STUDIES ON LITTER PRODUCTION IN HAYATHNAGAR AND MUDIMYAL URBAN FOREST BLOCKS, RANGA REDDY DISTRICT, TELANGANA STATE.

Dissertation
submitted to Palamuru University in partial fulfilment
of the requirement for the award of

Student Study Project

IN

BOTANY

by

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JADCHERLA – 509 301

MAY- 2023

DECLARATION

We hereby declare that the Research work presented in this Dissertation entitled "**Studies on Litter Production in Hayathnagar and Mudimyal Urban Forest Blocks, Ranga Reddy District, Telangana State"** is original work carried out by us under the supervision of **Dr. B. Sadasivaiah**, Department of Botany, Dr. BRR Government Degree College, Jadcherla during the period 2022-2023 for the award of the degree of Student Study Project in Botany. The research work is original and no part of the work has been submitted for the award of any degree or diploma of this College or any other College/University.

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……. Mallishwari, Ms. K. Priyanaka, Ms. B. Nandini

CONTENTS

Chapter-I

INTRODUCTION

Litter fall, transferring organic matter and energy from the vegetation to the soil,is one of the major global carbon fluxes, in forest ecosystem, bark and reproductive organs, and usually, foliage litter fall occupies a major fraction of total litter fall. At a continental or global scale, the synthesis of litter fall data is important for estimating and explaining quantitative litter fall, as well as it's pattern.

The Eurasian continent comprises a variety of climatic condition and forest vegetation(Ahti et al.1968; Hou 1982; FAO 2001).Eurasian forest currently cover around 1.5 billion hm square,or 41%of the total global forest area (FAO 2001) and thus play an important role in global carbon cycle. In the context of forestry management as a strategy to sequestrating carbon in forest ecosystem,it is necessary to quantity the litter fall to obtain a better understanding of carbon dynamics in Eurasian forest.

Litter fall on the stand level has been long observed in European forest (see Rodin and Bazilevich 1967).During the period of the international Biological program (IBP),litter fall data were collected also at some sites of Japanese and Asian tropical forest(Deangelis et al.1981, Cannell 1982). Since the beginning of the 1980s, a lot of litter fall investigations have been conducted in Chinese(Zhou1995) and Indian forest (Dadhwal et al. 1997). Most of these litter fall data have not yet been synthesized at a continental scale.

The importance of litter production in the forest ecosystem has long been recognized;therefore this is one of the aspects that has received much attention (BRAY&GORHAM, 1964;JENSEN, 1974;JORDEN&MURPHY, 1978.) While most of the studies on litter production have been done on temperature forests, tropical and sub tropical forest ecosystems have also received some attention. However, the data available on tropical and sub tropical belt are those of JENNY, 1949 in colombia.

The present study on litter production pattern of a sub tropical Montana forest at an Evelation of 1900 m near shillong concerns that of a mixed evergreen scared forest grove. This scared grove has been maintained by the local Khasi tribe with least disturbance as they believe that their sylvan

deities live here and therefore this represents a relict climax community of this area which otherwise is highly disturbance due to slash and burn agriculture (Ramakrishnan &Toky, 1978) which is a prevalent from of agricultural practice of the region.

The importance of litter production in the forest ecosystem has long been recognized because the majority of organic matter produced by plants through photosynthesis is returned to the soil as litter. Litter fall may be a seasonal or a continuous process, and represents one of the most important pathways for the transfer of energy and material. The ways in which these two processes are accomplished , determine to a large extent the structural and functional features of the ecosystem.Litter decomposition plays a crucial role in regulating the nutrient budget of forest ecosystem where vegetation depends mainly on the recycling of nutrients contained in the plant detritus. During this process plant nutrients became available for recycling within the ecosystem. Decomposition of plant residues and the resulting release of nutrient elements are key functions of soil microorganisms.(Rottmann et al. 2010).(Singh et al.(1990) have have stated that abundance of decomposing microbes depends partly on the native litter through its influence on soil properties. Decomposition process plays an important role in maintaining soil fertility in terms of nutrients cycling and the formation of soil organic matter (Bargali et al. 1993; Guendehou et al., 2014; Gupta & Singh 1977; Pandey & Singh 1982; Singh et al., 2007; Upadhyay & Singh 1989; Usman et al.2000). Decomposition is regulated by soil organisms, environmental conditions and chemical nature of the litter. Decomposition and a nutrient release or two key processes in tropical forests, where the vegetation is generally sustained on soil with low fertility (Lavelle et al. 1993). Therefore, forest productivity depends on efficient nutrient cycling mechanisms that ensure rapid turnover of litter nutrients(Vendrami et al. 2012).Foliar litter occupies a major fraction of the litter in forest ecosystems and may be totally decomposed within a year in subtropical and tropical areas(Meentemeyer 1984). It is thus of importance to investigate the pattern of forest leaf litter decomposition and its influence on the ecosystem functioning.

