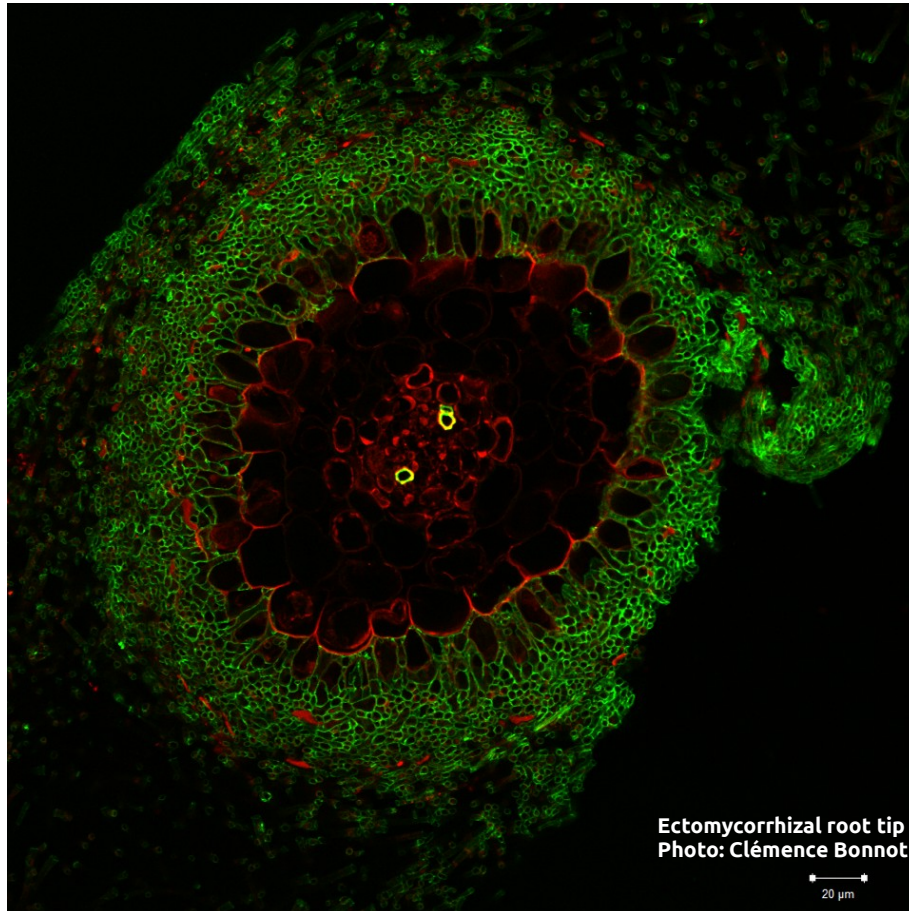




# IMS Newsletter

*The International Mycorrhiza Society quarterly e-newsletter*



## CONTENT:

Editorial & News	2
Top 10 papers	4
Research commentary	5
YouTube interviews	15
Tools	16
Events & Jobs	17

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# Editorial

We are very happy to present you the third newsletter of the International Mycorrhiza Society. The purpose of this newsletter is to provide you with society news and information, and recent research highlights on one of the most ancient and abundant symbiosis on Earth, namely that between plants and mycorrhizal fungi. This symbiosis drives the growth of >90% of all land plants and it plays a key role in driving ecosystem functioning of our planet.

## Society news

We would like to announce that the next International Conference on Mycorrhiza will be held in Beijing, China from 31<sup>st</sup> July 2022 to 4<sup>th</sup> August 2022. Due to COVID-19 we decided to postpone this meeting one year. There are a number of changes to the board of directors. John Klironomos stepped down as president and Marcel van der Heijden is the new president, with Francis Martin acting as vice and past president. We would like to thank John for his excellent and groundbreaking work on mycorrhizas and his large contribution to the mycorrhizal society. We welcome Franck Stefani (Agriculture and Agri-Food, Canada) as the new treasurer of the society and thank him for his willingness to take on this new job. At the last meeting, the board of the directors prepared a diversity and inclusivity statement for the IMS (see below), emphasizing the need to not tolerate any racism in our community and to promote a diverse research community. For further questions or comments, please contact Justine Karst or one of the members of the board of directors.

If you wish to write an article for one of the next issues of this newsletter or you wish to have a more active role within our society, please contact us. We particularly invite contributions that highlight diversity and inclusivity in mycorrhizal research. Please consider sharing your research! If you have ideas for developing the newsletter, please contact us. **Last but not least, please do become member, which strengthens our society and mycorrhizal research.**

