

Ecological Studies on Food and Feeding Habits and Daily Feeding Time Schedule of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1758) in Saraswati Plantation Wildlife Sanctuary, Haryana (India)

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Abstract: Rhesus monkey (*Macaca mulatta*) is an old world monkey belongs to Family- Cercopithecidae. Rhesus monkey has a major role in biodiversity and in medical biological study such as surrogate mother, immunodeficiency disease, captive breeding, blood grouping and sequence of genome etc. (Zahn et al. 2007). The present study was carried out from February, 2008 to July, 2008 to record different food habits as well as daily feeding time schedule of Rhesus monkey in Saraswati Plantation Wildlife Sanctuary (SPWS), Haryana (India). Selected three troops (T-I, T-II, T-III) of Rhesus monkey in Saraswati Plantation Wildlife Sanctuary was found to fed on 13 species of trees (*Acacia nilotica*, *Albizia lebbek*, *Butea monosperma*, *Delbergia sissoo*, *Eucalyptus sp.*, *Ficus religiosa*, *Morus alba*, *Prosopis juliflora*, *Cordea dichroma*, *Ficus religiosa*, *Syzigium cuminis*, *Ziziphus mauritiana*, *Terminalia arjuna*), 2 species of shrubs (*Ziziphus nummularia*, *Capparis sepiaria*) and 7 species of herbs (*Brassica campestris*, *Oryza sativa*, *Triticum aestivum*, *Saccharum officinarum*, *Trifolium alexanderium*, *Chenopodium album*, *Cynodon dactylon*). In all, 72 sighting of feeding was observed in which troop I fed for minimum time 2.25 hrs (in February, 2008) to maximum time 4.41 hrs (in July, 2008), troop II fed for minimum time 2.28 hrs (in February, 2008) to maximum time of 4.37 hrs (in June, 2008) and troop III was observed to fed for minimum time 2.13 hrs (in February, 2008) to maximum time 4.44 hrs (in July, 2008).

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1. Introduction

Among mammals Primates, are the most complex- creatures, which appeared on the planet earth around 63 million years ago in Eocene period of Coenozoic era (Moody, 1962). Rhesus monkey, *Macaca mulatta* is an old world monkey and belongs to Order- Primates, Family- Cercopithecidae, Genus- *macaca* and Species- *mulatta* (Wilson, 2007). Rhesus monkey is distributed ubiquitously throughout mainland Asia, from Afghanistan to India and Thailand to Southern China, Bangladesh, Bhutan, Nepal and Pakistan (Ferris et al. 1980; Rowe, 1996; Groves, 2001; Smith and Mc Donough, 2005). In India, it is found in good number in peninsular region (Assam, Madhya Pradesh and West Bengal), north region (Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Rajasthan, Gujrat) and central region (Orissa, Bihar) of country (Seth et al. 2001). In Haryana, rhesus monkey is found in different habitats including villages, road side forest, towns, temples and near agricultural fields (Hunger, 2004). Rhesus macaques characterized by dusty brown in color with little to no fur on their reddish-pink faces. Male and female are

sexually dimorphic. Male have more red color on rump than female resemble with their faces. Average body length for female 207.6 mm and for male 227.9 mm. Average weight for male is 7.70 kg and for female is 5.34 Kg (Fooden, 2000; Singh and Sinha, 2004).

2. Materials and Methods

2.1 Study area

To study food and feeding habits of *Macaca mullatta*, Saraswati Plantation Wildlife Sanctuary (76° 27' -76° 33' E latitude and 29° 56'- 30° 01' N longitude) was selected as study site. Saraswati Plantation Wildlife Sanctuary is located in two districts (Kurukshetra and Kaithal) of Haryana (India). It is covering an area of 11,003 acres. The climate of area is subtropical, semi arid type and contain alkali soil. Annual rain fall in the area is 516 mm and average temperature is 32.4° C (Dagar et al. 2001). The vegetation of the Saraswati Plantation Wildlife Sanctuary is categorized as "Sub-group 5B tropical deciduous forest" (Champion and Seth, 1968). The dominant fauna of the Saraswati Plantation Wildlife Sanctuary

includes avian species (*Anas poecilorghyncha*, *Arcidotheres tristis*, *Bubulcus ibis*, *Centrophus sinsnsis*, *Culumbia livia*, *corvus splendens*, *Dinopium savanense*, *Egretta garzetta*, *Himantopus himantopus*, *Meropus orietalis*, *Passser domesticus*, *Pristuculla krameri*, *Phalacrocorax niger*, *Pycnonotus cafer*, *Primia gracilis*, *Streptopelia senegalensis*, *Sturnus contra*, *Turdoides caudatus*, *Upipa epopus*), mammalian species (*Boselaphus tragocamelus*, *Sus scrofa*, *Felis sp.*, *Macaca mulatta*, *Funambulus pennanti*) and dominant flora of the area includes *Acacia nilotica*, *Albizza lebbek*, *Butea monosperma*, *Eucalyptus sp.*, *Dalbergia sissoo*, *Prosopis juliflora*, *Morus alba*, *Ficus bengalensis*, *Ficus glomerata*, *Syzygium cumini* and many species of herbs and shrubs (Dagar et al. 2001).