Much literature has accumulated in recent years on litter decomposition of plants of various forest ecosystems of the tropical and the temperate regions. In the present region a few studies on leaf litter decomposition of planted multipurpose species are available (Bargali et al.2006; Pandey et al.2006; Singh et al. 2007). However, no quantitative study on leaf litter decomposition in natural dry deciduous forests is known from this part of India.

The importance of litter production in the forest ecosystem has long been recognized;therefore this is one of the aspects that has received much attention (Bray&Gorham, 1964; Jensen, 1974; Jorden&Murphy, 1978.) While most of the studies on litter production have been done on temperature forests, tropical and sub-tropical forest ecosystems have also received some attention. However, the data available on tropical and sub-tropical belt are those of Jenny, (1949) in colombia.

The present study on litter production pattern of a sub-tropical Montana forest at an Evelation of 1900 m near shillong concerns that of a mixed evergreen scared forest grove. This scared grove has been maintained by the local Khasi tribe with least disturbance as they believe that their sylvan deities live here and therefore this represents a relict climax community of this area which otherwise is highly disturbance due to slash and burn agriculture (Ramakrishnan &Toky, 1978) which is a prevalent from of agricultural practice of the region.

Litter production is an important pathway for transfer of organic matter and chemical elements from vegetation to soil. It is also an important component of primary production and there have been several studies of litter production in tropical forests including on the Indian subcontinent (Singh and Ramakrishnan, 1982; Proctor et al., 1983; Prasad and Sharat Chandra 1984; Whitmore 1984; Rai and Proctor, 1986) The present communication reports for the first time on the levels of litter fall in the moist tropical forests of the Western Ghats district of Uttara Kannada as a part of an ongoing comprehensive study of the forest ecology of this region. The main objective of the study are mentioned below.

Objectives

- To quantify the fine litter production and standing crop of litter
- To determine the contribution of various plant species to total leaf litter production in Hayathnagar and Mudimyal Urban forest blocks

Chapter-II
REVIEW OF LITERATURE

Arul pragasan and parthasarathy (2005) studied on litter production in tropical evergreen forests of south india in relation to season, plant life forms and physiorganic groups and stated that litter production peaked during summer and the majority litter is coming from leaves.

- Linasanework, N. and Michelsen, A., (1994). Litterfall and nutrient release by decomposition in three in the ethiopian highland.
- Deangelis et al. 1981;cannell 1982 during the period of the international biological program litterfall data were collected also at some sites of Japanese and Asian tropical forests
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Chapter-III

STUDY AREA

The Hayathnagar Reserve Forest (RF) Block, Hayathnagar Mandal of Ranga Reddy District, Telangana was notified as per the Government vide GORT No. 73 EFS&T (For.I) Department, dated 25.05.2018.

Hayathnagar Reserve Forest (RF) is covering an area of 1371 ha and Mudimyal RF covering an area of 623.59 ha with natural forest land was developed as an urban park and it is with hillocks and plans areas with few water holes. Both Reserve forest is basically Tropical Dry Deciduous Forest and Open Scrub Forest as per Champion and Seth Classification's revised forest types of India (1968). The study area is shown in **Fig.1, 2** and the land use pattern presented in **Table 1, 2**.

