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STUDIES ON EVER GREEN FOREST LITTER DECOMPOSITION FROM SOUTH INTERIOR KARNATAKA

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Litter decomposition is an important phenomenon and is a complex process initiated by microbes for the continuous supply of nutrients and minerals to the green vegetation and crop productivity.

Fungi, bacteria and Actinomycetes associated with ever green forest localities of Arabitattu and Makut regions of Coorg District, South Karnataka has been worked out. There has been changes in the microbial number as per the decomposition stage of the litter samples. A temperature of 25^0 to 28^0C has supported good microbial population. More than 50% of the litter was degraded in the first phase followed by complete degradation, which has been documented with weight loss. The CO_2 evolution is inversely proportional with the weight loss. Rainfall, temperature, moisture and pH have also influenced litter decomposition.

Key words: Decomposition, factors, fungi, litter, nutrients.

The material of wood lands and accumulated leaves which provides nutrients and moisture for the growth of microbes constitute the litter. Leaves which fall on to the ground form the major bulk of the litter. The litter may be clearly distinguished from an underlying mineral layer or there may be no sharp boundary between a layer containing plant structures and amorphous organic materials. It may constitute senescent plant part, dead plants and mineral materials. The organic constituents include cellulose, hemicellulose, lignin, water soluble fractions, ether and alcohol soluble constituents, proteins and other mineral constituents.

Huge quantities of forest litter is decomposed above the soil surface. Decomposition includes mechanical disintegration of tissues from the stage of its attachment to the living plants and its inclusion as humus into the soil. It also means the breakdown of complex organic molecules into CO_2, water and mineral components besides the process operating on a specific class of materials and such discontinuities in space and time do exist in nature biologically speaking it gets colonized by a variety of living organisms such as microbes and macroscopic animals including nematodes and earth-worms. Further decomposition also includes chemical breakdown of senescent and dead plant materials by micro-organisms which include the decomposition of soluble carbohydrates, starch, pectin and nitrogenous compounds. However, a proportion of inorganic fraction in the fallen leaves is rapidly lost by leaching. Ultimately litter decomposition gets completed by the disappearance of litter from the soil surface and inclusion of all its components into the soil. The decomposition of litter is of paramount importance as the return of carbon as CO_2 to the atmosphere is essential for the photosynthesis followed by the release of minerals which become available for the plant.

Many fungi and other microbes take active part in biodegradation of litter. The colonization of micro-fungi proceeds that of the cellulose and lignin degradation by Basidiomycetes. The decomposed litter may also support the wood land fauna. A number of micro-fungi belonging to Mucorales, Ascomycotina and Fungi imperfect colonize the leaf litter in succession. Further the rate of litter decomposition in different plants vary nearly under similar environmental conditions, due to the structural and chemical differences.

Decomposition of plant remains is one of the important and complex processes initiated by microbes for the continuous supply of nutrients and

minerals to the existing green vegetation and crop productivity. Fungi, Bacteria and actinomycetes play an important role in the mobilization of nutrients and soil humification. Compost, an organic matter is a product of microbiological processing and biochemical activity of a number of micro organisms releasing the useful nutrients for plant growth and is suitable substrate for mushroom production. The microbiological aspects of plant litter decomposition is dependent upon litter microbes, decomposition parameters, meteorological factors, degradation of polysaccharides and many other factors. There has been much work on the plant litter decomposition with reference to crop litter, deciduous forests and specific host litter decomposition. (Alexander, 1977; Aneja, 1981; Sinha and Dayal, 1981; Forbes, 1974; Frankland, 1981; Hudson, 1968; Sinha, 1982). The sustenance of any forest is dependent on nutrients made available degradation helps in the removal of pollutants from the atmosphere, cleaning the environment, helps in nutrients cycling and adds fertility factor.

The evergreen forest located in south India has not been worked out for its litter decomposition as implicated by microbes. Therefore an attempt is made to study the following aspects of the ever green forest litter decomposition by microbes. The ever green is confined to western ghats, Makut range of South Interior Karnataka which supports humid tropical ever green forest. The forest is found in the ranges of 600 to 2186 msl. And the minimum altitude being around 190 msl. It is characterized by high humidity heavy rainfall, cold nights and windy days. The aspects studied are:

1. Microbial numbers and their seasonal variations.
2. Litter dry weight loss in relation to microbes
3. Evolutions of CO_2 in litter decomposition.
4. Role of temperature, rainfall, moisture and pH on plant litter decomposition as implicated by microbes.

