

## Feeding Ecology of Sloth Bear (*Melursus ursinus*) in Nawada Forest Division (Bihar) by Scats Analysis

G. Kumar, D. K. Paul

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### ABSTRACT

The present study deals with the feeding ecology of species which influences the home ranges and habitat use of sloth bear (*Melursus ursinus*). Seasonal diet composition of sloth bear in Nawada Forest Division (NFD), Nawada, Bihar was determined from 115 scats. With microscopic analysis of scats, different types of food items such as plants, termites, ants and mammalian hairs were identified. On frequency of occurrence basis in scats, plants species contributed highest followed by the insects (28.9%) and mammalian hairs (10.3%). Among the plants species, *Zyzyphus* sp. (14.8%) ranked highest among the plants followed by *Aegle marmelos* (13.3%). Of the insects found in scats, termites (8%), larvae of beetles (7.3%), black ants (5.0%) and red ants (4.3%) respectively were observed. Some unidentified materials (2.6%)

were also identified during scats analysis. Based on percent dry weight composition, plants species dominated followed by insects, unidentified matters and mammalian hairs respectively.

**Keywords :** Sloth bear, Scat, Diet composition, Feeding, Nawada Forest Division (NFD).

### INTRODUCTION

The sloth bear *Melursus ursinus* is a myrmecophagous (ant or termite eating). Ursids are most prevalent in India, Nepal, Bhutan, Bangladesh and Sri Lanka so far, few years ago these species were evidently reported to disappeared in Bangladesh. The sloth bear is enlisted as 'vulnerable' by the World Conservation Union (IUCN 2016). Evidently, sloth bears habitat existence was reported in 174 protected areas of India including 46 National parks (NP) and 128 Wildlife Sanctuaries (WLS). Sloth bear enlisted in both Schedule I of Wildlife Protection Act, India 1972 and Appendix I of CITES (Committee on International Trade in Endangered Species). Bears are reported in few protected areas of Bihar such as Bhimbandh Wildlife Sanctuary, Kaimur Wildlife Sanctuary. Recently, in Nawada district of Bihar, additionally one new Wild-life Sanctuary named as Rajauli Wildlife

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G. Kumar\*, D. K. Paul  
Environmental Science and Management,  
Department of Zoology, Patna Science College, Patna University,  
Patna 800005, India  
Email : gourav.raj.gwl@gmail.com\*,  
dkpaul.pat31@gmail.com

\*Corresponding author

Sanctuary have been reported August 2019. During fruiting season period, 70-90% of bear diet may comprises of fruits, while for the rest of the seasonal year, more than 80% of the diet may comprise of termites and other insects, respectively (Seidensticker *et al.* 2011, Yoganand *et al.* 2012). The diet composition of sloth bear with respect to insects to fruits ratio, varies with the season (Mewada and Dharaiya 2010, Sukhadiya *et al.* 2013). The objective of the present study was aimed to document food habits of sloth bears in a heavily disturbed and fragmented habitat. Data on seasonal variation in bear diet composition can be collected either directly through foraging observations or indirectly through scat analysis (20<sup>th</sup> International Conference on Bear Research and Management, Ottawa, Ontario, Canada 2011) (Chauhan *et al.* 2011). It is found that sloth bear forage mostly at night due to which it is challenging to collect data on food habit based on direct observations and thus depended on indirect via scat analysis. Sloth bears are able to uptake both natural and cultivated plant food from the ground as well as trees. Some of the 13 natural plants and 7 cultivated plant species were identified to be consumed by sloth bear in different seasons found in the sanctuary. These 20 plant species were taken in the form of young and mature leaves, flower buds, flowers, unripe/ripe fruits and also their seeds, bark, Aerial roots and young stem shoots.

Understanding of sloth bears food habit which differs across its distributional range along with diverse habitats and different vegetation composition would reflect the ability of sloth bears to adapt to landscape modified by humans and proves important for effective conservation planning. Thus, the study of food habit is essential for the management of the habitats of the sloth bears, especially in the human-dominated landscapes (Palei *et al.* 2014, Ramesh *et al.* 2009).

The major aim of the present research was to study the food habits and feeding ecology of sloth bear in the underlying study area and to assess the distribution and habitat use of sloth bears. At present, in Bihar, no preliminary studies have been carried out on sloth bear. Sloth bear as well as human residing in Rajauli, Kauwakol and in some part of Nawada forest range share the common food resources present in Nawada Forest Division (NFD) which might results in conflicts.

