

A CASE STUDY ON FIGURES WITH EMPHASIS COMPONENTS OF RHESUS MONKEY, *MACACA MULATTA* (ZIMMERMANN, 1780) IN SARASWATI PLANTATION CONSERVATION RESERVE FOREST IN DISTRICT KURUKSHETRA, HARYANA (INDIA)

Pawan Kumar Sharma¹, Vikas^{2*} and Ajay Kumar³

¹Department of Zoology, Government Collage for Women, Narnaul, Mahendergarh - 123 001, India.

²School of Life Sciences, Singhania University, Pachari Bari, Jhunjhnu - 333 515, India.

³Department of Zoology, Kurukshetra University, Kurukshetra - 136 119, India.

*e-mail : vikas17sikerwal@gmail.com

(Accepted 26 November 2017)

ABSTRACT : Rhesus monkey is a part of biodiversity. According to IUCN the population trend of Rhesus Monkey is unknown and is considered unthreatened, though the original habitat of these species is increasingly being lost for human settlement. During fortnightly periodic visits from December, 2015 to November, 2016 direct sighting method and line transect method was used to record figures with emphasis components of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780). Monthly variation of total numbers of Rhesus Monkey varied from a minimum of 191 individuals (95.50±0.50 average numbers) in month of May to a maximum of 252 individuals (126.00±4.00 average numbers) in month of April with an average of 223.00±5.70 individuals were recorded. Overall, seasonal variation in total numbers (with average number) of Rhesus Monkey varied from a minimum of 618 individuals (206.00±6.35 average number) in winter season to a maximum of 708 individuals (236.00±1.73 average number) in monsoon season with an average of 669.00±18.80 individuals were recorded. Minor variation in the total number of sighted individuals of Rhesus Monkey in various months as well as seasons (winter, summer, monsoon and autumn) may be due to the effect of searching of food items toward road side (because people through food items on road side) as well as in agriculture areas, increase human activity with their domestic animals, i.e., Dogs (Human-Monkey conflict), seeing of food near holy temple of lord Mahadev situated at village Helwa near the forest area, scarcity of water resources and less number of fruit tree in forest area.

Key words : Rhesus monkey, figures, emphasis components, Saraswati plantation, conservation reserve forest, Haryana.

INTRODUCTION

Asian primates, *Macaca mulatta* commonly known as Rhesus Macaques is also listed as Least Concern species in IUCN Red list data book and it is geographical distributed in countries like Afghanistan, Bangladesh, Bhutan, Burma, China, India, Laos, Nepal, Pakistan, Thailand and Vietnam (Tiwari and Mukherjee, 1992). The Rhesus Monkeys are widely distributed throughout northern part of India and are highly adapted to exploit human habitation (Srivastava, 1999). People and non-human primates have lived in close association in most primate ranges for thousands of years (Hill, 2002). Macaques in particular are found to have a high rate of interaction with humans (Fuentes and Gamerl, 2005). These are live in troops of 20–70 individuals with adult females, juveniles and infants as well as several males in and around human population (Molur *et al*, 2003). Generally, Rhesus Monkeys destroy home gardens, fruit trees and crops and on the other hand, monkeys are also

beaten, injured and even killed by the local people. The rapid increase in the number of Rhesus Monkeys in recent years in India have lead to increased competition for food and space between humans and monkeys (Srivastava, 1999). Damage to human property and harassment by the monkeys are the common feature in many parts of India. These interactions may increase the risk of bidirectional disease transmission (Jones-Engel *et al*, 2008). Research for beneficial use for human health is not possible without the use of Rhesus Macaques such as development of the rabies, smallpox, polio vaccines, discovery of rhesus factor in blood, creation of drugs to manage HIV/AIDS, understanding of the female reproductive cycle, development of the embryo, propagation of embryonic stem cells and a number of behavioral discoveries (Mitruka, 1976). The population trend of these is unknown according to IUCN and is considered unthreatened, though the original habitat of these species is increasingly being lost for human settlement.