## Scientific highlights

This newsletter includes a list of the top 10 mycorrhizal papers that a panel of experts have selected from over 151 papers across different disciplines, published between May and August, 2020. We congratulate Nadia Soudzilovskaia and co-authors with the first rank and the publication of a global database (FungalRoot) which summarizes publicly available data about vascular plant mycorrhizal type and intensity of root colonization by mycorrhizal fungi, including 36,303 species-by-site observations for 14,870 plant species (*New Phytol* 227: 955-966; <https://doi.org/10.1111/nph.16569>). A short article in this newsletter by Nadia and a YouTube interview on this database provide further information. Other scientific highlights of the last four months include a paper by Jason Hoeksema and co-authors on ectomycorrhizal plant-fungal co-invasions (*Front For Glob Change* 3: 84; <https://doi.org/10.3389/ffgc.2020.00084>), and a paper by Bala Chaudhary and co-authors on the morphological functional traits that determine the aerial

dispersion of arbuscular mycorrhizal fungi (*New Phytol* 228: 238-252; <https://doi.org/10.1111/nph.16667>). In addition, this newsletter provides research commentaries on recently published papers including a commentary by César Marin and Marcel van der Heijden on global soil biodiversity, mycorrhizas, and ecosystem functioning and an article by Minxia Liang and Xubing Liu discussing the importance of fungal networks for tree fitness (also in our top 10). Please also have a look at the YouTube video interviews of recent highlights and papers on the effects of forests disturbance on soil fungal communities (Rodriguez-Ramos *et al. New Phytol*; <https://doi.org/10.1111/nph.16749>), and on the nuclear dynamics of arbuscular mycorrhizal fungi (Kokkoris *et al. Trends Plant Sci* 25: 765-778; <https://doi.org/10.1016/j.tplants.2020.05.002>).

### **Diversity and Inclusivity Statement**

Recent events around the globe have underscored our need to address systemic racism. Racism has tragic consequences for communities. We are saddened that within our own mycorrhizal research community, bright and curious minds likely have been lost owing to barriers created by racism. We do not want to lose more. The IMS strives to elevate and amplify voices from under-represented groups so that they know that their contributions are valued and respected. Towards our goal, we have several new and existing initiatives we highlight below.

1. We have posted a 'Diversity and Inclusivity Statement for the IMS' on the IMS website (<http://mycorrhizas.org/home/about-us/code-of-conduct/>). In this Statement we

affirm our commitment to promoting a culture of equity, diversity, and inclusivity. We also present our new Code of Conduct that members of IMS will be expected to abide. Please review these documents as they outline unacceptable behaviors including harassment in any form.

2. As funds allow, we will continue to offer scholarships to students from under-represented groups wanting to attend ICOM.

3. We will continue to consider proposals for symposia at ICOM in light of our Diversity and Inclusivity Statement. We look for broad representation across countries and gender in the composition of participants. The Board of Directors is responsible for ensuring these targets are met.

4. We also have clarified protocols for nominating candidates (including self nominations) for the Executive and Board of Directors of the IMS.

Thank you for working with us to empower our community to be a positive change in the world. Please let us know if you see opportunities to promote equity, diversity, and inclusivity in the IMS and at ICOM. In the next editorial we will consider the topic of careers in research and what we think is important for a career in mycorrhizal research and science in general.

Marcel van der Heijden, President  
Francis Martin, Vice & Past-President  
Ian Dickie, Director  
Liang-Dong Guo, Director  
Justine Karst, Director  
Jonathan Plett, Director  
Miranda Hart, Director

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## Top 10 papers on mycorrhizal research\*

1. Soudzilovskaia NA, Vaessen S, Barcelo M, *et al.* 2020. FungalRoot: global online database of plant mycorrhizal associations. *New Phytol* 227: 955-966. <https://doi.org/10.1111/nph.16569>
2. Liang M, Johnson D, Burslem DFRP, *et al.* 2020. Soil fungal networks maintain local dominance of ectomycorrhizal trees. *Nat Commun* 11: 2636. <https://doi.org/10.1038/s41467-020-16507-y>
3. Hoeksema J, Averill C, Bhatnagar JM, *et al.* 2020. Ectomycorrhizal plant-fungal co-invasions as natural experiments for connecting plant and fungal traits to their ecosystem consequences. *Front For Glob Change* 3: 84. <https://doi.org/10.3389/ffgc.2020.00084>
4. Chaudhary VB, Nolimal S, Sosa-Hernández MA, *et al.* 2020. Trait-based aerial dispersal of arbuscular mycorrhizal fungi. *New Phytol* 228: 238-252. <https://doi.org/10.1111/nph.16667>
5. Kokkoris V, Stefani F, Dalpé Y, *et al.* 2020. Nuclear Dynamics in the Arbuscular Mycorrhizal Fungi. *Trends Plant Sci* 25: 765-778. <https://doi.org/10.1016/j.tplants.2020.05.002>
6. Vlk L, Tedersoo L, Antl T, *et al.* 2020. Alien ectomycorrhizal plants differ in their ability to interact with co-introduced and native ectomycorrhizal fungi in novel sites. *ISME J* 14: 2336-2346. <https://doi.org/10.1038/s41396-020-0692-5>
7. Policelli N, Horton TR, Hudon AT, *et al.* 2020. Back to roots: the role of ectomycorrhizal fungi in boreal and temperate forest restoration. *Front For Glob Change* 3: 97. <https://doi.org/10.3389/ffgc.2020.00097>
8. Zhou Z, Wang C, Luo Y. 2020. Meta-analysis of the impacts of global change factors on soil microbial diversity and functionality. *Nat Commun* 11: 3072. <https://doi.org/10.1038/s41467-020-16881-7>
9. Vetrovsky T, Morais D, Kohout P, *et al.* 2020. GlobalFungi: Global database of fungal records from high-throughput-sequencing metabarcoding studies. *Sci Data* 7: 228. <https://doi.org/10.1038/s41597-020-0567-7>
10. Grünfeld L, Wulf M, Rillig MC, *et al.* 2020. Neighbours of arbuscular-mycorrhiza associating trees are colonized more extensively by arbuscular mycorrhizal fungi than their conspecifics in ectomycorrhiza dominated stands. *New Phytol* 227: 10-13. <https://doi.org/10.1111/nph.16377>