## METERIALS AND METHODS

### Study area

The study was carried out in Nawada forest division



**Fig. 1.** Map showing scat collection in different forest ranges in Nawada forest division, Nawada District, Bihar.

during 2016-2019. Nawada is located in South Bihar between North latitudes 24° 52' 47.99"N latitude and 85°31' 47.99" E longitude. Nawada forest division is divided into four forest ranges- Nawada Forest Range (NFR), Hisua Forest Range (HFR), Rajauli Forest Range (RFR) and Kawakol Forest Range (KFR) (Fig.1).

The district is surrounded by Nalanda and Sheikhpura District in Northern side, by Jamui District in Eastern side, by Gaya district in Western side, by Jharkhand State boundary in Southern half boundary of district. The geographical area of Nawada district with 2494 km<sup>2</sup> comprises of 1.43% of the total geographical area of the Bihar State. Average rainfall is 1037 mm per annum in Nawada. After analysis of rainfall data it was revealed that there was a large variation in average annual rainfall values being the least rainfall in Rajauli and maximum at Nawada. The climate is generally sub-tropical and sub-humid in nature. The temperature ranged from 16°C to as low as 4°C in winter whereas during the summer the mercury shoots to 46°C. During rainy season it becomes cooler and temperature drops to 35°C to 25°C. Approximately 25% of the total land area of the Nawada District is covered by Forest (637.75 sq km). The soil is mixture of sandy, clay loam, sandy loam and clay loam in the Nawada District. Kakolat waterfall is the famous natural waterfall situated on the border of Bihar and Jharkhand that is just 33 km ahead from Nawada. This waterfall serves as natural water reservoir for peoples residing nearby this forest area as well as water resource for the wild animals living in this forest range. This is most visited site where tourists come from all over the state and adjoining areas to witness beauty throughout the year. In addition to sloth bear, the other common wild animals Hyena, Wolf, Wild dog, Wild boar, Sambar, Spotted deer, Nilgai, Hare and birds such as Pea fowl, Jungle fowl, Partridge, Black and Gray quail, Hornbill, Parrot, Dove have also been reported in this area. In addition to above, a lot of snakes as python and small creatures of reptelia are also found in the area. The rivers flowing through this division are not perennial and hence availability of fishes is of not much significance. In this study, sloth bear habitat was found to be reported in RFR, KFR and NFR,

respectively. It was also observed that the high rate of the conflicts between human and sloth bear exist in the above three range respectively. Due to edibility of same food items by both human as well as sloth bear, the chance of conflicts increases in near by villages.

### Collection of scats

Scats were collected during 2016 to 2019 from RFR, KFR and NFR of the selected sub-beats (25-30) as well as along the walking and trailed roads. Collected scats were dried in the sun in forest area. After getting dried it was packed in polythene bags with appropriate labeling. Then these scats were taken to laboratory of Department of Zoology, Patna University for further analysis.

Season wise collection of scat in WLS (Wildlife sanctuary).

Season	No. of scat obtained inside WLS	Outside WLS
Summer	32	18
Monsoon	18	7
Winter	24	16
Total	74	41

### Analysis of scats

A total of 115 scats were collected during the period of 2016 to 2019 from the various patches of the habitat like forest roads, trails, feeding grounds, area around water hole. The sloth bear scats were distinguished by their appearance (size, shape, composition of seeds and animal remains) and by their associations with other sloth bear by indirect evidences (diggings, pugmarks). Each scat sample was transferred to separate zip lock polythene bags and details of date, location; nature (fresh, old), type of habitat patch were noted and tagged on each bag. The scats were soaked in water and sun dried to recover seeds and animal matter. Scats of each month was pooled and repeatedly mixed well. Five samples of 500 cc each were taken separately and each was made up to 1

