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Fungal succession during coir pith decomposition

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SUMMARY

A laboratory study was conducted on the fungal succession in coir pith samples undergoing different degrees of decomposition at regular interval of 15 days from 0- 90 days. The results of the study revealed that coir pith samples: fresh (S_1) and decomposed to different degrees (S_2 – S_9) were initially invaded by primary saprophytic sugar loving fungal colonizers like *Rhizopus* sp., *Mucor* sp., *Syncephalastrum* sp. etc. As decomposition proceeded (30 – 60 days), the primary colonizers gave way for the colonization of secondary cellulose decomposers like *Aspergillus* spp., *Penicillium* spp., *Chaetomium* spp., *Trichoderma* spp., *Cladosporium* spp., *Monascus* sp., *Verticillium* sp., etc. In the last phase of decomposition (75 –90 days), wood rotting lignolytic basidiomycetes fungi like *Agaricus* sp., *Pleurotus* sp., *Trametes* sp., etc. emerged as dominant mycoflora.

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Key words : Fungal succession, Decomposition, Primary colonizers, Dominant mycoflora

Coconut coir pith or coir waste is the elastic, soft, spongy, highly hygroscopic, cork like pith material forming the non fibrous tissue of husk and is a renewable agro waste resource that accumulates in huge quantities. It is estimated that for extracting one kg of coir fibre, as much as two kg of coir pith is produced as a waste. It is a lignocellulosic waste and contains 34.8 per cent of lignin and 28.6 per cent cellulose (Gopal and Gupta, 2001). As it has no economic utility, it is often dumped outside the coir industry in large quantities. Being very low in density, it is blown away by wind when left on roadsides, thus causing vehicular obstruction. When it is burnt, it does not burn completely but emits abundant smoke for several days polluting the environment. Coir pith undergoes decomposition mostly by a plethora of microorganisms. This study brings out the successional colonization of coir pith that partakes in the decomposition process.

MATERIALS AND METHODS

Source of coir pith waste:

Coir pith samples (25 kg), fresh and decomposed (at different degrees) were collected from coir waste disposal sites near each unit in thick gauge polythene bags from parts of Pollachi, Coimbatore District, Tamil Nadu.

Preparation of coir pith samples:

The coir pith samples were graded on the basis of their year of decomposition as S_1 (fresh) and S_2 – S_9 (decomposed to different degrees). A quantity of 100 g of sample was taken in perforated thick gauge polythene bags.

Fungal succession in coir pith samples:

The experiment was performed at regular intervals of 15 days for 90 days to analyze the successional occurrence of various fungi in coir pith samples.

Medium for enumerating fungi:

For enumerating fungi, Potato Dextrose Agar Medium (Riker and Riker, 1936) and Oat Meal Agar Medium (Johnson and Curl, 1972) were used.

Enumeration of fungi:

Enumeration of fungi were done by serial dilution plate technique (Warcup, 1950). The number of fungal colonies per plate was carefully counted and the population of fungal flora was enumerated and expressed as number per g of coir pith on dry weight basis.

Identification of fungi:

The fungal isolates were identified based on their morphology, mycelia structure and spore formation (Domsch and Gams, 1972 and Ellis, 1976).

RESULTS AND DISCUSSION

The succession of fungi occurring in coir pith was studied by observing the frequency of the predominant fungi appearing in coir pith samples to the total number of

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fungi. The relative per cent of occurrence was calculated for each species of the most frequently appearing fungi. In the present investigation, coir pith samples fresh (S_1) and decomposed to different degrees ($S_2 - S_9$) initially (0 – 30 days) were invaded by primary saprophytic, sugar loving and fast growing fungi like *Rhizopus* sp., *Mucor hiemalis* and *Syncephalastrum racemosum*. The presence of these fungi in particular could be attributed to the availability of reducing sugars and soluble carbohydrates in coir pith. The initial invaders make use of the readily available carbohydrates and nitrogenous compounds for their nutrition and proliferation. As decomposition of coir pith samples proceeded (30 to 60 days), the primary, saprophytic, sugar loving fungi gradually disappeared. Sooner, the secondary invaders colonized the coir pith samples. The cellulose decomposing fungi like *Aspergillus* spp., *Fusarium* spp., *Penicillium* spp., *Trichoderma* spp. and *Chaetomium* spp. became distinctly dominant and they degraded cellulose and hemicelluloses. By utilizing the carbon as energy source, these mycoflora proceeds to establish on the organic matter up to a point where only complex carbohydrates alone are left out. During the decomposition of coir pith samples from 60 to 90 days, wood rotting lignolytic fungi like *Agaricus* sp. *Pleurotus sajor-caju, Trametes versicolor* and some fungi imperfecti forms like *Cladosporium* sp., *Trichoderma* spp, *Steganosporium* sp., *Fusarium* sp., *Trichocladium*, *Verticillium alboatrum* etc. emerged as dominant mycoflora in the last phase of decomposition.

Fungal succession:

The above fungal forms are known for their degrading ability of wood and could degrade lignin and lignocellulosic materials.

The conclusions of the present study are in conformity with those of Senthil Kumar *et al*. (1993). They studied the successional pattern of fungi dominated on tropical grassland. The primary colonizers were mainly saprophytic fungi, which survived well on undecomposed litter. The secondary colonizers were those capable of utilizing high molecular weight compounds like cellulose and lignin. Sankaran (1994) during the investigation on the succession of fungi associated with the decomposition of leaf litters of teak and *Albizzia* observed the dominance of *Aspergilli, Penicillia, Doliomyces mysorensis, Robillardia* sp. and *Trichoderma viride* in *Albizzia* litter and teak litter. Secondary colonizers of both litters included several genera of fungi imperfecti and sterile forms.

Conclusion:

Due to the complexity of substrate and intermediate products, the microbial diversity and succession of population is a prerequisite to ensure complete biodegradation .The successional changes in the mycoflora were indeed dictated primarily by the chemical composition of coir pith samples and the saprophytic colonization capacity of fungi. The colonization of fungi in coir pith waste brings about mineralization of organic matter, making the mineral element again available to the soil, thus protecting the environment from lignin related pollutants. Thus, fungal succession plays an important role in the maintenance of nutrient cycle in ecosystem and consequently in the enhancement of soil fertility.

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