\*Selected from 151 Web of Science articles published between May – August, 2020 by: Justine Karst, Jonathan Plett, Melanie Jones, Marcel van der Heijden, Francis Martin, Jan Jansa, John Klironomos, Liang-Dong Guo, Jason Hoeksema, Judith Lundberg-Felten, and César Marín.



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## Research commentary

### FungalRoot – a new comprehensive database of field and lab-based evidence for plant mycorrhizal association types and associated metadata

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The mycorrhizal symbiosis shapes plant and soil biotic communities and drives biogeochemical cycling around the world. The importance of mycorrhizal associations for functioning of terrestrial ecosystems is increasingly recognized. Mycorrhizas shape plant community diversity and composition, mediate plant seedling establishment, and impact carbon and nutrient flow between plants and soil (Phillips *et al.* 2013; Teste *et al.* 2017; van der Heijden *et al.* 2015; Tedersoo *et al.* 2020). Yet, there are many questions that remain to be answered: what are the exact mechanisms of mycorrhizal effects on ecosystem functioning? How did mycorrhizas evolve and how did they shape plant evolution? What are the environmental drivers of geographical distribution of mycorrhizal associations?

Besides, differing in types of mycorrhizal colonization, plants also differ in the intensity of root colonization by mycorrhizal fungi. This trait provides insights into the level of intimacy closeness of the plant-fungal relation, which is potentially associated with the effectiveness of plant nutrition (Treseder 2013), and with carbon budget of the mycorrhizal fungi (Soudzilovskaia *et al.* 2015). Yet, the intriguing questions 1) what is the variation among vascular plant species in the type and intensity of

mycorrhizal colonization? and 2) what does this variation mean for terrestrial ecosystems? remain to be answered.

Addressing all these questions requires the use of correct and exhaustive data about type and intensity of mycorrhizal associations with vascular plant species. However, this information is unknown for the great majority of vascular plants and, when available, till now was scattered in multiple narrow-focused data sets, most of which cover specific Earth regions or mycorrhizal types.

In April 2019 we have released a huge database, FungalRoot, that contains data about the type and intensity of mycorrhizal colonization of vascular plants. The database is presented in *New Phytologist* (Soudzilovskaia *et al.* 2020), and is available at the **GBIF** and **PlutoF** platforms, upon citing the original publication. The new database is the largest and most exhaustive compilation of published data on plant mycorrhizal colonization. It contains 36,303 observations for 14,870 plant species, tripling the previously available amount of data about mycorrhizal types of individual plant species. It is tenfold increasing previously available data about intensity of mycorrhizal colonization of individual species. Additionally the database environment

(a) Arbuscular mycorrhizal colonization



(b) Ectomycorrhizal colonization



(c) Ericoid mycorrhizal colonization



(d) Nonmycorrhizal plants



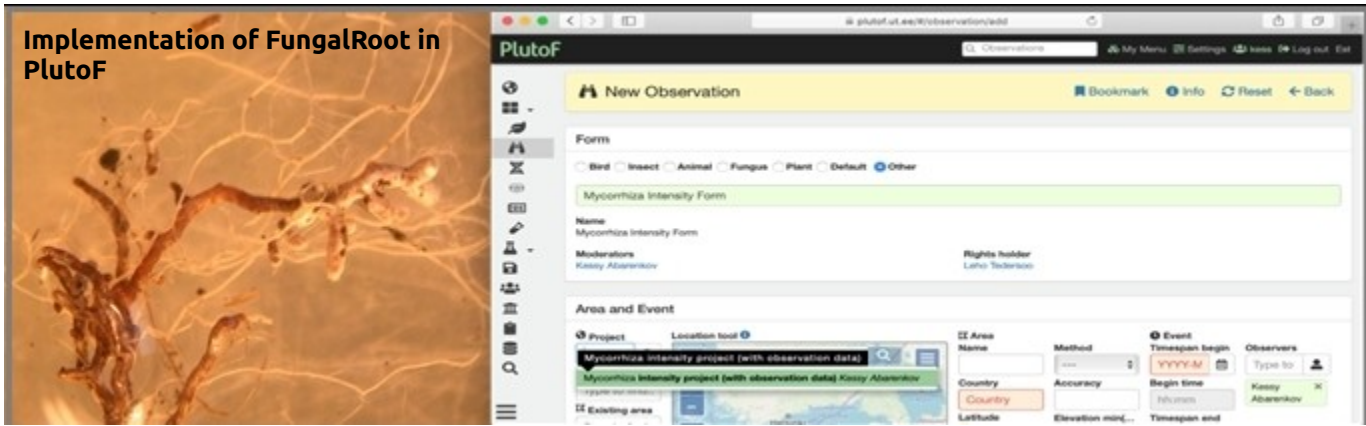
Georeferenced records included in the FungalRoot database. Figure (1) taken from Soudzilovskaia *et al.* 2020.

