



2nd BioAsia Mycodipt Workshop

**Role of mycorrhizal fungi in the natural regeneration,
sustainable management and biodiversity of Dipterocarp
forests in South-Est Asia**

Held at Villa Aromatica

Forest Research Institute of Malaysia (FRIM)

Kuala Lumpur, 13 & 15 October 2015



ANNOUNCEMENT

2nd BioAsia Mycodipt Workshop

Role of mycorrhizal fungi in the natural regeneration, sustainable management and biodiversity of Dipterocarp forests in South-Est Asia

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Introduction

A collaborative project involving researchers from the Forest Research and Development Agency (FORDA) of Palembang, Indonesia, the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (DIRAD), France, and the Forest Institute of Malaysia (FRIM), Malaysia, was undertaken between 2011 and 2014 and funded by Bio-Asia under the auspices of the Ministry of Foreign and European Affairs, France.

The project entitled “ Role of mycorrhizal fungi in the natural regeneration, sustainable management and biodiversity of Dipterocarps forests in South-Est Asia “, under the Mycodipt acronym, was conducted with the aim of strengthening scientific collaboration between South-East Asian and French institutions that share similar scientific, educational and development policies through interdisciplinary approaches combining basic and applied research.

The general objectives of this collaborative project are: i) to generate basic knowledge on the diversity, interactions and role of plant-microbe symbioses in the processes of colonization and succession of plant species in natural and disturbed ecosystems, and ii) from this knowledge, to provide new tools and technical methods using microbial symbioses in enrichment programs for reforestation of exploited forests.

Objectives

This workshop has two main objectives where invited speakers will: i) share the results obtained from this project, and ii) share information on the ecology and diversity of dipterocarps and their fungal symbionts, including their threat status, in particular in Malaysia and Indonesia. Workshop participants, including researchers, magister and doctoral students will come from FRIM, UPM (University of Putra Malaysia), FORDA and UGM (Forestry Faculty, University of Gadjah Madah, Yogyakarta, Indonesia).

Scientific Program

Program of Day 1 (Tuesday, October 13)

Venue : Villa Aromatica

Time	Schedule	Speakers
08.30 - 09.00	Registration	Committee
09.00 - 09.15	Organizing committee	Committee
09.15 - 09.30	Welcome and opening ceremony	Dr. Alain RIVAL (CIRAD representative for Insular South-East Asia)
09.30 - 09.45	Interval (tea break)	
09.45 - 10.15	Importance of Dipterocarps in the Malaysian and International wood market	Dr. Jean-Marc RODA (CIRAD, Malaysia)
10.15 - 10.45	Progress in Dipterocarp ectomycorrhizal research	Dr. Su See LEE (FRIM, Malaysia)
10.45 - 11.15	Role of mycorrhizal fungi in the natural regeneration, sustainable management and biodiversity of Dipterocarps forests in South-Est Asia - Contribution of the BioAsia Mycodipt project	Dr. Antoine GALIANA (CIRAD, France)
11.15 - 11.45	Mycorrhizal plant facilitation : a promising key tool for nickel mine site ecological restoration in Madagascar and New Caledonia	Dr. Marc DUCOUSSO (CIRAD, France)
11.45 - 12.15	Diversity of ectomycorrhizas in lowland and mountain forests of south Sumatra	Maliyana ULFA (FORDA/UGM, Indonesia)
12.15 - 12.45	Afforestation of ex-tin mines with Dipterocarps on other tree species in Malaysia	Dr. Lai Hoe ANG (FRIM, Malaysia)
12.45 - 14.00	Interval (lunch and break time)	
14.00 - 14.30	Rehabilitation of BRIS soil using mixed plantations of Acacia-Dipterocarp species	Patahayah MANSOR (FRIM, Malaysia)
14.30 - 15.00	Identification of large litter-colonizing-fungi within a dipterocarp forest and their relation with the hypothesis of ectomycorrhizal niche differentiation	Rimbun CHAIDIR (UPM, Malaysia)

15.00 - 15.30	Host specificity of ectomycorrhizal fungi of three Dipterocarp species	Mohd SALLEH SANUSI (FRIM, Malaysia)
15.30- 16.30	Engaging the participation of the public and institutions for the conservation of Dipterocarpaceae	Pr., Dr. Jean WEBER (UPM, Malaysia)

Program of Day 2 (Thursday, October 15)

Field trip

07.30	Departure from FRIM for Tin Tailing Afforestation Center (TTAC), Bidor (Perak)	Committee
10.00	Arrival at TTAC	
10.15	Briefing on TTAC by the manager, Dr. Lai Hoe Ang	
10.30	Site Visit : - Site 1 : mixed Acacia mangium-Dipterocarps Plot (EU Project) - Site 2 : Multi-species plot	
12.30	Lunch	
14.00	Departure for FRIM	
16.30	Arrival at FRIM and hotel	