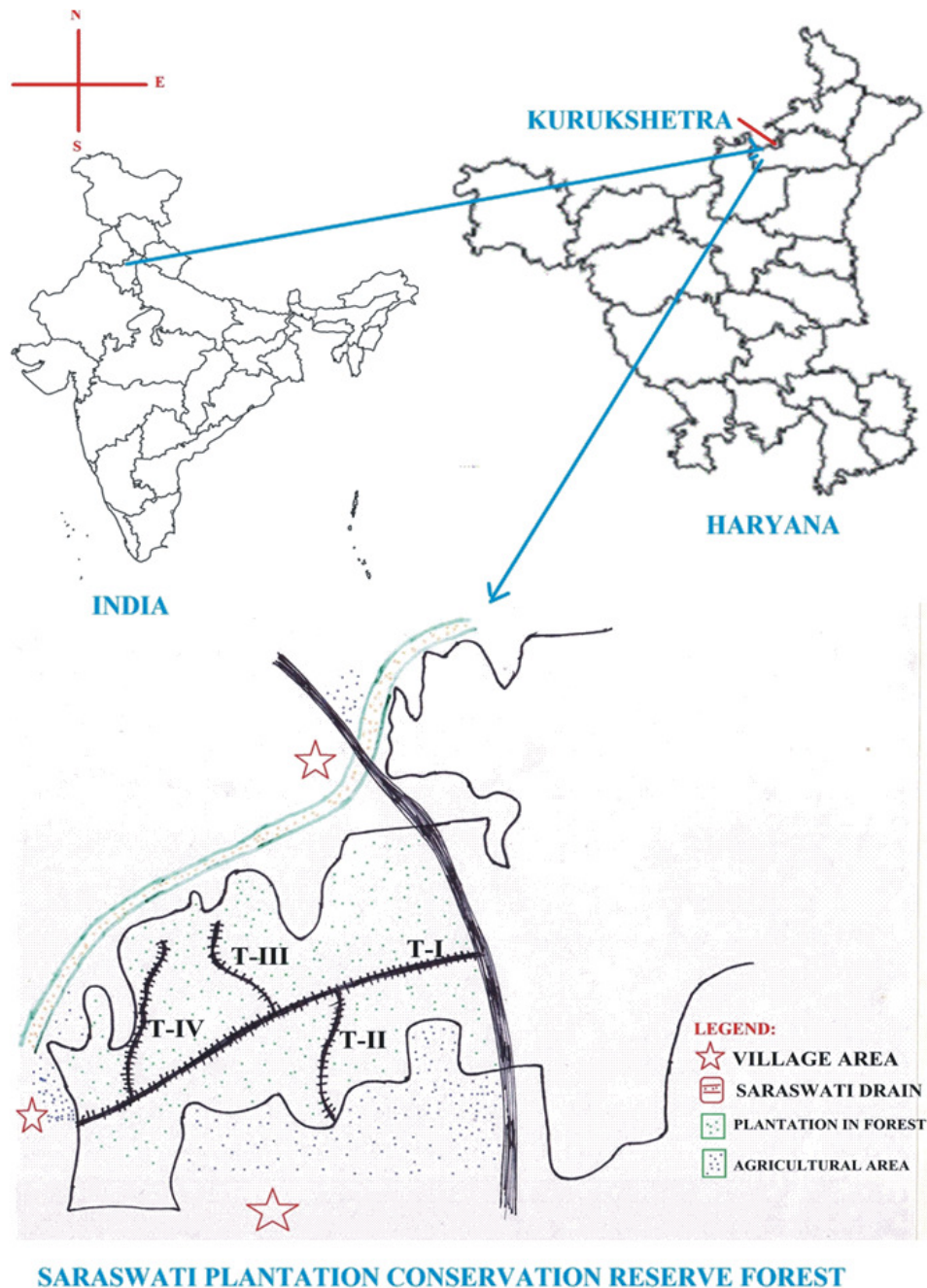


Fig. 1 : Saraswati Plantation Conservation Reserve Forest in district Kurukshetra, Haryana (India).

