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SOIL FUNGAL COMMUNITY STUDY OF TERMITE NEST GROWN ON ORNAMENTAL PLANTS IN KMGIPSR AND TAGORE COLLEGE CAMPUS, PUDUCHERRY, INDIA

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ABSTRACT

Fungi are well known for their accessibility from different sources in particularly soil and their involvement in providing fruitful bio-compounds for the purpose of bioprospecting. Fungi are significant decomposers in ecosystems, ensuring the assimilation of dead plants and animals into smaller molecules that can be used by other organisms of the ecosystem. During the present work, termite nest soil samples of different plants available in Tagore and KMGIPSR campus were studied to record the incidence of fungal concentration and their composition. *Aspergillus* spp was found as the dominant one and it was followed by *Penicillium chrysogenum* and Sterile mycelia. One-gram termite nest soil was found to harbour 100 to 500 fungal spores in our study. The results clearly indicated that *Aspergillus niger, Aspergillus awamori, Aspergillus terreus* and *Penicillium chrysogenum, Penicillium citrinum* and sterile mycelia were of high occurrence in termite nest soil and other fungi like *Candida, Fusarium, Trichoderma* and *Drechslera* were isolated with least numbers. Among the isolates, aspergilli, penicilli and white sterile mycelia were dominant in termite nest soils due to their high sporulation capacity and high adaptability nature. Plants like, *Tectona grandis* contributed the maximum number of fungal species followed by *Samanea saman* among all the six plants by holding the termite nest soils on their trunks. The frequency of mycoflora in the termite nest soils were found to be regulated by many factors like the available nutrients on the trunk, seasonal humidity, prevailing temperature, soil type and its texture.

KEYWORDS: Soil fungal community, Termite nest soil, Ornamental plants, Aspergilli, Penicilli, Sterile mycelia.

INTRODUCTION

Soil microbiota particularly fungi act an essential role in estimation of soil conditions and in exciting plant metabolism.[1,2] Fungi are considered as the important entities in increasing the soil fertility and plant growth as they are equipped with several biochemical amendments and mineralization in the soil. Soli fungi are greatly approached to the source of their occurrence which have greater influences on the activity of other soil microbiota.[3] Termites are one of the insects belonged to the order Isoptera who dwell on the trunks of the plants in any tropical environments and accumulate soil as their nest. Most termites use soil together with saliva and feces to construct their nests on the plants. In general, 2000 termite species are available worldwide, of which at least 20 are from India.[4] In forest plants, termites were observed to dwell at heights of more than 30m on and in the standing trees and down to a depth of 30 cm in the soil.[5] Termites show significant role in energy flow as well as of nutrients cycling in the tropical ecosystem. The termite gut inhabits a variety of microflora which play an important role in improving the soil productivity. Fungi in termite nest soil particularly in the soil of forest and agricultural fields perform a major role in many essential progressions such as organic matter disintegration and mineralization.[6] Micro-fungi are a significant component of the soil micro biota.[1,7] Moreover, micro-fungi perform a major role in nutrient cycling by modifying soil biological movement.[8] The present study is an attempt to isolate, enumerate and identify different fungal species from a different environmental source i.e., termite nest soil samples collected from different forest ornamental plants available in KMGIPSR and Tagore College campus, Puducherry.

MATERIALS AND METHODS

During our present study period, isolation, enumeration

and identification of termite nest soil fungi were carried out from different ornamental plants viz., *Anacardium occidentale, Tectona grandis, Ceiba pentandra, Ficus religiosa, Samanea saman* and *Delonix regia* found in KMGIPSR and Tagore College campus, Pondicherry, India.

Collection of soil samples

The termite nest soil samples were collected from different ornamental plants viz., *Anacardium occidentale, Tectona grandis, Ceiba pentandra, Ficus religiosa, Samanea saman* and *Delonix regia* available in the KMGIPSR and Tagore College campus site, Pondicherry, India and brought to the Microbiology laboratory, Department of Botany, K. M. Govt. Institute for Postgraduate Studies and Research (Autonomous), Lawspet, Pondicherry, India with utmost care, stored at 4^{o} C in the refrigerator for further studies. The collection of soil samples is given in Plate I, which shows the physical appearance of the termite nest soil samples.

