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DECOMPOSITION OF LEAF LITTER OF *HEVEA BRASILIENSIS* MUELL. ARG. UNDER SUBTROPICAL CONDITIONS OF MEGHALAYA

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The decomposition rate, changes in the leaf component and the total microflora associated with the rubber leaf-litter was studied in West Garo Hills of Meghalaya. Nylon litter bags (1 mm mesh) containing rubber leaf-litter were placed in a 10 year old rubber plantation in March 1993 and allowed to decompose. The rate of decomposition of rubber litter was found to be much faster during the rainy season when the microbial activity is higher. The rate gradually decreased towards the later part of decomposition. Amongst the various species, *Alternaria alternata, Aspergillus* sp., *Cladosporium herbarum, Penicillium* spp., *Trichoderma* sp., *Cephalosporium* sp., *Fusarium* sp. and a filamentous yeast were found to be quite dominant. The loss of hemicellulose was the fastest which was followed by cellulose and lignin.

INTRODUCTION

Decomposition of litter is defined as the enzymatic oxidation of chemically complex plant materials by microorganisms to make simple compounds and nutrients that become part of the soil (Satchell, 1971). The decomposition of plant litter is a complex phenomenon associated with nutrient cycling whereby essential elements tied up in the litter are made available for plant growth. Therefore, assessing the role of microbes as well as mesofauna in the decomposition of plant litter is important in understanding the nutrient recycling. It was estimated that in a well manured mature rubber plantation, leaf fall could return 53 kg/ha of nitrogen annually to the soil (Heng and Moris, 1989). Many studies have been conducted on the decomposition of litter and subsequent release of nutrients (Attiwell, 1968; Hayes, 1965; Howard and Howard, 1974; Gosz *et al.*, 1973), but there are only few attempts to study the ecology of microflora colonizing the leaf-litter and decomposition rate from subtropical regions of India. This study was, therefore, initiated to examine the microflora associated with rubber litter decomposition in a mature plantation.

MATERIALS AND METHODS

The study was conducted in a 10 year old plantation of Rubber Research Institute of India's research farm which is located 13 km North to Tura (longitude 90°E - 92.45°E and latitude 25°N - 26°N) of West Garo Hills district of Meghalaya in N.E. India. The area receives an annual rainfall of 2000 mm with minimum and maximum air temperatures 7°C and 34°C respectively. The climate of the region is subtropical. The soil is a lateritic sandy loam of pH 5 to 6.5.

The decomposition of rubber leaf-litter was studied using nylon litter bag technique as

described by Bocock *et al.*, (1960). Fresh rubber leaf-litter was collected and air dried to constant weight. The size of nylon bags were 20 x 20 cm with a mesh size of 0.1 mm. The bags were filled with 20 g of litter, closed by folding over the open end and stitching. The bags were placed randomly on the ground within the plantation during March 1993 and allowed to decompose under natural conditions. Sampling was done regularly at monthly interval and five replicate bags were collected each time. The litter bags were washed in a 200 μ mesh sieve to remove all the adhering extraneous matter and dried in a hot air oven at 80°C and the percentage loss of litter (weight) calculated. The changes of litter components like cellulose, hemicellulose and lignin were estimated by the methods described by Peach and Tracey (1955).

The dilution plate method was used to estimate the litter microflora. One gram of fresh weight of the litter sample was cut into 1 cm strips by a flammed pair of scissors and a series of dilutions prepared. For the isolation of fungi, 8.5 ml aliquots of 1:1000 dilution was pipetted into petridishes containing peptone-dextrose rose bengal agar medium. For bacteria and actinomycetes, a 1:10000 dilution was considered suitable and the medium used was nutrient agar and starch casein agar medium respectively. The plates for fungi were incubated at 25±1°C for 7 days while bacterial and actinomycetes plates were incubated at 30±1°C for 24 hours respectively. Three replications were maintained for each set.

