



CONTRIBUTION OF GROUND VEGETATION IN THE LITTERFALL OF THE BALA FORT RESERVE FOREST IN ALWAR, RAJASTHAN

VIVEK MISHRA^{1*}, ATAR SINGH YADAV² and RITU MATHUR¹

¹Department of Chemistry, Raj Rishi College, Alwar, Rajasthan 301001, India

²Department of Botany, Raj Rishi College, Alwar, Rajasthan 301001, India

*Corresponding Author's Email: mvivek7777@gmail.com

The Bala-fort tropical dry deciduous forest in the Aravalli ranges is located in Alwar district of Rajasthan (27°4' to 28°4' N and 76°7' to 77°13' E). It supports a dense layer of herbs and shrubs because of its open forest canopy. Hence, the role of dominant herb and shrubs in the litter dynamics has been evaluated in this forest. The total annual litter of the forest floor was 328 g m⁻² out of which more than 32 % was contributed by the selected shrubs of the ground vegetation. The shrub *Grewia flavescens* contributed from September to March, *Capparis sepiaria* from March to June whereas *Justicia adhatoda* throughout the year. It seems from the study that *Justicia adhatoda* plays greater role whereas the common herb *Achyranthes aspera* played the lowest role in the litter dynamics of this forest.

Key Words: Biomass; Dry deciduous forest; Litter dynamics; Nutrients; Shrubs.

Introduction

Litterfall plays an important role in the return of nutrients from aerial parts of the plant community to the soil; hence it has a great impact on soil development and fertility¹. The timing and amount of litter fall are controlled by water, temperature, photo period, soil nutrients and other abiotic factors^{2,3}. In tropical dry deciduous forests the litter production represent a more synchronized pulse of nutrient input to the soil system than in other kind of tropical forests⁴. Litter fall in tropical dry deciduous forests in India has been evaluated by many workers⁵⁻⁸. However, only a few attempts have been made to study the litter fall in dry deciduous forests of Rajasthan⁹⁻¹¹. Hence the present study has been undertaken to understand (i) the seasonal pattern of litter fall (ii) contribution of selected dominant herb and shrubs in the litter fall of the tropical dry deciduous forest of the Bala fort reserve forest in Alwar, Rajasthan.

Material and Methods

The study site was located on a West facing hill slope in the Bala fort reserve forest in Alwar district of Rajasthan (27°4' to 28°4' N and 76°7' to 77°13' E). The climate is hot and dry with three distinct seasons in a year. The summer season from mid-March to June is extremely hot and dry, temperature soaring to about 46°C. The rainy season from July to mid-September which receive 90% of the average annual rainfall (730 mm) and the dry cold winter season prevail from October to February with temperature dropping to 2°C in December and January with little rainfall (Fig 1). The vegetation of this forest is tropical dry deciduous forest according to Champion and Seth¹² classification of forests. The vegetation is dominated by *Anogeissus pendula*, *Acacia leucophloea*, *Boswellia serrata*, *Grewia flavescens*, *Capparis sepiaria*, *Capparis deciduous*, *Justicia adhatoda* and *Achyranthes aspera*¹³.

The litter was collected by laying 12 litter traps (Plate 4) at the middle part of the West facing hill slope of the Bala-fort Forest. Litter traps of 50cm × 50cm × 15cm were placed strategically so that the litter of the desired plant species could be obtained at monthly intervals. The litter was sorted out into two main components: (i) leaves of the desired species and (ii) remaining litter of miscellaneous species. Collection of litter accumulated in the litter traps was done at monthly intervals from September 2011 to

August 2012. However, in January 2012 to February 2012 and May 2012 to August 2012 the litter was collected after two months interval as litter fall was very low in these months. The litter obtained from each trap was put in a paper bag separately and brought to the laboratory where the litter was separated species wise. Miscellaneous litter includes seeds, fruits, twigs and unidentified litter components of plant species other than the selected species, the litter of which was separated from it.

