Trap cultures reveal higher species richness of arbuscular mycorrhizal fungi in comparison to soil samples in the Phoenix metropolitan area.

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INTRODUCTION

Arbuscular mycorrhizal fungi (AMF) form a symbiotic relationship with plant roots and are a key functional group found in desert soils. Results from trap cultures are considered to be the most accurate reflection of AMF diversity in urban environments. Urbanization processes and environmental changes due to urban development have been shown to affect AMF diversity in urban environments. Many difficulties have been encountered when attempting to characterize AMF diversity in urban ecosystems. Urbanization processes and community structure in oak forest stands exposed to contrasting anthropogenic impacts. This research was funded in part by the Central Arizona-Phoenix Long Term Ecological Research Project.

RESULTS AND DISCUSSION

Species richness increased from 0-6 species to 2-10 species per site after analyzing trap cultures (Figure 1). The number of AMF species that were detected in trap cultures but not in soil samples ranged from 1 to 6 species/sampling site with a mean of 2.9 AMF species/sampling site. At about half of the sites, spores of some AMF species were present in soil but were not detected in trap cultures grown in the greenhouse. If trap cultures alone were used to assess AMF biodiversity, overall mean species richness would increase 2.3 species/sampling site. In their study of AMF populations associated with soil gramineae, Koske and Grimes (1997) also found that the AMF community detected in soil samples was highly dissimilar to that estimated by trap cultures.

The number of species detected across the study area increased from 14 to 18 species after analyzing trap cultures (Figure 2). Additional species detected in the study area included Glomus decisum, Glomus elatum, Glomus delicosum and an undescribed Acaulospora species. Two species, Entrophospora infrequens and Acaulospora auriformis, were found in the soil but not in the trap cultures. This is most likely because they were present in low numbers in the soil (data not shown).

In a study of AMF biodiversity in the Sonoran Desert by Stutz et al. (1995), fewer species were detected in trap cultures than there was an overlap in AMF species composition with those detected in this study.

The frequency with which most species were detected increased from 0-65% in the soil to 5-80% after analyzing soil and trap culture samples (Figure 2). In the soil samples, Glomus decisum was found to predominate and was detected 15% more frequently than any other species. After analyzing the second generation trap cultures, four species (G. chiloense, G. etunicatum, G. spurcum, and G. macrocarpum) were detected in nearly all of the sites.

METHODS

Establishment of Trap Cultures

Soil samples were collected from twenty sites located in the Phoenix valley in May of 1999 and AMF spores were extracted and identified. Successive trap cultures were established using the soil samples to stimulate sporulation and to determine if additional AMF species could be detected.

Spore Extraction and Identification

Spores were extracted from a subsample (50-100 cm³) of each soil sample. Spores were examined under a dissecting microscope, and a representation of each spore morphotype (as distinguished by color or size) was measured on slides using polynuclear aromatic hydrocarbons (Bacillus subtilis) as standards. The supernatant was collected in a 45 µm sieve and washed into a petri dish. Additional spores were extracted from a subsample of each soil sample and a 100 cm³ subsample from each second generation trap culture sample by wet sieving and macerating gradient centrifugation (Daniels and Skipper, 1982). Soil was washed through a 90 µm sieve, collected in a 45 µm sieve, poured onto a 20/60% sucrose density gradient, and centrifuged at 900 x g for three minutes. The supernatant was collected in a 45 µm sieve and washed into a petri dish. Collected spores were observed under a dissecting microscope, and a representation of each spore morphotype (as distinguished by color or size) was measured on slides using polynuclear aromatic hydrocarbons (Bacillus subtilis) as standards. The supernatant was collected in a 45 µm sieve and washed into a petri dish. Collected spores were observed under a dissecting microscope, and a representation of each spore morphotype (as distinguished by color or size) was measured on slides using polynuclear aromatic hydrocarbons (Bacillus subtilis) as standards.

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REFERENCES


CONCLUSION

Many difficulties have been encountered when attempting to characterize AMF diversity from soil, and species richness may be underestimated when soil samples are used. Results from this study show that species richness per site as well as the number of species increased after analyzing trap cultures in addition to soil samples. Moreover, a greater number of species were detected more frequently in the sites. Species richness between the soil and trap culture samples was dissimilar in many of the sites. There would be some underestimation of species richness of AMF in urban ecosystems. Urbanization processes and community structure in oak forest stands exposed to contrasting anthropogenic impacts. Canadian Journal of Botany 73: 771-782.