Effects of arbuscular mycorrhizal suppression on productivity of *Encelia farinosa* (brittlebush) at an urban and a desert site.

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INTRODUCTION

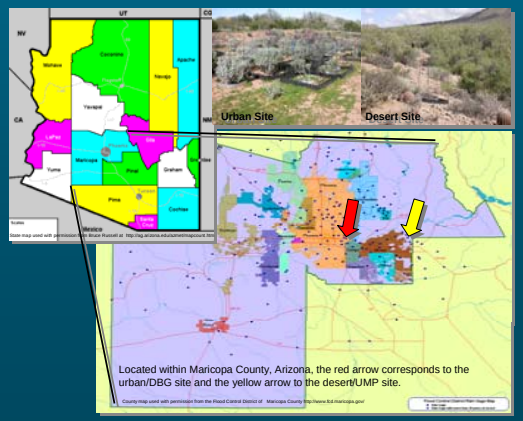
Arbuscular mycorrhizal (AM) fungi are obligate symbionts that are found in roots of roughly 75% of the terrestrial plants around the world (Smith and Read, 1997). Plants receive growth-limiting phosphorus from the fungus in exchange for photosynthates (Read and Moreno, 2003). AM fungi also appear to have a role in drought tolerance in plants (Augé, 2004), the control of some soil and root pathogens (Newsham et al., 1994; Smith and Read, 1997), and in improving the reproductive output of infected plants (Janos, 1980; Koide, 1991). Information on mycorrhizal functioning and its impact on plant productivity in urban desert areas is limited (Martin and Stutz, 1994). The purpose of this study is to examine the impact of AM fungi on the productivity of *Encelia farinosa* (brittlebush) plants at an urban and desert site. For this project, normal colonization levels of AM fungi were suppressed using a fungicide treatment.

METHODS

Sites and Plants Two sites were selected for this study, an urban site located at the Desert Botanical Garden (DBG) in Phoenix, Arizona (elevation 1261 feet), and a desert site located at Usery Mountain Park (UMP), Mesa, Arizona (elevation 2018 feet). Data was collected from *Encelia farinosa* (Gray) (Asteraceae) (brittlebush) growing at both sites. Brittlebush plants located at DBG were transplanted into the site as part of 2 long-term concurrent studies. Brittlebush plants located at UMP were randomly selected from within the plant community. Fourteen brittlebush plants growing at each site were selected for this study.

Fungicide Treatment A Benomyl treatment (.24 grams of benomyl/Liter of water) was applied to half of the plants at each site using the method described by Dhillion and Gardsjord (2004). From July 2004 to May 1, 2005, two liters of Benomyl solution was applied every five weeks with one liter of solution applied to the above ground foliar and stem tissue and one liter applied as a drench to the soil area under the shrub canopy.

Data Collection During February 2005, plants were pruned to a uniform cube with a height and width of 80 cm. Leaves were randomly collected October 2004, December 2004, February 2005 and June 2005. The areas of the collected leaves were measured using a CID inc. CI-203 Laser Area Meter with conveyor attachment. Several plant productivity measurements were taken during mid June 2005 at the end of the spring growing season. The number of flowers, when present, were collected, counted, dried, and weighed to calculate reproductive effort (Koide, 1991). Measurements were taken of plant height and width. Plants were then be clipped back to their starting volume. The plant tissue removed from each plant was bagged individually, dried for 86 hours at 70º C (Koide, 1985) and weighed to determine biomass accumulation during the growing season.



Brittlebush Vegetative Output

Figure 1 Vegetative biomass (dry mass)

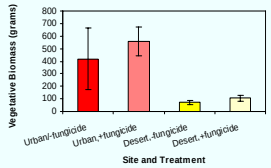


Figure 2 Brittlebush increase in height

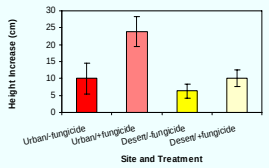


Figure 3 Brittlebush increase in diameter

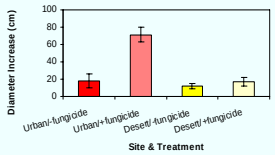
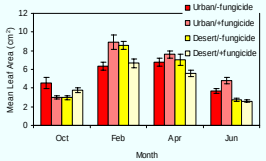


Figure 4 Brittlebush leaf area changes over time



Brittlebush Reproductive Output

Figure 5 Number of Brittlebush flowers

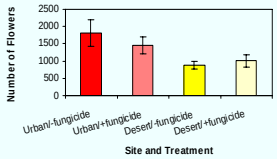


Figure 6 Brittlebush seed and flower dry mass

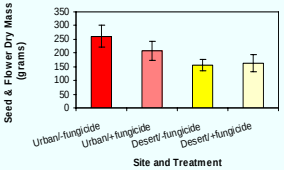
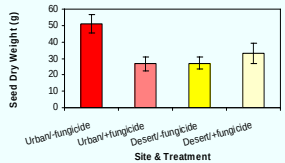


Figure 7 Brittlebush seed dry weight



Statistical Analysis Analysis of variance (ANOVA) was used to test for significant differences between site treatments. Tukey's HSD was used to test comparisons of means when appropriate. Data was assessed use of parametric statistical tools and transformed when necessary. Data was analyzed using JMP 5.0.1 (SAS Institute Inc, 2002).

RESULTS

Vegetative growth of brittlebush was significantly greater in plants growing at urban sites in comparison to desert sites (Figure 1-3).

Plants growing at the urban site had significantly greater vegetative dry mass accumulation and greater increases in increase in height and diameter than plants growing at the desert site.

Treatment of brittlebush plants with fungicide appeared to have a stimulatory effect on vegetative growth (Figure 1-3).

Plants treated with fungicides had significantly greater increases in height and diameter. The effect of fungicide treatment appeared to be greater at the urban site in comparison to the desert site especially for diameter increases.

Leaf areas varied with season and were greater at the urban site compared to the desert site (Figure 4). There was also significant interaction between the site and fungicide treatments.

Winter leaves (February and April) had greater leaf area than fall and summer leaves (October and June). In winter months, leaves from plants treated with fungicide had a greater leaf area than non treated plants at the urban site, but at the desert site treated plants had a smaller leaf area than non treated plants.

Reproductive output of brittlebush was significantly greater in plants growing at urban sites in comparison to desert sites. (Figure 5-7).

The number of brittlebush flowers, the total reproductive biomass (flowers and seeds) and seed dry mass was significantly higher in plants at the urban site in comparison to the desert.

Although the fungicide treatment did not have a significant effect on the number of flowers or the total reproductive biomass (Figure 5 & 6), there was a significant interaction between the site and fungicide treatments on the dry mass of brittlebush seeds (Figure 7).

The highest seed dry mass was from plants that had not been treated with fungicide at the urban site with little difference between seed dry mass from plants from the other treatments.

CONCLUSION

•Urban brittlebush had greater vegetative and reproductive output than desert brittlebush.

•So far, the effect of suppressing arbuscular mycorrhizal colonization is limited to some vegetative variables such as plant height, leaf area and diameter.

• In general, plants with suppressed mycorrhizal colonization had greater vegetative growth.

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