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Food and Feeding of Hanuman langurs (Semnopithecus entellus) living in and around Sariska Tiger Reserve, Alwar, Rajasthan, India.

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ABSTRACT:

Hanuman langurs (Semnopithecus entellus) inhabiting the Sariska Tiger Reserve primarily follow a florivorous diet, meaning they consume a large portion of their food from leaves. However, their diet is more diverse than just leaves and includes: Leaves: They prefer young, tender leaves with high nutritional value. Their specialized digestive system allows them to efficiently process these fibrous materials. Fruits: A variety of fruits are consumed depending on season and availability. These provide essential sugars and vitamins. Flowers: Flowers are another source of nutrients, particularly during times of limited fruit availability. Seeds: Though not a major component, langurs may consume seeds found in fruits or flowers. Others: Studies suggest they may occasionally consume insects or bird eggs, but this is not a regular part of their diet. Factors Affecting Food Choice in Sariska: Seasonality: The availability of different food sources fluctuates throughout the year. During dry seasons, langurs may be forced to consume more leaves and bark due to limited access to fruits and flowers. Habitat type: The specific plant communities within their home range influence their diet. For example, areas with a higher density of fruit-bearing trees will likely see langurs consume more fruits. Nutritional requirements: Pregnant and lactating females, as well as juveniles, may have specific dietary needs that influence their food choices. Research conducted in Sariska has explored the langur's food preferences within the reserve. The study suggests that: Langurs exhibit a selective feeding behaviour, choosing specific plant species based on nutrient content and digestibility. The availability of food sources influences their home range size. During periods of scarcity, they may need to travel further to find sufficient food. Conservation and Food Availability: Human activities like deforestation and habitat fragmentation can disrupt the natural food sources for langurs. This can lead to increased conflict with farmers as

langurs may be forced to raid crops for sustenance. Conservation efforts that focus on protecting and restoring langur habitat are crucial for ensuring their long-term survival and minimizing conflict with human settlements.

Keywords: Hanuman langurs (Semnopithecus entellus), Sariska Tiger Reserve, Primates, Food, Feeding, Nutrition

Introduction

Survival and reproduction of individuals depend on their ability to locate and harvest sufficient food to meet their nutritional needs. Timings and selection of food plants are synchronized to meet the requirements of proteins, carbohydrates, fats, vitamins, water, minerals, trace elements, etc. All primates have the same general need to acquire energy. The specific patterns of resource utilization may however vary according to species, age-sex classes, social group, population and habitat. All primate species interact with a variety of food distributed in their home range and is within their reach. In general, the primate feeding behaviour is extremely complex. The complexity is further increased by the surroundings in which feeding takes place, like the one in which predators must be avoided, competitors and weather coped with, social relationships maintained and reproduction pursued (Oates, 1986). Primates are therefore faced with frequent decisions between conflicting pressures on their allocation of time (Krebs, 1978). Since food is such a crucial resource, the actions needed to find it and gather it becomes the major determinants of patterns of primate activity in space and time.

Colobine monkeys are characterised by a specailised digestive system that enables them to break down plant cell walls and presumably also to detoxify otherwise indigestible, even lethal compounds present in plant foods (Bauchop and Martucci 1968; Parra, 1978). In this context Hanuman langurs are specialised. They can eat the fruit (including seeds) of *Strychnos nox-vomica*, the plant from which the poison strychnine is made (Roonwal and Mohnot, 1977). It can also eat without ill effects such repulsive and evil smelling latex bearing plants which are avoided by most animals and even insects – *Calotropis procera* in the Indian desert (Mohnot, 1974). Their complex gut anatomy aided by the presence of symbiotic *Celluloytic microflora* in the forstomach may enable

Colobines to harvest plant feeds (Davies et al. 1988). Chivers and Hladik (1980) had demonstrated the occurrence of forstomach of Colobines capable of generating volatile fatty acid in quantities comparable to small domestic ruminents (Bauchop, 1978).