STUDY AREA AND METHODOLOGY

Study area

Saraswati Plantation Conservation Reserve Forest (29°58' N latitude and 76° 32' N longitude) is commonly known as Seonsar forest and it is located on Kurukshetra–Pehowa– Cheeka road around 35 Km toward West side of Kurukshetra city (Fig. 1). It is also the third biggest forest in the state of Haryana which occupied 11231 acres of area. In the year 1966, it came under the jurisdiction of forest department, Government of Haryana. It was

declared as wild life sanctuary on dated July 29, 1988 and Haryana government notified this area as conservation reserve forest on dated October 11, 2007. In Saraswati Plantation Conservation Reserve Forest, dominant tree species, *i.e.*, Kikar (*Acacia nilotica*), Neem (*Azadirachata indica*), Shisham (*Dalbergia sissoo*) and Safeda (*Eukalyptus hybrid*); dominant herbs and shrubs species, *i.e.*, Bansa (*Adhatoda vasica*), Kandai (*Aegemone maxicana*), Kair (*Capparis desidua*) and Bathua (*Chenopodium album*); dominant animal species, *i.e.*, Neelgai or Blue bull (*Boselaphus*

tragocamelus), Jackel (*Canis aureus*), Hanuman Langur (*Presbytis entelles*) and Rhesus Monkey (*Macaca mullata*) and dominant birds species, *i.e.*, Blue peafowl (*Pavo cristatus*), Rufous treepie (*Dendrocitta vagabunda*), Greater coucal (*Centropus sinensis*), Indian grey hornbill (*Ocyrceros birostris*) and Jungle babbler (*Turdoides striata*) were recorded in prescribed area.

Methodology

During fortnightly periodic visits from December, 2015 to November, 2016 direct sighting method (Chetry *et al.*, 2007) and line transect method (Sale and Berkmueller, 1988; Chopra and Kumar, 2009) was used to record figures with emphasis components of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in study area. In the present study four transects namely, T-I, T-II, T-III and T-IV with covering an area of 0.63 Km² were selected in study site (Fig. 1). Different age classes of sighted individuals *viz.*, all male, all female, juveniles and infants were identified following age-sex wise classification of Rhesus Monkey given by Kent *et al.* (1994), Chopra and Kumar (2009), Kumar (2015).

RESULTS AND DISCUSSION

In Darjeeling, a total number of 21 groups of Rhesus Macaques with 403 monkeys (55 of adult males, 215 of adult females, 78 of juveniles and 55 of infants) in area of 1200 km² were observed (Chaudhuri *et al.*, 2006). Also a total numbers of 445 individuals of Rhesus Monkey, distributed in 21 groups were observed in the Chakrashila Wildlife Sanctuary of Assam from December, 2006 to January, 2007 (Chetry *et al.*, 2007). Ekwali Imam and Anees Ahmad (2013) were observed 84 troops of Rhesus Monkeys comprising of 4051 individuals in different types of habitats in the district Aligarh, Uttar Pradesh with troop size ranging from minimum of 15 individuals/troop to maximum of 155 individuals/troop with an average of 48 individuals/troop. In Saraswati Plantation Wildlife Sanctuary, 173 individuals of all male, 706 individuals of all female, 140 individuals of juveniles and 148 individuals of infants of Rhesus Monkey, while in Bir Sonti Reserve Forest, 170 individuals of all male, 760 individuals of all female, 134 individuals of juveniles and 114 individuals of infants of Rhesus Monkey, respectively were observed (Kumar, 2015; Kumar, 2016). Similarly, in the present study, a total numbers of 2676 individuals of Rhesus Monkey which compose of 380 individuals of all male, 1547 individuals of all female, 403 individuals of juveniles and 346 individuals of infants with male: female ratio is 1 : 4.03, juvenile: female ratio is 1 : 3.83 and infants : female ratio is 1 : 4.47 were observed in study area (Table 1).

