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Utilization of food plant species and abundance of hanuman langurs (*Semnopithecus entellus*) in Pench Tiger Reserve, Madhya Pradesh, India

Utilization of food plant species and abundance of hanuman langurs (*Semnopithecus entellus*) were studied between January 2009 and August 2010 in Pench Tiger Reserve, Madhya Pradesh (78° 55' to 79° 35' E and 21° 8' to 22° N), India. This nature reserve is in the southern lower reaches of the Satpura Hill Range, on the southern border of Madhya Pradesh and covers an area of 758 km². According to Champion & Seth (1968) Pench Tiger Reserve is under both tropical dry and moist deciduous forest systems. Floristically, Pench is very rich and composed with 189 tree species, 138 shrubs, 452 herbs, 102 climbers, 10 epiphytes and parasites and 119 grasses and bamboos (Dungariyal, 2008). The year is broadly grouped into four major seasons: summer (March to June), monsoon (July to August), post monsoon (September to October) and winter (November to February). Temperature varies annually from 2 °C in winter to 49 °C in summer. The average rainfall is almost 1400 mm (Biswas & Sankar, 2002). Hanuman langur is listed as the least concern species in IUCN red list categories, CITES Appendix I and Schedule II in Wildlife Protection Act 1972 (India).

We studied the utilization of different food plant species by hanuman langurs opportunistically in the study area. Overall, different plant parts of 50 plant species (Table 1) were utilized by hanuman langurs during the study period.

Distance sampling by line transect method (Burnham *et al.*, 1980; Buckland *et al.*, 1993) was used to estimate approximate densities of hanuman langurs in the intensive study area (410 km²). We walked a total of 44 line transects in both summer and winter (total effort 752.8 km/season). Each transect was walked early in the morning (Schaller, 1967; Jhala *et al.*, 2008) and radial distance (using a laser range finder) and sighting angles (using a SUNTO compass) were recorded in each detection. DISTANCE version 5.0 was used to analyze the data. The results from line transects showed that densities of adult hanuman langurs were 73.8/km^2 (SE ± 6.4) during winter and 91.2/km^2 (SE ± 9.2) in summer (Table 2). Densities were multiplied by the study area (410 km^2) to obtain populations of hanuman langur in winter 30347 (SE ± 2637) and in summer 37532 (SE ± 3790). Average troop size was 7.1 in winter and 8.7 in summer.

On comparison with other studies of Indian sub-continent it is evident that Pench harbours a very high density of hanuman langur (Table 3). A combination of factors is responsible for their high abundance in Pench Tiger Reserve. First they were found to be less preferred by large carnivore species found in the study area as compared to their availability (Biswas & Sankar, 2002). Second, the study area is dominated by fairly open canopy, mixed forest with considerable shrub cover interspersed with small open grassy patches. The relationship (Newton, 1989) between troop of hanuman langur and axis deer (*Axis axis*) may be one of the major reasons in such type of habitat for their less predation as the axis deer population is also high in Pench Tiger Reserve (Biswas & Sankar, 2002). Although, the study area is mostly tropical dry deciduous forest (Champion & Seth, 1968), not all plant species loose their leaves at the same time. Many plant species are in their deciduous phase in some parts of the study area while others remain in leaf. The langurs debarked some selectively soft-bark species such as *Schleichera oleosa*, *Terminalia arjuna*, *Mitragyna parvifolia*, *Terminalia tomentosa*, *Lanea coromandelica*, *Boswellia serrata* and *Anogeissus latifolia*. We have opportunistically found that sometimes hanuman langurs sitting on ground were very fond of the dry seeds of the *Ougeinia dalbergioides* tree. We also found, strangely, that hanuman langurs utilized not whole plants, but some portion such as the leaf apex of *Butea monosperma*, mid vein of the leaf of *Terminalia*

tomentosa, fruit apex of *Madhuca longifolia*, and fruit apex of *Syzygium cumini* in summer. We observed langurs taking fresh bark of trees mostly during summer as 'famine food' to overcome food scarcity. Therefore, regular availabilities of resources in the study area and their hardy and highly adaptive nature (Raemakers, 1980; Marsh, 1981; Isbell, 1983; Bennett, 1986; Newton, 1992) may have enabled them to recruit though out the year in Pench.

Table 1: Overall utilization of food plant species by hanuman langurs (*Semnopithecus entellus*) in Pench Tiger Reserve, between January 2009 and August 2010 (for plant type, T=tree; C= climbers; G=grass; S=shrub and for season, S=summer; W=winter)