MATERIALS AND METHODS

Sampling Sites: The ever green forest litter was collected from higher altitude area i.e. Arabitattu, located at 2,186 msl. And from Makut area which is of lower altitude located at an altitude of 193 msl. The litter collected was of mixed host species belonging to diversified angio-spermic plants. The study period was from June 1989 to May, 1990. Standard methods have been followed to evaluate the microbial data and physico chemical factors of two liter samples.

The freshly fallen leaves of the forest plants were collected and bagged at the rate of 100 g per nylon mesh bag. 24 bags at Arabitattu and 24 a Makut were kept on the soil surface by removing one inch surface soil. All such litter bags were covered with freshly fallen leaves. Sampling was done every month for a period of one year. At the time of sampling two nylon mesh bags from each spot were removed and brought to the laboratory to determine the microbes. Physio-chemical factors. CO_2 evolution and dry weight loss. The litter sample were collected and studied for a period of one year (June 1989 – May 1990).

Quantitative estimation of Fungi, Bacteria and actinomycetes in litter: For the quantitative estimation of fungi, bacteria and actinomycets, the dilution plate method of Waksman (as detailed by Jhonson and Curl, 1972) was used as it allowed qualitative and quantitative assessments. The litter was powdered with a sterilized pestel and mortar. 10g of powdered litter was added in 100 ml sterile distilled water and then taken into horizontal shaker (120 throws min-1 and 1.5 cm displacement) of form a homogeneous suspension. Successive dilution were made as required. 1:10,000, 1:20,000 and 1:30,000 were chosen for the quantitative analysis of fungi, actinomycetes and bacteria, respectively. 1 ml of each from these diluted suspension, were removed and transferred aspectically into six replicate corning petridishes (sterile) containing 20 ml of melted agar medium. The petridishes were rotated clockwise and anticlockwise to get a homogeneous distribution of the inoculums into the medium. They were incubated at 27^0C - 30^0C. The acidified potato sucrose agar, Jensen's agar and Nutrient agar media were used for isolating fungi, actinomycetes and bacteria, respectively and weight of litter was determined. For qualitative analysis of

fungi, every colony was picked up and transferred separately to the tubes of acidified potato sucrose agar medium. Besides the dilution plate method. The litter inhabiting microfungi were studied by the following two methods.

1. *Direct observation of the litter sample:* The litter from the nylon bags was observed under a binocular microscope.

2. *Damp chamber incubation:* The litter was cut into 5 mm disks by sterilized cork borer and the disks were placed on a wad of wet blotting paper in petri dishes. The plates were incubated at 27^0C - 30^0C for 15 days.

Qualitative determination and identification: Identification of the fungal isolates was made both on the dilution plates and moist incubated disks besides observing the litter directly. Single spore cultures were raised in the tubes containing acidified potato sucrose agar medium for species identification.

Aspergilli and Penicillia were studied on Czapek's solution agar as recommended by Thom and Raper (1945) and also remaining fungi were identified with the help of manuals (Booth 1977, Ellis 1971, 1976, Sakaguchi & Abe, 1957, Manoharachary & Ramarao 1991.

Determination of litter decomposition : Progressive weight loss of leaf litter collected from June 1989 to April, 1990 was estimated as per Rai and Srivastava (1982) method.

Monthly sampling was done for period of one year. On each sampling date 2 bags for each litter were removed in a sequential order of its arrangement and brought to the laboratory. After removing soil particles, progressive weight loss was recorded. Oven dry weight was recorded after drying the samples at 80^0C for 2 hrs. till the constant weight was obtained. This weight was deducted from the initial weight of 100g and percentage was calculated later.

Determination of microbial activity (CO_2 evolution) : Microbial activity in the leaf litter was determined in terms CO_2 evolution from decomposing litter using inverted box method. One set of litter bags were kept under metabolic cylinder (Diameter 19 cm, height 25 cm) containing KOH solution of known strength (for absorption of CO_2). The set was left for 24 hrs and side tube of the cylinder was sealed with paraffin. Later KOH solution was titrated against. 0.1 N HCI using phenopthalein as an indicator. A control was run without litter to determine the net release of CO_2, CO_2 released was calculated for the known amount of litter over the area of cylinder during 24 hrs. This data was further stream lined to indicate CO_2 evolution for one hour duration.