To study, daily feeding time schedule and food and feeding habits of rhesus monkey

direct contact method (Barwer, 1971) was followed. Three troops of rhesus monkey, *Macaca mulatta* were selected in Saraswati Wildlife Plantation Sanctuary. The troops were assigned the number in roman digits as T-I, T-II, T-III (Fig 1). Each troop was silently followed and monitored in three phases of the day, i.e., morning phase (6.00 AM - 11.00 AM), noon phase (11.00 AM - 3.00 PM) and evening phase (3.00 PM - 7.00 PM). The time taken by Rhesus monkey for feeding was recorded. Side by side, the feeding sites where, the individuals were found to feed were marked and scanned to identify the feeding objects (plant parts, i.e., bark, gum, leaves, inflorescences etc. or animals if any) by Rhesus monkey. Simultaneously, sign of crops and plant parts damage by Rhesus monkey was also taken into account of feeding habit of Rhesus monkey. The collected data was later on statically analyzed.

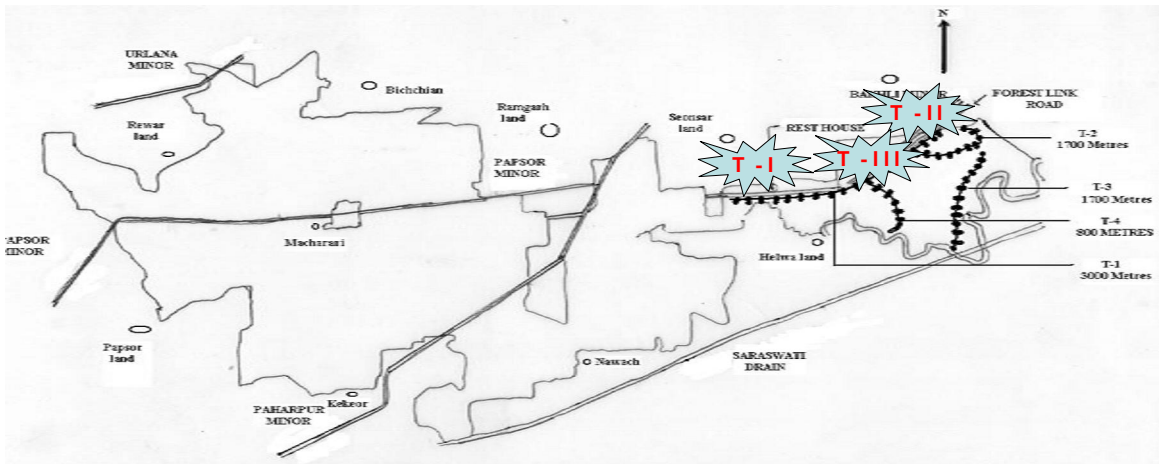


Fig. 1 Selected Rhesus monkey troops in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India).

3. Results and Discussion

Southwick et al. (1985) observed 25 species of plants in Tawang district (Arunachal Pradesh) on which, rhesus monkey were found to feed. Among these plants species, *E. parvifolia* and *E. arborescence* composed 80% diet Rhesus monkey.

In present study, Rhesus monkey was observed to feed on different parts of 13 species of trees, 2 species of shrubs and 7 species of herbs. Among these, *Macaca mulatta* was recorded to feed on leaves of 9 species of trees (*Acacia nilotica*, *Albizza lebbek*, *Butea monosperma*, *Delbergia sissoo*, *Eucalyptus sp.*, *Morus alba*, *Cordea dichtoma*, *Syzygium cuminis*, *Ziziphus mauritiana*, *Terminalia*