Fig. 1. Study area of Hyathnagar RF

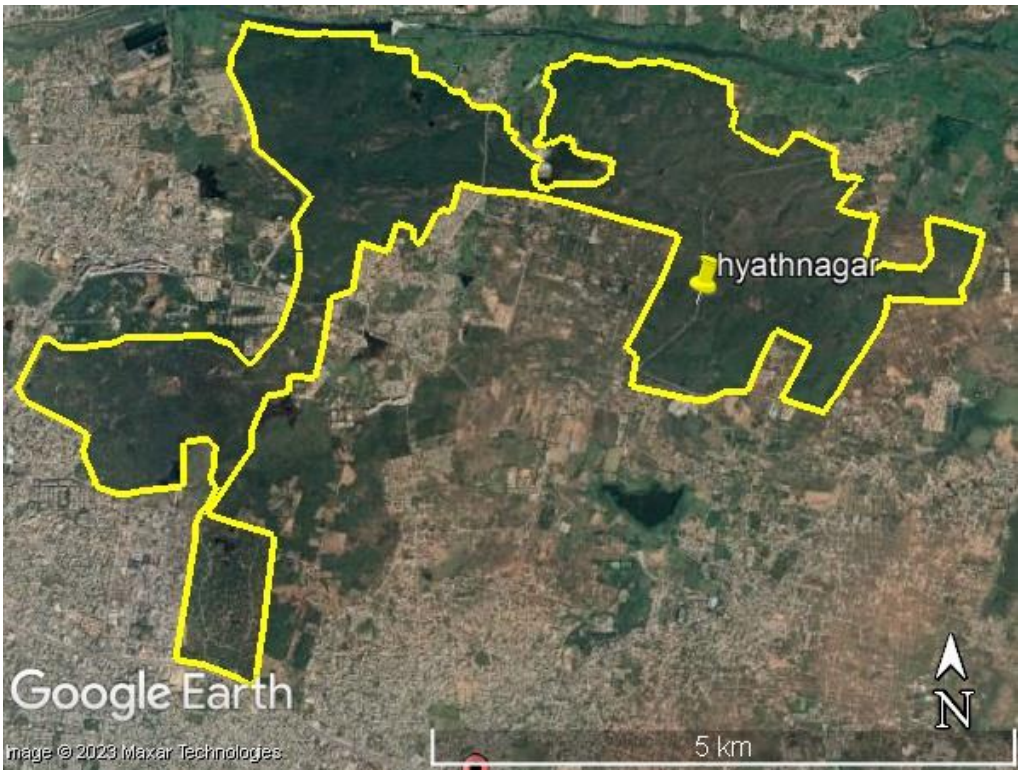


Fig. 2: Study area of Mudimyala RF

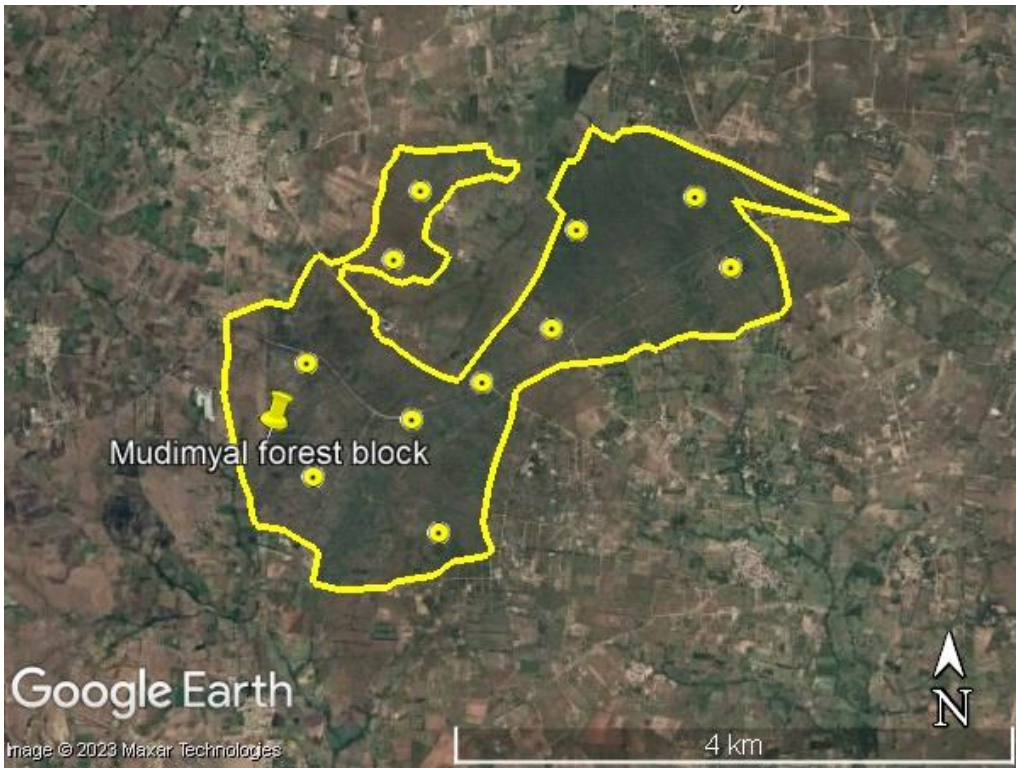


Table 1. NDVI Change analysis for Hayatnagar-Cluster Urban Forest Block						
S. No.	**NDVI Category**	**Areas in Ha Year 2015**	**% of Category**	**Areas in Ha Year 2020**	**% of Category**	**Changes in the study area over year 2015 in Ha**
1	No vegetation	4.64	0.34	4.23	0.31	0.41 (Reduced)
2	Low vegetation	313.00	22.83	12.63	0.92	300.37 (Reduced)
3	Sparse vegetation	639.77	46.67	110.98	8.10	528.79 (Reduced)
4	Moderate vegetation	394.81	28.80	816.34	59.54	421.53 (Increased)
5	Dense vegetation	18.76	1.37	426.81	31.13	408.05 (Increased)

