

CHAPTER 4

OVERVIEW OF PHYTOCHEMICAL STUDIES ABOUT MYCORRHIZAL HOSTS IN THE BRAZILIAN NORTH AND CENTRAL-WEST REGIONS: CHALLENGES TO OVERCOME

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ABSTRACT: The North is one of the regions with the lowest number of studies dedicated to verifying the influence of arbuscular mycorrhizal fungi (AMF) on the production of biomolecules in plant tissues, second only to the Midwest. Pará is the only state to have studies from this perspective; these approaches were focused on *Piperaceae* representatives, which are recognized for their medicinal relevance. The studies in question used mycorrhizal isolates native to the northern region, aiming to evaluate their effect on reducing the impact caused by pathogens and verifying the leaf and root anabolism of mycorrhizal pepper grown in a greenhouse. Despite this, more research is needed, given the medicinal importance of species native to the northern region and the agricultural potential reported for the Midwest.

KEYWORDS: AMF, biomolecules, *Piperaceae*.

1. INTRODUCTION

The Brazilian North covers an area of approximately 3,850,593.104 km², the largest national region, equivalent to around 45% of the country's territory. Made up of seven states (IBGE, 2022), this region is marked by the Amazon Rainforest biome, one of the most exuberant and with the greatest fauna and flora biodiversity (Ministério do Meio Ambiente, 2024a). The equatorial climate prevails in this region and is characterized by high temperatures and humidity throughout the year (IBGE, 2024). These climatic conditions support the vast diversity that includes native plants with medicinal relevance (Breitbach *et al.*, 2013).

In addition to the Amazon Rainforest, some North areas are also home to the *Cerrado*, but it is in the Center-West where this biome is predominant (Ministério do Meio Ambiente, 2024b). This region covers approximately 19% of the national territory (IBGE, 2022), and is characterized by a tropical climate (IBGE, 2024). The Midwest is one of the country's main agricultural regions, contributing to the production of commodities (Ministério da Agricultura e Pecuária, 2022). Notwithstanding, only a few studies have investigated the role of inoculating arbuscular mycorrhizal fungi to optimize the synthesis of biomolecules responsible for pharmacological properties in plants native to the Amazon Rainforest. Additionally, there are no reports of this mycorrhizal benefit in plant species found in the Midwest, the region with the highest agricultural production in Brazil. Filling this gap is important, considering that species with medicinal potential from these regions, when harvested with higher levels of bioactive compounds, can be used in the pharmaceutical industry, adding value to other plant tissues that are not commonly used for therapeutic purposes.

This review aimed to gather studies on the phytochemistry of mycorrhizal plants carried out in North and Midwest Brazil. To this end, the search for papers was performed as described in the first chapter.

2. RESULTS AND DISCUSSION: SCENARIO OF STUDIES ON THE PHYTOCHEMISTRY OF MYCORRHIZAL SPECIES IN THE MAJOR BRAZILIAN REGIONS

In the North, the published papers about the benefits of mycorrhizal symbiosis in the biosynthesis of secondary biomolecules were for *Piperaceae*. The research is concentrated in the Pará state (Table 1) and was carried out by the Bioprospecting and Technological Innovation of Natural Products from the Amazon research group. The authors evaluated varied species of *Piper*, such as *Piper aduncum* L. (Oliveira *et al.*, 2019), *Piper nigrum* L. (Trindade *et al.*, 2021), and *Piper divaricatum* G. Mey (Oliveira *et al.*, 2022).

Table 1. Phytochemical studies about mycorrhizal plants conducted in the Brazilian North

Plant species	Plant part	Cultivation site	Evaluated bioactive compounds	AMF species	Mycorrhizal parameters	Reference
<i>Piper aduncum</i> L.	Leaves and roots	Greenhouse	Terpenes	<i>Entrophospora etunicata</i> (W.N. Becker & Gerd.) Blaszk., Niezgodna, B.T. Goto & Magurno; <i>Rhizogloium clarum</i> (T.H. Nicolson & N.C. Schenck) Sieverd., G.A. Silva & Oehl	Mycorrhizal colonization	Oliveira <i>et al.</i> (2019)
<i>Piper nigrum</i> L.	Leaves and roots	Greenhouse	Terpenes; Phenols	<i>E. etunicata</i> ; <i>R. clarum</i>	None	Trindade <i>et al.</i> (2021)
<i>Piper divaricatum</i> G. Mey.	Leaves	Greenhouse	Terpenes; Phenols	<i>E. etunicata</i> ; <i>R. clarum</i>	None	Oliveira <i>et al.</i> (2022)

Pepper species are relevant in medicine due to their anti-inflammatory, anti-dermatitis, antinociceptive (Branquinho *et al.*, 2017), antioxidant, and antimicrobial actions (Salleh *et al.*, 2014), conferring commercial value to the phytomass (Oliveira *et al.*, 2019b). The studies conducted with AMF aimed to reduce the impacts caused by *Neocosmospora piperis* (F.C. Albuquerque) Sand.-Den. & Crous (previously known as *Fusarium solani* f. sp. *piperis* F.C. Albuquerque) (Trindade *et al.*, 2021) and the influence of P in the substrate, considering different cultivation periods (Oliveira *et al.*, 2022), on the anabolism of essential oils and phenolics (Oliveira *et al.*, 2019b;2022; Trindade *et al.*, 2021).

All the studies conducted in this region were based on propagation by cuttings, in a greenhouse, using a commercial substrate, with plants inoculated with mixed inoculum. In these studies, isolates of *R. clarum* and *E. etunicata* (Oliveira *et al.*, 2019b;2022; Trindade *et al.*, 2021), native to Pará, were evaluated. This may be relevant for selecting inoculants adapted to the soil and climate conditions of the region.

Although Oliveira *et al.* (2019) verified mycorrhizal colonization in *P. aducum*, information on other aspects, such as the production of Glomalin-Related Soil Proteins (GRSP) and glomerospores were not reported in any of the studies conducted in the northern region. Therefore, data on mycorrhizal activity in the rhizosphere could be added to future studies conducted by researchers in Northern Brazil.

Despite being a region with agronomic relevance, there are no studies on the phytochemistry of mycorrhizal species conducted in the Central-West region; in this case, it is important to set up research groups in this field of mycorrhizology.

3. CONCLUSIONS AND PERSPECTIVES

The North has a wide biodiversity of medicinal plants, while the Center-West stands out for its agricultural relevance. However, little is known about the role of AMF in increasing the production of biomolecules in plants native to these regions. In context, it is necessary to conduct studies under field conditions to explore the therapeutic potential of mycorrhizal species and to understand the mechanisms involved in this interaction. Furthermore, it is important to investigate the effect of other mycorrhizal isolates present in these regions, considering that mycorrhizal efficiency can vary depending on the AMF species and host.

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