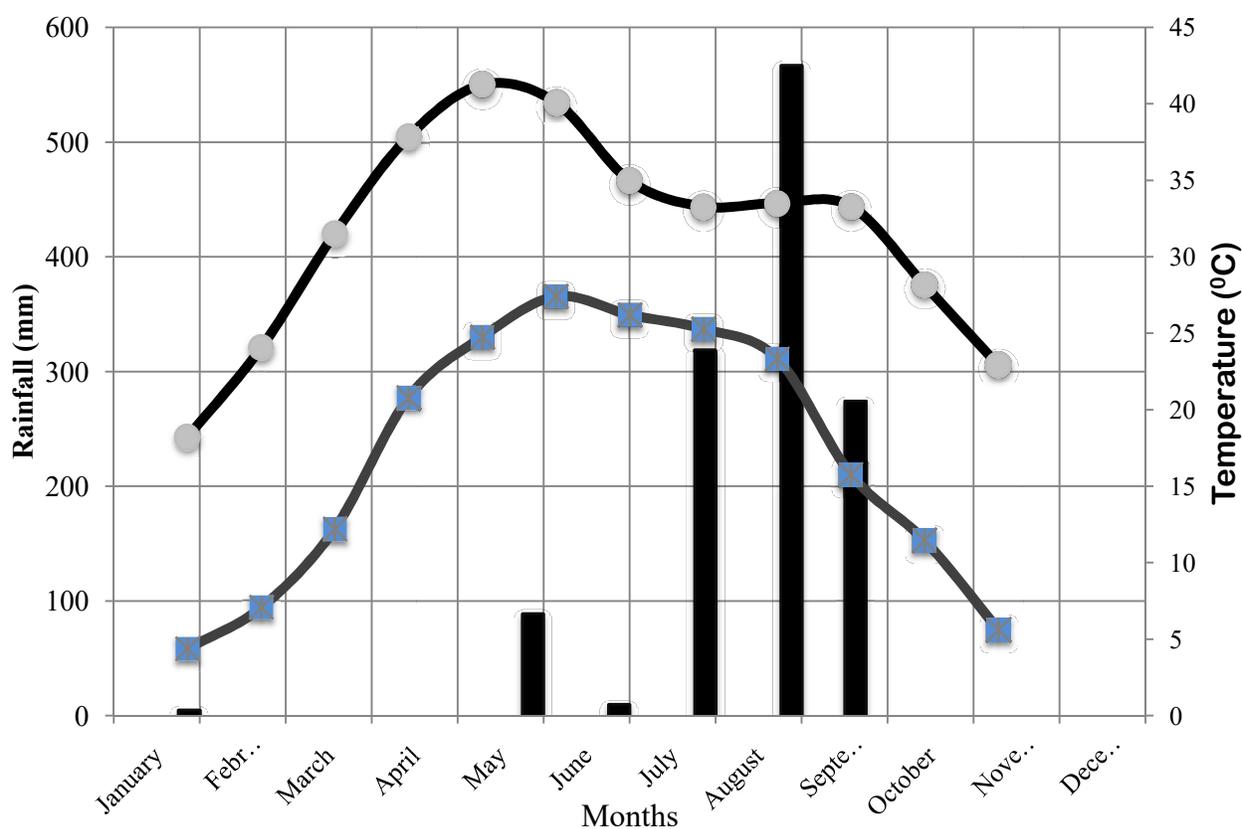


Fig. 1: Ombrothermic diagram of the study site from the year 2009 to 2012. Average monthly maximum temperature (—●—) and minimum temperature (—■—) and total monthly rainfall (■) September 2011 to August 2012.

Results and discussion

Justicia adhatoda:

The litterfall of *Justicia adhatoda* takes place throughout the year (Table 1). The collection of litterfall of *Justicia adhatoda* was found to be 18.79 g m⁻² in the month of

April, which was the highest, whereas, it was lowest in the months of July and August (0.34 g m⁻²). The annual average litterfall of *Justicia adhatoda* (67.25 g m⁻²) comes to be the highest among the four species.

Grewia flavescens:

The litter fall of *Grewia flavescens* was high from September to March whereas in the rest of the five months it was almost negligible. The litter fall of *Grewia flavescens* was observed to be the highest (5.36 gm⁻²) in the month of March and it was the least (0.23 g m⁻²) in the month of July and August (Table1). The data obtained indicate that the annual average litterfall of *Grewia flavescens* (22.72 g m⁻²) was higher than *Capparis sepiaria* and *Achyranthes aspera*.

Capparis sepiaria:

The litterfall of *Capparis sepiaria* was very low throughout the year except from March

to June. The maximum litterfall was recorded (7.97 g m⁻²) in the month of May and June whereas it was almost negligible in July and August. In the rest of the four months i.e., from October to February, very little litter fall was recorded in *Capparis sepiaria* (Table 1).

Achyranthes aspera:

Achyranthes aspera is an annual herb which completes its life cycle from July to October, therefore, the whole plant dies in the month of October. The amount of litterfall produced by this species was very less (0.90 g m⁻²) in comparison to the other plant species under investigation (Table 1).

Table 1: Litter fall (g m⁻²) of different species on the West facing slope in the Bala fort reserve forest in 2011-2012 (SE±).

Observation Periods	<i>Justicia adhatoda</i>	<i>Grewia flavescens</i>	<i>Capparis sepiaria</i>	<i>Achyranthes aspera</i>	Total Litter
September 2011	3.02±2.2	2.54±2.1	0.1±0.05	*	10.91±3.2
October	3.22±2.3	3.64±2.2	0.58±0.3	0.90±0.2	11.3±3.3
November	2.97±2.0	3.91±2.1	0.24±0.1	*	14.74±2.3
December	3.86±2.4	2.18±1.2	0.46±0.2	*	58.81±2.6
January and February 2012	8.96±4.0	4.08±1.7	0.78±0.6	*	55.78±8.2
March	11.64±4.8	5.36±3.9	2.14±1.3	*	48.11±11.8
April	18.79±5.8	0.3±0.1	3.26±2.5	*	47.76±7.1
May and June	14.45±4.3	0.48±0.2	7.97±4.9	*	79.08±13.2
July and August	0.34±0.2	0.23±0.1	0.07±0.04	*	1.74±0.4
Total	67.25	22.72	15.6	0.9	328.23

* *Achyranthes aspera* is an annual plant so the litter fall was almost negligible.

