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Experimental investigation and the importance of litter fall

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ABSTRACT

Litter fall is a significant measure of productivity. The cycling of nutrients in litter fall is contributed in mechanism of the maintenance of soil fertility in forest but its importance has rarely quantified experimentally. There is species wise, age wise difference observed in the production of litter. However, to know the changes i.e. dry monsoon and highly wet monsoon the experiment was designed by choosing five different species viz *Swietenia macrophylla* King., *Muntingia calabura* L., *Grevillea robusta* A., Cunn. ex R.Br., *Eucalyptus globules* Labill., *Azadirachta indica* Juss. The experiment was conducted in Lead Botanical Garden of Shivaji University, Kolhapur. Three months were considered for the measurement of litter by following standard method for three years i.e. 2015, 2016 and 2017. It was observed that maximum litter fall was obtained by *Muntingia calabura* and minimum by *Azadirachta indica.* The sequential pattern of litter fall was observed in species i.e. *Muntingia calabura* > *Eucalyptus globules* > *Swietenia macrophylla* > *Grevillea robusta* > *Azadirachta indica.* The piece of work suggests the climate changing pattern of litter fall as in 2015 maximum litter production in the species may be due to dry monsoon.

Key words: Litter fall, Rain fall, and Climate changing pattern.

INTRODUCTION

Litter fall is an important stage in life of plant which contributes to the dynamics of the community. Litter dynamics constitute an important aspect of nutrient cycling and energy transfer in forest ecosystems (Maguire, 1994). Litter fall is closely related to growth rate of managed forests, excluding old or moribund forests, and is a principal pathway for the return of nutrients to the soil (Miller, 1984). The amount of nutrients added to the soil is directly proportional to the amount of litter produced. Different species have different nutrient release patterns, which are related to litter quality and seasonal environmental factors (Khiewtam and Ramakrishnan, 1993). The complex process of litter decomposition includes the breakdown of litter and transport of organic matter along with other nutrients to the soil in simpler form for the utilization by the plants in an ecosystem. Chemical contents of leaf litters consist of structural component of plant cell wall as hemicelluloses, celluloses and lignin, therefore carbon contents are greater than other nutrients.

During decomposition process, the organic materials flow to soil subsystem in the forest ecosystem. Rates of litter decomposition depend on many factors, for example decomposer populations, environmental conditions, and quality of decomposed materials. The last factor supposed to be a primary determinant of decay rate (Sariyildiz, 2003). To test if topographic metrics were correlated with litter fall as the dependent variable and many topographic metrics, such as slope, aspect, and upslope contributing area as the independent variables, but found no correlation between any one or combination of these metrics (Peterson *et al*., 2013). Litter fall had two relative maximums throughout the year, the largest during the months of July, August and September, and the second one during January and February. The temperature of the previous month and moisture deficit resulted to be the most correlated climatic variables with monthly litter fall. Both time and treatments, and also their interaction, had a significant effect on litter fall, decreasing the quantity of litter fall with thinning intensity. Five years after thinning, this effect on the litter fall disappeared (Roig *et al*., 2005). Monthly leaf fall was similar in primary and secondary forest and was negatively correlated with rainfall, *Eucalyptus* plantations showed the opposite pattern, and was positively correlated with rainfall. The temporal pattern of litter fall in primary and secondary forests was similar for all litter together, leaves and fruits, but not for flowers or branches. None of the litter fall components within *Eucalyptus* were correlated with the seasonal patterns of litter fall found in either primary or secondary forest (Barlow *et al.*, 2007).

MATERIAL AND METHOD

The study was conducted in Lead Botanical Garden of Shivaji University, Kolhapur. (M.S.) India. In the following study we have randomly selected five tree species and placed the quadrates (1m×1m) permanently in the study area. Tied up a net to the sticks by placing quadrates and these litter traps were placed just below the canopy area of the selected plant species. After every week, litter was collected from each quadrat and weighed it separately. The first collection is treated as the initial record for the season. This can be recorded up to the end of the season.While the data was analyzed and it is correlated with annual rainfall at the end of each season.

