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ISOLATION OF ACAULOSPORA SPECIES FROM JATROPHA CURCAS L AND PONGAMIA PINNATA PIERRE

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ABSTRACT

Jatropha curcas L. and *P. pinnata* Pierre is gaining importance as bio-diesel crop in India. *Jatropha curcas* L. a member of the family Euphorbiaceae and *Pongamia pinnata*, a member of the family Leguminosae. A study was conducted to identify common arbuscular mycorrhizal fungi present in its rhizosphere from different regions of India viz., Jodhpur (Rajasthan), Hissar (Haryana), Jhansi and Lalitpur (Uttar Pradesh) and Hyderabad (Andhra Pradesh). The results showed that different AM fungal species were present at different locations. A total of five *Acaulospora* AM species were recorded in different location of India. The highest frequency of occurrence was recorded for *Acaulospora scrobiculata* Trappe (100%), minimum frequency of occurrence was observed in *A. mellea* in *J. curcas*. The highest frequency of occurrence was recorded for *Acaulospora scrobiculata* Trappe (75%), Moderates frequency of occurrence was observed in *A. mellea* in *P. pinnata*. Maximum species richness was recorded at Jodhpur, followed by Jodhpur, Hissar, Hyderabad, Jhansi, Lalitpur, and Pantnagar. Isolation of five species of *Acaulospora* species (*A. dilatata* (Morton), *A. denticulata* (Sieverding & Toro), *A. Longula* (Spain & Schenck), *A. mellea* (Spain & Schenck), and Spores formed singly in the soil, borne or in sporocarps, spores are globose and subglobose, borne laterally on subtending hypha of large, terminal, relatively thin walled, sporogenous saccule. Spore composed to essentially two distinct, separable wall groups: at least part of outer is continuous with wall of subtending stalk, may be pigmented, laminated or composed distinct wall, and variously ornamented; inner is composed of one or more walls that are usually membranous, hyaline, may be laminated, ornamented, and stain pink, red, or purple in Melzer's-reagent

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INTRODUCTION: India has 146 m ha of wasteland (NBSSLUP, 04) of which 33 m ha can be reclaimed for plantation of the bio-diesel plants, in addition to arable land that is being used for the plantation. *Jatropha curcas* L a member of the family Euphorbiaceae and *Pongamia pinnata* Pierre members of the family leguminosae are gaining importance as bio-diesel plants. AM fungi form symbiotic association with most economically important plants. These fungi improve plant growth under low fertility conditions, confer tolerance against certain plant pathogens, improve water balance of the plants, contribute to the formation of soil structure and help plants to establish in new areas (Panwar and Vyas 2002).

In *J. curcas* and *P. pinnata* a very few references are available. The role of arbuscular mycorrhizal (AM) fungi in enhancing plant growth and yield, resistance to drought and salinity and tolerance to pathogens is well documented (Smith and Gianinazzi-Pearson, 1988). However, wide diversity exists within the group of fungi responsible for the formation of AM by most plants in the majority of terrestrial ecosystems. The selection of the most specific appropriate plants fungus association for each specific environmental and ecological situation is one of the main challenges in current research on AM.

MATERIAL AND METHOD:

Selection of Site: The study was conducted at National Research Centre for Agroforestry (NRCAF), Jhansi (24° 11'

N latitude and 78° 17' E longitudes), and Uttar Pradesh, India. The region lies in agro-ecoregion 4 of India, Northern Plain and Central Highlands, Hot Semi Arid Ecoregion with Alluvium-derived Soil (Sehgal et al. 1990). Mean annual rainfall is 960 mm with an average of 52 rainy days per year. Mean maximum temperature ranges from 47.4°C (June) to 23.5°C (January) and mean minimum temperature from 27.2°C (June) to 4.1°C (December).