Food selection by both Old and New World primates have been considered an optimizing process, balancing nutrient intake with level of toxins and digestion inhibitor such as fiber (Milton 1980; Freeland and Janzen, 1974). Most dietary studies of Colobine monkeys have involved species that live in small one-male group, occupy small defended home ranges and feed largely on leaves (e.g. black and white Colobus, Oates, 1977). Exceptions like seed eating in *Presbytis rubicunda* and *Colobus satanus* is correlated with large home range and long day range. Thus it is expected that *Presbytis entellus* at Sariska Tiger Reserve living in one-male groups, would be both territorial and folivorous. Food resource of langurs at SARISKA TIGER RESERVE was highly seasonal in their availability and leaves were the major portions of diet. Although leaves were the major dietary item, *P. entellus* showed seasonal preference for other food and plant items as they become available (Mohnot, 1971b, 1974; Roonwal and Mohnot, 1977; Srivastava, 1989, Chhangani, 2000, 2004). Rowell and Richards (1979), for instance, suggested that seasonal availability of food influences the timings of reproduction in patas monkeys. Observations at SARISKA TIGER RESERVE suggest some kind of relationship between food plants consumed and animals reproduction, birth seasonality and milk production.

Material and Methods

Study site: Sariska Tiger Reserve is a tiger reserve in Alwar district, Rajasthan, India. It stretches over an area of 881 km2 (340 sq mi) comprising scrub-thorn arid forests, dry deciduous forests, grasslands, and rocky hills. This area was a hunting preserve of the Alwar state and was declared a wildlife sanctuary in 1958. It was given the status of a tiger reserve making it a part of India's Project Tiger in 1978. The wildlife sanctuary was declared as tiger reserve and national park in 1982, with a total area of about 273.8 km2 (105.7 sq mi). Altitude varies from 900 to 3200 feet metric system above a level. Sariska is characterized by distinct winter, summer and monsoon. During summer,

temperature fluctuates between 30 – 35oC, and reach may 48oC during May and June. Mean winter temperature is 5oC, and may go down to 2oC during December – January. The average annual rainfall is about 825 mm; minimum 423 mm and maximum 950 mm. This wide range of climatic conditions along with the great altitudinal variations provides different micro- habitats. There fore, this sanctuary encompasses different vegetation types such as deciduous, dry-deciduous, dry-savannah-forest, euphorbia scrub and dry grasslands.

The forest is dominated by 'gorya dhawa' (Anogeissus latifolia), dhawa (A. pendula), salar (Boswellia serrata), gol (Lannea coromandelica), kherni (Wrightia tinctoria), kumbat (Acacia senegal), khair (A. catechu), ber (Zizyphus mauritiana), dhonk (Butea monosperma), etc. The undergrowth mainly consists of jharber (Z. nummerlaria), ardnsa (Adhatada vasica), gangan (Grewia tenex), franger (G. flavescens), kanter (Capparis separaia), lantana (Lantana indicus), etc. Some climbers and grasses are also found.

The main fauna of Sariska includes Tigers (Panthera tigris), leopard (Panthera pardus), hyaena (Hyaena hyaena), Indian Wolf (Canis lupus), Jackal (Canis aureus), Sloth bear (Melwisus ursinus), Hanuman langur (Semnopithecus entellus), Rhesus Macaque (Macaca mulatta), Porcupine (Hystix indica), Fourhorned antelope (Tetracerus quadricornis), Chinkara (Gazella g. bennetti), Porcupine (Hystrix indica indica), Samber (Cervus unicolor), Spotted dear (Axis axis), (Bluebull (Boselaphus tragocamelus), Toddy cat (Paradoxurus hermaphroditus), Jungle cat (Felis chaus), Fox (Vulpes bengalensis), Crocodile (Crocodylus palustris) and Rock python (Python molurus).

Methods: Data was collected as and when encountered during travelling and regular field visits recorded from December 2016 to December 2018 in and around Sariska National Park. A well-planned questionnaire was prepared for generating information on type of crops, crop raid behaviour, seasonality food preference, crop protection strategies, economic loss estimation and such other issues concerning livelihood and wildlife conservation. Besides this scane sampling and ad-libitum sampling methods (Altamann, 1974) were also used to collect additional information by direct observations. For

population estimation of wild animals' census data of state forest department were used. Photography and videography were also done to confirm the presence of vertebrate pests in the study area. During this sample interval scan sample of five minutes for all animals was attempted. If any animal was eating, the record of plant species and plant part eaten was noted. Observation schedules for all the troops were evenly distributed over the study period so as to achieve statistical compatibility of data.