Litter analysis for physical factors: The following procedures were used during the analysis:

Temperature: The litter temperature was recorded for every sampling time with the help of thermometer. Five readings were obtained at random from litter by inserting thermometer without disturbing the litter bags.

Rainfall: The rainfall data as recorded by the meteorological center was taken and tabulated (Table has been given in Results)

Moisture Content: Oven drying method was adopted for measuring the moisture content in litter. 5g was kept in the hot air oven at 80^0C for 24 hrs. in triplicate and oven dry weights were obtained till the constant weights are maintained. The moisture in the litter (% w/w) was calculated.

pH: 10g of litter was powdered and mixed with the double distilled water in 1:5 ratio. This was shaken for 1 hour and the pH of supernatant solution was read with the help of Elico pH meter.

RESULTS

Microbial Numbers and Seasonal Variations : Number of fungi, Actinomycetes and Bacteria were

Table 1: Microbial Numbers in thousands per one gram of Moisture Free Litter

Month	Fungi		Actinomycetes		Bacteria	
	I	II	I	II	I	II
June 1989	36	69	217	482	63	225
July. 1989	49	68	30	32	48	46
Aug. 1989	61	82	39	215	58	120
Sept. 1989	42	48	1005	1275	55	54
Oct. 1989	71	46	820	1333	486	135
Nov. 1989	52	38	43	54	40	112
Dec. 1989	22	6	48	174	52	48
Jan. 1990	9	33	613	664	765	894
Feb. 1990	30	33	1844	347	750	813
Mar. 1990	36	27	373	354	574	582
Apr. 1990	79	127	273	182	757	900
May. 1990	132	122	536	412	153	145

Litter – I (Higher Altitude – Arabitattu – 2186 Msl).
Litter 0II (Lower Altitude – Makut – 193 Msl.)

Table 2: Relative Percentage weight loss in two litter samples

Month	Relative % weight remaining	
	Litter – I	Litter – II
June 1989	100.00	100.00
July. 1989	81.15	82.20
Aug. 1989	72.05	80.90
Sept. 1989	68.00	73.60
Oct. 1989	51.50	62.15
Nov. 1989	40.80	42.05
Dec. 1989	33.05	34.20
Jan. 1990	22.60	27.50
Feb. 1990	18.90	25.50
Mar. 1990	9.20	12.60
Apr. 1990	2.60	4.00
May. 1990	Nil	1.90

Litter – I (Higher Altitude – Arabitattu – 2186 Msl.)
Litter 0II (Lower Altitude – Makut – 193 Msl.)

Table 3: Monthly variation in CO_2 evolution (mg/m2) from decomposing litter

Month	Relative % weight remaining	
	Litter – I	Litter – II
June 1989	34	78
July. 1989	43	50
Aug. 1989	35	56
Sept. 1989	38	105
Oct. 1989	56	141
Nov. 1989	24	78
Dec. 1989	48	92
Jan. 1990	22	45
Feb. 1990	51	86
Mar. 1990	91	143
Apr. 1990	93	178
May. 1990	46	129

Litter – I (Higher Altitude – Arabitattu – 2186 Msl.)
Litter – II (Lower Altitude – Makut – 193 Msl.)

Table 4: Temperature ^0C

Month	Arabitattu Area		Makut Area	
	Litter Temp.	Atmosphere Temp.	Litter Temp.	Atmosphere Temp.
June 1989	27	30	27	32
July. 1989	23	3	22	24
Aug. 1989	22	22	24	23
Sept. 1989	23	22	27	29
Oct. 1989	25	25	27	30
Nov. 1989	23	23	25	30
Dec. 1989	20	21	26	28
Jan. 1990	23	24	28	31
Feb. 1990	23	24	28	31
Mar. 1990	23	25	29	31
Apr. 1990	24	25	30	345
May. 1990	23	24	29	34

Litter – I (Higher Altitude – Arabitattu – 2186 Msl.)
Litter 0II (Lower Altitude – Makut – 193 Msl.)

estimated using dilution plate technique. The data of microbial number estimated for one gram of moisture free litter are given in Table 1.