The maximum-recorded temperature on a particular day often touches 47- 48°C during summer. Soil samples were collected from rhizosphere of 120 plants of *J. curcas* and 120 plants of *P. pinnata* (20 plant per species per location) from seven locations viz., Hissar (Haryana; Western plain, hot arid with desert and saline soils N8E1), Hyderabad (Andhra Pradesh; Deccan plateau and Eastern ghats, hot semi arid with red and black soils K6D2), Jodhpur (Rajasthan; Western plain, hot arid with desert and saline soils M9E1), Jhansi, (Uttar Pradesh; Northern plain and Central highlands, hot semi arid with alluvium-derived soils N8D2) and Pantnagar (Uttarakhand); Western Himalayas warm sub-humid (inclusion humid) eco-region with brown forest and podzolic soils AL1C4). Sampling was done during June 2007-2008.

Selection of crops: These crops are wasteland *J. curcas* and *P. pinnata*, important available bio-fuels crops grown in different location were assessed for AM species and spore population in rhizosphere soil.

Sampling: The sampling was done during June 2007- 2008 and 10 samples were taken per tree species from each location. Using different soil samples set trap cultures. The soil collected from field was mixed in 1:1 ratio (v/v) with autoclaved coarse sand. The mixture was transferred to 15 cm plastic pots, which were seeded with *Zea mays* L. (maize) and *Phaseolus mungo* L. (black-gram) and were maintained in green house. After 4-5 months, spore/ sporocarps were isolated from the substrate taken from the trap cultures according to the method of Geredmann and Nicolson (1963). Taxonomic identification of spores was matched with the description provided by the International Collection of Vesicular Arbuscular Mycorrhizal Fungi (INVAM, 2006). Characteristics of unidentified species are presented in table 2. Species richness and frequency of occurrence (%) of AM fungi associated with different

studied plant species were also calculated (Khade and Rodrigues 2008).

RESULT AND DISSCUSSION: The results showed that different AM fungal species were present at different locations in India. Isolation of five AM species of *Acaulospora* was recorded (Fig 1) were recorded in the trap cultures of *J. curcas*, and *P. pinnata*. Characteristics of AM species isolated were as under Table 1.

In *J. curcas*, the highest frequency of occurrence was recorded for *A. scrobiculata* Trappe (100%), Moderate frequency of occurrence (33%) was recorded for *A. denticulata* (Trappe), and minimum frequency of occurrence (17%) was recorded for *A. mellea* (Spain & Schenck). *A. scrobiculata* is most dominant species present in all studied location, richness of species were under (Table-2).