Chivers (1974) and Hledik (1977) have used estimate of feeding rates and food weight to quantify diet more precisely. Since food weight for different types of plant vary, but in a long-term study with large amount of data hours proportions of time is considered acceptable. The measure being used for diet is therefore feeding effort rather than food intake. This treatment is consistent with nearly all other studies of Colobine behavioural ecology (Curtin, 1975; Struhsaker, 1975; Hladik, 1977; Oates, 1977; Davies, 1984; Gurmaya, 1986; Srivastava, 1989; Stanford, 1991 Newton, 1992; Bennett and Davies, 1994 and Koenig et al. 1998).

Food from tourist near roadside

Feeding in the Forest

Feeding in the Colonies

Results and Discussion:

Results: On an average langurs of SARISKA TIGER RESERVE spent 34.6% of their daily activity time on feeding. The daily activity period for Hanuman langurs ranged from more than 14 hours in the longer daylight period of Summer (May – June) to 11 hours during shorter day light period of winter (December – January). The time spent on feeding activity differ for all the three focal troops. On the basis of data gathered at Sariska Tiger Reserve the Hanuman langurs may be regarded as wholly vegetarian. Langurs eat about 184 types of foot items, which includes natural and cultivated plant parts and artificial food provided by the people. Natural food includes leaves, flowers, fruits, seeds, gum, bark and arial roots. Cultivated food in the form of fruits, seeds, grains, vegetables, flowers, and parts of garden bushes are commonly eaten. They receive variety of artificial food from the people in the form of raw, cooked, fried and roasted stuffs. Besides this langurs were observed eating sand, chewing bee-wax and licking plant latex and rocks. Common food plants consumed by langur troops during study period is given in Table 1 and 2.

Food and Feeding by Langurs

In nature, langur consumed a variety of plant parts which include young and mature leaves, flower buds and flowers, unripe and ripe fruits, bark, gum, arial roots, etc. 98 common food plants consumed by langur troops gven in the table 1. Langurs also eats 13 crops, flowers and fruits grown in crop fields, gardens and orchards (Table 2).

Out of these 47 provisioned food items, offered in different seasons, 18 food items were given raw, 16 in cooked form (roasted or fried) and 13 were mixed. However, some 20 items were available round the year and the rest in different seasons (Table 2).

Food and feeding

Forest troop fully dependent on natural food. Some 98 food plants were consumed by langurs given in Table 1. Out of 98 natural plant species, 9 of them were eaten round the year in the form of young and mature leaves, flower buds, flowers, unripe and ripe fruits, gum, arial roots, seeds, bark and stem. The most frequently eaten species are: Acacia senegal, Azadirachta indica, Anogeissus pendula, Anogeissus latifolia, Bauhinia

racemosa, Ficus benghalensis, Ziziphus nummularia, Terminalia arjuna and Ziziphus mauritiana. Plant parts of these species are consumed in all months followed by 3 species, Prosopis juliflora, Tamarindus indica and Annona squamosa eaten for 11 months in a year. Seven plant species, which were observed, eaten for 10 months in a year are Acacia leucofoloea, Boswellia serrata, Ficus racemosa and Dichrostachys cinerea.

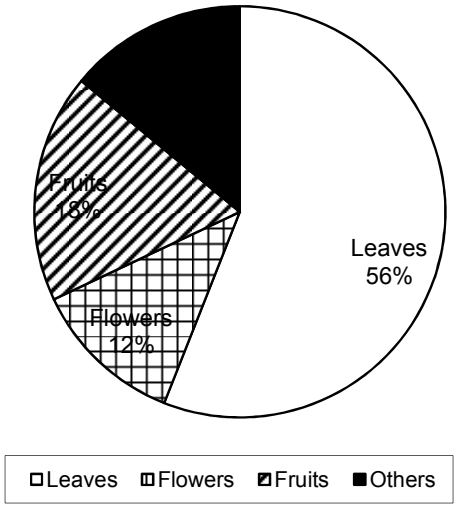

Figure1: Annual percent feeding time of langurs on natural leaves, fruits, flowers and other stuffs.

