

# Mycorrhizas of trees in the cloud forest of southern Ecuador

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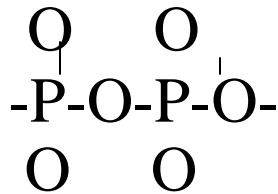
## Mycorrhiza = Symbiosis between root and fungus



- Trees do not have roots - they have mycorrhizas
- The fungi take up the nutrients from soil
- Trees cannot survive without the symbiotic fungi

## Symbiotic fungi improve P-nutrition of trees

- P in forest soil is limited, mostly organically bound
- Fungi can dissolve organic P from soil
- Fungi form polyphosphate chains with high energy bonding
- polyP is stored and transport in the vacuoles of the hyphae



- In the mycorrhiza the root takes P from the fungus
- The fungus obtains glucose from the plant
- The symbiotic interaction works on a low cost low energy level intended for long term sustainability

# **Mycorrhizas of trees are differently organized**

Endomycorrhiza

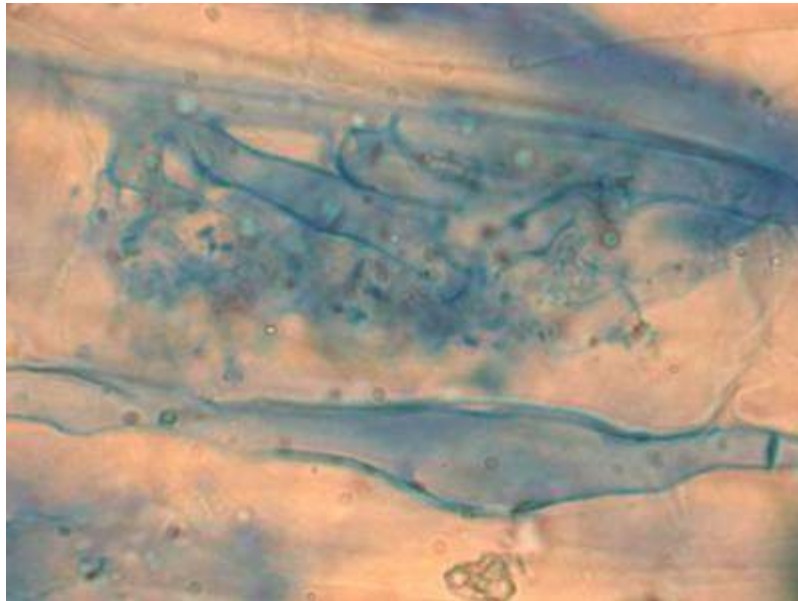
fungus invades root cell  
arbuscules

**AM** arbuscular mycorrhiza

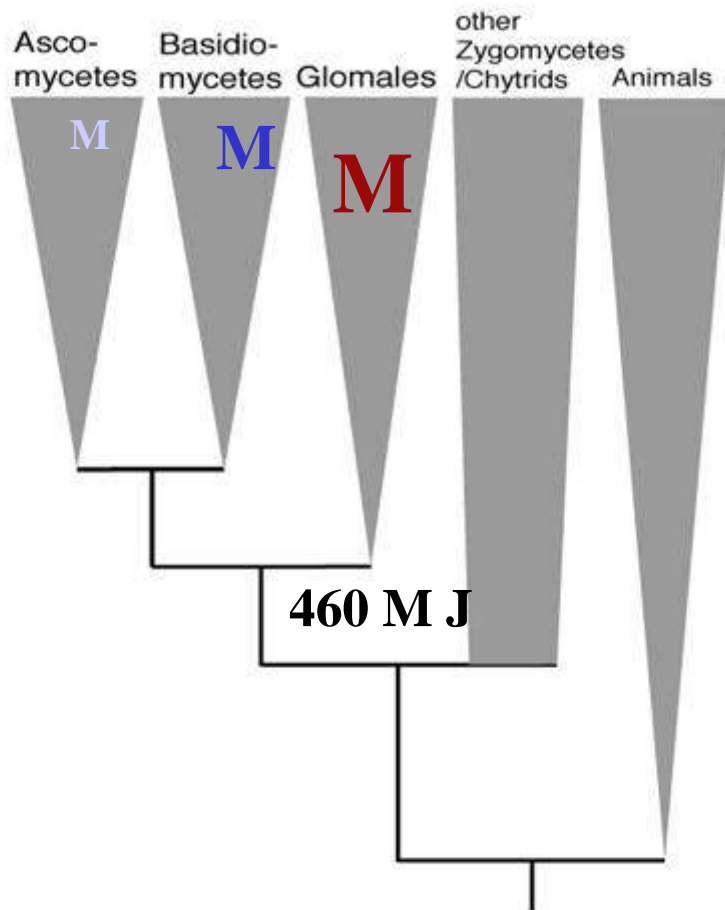
Ectomycorrhiza

fungus covers root cells  
hyphal mantle, Hartig net

**ECM** Ectomycorrhiza



# AM and ECM are formed by different fungi

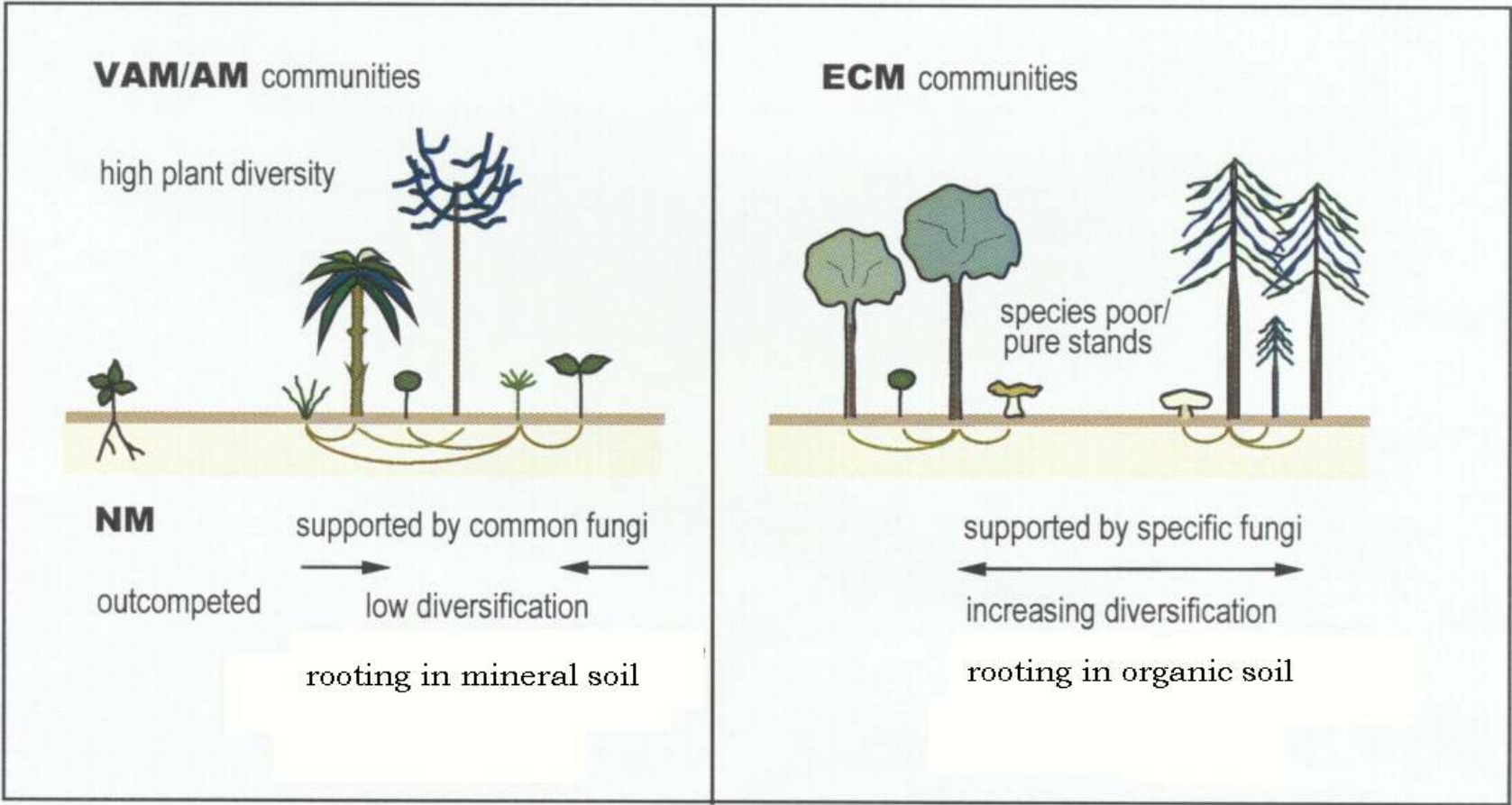


- **Glomales form AM**
- **Ascomycetes and Basidiomycetes form ECM**
- **AM is much older than ECM and much more widespread (80% of land plants)**

