Diversity and distribution of mycorrhizal arbuscular fungi associated to Bambara groundnut (Vigna subterranea (L.) Verdcourt) in Benin

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INTRODUCTION

The food insecurity areas worldwide are most concentrated under tropics, especially in Africa in the south of Sahara. Indeed, Arbuscular mycorrhizal fungi enable the plant to get soil nutrients which are few, steady in the soil like phosphorus, nitrogen, and most soil micronutrients. Different researches have permitted the identification of some species of Glomeromyceta associated to many crops in Benin. To our knowledge, no research in West Africa and especially in Benin has so far been focused on AMF associated to Bambara groundnut, that is a neglected and underutilized specie. It is important to evaluate species and diversity of AMF associated in Vigna subterranea rhizosphere in different agro-ecological zones in Benin.

METHODOLOGY

The samples of soils and roots associated in Bambara groundnut production have been appropriated in six agro-ecological zones that are: the Far North Benin (AEZ 1), Cotton region of North Benin (AEZ 2), Food crop region of South Borgou (AEZ 3), West zone of Atacora (AEZ 4), Cotton region of the centre (AEZ 5) and bar lands (AEZ 6).

According to Bambara groundnut sowing date in the different areas and to his flowering date, the prospection phase has been done in September. Two regions have been selected per agro-ecological area. Each sampling place was geo-referenced with GPS. Indeed, in order to obtain composite samples, four soil samplings have been done at four different locations with a custom-made corer at 20 cm in depth.

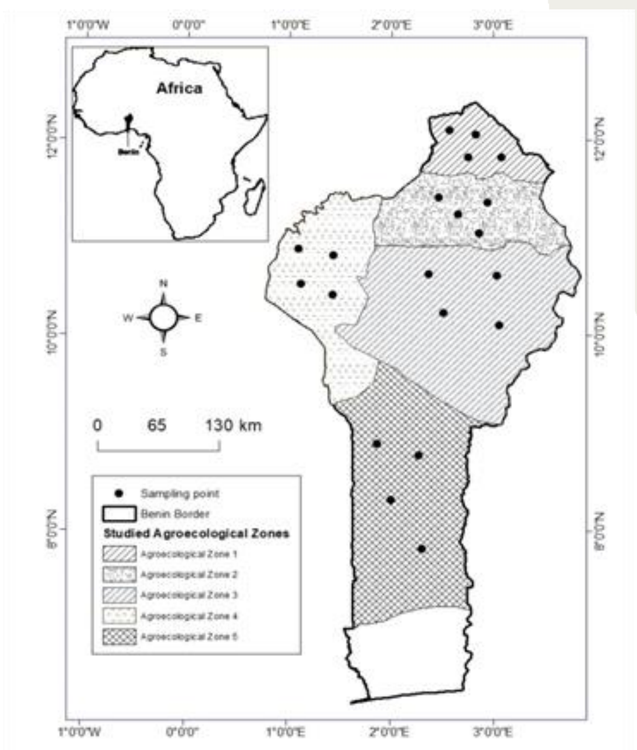

Fig. 1: Benin geographic map with different sampling places

The collected roots of bambara groundnut were used to determine mycorrhization frequency and intensity by the Phillips and Hayman method (1970). AM spores were extracted using the wet sieving and centrifugation method of Gerdmann and Nicholson (1963). After this process the spores were counted under binocular glass. It is based on morphological criteria (colour, presence or absence of suspensor bulb and hyphae, etc) then identified by the key of INVAM description.

RESULTS

AMF diversity - In bambara rhizophere of this study, fourteen mycorrhizal fungi morphotypes have been identified according to morphological criteria. After identification of these morphotypes, it appeared that they belonged to five genus (Glomus, Gigaspora, Acaulospora, Scutellospora and Diversispora) (Fig. 2) which belong to four (04) different orders (Glomeraceae, Acaulosporaceae, Diversisporaceae and Gigasporaceae) and two (02) families (Diversisporales and Glomerales). Relative abundance of these genus, globally showed that Glomus are the most abundant genus which were present in all prospected AEZs and occupy about mean of 66.82%. Other genus were also represented in all prospected AEZs and scored 18.46%, 8.25%, 4.89% and 1.58% respectively for Gigaspora, Scutellospora, Acaulospora and Diversispora genus (Fig. 3).