arjuna), 2 species of shrubs (*Ziziphus nummularia*, *Capparis sepiaria*) and 5 species of herbs (*Oryza sativa*, *Triticum aestivum*, *Trifolium alexanderium*, *Chenopodium album*, *Cynodon dactylon*). It observed to consume inflorescenc of 6 species of trees (*Acacia nilotica*, *Albizza lebbek*, *Eucalyptus sp.*, *Ficus reliogiosa*, *Cordea dichtoma*, *Syzygium cuminiv*, *Terminalia arjuna*) and 1 species of shrubs (*Capparis sepiaria*). In addition, rhesus macaques were noticed to feed on pod/fruit of 5 species of trees (*Butea monosperma*, *Cordea dichtoma*, *Ficus bengalensis*, *Syzygium cumini*, *Ziziphus mauritiana*), 1 species of shrubs (*Ziziphus nummularia*) and 1 species of herbs (*Brassica compestris*). Rhesus macaques were

also observed to feed on bark of 5 species of trees (*Acacia nilotica*, *Delbergia sissoo*, *Morus alba*, *Prosops juliflora*, *Terminalia arjuna*), sucks gum of 1 species of tree (*Acacia nilotica*),

stem of 1 species of herbs/grasses (*Saccharum officinarum*) and seeds of 3 species of herbs (*Oryza sativa*, *Triticum aestivum*, *Saccharum officinarum*) (Table 1).

Table 1. Different species of plants used by *Macaca mulatta* in Saraswati Plantation Wildlife Sanctuary (SPWS).

| Sr. No. | Tree species | Comman name | Family | Plant parts |
|---------|------------------------------|---------------|---------------|-------------|
| 1 | <i>Acacia nilotica</i> | Babool | Fabaceae | L,B,I,G |
| 2 | <i>Albizza lebbek</i> | Siris | Fabaceae | L,I,I |
| 3 | <i>Butea monosperma</i> | Dhak | Fabaceae | L,F |
| 4 | <i>Delbergia sissoo</i> | Shisham | Fabaceae | F,L,B |
| 5 | <i>Eucalyptus sp.</i> | Safeda | Myrtaceae | L,B,I |
| 6 | <i>Ficus religiosa</i> | Peepal | Maraceae | I,F |
| 7 | <i>Morus alba</i> | Shahtoot | Moraceae | F,L,B |
| 8 | <i>Prosops juliflora</i> | Valaiti kikar | Fabaceae | P,B |
| 9 | <i>Cordea dichtoma</i> | Lasora | Boraginaceae | F,I,L |
| 10 | <i>Ficus bengalensis</i> | Bargad | Moraceae | F |
| 11 | <i>Syzgium cuminiv</i> | Jamun | Myrataceae | F,I,L |
| 12 | <i>Ziziphus mauritiana</i> | Ber | Rhamnaceae | F,L |
| 13 | <i>Terminalia arjuna</i> | Arjun | Combretaceae | L,B,I |
| | Shrubs | | | |
| 1 | <i>Ziziphus nummularia</i> | Jharber | Rhamnaceae | F,L |
| 2 | <i>Capparis separia</i> | Caper bushes | Capparidaceae | L,I |
| | Herbs/grasses | | | |
| 1 | <i>Brassica compestris</i> | Sarson | Brassicaceae | F |
| 2 | <i>Oryza sativa</i> | Dhan | Poaceae | S,L |
| 3 | <i>Triticum aestivumv</i> | Gehun | Poaceae | S,L |
| 4 | <i>Saccharum officinarum</i> | Ganna | Poaceae | S,St |
| 5 | <i>Trifolium alexandrium</i> | Barseem | Bebaceae | L |
| 6 | <i>Cheanopodium album</i> | Bathua | Amarnathaceae | L |
| 7 | <i>Cynodon dactylon</i> | Dubh | Poaceae | L |

L- Leaves, I- Inflorescences, P/F- Pod/Fruit, B-Bark, G-Gum, St-Stem, S-Seed

Rhesus monkey is considered as omnivorous in its feeding habitats as it was observed to feed on eggs, termites and moulds in addition to plants (Lindburg, 1971). In human influenced areas, they focus on fruits, flowers, leaves, seeds, gums, buds, clover, roots, bark and they supplement their food diet with termites, grasshopper, ants, beetles and mushrooms (Fooden, 2000; Wolfe, 2002). In some areas, rhesus macaque depends directly as well as indirectly, on parts of their diet from human activities (Richard et al. 1989; Southwick and Siddiqi, 1994). Wolfe (1992) described about food given to the rhesus macaques in temples include bread, bananas, peanuts, seeds, fruits, vegetables, and assorted miscellaneous foods like ice creams and fried bread etc. In present study no animal objects or remains was observed to be fed by Rhesus macaques, so, it is categorized in herbivorous category.