Drinking period lasts about 45-80 minutes for the whole troop in a day. Infants below 5 months of age were never observed to drink water. At a time only 2 – 4 animals were observed drinking. The number of animals who drink water at one time depend on location of water hole and availability of predators around. When some animals drink, others wait and watch around as was common. On the contrary, troop near farm land and human habitation as many as 5 to 10 animals were observed drinking at one time. Here, predator pressure and interaction with other animals is bare minimum. Water is taken by applying tongue on water surface and is sucked with the help of tongue and lips. During the process of drinking the weight of langurs' body fall on the forelimbs, and the abdomen

almost touches the ground. Sometimes they used to take water from tree trunk of *Ficus benghalensis, F. racemosa* and *Tamarindus indica*. During rainy season tree truck holes are filled with rainwater.

Discussion

The time spent in feeding differed in all the langur troops as per the habitat, forest troops devoted more time in feeding compared to troop near farm land and human habitation. The reason for this variation for directly related to kind of food available to langurs. the feeding variation is although related to the availability of food, which is composed of young leaves, flowers, and fruits which were less in winter and these troops had to spend more time feeding these stuffs to get a balance diet. Because troops in the forest did not get artificial food compared to troop near farm land and human habitation which gets plenty of artificial food in winter months. Because of this it restrict troop movement in a limited area.

The diurnal feeding activity of three focal troops showed a clear biomodal peak. Langurs spending more time on feeding during morning and evening hours. But, they may continue feeding even after the last scan (18.30 hrs) when it becomes almost dark. This might compensate the energy required during the night hours when they have to stay without food for long hours till next morning. The similar trend was found in other studies of *Presbytis entellus* by Mohnot (1974), Roonwal and Mohnot, (1977), Srivastava (1989), Sahoo (1993) and Chalisa, (1995). A similar situation exists in other species like Presbytis *melalophos, Presbytis pileatus, Presbytis geei* and *Presbytis johnii.* (Curtin, 1980; Marsh, 1981; Stanford, 1991; Wag Chuk, 1995; Sunderraj, 1998).

Hanuman langurs exploit over 140 types of natural, cultivated and artificial food at Sariska Tiger Reserve. Of them consumed 73 natural and 43 cultivated plants and 45 artificial food items besides 5 other items like salt, sugar, charcoal, etc. Number of food plants eaten in other field studies in this species are as follows: 92 plant species and 17 artificial food items by Mohnot (1974) at Jodhpur; 41 plant species by Rahman (1974) at Gir Forest, Gujarat; 30 species by Krishnan (1972) in peninsular India; 68 plant species by Oppenheimer (1977) at Singur; and 87 natural, 35 cultivated and 35 provisioned items by Srivastava (1989) at Jodhpur.

Based on their food eating habits primates may be labeled as frugivorous, folivorous, insectivorous and so on. However, there is not only a great deal of interspecific variation but amongst the highly adaptable species like Hanuman langurs considerable intraspecific variation exists from habitat to habitat and even within the same area they inhabit (Srivastava, 1989). Langurs at Sariska Tiger Reserve had 56% of leaves in their diet and therefore can be classified as folivorous like other Colobines. The overall annual feeding of forest troop, accounted for 56% of young and mature leaves, 18% unripe and ripe fruits, 12% of flower buds and flowers and remaining 14% comprising of seeds, gum, stem, bark, arial roots, etc. in addition to licking of rocks and latex, chewing of bees hieves and eating sand. Likewise, 71.9 – 83.7% leaves, 7.9 – 12.5% fruits and 7.9 – 6.8% flowers were found in the diet of Grey langurs *Presbytis senex* at Polonnaurwa in Sri Lanka by Ripley (1970) and Hladik and Hladik (1972). *Presbytis entellus* diet in Nepal is comprised of 45% leaves and 47% fruits and seeds (Curtin, 1975). Langurs at Jodhpur eat 66% leaves, 23% fruits, 7% flowers and 4% other foodstuffs observed by Srivastava (1989). In Kanha tiger reserve, Central India, Newton (1992) found that langurs consume 34.9% mature leaves, 24.4% fruits, 10.6% leaf buds, 9.5% flowers and flower buds, 3.6% young leaves, 3.0%, insects and 1% gum in their diet. Bennett and Davies (1994) found 39% leaves, 24% fruits, 11% buds, 9.5% flowers and 16% other food parts in the diet of *Presbytis entellus*. In Ramnagar, Nepal, Podzuweit (1994) found 64% leaves, 15% fruits, 6.3% flowers and 4.9% other foodstuffs in the diet of *P. entellus*.