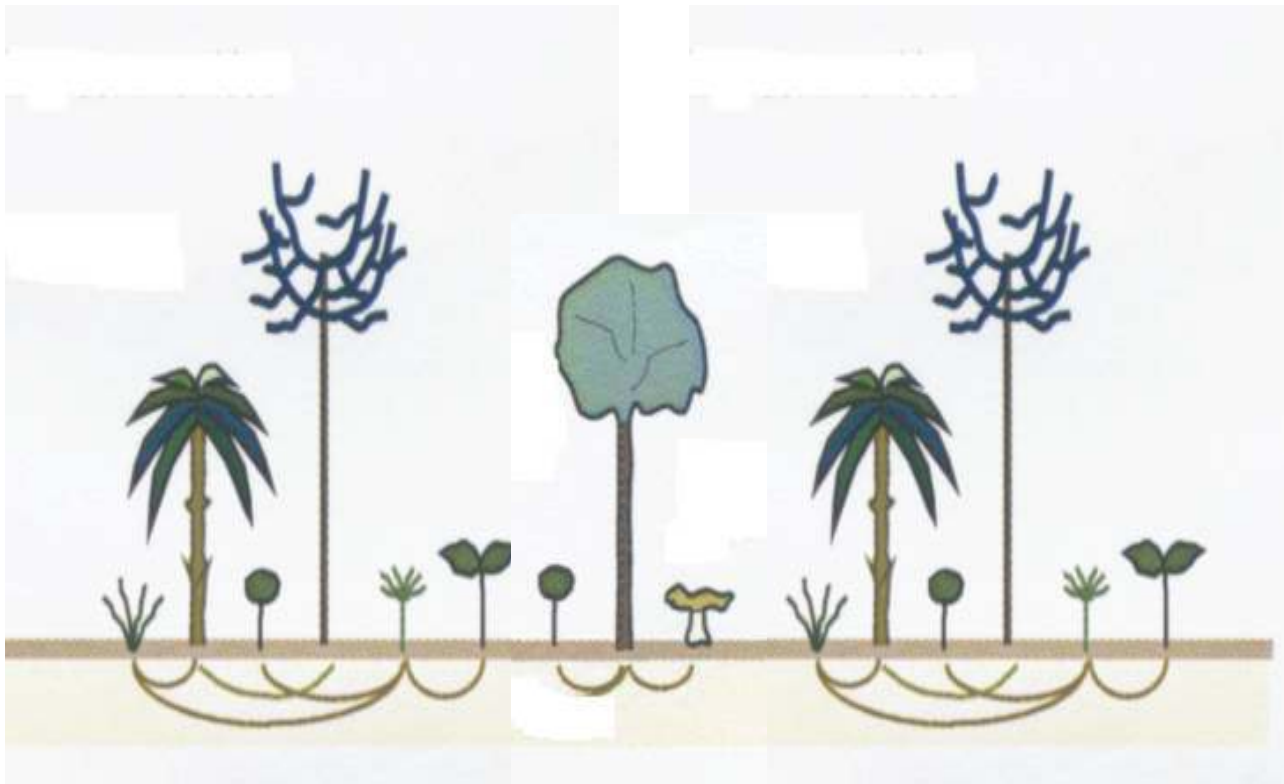


# Significant ecological implications of mycorrhizal types

## successful strategies



**Situation in the cloud forest:  
AM trees mixed with few ECM trees**



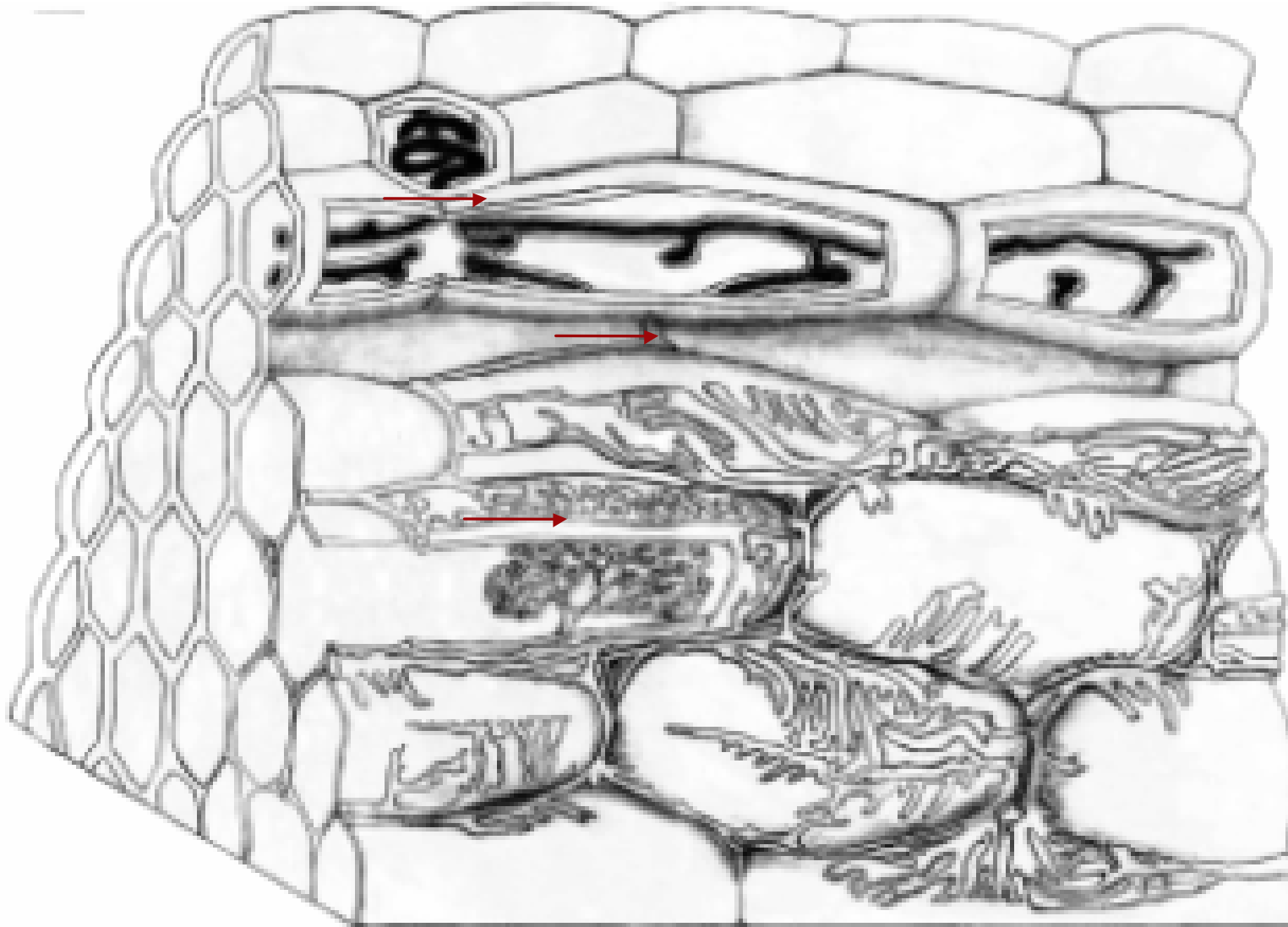
**112 species form  
AM**

