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Studies on the Arbuscular Mycorrhizal Biodiversity in the Plant Species of River Bhavani and Its Embankments, Mettuppalyam Taluk, Coimbatore District, Tamilnadu

Research Article

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Abstract

Most agricultural crop roots and soils host arbuscular mycorrhizal fungi (AMF), which are obligate symbionts. These fungi play a crucial role in the survival and fitness of various plant taxa across different ecosystems. Tropical forests, which host the greatest diversity of mycoheterotrophs, have AM symbiosis present in about 70% of all plant species. This study aimed to isolate and identify AMF from rhizosphere soil samples collected from plant species along the Bhavani River in Coimbatore district, India, and assess AM fungal infection in plant roots. We found that *Thespesia populnea* exhibited the highest AM fungal infection rate (58%), whereas *Ipomea pestilpesticides* the showed the lowest (16%). Additionally, *Colocasia sp*. had the lowest spore population (121/100g of soil), while *Cassia tora* had the highest (578/100g of soil). These findings underscore the diversity and ecological significance of AM fungi in this region, highlighting their role in plant health and ecosystem dynamics.

Keywords: Arbuscular Mycorrhizal Fungi; Symbiosis; Fungal Infection; *Glomussps*

Introduction

The development and maintenance of terrestrial ecosystems' structure and diversity, as well as the evolution of plants on Earth, have been profoundly influenced by arbuscular mycorrhizal fungi (AMF) [1]. Mycorrhizas are indispensable for the survival of the majority of plants, especially in unstable and stressful environments [2]. AM fungi colonize the root cortex, forming intercellular hyphae and arbuscules, which are intracellular hyphae with numerous branches [3,4]. They notably enhance nutrient uptake, particularly phosphorus, thereby promoting plant growth. In natural ecosystems and typical cropping systems, mycorrhizal associations, predominantly arbuscular mycorrhizae (AM), are ubiquitous [5-7]. AM symbioses play crucial roles in nutrient cycling in ecosystems [8] facilitating water-stable aggregate formation with other soil organisms [7]. Arbuscular mycorrhizal fungi contribute significantly to soil communities, utilizing extensive hyphal networks to access nutrients such as phosphorus, nitrogen, sulfur, water, and microelements from soil regions inaccessible to plant roots [9,10].In highly stressed environments, AMF play pivotal ecological roles [11] .Given that 95%of all plant species depend on mycorrhizae for survival, these fungi are considered essential components of plant health [12]. India boasts diverse ecoregions and natural ecosystems, emphasizing the

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need to elucidate seasonal AM fungal diversity to comprehend plant-fungus ecological interactions and their role in ecosystem dynamics. The rhizosphere, critical for plant-soil interactions, forms through the stimulation of natural microbial populations around plant roots. The rhizosphere, created by the stimulation of natural microbial populations around plant roots, is a critical concept in understanding plant-soil interactions. AM fungi are crucial for the survival and fitness of many plant taxa across diverse ecosystems, including agricultural crops. AM fungi are crucial for the survival and fitness of many plant taxa across diverse ecosystems, including agricultural crops.

Materials and Methods

Study Area and its Topography

The study area is selected that the riverbank of Bhavani located near Sirumugai, Mettupalayam Taluk, Coimbatore District. (Figure 1) (Plate -1). It comprises two types of vegetation such as riparian vegetation and dryvegetation. There are two types of soils present in the hills they are clay sandy soil in the riparian vegetation and red soil in dry vegetation. It receives an annual rainfall of 187 mm. The maximum temperature occurred in the month of March 34.5°C and lowest in 19.5°C (Table 1) in the month of January, The Nilgiri hills are parted by the Bhavani River.

Soil Sample Collection

On the river bank of Bhavani, 25 different plant species from 18 different families were gathered in 2015. Plant species growing along the Bhavani river and its embankments were observed, and soil samples from the rhizosphere and their roots were taken. Immediately following collection, the soil and root samples were brought to the lab.

Estimation of Arbuscular Mycorrhizal Colonization in Roots

Root Samples

5to15cm long root samples were taken from the plant species between 2015 and 2016. Care was taken during collection to identify specific plants whose roots could be positively. attributed to a specific plant species. The following manual was used for plant species identification and nomenclature [13,14].

Table 1

MONTH	RAINFALL (mm)	TEMPERATURE°C MAX	MIN	RELATIVE HUMIDITY (%) 7.22 HOURS
JANUARY	0	30.1	19.5	86
FEBRUARY	0	32.2	20	80
MARCH	3.7	34.5	23.1	80
APRIL	62.7	32.7	24	83
MAY	195.8	32.3	23.5	91
JUNE	46.9	32.3	23.7	82
JULY	5.1	32.2	22.9	85
AUGUST	28.1	32.3	23.2	86
SEPTEMBER	66.2	33	23.8	83
OCTOBER	65.2	31.6	23.3	87
NOVEMBER	191.3	28.6	22	93
DECEMBER	24.1	29.0	21.5	90