RESULTS AND DISCUSSION

The weight losses of the mesh bags over a period of 7 months (April to October) is shown in Fig. 1. Only 20.3 per cent of litter remained after a period of 7 months of decomposition. The rate of decomposition was faster during the rainy season (May to September). There could be some loss due to leaching during the period (Anderson, 1973; Gosz *et al.*, 1973). Increased activity

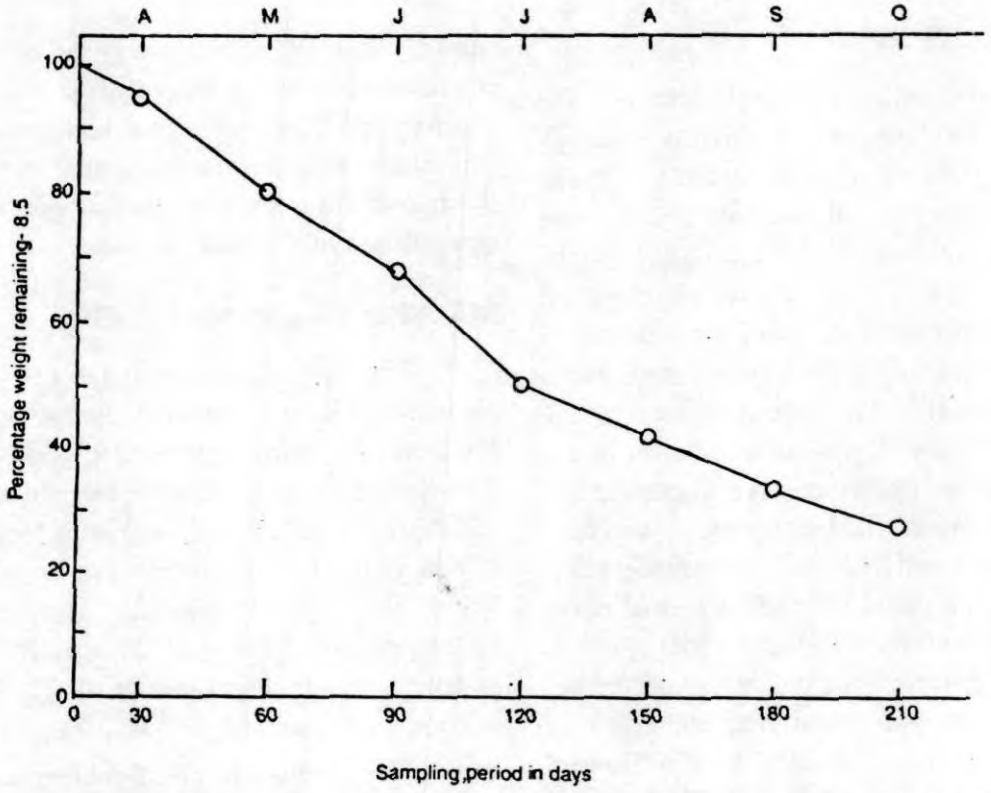

Fig. 1. Rate of rubber leaf litter decomposition under natural condition

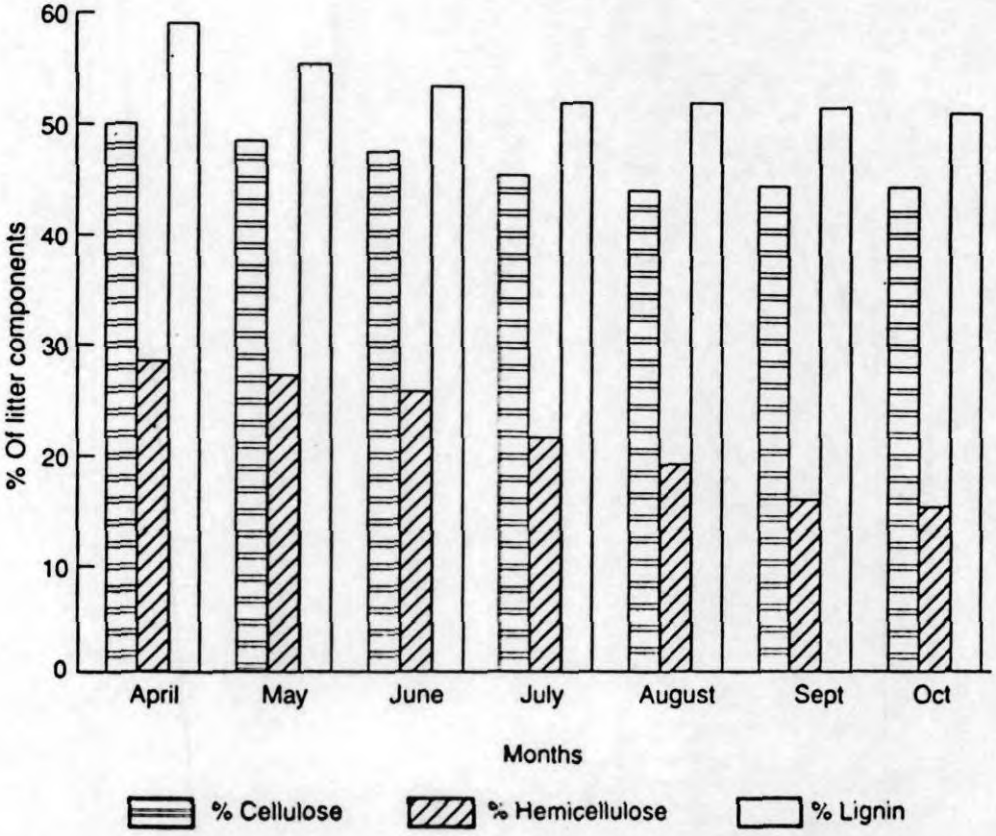

Fig. 2. Loss of chemical components of decomposed rubber leaf litter

of soil microflora and mesofauna, is the other factor which accelerate the rate of decomposition. The high rate of decomposition during the rainy season in tropical conditions has been reported (Singh *et al.*, 1979, 1980; Pandey and Singh, 1982). Climatic conditions and changes in the relative proportions of chemical constituents of litter might also influence the rate of decomposition (Singh, 1969; Vancleve, 1974; Meentameyer, 1978).

The loss of chemical components of rubber leaf-litter are shown in Fig. 2 with progressive decomposition loss of litter components also increased. In general, the rate of hemicellulose breakdown was the fastest followed by cellulose and lignin. During decomposition hemicellulose disappeared at a more rapid rate than cellulose and lignin (Alexander, 1961). When the exponential decay model (Olson, 1963) was applied, the half life and 95 per cent life of rubber leaf litter after 7 months was found to be 113.6 days and 491.8 days respectively.

The total number of microflora per gram dry litter recorded during the study period is presented in Fig. 3. The fungal population increased from April onwards reaching a peak during July and thereafter decreased. Similarly, the bacterial and actinomycetes populations also reached its peak during the month of May and July and thereafter decreased. This initial rapid increase in the microbial population may be attributed to favourable climatic conditions and also to freshly fallen litters which provide the essential nutrients required for their growth and multiplication (Gray *et al.*, 1974; Jensen, 1974; Mary and Sankaran, 1991).

A total of 15 genera of fungi were isolated from the decomposing litter, most of which belonged to *fungi imperfecti*. The relative abundance of various fungi isolated from litters is presented in the Table 1. Among these, *Alternaria alternata*, *Aspergillus* sp.,