**•3 Nyctaginaceae  
form ECM (*Neea*,  
*Guapira*)**

**•1 Melastoma-  
taceae forms AM  
and ECM  
(*Graffenrieda*  
*emarginata*)**

**Investigation of 115 species out of 40 families**

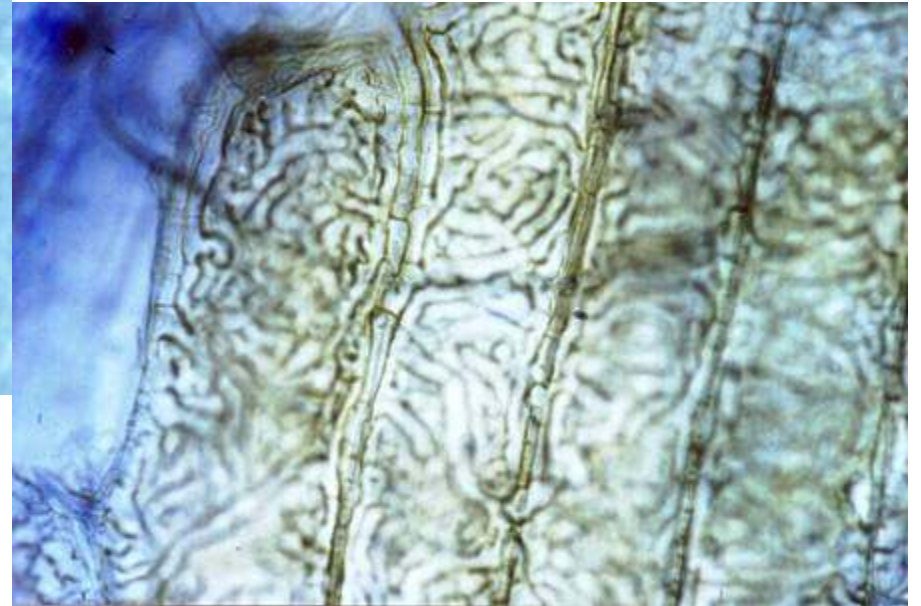
## Ectendomycorrhiza of Glomales in *Alzatea verticillata*