In Saraswati Plantation Wildlife Sanctuary, total numbers of sighted Rhesus Monkeys varied from a minimum of 65 individuals (July, 2008; December, 2008) to a maximum of 132 individuals (April, 2008; August, 2008) with an average of 96.11 individuals (Kumar, 2015). Also in present study, monthly variation of total numbers of Rhesus Monkey varied from a minimum of 191 individuals (95.50±0.50 average numbers) in month of May to a maximum of 252 individuals (126.00±4.00 average numbers) in month of April with an average of 223.00±5.70 of individuals were recorded (Table 1). As far as in the present study, the monthly variation in total numbers of all male Rhesus Monkey varied from a minimum of 28 individuals (14.00±1.00 average numbers) in month of March and May to a maximum of 34 individuals (17.00±1.00 average numbers) in month of March and November with an average of 31.66±0.58 individuals (Fig. 2 a); total numbers of all female of Rhesus Monkey varied from a minimum of 99 individuals (49.00±1.50 average numbers) in month of May to a maximum of 142 individuals (71.00±2.00 average numbers) in month of April and September with an average of 128.92±3.65 individuals (Fig. 2b); total number of juveniles of Rhesus Monkey varied from a minimum of 24 individuals (12.00±1.00 average numbers) in month of May to a maximum of 44 individuals (22.00±0.00 average numbers) in month of September with an average of 33.58±1.70 individuals (Fig. 2c) and the total number of infants of Rhesus Monkey varied from a minimum of 15 individuals (7.50±0.50 average numbers) in month of December and February to a maximum of 45 individuals (22.50±0.50 average numbers) in month of June with an average of 28.33±3.35 individuals (Fig. 2d) (Table 1).

In the present study, the minimum individuals of Rhesus Monkey were recorded in the month of May because maximum individuals of Rhesus Monkey spent more time for feeding in agriculture areas nearby the forest. As well as in the month of April of study year the maximum individuals of Rhesus Monkey were recorded because it is peak month of reproductive period of the Rhesus Monkey as they spent more time in their natural habitat. So it is the main reason for minor difference in monthly variation in the numbers of Rhesus Monkey (Table 1). Similar result, related to minor difference in monthly variations of numbers of Rhesus Monkey were recorded by Kumar (2015), Kumar (2016), Sharma *et al.* (2017).

Overall, seasonal variation in total numbers (with average number) of Rhesus Monkey, varied from a minimum of 618 individuals (206.00±6.35 average number) in winter season to a maximum of 708 individuals