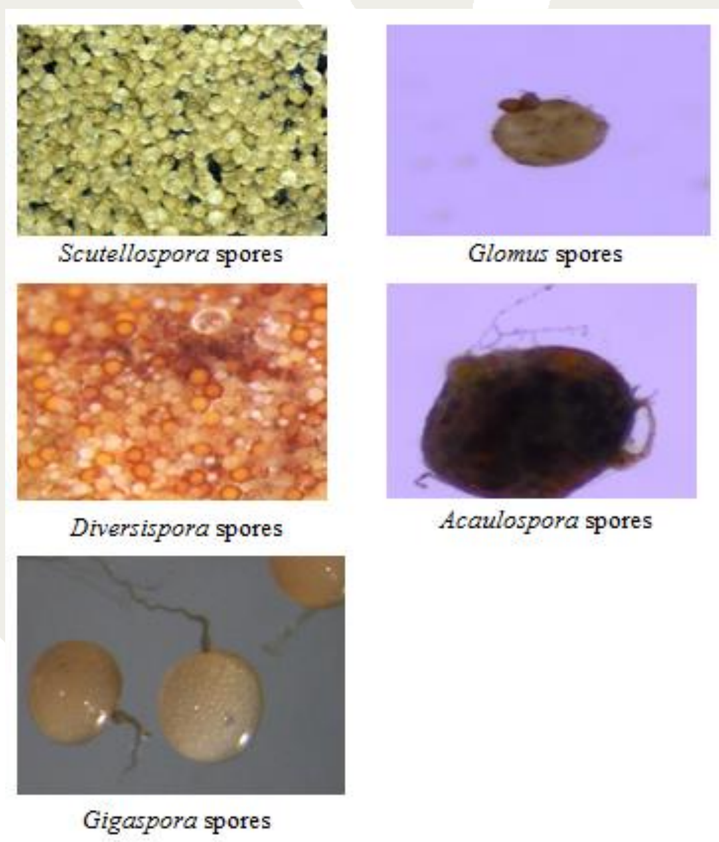

Fig. 2: The different types of spores observed

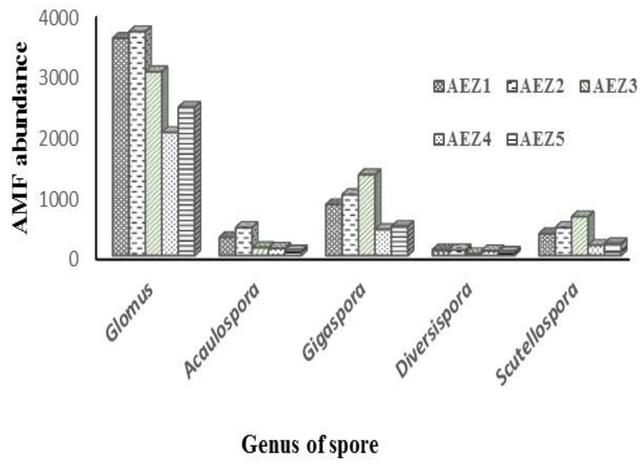

Fig. 3: Relative AMF genus abundance of all prospected zone in Benin

Assessment of natural mycorrhization level - As it can be seen on the figure 4, there was significant ($p<0.0001$) difference between the studied AEZs basing on the mycorrhization frequency. Highest frequency (45.625%) was registered in AEZ 1 which was different than remaining AEZs. Remaining zones were not statistically different and the lowest rate of mycorrhization frequency was recorded in AEZ 4 (17.25%).

In the case of mycorrhization intensity, it appeared that AEZ 3 has registered the highest value (8.06%) and the lowest rate has been recorded in AEZ 4 (2.39%). All of AEZs were also significantly different ($p<0.0001$) according to mycorrhization intensity.

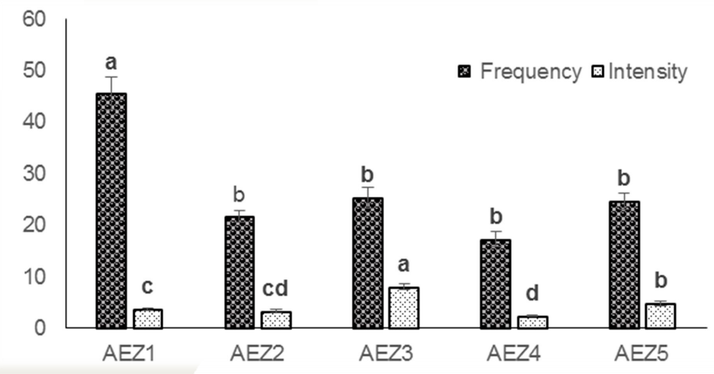

Fig. 4: Mycorrhization frequency and intensity according to AEZ

The present study has shown that there is an important spore diversity of AMF associated with Bambara groundnut and that differs significantly from one AEZ to another.

Also, achievement of molecular characterization will allow more accuracy in species identification. This will enable an evaluation of effectiveness and efficiency of different collected species in order to develop some ecological technologies in Bambara groundnut fertilization based on AMF.