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SHORT NOTE

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Mycorrhizae in Monocotyledonae of Northeast Brazil: subclasses Alismatidae, Arecidae and Zingiberidae

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Abstract We studied the mycorrhizal condition of three subclasses (Alismatidae, Arecidae, Zingiberidae) of Liliopsida (Monocotyledonae) occurring in different natural areas of the State of Pernambuco, Northeast Brazil. Twenty-two of 35 specimens (62.8%) were colonized by arbuscular mycorrhizal (AM) fungi. No association was found in specimens of five families (Alismataceae, Cannaceae, Cyclanthaceae, Hydrocharitaceae, Limnocharitaceae), but in two other families (Costaceae, Zingiberaceae) all specimens formed mycorrhizae. Four families showed variable mycotrophy (Araceae, Bromeliaceae, Heliconiaceae, Marantaceae). This is the first evaluation of the mycorrhizal condition of 24 Monocotyledonae species from this region, 15 of which were found to form AM.

Keywords Arbuscular mycorrhizae · Liliopsida · Natural areas

Introduction

There are relatively few reports on the formation and distribution of arbuscular mycorrhiza (AM) in natural areas. Trappe (1987), in reviewing investigations of mycorrhizal host species, found that only 1,487 (3%) of 49,900 known species of Monocotyledonae had been evaluated with respect to mycorrhizal condition. Of these, 21% showed no association and 49% formed mycorrhizae of the arbuscular type. In Alismatidae, only 4% of the 26 species examined (5% of the total known) formed AM. In Arecidae, of the 61 species examined (1% of the total known) 56% were associated with AM. In Zingiberidae, of the 1% of known species analyzed, 71% formed a symbiosis with AM fungi.

Recently, Miller et al. (1999) and Murakoshi et al. (1998) found differences in the presence of mycorrhizae and degree of colonization in other Monocotyledonae families in the United States and Japan, respectively. The objective of our work was to evaluate the mycorrhizal condition of species of Monocotyledonae (subclasses Alismatidae, Arecidae, Zingiberidae) in the State of Pernambuco, Brazil.

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Materials and methods

Entire, adult, arbustive or herbaceous flowering plants were collected during 2 years in 11 different natural areas of Pernambuco (Northeast Brazil, 7° 15′ 45″ – 9° 28′ 18″ S and 34° 48′ 35″ – 41° 19′ 54″ W). The region ranges from the humid coastal zone, characterized by tropical forest, to the “caatingas”, a zone including areas known as “Agreste” (intermediate sub-humid) and “Sertão” (semi-arid) (Table 1). Species and number of specimens collected were chosen according to availability and floristic composition at each collecting location.

Roots of each plant were washed, cleared, and stained with Trypan blue (Phillips and Hayman 1970). Percentage mycorrhizal colonization was evaluated by the gridline intersect method (Giovannetti and Mosse 1980) using three root samples from each collected plant. Only roots presenting typical mycorrhizal structures such as arbuscules, vesicles and coenocytic hyphae were considered to be mycorrhizal.

Results

Thirty-five specimens distributed among 24 species, 21 genera and 11 families of Monocotyledonae were studied. Of these, 22 specimens (62.8%) were colonized by AM fungi at levels ranging from 17% (*Renealmia guianensis*) to 77% (*Costus spiralis* var. *spiralis*) (Table 1). Seven species from different families had roots with more than 50% colonization. Most of the plants form-

Table 1 Mycorrhizal colonization of Monocotyledonae in the State of Pernambuco, Brazil. Collecting areas: *A* Cabo, *B* São Vicente Férrer, *C* Igarassú, *D* São Lourenço da Mata, *E* Maraial, *F* Recife, *G* Caruaru, *H* Bezerros, *I* Alagoinha, *J* Algodões, *K* Serra Talhada. *A* to *F* are in the humid coastal zone; and *G* to *K* in the intermediate sub-humid and sub-arid zones. Data are the means of three root preparations per plant; each value represents one specimen