**Table 1.** Overall frequency of occurrence of food items in scats of sloth bears in Nawada forest division.

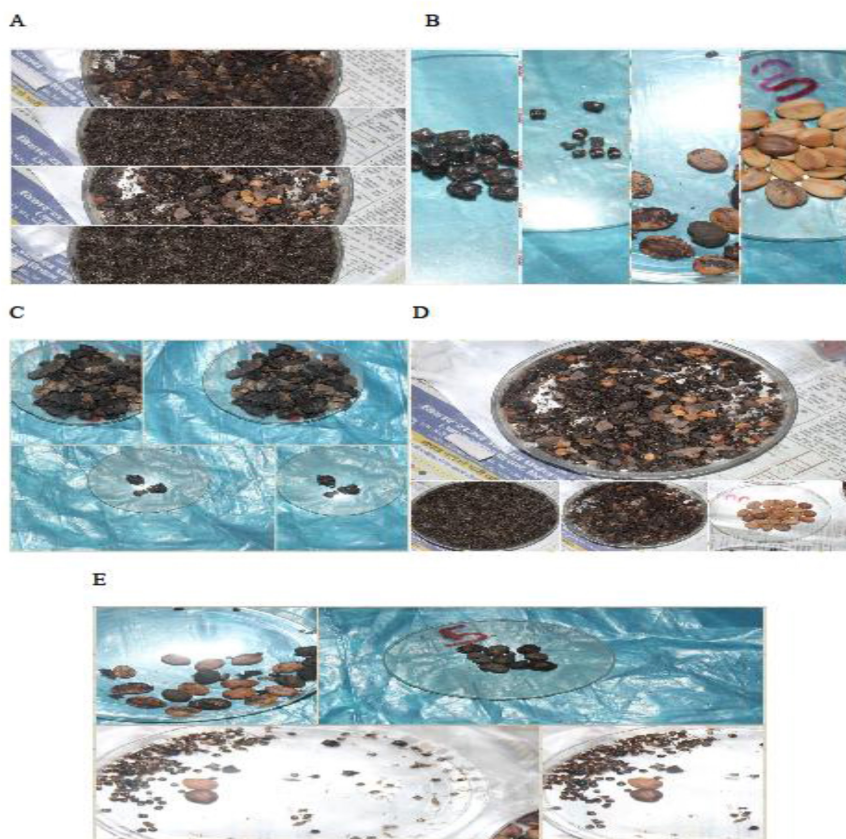
Food items (plant)	Local name	Summer (n = 40) FO (%)	Monsoon (n = 25) FO (%)	Winter (n = 40) FO (%)	Overall (n = 105) FO (%)
<i>Zyzyphus jujube</i>	Ber	36	0.0	8.6	14.8
<i>Ficus bengalensis</i>	Bar	0.0	0.0	2.3	0.76
<i>Dendrocalamus strictus</i>	Bans	1.0	2.2	0.0	1.0
<i>Aegle marmelos</i>	Bel	28	12	0.0	13.3
<i>Mangiferai ndica</i>	Am	1.6	0.6	0.0	0.7
<i>Cassia fistula</i>	Amaltas	12.1	0.0	6.8	6.3
<i>Cucurbita spp.</i>	Seetaphal	0.0	1.5	0.0	0.5
<i>Syzygium cumini</i>	Jamun	24	42	0.0	22
<i>Zyzyphus oenopila</i>	Dithor	6.5	2.4	11.5	6.8
<i>Ficus qlomerata</i>	Dumar	0.8	6.6	1.8	3.0
<i>Anogeissus latifolia</i>	Dhautha	0.0	0.0	4.5	1.5
<i>Semecarpus anacardium</i>	Bhelwa	6.8	9.8	1.5	6.0
<i>Pithecellobium dulce</i>	Jalebi	0.0	4.3	0.0	1.4
<i>Phoenix acaulis</i>	Khajur	0.0	24	0.0	8
<i>Madhucai ndica</i>	Mahua	4.5	0.0	7.2	3.9
<i>Buchanania anzan</i>	Piar	0.0	13.5	0.0	4.5
<i>Brideliaretusa</i>	Kajh	3.3	0.0	0.0	1.1
<i>Diospyros melanoxylon</i>	Kend	2.6	0.0	0.0	0.8
<i>Ficusr eligiose</i>	Pipal	0.0	0.0	3.5	1.1
<i>Canthium parviflorum</i>	Kadbar	0.0	22.2	3.3	8.5
Mammalian					
Bone		0.0	4.0	0.0	1.33
Hair		3.0	16.0	12.0	10.3
Unidentified material		2.0	6.0	0.0	2.6
Insects					
Honey bees		9.0	0.0	4.0	4.3
Larvae of beetles		14.0	0.0	8.0	7.3
Black ants		0.0	12.0	3.0	5.0
Red ants		0.0	10.0	3.0	4.3
Termites		0.0	18.0	6.0	8.0