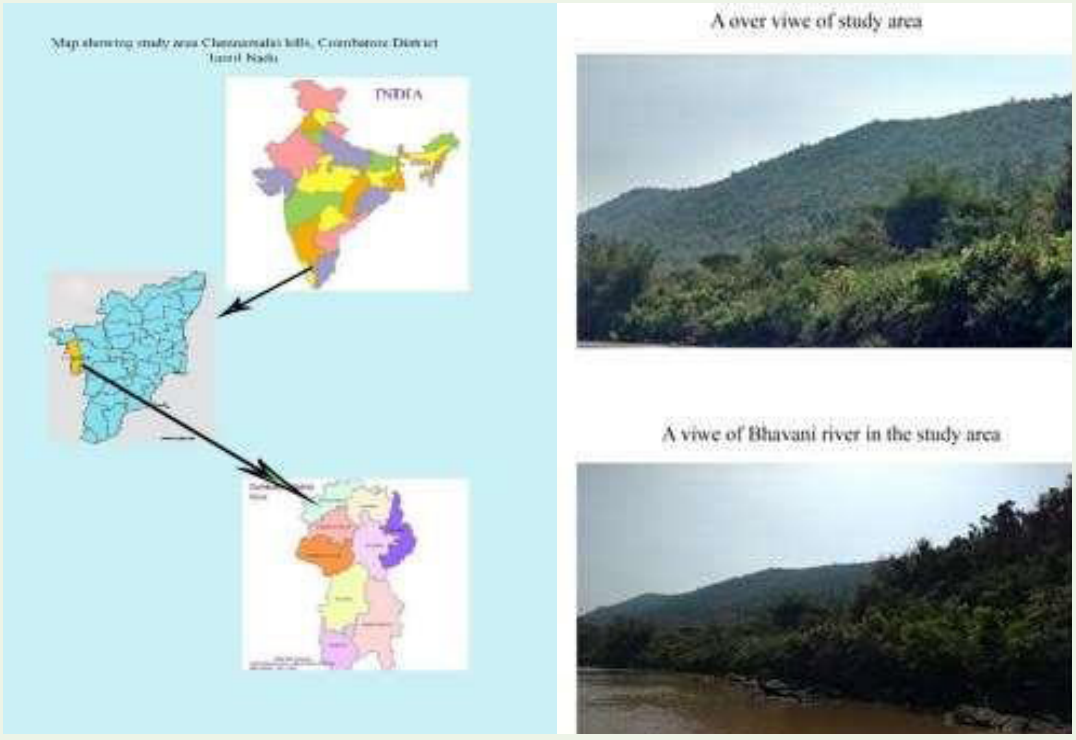

Figure 1: Study Area. River Bhavani and Its Embankments, Mettuppalyam Taluk, Coimbatore trict, Tamilnadu.

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Plate 1

Citation: Praveen RS, Swapna Sebastian S, Sneha S, Kumar S, Nagarajan N, et al. Studies on the Arbuscular Mycorrhizal Biodiversity in the Plant Species of River Bhavani and Its Embankments, Mettuppalyam Taluk, Coimbatore District, Tamilnadu. J Plant Sci Res. 2024;11(2): 267

Soil Samples

After removing the top layer of soil and any litter covering, the rhizosphere soil was dug up from each plant species to a depth of10 cm. After being collected, these samples were placed in sterilized bags and sent straight to the lab for analysis of the isolation of arbuscular mycorrhizal fungal spores.

Sample Preservation

Wet sieving was used in the lab to separate the roots from the soil. When possible, the roots were processed immediately after being washed with water. As mentioned by [16], the washed roots were otherwise fixed in a formaldehyde-acetic acid-ethanol (FAA) solution (90:5:5).The soil sample was dried by air and kept in a freezer until processing.

Each sample of soil was subjected to chemical analysis, spore counts, Smithification into different types, and multiplication, concentration, and separation of AM fungal spore for identification.

Preparation of Soil Samples for Analysis

Each soil sample was spread out on a flat piece of wood or plastic, and it was left to air dry in the shade. The removal of stones and macro organic matter pieces. Large lumps were manually broken into smaller pieces, and the soil was ground using a wooden roller. The ground-up soil Was then screened through a 2mm sieve, with the fine soil being used for further investigation.

Soil pH

With the aid of a pH meter (Elico),the pH of soil samples was determined (soil-water suspensions 1:5).

Evaluation of AM Infection

Using a modified version of Phillips and Hayman's (1970) [16] method, the root samples were cleaned and stained in tryphan blue. For about an hour, roots were heated at 900 C in 10% KOH after being cut into one or two pieces. The time period was extended for older, thicker roots. Following a water rinse, the root segments were acidified with weak HCL. The root pieces were stained for 5 minutes with0.05% tryphan blue in lacto phenol, and any excess stain was cleaned off with clear lacto phenol.

The colored roots were heated for two hours at 90o C in 10% KOH, washed with new 10% KOH, and then bleached for thirty minutes at 250 Cinan alkaline solution of H2O2. To remove the H2O2, they were thoroughly rinsed with water. They were then acidified in diluted HCL and stained as previously mentioned. In some instances, the modified Merry weather and Fitter (1991) [17] method was used instead, skipping the autoclaving and H2O2 bleaching steps. A few times, intact, fresh, and unstained roots were directly observed [18] (Arias et al., 1987).

The grid line-intersect method of Giovannetti and Mosse (1980) [19] was used to measure the arbuscular mycorrhizal infection in the roots. On a square Petridish made of plastic (10.2x 10 cm), the stained root pieces were evenly distributed. On the dish's bottom, a grid of lines was drawn with 1-cm-squares as the unit of measurement. Under a dissecting microscope, vertical and horizontal gridlines were scanned, and at each point where the roots crossed a line, the presence of infection was noted. Four sets of observations were made, recording the intersections of the root gridlines at 100, 200, and 300. A new reorganization of the same root sample served as the basis for each of the three replicate records.

The percentage of AM infection was calculated using the formula:

$$\%\text{Percentage of infection} = \frac{\text{No.of root segmentsinfected}}{\text{Total no of root segmentsobserved}} \times 100$$

Using Giovannetti and Mosse's grid line-intersect method, arbuscular mycorrhizal infection in the roots was evaluated. On a square plastic Petridish(10.2x10cm),the stained root pieces were evenly dispersed. On the dish's bottom, a grid of lines was drawn with 1-inch-square markers. A dissecting microscope was used to scan vertical and horizontal gridlines, and at each intersection point where the roots crossed aline, the presence of infection was noted. The intersections of the 100, 200, 300, and all root gridlines were recorded during four sets of observations. On a brand-new reorganization of the same root sample, each of the three replicate records was created.

Isolation of Arbuscular Mycorrhizal Spores from the Soil Samples

Wet-sieving and decanting was used to extract spores from soil samples [20]. Each soil sample contained 100g of soil, which was combined with a 1:1 mixture of luke warm water in a big beaker until all the aggregates were dispersed and the suspension was uniform. The ability to settle heavier particles was granted. The suspension was decanted through a710-msieve to filter out roots and organic matter. The suspension that had passed through a sieve of 710 mm was successively decanted through sieves of 425 mm, 250 mm, 150 mm, 75 mm, and 45 mm. A dissecting microscope was used to look for AM fungal spores in the residues in each sieve after they were collected in petri dishes with about 10–20 ml of water.