Subclass	Family/Species	Collecting area and % colonization
ALISMATIDAE	Alismataceae	
	Echinodorus grandiflorus (Chamisso & Schlecht) Micheli[a]	J-0
	Limnocharitaceae	
	Hydrocleys nymphoides (Willd.) Buchenau	K-0
	Hydrocharitaceae	
	Egreria densa Planch.	C-0
ARECIDAE	Araceae	
	Anthurium affine Schott	A-19
	Anthurium pentaphyllum (Aubl.) G. Don	D-61
	Caladium bicolor (Vent.) Aiton	A-41
	Dieffenbachia amoena Gent	F-33
	Philodendron ornatum Schott[a]	B-0
	Philodendron undulatum Engl.	A-0
	Pistia stratiotes L.	J-0, 0
	Cyclanthaceae	
	Asplundia gardneri (Hook.) Hart.	B-0
ZINGIBERIDAE	Bromeliaceae	
	Aechmea stelligera L. B. Smith	H-0
	Vriesea limae L. B. Smith	E-37
	Cannaceae	
	Canna coccinea L.	H-0
	Costaceae	
	Costus scaber Ruiz & Pav.	A-72
	Costus spiralis (Jacquin) Roscoe var. *spiralis*	A-77; B-56
	Heliconiaceae	
	Heliconia psittacorum L. f.	A-0, 57, 60; F-19, 18
	Marantaceae	
	Calathea sp.[a]	A-52
	Ctenanthe sp.	G-75
	Ischnosiphon gracilis (Rudge) Koern.	A-38
	Monotagma plurispicatum (Koern.) K. Schum.[a]	A-40; E-40; G-56; I-0
	Saranthe compositae (Link) Shum	G-0
	Stromanthe porteana Gris.	C-39; F-49, 49
	Zingiberaceae	
	Renealmia guianensis Maas	E-17

[a] Presence of non-mycorrhizal fungi in roots

ing mycorrhizae were collected in the humid coastal zone.

Variation in presence of AM fungi and colonization level in different collections was observed at the family, genus and species levels. Specimens of five families showed no association (Alismataceae, Limnocharitaceae, Hidrocharitaceae, Cyclanthaceae, Cannaceae), all specimens of two families contained AM (Costaceae, Zingiberaceae), and the association varied in four families (Araceae, Bromeliaceae, Heliconiaceae, Marantaceae).

The abundance of mycorrhizal structures varied between the different hosts. In some specimens, e.g., *Stromanthe porteana,* there were many hyphae and vesicles in the same root segment. In others, arbuscules were also observed. Differences in the formation of structures inside roots between members of Glomineae and Gigasporineae was noted previously by Morton and Benny (1990). In all of the mycorrhizal hosts studied, only the *Arum*-type of formation (Smith and Smith 1996, 1997) was identified.

No ecto- or ectendomycorrhizae were observed. However, in two species represented by five of the 35 specimens analyzed, non-mycorrhizal fungi with dark, septate hyphae were found.

Discussion

This investigation is the first evaluation of the mycorrhizal condition of the 24 species of Monocotyledonae studied. The presence of AM in 58% of the species demonstrates the dominance of this type of mycorrhiza over ecto- and ectendomycorrhizae, which were not found in the areas studied. Similar observations have been reported for the Amazon forest (St. John 1980a) and for a humid forest in the State of Pernambuco, Brazil (Rose and Paranka 1987).

Taber and Trappe (1982) found hyphae of AM fungi in the xylem of *Zingiber officinale* Roscoe (Zingiberaceae). However, we observed structures of AM fungi in the root cortex of another species of this family (*Renealmia guianensis)*. Trappe (1987) described Bromeliaceae as non-mycorrhizal, but we observed AM in *Vriesea limae*, in agreement with other reports (see Janos 1993). Marantaceae was represented in our study by 11 specimens from six species. Nine specimens (representing five species) formed AM. Grandi and Trufem (1991) found that four species of this family (*Calathea stromata*, *Ctenanthe oppenheimiana*, *Marantha bicolor, Stromante sanguineae*) also formed mycorrhiza.

Species of *Philodendron*, collected twice in this study, were non-mycorrhizal. In contrast, St. John (1980b) found mycorrhizae in species of *Philodendron* from the Amazon region. *Hydrocleys nymphoides* (Limnocharitaceae), *Egreria densa* (Hydrocharitaceae), and *Pistia stratiotes* (Araceae) were not colonized by AM fungi, which may be related to their aquatic habit. Bagyaraj et al. (1979) found that only three of 12 aquatic specimens formed AM and suggested that the symbiosis is not favored in aquatic environments. Non-mycorrhizal fungi forming dark, septate hyphae were observed in the roots of five specimens, similar to the report by Hirrel et al. (1978) for specimens of Cruciferaceae and Chenopodiaceae.

In general, the results indicate a wide distribution of AM associations in the three subclasses of Liliopsida investigated in this study.

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