European Network for the durable exploitation of crop protection strategies

IA3 Activity: *Human resource exchange*

ENDURE - Internal Mobility

Final activity report

(The form has to be filled in and sent to the activity leader – message should be sent to his p.a. federica.piccolo@ibaf.cnr.it – within 15 days after the end of the visit)

Topic of the visit

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1. Information about researcher and sending partner

Name and surname: Alberto Orgiazzi

Professional status: PhD student

Sending partner: CNR – Consiglio Nazionale delle Ricerche

Institute/Department/Research Unit: IPP – Istituto per la Protezione delle Piante

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Supervisor name*: Valeria Bianciotto

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Supervisor phone number*: +39 011 650 2927 (ext. 51)

*Supervisor information only for PhD student, post-doc and junior researchers

2. Information about hosting partner

Hosting partner: AGROS – Agroscope Swiss Federal Research

Institute/Department/Research Unit: Swiss Federal Research Station Agroscope Reckenholz-Tänikon, Department of Grassland Systems and Arable Farming Systems

Address: Reckenholzstrasse 191, 8046 Zurich

Supervisor name*: Marcel van der Heijden

Supervisor e-mail*: marcel.vanderheijden@art.admin.ch

Supervisor phone number*: +41 44 377 7278

* For senior scientist indicate the name of the collaborating colleague

3. Information about the visit

Starting date: 01/03/2010 **Ending date:** 30/06/2010
(please specify starting date and ending date for EACH period of mobility, add lines if needed)

Total duration *(number of weeks)*: 17 weeks

4. Description of the activities and outcomes

Background and context: *maximum 10 lines*
Arbuscular Mycorrhizal Fungi (AMF) are a group of soil fungi living in symbiosis with plants. As obligate biotrophs, they can be only cultivated together with their host plants. This symbiosis is important for plant health and nutrition. Many studies have investigated the AMF biodiversity through a huge number of different agro- and natural ecosystems using both traditional approach and new high-throughput technology. Even though several AMF assemblages were well characterized using morphological and molecular approaches, little is known about the functioning of these fungal populations. Knowing which AMF species are active and what they do could improve the comprehension of the ecosystem processes and thus the ecosystem functioning. For this purpose it is necessary focusing the analysis on functional genes. This knowledge will allow the development of strategies in order to use AMF as “biofertilizers” in the frame of a more sustainable agriculture with reduced chemical inputs.

Objective: *maximum 10 lines*
In a context of increasing interest on the functional gene identification and expression in AMF assemblages two experiments were set up at Agroscope Research Station. The aim of the first experiment is the identification of new genes expressed in soil by different AM fungal species during the symbiosis process. For this purpose a cDNA library construction

approach will be used. The main objective of the second experiment is assessing whether there is a positive correlation between gene expression in AMF and plant benefits. The expression of some important functional genes of the fungal species *G. intraradices*, inoculated in host-plant species which respond differentially to fungus colonization, will be investigated. The target genes are involved in the three major AM-related element fluxes: those of phosphorus, nitrogen and carbon and play a key-role for plant nutrition.

Activities carried out: *maximum 20 lines*

The study of AMF in semi-natural conditions requires the use of trap culture, in which fungi have to grow at least three-four months to conclude their life cycle (from old spores to new spores). For the first experiment (construction of cDNA libraries) four different AM fungal species were selected on the basis of their phylogeny: *Glomus intraradices* and *Glomus mosseae*, belonging to *Glomerales* order, and *Gigaspora margarita* and *Gigaspora rosea*, belonging to *Diversisporales* order. Spores of the four fungal species were harvested and inoculated in pots filled with a sterilized substrate (soil:sand - 1:1) and sown with the plant species *Trifolium pratense*. Each pot contained a 4x5cm mesh bag, filled with about 40g of the same substrate, which allows the passage of fungal hyphae blocking off plant roots. After three months of growth in greenhouse, plants will be harvested and bags removed from pots and frozen in liquid nitrogen. The substrate inside each bag, where hyphae were growing, will be used to extract fungal mRNA for cDNA library construction.

For the second experiment (gene expression reliance on plant-host response) six different plant species were selected on the basis of their mycorrhizal dependency: *Trifolium pratense* and *Plantago lanceolata* with positive response, *Triticum aestivum* and *Lolium multiflora* with neutral response, *Echinocloa crus-galli* and *Setaria viridis* with negative response. Each of these plant species was planted in presence (AMF) and absence (non-AMF) of the AM fungal species: *G. intraradices* (BEG21 isolate). Each pot contains the same mesh bag used for the first experiment. Two sampling times were decided: 8 and 10 weeks. At those times plants will be harvested and mesh bags collected, frozen and afterward used for RNA extraction. The obtained RNA will be used for real-time PCR assays to assess the expression level of three already described genes involved in the major AM-related element fluxes (P, N and C).

5. Links between visit activity and ENDURE

Describe links and relevance of your visit in relation to a specific ENDURE activity(ies) and sub-activity(ies) – maximum 15 lines

Symbiotic associations between Arbuscular Mycorrhizal Fungi (AMF) and plant roots are widespread in the natural and agricultural environment and can provide a range of benefits to the host plant. For this reason they can be considered as “biofertilizers”. Indeed they improve mineral plant nutrition and resistance to drought and they enhance resistance to soil-borne diseases. The AMF can also be considered as “bioindicators”. Therefore a better understanding of the functional role of AMF communities in agrosystems is essential to understand their ecological function in the ecosystems. All these general aspects of AMF symbiosis are consistent with the objectives of many ENDURE research actions (for example: RA 2.2). In particular, the established experiments can help in developing new tools for the study of AMF biodiversity and functionality.

6. Impact

Added value for the researcher: *maximum 10 lines*

During the period I spent at Agroscope Reckenholz-Tänikon Research Station, I could interact with a research group with lot of experience in the ecological study of arbuscular mycorrhizal fungi. This led me to learn how arranging and setting up a greenhouse experiment with different plant species and AMF inocula in order to analyze the AMF functional activity using a combined approach of ecology and molecular biology. Since my PhD project is focused on the molecular analysis of AMF assemblages in soils subjected to different land-use, the opportunity to understand how working on AMF from an ecological point of view, has represented a great opportunity for me.

Moreover, I held a talk entitled “A metagenomic study to disclose mycorrhizal fungal biodiversity in soil through a land-use gradient: a pyrosequencing approach”, in which I presented the results I obtained during the first year of my PhD.

Added value for sending partner and hosting partner: *maximum 10 lines*

The mobility period offered the opportunity to combine the ecological knowledge of the hosting research group with the molecular skills of the sending group in order to investigate the AM fungal functionality in ecosystems. This combined approach is fundamental in a context of increasing melting of different fields’ science and gives the

chance to share ideas and knowledge improving both the involved partners.

Date of submission 09/06/2010

Dr. Maurizio Sattin
IA3 activity leader

Approved