By counting the spores, the overall spore count was determined. The spores were then divided and separated using a glass pipette. The spores were sealed with DPX medium after being lacto phenol or polyvinyl alcohol lacto phenol (PVL) mounted on clear glass slides.

Identification of AM Fungi

The AM fungal spores were recognized based on microscopic characteristics. [21,22] manual authors' keys were used for nomenclature and identification. Color, size, shape, surface, structure, general nature of the spore contents, and hyphal attachment are used for classification. A Magnus Olympus microscope was used to take photomicrographs.

Results and Discussion

In the current investigation, 25 plant species from 18 families were observed to have arbuscular mycorrhizal fungal infection, and the pH of the soil samples from the rhizosphere was also recorded (Table 2). The pH scaled from 4.5 to 8.4.

25 plant species from 18 different families were all carefully inspected for AM fungal association. The plant species Cassia tora

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Table 2: Isolation and identification of AM fungal species from the river bank of Bhavani, Coimbatore District, Tamil Nadu

S No	Botanical name	Family	Soil pH	Type of infection HVA	% of root colonization	AMF Spore Population/100g of soil	AMF spore species
1	*Adathoda vasica*, Nees.	Acanthaceae	4.9	+ + -	23	261	LABS, LDST
2	*Ageratum conyzoides* L.	Asteraceae	5.2	+ + -	31	273	LDMR,LFSC, AAPD
3	*Boerhavia diffusa* L.	Nyctaginaceae	6.7	+ - -	42	472	LAHTS, LAST
4	*Cassia tora* L..	Caesalpinaceae	7.2	+ - -	53	578	LDST, LFSC, CNGR
5	*Cissus quadrangularis* L.	Vitaceae	5.3	+ - -	33	213	LCTC, LAGR, AAPD
6	*Colachia* Sp.	Asteraceae	4.9	+ + -	21	121	LABS, LDMR, CGRG
7	*Crotalaria pallida* Aiton.	Papiloniaceae	6.1	+ + +	24	241	LDMK, LFSC, CNGR
8	*Eragrostis uniloides* Nees.	Poaceae	7.3	+ + +	26	321	LCTC, LABD, LFSC
9	*Ipomea pestigridis*	Euphorbiaceae	8.1	+ - +	16	235	LHTS, LFSC, CGRG
10	*Ludwigia parvifolia* Roxb	Onagaraceae	7.4	+ + -	19	182	LABS, ASCB, GRSA
11	*Justicia betonica* L.	Acanthaceae	8.4	+ + -	22	265	LDST, LDMK, LAST
12	*Ipomea cordata* L.	Convolvulaceae	5.7	+ - +	17	164	LAGR, LFSC, AAPD
13	*Portulaca tuberosa*, Roxb.	Portulaceae	6.2	+ + +	21	129	LDMR, LABD, CGRG
14	*Helotrophium indicum*, L.	Boraginaceae	4.8	+ - -	20	341	LABS, LFSC
15	*Zizyphus rugosa* Lam.	Rhamnaceae	5.3	+ - -	35	461	LHTS, LFSC, CGRG
16	*Justicia jendarussa* L. *Solanum*	Acanthaceae	6.2	+ - +	26	375	LAGR, LAST, GRSA
17	*xanthocarpum* Sch & Wendl.	Solanaceae	5.6	+ + -	47	572	LCTC, LFSC, ASCB
18	*Solanum nigrum* L.	Solanaceae	6.1	+ + -	33	472	LDMK, LFSC
19	*Plumbago auriculata* Poir	Plumbaginaceae	6.4	+ + +	24	143	LABS, LHTS, LAST
20	*Tragia involucrate* L.	Urticaceae	4.6	+ - +	26	232	LHTS, LFSC, CNGR
21	*Phyllanthus amarus* Schum &Thorn	Euphorbiaceae	4.5	+ + -	33	441	LDMR, ASCB, CGRG
22	*Jatropha curcus* L.	Euphorbiaceae	5.2	+ + -	27	352	LABS, LHTS, LAST
23	*Thespesia populnea* L.	Malvaceae	5.3	+ - +	58	423	LHTS, LFSC, CNGR
24	*Sida rhombifolia* L.	Malvaceae	6.3	+ + -	48	526	LDMR, ASCB, CGRG
25	*Spillanthus calva* W.	Asteraceae	6.4	+ + -	21	331	LDMK, LABD, LAST

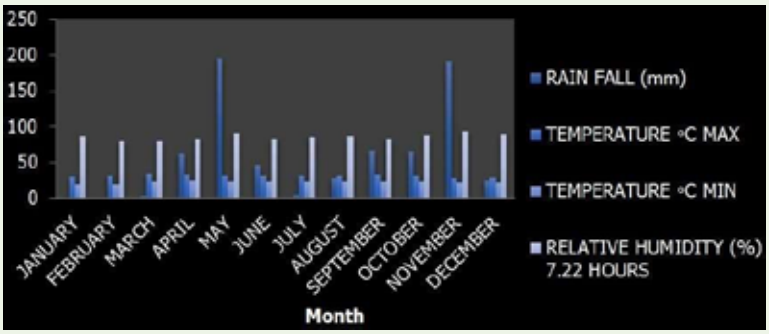

Figure 2: Graphical representation of Temperature and Rainfall data of the study area river bank of Bhavani, Mettupalayam Taluk, Coimbatore District, Tamil Nadu.

(578/100g of soil), which is a member of the Caesal pinaceae family,had the highest pore population, and Colachasiasp.(121/100gofsoil), which is a member of the Aeraceae family, had the lowest. The spesia populnea, a member of the Malvaceae family, had the highest rate of AM fungal infection (58%) while Ipomea pestigridis, a member of the convolvulaceae family, had the lowest rate (16%).