From Adela Beck



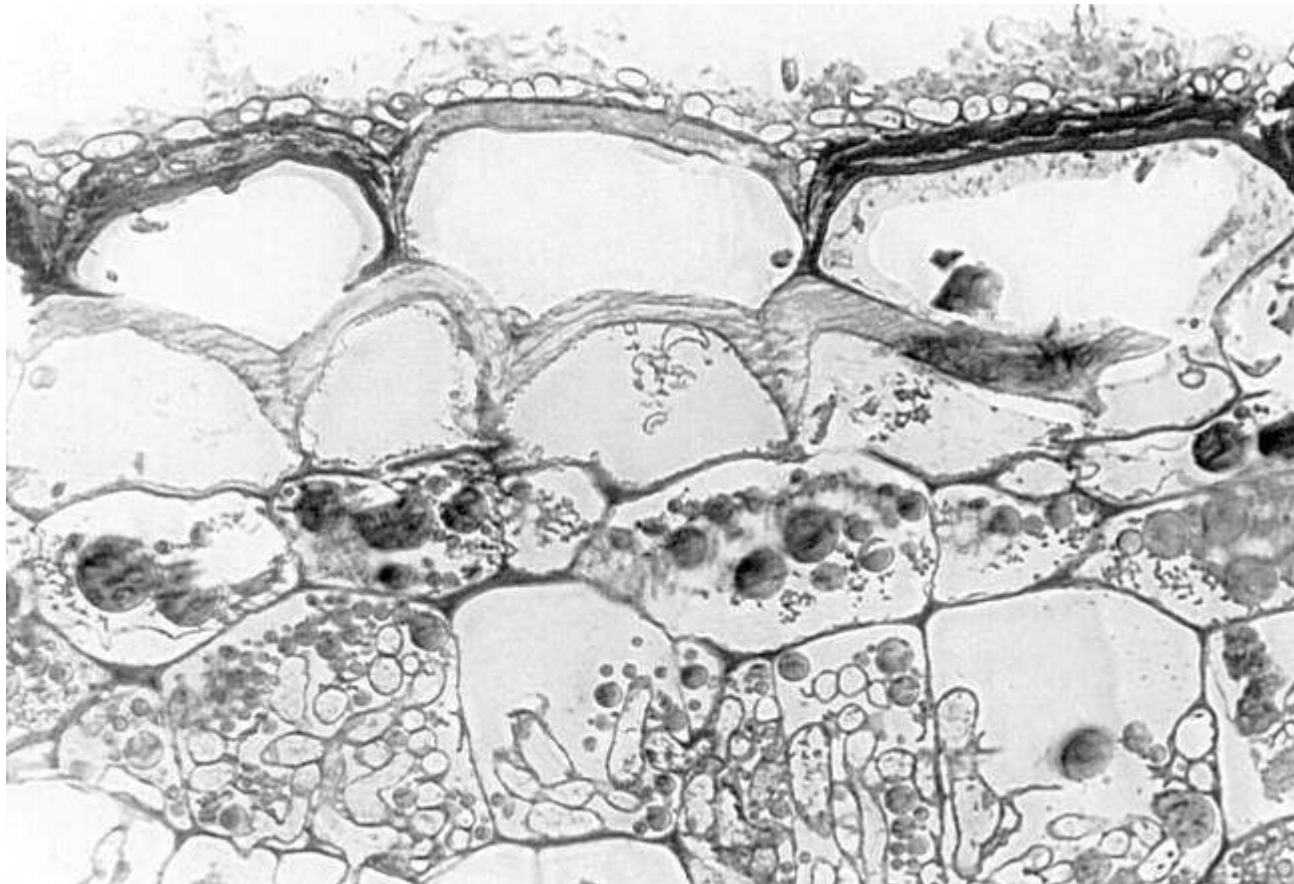
## **Mycorrhiza of *Graffenrieda emarginata***



*Graffenrieda emarginata*