The langurs at Sariska Tiger Reserve were observed devoting 81% of their total feeding time on 12 plant species. This low dietetic diversity was also found in other studies. At Polonnaruwa, Sri Lanka Hladik (1975) found 70% of total food intake distributed in 10 plant species consumed by *P. entellus*. Further, Hladik (1979) compared *Presbytis entellus* diet with *P. senex* and found that the top three food plant species constitute 70% of their total diet.

Langurs at Jodhpur were found devoting 79% of their total feeding time on six natural food plants observed by Srivastava (1989). At Ramnagar, Nepal langurs spent 73.2% of total feeding time on 12 plant species observed by Koening et al. (1998). At Kanha national park in Central India, langurs spent 57.4% feeding time on 6 plant species

recorded by Newton (1992). The gray langurs and red colobus spent 70% of their feeding time on 9 species worked out by Clutton – Brock (1975). The low dietetic diversity was also found by Struhsaker (1975) in red colobus monkeys. In Japanese monkeys, 86.7% of their feeding was devoted to 10 plant species (Maruhashi, 1980). In rhesus macaques of northern India diet contains 36% fruits and seeds, 9% flowers, 34% leaves and rest gum, buds, grass, clover, roots, bark and animal prey (Makwana, 1979b).

In addition to natural feeding, artificial feeding was also common at Ranakpur temple premises. Troop B-5 members consumed cooked food regularly since the community kitchen of temple lie within troop's home range where 500 to 2000 people eat every day round the year. The left out food and extra cooked food is thrown from the kitchen in the backyard where from langurs pick and eat plenty of cooked food. The foodstuff is comprised of *puri*, rice and vegetables. Two meals a day is the common feature in Ranakpur temple served to visitors in the morning around 11.00 to 13.00 hours and in the evening between 16.30 to 18.30 pm. Interestingly the artificial feeding at Sariska Tiger Reserve is quite different from Jodhpur where people from city carry a variety of raw, cooked and fried food stuffs in the bags and feed langurs every day. At Sariska Tiger Reserve , however, such regular feeding on variety of foodstuffs was not observed except for the left out cooked food. Langurs may also get biscuits, fruits, bread and other food stuffs from tourists or by casual travelers when their bus stops at Ranakpur temples. Provisioning or artificial feeding was reported in several studies conducted on Hanuman langurs like, Mohnot (1971b, 1974) at Jodhpur; Hrdy (1977) at Mt. Abu; Roonwal and Mohnot (1977) from Jodhpur and other habitats; Winkler (1981) from Jodhpur and Srivastava (1989) again from Jodhpur.

Drinking behaviour

Drinking often takes place after an active bout of feeding. It is difficult to know how much water langurs drink daily. But, on the basis of time they devote to drinking (30 seconds to 4 minutes) it seems in summer they consume more water then in monsoon or winter. Drinking is higher in the langur troop receiving artificial food from people. Artificial food, which is fried and oily need more water. In summer, water requirements