The species like *Ludwigia parvifolora* (19%) On agraceae, *Ipomea cordata* (17%) Convolvulaceae showed 10 to 20% of AM fungal infection. The other species like *Adathoda vasica* (23%) Acanthaceae, *Colachasia* sp. (21%) Aeraceae, *Crotalaria pallida* (24%) Papilionaceae, *Eragrostis umiloides* (26%) Poaceae, *Justicia betonica* (22%) Acanthaceae, *Ipomea cordata* (17%) Convolvulaceae, *Portulaca tuberosa* (21%) Portulacaceae, *Heliotropium indicum* (20%) Boraginaceae, *Justicia jendarussa* (26%) Acanthaceae, *Plumbagoauriculata* (24%) Plumbaginaceae, *Tragiainvolucrata* (26%) Urticaceae, *Jatropha curcus* (27%) Euphorbiaceae, *Spillanthescalva* (21%)belongs to Asteraceae showed 20% and less than 30% of AM fungal infection.

The plant species like *Ageratum conyzoides* (31%) Asteraceae, *Boerhavia diffusa* (42%) Nyctaginaceae, *Cissus quadrangularis* (33%) Vitaceae, Zizyphus rugosa (35%) Rhamnaceae, *Solanum xanthocarpum* (47%) and *Solanum nigrum* (33%) Solanaceae,

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Phyllanthus amarus (33%) Euphorbiaceae, *Sida rhombifolia* (48%) Malvaceae showed 30 and less than 50% of AM fungal infection. The species like *Cassia tora* (53%) Caesalpinaceae showed 50 and less than 60% of AM fungal infection. In the present studies, the arbuscular my corrhizal fungal spores observed in totally 25 plant Species of rhizosphere soil samples belongs to18 plant families.Among the AM fungal species *Glomus* is considered to be the most common. All the plant species colonized by AM fungi. The plant species infected by hyphae, vesicles and arbuscules. Some of the plant species infected by only hyphal and vesicles. But all the species infected by hyphae. In the present investigation, the Euphorbiaceae family member of *Pyllanthus amarus*, *Jatropha curcus* **and** *Ipomea pestigridis s* were infected by AM fungi. The same results was obtained by Pyrshangs well [22] analysed the mycorrhizal association in some trees of north-eastern India. Majority of the plant species showed end omycorrhizal association. In most of the plant species acorticalhyphae and vesicles were observed in the roots of the same plant. Mycorrhizal association occurred naturally with many important forest trees. The variation in spore population and quantum of root colonization was recorded. This fluctuation might be due to the influence of different environmental factors on AM sporulation and infection. In the present investigation, the rhizosphere soils of all the plants species contains different types of arbuscular mycorrhizal spores.

Totally 15 arbuscular my corrhizal fungal species were isolated and identified from the river Bhavani area's rhizosphere soil samples. The two species of *Acaulospora, Aca. Appendicula, Aca. scorbuculicata one species of Gigaspora, Gig. rosea, ten species of Glomus, Gl. ambisporum, Gl. citricola, Gl. deserticola, Gl. dimorphicum, Gl.dominikki.Gl.hetrosporum.Gl.aggregatum.Gl.albidium.andGl.fasic ulatum***an**dtwospeciesof*Scutellispora,Scu.nigra and Scu. gregaria* were recorded. The name of the species with species code are presented in (Table 3).

Species Description

Table 3: AM fungal species inriver bank of Bhavaniarea, Mettupalayam Taluk, Coimbatore District, Tamil Nadu.

SL. NO	GENUS	SPECIES	SPECIE SCODE
1	*Acaulospora*		
		appendicula	AAPD
		scrobiculata	ASCB
2	*Gigaspora*		
		rosea	GRSA
3	*Glomus*	*ambisporum*	LABS
		citricola	LCTC
		deserticola	LDST
		dimorphicum	LDMR
		dominikii	LDMK
		heterosporous	LHTS
		aggregate	LAGR
		albidum	LABD
		fasciculatum	LFSC
		austral	LAST
4	*Scutellispora*		
		gregaria	CGRG
		nigra	CNGR

Medicinal uses of plant species:

1) *Adathoda vasica Nees.*

Family: Acanthaceae

Common Name: Adathodai

Description: White flowers with red or yellow bars on the thorax are found on adense shrub with a foetid scent.

Uses: The leaves are used as an insecticide and in indigenous medicine. Due to their pharmacological properties, the entire plant as well as its root, leaves, bark, and flower are frequently used to treat asthma, bronchitis, whooping cough, and other respiratory conditions. (Plate -2a).

2) *AgeratumconyzoidesL.*

Family: Asteraceae

Common Name: Appakotai, Pumppillu.

Description: A weed that blooms annually and has ovate, crenate-petioled leaves and black branches. The flowers are less than 6 mm in size, pinkish, white, purple, or blue, with a fibrous root system all around. It reachesaheightofabout1m, has egg-shaped leaves, stems covered in fine white hairs, and a height of 7.5 cm (Plate 6a).

Uses: In non-industrialized societies, herbs are almost always used to treat illnesses.

3) **Boerha***via diffusaL.*

Family: Nyctaginaceae

Common name : Mukkarataikeerai

Description: A weed that blooms annually and has ovate, crenate-petioled leaves and black branches. The flowers are less than 6mm in size, pinkish, white, purple, or blue, with a fibrous root system all around. It reaches a height of about 1m, has egg-shaped leaves, stems covered in fine white hairs, and a height of 7.5 cm (Plate -6a).

Uses: In non-industrialized societies, herbs are almost always used to treat illnesses.(Plate- 2b).

5) Cassia tora L.

Family : Ceasalpinaceae Common name : Tagarai

Description: An annual weed that resembles a small shrub with small yellow flowers and long, curved pods that contain rhombohedra seeds that can be used to make blue dye.

Uses: Due to its dark color, cassia bark oil is very infrequently added to perfume products. It is frequently employed in food as a flooring agent. Like cinnamon, it is also used in the preparation of pharmaceuticals (Plate -2c).

6) CissusquadrangularisL.

Family: Vitaceae

Common name: As this amharaka, Hadjod and Pirandai.

Description: A very sprawling hrub with branches that reach far over nearby bushes.