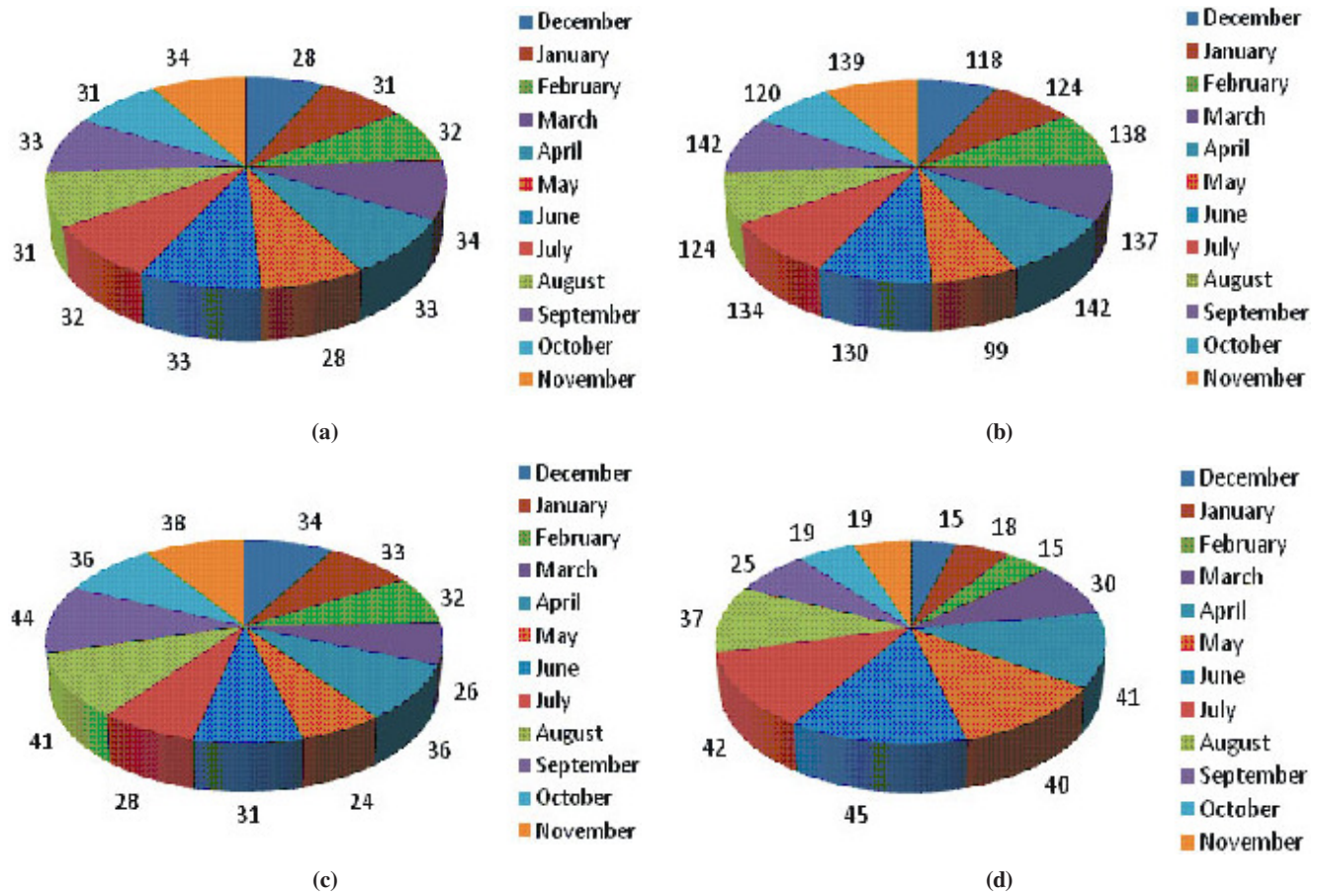


Fig. 2 : Monthly variation in figures (numbers) (a) all male, (b) all female, (c) juveniles and (d) infants of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Conservation Reserve Forest in district Kurukshetra (Haryana).