increases because of extensive travel undertaken by langurs in search of food, which is scarce. For example, limited flowers and fruits are available in some pockets in their range in summer months. The need of water is a question of both physiology and food supply (Jolly, 1985). On an average, drinking was observed once every 6.9 hours (Srivastava, 1989) at Jodhpur. In most places langurs have been recorded drinking water regularly. But, at Dharwar langurs live without water for 4 to 5 months (Sugiyama, 1964). Similar conditions have been observed in Sri Lanka by Ripley (1970). At Jodhpur they were observed going without drinking for 12 days (Mohnot, 1974) and more then 60 days during drought of 1988 (Srivastava, 1989). In the present study at Sariska Tiger Reserve langurs lived without water for 12 weeks in 1996 because of low rains in the months of August and September Langurs were observed drinking water in small subgroups of 3 – 15 animals while others keep watch. This strategy helps langurs to avoid attacks of predators. This also helps develop skill among upcoming young members of the troop. Drinking phase of langurs is perhaps the best time for predators to attack langurs at water holes since predators can hide easily in the vegetation around.

Food and Water Contamination by the Pesticides

Another potential threat which has been quite neglected by the wildlife researchers till date is pesticide contamination through the consumption of the pesticide contaminated food and water by vertebrate pests. Usually around the wildlife habitats there are crop fields which are the perfect sites for the application of the fertilizers and pesticides. This aspect needs to be highlighted here is the pesticide contamination of the environment leading to the decline in the population of the animals especially by organochlorine pesticides (OCPs). Since many animals live in water and on shores and thrive on fishes and other aquatic animals therefore, they get exposed to OCPs because of bioconcentration and biomagnification of these xenobiotics. Here an example of bald eagle from USA needs to be considered. The bald eagle is the North American species with a historic range from Alaska and Canada to northern Mexico, is the national bird of the USA which has been an endangered species for many years. The reasons being the Habitat destruction and degradation, illegal shooting, and the contamination of its food source, because of DDT contamination, there is a decline in the eagle population, The banning of DDT by the Federal government of USA and related pesticides, habitat protection done by the Endangered Species

Act, and conservation actions taken by the general American public have helped bald eagles to survive. Nevertheless DDT and its residues contaminated nearby water areas, where aquatic plants and fish absorbed it and biomagnified it . Bald eagles, in turn, were poisoned with DDT as and when they consumed the contaminated fish. As a consequence, their eggs had shells so thin that they usually broke during incubation or otherwise failed to hatch at all. DDT contamination and its residues also affected other species such as peregrine falcons and brown pelicans. Many Other pesticides having the same structure as DDT are suspected to have caused increased death, in addition to the harmful effects on reproduction. By 1963, with only 417 nesting pairs of bald eagles existing, the species was facing the danger of extinction. At the time, a controversial step of banning the use of DDT and some related pesticides in the United States was taken by the federal government of the USA. That was in 1972, and it was the first step on the road to recovery for the bald eagle (U.S. Fish & Wildlife Service Migratory Bird Program, February 2021). This shows how dangerous DDT contamination is how disastrous it can be for the avian fauna. More scary studies have indicated that we have largely over looked the darker side of these chemicals as OCPs are reported to be carcinogenic (Mathur et al, 2002 & Ingber et al 2013) mutagenic (Ingber et al 2013&Yaduvanshi et al 2012) teratogenic (Yaduvanshi et al 2012 & ATSDR. Atlanta, GA.1994) immunosuppressive (Repetto. R & Baliga. S.S, 1997 & Corsinia et al, 2003) create endocrine dysfunction such as hypothyroidism or high estrogenic activity (Dewailly et al, 2000 & Rathore et al, 2002) disturb reproductive processes (Pant et al ,2007 & Tiemann.U. 2008) growth depressants (Colborn et al, 1993 & Mercier. M, 1981) induces several psychogenic and neurogenic abnormalities in adult stages (Mactutus & Tilson, 1986 & Van Wendel de Jood et al,2001) and are associated with abortions, premature deliveries, still births and infants with low birth weights (Saxena et al, 1981; Saxena et al, 1980; Tyagi et al 2015; Chen. Q et al 2014 & Sharma & Bhatnagar, 1996). OCPs have been in use in India nearly for a half century now. Even after having clear cut evidence suggesting that these chemicals have the ability to eliminate entire species from the planet, the annual consumption of pesticides in India is about 85,000 tons of which OCPs comprise the bulk (India Environment Portal Knowledge for change, 30/10/1998.). Therefore, today OCPs are perhaps the most ubiquitous of the potentially harmful chemicals encountered in the environment and are still widely detected in humans despite the considerable decline in environmental concentrations (Dewan et al. 2003). This kind of environmental Contamination with organochlorine pesticides (OCPs) has also been reported by Sharma and her coworkers in 1996, from Jaipur City. She reported contamination of human samples like mothers' blood, cord blood, placenta and mothers' milk with OCPs. Presence of pesticides with OCPs