Table 2: NDVI Change analysis for Mudimyal Urban Forest Block						
S. No.	**NDVI Category**	**Areas in Ha Year 2015**	**% of Category**	**Areas in Ha Year 2020**	**% of Category**	**Changes in the study area over year 2015 in Ha**
1	No vegetation	5.37	0.86	1.90	0.30	3.47 (Reduced)
2	Low vegetation	250.74	40.21	67.04	10.75	183.70 (Reduced)
3	Sparse vegetation	254.89	40.88	371.91	59.64	117.02 (Increased)
4	Moderate vegetation	111.41	17.87	175.62	28.16	64.21 (Increased)
5	Dense vegetation	1.17	0.19	7.12	1.14	5.95 (Increased)

Chapter-IV

METHODOLOGY

Leaves, twigs and pieces of bark that have fallen to the ground makeup leaf litter. Leaf litter is an important component of healthy soil. Decomposing leaf litter releases nutrients into the soil and also keeps it moist. It also serves as great nesting material, hiding places and protected spots for animals. The forest leaf litter is the dead plant material that has fallen from trees, shrubs and other plants. There are many different names for leaf litter or duff, but it's all the same thing.

In the data compilation, some criteria were followed. We used the data of forested areas to estimating litter fall data was obtained in this study meet the definition of forest of FAO: stands, which had been fertilized or disturbed by forestry practice. To determine fine litter production and standing crop of litter, a permanent plot of 1 ha was established at each site. Litter fall was quantified by stone-block lined denuded quadrat technique in 25 replicates of 1m×1m area, placed regularly at 20m inter-distance with in the 1 ha plot in each site.

All forest floor material with in the 1m×1m area were removed in December and these denuded quadrates were bordered with locally available large pebbles and stones, as to facilitate subsequent monthly collection for one year from the forest areas Hayathnagar and Mudimyal. Also, possible methodical errors by this method are avoided. Litter fall quantification by stone block lined denuded quadrat technique is being reliably adopted because there are no medium and large wild animals in these forests and hence trampling by them is ruled out.

Leaf litter was collected in traps set up at 15cm above ground level during the peak fall period of each species was kept in 15cm×15cm nylon bags. All bags of each species were randomly placed in direct contact with soil in each plot within 2 weeks after litter collection. We collected 20 bags from Hayathnagar and 10 bags from Mudimyal. One bag of each species from each plot was recovered at monthly intervals over a period of 1 year litter was removed from each sampled bag, including flowers, seeds, fruits, leaves, bark and stem, brushed gently to remove soil. There were weighed separately using electronic top pan balance.

The annual decomposition quotient (Kl) was calculated as Kl=l/x, where l is the annual litter input to the forest floor and x is the mean standing crop of litter. A test was performed to check for significant difference in total litter production, standing crop of litter and litter fall components between the two sites, and between tree and liana leaf litter production. One way ANOVA was used to check for difference in leaf litter contribution among plant species categorized into deciduous, brevi-deciduous and evergreen types. Also a spearman rank correlation was performed between temperature and total litter fall.

Chapter-V

RESULTS

I. Mudimyal Reserve Forests

The litter production of Mudimyal Reserve Forest is 869.5gr for 10 sampling points with 1x1m size. A total of 17 species of plant produce litter was collected from the study area and mentioned in Table 3 and point wise litter production mentioned in **Table 4**.