enables a discussion platform on the correctness of mycorrhizal types assignments, an issue heavily affected by variation in formal definitions of mycorrhizal types, and being a hot topic of scientific debates of the recent years (Bueno *et al.* 2019; Tedersoo *et al.* 2019; Brundrett and Tedersoo 2020).

Beyond the baseline information about plant species' mycorrhizal types and colonization intensity, our database contains rich metadata about geographical locations, soil conditions, and host plants, allowing a detailed ecological analyses of the role of mycorrhizal associations in the functioning of terrestrial ecosystems. The first examples of such analysis are the two recently published papers examining the global distribution of mycorrhizal plants (Gomes *et al.* 2019a; Soudzilovskaia *et al.* 2019), and the environmental drivers (Barceló *et al.*

2019; Gomes *et al.* 2019b) of this distribution.

While our database covers the wealth of published data about type and intensity of root colonization of mycorrhizal plants, it lacks the data for many vascular plants that have not been yet investigated. Additionally, the correctness of mycorrhizal type assignments of vascular plants remains a hot topic in scientific debates. Therefore, we have shaped our database as an open platform allowing additions of new records and comments about mycorrhizal plant assignments. We kindly invite colleagues working the fascinating topic of mycorrhiza to actively collaborate on further enlarging and the data and making in as accurate as possible.



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# Global soil biodiversity, ecosystem multifunctionality, and the mycorrhizal symbiosis

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Soil ecological research is gaining a lot of attention and major discoveries have been made in recent years. Large-scale collaborations among scientists untapped the hidden world below our feet at a global scale, and studies describing the global distribution of soil bacteria (Bahram *et al.* 2018; Delgado-Baquerizo *et al.* 2018), soil fungi (Tedersoo *et al.* 2014), arbuscular mycorrhizal fungi (AMF; Davison *et al.* 2015), earthworms (Philipps *et al.* 2019), and protists (Olieverio *et al.* 2020) have appeared. For instance, Delgado-Baquerizo *et al.* (2020) recently elucidated that climate (aridity and mean annual temperature), plant richness/cover, soil pH, and carbon and soil clay content, were the main factors explaining global soil biodiversity. In turn, global soil biodiversity altogether with soil carbon content, explained ecosystem multifunctionality.

Mycorrhizal research is at the forefront of this development. Mycorrhizal fungi play a pivotal role in the soil food web (Soudzilovskaia *et al.* 2019; Steidinger *et al.* 2019; Tedersoo *et al.* 2020) and drive key ecosystem functions including nutrient uptake, soil structure formation, and plant productivity. Thus it is important to assess their global distribution and how they affect plant growth and ecosystem functioning. Davison *et al.* (2015) and Steidinger *et al.* (2019) for instance demonstrated that

AMF and AMF-associated plant diversity peaks in the tropics, respectively, while ectomycorrhizal fungi (EMF) and EMF-associated plants are more diverse in temperate/boreal ecosystems (Tedersoo *et al.* 2014). Plant diversity is usually related with soil fungal diversity, except for EMF (Tedersoo *et al.* 2014). Moreover, Steidinger *et al.* (2019) showed that a small number of climatic variables related to decomposition control the transition between EMF to AMF-dominated forests. Several meta-analyses have addressed the global distribution of mycorrhizal hosts (Soudzilovskaia *et al.* 2017) and the climatic drivers of their distribution (Barceló *et al.* 2019). In particular, Barceló *et al.* (2019) found that among 39 climatic and edaphic variables, temperature-related variables were the main predictors of mycorrhizal host's distribution: AMF-associated plants are favoured by warm climates, while EMF-associated plants are favoured by colder climates.

A next major frontier is how to assess whether there is a causal link between soil biodiversity (including mycorrhizal diversity) and ecosystem functions and/or services at the field scale (Wagg *et al.* 2014; Crowther *et al.* 2019; Delgado-Baquerizo *et al.* 2020; Zhou *et al.* 2020). In particular, it is important to experimentally test whether the observed patterns and correlations have





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In ecological research it is a key goal to link belowground biodiversity to aboveground processes at a local and a global scale.

functional implications. In other words, does an increase in soil biodiversity or mycorrhizal diversity at a particular site results in increased ecosystem functioning? Although major breakthroughs have been made, soil ecological research is still in need of integration, as a recent meta-analysis of soil macroecological studies found that only at 0.3% of a total of 17,186 sampling sites across the globe, soil biodiversity and ecosystem functions were jointly investigated (Guerra *et al.* 2020). Furthermore, temporal variation on this relationship has not been explored. A meta-analysis of global datasets by Graham *et al.* (2016) observed that the explanatory power of models predicting processes associated with carbon and nitrogen cycling, increases significantly when adding measurements of soil microbial

functional diversity and community structure, pointing to the relevance of this research.