All the microbial numbers fluctuated significantly and varied results have been obtained in the monthly fluctuations. It is also clear from the table that the fluctuations between the samples seems to be significant. Maximum fungal numbers were recorded in the month of May for litter I and April for litter II. February seems to be a favourable month for actinomycetes in litter I and October in litter II. The bacterial population was more during January for litter I and during April for litter II. On an average fungal population was more in litter I which is collected from higher altitude (Arabitattu) than in litter II which is collected from the lower altitude (Makut). Both actinomycetes and bacterial populations were high in liter II which is of lower altitude. On the litter II collected from Makut area

which is located at lower altitude has been found to be a rich sustrate for the post monsoon season while bacteria have greatly proliferated during late monsoon season. The accumulated litter in both the places are showing a range of temperature between 23^0C to 25^0C in April and May and supported microbial population.

Dry Weight Loss and Microbial Numbers : The progressive decomposition was studied from June 1989 to May 1990. The weight loss data was presented in Table II. Maximum weight loss was observed in the month of April where the litter has almost vanished form the nylon bag and nothing was left excepting one or two grams of litter powder. The decomposition was gradual. Initially the degradation was fast from July to November in both the litter samples. More than 50% of litter was degraded. During this period, the bacterial and fungal activity seems to be high in the later part of decomposition. However, fungal and actinomycetes have been active initially in the first phase of decomposition.

Carbondioxide Evolutions and Microbial Numbers : Data pertaining to CO_2 evolution has been shown in Table III. The peak activity of CO_2 was recorded in litter II than in litter I. However the activity was more in the months of March, April and May in both the samples, indicating that the average temperature have coincided with the release of more CO_2 in later stages of decomposition. The CO_2 evolution is inversely proportional with the weight loss.

Temperature and Microbial Numbers : Temperature data has been recorded in Table IV in both the areas of litter collection. Two litter samples differed to some extent in their temperature values. The litter collected from higher altitude has shown a range of 20^0C to 27^0C while the litter collected in the lower altitude has shown 20^0C to 30^0C of temperature. Similarly the atmosphere temperature range has also deferred significantly in both the areas. The temperature range between 22^0C to 27^0C seems to be the active temperature range for greater decomposition. Atmosphere temperature was more than the litter temperature in both the areas of sample collection.

Rainfall and Microbial Numbers : Rain fall data has been shown in Table V data shows significant relation with fungal number. Actinomycetes and Bacteria have shown a positive relation in the post monsoon period. Thus the early rainfall starts from June to August and has favored the multiplication of Fungi, Bacteria and Actinomycetes.

Moisture Content in the Litter and Microbial Numbers : The data of moisture has been tabulated in Table VI from which it is evident that the moisture has increased from August onwards and minimum has been recorded in the month of December for both the samples. Slight increase of moisture was also recorded form February onwards due to some sporadic rains. Average moisture levels have shown positive relation with the microbial numbers.

pH and Microbial Numbers : pH values have been listed in Table VII. The pH range for litter I being 7.02 to 9.0 and for litter II it is 7.0 to 9.5. Both the litter samples are natural to alkaline. It is interesting to note that the litter samples collected during September month has more pH (9.02 to 9.5). 7.0-9.5 seems to be the range of pH influencing the microbial populations.

DISCUSSION

Litter forms an important habitat for fungi Bacteria and Actinomycetes. It is the major source of cellulose, hemicellulose, lignin and other organic compounds. Litter decomposition means the break down of complex organic molecules into CO_2, H_2O, and mineral components, besides the weight loss. Decomposition of litter is one of the important activities accomplished by the microbial action in nature, as it facilitates the continuous requirements of green plants for the raw materials. Trees and Shrubs contribute for major biomass accumulation on terrestrial environment. The decomposition involves physical and chemical breakdown until

Table 5: Rainfall data in mm

Month	Litter – I	Litter – II
June 1989	143.5	1005.1
July. 1989	1718.3	1358.4
Aug. 1989	841.2	564.3
Sept. 1989	721.0	622.4
Oct. 1989	217.0	283.0
Nov. 1989	05.0	93.4
Dec. 1989	12.3	15.0
Jan. 1990	9.2	15.0
Feb. 1990	—	3.0
Mar. 1990	—	12.0
Apr. 1990	39.2	23.0
May. 1990	231.2	357.0

Litter – I (Higher Altitude – Arabitattu – 2186 Msl.)
Litter 0II (Lower Altitude – Makut – 193 Msl.)