Table 3: List of species produced litter

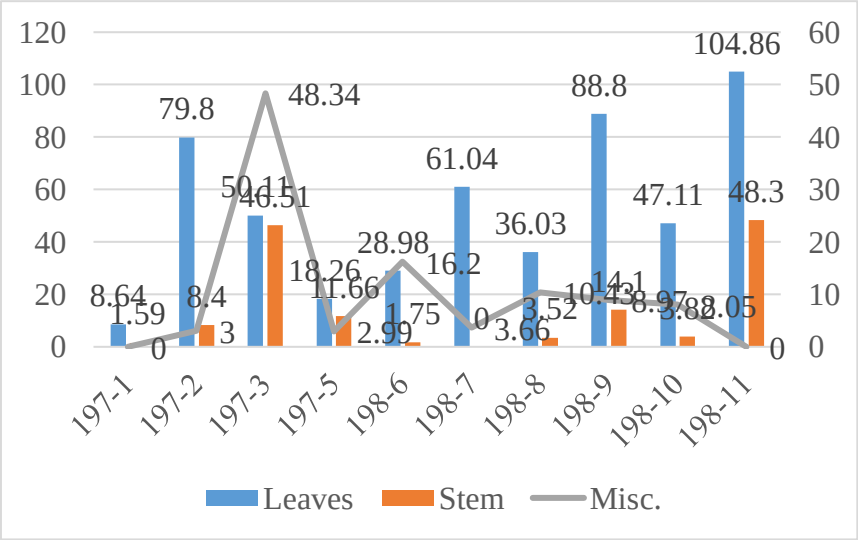
S. No.	Name of the plant	Leaves	St	Total
1	*Acacia chundra*	0.63	0	0.63
2	*Albizia procera*	3.48	0	3.48
3	*Bridelia montana*	10.33	0	10.33
4	*Anogeissus latifolia*	41.3	0	41.3
5	*Butea monosperma*	20.4	0	20.4
6	*Cassine glauca*	0.47	0	0.47
7	*Cassia fistula*	17.35	0	17.35
8	*Barleria strigosa*	0.14	0	0.14
9	*Diospyros melanoxylon*	79.3	0	79.3
10	*Diospyros chloroxylon*	4.54	0	4.54
11	*Grewia tillifolia*	139	2.8	141.8
12	*Grewia hirsuta*	0.29	0	0.29
13	*Kydia calycina*	2.96	0	2.96
14	*Lannea coramandalica*	24.9	0	24.9
15	*Maytenus emarginatus*	0.36	0	0.36
16	*Semecarpus anacardium*	126.5	1.3	127.9
17	*Terminalia alata*	51.54	2.9	54.43
		523.5	7	530.5

Table 4: Point wise litter production of Mudimyal RF

Point No.	No. of species	Leaves	Fr	Stem	Bark	Misc.	Total
197-1	1	8.64	0	1.59	0	0	10.23
197-2	2	79.8	0	8.4	0	3	91.2
197-3	8	50.11	3.33	46.51	90	48.34	238.29
197-5	1	18.26	0	11.66	0	2.99	32.91
198-6	3	28.98	0	1.75	0	16.2	46.93
198-7	1	61.04	0	0	0	3.66	64.7
198-8	2	36.03	0	3.52	0	10.43	49.98
198-9	4	88.8	0.9	14.1	0	8.97	112.77
198-10	2	47.11	2.75	3.82	0	8.05	61.73
198-11	6	104.86	0	48.3	7.25	0	160.41
Total		**523.63**	**6.98**	**139.7**	**97.3**	**101.6**	**869.15**

Out of total 869.15 gr, Leaf litter (17 species) occupies major portion with 523.63 gr followed by dead stems139.7gr, Miscellaneous parts with 101.6gr, bark with 97.3gr (2 species) and 6.98gr of fruits. There are no flowers and seeds were recorded in the litter. The parts of litter was graphically represented in **Fig. 3**

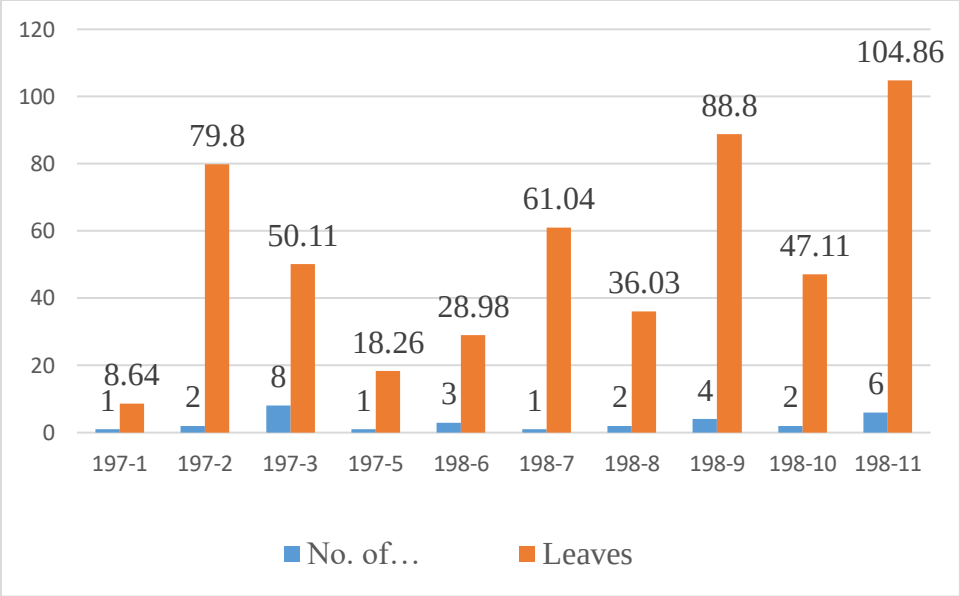
Fig. 3: Parts of litter vs sampling points