litter using distilled water and then segregated using meshes of sieve size ranging from  $100 \times 100$  mm to  $1 \times 1$  mm. Each component was sorted out and respective percentage volume was calculated for all the five samples and its mean values were taken for every month. The volume was estimated to the nearest 1 ml using the water displacement method as suggested by Baskaran and Desai (2010). Plant matter was identified up to species level using seeds in comparison with available seasonal fruits. The animal matter was broadly classified into bees, ants, termites and beetles and other insects observed. Particles below 1 mm size were examined under simple and compound microscopes. Those food items that could not be identified were categorized as unidentified matter as suggested

by Baskaran and Desai (2010). Scats analysis has been depicted in Fig. 2.

## RESULTS

Seasonal variation in dietary composition in summer, monsoon and winter seasons were estimated. In the present study, altogether 115 scats (n=50 in summer), (n=25 in monsoon) and (n=40 in winter) were collected and analyzed by both frequency of occurrence and percent dry weight of the seasonal diet. Many different types of food items includes plant matters, mammalian hairs, termites, ants found in total scats (Table 1). Based on frequency of oc-



**Fig. 2A.** Case 01: Laboratory analysis of scat as obtained from NFD indicates shift in food pattern of sloth bears with seasons.  
**B.** Laboratory analysis of scat as obtained from NFD indicates shift in food pattern of sloth bears with seasons.  
**C.** Laboratory analysis of scat as obtained from NFD indicates shift in food pattern of sloth bears with seasons.  
**D.** Case 02: Laboratory analysis of scat as obtained from NFD in winters.  
**E.** Case 03: Laboratory analysis of scat as obtained from NFD indicates shift in food pattern of sloth bears with seasons.

currency in scats, plants species contributed highest followed by the insects (28.9%) and mammalian hairs (10.3%). Among the plants species, *Zizyphus* sp. (14.8%) ranked highest among the plants followed by *Aegle marmelos* (13.3%). Of the insects found in scats, termites (8%), larvae of beetles (7.3%), Black ants (5.0%) and red ants (4.3%) respectively were estimated. Some unidentified materials (2.6%) were also identified during scats analysis. Based on percent dry weight composition, plants species (67.8%) dominated the composition followed by insects (22.4%), unidentified matters (5.9%) and mammalian hairs (3.5%), respectively (Table 2).

### Seasonal variation in dietary composition

In summer, *Zizyphus* sp. (36%) was found to be most frequently utilized food items by the sloth bear followed by *Aegle marmelos* (28%) and *Syzygium cumini* (24%) (Fig. 3).

With the onset of the monsoon, the major food item of sloth bear are *Syzygium cumini* (42%), followed by *Phoenix acaulis* (khajur) (24%) along with the insects (termites: 18%, black ants: 12%) (Fig. 4).

**Table 2.** Percent dry weight composition of food items in the scats of sloth bears by seasons in Nawada forest division.