Table 6: Percentage Moisture of two Litter Samples

Month	Litter – I	Litter – II
June 1989	2.50	4.30
July. 1989	2.50	4.00
Aug. 1989	6.85	6.40
Sept. 1989	6.98	6.95
Oct. 1989	5.64	5.42
Nov. 1989	5.65	3.80
Dec. 1989	1.00	0.50
Jan. 1990	1.70	1.50
Feb. 1990	3.00	2.75
Mar. 1990	2.50	2.25
Apr. 1990	3.70	2.50
May. 1990	4.00	3.50

Litter – I (Higher Altitude – Arabitattu – 2186 Msl.)
Litter 0II (Lower Altitude – Makut – 193 Msl.)

their disappearance and its incorporation in elemental from into the soil. In temperate countries this microbial process concerning plant litter decomposition has been worked out at length. However in tropics and semi-arid tropics the decomposition process as initiated by microbes has not been worked out to the extent of it's requirements. The Indian environment is unique as it has varied environmental conditions and composite vegetation. Each particular region is characterized by one or more types of forests harbouring a wide variety of angiosperms. Temperature, rain fall and moisture are the major factors influencing the plant litter decomposition by microbes. Further there is no typical or limited microflora that takes part in the plant litter decomposition resulting in a complex phenomena. Therefore a worthy consideration has to be given for the study of tropical and semi-arid tropical plant litter decomposition by indigenous microbes in relation to physical and chemical changes. Litter decomposition results in the supply of nutrients to the vegetation. It is a fact that population pressure and human needs due to selfishness has resulted in the loss of forest which paved the way to loss of litter and creation of waste lands. Therefore there is a need for undertaking litter decomposition and its application as green manure and decomposed litter on to the waste land system in the process of reclamation. South India is the geographical region from where there is hardly reliable data for decomposition of plant litter by microbes. The tropical green forests of Karnataka state are very much neglected from this point of view. Therefore it has been though worth while to study the litter decomposition from Kodagu District area located in the south interior Karnataka. It is the humid tropical belt of western ghats and supports tropical rain forest with luxuriant vegetation. Therefore study has been under taken on the litter decomposition by collecting the litter for a period of one year (1989-1990) from Arabitattu (2186 msl) and Makut (193 msl), the higher altitude and lower altitude regions, respectively. There are not many reports on the mixed forest litter decomposition by microbes. Therefore it is a significant addition to the litter decomposition studies as it recycles the elements, nutrients and builds up soil fertility factor. The present piece of work includes litter decomposition, microbial number and their seasonal variation, dry weight loss, CO_2 evolution, impact of temperature, rainfall, changes in pH and chemical changes brought out during litter decomposition and qualitative information of fungi. This is the area which has not been worked out. Standard methods are followed for the quantitative and qualitative estimation of bacteria, actinomycetes besides identifying fungi up to the species levels using standing manuals. Litter decomposition factors were evaluated as per the standard methods.

Table 7: pH Values recorded in two Litter Samples

Month	Relative % weight remaining	
	Litter – I	Litter – II
June 1989	7.0	7.5
July. 1989	8.0	7.5
Aug. 1989	7.5	7.5
Sept. 1989	9.0	9.5
Oct. 1989	7.0	6.8
Nov. 1989	7.5	7.0
Dec. 1989	7.0	7.5
Jan. 1990	7.0	7.0
Feb. 1990	7.5	7.0
Mar. 1990	7.5	7.0
Apr. 1990	7.5	7.0
May. 1990	7.5	7.0

Litter – I (Higher Altitude – Arabitattu – 2186 Msl.)
Litter – II (Lower Altitude – Makut – 193 Msl.)

Microbial Numbers and Seasonal Variations: Decomposition is a complex and often prolonged process initiated before death. In decomposition it is the substrate and its constituents are important. The breakdown of various complex substances are effected by bacteria Actinomycetes and Fungi. The fluctuations of microbial numbers are significant between the samples, and mostly fluctuations are of the varied nature. Litter II which is collected from Makut area (lower altitude) has been found to be a rich substrate and the colonization of microbes. A range of temperature between 23^0C to 25^0C has helped in the decomposition process. Interestingly the microbial population was less upto 4^{th} month indicating that the mixed litter is a complex medium and forcible microbial attack by virulent strains is essential. Therefore such process has occurred and resulted in the breaking down of litter into simpler substances. Gradually, the soluble form of litter has undergone rapid decay as it has provided all the nutrients in the soluble form to the fungi, bacteria and actinomycetes. By the end of April nothing was left in the litter bags but for little bebris of one gram. Litter has been decomposed by Fungi, Bacteria and to some extent actinomycetes. In India Rai and Srivastava (1982), Bhatt *et al* (1985) and Sinha and Dayal, (1983) have drawn similar conclusions regarding the role of microbial communities in the plant litter decomposition.