To establish causal relationships between soil microbial communities and functions, it is not only important to understand the biogeographical mechanisms governing these communities (Xu *et al.* 2020), but also to properly select which community characteristics to use (Hall *et al.* 2018). In other words, although correlational approaches (Le Bagousse-Pinguet *et al.* 2019) that relate different biodiversity measurements (ie. functional, phylogenetic, and taxonomic) to ecosystem functions help to gain insights into this relationship, the selection of community characteristics should be causally orientated (Hall *et al.* 2018). In this sense, Hall *et al.* (2018) proposes three categories of microbial communities characteristics: microbial processes (ie. nitrogen fixation, denitrification, nitrification), microbial community properties (ie. emergent properties as biomass C:N ratio, or community-aggregated traits as functional gene abundance, functional diversity overall), and microbial membership (ie. taxonomic and phylogenetic diversity, community structure, co-occurrence networks). In this approach (Hall *et al.* 2018), microbial processes would more directly affect a nutrient pool or flux, while the effect of community properties and microbial membership is more indirect, mediated by their concatenate effect on microbial processes. For instance, Wagg *et al.* (2019) observed that microbiome network complexity and mycorrhizal abundance best explained ecosystem multifunctionality in experimental grassland microcosms.

The stimulation of plant growth constitutes is one of the main ecosystem functions provided by mycorrhizal fungi. The effects of mycorrhizal fungi on the growth of a wide range of plant species is summarized in a global database called MycoDB (Chaudhary *et al.* 2016). Moreover, at a global scale, Delgado-Baquerizo *et al.* (2020) found significant correlations between the abundance of mycorrhizal fungi and P mineralization, soil respiration, available N, and reduction of antibiotic resistance genes. Other important mycorrhizal ecosystem functions, such as pathogen defense, metal alleviation, among others, have barely been explored at a global scale. Similarly, and as mentioned before, decomposition and the presence of AMF and EMF are strongly related at a global scale (Steidinger *et al.* 2019). Several local and regional studies have elucidated the relationships between mycorrhizal fungi and microbial processes as biogenic weathering (Koele *et al.* 2014), and different fluxes of the nitrogen cycle (Veresoglou *et al.* 2012), but global explorations are needed.

Trait-based approaches have also been used to explore the relationship between mycorrhizal fungi and ecosystem functions (Wurzburger and Clemmensen 2018). For example, Chen *et al.* (2018) suggested to use mycorrhizal traits such as hyphal exploration distance, hyphal turnover, and hyphal uptake capacity and efficiency as good functional traits that influence nutrient foraging. These and related traits have been proven difficult to assess and have been analyzed in few species. Given these difficulties, for capturing AMF functional diversity other authors propose the use of AMF N:P stoichiometry (Powell and Rillig 2018), or the association of a particular taxa to

the availability of a given nutrient (ie. nitrogen; Treseder *et al.* 2018). The increasing effort to analyze and include functional mycorrhizal measurements (also including functional genes, enzymes, fatty acids, nutrient consumption profiles, etc), shows the importance of trait-based approaches when talking about mycorrhizal diversity and ecosystem functions.

A number of major questions still need to be addressed, including:

- In which ecosystem(s) mycorrhizas are most important, and specifically which ecosystem functions are provided by the different mycorrhizal types?
- Is the relationship between soil biodiversity and ecosystem functions different in vegetation types dominated by ecto, orchid, ericoid, or arbuscular mycorrhizal fungi (and without mycorrhizas)?
- How to relate different mycorrhizal traits (ie. type, status, functional gene reservoir and diversity, flexibility, dependency, etc) with different ecosystem functions?
- How do mycorrhizas interact with other soil organisms (bacteria, protists, small invertebrates) and how does this interaction influences ecosystem functioning and multifunctionality?

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## Consequences of soil fungal networks for tree seedling fitness

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High diversity is a striking feature of almost all tropical forests, which provides numerous ecosystem functions, and contributes to both the resistance and the resilience of communities in response to global change. Several mechanisms have been proposed to explain the origin and maintenance of tropical forest diversity; among them the 'Janzen-Connell' effect, which is mainly mediated by soil pathogens, and is widely proved to be one of the main contributors to tropical plant diversity and coexistence. While there is clear evidence for pathogen-mediated density-dependence, the effects of mycorrhizal fungi on seedling fitness has been largely overlooked.