no	Plant Species	Family	Plant type	Season	Plant parts utilized
1	*Terminalia arjuna*	Combretaceae	T	S	Young leaves and bark
2	*Syzygium cumini*	Myrtaceae	T	S	Young leaves and young flower
3	*Bahunia vahlii*	Leguminosae	C	S	Young flower
4	*Diospyros melanoxylon*	Ebenaceae	T	S & W	Ripe fruit and young leaves
5	*Buchnania lanjan*	Anacardiaceae	T	S	Young leaves, ripe and un ripe fruit
6	*Ficus infectoria*	Moraceae	T	S & W	Young leaves
7	*Schleichera oleosa*	Sapindaceae	T	S & W	Young leaves, ripe fruit and bark
8	*Lanea coromandelica*	Anacardiaceae	T	S & W	Young leaves, ripe fruit and latex
9	*Ficus bengalensis*	Moraceae	T	S	Young leaves and ripe fruit
10	*Ougeinia dalbergioides*	Leguminosae	T	S	Young leaves, flower, latex and dry seed
11	*Lantana camara*	Verbenaceae	S	S & W	Young leaves and young flower
12	*Soymida febrifuga*	Meliaceae	T	S	Young leaves
13	*Albizzia procera*	Leguminosae	T	S	Bark
14	*Madhuca longifolia*	Sapotaceae	T	S & W	Flower, young leaves, apex of un ripe fruit and bark
15	*Butea monosperma*	Leguminosae	T	S & W	Flower and young leaves
16	*Mangefera indica*	Anacardiaceae	T	S	Young leaves, flower and ripe fruit
17	*Semecarpus anacardium*	Anacardiaceae	T	S	Ripe fruit
18	*Ficus glomerata*	Moraceae	T	S & W	Young leaves
19	*Lagerstroemia purviflora*	Lythraceae	T	S & W	Young leaves
20	*Acacia catechu*	Leguminosae	T	W	Young leaves
21	*Cynodon dactylon*	Poaceae	G	W	Node and inter node, young leaves
22	*Tamarindus indica*	Leguminosae	T	S	Young leaves
23	*Miliusa velutina*	Annonaceae	T	S	Fruit, young leaves
24	*Zizyphus mauritiana*	Rhamnaceae	T	S	Ripe fruit
25	*Dalbergia paniculata*	Leguminosae	T	S	Young leaves
26	*Mitragyna parvifolia*	Rubiaceae	T	S & W	Young leaves and bark
27	*Bombax ceiba*	Bombacaceae	T	S & W	Flower
28	*Ficus religiosa*	Moraceae	T	S	Young leaves
29	*Aegle marmelos*	Rutaceae	T	S	Ripe fruit
30	*Zizyphus xylopyra*	Rhmanaceae	T	W	Young leaves and ripe fruit
31	*Bauhinia racemosa*	Leguminosae	T	W	Young leaves
32	*Cleistanthus collinus*	Phyllanthaceae	T	S & W	Young leaves
33	*Terminalia tomentosa*	Combretaceae	T	S & W	Young leaves
34	*Cordia myxa*	Boraginaceae	T	S	Ripe fruit
35	*Stereospermum chelonoides*	Bignoniaceae	T	S	Young leaves
36	*Casia fistula*	Leguminosae	T	S & W	Flower and ripe fruit
37	*Gardenia latifolia*	Rubiaceae	T	S	Flower, fruit and mature leaves
38	*Ixora parviflora*	Rubiaceae	T	W	Young leaves
39	*Heteropogon contortus*	Poaceae	G	S & W	Node and inter node
40	*Anogeissus latifolia*	Combretaceae	T	S & W	Young leaves and bark
41	*Chloroxylon swietenia*	Rutaceae	T	W	Young leaves
42	*Pterocarpus marsupium*	Leguminosae	T	S & W	Young leaves
43	*Alangium lamarckii*	Alangiaceae	T	S	Bark
44	*Boswellia serrata*	Burseraceae	T	S & W	Young leaves
45	*Sterculia urens*	Sterculiaceae	T	S	Latex
46	*Adina cordifolia*	Rubiaceae	T	S & W	Young leaves and ripe fruit
47	*Datura metel*	Solanaceae	S	S	Young leaves

48	*Chloris virgata*	Poaceae	G	W	Node and inter node
49	*Hardwickia binnata*	Leguminosae	T	S & W	Young leaves and bark
50	*Emblica officinalis*	Euphorbiaceae	T	S & W	Young leaves, ripe and unripe fruit

Table 2: Seasonal variation of densities, populations and troop sizes of hanuman langurs (*Semnopithecus entellus*) in Pench Tiger Reserve, Madhya Pradesh (January 2009 and August 2010)

Seasons	Observations	D±SE	Population± SE	Troop size %				
				1-10	11-20	21-30	31-40	41-50
Winter	610	73.8±6.4	30347 ± 2637	78.2	18.6	3	0.2	0
Summer	795	91.2±9.2	37532 ± 3790	69.6	23.8	4.9	1.3	0.5

D: Individual density, SE: Standard Error

Table 3: Densities of hanuman langurs compared with different study areas in the Indian sub-continent.

Location	**Forest type**	**Density/km²**
Bandipur[1]	Tropical dry deciduous	7.5
Pench[2]	Tropical dry and moist deciduous	77.2
Bhadra[3]	Tropical moist deciduous	22.6
Ranthambore[4]	Tropical thorn and dry deciduous	21.7
Bori-Satpura[5]	Tropical dry and moist deciduous	28.3
Mudumalai[6]	Tropical dry thorn, moist, dry deciduous and semi evergreen	25.9
Present study*	Tropical dry and moist deciduous	**82.5**

[1] – Johnsingh, 1983; [2] – Biswas and Sankar 2002; [3] – Jathanna, 2001; [4] – Bagchi *et al.*, 2003 ; [5] – Edgaonkar, 2008; [6] Ramesh *et al.*, 2009; * - Present study (Over all density).

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