AM with Glomales

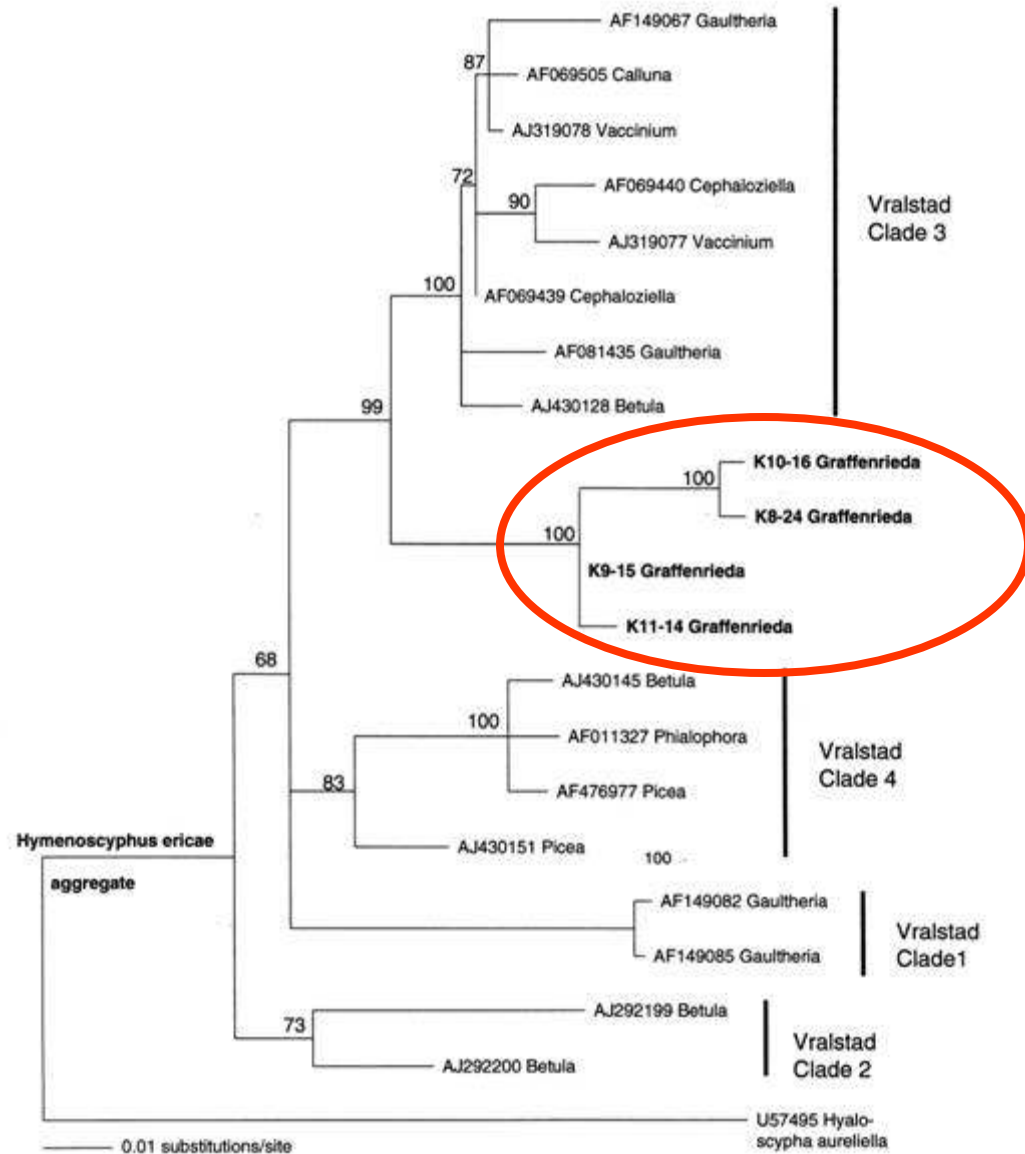
ECM with *Hymenoscyphus graffenriedae* sp. nov.  
(Ascomycete)