Among the 17 species, Grewia tilifolia produced 141.77 litter including Leaves and stems followed by *Semecarpus anacardium* (127.87gr) including leaves and stems; *Diospyros melanoxylon* (79.3gr) only leaves; *Terminalia alata* (54.43 gr) including leaves and stems and

Anogeissus latifolia (41.3gr). The least production of litter was recorded in *Barleria strigosa* with 0.14 gr and *Grewia hirsuta* with 0.29 gr. The sampling point wise species diversity and leaf litter production presented in **Fig. 4.**

Fig. 4: Species diversity and Leaf litter production



II. Hayathnagar Reserve Forests

The litter production of Hayathnagar Reserve Forest is 1090.63 gr for 20 sampling points with 1x1m size. A total of 32 species of plant produce litter was collected from the study area and mentioned in **Table 5** and point wise litter production mentioned in **Table 6**.

Table 5: List of species produced litter

S. No.	Name of the plant	Leaves	st	Total
1	*Azadirachta indica*	14.97	1.05	16.02
2	*Acacia chundra*	3.84	0	3.84
3	*Annona squamosa*	7.54	0.25	7.79
4	*Anogissus latifolia*	6.97	0	6.97
5	*Albizia amara*	1.09	0	1.09
6	*Butea monosperma*	83.36	0	83.36
7	*Bauhinia racemosa*	46.24	0	46.24
8	*Bridelia montana*	1.3	0	1.3
9	*Cycas religiosa*	8.75	0	8.75
10	*Cassia fistula*	5.4	0	5.4
11	*Diospyros chloroxylon*	10.65	0	10.65
12	*Dalbergia sissoo*	11.61	0	11.61

13	*Delonix*	0.95	0	0.95
14	*Dalbergia paniculata*	0.60	0	0.60
15	*Dalbergia lanceolaria*	9.40	0	9.40
16	*Flacourtia indica*	98.50	0	98.50
17	*Grewia rhamnifolia*	109.46	0	109.46
18	*Grewia damine*	38.48	0	38.48
19	*Grewia hirsuta*	5.61	0	5.61
20	*Holoptelea integrufolia*	54.55	0	54.55
21	*Holoptelea indica*	1.48	0	1.48
22	*Hardwica binata*	137.9	0	137.9
23	*Ixora arborea*	31.92	0	31.92
24	*Lantana camara*	25.52	0	25.52
25	*peltophoram pterocarpus*	56.38	0	56.38
26	*Pongamia pinnata*	153.20	0	153.20
27	*syzygium cumini*	105.70	0	105.70
28	*Tamarindus indica*	1.02	0	1.02
29	*Textoca grandis*	57.31	0	57.31
30	*ziziphus Mauritania*	0.93	0	0.93
31	*Tamarind us indica*	0	0	0
32	*Cassia senna*	0	0	0
		1090.63	1.30	1091.93

