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Vesicular-Arbuscular Mycorrhizae on *Pistacia* Sp*

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Abstract

The mycorrhizal status of indigenous *P. lentiscus* and *P. terebinthus* in two prospective *P. vera* growing areas has been assessed and found to be forming vesicular-arbuscular mycorrhizae. *P. vera*, *P. atlantica* and *P. palestina* from commercial and experimental plantations were also shown to have VA-mycorrhizae. A bioassay was used to isolate and identify the fungi involved in the symbiosis. The VA-mycorrhizae symbiosis was established under controlled conditions using *P. vera*, *P. terebinthus* and *P. atlantica* as host plants and *Glomus mosseae* as the endophyte.

Introduction

Pistacia vera has recently been introduced in Spain as a crop aimed to improve marginal, semi-arid areas where other non-fruit bearing members of this genera grow. The object of this work was to assess the mycorrhizal status of pistachio rootstocks in vew of the importance that the symbiosis might have in the establishment of the crop in semi-arid areas (Trappe, 1981), the seedlings quality (Pope et al., 1983) and the transplanting performance (Plenchette et al., 1981).

Pistachio rootstocks were systematically sampled as well as their associated weeds from two orchards in Catalunya (North East of Spain). The indigenous genera *P. lentiscus* and *P. terebinthus* were also sampled from natural communities. The fungi associated have been isolated and identified. The VA symbiosis has been established under controlled conditions with *P. atlantica*, *P. terebinthus* and *P. vera* and the growth response has been studied.

Materials and Methods

Thirty-seven samples were taken from two orchards and two natural ecosystems

*Reviewed

located south of Barcelona (North East Spain). Roots were collected around trees from three different areas in the tree canopy to obtain a composite sample. Accompanying weeds were also sampled by pulling out the entire root system. Roots were washed free of soil and debris, stained (Phillips & Hayman, 1970) and examined for the presence or absence of VA mycorrhizae. Soil samples were taken at each sampling site to determine soil characteristics.

To establish pure VA mycorrhizae fungal pot cultures soil collected from the different sites sampled was potted and an onion and clover seedlings transplanted. The different stages of the process of isolation and purification of the fungus have been described elsewhere (Camprubí et al., 1987). Mature spores were extracted from the pot culture soil by wetsieving and decanting. The identification of the spores has been done according to Schenck's criteria (Schenck and Pérez 1988). To assess the effect of the symbiosis on *P. vera*, *P. terebinthus* and *P. atlantica* a greenhouse experiment was designed under controlled conditions using *Glomus mosseae* as the endophyte. *P. vera* seeds were soaked in 20 ppm giberellic acid (GA_3) for 24 h and 1 h in a 32 g/l solution of Cu-oxychloride 50%. They were germinated in a sterile mixture of perlite-vermiculite in the greenhouse. Four weeks after germination 86 seedlings were transferred to plastic containers (17 cm diametre) with autoclaved sandy soil low in phosphorus, half of the pots were inoculated using a mixed *Glomus mosseae* inocula with 29 infecting units per plant. The remaining seedlings were given a soil filtrate of the same inocula free of VAM propagules.

P. atlantica and *P. terebinthus* seeds were soaked for two hours in H_2SO_4 (c), washed thouroughly, then soaked for 24 hours in giberellic acid (GA_3), superficially disinfected with a 10% solution of NaClO and planted in autoclaved quartz sand (1h, 120°C, twice on alternate days). Thirty seedlings of each species with two true leaves were transfered to 14 cm diametre pots containing the same sterile sandy soil used before. Half of the pots were inoculated with the same mixed inocula of *G. mosseae* used for *P. vera* with 15 infecting units per plant. The infection was assessed after 3 months in *P. atlantica* and *P. terebinthus* and after 5 months in *P. vera*. Dry weight was recorded and percentage infection was measured using a grid-line intersect method (Giovanetti and Mosse 1980).

Results and Discussion

The results of the rootstock sampling show that all *Pistacia* species examined were susceptible to be infected (Table 1). The lack of infection in several specimen is a reflexion on the characteristics of the soil, with a low inoculum potential as shown by the sampling of the accompanying weeds (Tabel 2). The soil from all the sites sampled had as commun features high pH (7.5 to 8.2) and low nutrient content. The fungi associated with the symbiosis in different sites have been isolated, multiplied in pure culture and tentatively identified as:

Table 1. VAM infection on *Pistacia* rootstock trees.