# A new fungus

Position  
in the  
*Hymenoscyphus  
ericae* aggregate,  
A symbiont of  
Ericaceae

obtained from ITS  
sequences



***Graffenrieda emarginata* (Melastomataceae)  
only frequent tree on mountain ridge  
between 1900 and 2250 m**

- 



**roots in organic layer**





***Hymenoscyphus ericae* can decompose organic N and improve Fe nutrition of ericaceous plants**

***Hymenoscyphus graffenriedae* is most probably similar**

***Hymenoscyphus graffenriedae* improves the competitiveness of *Graffenrieda emarginata***

**ECM of *Guapira* sp. and *Neea* sp. 1  
(Nyctaginaceae)  
in ravines, on nutrient rich mineral soil**





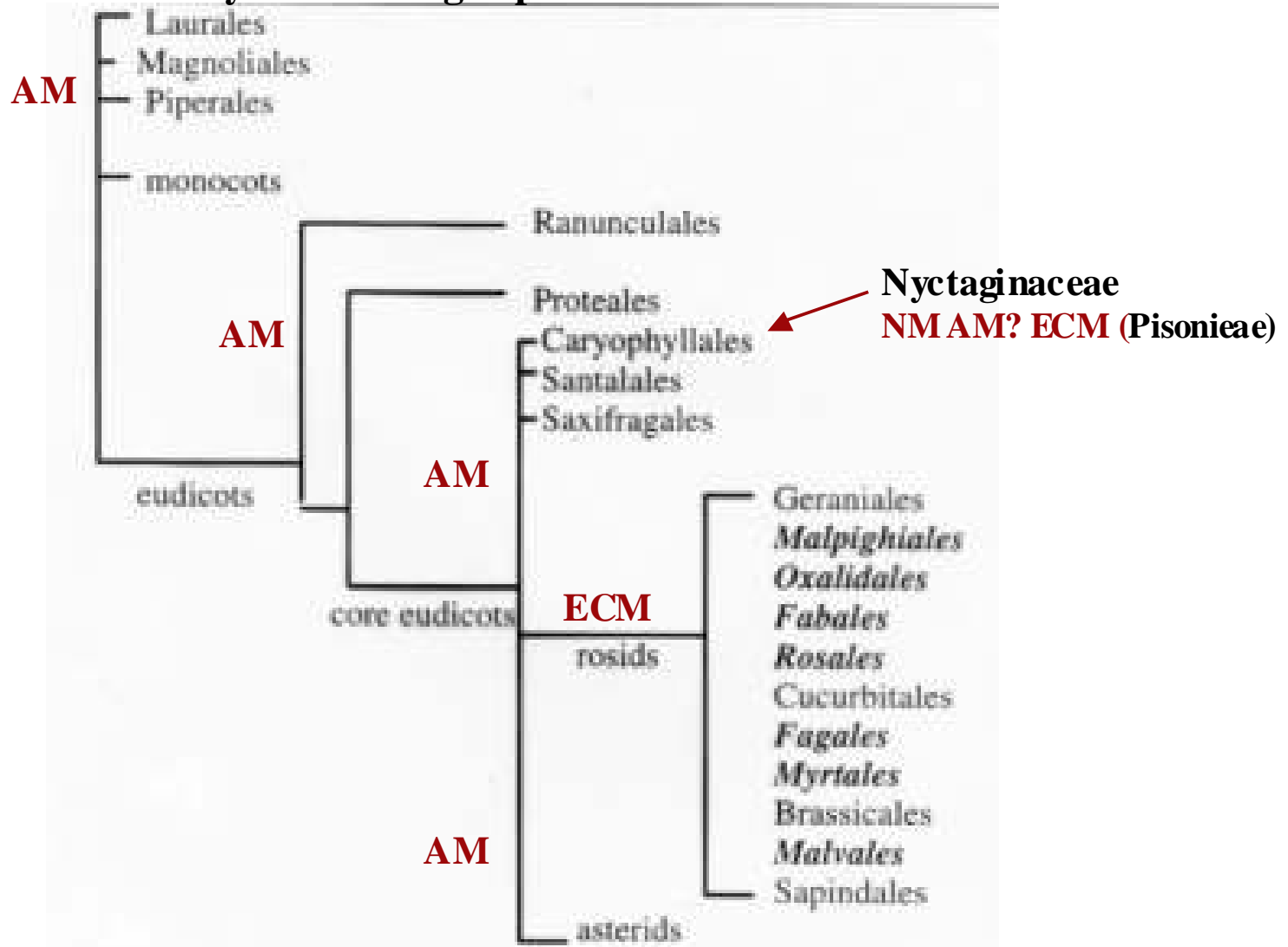
***Neea* sp.2 (Nyctaginaceae)**  
**border of forest, river side, roads**  
**4 different fungi, all roots mycorrhizal**



***Russula* cf. *puigarii***



# System of Angiosperms



- **In the cloud forest of Southern Ecuador historical events of evolution are preserved since million of years**
- **We need to understand them to manage the forest correctly**
- **The cloud forest is a treasure of humanity**
- **- Please let us preserve it**

## **Acknowledgements**

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## Publication of results

- Kottke I, Beck A, Oberwinkler F, Homeier J, Neill D 2004 Arbuscular endomycorrhizas are dominant in the organic soil of a neotropical montane cloud forest. *J. Tropical Ecology* 20: 125-129
- Haug I, Lempe J, Homeier J, Weiß M, Setaro S, Oberwinkler F, Kottke I 2004. *Graffenrieda emarginata* (Melastomataceae) forms mycorrhizas with Glomeromycota and with a member of *Hymenoscyphus ericae* aggr. in the organic soil of a neotropical mountain rain forest. *Can. J. Bot.* 82: 340-356
- Haug I, Homeier J, Oberwinkler F, Kottke I (in press) Russulaceae and Thelephoraceae form ectomycorrhizas with members of the Nyctaginaceae (Caryophyllales) in the tropical mountain rain forest of southern Ecuador. *New Phytologist*
- Beck A, Oberwinkler F, Kottke I (in press) Two members of the Glomeromycota form distinct ectendomycorrhizas with *Alzatea verticillata*, a prominent tree in the mountain rain forest of southern Ecuador. *Mycological Progress* .