Plate I: Termite nest soil samples collected from ornamental plants found in KMGIPSR and Tagore College campus, Puducherry, India.

Isolation of fungi from the soil samples

The termite nest soil micro-fungi were isolated and counted by two agar plate methods, namely Soil Dilution[9] and soil plate method[10] on different media such as Sabouraud Dextrose Agar and Potato Dextrose Agar.

Identification of the soil fungi

The isolated fungi and their morphological study were carried out by macroscopically through observing colony features (Texture and Color) followed by microscopically by staining with lactophenol cotton blue and detected under trinocular microscope with photography for the conidia, spore, conidiophores and arrangement of the spores. The fungi were identified with the help of the available literature in the Microbiology laboratory and the monographs present in the department as well as the expertise of the research personnel.[11-16]

Statistical analysis

The number of colonies per plate per gram soil was calculated and the percent occurrence of each fungal isolate was calculated by using the following formula.

$$\% \text{ occurrence} = \frac{\text{Total no. of CFU of an individual species}}{\text{Total no. of CFU of all species}} \times 100$$

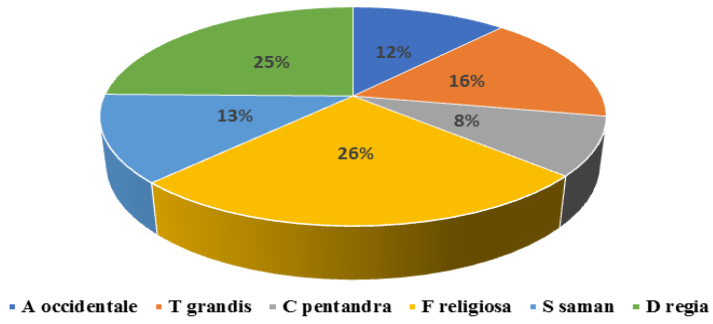
RESULTS AND DISCUSSION

During the present study period, altogether 93 fungal colony forming units (CFUs) were isolated from the termite nest soil samples of the six ornamental plants. In fungal composition, a total of 17 fungal species under 8 genera were recorded from the termite nest soils. Fungi like *Aspergillus* sp., *Aspergillus awamori, A. flavus, A. niger, A. terreus, A. ustus, A. versicolor, Candida* sp., *Drechslera* sp., *Fusarium* sp., *Penicillium chrysogenum, P. citrinum, P. notatum, P. oxalicum, Trichoderma harzianum,* Gray sterile mycelia and White sterile mycelia were enumerated and identified from the termite nest soil during the present study period. Qualitative and quantitative occurrence of anthill soil fungi in University campus is given in Table 1 which shows the total number of fungi isolated and their percentage occurrence.

Table 1: Percentage occurrence of termite nest soil fungi and their total CFUs isolated from different ornamental plants in Tagore College and KMGIPSR campus, Puducherry.

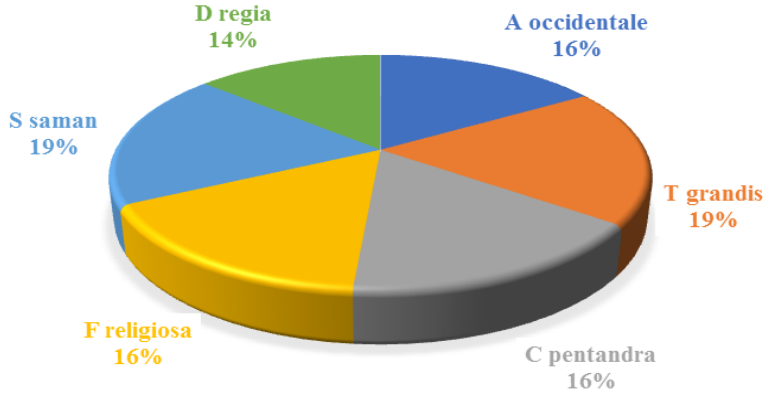
Fungi	*Anacardium occidentale*	*Tectona grandis*	*Ceiba pentandra*	*Ficus religiosa*	*Samanea saman*	*Delonix regia*
Aspergillus sp.					4/33.33	
A. awamori		2/13.33	2/25.0			
A. flavus	2/18.18			7/29.16		
A. niger		4/26.66	2/25.0	1/4.16	2/16.66	
A. terreus			1/12.5		1/8.33	12/52.17
A. ustus		3/20.0				
A. versicolor				5/20.83		
Candida sp.	5/45.45					
Drechslera sp.	1/9.09				1/8.33	1/4.34
Fusarium sp.	1/9.09	1/6.66				
Penicillium chrysogenum				3/12.5		6/26.03
P. citrinum	1/9.09	1/6.66	1/1.25	4/16.66		3/13.04
P. notatum				4/16.66	1/8.33	
P. oxalicum			1/1.25			
Trichoderma harzianum					1/8.33	
White sterile mycelia	1/9.09	3/20.0	1/1.25		2/16.66	1/4.34
Gray sterile mycelia		2/13.33				