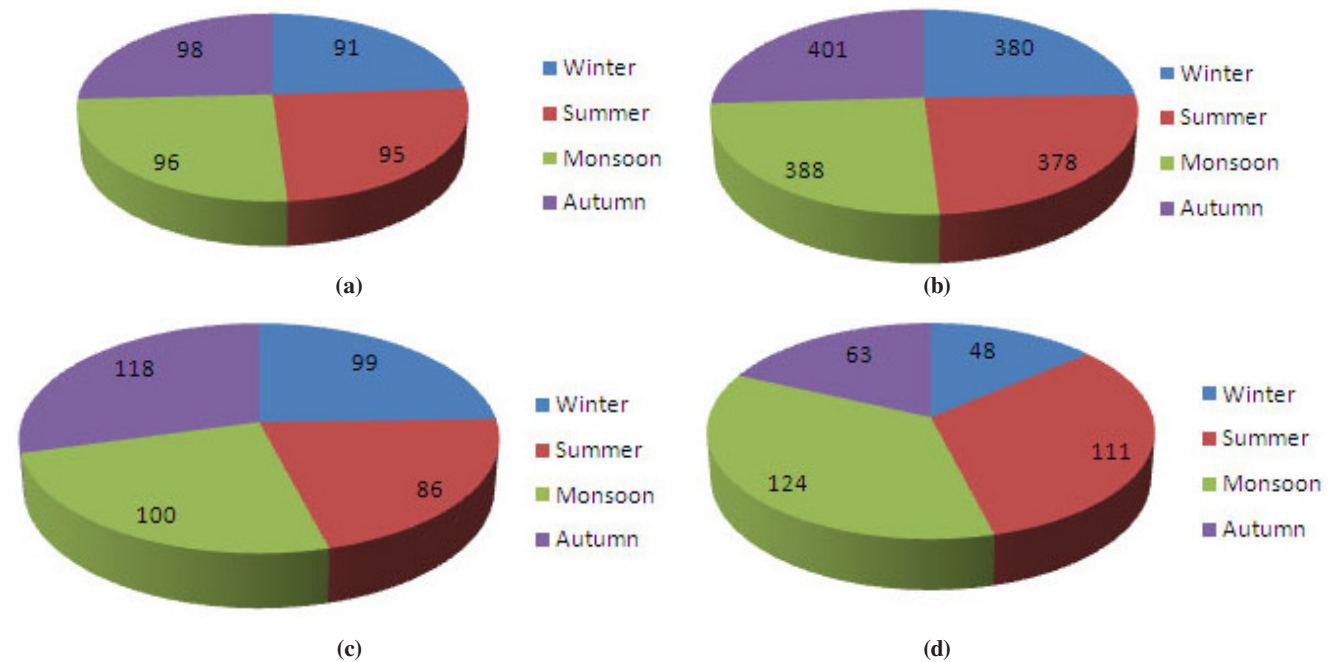


Fig. 3 : Seasonally variation in figures (numbers) (a) all male, (b) all female, (c) juveniles and (d) infants of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Conservation Reserve Forest in district Kurukshetra (Haryana).



(a)



(b)



(c)



(d)



(e)



(f)

Fig. 4 : (a) Searching for food items on road side outside the forest, (b) Entry of vehicle traffic in the forest, (c) Mahadev temple situated at village Helva (d) Rhesus Monkey drunk water at man-made pits, (e) Rhesus Monkey feed upon grasses due to non availability of fruit tree and (f) agriculture area nearby the forest.

Table 1 : Monthly variation in figures (average number) of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Conservation Reserve Forest in district Kurukshetra, Haryana (India) from December, 2015 to November, 2016.

Months of year	Figures (average number \pm S.E.) of individuals sighted/months of Rhesus Monkey				Overall
	All male	All female	Juveniles	Infants	
December, 2015	28(14.00 \pm 1.00) ^A	118(59.00 \pm 3.00) ^A	34(17.00 \pm 1.00) ^A	15(7.50 \pm 0.50) ^A	195(97.50 \pm 2.50) ^A
January, 2016	31(15.50 \pm 0.50) ^A	124(62.00 \pm 1.00) ^A	33(16.00 \pm 0.50) ^A	18(9.00 \pm 0.00) ^A	206(103.00 \pm 2.00) ^A
February, 2016	32(16.00 \pm 1.00) ^A	138(69.00 \pm 2.00) ^A	32(16.00 \pm 1.00) ^A	15(7.50 \pm 0.50) ^A	217(108.50 \pm 2.50) ^A
March, 2016	34(17.00 \pm 1.00) ^A	137(68.50 \pm 0.50) ^A	26(13.00 \pm 1.00) ^A	30(15.00 \pm 1.00) ^{AB}	227(113.00 \pm 1.50) ^A
April, 2016	33(16.50 \pm 0.50) ^A	142(71.00 \pm 2.00) ^A	36(18.00 \pm 1.00) ^A	41(20.50 \pm 0.50) ^A	252(126.00 \pm 4.00) ^A
May, 2016	28(14.00 \pm 0.00) ^A	99(49.00 \pm 1.50) ^{AB}	24(12.00 \pm 1.00) ^A	40(20.00 \pm 0.00) ^A	191(95.50 \pm 0.50) ^{AB}
June, 2016	33(16.50 \pm 0.50) ^A	130(65.00 \pm 0.00) ^A	31(15.50 \pm 0.50) ^A	45(22.50 \pm 0.50) ^A	239(119.00 \pm 0.50) ^A
July, 2016	32(16.00 \pm 0.00) ^A	134(67.00 \pm 1.00) ^A	28(14.00 \pm 1.00) ^A	42(21.00 \pm 1.00) ^A	236(118.00 \pm 1.00) ^A
August, 2016	31(15.50 \pm 0.50) ^A	124(62.00 \pm 0.00) ^A	41(20.50 \pm 1.50) ^A	37(18.50 \pm 0.50) ^A	233(116.50 \pm 1.50) ^A
September, 2016	33(16.50 \pm 0.50) ^A	142(71.00 \pm 3.00) ^A	44(22.00 \pm 0.00) ^{AB}	25(12.50 \pm 0.50) ^A	244(122.00 \pm 3.00) ^A
October, 2016	31(15.50 \pm 0.50) ^A	120(60.00 \pm 1.00) ^A	36(18.00 \pm 1.00) ^A	19(9.50 \pm 0.50) ^A	206(103.00 \pm 0.00) ^A
November, 2016	34(17.00 \pm 0.00) ^A	139(69.50 \pm 1.50) ^A	38(19.00 \pm 0.00) ^A	19(9.50 \pm 0.50) ^A	230(115.00 \pm 1.00) ^A
Total numbers(Mean \pm S.E.)	380(31.66 \pm 0.58)	1547(128.92 \pm 3.65)	403(33.58 \pm 1.70)	346(28.33 \pm 3.35)	2676(223.00 \pm 5.70)

S.E.= Standard Error.

