3rd Mediterranean Plant Conservation Week (3MPCW), 27 September to 1 October 2021, Chania, Greece.

Use of mycorrhizae to increase survival and resilience of transplanted plants in habitat restoration practices

Marco Iannaccone[1,2], Arthur Lamoliere[1,2], Joseph A Buhagiar[1,2].
marco.iannaccone@um.edu.mt
[1] Department of Biology, University of Malta, Msida, Malta.
[2] SiMaSeed, Interreg Italia-Malta, University of Malta, Msida, Malta.

Introduction

The UN's 2030 Agenda for Sustainable Development calls for the preservation of biodiversity, which is threatened due to habitat degradation and climate change. Actions to enhance restoration and resilience of habitats to reduce biodiversity loss are needed. Though in-situ conservation is considered the best way to preserve biodiversity where species can persist with all their natural ecological interactions, the latter element is often ignored. Criticalities can arise when ex-situ grown indigenous plants are translocated in-situ, without their natural soil microbial associations, especially in a Mediterranean climate where abiotic stresses are severe. Ectomycorrhizal fungi (ECM) are fundamental for terrestrial ecosystems, enhancing plant productivity, alleviating abiotic and oxidative stress, and regulating macronutrients recycling.
The aim of the project was to investigate the use of indigenous ECM to enhance acclimatization and survival of ex-situ grown plants translocated for habitat restoration.

Materials and Methods

1. Collection in Natura 2000 sites
2. Morphological dentification
3. Database accession
4. Preservation
5. Propagation
6. Inoculation

Pinus halepensis Mill. | ***Quercus ilex*** L.

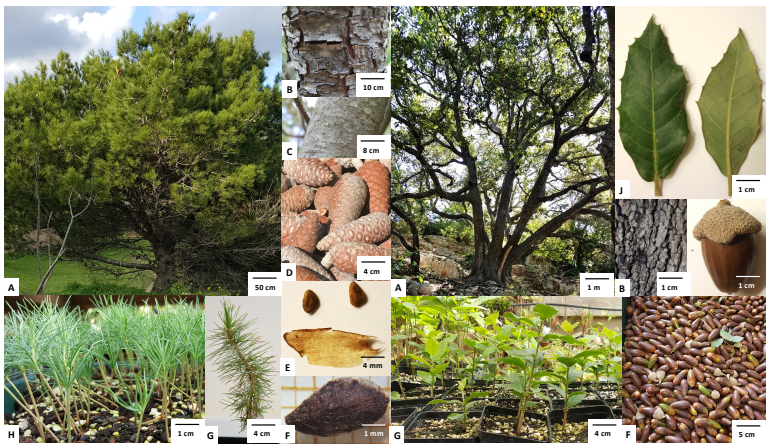

Figure 1. A Mother plant; **B-C** Bark; **D** Cones; **E-F** Seeds; **G-H** Seedlings; **J** Leaves.

Pisolithus arhizus (Scop.) Rauschert (1959) | ***Suillus collinitus*** (Fr.) Kuntze (1898)

Figure 2. A,B,C Mature sporocarps; **D,E** Immature sporocarps; **F** Spores; **G** Preservation; **H** Mycelium.

Results

Pinus halepensis and *Quercus ilex* (Figure 1) seeds collected in Natura 2000 sites of the Maltese Islands were successfully germinated, achieving a germination of 52% and 76% respectively. Sporocarps of naturally associated indigenous ectomycorrhizal fungi of *Suillus collinitus* and *Pisolithus arhizus* (Figure 2) were also collected in the same Natura 2000 sites. After a period of 1 year both ectomycorrhizal association were recorded as shown in Figure 3 and 4. For *P. halepensis* and *S. collinitus* was possible to also inoculate other seedlings through the technique of Mother Donor Plant, as shown in Figure 3. Whereas, for *Q. ilex* and *P. arhizus* was not possible to inoculate other seedlings but was possible to observe primordia of the fungus growing next to a mycorrhized root, as shown in Figure 4.
Both experiments are still on going at the Seed Bank of the Department of Biology at University of Malta.

Pinus halepensis and ***Suillus collinitus***

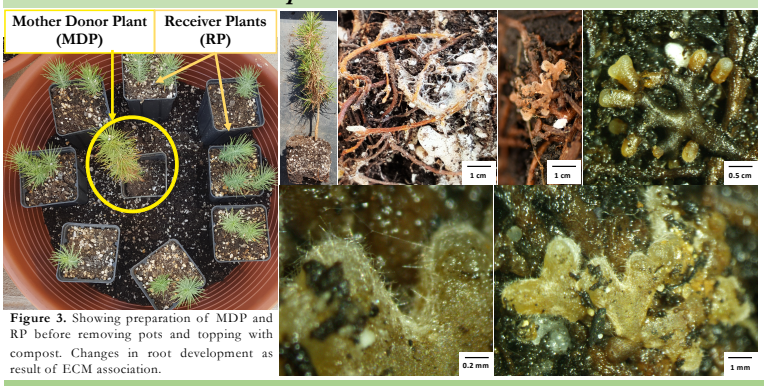

Figure 3. Showing preparation of MDP and RP before removing pots and topping with compost. Changes in root development as result of ECM association.

Quercus ilex and ***Pisolithus arhizus***

Figure 4. Stages of the development of ECM with *Q. ilex* roots and primordia.

Conclusion

All the mycorrhized plantlets produced will be reintroduced next fall into selected area of Natura 2000 sites in the Maltese Islands as part of SiMaSeed restoration project. In the present study ectomycorrhizal fungi (ECM) have been used, however it is nonetheless possible to use indigenous Arbuscular Mycorrhizal Fungi (AMF) as well as other soil born beneficial fungi such as *Trichoderma* spp. in habitat restoration practises.

References

Doyle CAT, Pellow, BJ, Rapmund RA, Ooi MKJ, 2021. Preparing threatened plants for translocation: does home soil addition and nutrient loading improve growth and flowering? Plant Ecol (2021) 222:829–842.
Fenu G, Bacchetta G, Christodoulou CS, Cogoni D, Fournaraki C, Giusso del Galdo GP, Gotsiou P, Kyratzis A, Piazza C, Vicens M, de Montmollin B, 2020. A Common approach to the conservation of threatened island vascular plants: First results in Mediterranean Basin. Diversity 2020, 12, 157.
Mc Naughton SJ, 1989. Ecosystems and conservation in the twenty-first century. In: Western, D., Pearl M. (Eds.), Conservation for the Twenty-first Century. Oxford University Press, New York, pp. 109–120.
Myers N, Mittermeier RA, Mittermeier CG, Fonseca GAB, Kent J, 2000. Biodiversity hotspots for conservation priorities. Nature 2000, 403, 853–858.
Smith SE, Read DJ, 2010. Mycorrhizal symbiosis. Academic press. 800 p.
van der Heijden M, Martin FM, Selosse MA, Sanders IR, 2015. Mycorrhizal ecology and evolution: the past, the present, and the future. New Phytologist 205(4): 1406–1423.

SiMaSeed - Protecting biodiversity in Sicily-Malta Natura2000 sites through Seed Banks and population reinforcement, has a total budget of 1.806.877 € and involves 4 project partners. This project is part financed by the European Union European Regional Development Fund (ERDF), through the INTERREG V-A Italy-Malta Programme. Co-Financing rate 85% EU Funds, 15% National Funds.