ABSTRACTS

2nd BioAsia Mycodipt Workshop

Role of mycorrhizal fungi in the natural regeneration, sustainable management and biodiversity of Dipterocarp forests in South-Est Asia

Kuala Lumpur, 13 & 15 October 2015

Importance of Dipterocarps in the Malaysian and International wood market

Jean-Marc Roda

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Abstract

Malaysia is at the geographical center of the region from where most of the commercial dipterocarps come. The overwhelming majority of traded dipterocarps come from South East Asia, up to Papua New Guinea, and from India and Sri Lanka. From the sixties to nowadays, the world market of tropical timbers has shifted from the North to the South, and so have shifted the markets for dipterocarps. Trade of tropical timber has always been a fraction of the total consumption, with the most of the volumes concerning domestic markets. The case of dipterocarps is not really different, and their major producer and consumer is now Indonesia. Malaysia has always exported a substantial share of its production of timber, and dipterocarps form the bulk of it. Red Meranti, Balau, Kapur, Kerning, Light red Meranti, Seraya etc. form 89% of the log exports from Malaysia, and 87% of the sawn timber exports. In terms of wood volume, all together, and with some variation from year to year, dipterocarps form between 80 to 90% of Malaysian timber products trade. The genera mostly represented are Shorea, Parashorea, Dryobalanops, Dipterocarpus. Asia represents 66% of their markets (mostly China and India), Oceania 5%, Africa 3% and the Western countries represent 26%. In the nineties, most of the South East Asia trade of dipterocarps was heading to Japan. Nowadays, China attracts the major share of the volume. Chinese imports of dipterocarps mostly come from Papua New Guinea, Malaysia, Thailand, Indonesia. India has is becoming the next big market for dipterocarps, with a special interest for “Malaysian Saal” (Shorea spp). The future demand of wood from dipterocarps will not increase in the Western markets, but will continue to increase in Asia, fuelled by the construction demand and the expansion of the middle classes in China, India, and Indonesia.

Role of mycorrhizal fungi in the natural regeneration, sustainable management and biodiversity of Dipterocarps forests in South-Est Asia - Contribution of the BioAsia Mycodipt project

Antoine Galiana⁽¹⁾, Maliyana Ulfa⁽²⁾, Patahayah Mansor⁽³⁾, Christine Le Roux⁽¹⁾, Marc Ducouso⁽¹⁾, Eny Faridah⁽⁴⁾ and Su See Lee⁽³⁾

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⁽⁴⁾ Gadjah Mada University, Laboratory Tree Physiology and Forest Soil, Faculty of Forestry, Universitas Gadjah Mada, Indonesia.

Abstract

The overexploitation of forests in South-East Asia and their replacement by industrial plantations led to their progressive disappearance in lowland and mountain areas in the last decades. Consequently, policies of forest preservation and the implementation of restoration programs have become priorities in view of sustainable production of timber and soil conservation. However, forest regeneration is highly dependent on the presence of their mycorrhizal symbiotic partners in soils. In the framework of the Mycodipt-BioAsia research project funded by the French Ministry of Foreign and European Affairs in a tripartite partnership between FORDA, FRIM and CIRAD, the first objective of our work was to describe the diversity of ectomycorrhizal trees and that of their associated fungi in two natural forests in South-Sumatra.

The Sungai Telang forest site (Muara Bongo District, 01.69635° S; 101.78889° E; alt. 300 m), was chosen as a typical lowland forest dominated by Dipterocarps. The second site, Rimbo Candi (Pagar Alam District, 04.16563° S; 103.19810° E; alt. 1450 m), was chosen as a typical mountain forest dominated by Myrtaceae and Fagaceae species. Systematic forest surveys were performed along appropriate transects in both sites. All the ectomycorrhizal tree species and their individuals observed were identified according to botanical traits. In addition, sapwood samples were collected for further molecular characterization of the different tree species by partial sequencing of the intron region of chloroplast *trnL* gene (*trnL*). Fruit bodies of ectomycorrhizal fungi found in these experimental plots were collected and identified based on morphological traits. In parallel, ectomycorrhizal root tips were collected at the basis of each tree for further molecular characterization of the fungal partner through partial sequencing of rDNA in the ITS region, and that of the associated host plant species through *trnL* sequencing.

A high diversity of ectomycorrhizal tree species was found in both forest types. Twelve different species, mostly *Shorea* spp. were identified from the 2 ha plot in Sungai Telang Dipterocarp forest. The Rimbo Candi mountain forest was dominated by trees of the Myrtaceae, Fagaceae and Lauraceae families represented by species of *Zyzygium*, *Lithocarpus* and *Cinnamomum* respectively. A low diversity of ectomycorrhizal fungi fruiting bodies were observed in lowland Dipterocarp forest contrary to the mountain forest site. The molecular analyzes showed that the mycorrhizal roots of the Dipterocarp forest were predominantly colonized by Thelephoraceae (*Tomentella* and *Thelephora* spp.) and *Russula* spp. although a high diversity of other fungal genera was found.