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Uses: This plant has been used medicinally since ancient times. In sidda medicine, cissus. is regarded isotonic and analgesic and is believed to aid in the healing of broken bones, hence its name as this amharaka (that which prevents the destruction of bones). Cissus has been used in various Ayurvedic classical medicines to heal broken bones and injured ligaments and tendons. C. quadrangular is has been used medicinally by the Garotribe of Bangladesh to treat bone fractures (Plate -2d).

7) Colachasiaesculantas Schott.

Family: Aaeraceae

Common name: shanadumpa

Description: Tall, coarse herbs with simple petalled, deciduous leaves that bloom simultaneously. Utilized as a vegetable in the well-known "Sindhu curry" and as asidedish with moongdal (greengram),the root"kachalu"isused.The thick, creamy curry with prawns is made with the roots. The stem is frequently used to make a flavorful but light chutney by grating it with coconut (Plate 2e).

8) CissusquadrangularisL.

Family: Vitaceae

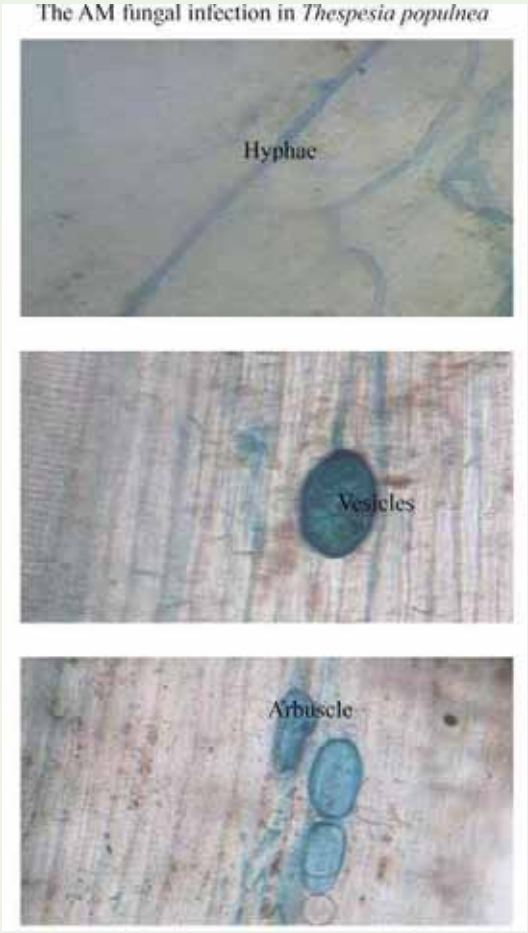

Plate 1

Common name: As this amharaka, Hadjod and Pirandai.

Description: A very sprawling hrub with branches that reach far over nearby bushes.

Uses: This plant has been used medicinally since ancient times. In siddha medicine, cissus is regarded as atonic and analgesic and is believed to aid in the healing of broken bones, hence its name as this amharaka (that which prevents the destruction of bones). Cissus has been used in various Ayurvedic classical medicines to heal broken bones and injured ligaments and tendons. C. quadrangular is has been used medicinally by the Garotribe of Bangladesh to treat bone fractures (Plate -2d).

9) CissusquadrangularisL.

Family : Vitaceae

Common name: As this amharaka, Hadjod and Pirandai.

Description: A very sprawling hrub with branches that reach far over nearby bushes.

Uses: This plant has been used medicinally since ancient times. In siddha medicine, cissus is regarded asatonicandanalges i can disbelieved to aid in the healing of broken bones, hence its name as this amharaka (that which prevents the destruction of bones). Cissus has been used in various Ayurvedic classical medicines to heal broken bones and injured ligaments and tendons. C. quadrangular is has been used medicinally by the Garotribe of Bangladesh to treat bone fractures (Plate -2d).

10) Colachasiaesculantas Schott.

Family: Aaeraceae

Common name: shanadumpa

Description: Tall, coarse herbs with simple petalled, deciduous leaves that bloom simultaneously.

Utilized as a vegetable in the well-known "Sindhu curry" and as asidedish with moongdal (greengram),the root "kachalu" isused.The thick, creamy curry with prawns is made with the roots. The stem is frequently used to make a flavorful but light chutney by grating it with coconut (Plate 2e).

11) Crotalariapallid Aiton.

Family: Papiloniaceae

Commonname: kattukozhinji.

Description: A subshrub species with surprisingly large, extremely membranous leaves, a stem covered in spreading hairs, and reflexed bracts.

Uses: The genus Crotalaria contains special foods that are rich in nutrients like starch, protein, dietary fiber, oligosaccharides, phyto-chemicals, and minerals. Their nutritional value helps people's health in a variety of ways. These plants are frequently chosen for their disease resistance, yields, and nutritional value in order to ensure their survival and best cultivation (Plate -3a).

12) *Eragrostis uniloides Nees.*

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Family: Poaceae

Common name: karyampullu.

Description: Herb 7cm long, oblong or ovoid panicles, branches that typically spear, pales without wings or with very narrow wings, falling with a lemmas. ellipsoid or ovoid in shape.

Love grass is frequently utilized as live stock feed. Although the seeds are small and difficult to collect for human consumption, some animals seem to find them to have a high nutritional value. Tiff, which is used to make traditional breads on the Horn of Africa (Plate 3b), is a notable exception.

13) Ipomeapestigridis L.

Family: Convolvulaceae Common name: Thannichedi

Description: The glabrous herb has spreading star-like prostate branches that are obtusely keeled in the later stages, glabrous stems and capsules, and glabrous, occasionally faintly furrowed seeds. Rarely exceeding 15 cm in length, with a cordate shape, an entire, rounded margin, and obscure nerves (Plate -6e).

Uses: Swelling, headaches, snake bites, and swelling are all treated with herbs.

14) LudwgiaparvifloraRoxb. Family: Onagraceae

Common name: *Musalkathilai.*

Description: An upright herb with leaves that are up to 3 cm long and are lanceolate or linear-lanceolate. The flowers are small, and the capsule is about 3 cm long. Smooth and inflated capsules contain many rows of seeds that are difficult to see through the cell walls.