Pistacia Rootstock	No. of trees sampled	No. of trees with VAM	Sites sampled
P. atlantica	14	9	1,3,4,5
P. palestina	7	3	2,3,4
P. vera	6	3	2,3,4
P. terebinthus	7	6	3,4,7
P. lentiscus	3	3	6,7

Table 2. VAM infected trees and weeds as related to sampling sites.

Site	No. of trees sampled	No. of trees with VAM	No. of weeds sampled	No. of weeds with VAM
Orchard 1: site 1	4	2	6	1
Orchard 1: site 2	6	3	4	1
Orchard 1: site 3	7	2	8	1
Orchard 1: site 4	8	6	4	3
Orchard 2: site 5	6	6	5	4
Natural communities sites 6 & 7	6	6	5	5

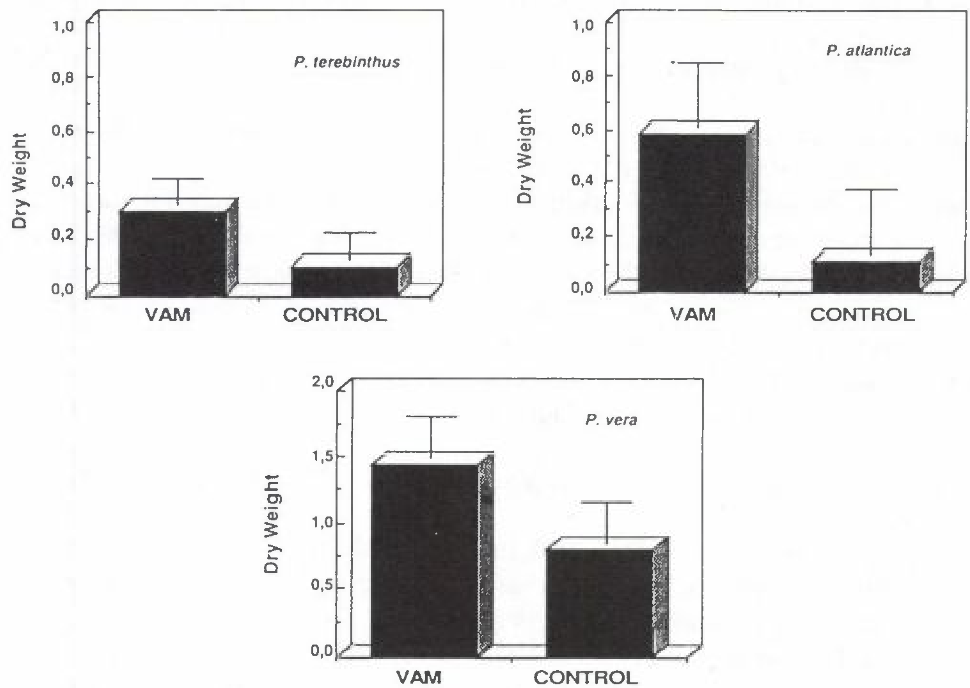

Figure 1. Effect of VAM inoculation on dry weight of three pistachio rootstocks: *P. vera*, *P. attantica* and *P. terebinthus*.

Glomus aggregatum Schenck and Smith
Glomus fasciculatum (Thaxter) Gerdemann and Trappe
Glomus mosseae (Nicol. and Gerd.) Gerdemann and Trappe

These fungi are reported as widely distributed and have been found in sand dunes, semi-arid zones and alkaline sites (Schenk and Pérez, 1988). The growth experiment in greenhouse controled conditions showed that the three species response to VAM infection was positive (Fig. 1). There are many examples of the importance of VAM inoculation on the establishment and growth of trees (Kormanik et al., 1982), (Pope et al., 1983), (Kormanik, 1985). Pistachio nut yield has been correlated with trunk cross-sectional area of rootstock (Crane and Iwakiri, 1986) a genetic character that could be enhanced by VAM infection. Furthermore the pistachio crop management in Spain with an initial phase in the nursery and the transplant in impoverished soils calls for further research to assess the importance and feasibility of pistachio rootstock inoculation to favour tree establishment and performance.

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