The understanding of mycorrhizal diversity and its exploitation in the frame of reduced-impact logging strategies is a key element to be considered for sustainable forest management and soil conservation in Southeast Asia.

Mycorrhizal plant facilitation : a promising key tool for nickel mine site ecological restoration in Madagascar and New Caledonia

Marc Ducouso ⁽¹⁾, Charline Henry ⁽²⁾, Anne Houlès ^(1,3), A. Razafimamonjy ⁽⁴⁾, P. Andrianaivomahefa ⁽⁴⁾, Antoine Leveau ⁽³⁾, Laure Hannibal ⁽⁵⁾, Fabian Carriconde ⁽⁶⁾, H. Ramanankierana ⁽⁷⁾, Michel Lebrun ⁽⁸⁾, Marc-André Selosse ⁽⁹⁾ and Philippe Jourand ⁽⁵⁾

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Abstract

Mycorrhizal symbiosis plays a key role in plant growth and development, especially in harsh contexts, where it may intervene in the facilitation process between plants. Madagascar and New Caledonia are considered as hot spot of biodiversity at plant level. Ecological restoration in these unique environments is challenging and facilitation constitutes a promising tool to succeed ecosystem reclamation. As mycorrhizal fungi can be associated with several plant species, one plant can facilitate the establishment of another by providing fungal inoculum in the form of already established and supported mycelia. Such a facilitation implies, however, that plants share a large and frequent portion of their ectomycorrhizal fungal partners. We characterized ectomycorrhizal communities on nickel and cobalt mining sites in Madagascar and New Caledonia to identify facilitator plants usable in ecological restoration technical itineraries. In Madagascar, four ectomycorrhizal tree species: *Asteropeia mcphersonii*, *Leptolaena* sp., *Rhodolaena bakeriana*, *Sarcolaena* sp. and *Uapaca* sp. locally dominate the canopy. In the wild, we demonstrate that these trees share most of their ectomycorrhizal partners, independent of tree age (adult or seedling). Following original ecosystem destruction, the only species spontaneously regenerating is *A. macphersonii*, making this species a candidate for its use as facilitator. In New Caledonia extreme soil constraints (heavy metal toxicities (Ni, Co, Mn, Cr), Ca/Mg unbalance ratio by Mg excess, nutrient (N, P, K) paucity and iron oxides (> 90%) excess), enable only a few planted species to grow after ecosystem destruction. Among them, we demonstrate that *Acacia spirorbis* shares most of its ectomycorrhizal fungal partners with endemic *Tristaniopsis* spp. (Myrtaceae) dominant species in some chaparrals, and it is now tested as facilitator within a set of field trials in the Koniambo massif. We demonstrate that facilitation is promising for successful ecological restoration of mine sites.

Identification of large litter colonizing fungi within a dipterocarp forest and their relation with the hypothesis of ectomycorrhizal niche differentiation

Rimbu Chaidir

Institute of Tropical Forestry and Forest Products (INTROP), University Putra Malaysia (UPM), 43400, Serdang, Selangor, Malaysia

Abstract

In dipterocarp forests, asymmetric feedbacks to ECM seedling regeneration could prevent ECM monodominance if ECM seedlings benefit from ECM fungi having different ecological niche and spatial distribution than ECM fungi associated with ECM canopy trees. Molecular identification of fungi within large patches of litter foraging mycelium occurring within the 50 ha demographic plot of Pasoh Forest in Negeri Sembilan Malaysia revealed the presence of putative ectomycorrhizal fungi. The presence of large zones of foraging ectomycorrhizal fungi capable of higher litter decaying activities as non-foraging EM suggests variations in the needs of hosts photosynthates supply and a possible spatial niche differentiation between different kinds of ectomycorrhizal networks.

Engaging the participation of the public and institutions for the conservation of Dipterocarpaceae

Jean Weber and Siti Khadijah Rambe

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Abstract

Most of the Dipterocarpaceae species that dominated and structured Southeast Asian lowland rainforests are currently endangered. Some short and long-term-economical limitations to classic top-down forest conservation approaches could be diminished or even removed by increasing people awareness of the value of biological diversity and by fostering its participation in effective biodiversity conservation as recommended by the Malaysian national policy on biological diversity and the first Aichi target. The presence of multiples small patches of local forest remaining within the Klang Valley provides unique opportunities for designing urban corridors of Dipterocarpaceae and other local tree species capable to strengthen and to promote existing conservation networks. Preliminary work explores how open-data and participative geographic information systems could support future collaborations between public and institutions within the Klang Valley for an effective conservation and protection of local tree species.