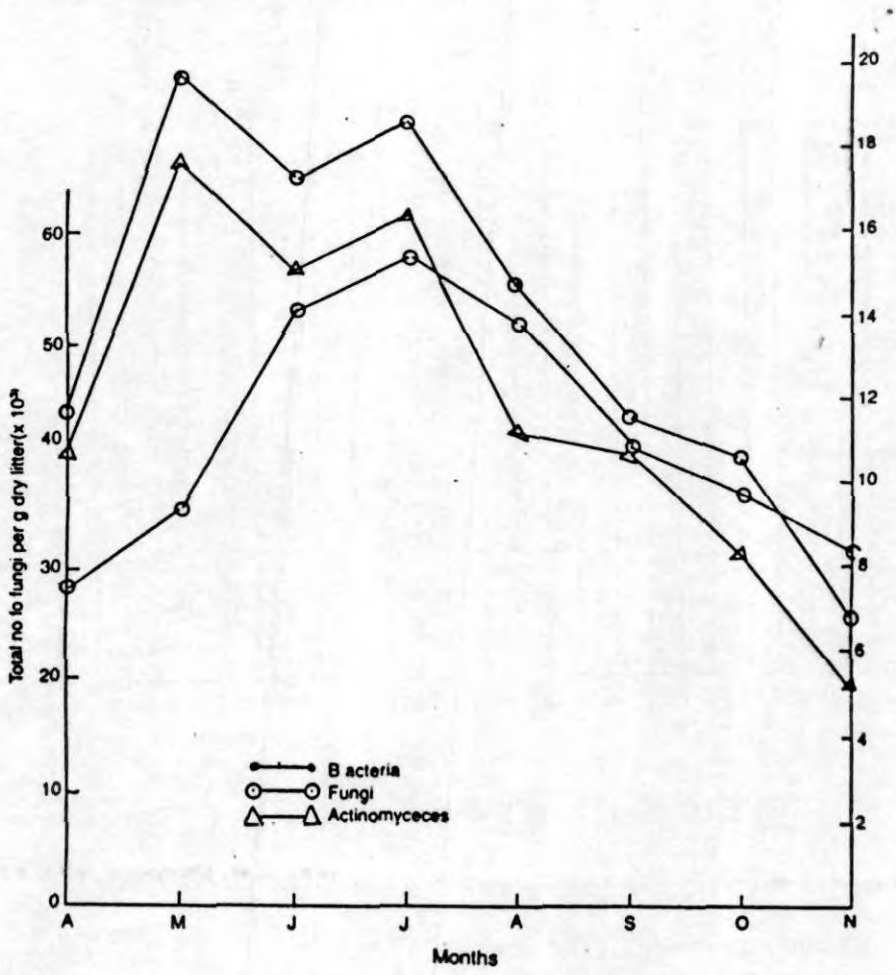

Fig. 3. Seasonal vriation of microbial popolation of decomposed rubber leaf litter

Table 1. Percentage relative abundance of fungal species isolated by dilution plate technique from decomposed rubber leaf litter

Fungi isolated	April	May	June	July	Aug	Sept	Oct
Absidia spinosa	—	—	—	2.66	3.03	4.54	3.33
Alternaria alternatum	4.0	6.25	6.09	4.54	10.61	4.54	6.66
Aspergillus niger	—	—	3.65	4.54	1.51	6.06	6.66
Aspergillus spp.	8.0	9.37	2.43	3.03	3.03	—	—
Cladosporium herbarum	—	6.25	8.53	9.33	3.03	7.57	10.00
Curvularia lunata	4.0	3.12	—	12.00	6.06	4.54	3.33
Cephalosporium coremioides	8.0	9.37	3.65	—	4.54	3.03	6.66
Fusarium oxysporum	8.0	6.25	2.43	5.33	6.06	3.03	3.33
Mucor hiemalis	—	—	3.65	2.65	6.06	4.54	3.33
Pythium sp.	—	—	1.22	—	—	6.06	3.33
Penicillium chrysogenum	8.0	9.37	4.87	5.33	3.03	1.51	10.00
Penicillium spp.	8.0	6.25	2.43	5.33	6.06	3.03	6.66
Trichoderma viride	4.0	3.12	6.09	5.33	3.03	4.54	3.33
Sterile mycelia	4.0	—	—	—	1.51	—	6.66
Filamentous yeasts	44.0	40.62	54.87	40.00	42.42	46.96	26.66

Cladosporium herbarum, *Fusarium oxysporum*, *Cephalosporium cormioides*, *Penicillium* spp., *Trichoderma viride* and filamentous yeasts were found quite dominant and was isolated throughout the study. These species are reported to be abundant in rubber growing soils in Meghalaya (Deka *et al.*, 1992). These fungi are strong colonizers of litter showing better adaptability and higher distribution (Shukla *et al.*, 1978; Cuevas and Uyenco, 1977; Macauley, 1979; Mary and Sankaran,1971). But dilution plate technique has an inherent weakness in such studies as the sporulating fungi are predominantly recovered while there are several non-sporulating soil colonizers (Garett, 1951, 1963; Harley, 1971). Hence the activity of such fungi also might have influenced the decomposition of the litter.

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