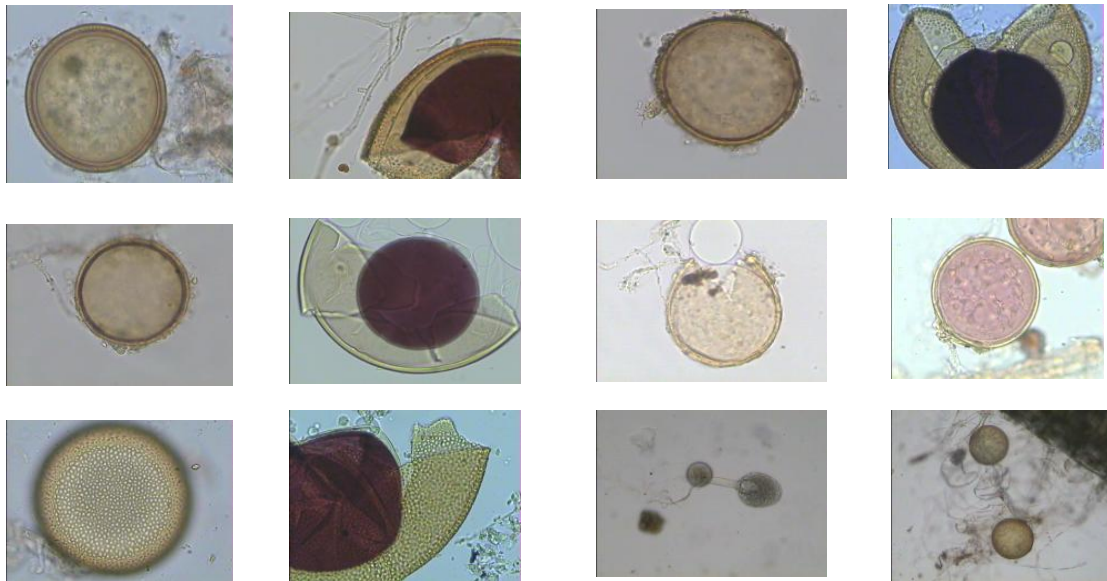


Figure 1: AM species isolated from rhizosphere of *J. curcas* and *P. pinnata*. a. *Acaulospora denticulata* 400x, b. *A. denticulata* with Meltzer's 400x, c. *A. dilatata* 400x, d. *A. dilatata* with Meltzer's, e. *A. logula* 400x, f. *A. logula* with Meltzer's, g. *A. mellea* 400x, h. *A. mellea* with Melzer's, i. *A. scrobiculata* 400x, j. *A. scrobiculata* with Meltzer's, k. formation of hyphal terminus 100x, l. Mature spore 100x.

Table 1: Characteristics of arbuscular mycorrhizal (AM) species isolated from rhizosphere of *Jatropha curcas* and *Pongamia pinnata* from different locations.

AM species	Characteristics of isolated AM species												
	A*	B	C	D	E	F	G	H	I	J	K	L	M
<i>Acaulospora denticulata</i>	Yellow brown	(67.0-) 78.0 (-108.0)	(6.0-) 8.4 (-9.6)	2	-	-	+	+	-	-	-	-	Pitted
<i>A. dilatata</i>	Light yellow	(84.0-) 78.4 (-100.0)	(6.0-) 6.6 (-7.2)	3	-	-	+	+	-	-	-	-	Pitted
<i>A. longula</i>	Pale Yellow	(72.0-) 77.0 (-84.0)	(2.5-) 4.8 (-7.2)	2	-	-	+	+	-	-	-	-	Smooth
<i>A. mallea</i>	Honey	(64.8-) 74.4 (-91.2)	(4.8-) 6.4 (-8.4)	3	-	-	+	+	-	-	-	-	Smooth
<i>A. scrobiculata</i>	Yellow	(108.0-) 115.0(-130.0)	(4.8-) 6.0 (-7.2)	2	-	-	+	+	-	-	-	-	Pitted

A- Spore color, B- Spore size, C- Composite spore wall width (μ), D- Number of wall group, E- Hyphal attachment size, F- Pore size, G-Presence of hyphal terminus, H- Wall reaction to Melzer's reagent, I- Spore formation with in root, J- Presence of spores with extrametrical mycelium, K- Sporocarp, L- Sporocarp color, M- Surface Ornamentation.

Table 2: Occurrence of arbuscular mycorrhizal AM species in rhizosphere of *Jatropha curcas* at different locations

AM species	AM species recorded from					Frequency of occurrence (%)
	Hissar	Hyderabad	Jhansi	Jodhpur	Pantnagar	
<i>Acaulospora denticulata</i>	+	+	-	-	-	33
<i>A. dilatata</i>	-	-	-	-	-	0
<i>A. logula</i>	-	-	-	-	-	0
<i>A. mellea</i>	-	-	-	+	-	17
<i>A. scrobiculata</i>	+	+	+	+	+	100
Species richness	2	2	1	3	1	-

^a + Present, ^b - absent

Table 3: Occurrence of arbuscular mycorrhizal AM species in rhizosphere of *P. pinnata* at different locations

AM species	AM species recorded from					Frequency of occurrence (%)
	Hissar	Hyderabad	Jhansi	Jodhpur	Pantnagar	
<i>Acaulospora denticulata</i>	-	-	-	-	+	16
<i>A. dilatata</i>	+	-	-	-	-	16
<i>A. logula</i>	+	-	-	-	-	16
<i>A. mellea</i>	-	-	-	+	-	16
<i>A. scrobiculata</i>	+	-	+	+	+	75
Species richness	3	0	1	2	1	-

^a + Present, ^b - absent

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