Mean with same letter in the same row are not significantly difference ($p < 0.05$) (Duncon, 1955).**Table 2** : Seasonal variation in figures (average numbers) of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Conservation Reserve Forest in district Kurukshetra, Haryana (India) from December, 2015 to November, 2016.

Seasons	Figures (average number \pm S.E.) of individuals sighted/seasons of Rhesus Monkey				Overall
	AM	AF	JU	IF	
Winter	91(30.33 \pm 1.20)	380(126.66 \pm 5.92)	99(33.00 \pm 0.57)	48(16.00 \pm 1.00)	618(206.00 \pm 6.35)
Summer	95(31.66 \pm 1.85)	378(126.00 \pm 13.57)	86(28.66 \pm 3.71)	111(37.00 \pm 3.51)	670(223.33 \pm 17.70)
Monsoon	96(32.00 \pm 0.57)	388(129.33 \pm 2.90)	100(33.33 \pm 3.92)	124(41.33 \pm 2.33)	708(236.00 \pm 1.73)
Autumn	98(32.66 \pm 0.88)	401(133.66 \pm 6.88)	118(39.33 \pm 2.40)	63(21.00 \pm 2.00)	680(226.66 \pm 11.09)
Total number (Mean \pm S.E.) (Sex wise)	380(95.00 \pm 1.47)	1547(386.75 \pm 5.21)	403(100.75 \pm 6.57)	346(86.50 \pm 18.35)	2676(669.00 \pm 18.80)

AM - All male, AF – All female, JU – Juveniles, IF – Infants.

(236.00 \pm 1.73 average number) in monsoon season with an average of 669.00 \pm 18.80 individuals (Table 2). The seasonal variation in total number of all male Rhesus Monkey varied from a minimum of 91 individuals (30.33 \pm 1.20 average number) in winter season to a maximum of 98 individuals (32.66 \pm 0.88 average number) in autumn season with an average of 95.00 \pm 1.47 individuals (Fig. 3a); seasonal variation in total numbers of all female Rhesus Monkeys varied from a minimum of 378 individuals (126.00 \pm 13.57 average number) in summer season to a maximum of 401 individuals (133.66 \pm 6.88) average number) in autumn season with an average of 386.75 \pm 5.21 individuals (Fig. 3b); seasonal variation in total number of juveniles of Rhesus Monkeys varied from a minimum of 86 individuals (28.66 \pm 3.71 average number) in summer season to a maximum of 118 individuals (39.33 \pm 2.40 average number) in autumn season with an average of 100.75 \pm 6.57 individuals (Fig.

3 c) and seasonal variation in total number of infants of Rhesus Monkeys varied from a minimum of 48 individuals (16.00 \pm 1.00 average number) in winter season to a maximum of 124 individuals (41.33 \pm 2.33 average number) in monsoon season with an average of 86.50 \pm 18.35 individuals (Fig. 3d) (Table 2).

During the study period, various type of minor variation in the total number of sighted individuals of Rhesus Monkey in various months as well as seasons (winter, summer, monsoon and autumn) may be due to the effect of searching of food items toward road side (because people through food items on road side as well as in agriculture areas), increase human activity with their domestic animals, *i.e.*, Dogs (Human-Monkey conflict), seeing of food near holy temple of lord Mahadev situated at village Helwa near the forest area, scarcity of water resources and less number of fruit tree in forest area.