RESULTS & DISCUSSION

The results are depicted in Table 1, Table 2 and Table 3. At the end of season 2015, 2016 and 2017 the highest litter fall was found in *M. calabura* (476.5 gm), *S. macrophylla* **(**386 gm), *M. calabura* **(**450 gm) and followed by *S. macrophylla* **(**376 gm), *G. robusta* **(**376 gm) and *E. globulus* (357 gm) while least litter fall was observed in *A. indica* **(**277 gm) *A. indica* **(**108 gm) and *G. robusta* **(**114 gm). The average highest litter fall was found in *M. calabura* **(**399.5 gm) followed by *E. globulus* (327 gm) and average least litter fall was recorded in *A. indica* (193 gm) respectively (Table 4) Total amount of litter fall among all the species is recorded as follows in the season of 2015 was (1803.5 gm), 2016 (1458 gm) and 2017 (1287 gm) sequentially.

Table 1 : Shows total Litter produced in year 2015 in gm

Name of plant species	*E. globulus*	*S. macrophylla*	*M. calabura*	*A. indica*	*G. robusta*
			(July to September 2015)		
3/7/2015	115	61	45	15	65
10/7/2015	6	25	59.3	5	30
17/7/2015	1	31	51.2	5	22
24/7/2015	11	5	20	11	10
31/7/2015	12	28	17	12	62
7/8/2015	15	15	12	7	15
14/8/2015	15	68	25	5	5
21/8/2015	20	110	43	48	75
28/8/2015	12	22	49	25	6
4/9/2015	29	8	52	25	40
11/9/2015	35	3	50	30	20
18/9/2015	20	-	30	54	7
25/9/2015	17	-	23	35	9
Total (gm)	**308**	**376**	**476.5**	**277**	**366**

Table 2 : Shows total Litter produced in year 2016 in gm

Name of plant species	*E. globulus*	*S. macrophylla*	*M. calabura*	*A. indica*	*G. robusta*
July to September 2016					
8/7/2016	10	65	12	14	82
15/7/2016	7	5	4	5	5
22/7/2016	75	32	14	7	15
29/7/2016	27	26	30	7	65
5/8/2016	52	68	47	45	62
12/8/2016	9	28	27	10	40
19/8/2016	50	115	27	3	31
26/8/2016	24	28	7	5	22
2/9/2016	15	15	5	2	15
9/9/2016	10	4	9	4	5
17/9/2016	9	-	52	2	7
23/9/2016	18	-	26	2	2
30/9/2016	10	-	12	2	17
Total (gm)	**316**	**386**	**272**	**108**	**376**

Table 3 : Shows total Litter produced in year 2017 in gm

Name of plant species	*E. globulus*	*S. macrophylla*	*M. calabura*	*A. indica*	*G. robusta*
July to September 2017					
7/7/2017	6	2	27	1	27
14/7/2017	11	62	2	19	19
21/7/2017	5	7	19	24	2
28/7/2017	32	1	4	47	2
4/8/2017	37	67	2	35	7
11/8/2017	32	8	10	29	7
18/8/2017	32	7	29	10	8
25/8/2017	59	7	84	2	5
1/9/2017	52	1	20	3	2
7/9/2017	15	5	27	4	7
15/9/2017	27	2	22	5	17
22/9/2017	24	1	114	1	7
29/9/2017	25	2	90	14	4
Total (gm)	**357**	**172**	**450**	**194**	**114**

Table 4 shows comparative litter produced in three seasons

Name of plant species	Total litter of 2015(gm)	Total litter of 2016(gm)	Total litter of 2017 (gm)	Avg. litter of three seasons(gm)
E.globulus	308	316	357	327
S.macrophylla	376	386	172	311.33
M.calabura	476.5	272	450	399.5
A.indica	277	108	194	193
G.robusta	366	376	114	285.33