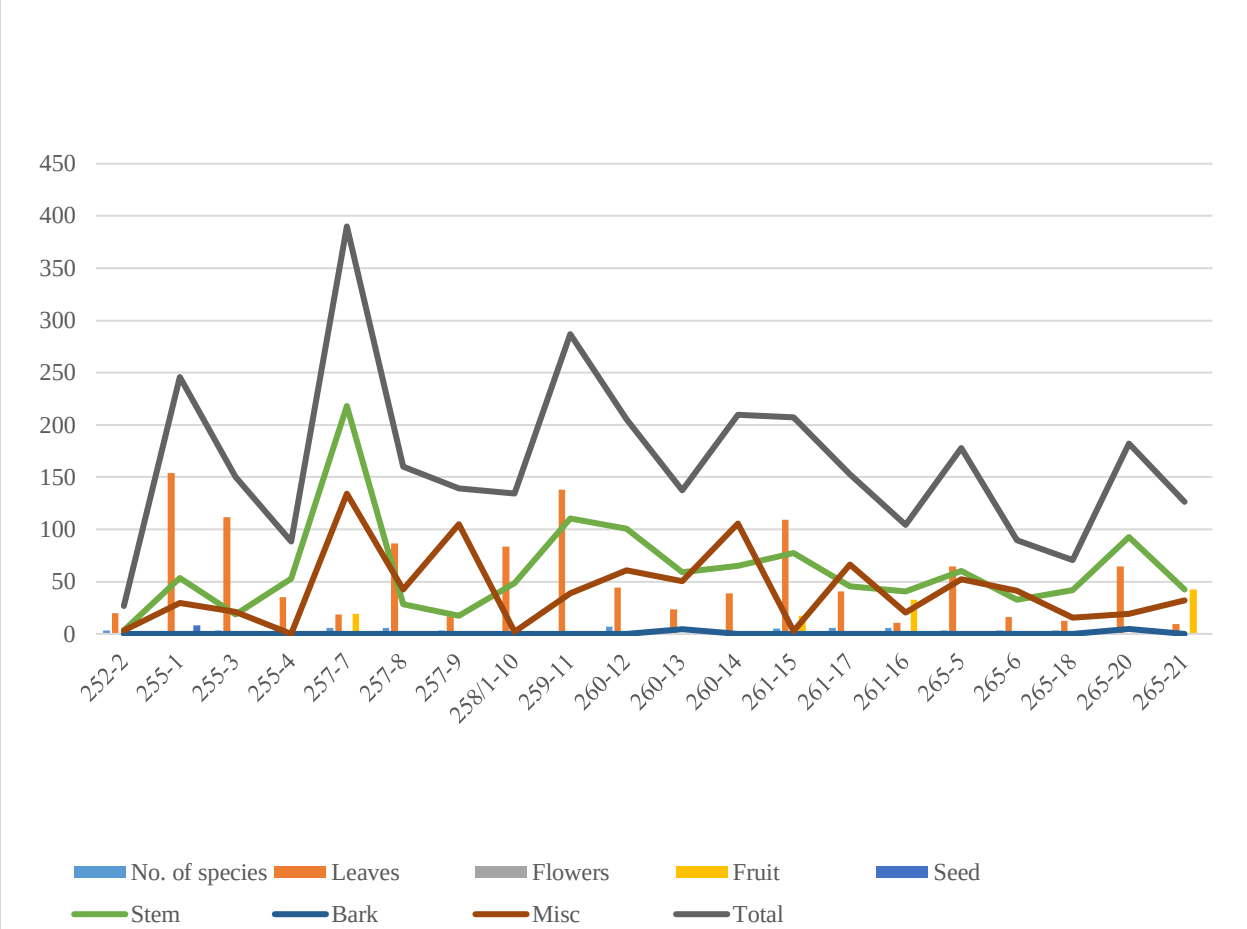
Table 6: Point wise litter production of Hayathnagar RF

Point No.	No. of species	Leaves	fl	Fr	Bark	Stem	Misc.	Total
252-2	3	20.08	0	0	0	3.33	0	3.3
255-1	2	153.8	0	0	8.35	53.5	0	29.8
255-3	3	111.42	0	0	0	18.32	0	20.8
255-4	2	35.23	0	0	0	53.1	0	0
257-7	6	18.35	0	19.31	0	218.17	0	134.16
257-8	6	86.43	0	2.6	0	28.53	0	42.25
257-9	3	16.93	0	0	0	17.2	0	105.12
258/1-10	2	83.8	0	0	0	48.45	0	2.35
259-11	1	137.9	0	0	0	110.2	0	38.62
260-12	7	44.15	0	0	0	100.46	0	60.64
260-13	2	23.57	0	0	0	59.05	4.52	50.15
260-14	4	39.04	0	0	0	65.05	0	105.7
261-15	5	109.54	0	17.4	0	77.3	0	2.73
261-17	6	40.47	0	0	0.25	45.8	0	66.31

261-16	6	10.52	0	32.4	0	40.48	0	20.65
265-5	3	64.53	0	0	0	60.52	0	52.57
265-6	3	15.94	0	0	0	32.7	0	41.3
265-18	3	12.48	0	0	1.05	42	0	15.4
265-20	4	64.6	0	0.91	0	92.72	4.74	19.01
265-21	1	9.4	0	42.3	0	42.6	0	31.9
	72	1098.18	0	114.92	9.65	1209.48	9.26	842.76