Uses: Tender shoots are applied to so regums, and the plant is boiled and the resulting oil is applied to the body to lower fever (Plate 3c).

15) IpomeapestigridisL.

Family: Convolvulaceae Common name: Thannichedi

Description: The glabrous herb has spreading star-like prostate branches that are obtusely keeled in the later stages, glabrous stems and capsules, and glabrous, occasionally faintly furrowed seeds. Rarely exceeding 15 cm in length, with a cordate shape, an entire, rounded margin, and obscure nerves (Plate -6e).

Uses: Swelling, headaches, snake bites, and swelling are all treated with herbs.

16) LudwgiaparvifloraRoxb.

Family: Onagraceae

Common name: Musalkathilai

Description: An upright herb with leaves that are up to 3 cm long and are lanceolate or linear-lanceolate. The flowers are small, and the capsule is about 3 cm long. Smooth and inflated capsules contain many rows of seeds that are difficult to see through the cell walls.

Uses: Tender shoots are applied to so regums, and the plant is boiled and the resulting oil is applied to the body to lower fever (Plate 3c).

17) Justicia betonicaL.

Family: Acanthaceae

Comman name: Velimungil

Description: A tall, upright shrub with a corolla that is white with pink spots. Levees are petioled, ovate or lanceolate, acuminate, quickly attenuate at base, glabrous or villous underneath,entireorornate-den tate,upto6incheslong,3incheswide;capsulesare3-5inches long, clavate pubescent.

Applications: It is used to treat a variety of gastro intestinal complaints. While the leaves and flowers are used in Kenya, the plant is used by the Indians to treat diarrhea. The oral inflorescence was used by the Indians to treat nausea and constipation. The Lou tribe of Tanzania uses a decoction of the entire plant to treat stomachaches (Plate 3d).

18) IpomeachordataL.

Family: Convolvaceae

Common name: CakkaravarttiKeerai

Description: A very hairy climber with oddly lobed leaves and white or pink flowers that are cut to about 5 inches from the top of the petiole in a sinus shape.

Utilization: In the past, some aula varieties were used as medicines. Aula was used to stimulate lactation and as a tonic during pregnancy. Asthma was purportedly cured by other varieties. When it was necessary to cause vomiting, raw'aula was combined with Tistem (Plate-6d).

19) Portulaca tuberose Roxb.

Family: Portulacaceae

Common name: PuruppuKeerai

Description: Stems many, diffused from the top of a fusi form fleshy root; leaves linear, margined; flowers clustered; abundant brown hairs round the flowers and typically at the nodes; leaves serrate or linear; hairs plentiful and conspicuous.

Uses: Indysuria, leaves and fusion are given internally. Erysipelas is visible from the outside. The plant possesses diuretic, calculolythic, angalesic, and anti-butric qualities. a treatment option for milder, non-specific acute diarrhea. Plate -6b.

20) Heliotropium indicum L.

Family: Boraginaceae

Common name: Thel-Kodukku

Description: Common in all plains districts are rodesides and waste areas. a rough annual herb growing to a height of 2feet,with long spikes of large leaves and paleviolet small flowers. A long, petiole up to 4 inches long, 3 to 4 inches wide, and hispid-pubescent, the leaves are ovate, obtuse, narrowed or cor date at base, frequently unequal, undulate, and usually decurrent. Plants have astringent, emollient, culinary, and diuretic properties. It is applied locally for the treatment of ulcers, sores, wounds, gumboils, skin affections, insect strings, and

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rheumatism. The leaves are used to keep rings warm,the juice is used to treat eye diseases, and the roots are aphrodisiacs that are used to treat night blindness(Plate3e).

21) Zizyphus rugosa Lam.

Family: Rhamnaceae

Common name: Charai, kottamullu.

Description: A small tree or shrub with large, elliptic, typically cordate leaves, paniculate flowers, and small fruit that is straggly and thorny. Reddish and moderately hard wood.

Uses: Four grain pills containing the flowers, equal amounts of petal leaf petioles, and half as much lime are taken twice daily to treat men or rhagia (Plate-4a).

22) Justica jendarussa L.

Family: Acanthaceae

Common name: karunochi, vadaikuthi.

Description: The capsule is glabrous and5cmlong.The leaves ares hortpetiolated, narrowly lanceolate, glabrous, up to 5 cm long, and 1 cm wide. An upright underbrush with white and rose or purple spots called a corella.

Uses: The plant is used as a border for gardens, and its leaves are widely used in traditional medicine. The leaf has carminative, anti-periodic, and antispasmodic properties. A decoction made from the leaves of the tenter toung shoot is used to treat chronic rheumatism. Headaches can be treated using an internal infusion of the leaves (Plate -4d).

23) Solanum xanthocarpum Sch.&Wendl.

Family: Solanaceae

Common name: kantankattri

Description: The fruit is a berry with many, smooth seeds, and the leaves are ovate or elliptic, acute, pinnatified halfway down, or occasionally only sinuate. A dispersed perennial noticeable herb, the flowers are typically 75 cm in diameter.

Uses: Include treating worms, colds, hoarseness of voice, fever, dysuria, liver enlargement, musculo skeletal pain, spleen stones, and urinary bladder stones. In piles, kantakari fumigation Is beneficial. The berry juice is used to treats ore throats (Plate-4c).

24) Solanum nigram L.

Family: Solanaceae Common name : Manathakkali.

Description: An upright annual herb with white flowers. Auxiliary or lateral umbellatecy me withthin, glabrous leaves, ovate-lanceolate berries with entireorsinuateteeththataretypically black but can also be yellow.

It is a common herb that is found in wooded are as and is used for both culinary and medicinal purposes. It also has many health advantages. The fruit, stem, and leaves are used to treat a variety of illnesses (Plate -4d).

25) Plumbago auriculatapoir Lam.

Family: Plumbaginaceae

Common name: Cittramulam.

Description: It is an evergreen shrub with white flowers and alternate, entire petioles that are frequently auricled at the base. Calyx tubular, cotyledons of the single, round seed.

Uses: It is used for its antioxidant and antimicrobial properties, as well as its anti-fertility and anti-cancer properties (Plate -4e).