The negative density-dependent effect describes a process of self-limitation: higher densities of conspecific trees lead to higher aggregation of fungal pathogens suppressing further establishment of their own offspring. Although this process could promote local species coexistence and diversity, it still seems very confusing why adult trees lead to negative effects rather than positive parental care on conspecific seedlings. Patterns of parental care are widespread and highly diverse across the animal kingdom, but rarely investigated for plants. A critical mechanism by which new recruits could benefit from mother trees is through integration into "common mycorrhizal networks" (Selosse *et al.* 2006); such networks are formed when the

mycelium of an individual mycorrhizal fungus connects multiple plants simultaneously. In several ecosystems these networks have been shown to have key roles in nutrient transport, seedling establishment, and inter-plant signaling. However, how these mutualistic relationships contribute to stabilizing mechanisms has not been addressed in classical coexistence frameworks (Tedersoo *et al.* 2020).

Many tropical and subtropical forests are dominated by a small number of ectomycorrhizal (ECM) tree species from just a few plant families, representing most of the canopy individuals. In such forests there are also a high diversity of understory arbuscular mycorrhizal (AM) tree species from a greater number of families. However, the mechanisms that maintain differential abundance and diversity patterns between ECM and AM species remain poorly understood (Peh *et al.* 2011). In a previous study, we demonstrated how the formation of different mycorrhizal types mediates phosphorus resource partitioning among tropical and subtropical tree species (Liu *et al.* 2018). Recently, we experimentally tested the specific role of common mycorrhizal networks in regulating plant-soil feedbacks, and quantified how access to these networks affects growth, survival, and pathogen loads of seedlings in patches of subtropical forests dominated by adult trees that associate with either ECM or AM fungi (Liang *et al.* 2020). We revealed the





*Amanita heishidingensis*  
Southern China  
Photo: Dr. Fang Li

*Pulveroboletus sinensis*  
Southern China  
Photo: Dr. Fang Li

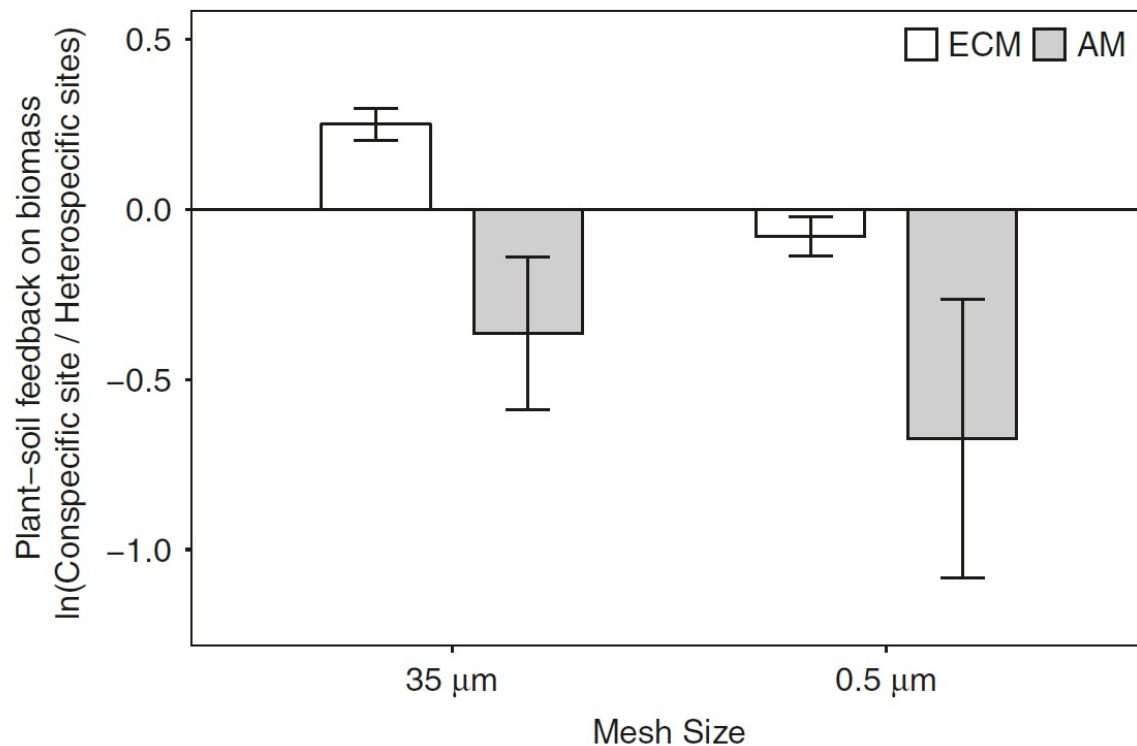
Two endemic ectomycorrhizal fungi at Heishiding Nature Reserve. These fungi are closely associated with and maintain local dominance of Fagaceae trees, through underground fungal networks.

critical role of underground fungal networks (the “wood-wide web”) in facilitating seedling growth and fitness, which consequently promotes tree species diversity and community structure in subtropical forests (Liang *et al.* 2020).

This research was conducted at the Heishiding Nature Reserve in southern China, and reports findings from experiments undertaken at large temporal and spatial scales, in hyper-diverse forests of significant ecological, conservation, and economic importance. We integrated a long-term field investigation on seedling dynamics, including censusing 17,824 individual seedlings over ten years within 1200 1-m<sup>2</sup> quadrats in the field. These surveys showed that survival of AM seedlings over ten years was negatively related to the density of surrounding conspecific plants, whereas the opposite was seen

for ECM seedlings.