Food items (Plants)	Lacal name	Summer (n = 40) DW (%)	Monsoon (n = 25) DW (%)	Winter (n = 40) DW (%)	Overall (n = 105) DW (%)
<i>Zyzyphus jujube</i>	Ber	12.5	0.0	6.5	6.3
<i>Ficus bengalensis</i>	Bar	0.0	0.0	3.3	1.1
<i>Dendrocalamus strictus</i>	Bans	0.0	0.0	0.0	0.0
<i>Aegle marmelos</i>	Bel	11.5	3.2	0.0	4.9
<i>Mangifera indica</i>	Am	0.0	0.0	0.0	0.0
<i>Cassia fistula</i>	Amaltas	11.2	0.0	9.6	6.9
<i>Cucurbita</i> spp.	Seetaphal	0.0	0.0	0.0	0.0
<i>Syzygium cumini</i>	Jamun	22.2	25	0.0	15.7
<i>Zyzyphus oenopila</i>	Dithor	5.2	1.2	15.4	7.2
<i>Ficus glomerata</i>	Dumar	0.6	3.2	2.2	2.0
<i>Anogeissus latifolia</i>	Dhautha	0.0	0.0	8.8	2.9
<i>Semecarpus anacardium</i>	Bhelwa	5.3	6.0	3.9	5.0
<i>Pithecellobium dulce</i>	Jalebi	0.0	2.0	0.0	0.6
<i>Phoenix acaulis</i>	Khajur	0.0	12.2	0.0	4.0
<i>Madhuca indica</i>	Mahua	2.7	0.0	0.0	0.9
<i>Buchanania anzan</i>	Phar	0.0	5.2	0.0	1.7
<i>Bridelia retusa</i>	Kajh	2.5	0.0	0.0	0.8
<i>Diospyros melanoxylon</i>	Kend	1.8	0.0	0.0	0.6
<i>Holorrhena antidyenterica</i>	Koraiya	-	-	-	-
<i>Ficus religiosa</i>	Pipal	0.0	0.0	9.8	3.2
<i>Canthium parviflorum</i>	Kadbar	0.0	12.0	0.0	4.0
<b>Mammalian</b>					
Bone		0.0	1.0	0.0	0.4
Hair		4.2	2.0	3.8	3.5
Unidentified material		0.0	4.8	10.4	5.9
<b>Insects</b>					
Honey bees		8.5	0.0	6.5	5.0
Larvae of beetles		3.0	5.2	4.4	4.2
Black ants		2.3	3.2	2.8	2.7
Red ants		0.7	2.8	2.4	1.9
Termites		6.0	11.0	9.0	8.6

In winter, in terms of frequency of occurrence, the mammalian hairs (12%) along with *Zyzyphus oenopila* (11.5%) was extensively found to be reported in scats (Fig. 5).

## DISCUSSION

The seasonal diet diversity (115 scat samples) of sloth bear have been detected in this study as compared to previous other studies. In NFD, on frequency of occurrence basis in scats, plants species contributed highest followed by the insects (28.9%) and mammalian hairs (10.3%). Among the plants species, *Zyzyphus* sp. (14.8%) ranked maximum among the

plants followed by *Aeglemarmelos* (13.3%). Of the insects found in scats, termites (8%), larvae of beetles (7.3%), Black ants (5.0%) and red ants (4.3%) respectively were estimated. Some unidentified materials (2.6%) are also found during scats analysis. Based on percent dry weight composition, plants species (67.8%) dominated the composition followed by insects (22.4%), unidentified matters (5.9%) and mammalian hairs (3.5%), respectively (Fig. 6). The difference in seasonal diet diversity in the study probably be related to change in habitat conditions and availability of food items. The mammalian hairs and bones in scat were also reported by Sreekumar and Balakrishnan (2012). All these facts indicate that

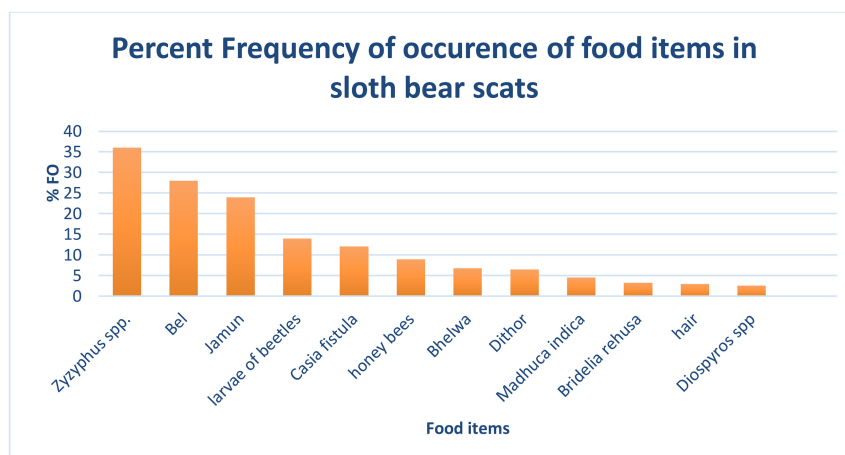


Fig. 3. Summer diet.

sloth bear has feeding diverse food items. During winter season, utilization of insect matter was higher, hard soil during the summer season probably deterred bears from digging for termites and ants (Sukhadiya *et al.* 2012, Ramakrishnan and Deepalakshmi 2012). Among the plants, *Zizyphus* sp. (36%) followed by *Aegle marmelos* (28 %) in summer and *Syzygium cumini* (42%) in monsoon and *Zizyphus oenopila* (11.5%) in winter, respectively were recorded. Plants showed lesser contribution in diet during winter season than in summer season and monsoon season. The

relative importance of the plant matter in bear diets during summer and monsoon season may be due to seasonal flowering and fruiting.