shows that how these xenobiotics have contaminated our Mother Nature and now faunal diversity is facing danger of existence and Smooth-coated Otters is not staying away from this potential danger. It can be concluded that the magnitude of pollution is quantitatively enough to contaminate the food and environment and reaching out to all faunal diversity. It can be concluded that the magnitude of pollution is quantitatively enough to contaminate the food and environment and the pesticides reach the human body through various sources mainly by absorption form the gastrointestinal tract through contaminated food chain, are circulated in blood, stored milk and secreted during lactation resulting in sufficient neonatal intake. The battle against the harmful insects would be much less costly and more efficient, and the problem of contamination of the environment by toxic materials would be vastly reduced, if insect activities are controlled by natural means. The use of pest-specific predators; parasites or pathogens; sterilization of insects with the help of radiations; trapping insects using insect attractants like pheromones; use of juvenile hormones or hormone inhibitors may therefore be suggested as alternate ways of pest control (Sharma, 1996; Sharma & Bhatnagar, 1996 & 2017, Sharma, 2018).

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Table 1: List of various Food Plants consumed by Hanuman Langurs at Sariska Tiger Reserve

Local Name	Botanical Name
1. Kher	Acacia catechu
2. Aranjia	Acacia leucophloea
3. Babool	Acacia nilotica
4. Kumbhat	Acacia senegal
5. Adusa	Adhatoda zeylanica
6. Beel	Aegle marmelos
7. Arru	Ailanthus excelsa
8. Sarais	Albizia lebbeck
9. Safad-saras	Albizia procera
10. Sitaphal	Annona squamosa
11. Safed Dhaw	Anogeissus latifolia
12. Dhawra	Anogeissus pendula
13. Neem	Azadirachta indica
14. Jhinjha	Bauhinia racemosa
15. Samel	Bombex ceiba
16. Salar	Boswellia serrata
17. Palas	Butea monosperma
18. Aak	Calotropis procera
19. Ker	Capparis decidua
20. Pachunda	Capparis grandis
21. Jal	Capparis sepiaria

22. Anwal	Cassia auriculata
23. Amal tash	Cassia fistula
24. Gugal	Commiphora wightii
25. Gunda	Cordia dichotoma
26. Gundi	Cordia gharaf
27. Kolai	Dichrostachys cinerea
28. Timru	Diospyros melanoxylon
29. Tamboli	Ehretia laevis
30. Thor	Ephorbia caducifolia
31. Bargad	Ficus benghalensis
32. Gular	Ficus racemosa
33. Pepal	Ficus religiosa
34. Kankairo	Flacourtia indica
35. Gangan	Grewia damine
36. Farangnee	Grewia flavescens
37. Gangeran	Grewia tenax
38. Haldu	Haldina cordifolia
39. Maror phali	Helicteres isora
40. Inderajo	Holarrhena pubescens
41. Churit	Holoptelea integrifolia
42. Makki	Kirganelia reticulata
43. Godal	Lannea coromandelica
44. Latina	Lantana camara

45. Sinduria	Mallotus philippensis
46. Aam	Mangifera indica
47. Umbia	Miliusa tomentosa
48. Kadam	Mitragyna parvifolia
49. Harsingar	Nyctanthes arbor-tristis
50. Karanj	Pongamia pinnata
51. Vilayti Babul	Prosopis juliflora
52. Hingwal	Spermadictyon suaveolens
53. Kadaya	Sterculia urens
54. Jamun	Syzygium cumini
55. Imli	Tamarindus indica
56. Arjun	Terminalia arjuna
57. Nirgundi	Vitex negundo
58. Ban-Mahendi	Woodfordia fruticosa
59. Khirni	Wrightia tinctoria
60. Ber	Ziziphus mauritiana
61. Jhar Ber	Ziziphus nummularia
62. Datura	Datura officinasumj
63. Gokhru	Pedalicum murex
64. Gokhru	Echinops echinatus
65. Kankaro	Momordica dioica
66. Bisoni	Tephrosia purpurea
67. Biyani	Tephrosia wallichii