Fig 1: Quantitative difference of termite nest soil fungal CFUs in various plants

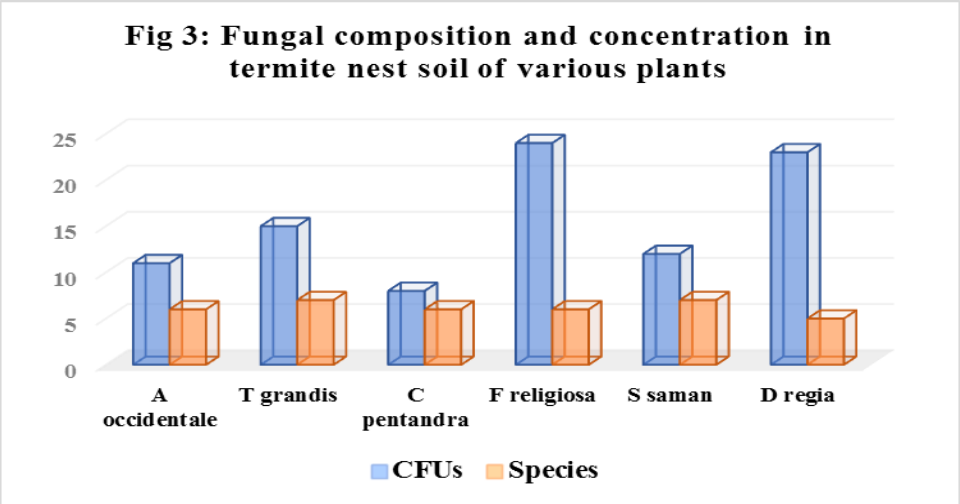


Ficus religiosa contributed the maximum fungal spore and their CFUs followed by *Delonix regia* and other four plants in their termite nest soils (Fig 1and Fig 3).

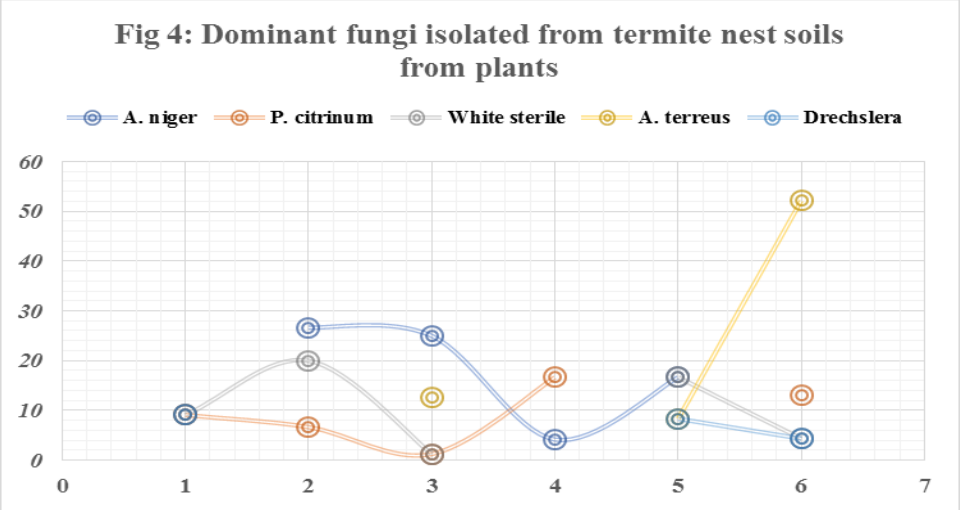
FIG 2: FUNGAL COMMUNITY (%) IN TERMITE NEST SOIL OF VARIUOS PLANTS