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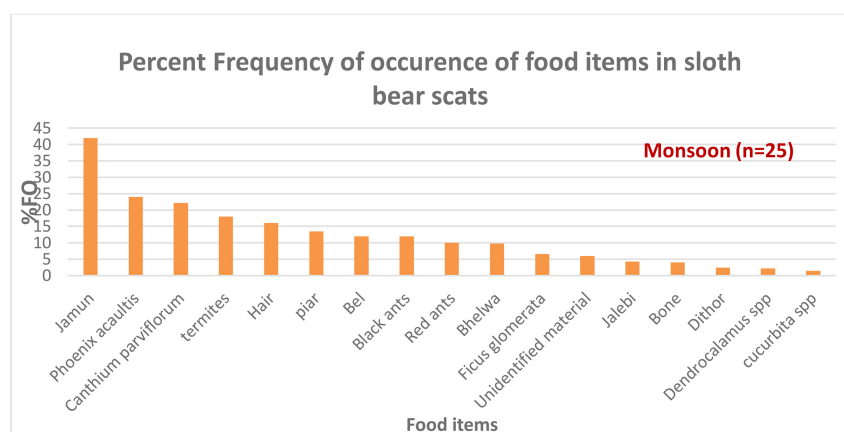


Fig. 4. Monsoon diet.

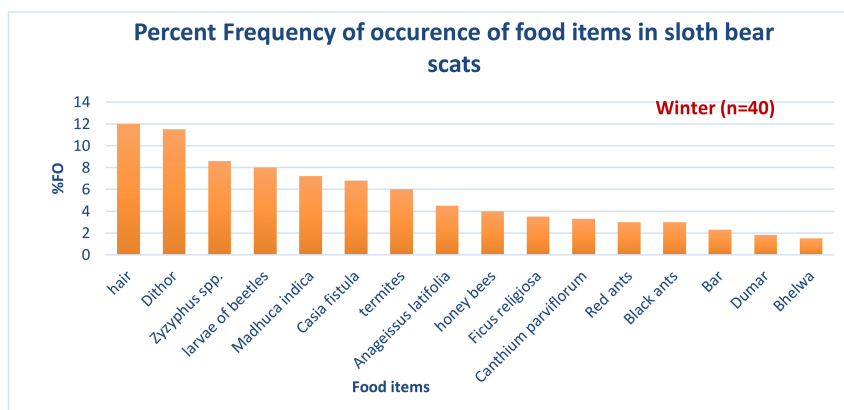


Fig. 5. Winter diet.

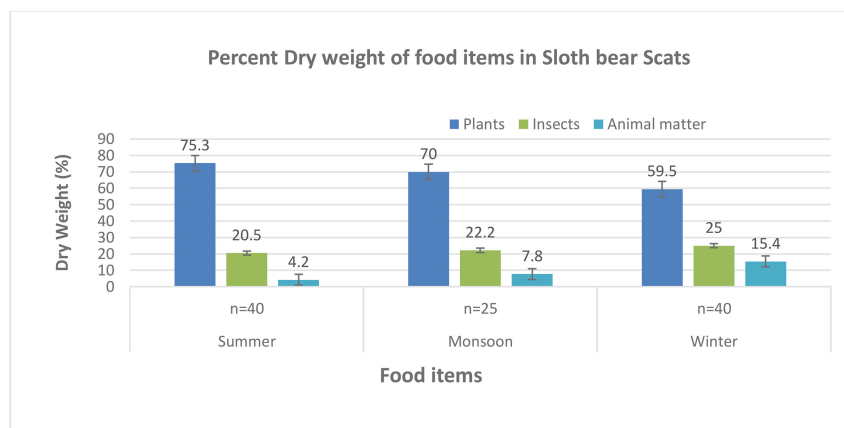


Fig. 6. Percent Dry weight (DW %) of food items in sloth bear scats.

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