68. Jinjanio	Memosa hamata
69. Rajgira	Amaranthus spinosus
70. Bajradanti	Barleria acanthoides
71. Satha	Boerhavia diffusa
72. Hedula	Ceropegia bulbura
73. Chilario	Chenopodium album
74. Safed akra	Cleome gyanandra
75. Pilwan	Cocculus pendulus
76. Buchna	Commelina benghalensis
77. Motio	Cymbopogon martinii
78. Khanjru	Digera muricata
79. Kali-bui	Helotropis europaeum
80. Kankro	Maytenus emarginatus
81. Liguru	Polygonum plebeium
82. Lunkha	Partulaca oleracea
83. Chirimotia	Rhynchoria minima
84. Makoi	Solanum nigrum
85. Safeda	Eucalyptus camaldulensis
86. Banda	Dendrophthoe falcata
87. Baboo	Acacia nilotica
88. Aak	Calotropis procera
89. Gunda	Cordia dichotoma
90. Adusa	Adhatoda zeylanica
91. Datura	Datura innoxia

92.	Gundi	Cordia gharaf
93.	Rajgira	Amaranthus spinosus
94.	Safeda	Eucalyptus camaldulensis
95.	Anwal	Cassia auriculata
96.	Gugal	Commiphora wightii
97.	Ker	Capparis decidua
98.	Thor	Euphorbia caducifolia

Crops

1.	Ganwar	Cyamopsis tetragonaloba
2.	Genhu	Triticum eastivum
3.	Chana	Cicer arietinum
4.	Moong	Phaselus radiatus
5.	Rizka	Medicago sativa
6.	Makka	Zea mays
7.	Moth	Vigna aconitifolia
8.	Ganna	Saccharum officinarum
9.	Momphali	Arachis hypogaea
10.	Sarson	Brassica campestries
11.	Jawar	Sorghum bicolor
12.	Til	Brassica juncea
13.	Kapas	Gossypium herbaceum

Table 2: **Artificial Food Consumed by Langurs during tudy period at Sariska Tiger Reserve**

1. Puri / Chapati	Cooked
2. Chana	Cooked
3. Momphali*	Raw / Cooked
4. Bread	Cooked
5. Biscuits	Cooked
6. Makhana	Cooked
7. Kachori	Cooked
8. Potato Chips	Cooked
9. Naryal	Raw
10. Alu	Raw / Cooked
11. Mirchi*	Raw / Cooked
12. Chawal	Cooked
13. Chana Dal	Cooked
14. Rajma	Cooked
15. Papar	Cooked
16. Namak	Raw
17. Laddu	Cooked
18. Jalaibi	Cooked
19. Petha	Cooked
20. Mathari	Cooked
21. Bhujiya	Cooked
22. Gulab	Raw
23. Kakari*	Raw
24. Matar	Raw / Cooked
25. Kaila*	Raw
26. Amrood*	Raw
27. Sita Phal*	Raw
28. Shakarkand*	Raw / Cooked
29. Mooli*	Raw / Cooked
30. Gajar*	Raw / Cooked
31. Makki*	Raw / Cooked
32. Khajoor	Raw
33. Santra	Raw

34. Toru	Raw / Cooked
35. Gawar phali*	Raw / Cooked
36. Kamal	Raw
37. Hajara*	Raw
38. Gulab*	Raw
39. Aam	Raw
40. Anar*	Raw
41. Angoor	Raw
42. Chiku	Raw
43. Tinda	Raw / Cooked
44. Gobi*	Raw / Cooked
45. Bore*	Raw
46. Baingan	Raw / Cooked
47. Ganna*	Raw