26) Tragi ainvolucrata L.

Family: Urticaceae

Common name: Kanchori

Description: An evergreen climbing hispid herd with stinging bristles, variable in foliage, the leaves rather thick. Leaves are not cordate at the base.

Uses: Roots are diaphoretic, alternative, diuretic and blood purifier. They are valued in febricula and in itching of the skin, also for pain sin leg sand harms. Roots are also used in old venereal complaints and externally in enlarged in spleen; the fruits are rubbed on ahead with little water to cur baldness. Leaf juice is given for jaundice in Rangamati (Plate -5a).

27) Phyllanthus amarus schum&Thorn.

Family: Euphorbiaceae

Common name: Keelanelli

Description: A thin annual herb with a stem that is necked below and thin, angular branches that are covered in leaves, measuring 15–45 cm high, is described. Flowers are tiny, plentiful, and quickly dispelled. Small, compressed globose capsules.

Uses: It could lower blood pressure. People who have kidney and liver stones can benefit from this. It is reportedly also applied to anorexia (Plate 5b).

28) Jatropha curcas L.

Family: Euphorbiaceae

Common name: Kaat-amunak.

Description: It is described as a thin annual herb that grows 15–45 cm high, has a necked stem below, and thin, angular branches with leaves. Flowers are small, numerous, and quickly gone. tiny, tightly-packed globose capsules.

Uses: It might bring down blood pressure. This is helpful for those who have kidney and liver stones. According to reports, it is also used for anorexia (Plate 5b).

29) Thespesia populnea L

Family: Malvaceae

Common name: Puvarasam

Description: A fairly large evergreen tree with long-petioled

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cordate leaves that are 3-5 inches long and 2-3 inches wide, and long peduncle flowers with yellow petals that turn purplish pink.

Uses: The paste made from this tree's leaves is used to bandage up inflammations. The treatment for skin conditions likes cabies and purities involves applying flower paste. On skin conditions, the fruit's milky secretion is applied (Plate -5d).

30) Sida rhombifolia L.

Family: Malvaceae

Common name: Paniyartuttil, Paniyartuti.

Description: The stems are 50–120 centimeters tall, erect to sprawling, and branched, with the lower portions being woody. With petioles that are only about one-third the length of the leaves, the dark green, diamond-shaped leaves are alternately arranged along the stem and range in length from 4 to 8 centimeters. Small, spiny stipules are present at the bases of the petioles. They have short, grayish hair and are paler underneath.

Uses: In Mexico, the leaves are smoked, and in India, a tea is made. The reason arrow leaf sidaisunpala table to cattle may be related to these chemicals.

According to a different source, the root has a 0.1 percent alkaloid content and contains in do le alkaloids related to choline, pseudoephedrine, beta-phenethylamine, vascin, and hipaphorine (Plate -5e).

31) Spillanthes calv W.

Family: Asteraceae

Common name: Vanamugali

Description: An upright annual herb with leaves that are 2.5 to 5 cm long, ovate, acute or subobtuse, irregularly crenate-serrate, and have a cute base. Heads are yellow, 0.6 to 1.3 cm long, ovoid, single or sub panicled, and occasionally reach a length of 10 cm.

Uses: The flower head's stimulant and sialagogue properties make it an effective treatment for toothaches, gum and throat ailments, and tongue paralysis. It works well as a mosquito larvalicide. The plant's decoction is diuretic, lithontriptic, and used as a bath for rheumatism and dysentery (Plate -6c).

Spore Description

Spain, Sieverding and Schenck's *Acaulospora appendicula* (Plate-7a).

The azygospore (170-) 250 (-390) µm diam. When young, it is opaque white; as it ages, it turns from dull yellow-cream to orange-tan: Attached to the reticulate inner wall and forming an appendage on the spore is a hyphal pedunculate protuberance. 8-16 (-20) m thick external wall. Roughened a little. age-related browning from yellow. Smooth innermost hyaline wall. 2-4 m thick.

Acaulosporascorbiculata Trappe(plate-7b)

Sessile azygospores that form singly in the soil are carried laterally on a broad, thin-walled hyaline hypha that ends nearby in a vesicle with a thin wall. Vesicle is globose-shaped, and matures pores range in color from olive to light brown. Except for the circular, rimmed vesicle

Gigasporarosea NicolsonandSchenck(plate-7c)

Azygospores produced singly, globose, 250-300 µm diameter, cream in colour with rose- pink tint, wall upto 8µmthick, with 2-5 inseparation layers,outer wall smooth suspens or like cell, bulbous, subtending hyphae upto 50 µm thick, wall upto 2 µm thick.

Glomusambisporum Smith and schenck (plate-7d)

Chlamydospores formed singly in the soil, sub globose, peridominatly globus and occasionally sub globose, 98-166×93-157 c, sporocarp dark brown to black, central core of thick inter woven hypha, periderm absent, sporo carpaggrigates, three walled spores, inner wall membranous, middle wall laminate dark brown, confluent with hyphal attachment, outer wall reticulate.

Glomuscitricolum Tang *and* **Zang.(Plate-7e)**

Specocarps are unknown. Chlamydospores can be dispersed singly, in loose clusters in the ground, or in dense clusters in the cortex of roots. Spores are light brown, 35-65 m wide, and 60-90 m long. They can be globose to sub globose or ovoid, obovoid, or irregular. Spore wall is two layered and smooth. A septum may occasionally close off the distal end. creation of vesicular arbuscular mycorrhizae.

Glomusdeserticola Trappe, Bloss and Menge (plate-7f)

The soil-borne spores are globose to sub globose, 54-115 52-102 m, shiny-smooth, and reddish brown in color. They have a single attached hypha that is 6-12 m in diameter and has a cylindric to occasionally somewhat funnel shape. At hyphal attachment, the spore wall thickened at maturity to form an inner mounded color that appears to be closed by a membranous septum.