Lindburg (1971) observed the variations in the daily activity cycles of the forests group of rhesus macaques with respect to the pattern, frequency and intensity followed the natural cycle of the warm-wet season (July-October), the cool season (November-February) and hot-dry season (March and June) to describe such differences. Bernstein (1972) recorded maximum frequencies of different activities (travel, feeding, play, sex and agonist) at the time of sunset and theses activities were also influenced by temperature, weather and replacement of alpha male. The diurnal dispersion pattern of free-ranging rhesus monkeys using three dimensional version of Clark-Evans model and follow 2 peaks of dispersion, one of the morning and other in the evening. The clumping of the animals occurred in the late hours of the day (Khalid and Qaza, 1986).

In present study, time schedule of food and feeding habit was also calculated from February,

2008 to July, 2008 in Saraswati Plantation Wildlife Sanctuary. The total number of 72 sightings of feeding by rhesus macaques was observed. The results revealed that among all the three troops of rhesus macaques. Troop I fed for minimum 2.25 hrs in February, 2008 (winter season) to maximum 4.41 hrs in July, 2008 (autumn season). Troop II feed for minimum 2.28 hrs in February, 2008 (winter season) and

for maximum time of 4.37 hrs in June, 2008 (autumn season) while Troop III was observed to feed for minimum 2.13 hrs. in February, 2008 (winter season) and for maximum time i.e., 4.44 hrs in July, 2008 (autumn season). Individuals of troop I, troop II and troop III devoted average time for feeding 3.36hrs, 3.43hrs and 3.25hrs, respectively.

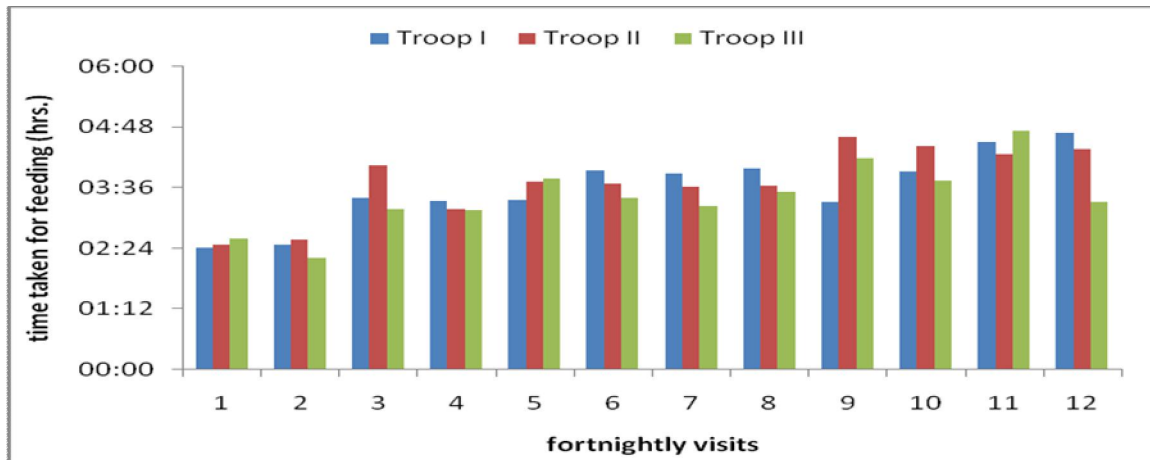


Fig.2 Time devoted for feeding by different troops of Rhesus monkeys in Saraswati Plantation Wildlife Sanctuary.

Seth and Seth (1986) and Seth (2000) was observed that climate, season, photoperiod (sunset, sunrise) affect the timing of daily feeding time schedule of rhesus macaques and spent more time resting in noon phase They are more active for searching food in evening hours performing variety of behavioural display (Hauser, 1999; Menon, 2003). Southwick et al. (1985) were observed that the food and feeding habits of rhesus monkey, *Macaca mullatta* and are more active in morning and evening time for searching the food.

In present study feeding time is affected by activation time of rhesus macaques. It is inversely proportional to time of activation and directly proportional to the time of inactivation. Karl Pearson correlation between time of activation and total time taken for feeding of troop I give negative correlation ($p = -.846$, $r \leq .1$) and positive correlation ($p = .587$, $r \leq .1$) in between time taken for feeding and time of inactivation. Negative correlation was observed ($p = -.861$, $r \leq .1$ and $p = -.732$, $r \leq .1$ for troop II and troop III, respectively) between the time of activation and total time devoted for to feeding. However, positive correlation was observed between total time taken for feeding and time of inactivation ($p = .402$, $r \leq .1$ and $p = .627$, $r \leq .1$

for troop II and troop III, respectively). The variability in the time taken for feeding by rhesus macaques in different months may vary due to availability of food from nearby food resources as well as climatic factor like photoperiod (on sunset, sunrise), temperature, rain fall etc.

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