Weight loss and Microbial Numbers: Decomposition rates are estimated based upon dry weight loss. It is important to distinguish the physical separation from that of chemical breakdown. Therefore dry weight loss of the litter can be considered as the indication of the decomposition rate. Earlier Anderson *et al* (1983), Mitchell (1986), and Swift *et al* (1981), have recorded weight loss changes, through litter bag method. The condition provided in this matter are almost natural. In the present investigation the weight loss values have differed. Both the litters have shown rapid decomposition rates that is through weight loss from May to November reflecting the efficient activity of microbial communities. Bhatt *et al* (1985) have reported 90% decomposition in nearly 150 days. In the present study 80% of the decomposition was achieved in 160 days. Such decomposition rates differ from region to region and plant to plant. In the present investigation the litter being of mixed host plant gets exposed to diversified groups of fungi, actinomycetes and bacteria. In the present study 50% of the decomposition was achieved during monsoon and similar results were obtained by Rai and Srivastava (1982). While working on tropical deciduous forest consisting of mixed litter. In the present investigation the weight loss was maximum in monsoon and post monsoon season. It is because of the availability of efficient strains of indigenous microbes, high moisture contents and optimum temperatures maintained in the litter bags for a considerable period. The maximum weight loss has coincided with the release of large amounts of carbondioxide.

Carbondioxide production and litter decomposition: Carbondioxide production is an indication of active decomposition. Due to the maintenance of optimum levels of moisture and temperature, under undisturbed conditions of the nature the process of carbondioxide evolution is monitored by multiple factors. The rate of carbondioxide production is also dependent upon the chemical nature of the litter. Peak activity of carbondioxide was recorded in the litter collected from Makut area. The carbondioxide production was

more during March, April and May coinciding slightly with high temperatures. Despite more leaching of minerals, still carbondioxide gets released rapidly. Initially high rate of carbondioxide will be released and the present data is in agreement with Gupta and Singh (1981) who have reported similar results while working on the decomposition of mixed forest litter.

Temperature and Microbial Numbers: Temperature is one of the important factors influencing the litter decomposition by microbes. In nature the temperature is not static but fluctuates to a greater extent seasonally. The average temperature seems to be the favourable factor in tropics for maximum decomposition. However there is no single paper that is published with reference to the temperature variations and mixed forest litter decomposition. Rai and Srivastava (1982) and Gupta and Singh (1981) showed no significant correlation between temperature and decomposition of forest litter. In the present investigation a range of temperature i.e. 22^0C to 27^0C seems to be the active temperature range for rapid decomposition. Among the two litter samples investigated the temperature range was more in the Makut area. In the present study temperature has been identified as an important factor in influencing the decomposition rate.

Rain fall and Microbial Numbers: Moisture is an important factor affecting the rate of decomposition and gets supplied through rain fall and also by the water holding capacity of litter. in the present investigation monsoon and post monsoons are intimately connected with the greater decomposition, thus resulting in the multiplication of microbes and more decomposition. Therefore rainfall forms an important climatic factor.

Litter moisture and Microbial Numbers: Litter moisture is an important factor as it has dissolved nutrients useful for micro-organisms. Moisture act as a free water on growing mycelium which indirectly affects the availability of nutrients on the concentration of toxic substances with the on set monsoon. The microbes become active and increase their population, thus taking part in the decomposition. In the present investigation the litter moisture has increased from August onwards and reached minimum in December, for both samples. Average moisture levels have shown positive relation with the decomposition of the litter by the respective microbes.

pH and Microbial Numbers: Litter pH affect the availability of nutrients and influences the physiological functions of the microbes. Decomposition may proceed more rapidly in alkaline pH than in acid pH. In mixed forest litter there will be an increase in the base content thus improving the buffering capacity and decreasing acidity. The type of litter, organic fraction of the host leaves, physical variables, loss of leachates and extent of decomposition, and pH are some of the factors influencing pH variation. Preliminary data has been brought by Rai and Srivastava (1982) on changes in pH in relation to litter decomposition. In the present investigation the pH range of 7 to 9.5 and it is the range which has helped the decomposition. This data clearly indicates the impact of pH as an important factor.

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