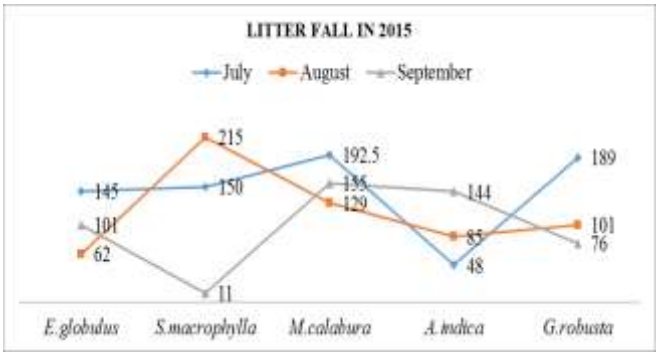

Fig. 1 shows total amount of litter produced in 2015

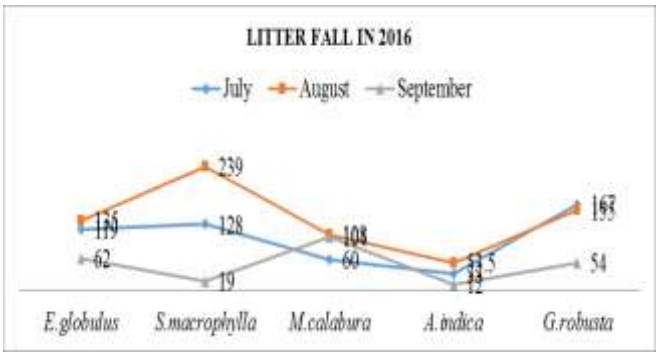

Fig. 2 shows total amount of litter produced in 2016

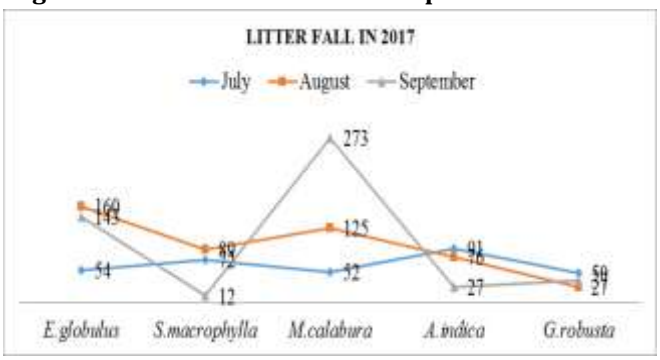

Fig. 3 shows total amount of litter in 2017

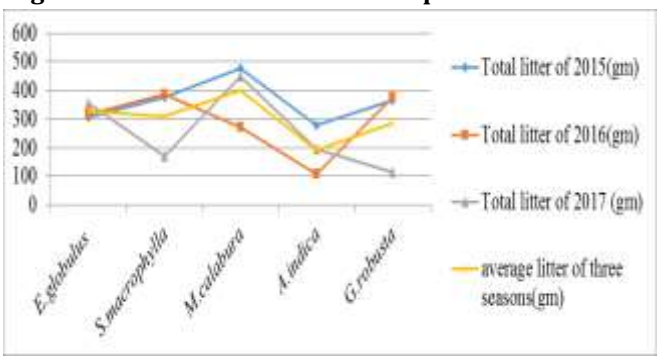

Fig 4 shows comparative litter produced in three seasons

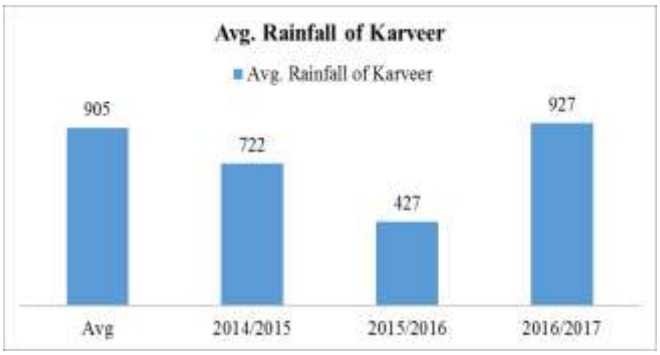

Fig.5 shows Rainfall pattern (mm)

Fig 5 shows the average rainfall of Karveer is (905 mm) and the highest rainfall is recorded in the season of 2017 (927 mm) and least rainfall was recorded in 2015/2016 season (427 mm).

CONCLUSION

The setup of experiment says that the decrease in rainfall leads to more litter production as compared these season shows drastic changes in litter production. At micro level of investigation says that the season of 2015 showed more litter fall due to dry monsoon. That means the climate change is a considerable factor on plant growth and their development.

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