We also conducted two hyphal-exclusion experiments to test how connection to fungal networks beneath adult trees influences the direction and strength of plant-soil feedbacks. Connection to fungal networks was manipulated using mesh-walled in-growth cores possessing 35  $\mu\text{m}$  (which prevents access to roots but not mycorrhizal hyphae) or 0.5  $\mu\text{m}$  (which excludes both) nylon mesh on the bottom and covering windows along the sides. We found that the survival and growth of ECM plants, which become canopy-dominants in these forests, increased markedly when plants could connect to fungal networks associated with neighbouring adult trees. Surprisingly, fungal networks did not affect AM seedling fitness; these species are usually restricted to the understory. This striking difference between species possessing different mycorrhizal types



**Effects of mycorrhizal hyphal connections on seedling growth for ECM and AM tree species.**

provides a mechanistic explanation for the local dominance of ECM trees in hyper-diverse subtropical and tropical forests. Moreover, in our study the lack of any apparent effect of AM fungal networks on seedling growth challenges the emerging popular, cooperative view that adult trees, regardless of mycorrhizal type, use fungal networks to support neighbouring seedlings.

The complementary molecular, manipulative, and census-based experiments provide confidence that the patterns observed in our data are broadly applicable. These findings therefore make a step-change in our understanding of the processes regulating species coexistence and dominance in tropical and subtropical forests, and emphasize the critical role of mutualistic fungal networks and pathogenic fungi in these processes. Our data show that fungal networks and interactions with pathogens are a critical

factor explaining global patterns of ECM and AM forest trees (Steidinger *et al.* 2019).

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## YouTube interviews\*

### - Jean Carlos Rodriguez-Ramos on the effect of disturbance in boreal forests

Camille Truong interviews Jean Carlos Rodriguez-Ramos, a PhD student at the University of Alberta, about his work on soil fungal communities affected by different disturbance types in boreal forest soils.

Interview: <https://southmycorrhizas.org/reading/july-2020/>

Study: Rodriguez-Ramos JC, Cale JA, Cahill Jr JF, *et al.* 2020. Changes in soil fungal community composition depend on functional group and forest disturbance type. *New Phytol.* <https://doi.org/10.1111/nph.16749>

### - Vasilis Kokkoris on the dynamics of nuclei in arbuscular mycorrhizal fungi

Camille Truong interviews Vasilis Kokkoris, a postdoc at the University of Ottawa and the Agriculture and Agri-Food Canada, about his research on the nuclear dynamics of arbuscular mycorrhizal fungi.

Interview: <https://southmycorrhizas.org/reading/august-2020/>

Study: Kokkoris V, Stefani F, Dalpé Y, *et al.* 2020. Nuclear Dynamics in the Arbuscular Mycorrhizal Fungi. *Trends Plant Sci* 25: 765-778. <https://doi.org/10.1016/j.tplants.2020.05.002>

### - Nadejda A. Soudzilovskaia on FungalRoot, a global mycorrhizal database

César Marín interviews Nadejda A. Soudzilovskaia, Assistant Professor at Leiden University in The Netherlands, about the development and use of the database FungalRoot, a global database on mycorrhizal types and colonisation.

Interview: <https://southmycorrhizas.org/reading/september-2020/>

Study: Soudzilovskaia NA, Vaessen S, Barcelo M, *et al.* 2020. FungalRoot: global online database of plant mycorrhizal associations. *New Phytol* 227: 955-966. <https://doi.org/10.1111/nph.16569>

### \*Section by:

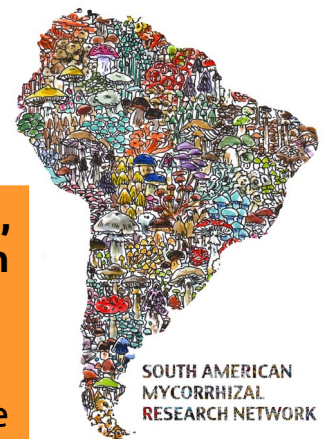
### South American Mycorrhizal Research Network

Contact/Join us: <https://southmycorrhizas.org/join/>

**Seminar by Peter Kennedy from the University of Minnesota, entitled: "Defining the niche of ectomycorrhizal fungi in lowland tropical dry and wet forests"**

Link: <https://youtu.be/bgwqtNgX5T8>

Organized by Camille Truong from the Biology Institute at the National Autonomous University of Mexico.





# Tools

## → **GlobalFungi: a global fungal metabarcoding database**

Vetrovsky *et al.* (2020) presents GlobalFungi (<https://globalfungi.com/>), a database with more than 600 million observations of fungal sequences across 17,000 samples. This database provides access to published data on fungal community composition obtained by next-generation-sequencing through a web-based interface that allows varied queries and results visualization.

Study: Vetrovsky T, Morais D, Kohout P, *et al.* 2020. GlobalFungi: Global database of fungal records from high-throughput-sequencing metabarcoding studies. *Sci Data* 7: 228.