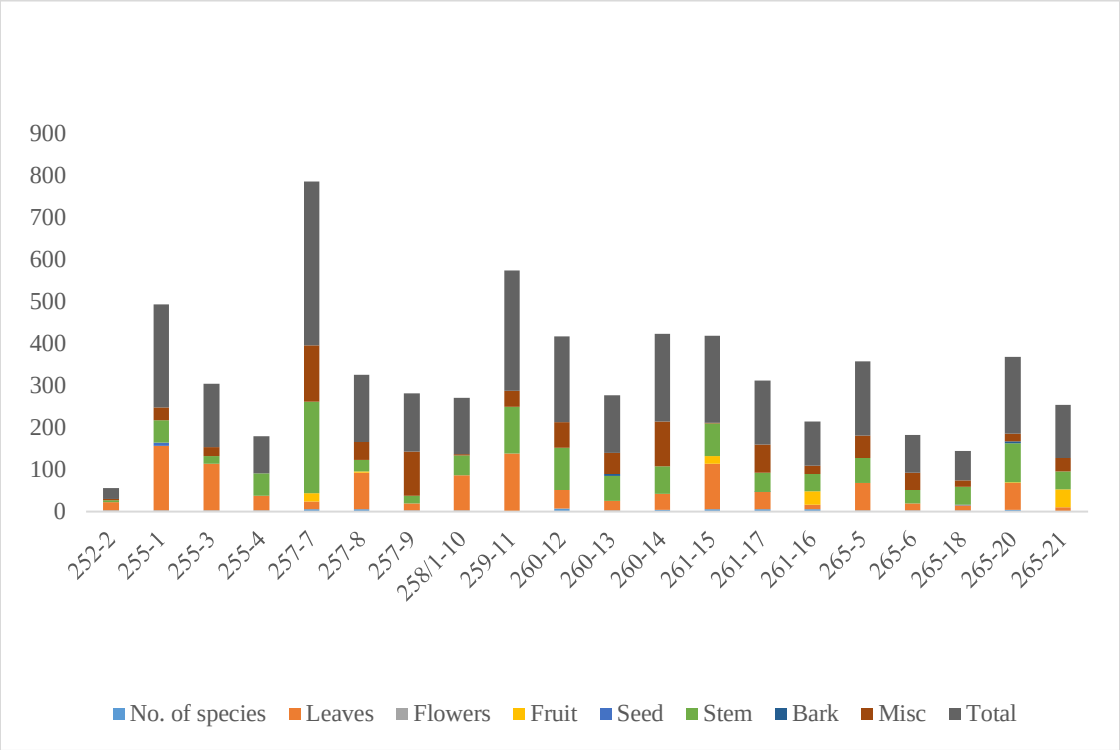
Out of total 842.76 gr, Leaf litter (72 species) occupies major portion with 1098.18 gr followed by dead stem 1209.48gr, Miscellaneous parts with 9.26gr, bark with 9.65gr (3species) and 114.92gr of fruits. There are no flowers and seeds were recorded in the litter. The parts of litter was graphically represented in **Fig. 5**

Fig. 5: Parts of litter vs sampling points



Among the 17 species, *Pongamia pinnata* produced 153.20 litter including Leaves followed by *Grewia rhamnifolia* (109.48gr) including leaves; *Syzygium cumini* (105.72gr) only leaves; *Hardwica binata* (137.9gr) including leaves and *Flacourtia indica* (98.50gr). The sampling point wise species diversity and leaf litter production presented in **Fig. 6.**

Fig. 6: Species diversity and Leaf litter production



CHAPTER – VI

SUMMARY & CONCLUSION

The litter production of Mudimyal Reserve Forest is 869.5gr for 10 sampling points with 1x1m size. A total of 17 species of plant produce litter was collected from the study area. Out of total 869.15 gr, Leaf litter (17 species) occupies major portion with 523.63 gr followed by dead stems139.7gr, Miscellaneous parts with 101.6gr, bark with 97.3gr (2 species) and 6.98gr of fruits. There are no flowers and seeds were recorded in the litter.

The litter production of Hayathnagar Reserve Forest is 1090.63 gr for 20 sampling points with 1x1m size. A total of 32 species of plant produce litter was collected from the study area. Out of total 842.76 gr, Leaf litter (72 species) occupies major portion with 1098.18 gr followed by dead stem 1209.48gr, Miscellaneous parts with 9.26gr, bark with 9.65gr (3species) and 114.92gr of fruits. There are no flowers and seeds were recorded in the litter.

Chapter-VII

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