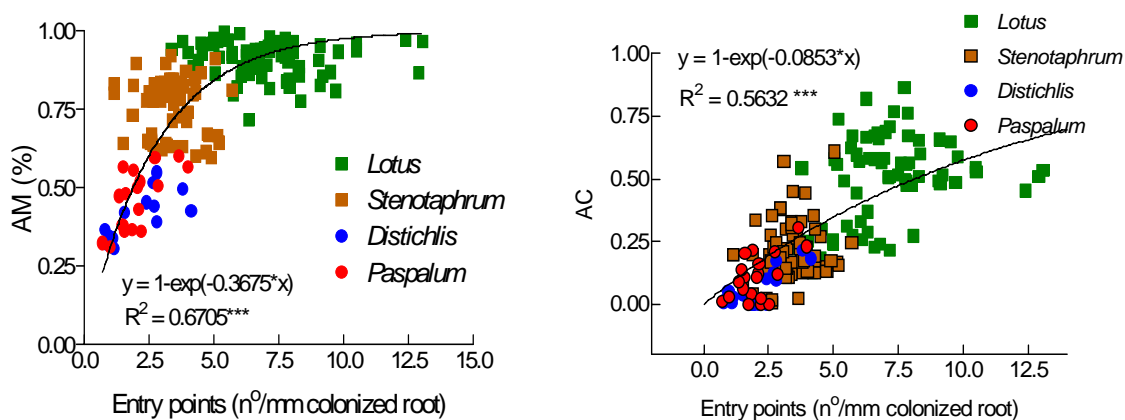


Figure 1. Changes in mycorrhizal (AM) and arbuscular colonization (AC) with the amount of entry points per millimeter of colonized root.

Different physical and chemical soil characteristics and vegetations types are present along the topographic gradient. If different plant species which grow along the gradient present a similar seasonal dynamic with respect to EP, AC, and VC at all the studied sites; it can be suggested that each mycorrhizal fungal community is adapted to the soil conditions at each site and respond seasonally associated with the stages of plant growth, but not necessarily different soil characteristics may modify the pattern of colonization in roots.

References

- ENTRY J.A., RYGIWICZ P.T., WATRUD L.S. and DONNELLY P.K. 2002. Influence of adverse soil conditions on the formation and function of arbuscular mycorrhizas. *Advances in Environmental Research*, **7**, 123-138.

- GARCÍA I. and MENDOZA R. 2007. Arbuscular mycorrhizal fungi and plant symbiosis in a saline sodic soil. *Mycorrhiza*, **17**, 167-174.
- GAVITO M.E. and VARELA L. 1993. Seasonal dynamic of mycorrhizal associations in maize fields under low input agriculture. *Agricultural Ecosystems and Environment*, **45**, 275-282.
- JOHNSON N.C., TILMAN D. and WEDIN D. 1992. Plant and soil controls on mycorrhizal fungi. *Ecology*, **73**, 2034-2042
- HIRSCH A.M. and KAPULNIK Y. 1998. Signal transduction pathways in mycorrhizal associations: comparisons with the *Rhizobium*-legume symbiosis. *Fungal Genetics and Biology*, **23**, 205-212.
- MENDOZA R. and PAGANI E. 1997. Influence of phosphorus nutrition on mycorrhizal growth response and morphology of mycorrhizae in *Lotus tenuis*. *Journal of Plant Nutrition*, **20**, 625-639.