

Training Workshop on Advanced Techniques in Mycorrhizal Research

21-23 February 2018

TERI Gram, Gual Pahiri, Gurgaon, Haryana

A report

I. BACKGROUND

The Mycorrhiza Network at TERI has been actively involved in development and application of mycorrhizal biofertiliser, technology development and its transfer; and information dissemination activities. The Network is responsible for linking scientists with the latest mycorrhiza information besides helping scientists and students carry out research in the field of Mycorrhiza and in promoting communication among mycorrhizologists. The Centre for Mycorrhizal Culture Collection (CMCC) of the Network provides opportunity to researchers to obtain specific cultures of interest; preserve germplasm available in India and elsewhere; procures strains of both ecto-mycorrhizal (EcM) fungi and arbuscular mycorrhizal (AM) fungi from India and abroad; multiplies and maintains these fungi in pure culture; and provides starter cultures for various research activities. The network publishes a quarterly newsletter "Mycorrhiza News" in order to promote communication among mycorrhiza scientists in India and other countries; and caters to the needs of the mycorrhiza researchers. This Centre is also involved in imparting training to promising youngsters who are interested in Mycorrhizal research. Earlier it has conducted three training programs. As part of the Mycorrhiza Network Programme, TERI has organized a three day training workshop on "Advanced Techniques in Mycorrhizal Research" at TERI Retreat and TERI-Deakin Nano-Biotechnology Centre, TERI Gram, Gual Pahari, Gurugram from 21st-23rd February, 2018. The event was sponsored by the Department of Biotechnology, Government of India, New Delhi.

II. OBJECTIVES

The workshop aimed at imparting hands-on training in research techniques on mycorrhizal research so that the participants can apply them in their research programmes. Therefore, besides demonstrating the techniques, participants were encouraged to learn the techniques and carry out laboratory exercises by themselves. The specific areas included:

- 1) Quantitative and qualitative analyses, Taxonomy, identification criteria (Morphotaxonomy), Molecular tools, viability, Germplasm maintenance, Root colonization, mycorrhizal dependency;
- 2) Work involving selection, culture and inoculation of arbuscular mycorrhizal fungi under nursery and field conditions;
- 3) Demonstration of advanced techniques, involving molecular, biochemical and bioinformatics tools;

- 4) Promoting understanding on the relevance of mycorrhizal research in the Indian context; and
- 5) Field visit and visit to various laboratories.

III. PROGRAMME

The course was essentially practical oriented. Laboratory sessions were supported by lectures and discussions. It included the following,

- a quantitative estimation of AM (arbuscular mycorrhizal) spores from soil, Root colonization
- Image analysis of AM spores
- Assessment of intraradical colonization by AM fungi
- Trap culturing and monosporal culturing for AM
- Morphotaxonomy, Biochemical and molecular characterization of AM fungi and information on Bioinformatics tools associated with Mycorrhizal Research,
- Bio-safety issues
- Impact of IPR (intellectual property right) regimes on agricultural biotechnology issues

In addition, lab tour of TERI-Deakin Nano-Biotechnology Research Centre (TDNBC) was organized along with a visit to other specialized facilities like Centre for Mycorrhizal Culture Collection (CMCC), Biomass Gasifier based Power Generation, etc. provided by TERI at TERI Gram, Gual Pahari, Gurugram..

IV. WORKSHOP SESSIONS

Inaugural session

The Workshop started with opening remarks by Dr Alok Adholeya, Senior Director, Sustainable Agriculture Division, TERI. Dr Adholeya, while setting the theme of the workshop, spoke on the role of mycorrhiza in sustainable agriculture and traced the origin and development of mycorrhizae, followed by the role of TERI in establishing mycorrhizal research network and the Centre for Mycorrhizal Culture Collection and the importance of organizing workshops in order to disseminate the information to a wide range of researchers.

The welcome speech was given by Prof. C Manoharachary, NASI Senior Scientist, Osmania University, followed by the Inaugural address by Dr. T. Madhan Mohan, Adviser, Department of Biotechnology, Govt of India. He stressed the role of mycorrhizal research and its utility as a biofertilizer, and emphasized the need for technological innovations. He has expressed his happiness in TERI for hosting the workshop and said such workshops will bring experts and learners to interact besides honing their hands on skills. In future also such



technical workshops be conducted at International and National level. Further Mr. T. P. Sankar, Fellow, Knowledge Management, TERI, gave a brief introduction about the Mycorrhiza Information Centre, which plays a crucial role in bringing researchers and students from different parts of the world to communicate and access information on mycorrhiza and assists in its progress and development. Following which Dr. Reena Singh, Fellow and Area Convenor, Centre for Mycorrhizal Research, TERI, gave vote of thanks to all the fellow speakers for being a constant source of inspiration and in motivating others to carry on the Mycorrhizal Research forward.

Technical session

DAY 1



Topic: Mycorrhizae : Evolution, Techniques, and Taxonomy – Indian Scenario

Prof. C. Manoharachary, NASI Senior Scientist, Osmania University, Hyderabad elaborated the work done by Indian Mycorrhizologists provided the basic information on identification and taxonomical data which influences the

classification of mycorrhiza was described. Further he also explained the properties and features based on which the fungal classification and methods for their identification are associated. He has presented data on mycorrhizal dependency of crop and forest plants. Methods of inoculation and building of inoculum were also explained. Finally he emphasized on the role of mycorrhizae in the sustenance of Agriculture and Forestry respectively.