<https://doi.org/10.1038/s41597-020-0567-7>

## → **Truffle species classification by their aroma profiles**

Strojnik *et al.* (2020) collected 460 ascocarps from 9 Tuber species in 11 countries, and explored their aroma profiles using gas chromatography-mass spectrometry. Truffle species can be 96.9% correctly classified by their aroma profile.

Study: Strojnik L, Grebenc T, Ogrinc N. 2020. Species and geographic variability in truffle aromas.

*Food Chem Toxicol* 142: 111434. <https://doi.org/10.1016/j.fct.2020.111434>

## → **HyLength: image software for analyzing dense mycelia**

Cardini *et al.* (2020) present HyLength (<https://gitlab.iit.it/EdelDottore/hylength>), a MATLAB-based, semi-automated digital tool for measuring the length of roots and fungal mycelia in different experimental systems. *HyLength* can also be implemented in *ImageJ/Fiji* via a plugin (*AnaMorf*), and considerably saves time compared to manual root and hyphae measurements.

Study: Cardini A, Pellegrino E, del Dottore E, *et al.* 2020. HyLength: a semi-automated digital image analysis tool for measuring the length of roots and fungal hyphae of dense mycelia. *Mycorrhiza* 30:

229-242. <https://doi.org/10.1007/s00572-020-00956-w>

## → **Fluorescent protein expression in ectomycorrhizal fungi**

Kemppainen *et al.* (2020) explore a technique for the basic requirements of fluorescent proteins expression in *Laccaria bicolor*. Specifically, they designed an *Agrobacterium*-mediated transformation compatible plasmid set for easy use of fluorescent proteins in *Laccaria*.

Study: Kemppainen M, Chowdhury J, Lundberg-Felten J, Pardo A. 2020. Fluorescent protein expression in the ectomycorrhizal fungus *Laccaria bicolor*: a plasmid toolkit for easy use of fluorescent markers in basidiomycetes. *Curr Genet* 66: 791-811.

<https://doi.org/10.1007/s00294-020-01060-4>

For previous Tools click: [here for Issue 1](#) (p. 11) and [here for Issue 2](#) (p. 15).



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# Events

## EVENTS POSTPONED DUE TO COVID-19:

### - Global Symposium on Soil Biodiversity

#### [Website](#)

FAO headquarters, Rome, Italy  
2-4 February, 2021

Organizers: UN Food and Agriculture Organization (FAO), Global Soil Partnership (GSP), Intergovernmental Technical Panel on Soils (ITPS), UN Convention on Biological Diversity (UNCBD), Global Soil Biodiversity Initiative (GSBI).

### - Soil Ecology Society Biennial Meeting 2021

#### [Website](#)

Discovery Hall, Richland, WA, United States  
24-28 May, 2021

Organizers: Soil Ecology Society (US) and local organizers.

### - Eurosoil 2020 (now 2021)

#### [Website](#)

Geneva, Switzerland  
Second half of 2021

Organizers: European Confederation of Soil Science Societies and local organizers.

### - 18<sup>th</sup> International Symposium on Microbial Ecology

#### [Website](#)

Cape Town, South Africa  
August 2021

Organizers: International Society for Microbial Ecology

### - 45<sup>th</sup> *New Phytologist* Symposium: Ecological and evolutionary consequences of plant–fungal invasions

#### [Website](#)

Campinas, Brazil  
Date not yet announced

Organizers: New Phytologist Trust and symposium organizers.

### 3<sup>rd</sup> Global Soil Biodiversity Conference

#### Website

Clayton Hotel, Dublin, Ireland

March 2023

Organizers: Global Soil Biodiversity Initiative



GLOBAL  
SOIL BIODIVERSITY  
INITIATIVE

## EVENTS AS SCHEDULED:

### X Latin American Mycology Congress

#### Website

University of Chile, Santiago, Chile,  
12-15 December 2020 (Online).

Organizers: University of Chile and local organizers.



X Congreso Latinoamericano de **Micología**  
**Chile 2020**

### 10<sup>th</sup> International Symbiosis Society Congress

#### Website

Lyon, France

18-23 July 2021

Organizers: International Symbiosis Society



## JOB OPPORTUNITIES

- **Five Postdoctoral Fellow positions in microbiology, molecular biology and ecology**

**Where?** Institute of Microbiology of the Czech Academy of Sciences, Czech Republic

**Deadline:** 4 October 2020

**Information:**

[https://mbucas.cz/wp-content/uploads/2020/09/MOBILITY-2\\_Postdocs\\_09\\_2020.pdf](https://mbucas.cz/wp-content/uploads/2020/09/MOBILITY-2_Postdocs_09_2020.pdf)

- **Staff Scientist in Forest Microbial Ecology and Evolution**

**Where?** Smithsonian Tropical Research Institute, Panama

**Deadline:** 15 November 2020

**Information:**

<https://www.ime-microbes.org/jobs/staff-scientist-forest-microbial-ecology-and-evolution>