Glomus dimorphicum Boyetchko Tewari. (Plate -8a)

Single, reddish-brown, dimorphic, globose to subglobose, 100-250nm, three walled,3-15nmthick,outer wall hyaline laminated 2-7 nm thick, middle wall reddish brown spores form singly or in loss clusters. Inner wall is reddish-brown and membranous, about 1 m thick, and 2–7 m thick, readily separating from outer wall. Straight orrecurved,12–25mmwide,2–6mmthick,andwith a septum mat the point of attachment, subtending hyphae are light yellow to light brown in color.

Glomusdominiki Blaszkowski(Plate- 8b)

Light yellow, ornamented, globose to subglobose, 100-175 m in diameter, singly borne chlamydospores. Spore walls have three layers and are divided into two groups: group A has anoutersinglewallthatishyaline,1-4mthick,andisdecoratedwiths mallwarts;groupBhas an inner wall that is hyaline, smooth and membranous, and it is 1 m thick. Hyaline, slightly recurved, up to 13 m wide, 2 m thick at the base of the spore, septum-free, constricted at attachment, subtending hyphae.

Glomusheterosporum Smith and Schenck(Plate-8c)

Light to darkbrown, oblongtoellipsoid, occasionally globoid, and

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99-20661-201minsize, chlamydospores are produced in sporocarps. two distinct walls on spores. Brown inner wall laminate that is 3 to 10 mm thick. Hyaline outer wall is smooth, ephemeral, and 2–7 m thick. Hyphae at the attachment point are 5-31 m wide. In a 43:15:1 ratio of single, dual, and triple attachments, spores frequently have multiple hyphal attachments. Hyphal connections often had branches.

Glomusaggregatum Schenck and Smithemend.Koske(plate-8d)

Chlamydospores are irregular spores that can range in size from 35-90 35-70 m and are smooth, globose to subglobose, pyriform, variable, pale yellow to orange brown in color, occasionallywithagreenishtint. Theyareformedinlooseclusters.Sporewallsaretwolayers and 3-5 m thick, with the outer wall being thicker. Straight, curved, swollen, irregular, or constrictive subtending hyphae range in width from 5 to 10 m.

Glomusalbidum Walker ***and*** Rhodes(plate-8e)

Chlamydospores are white, yellow to brownish-yellow, globose, with two spore walls: an outerhyaline wall that is 1-2 mm thick and an inner light yellow wall that is laminated and 1- 2 mm thick. The spore walls are continuous with the hyphal wall. Straight, two-walled subtenting hyphae with a thickened outer wall at the base of the spore. Oil droplets with a lot of spores.

Glomusfasciculatum(ThaxtersensuGerd)Gerd&Trappe.(Plate-8f)

Chlamydospores can be found in sporocarps, loose aggregations, dead rootlets, small, compactclusters,andsoil.Grayishbrown,tubercu late,upto8X5X5mmsporocarpsthatare irregularlygloboseorflattened. Absenceofperidium.Whenglobose,chlamydosporesmeasure 35–105 diam.; they are smooth or appear roughened due to adherent debris.

Glomusaustrale (Berck) Berch (Plate-9a)

Reniform, epigeous, white when fresh, and beige when dried, sporocarp. When dried material is cut,spores form in undetectable loose clusters that are not visible at the cut surface. Each cluster develops from a central, subtending hyphae, and is broad (20–25 m) at the point of attachment. Spores have two wall layers with a diameter of (120-)160 (-180) m; the inner layer is light or dark brown and 7(1-15) m thick, with the outer layer being hyaline or pale yellow. The spore is frequently found in subtending hyphae.

Scutellisporagregaria (Schenck and Nicolson)Walker and Sanders (plate-9b)

Spores formed singly, forcibly reddish, globose to subglobose, four cell walled 250-448 × 250-480 µm in size. second cell brittle yellow, suspensor like cells pale brown, septate subtending hypha, thick or thin walled hypha, the suspensor cell and extending towards the spores, the large wart like projections are closely packed.

Scutellisporanigra (Redhead)Walker and Sanders (plate-9c)

Spores formed singly, dark brown to black, globose, 2 walled, outerwall dark brown to black, pitted, inner wall light brown, transparent, laminate. Suspensor-like cell attached laterally, brown among the dark-spored species of *Scutellispora*. *Scutellispora nigra* can be easily distinguished by large, black and pitted spores.

Conclusions

The purpose of the study is to look at the arbuscular mycorrhizal fungus associations in the plants growing along the riverbank in Bhavani, Tamil Nadu's Coimbatore District. In the rhizosphere soil and root samples, 25 plant species from 18 families were examined for AM fungal association. All plant species had arbuscular mycorrizal fungal spore populations and varying degrees of root colonization. Recordings were made of the my celial structures such as hyphae, arbuscules, and vesicles. All 25 plant species in the rhizospore soil samples had different soil pH levels.

In this study indicated that that highest AM fungal infection in The spesia populnea (58%) and the lowest in Ipomea pestigridis (16%). The maximum spore population were reported in Cassa tora (578/100g of soil) and minimum in Colachasia sps. (121/100g of soil). Totally 15 AM fungal species belonging to 4 genera were observed such as Acaulospora, Gigaspora,Glomusands cuetellispora were found in the river bank of Bhavani of Coimbatore district. The two species of Acaulospora, Aca. Appendicula, Aca. Scorbuculicataone species of Gigaspora, Gig. rosea, ten species of Glomus, Gl. ambisporum, Gl.citricola, Gl.deserticola, Gl.dimorphicum, Gl.dominikki. Gl.hetrosporum. Gl.aggregatum. Gl.AlbidiumGl.austral and Gl. Fasiculatum, two species of Scutellispora Scu. gregaria, Scu.nigra. Of these the Glomusgenera were dominated followed by Acaulospora, Gigaspora, Scutellispora. Among the AM fungal species the Glomus fasiculatum was dominant one.

The findings of this study showed that the AM fungal diversity in plant species' rhizosphere soils can be regarded as essential diversity. The study came to the conclusion that the widespread presence of AM fungal in the soil and its increased favorability for better plant growth. It is clear from the findings of the current investigation that AM fungi are very common in the study area. AM fungi had colonized every species of plant that had been examined. AM fungi play a significant role in agriculture and are highly significant economically.

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