Likewise, *Tectona grandis* contributed the maximum number of fungal species followed by *Samanea saman* among all the six plants in their contribution by their termite nest soils (Fig 2 and Fig 3). *Penicillium citrinum* and white sterile mycelia were recorded from five plants, *Aspergillus niger* was isolated from four plants and *Aspergillus terreus* and *Drechslera* sp. were identified from three plant each (Fig 4 and Table 1).



White sterile mycelia were predominant in the termite nest soils studied herewith in our present work (Table 1).



Aspergilli contributed with a greater number of species (7) viz., *Aspergillus* sp., *Aspergillus awamori, A. flavus, A. niger, A. terreus, A. ustus, A. versicolor* and it was followed by four species of Penicilli viz., *Penicillium chrysogenum, P. citrinum, P. notatum, P. oxalicum* and two sterile mycelial forms. It was found that the termite nest soil contributed 100 to 500 fungi per gram soil only which may be associated with the lack of nutrients in the trunk of the plants where they are grown up. Further the diversity of fungal community in any soil depends on diverse factors viz., biological nutrient, pH, relative humidity and prevailing temperature in the soil environment.[18] They also explained in their work that the physicochemical constraints like, soil pH and its texture also define the fungal population in the soil samples. The soil fungal flora study made by Nayak and his co-workers[19] was in agreement with our report since they isolated fungal colonies under fungal species from the anthill soils. But our work diverges since it was made on different environments than anthill soils. In our present study, the maximum fungal species were fitted into Deuteromycotina followed by Zygomycotina and a few were under Ascomycotina, but no fungi were documented from Basidiomycotina. Amongst the fungal isolates, aspergilli were found as the dominant followed by penicilli and sterile mycelia. In qualitative and quantitative analysis, termite nest soil was found to be the good contributor of fungi per gram soil. White sterile and grey sterile mycelia were recorded in more numbers from the termite nest soils.

In our current study, Ramkumar et al[1] analysed soil samples of two different fields viz, Paddy field and Garden land and recorded the incidence of fungal composition and their diversity. *Aspergillus terreus* was found as the dominant one in paddy field soil but

Penicillium citrinum was the dominant one in garden soil. Their results indicated that *Aspergillus terreus, Aspergillus niger, Aspergillus flavus* and *Penicillium digitatum, Trichoderma* were of high occurrence in both the land soils and few fungi like *Fusarium, Chaetomium, Curvularia* and *Paecilomyces* were negligible. Further Ramkumar et al[19] in their study of anthill soil mycoflora showed that aspergilli were found as common fungal flora in the anthill soil followed by penicilli and sterile mycelia. They identified *Alternaria, Cladosporium, Curvularia, Fusarium* and *Trichoderma* from anthill soil. Plant pathogenic forms like *Alternaria, Fusarium* and *Curvularia* as well as biological controlling agents like *Trichoderma* were isolated from the soil. They also opined that isolates of *Aspergillus* and white sterile mycelia were dominant in the agricultural fields due to high sporulation capacity.[1]

CONCLUSION

During the present study, aspergilli were found as common fungal flora in the termite nest soils followed by penicilli and sterile mycelia in different ornamental plants in our KMGIPSR campus, Puducherry. A total of 100 to 500 fungal spores were documented from one-gram of termite soil. Fungi like *Aspergillus* sp., *Aspergillus awamori, A. flavus, A. niger, A. terreus, A. ustus, A. versicolor, Candida* sp., *Drechslera* sp., *Fusarium* sp., *Penicillium chrysogenum, P. citrinum, P. notatum, P. oxalicum, Trichoderma harzianum,* Gray sterile mycelia and White sterile mycelia were isolated from the termite nest soil. More works pertaining to soil mycoflora study of different termite nest soils of varied plants would be promoted to analyse their community structure and composition. Further the factors who are generally involved in promoting fungal population in the termite nest soils should be analysed.

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