In the Bala fort tropical dry deciduous forest, the litterfall commences in the month of September with the return of monsoon in this part of India (Fig 1). It continued steadily up to December with a peak in January and February. It may be due to the decreased water availability during this period. Sanchez-Azafeifa *et. al.*¹⁴ has also reported that dry season is the important trigger of leaf fall of the drought-deciduous species. Pezzini *et. al.* has also reported that 95% leaf fall may occur in tropical dry deciduous forests in dry season which may

lead to accumulation of large litter biomass on the soil surface^{3,16}. The peak of the litter fall of selected species in this dry deciduous forest for *Capparis sepiaria* was May and June (8 g m⁻²), *Grewia flavescens* in March (5.4 g m⁻²) and *Justicia adhatoda* in April (18.8 g m⁻²). The total annual litter of selected species plus the other species in the ambience of the forest floor was 328.23 gm⁻² out of which 32.4% was contributed by the selected shrubs with insignificant contribution by the dominant herb, *Achyranthes aspera*. Hence, the shrubs add

considerable amount of litter to the forest floor (Table 1). It was high from January to June in this forest which may be due to the high leaf fall of *Anogeissus pendula* which is a dominant tree of this forest^{17,18}. The less amount of annual forest floor litter may be attributed to nine months cold and dry October to March and hot and dry April to June period in this forest

(Fig1). The months of July and August observed the lowest total litter fall (1.74 g m^{-2}) whereas it was highest in December (58.81 g m^{-2}). The total annual litter fall in the middle part of the hill slope was 328 g m^{-2} with 20%, 7%, 5% and 0.3% contribution by *Justicia adhatoda*, *Grewia flavescens*, *Capparis sepiaria* and *Achyranthes aspera*, respectively (Fig 2).

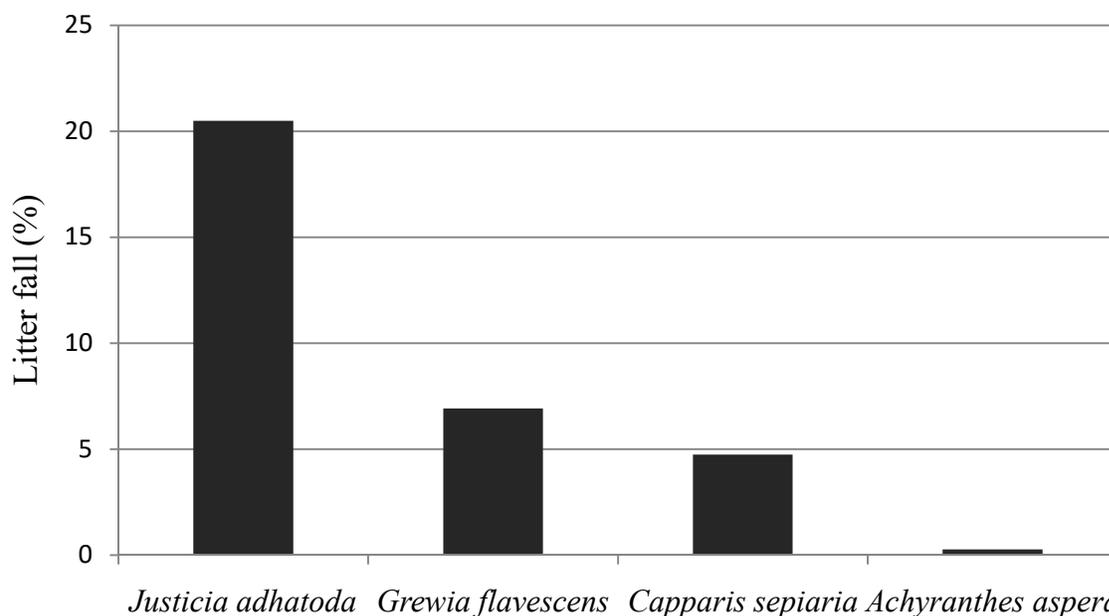


Fig. 2: Litter fall (%) of selected plant species of total fall on the West facing hill slope in the Bala fort reserve forest in 2011-12.

This indicates that among the selected species *Justicia adhatoda* plays highest whereas the herb *Achyranthes aspera* lowest role in the litter dynamics of this forest. Both *Justicia adhatoda* and *Grewia flavescens* return about 27% nutrients to the soil pool in this forest. *Capparis sepiaria* accumulates nutrients in its biomass as its litter fall is very less. The unique characteristic of these plant species of shedding leaves at different periods of time allows the passage of nutrients slowly in the soil. This facilitates the conservation of nutrients and help plants in the vicinity to grow and maintain the forest ecosystem. On the basis of these observations, it may be concluded that all the four selected species

play important role in the nutrient cycling of this tropical dry deciduous thorn forest because they contribute about 32% of the total annual litter fall.

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