Dancan's multiple range test (DMRT) result reveals that there was not significant difference ($p < 0.05$) recorded in average numbers of sighted individuals of all male, all female, juveniles and infants of Rhesus Monkey in different month of study year. However, Dancan's multiple range test (DMRT) results of average number of Rhesus Monkey of sighted individuals of all female, juveniles and infants is slightly difference (average number < 0.05 or > 0.05) in the months May, September and March, respectively.

REFERENCES

- Chetry R, Chetry D, Ghosh K and Bhajjerji G (2007) Status and Conservation of Rhesus Macaque (*Macaca mulatta*) in Chakrashila Wildlife Sanctuary, Assam, India. *Journal of Bombay Natural History Society* **114**(4), 15-21.
- Ekwal I and Anees A (2013) Population status of Rhesus monkey (MACACA MULATTA) and their menace: A threat for future conservation. *International Journal of Environmental Sciences*.
- IUCN (2012) *IUCN Red List of Threatened Species*. Version 2012. 1. www.iucnredlist.org.
- Kent M, Lues R and Coker P (1994) The general classification of rhesus macaques, *Macaca mulatta*. *International Journal of Biology Assay* **11**(6), 363.
- Chopra and Kumar A (2009) A study on the ecology and behavior of Rhesus Monkey, *Macaca mullatta* (Zimmeemann, 1780), *M. Phill dissertation*, Department of Zoology, Kurukshetra University, Kurukshetra, 1-114.
- Kumar A (2016) To Analyze Parameters Related to Population Size and Composition of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Bir Sonty Reserve Forest in district Kurukshetra, Haryana (India). *International Journal of Applied and Pure Science and Agriculture* **2**(9), 28-32.
- Sale J B and Berkmuller K (1988) *Manual of wildlife techniques for India*, Field document no. 11, Wildlife Institute of India, Dehradun. 1-118.
- Hill C M (2002) Primate conservation and local communities—ethical issues and debates. *American Anthropologist* **104**, 1184-1194.
- Shrivastava A (1999) A Text Book on Primates of North East India, Rajasthan. Megadiversity Press 1-202.
- Fuentes A and Gamerl S (2005) Disproportionate participation by age/sex classes in aggressive interactions between long-tailed macaques (*Macaca fascicularis*) and human tourists at Padangtegal monkey forest, Bali, Indonesia. *American Journal of Primatology* **66**(2), 197-204.
- Tiwari K K and Mukherjee R R (1992) Population census of rhesus macaques and hanuman langurs in India. *Records of the Zoological Survey of India* **92**(1-4), 349-369.
- Molur S, Brandon-Jones D, Dittus W, Eudey A, Kumar A, Singh M, Feeroz M, Chalise M, Priya P and Walker S (2003) Status of South Asian Primates: Conservation Assessment and Management Plan Report.
- Jones-Engel L, May C C, Engel G A, Steinkraus K A, Schillaci M A, Fuentes A, Rompis A, Chalise M K, Nantiya A, Feeroz M M, Grant R, Allan J S, Putra A, Wandia I N, Watanabe R, Kuller L, Thongsawat S, Chaiwarith R, Kyes R C and Linial M L (2008) Diversity contexts of zoonotic transmission of simian foamy viruses in Asia. *Emergence Infectious Diseases* **14**(8), 1200–1208; <http://dx.doi.org/10.3201/eid1408.071430>
- Mitruka B M (1976) Introduction. In: Mitruka B M, Rawnsley H M, Vadehra D V, editors. *Animals for medical research: models for the study of human disease*. New York : Wiley & Sons 1-21.
- Chaudhuri S, Murmu A, Mazumdar P C and Alfred J R B (2006) Rhesus monkey *Macaca mulatta* in three northern districts of West Bengal, India. *Rec. Zool. Surv. India* **106**(1), 1-10.
- Sharma Pawan Kumar, Sikerwal Vikas and Kumar Ajay (2017) Population size and population density of rhesus monkey, *Macaca mulatta* (Zimmermann, 1780) in Bir Bara Ban Conservation reserve forest in district Jind, Haryana (India) **2**(5), 164-170.
- Kumar A (2015) Population size and composition of rhesus monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati plantation wildlife sanctuary in district Kurukshetra, Haryana (India). *The Ecoscan* **9**(1&2), 147-152.