Topic: Identification and Multiplication of Ectomycorrhizal Fungi and Inoculum Production

Prof. N. Raaman, UGC-BSR Faculty, Former Director, Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai – 600025. Prof. Raaman, explored the different aspects of mycorrhizal phylogenetics and their identification. He also explained the various techniques through which the ectomycorrhizal community can be multiplied and employed for forest seedling establishments. He has also stressed on carrier materials.





Topic: Modern Tools in Characterisation of Fungi

Dr. Praveen Rahi, National Centre for Microbial Resource, NCCS, Pune. The techniques which can be employed for the characterization of Fungi were explored and molecular techniques and their advantages were described.

Topic: Scope of Patentability and Guidelines for Biotechnological Inventions including Microorganism.

Dr. Anushri Gupta, Founder, Anushri Gupta and Associates, Delhi, explained the intellectual property rights associated with the invention of various microbiological products. She described how these can be explained and used for the advantage of human race. Patenting methodologies, registration and commercialization of the product, etc. were explained.



DAY 2



Topic: Sustainable Crop Production by Mycorrhiza : Journey and Successful Case Studies for Application in Agriculture and Bioremediation.

Dr. Reena Singh, Fellow and Area Convenor, Centre for Mycorrhizal Research, TERI explained the association of mycorrhiza with plants and their subsequent increase in their efficiency which can be employed for the sustainable development and increasing the crop yield. She also spoke on molecular characterization, inoculum production strategies and application of mycorrhizae as

benefactor in agriculture and bioremediation.

Topic: Molecular and Biochemical Characterisation of Fungi

Prof. Rohit Sharma, Curator – Fungi, National Centre for Microbial Resource, NCCS, Pune. The different characteristics which can be used for the characterization and identification of fungi were explained. He also gave a description about the phylogenetic relation among the classes of fungi and their corresponding association.



DAY 3

Topic: Molecular Markers for Identification of AMF.

Dr. Pushpalata Singh, Computational Genomics, TERI. The different molecular markers that are associated with the AMF were explained and subsequent identification techniques were described.



Interactive session



During the three day workshop, the participants interacted with the fellow speakers by raising questions on suitability of mycorrhiza with plants, the suitability of AM fungi for different crops, the role of soil conditions, nutrient status of the soil, the different

perspectives that need to be assessed before the commercial use of mycorrhiza, and effective bio inoculants, purity of inoculum, quality and shelf life of commercialized

mycorrhizal product and on other related issues such as bioinformatics tools used. The experts answered the participants providing them knowledge on the technical aspects.

Practical Session

DAY 1: A tour of the TERI-Deakin NanoBiotechnology Centre was organized and training on various basic laboratory techniques and safety such as washing, sterilizing and culturing was provided to the participants.



DAY 2: A tour of the CMCC (Centre for Mycorrhizal Culture Collection) was done and the various mycorrhizal cultures were explored. The participants were given basic knowledge on the differential aspects of culturing and culture maintenance.



DAY 3: The participants were given some hands on experience on the different techniques and were allowed to explore the same.



Valedictory Session

Dr Reena Singh commenced the session with a welcome note. She summed up the 3-day technical sessions with a high note. Dr Gulshan Wadhwa, Joint Director, Department of Biotechnology, Government of India, in his special address, gave a description about the favorable association of plants and mycorrhizae. He explained the use of mycorrhiza for the benefit of agricultural economy and described the advantages of mycorrhizal research in the sustainable development and progress of agriculture. Mr T.P. Sankar gave vote of thanks and concluded the session.



V. KEY MESSAGES AND RECOMMENDATIONS

The key messages and recommendations that emerged out from the workshop for the participants and policy makers are:

- (i) The current agricultural practices involving the use of chemicals and fertilizers for producing crops are not sustainable as they have residual effect. In some, chemical resistance in crops has been noticed;
- (ii) The chemical fertilizers that are used for agricultural crops are mostly converted into forms that are not available for the plants;
- (iii) The mycorrhizal association with plants increases the absorbing area of the roots 100 to 1000 times which makes the nutrients available in the soil to reach the plants and make them grow efficiently;
- (iv) Mycorrhizae make the unavailable and other tightly bound soil essential nutrients available to the plants thereby facilitate the ability of the plants to utilize soil resources more efficiently;
- (v) Mycorrhizae increase the absorption and translocation of nutrients from soil to plants and they also assist in improving the tolerance of plants towards biotic and abiotic stresses viz high soil temperature, drought, heavy metal toxicity, salinity etc;
- (vi) The mycorrhizal association improves the resistance of plants towards plant pathogens, pests and improves their sustainability, growth and development.
- (vii) They build up macro-porous structure of soil through their extraradical hyphae that allow penetration of water as well as air and prevents erosion. Mycorrhizae are thus a viable alternative to current agro-chemicals and can play a vital role in sustainable agriculture;
- (viii) It has been recommended that such 3 day training workshop on mycorrhiza should be organized by TERI on a regular basis, where researchers can be given

training on different aspects of mycorrhiza research so that they can conduct mycorrhiza research at their respective institutes.

