

GENERAL ECONOMIC LOSS CAUSED BY RHESUS MONKEYS (*MACACA MULATTA SSP. MULATTA*) IN CHITRAKOOT REGION

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ABSTRACT : India has an exceptionally rich heritage of non-human primates. It includes 17 species and about 30 subspecies. *Macaca mulatta ssp. mulatta* is one of the species of non-human primates, which is commonly known as Rhesus monkey and Rhesus macaque. In Chitrakoot area, 25 troops of rhesus macaques are found in temples, urban, roadside, near human settlements, riverside and forests. A study on general economic loss caused by rhesus macaques in Chitrakoot region was carried out in the year 2009-2011. During survey shopkeepers, farmers and individual people were interviewed randomly. The estimate of average annual economic loss was assessed on the basis of the information gathered from shops of refreshments, vegetables, fruits, kirana stores, shopkeepers, pilgrims and farmers etc. The total loss caused by rhesus monkeys in Chitrakoot region during study period 2009-2011 was Rs. 1,95,291, out of which Rs. 94,978 was in year 2009-2010 and Rs. 1,00,313 was in year 2010-2011.

Key words : Economic loss, Rhesus Macaques, Chitrakoot region

INTRODUCTION

The study of non-human primates is very interesting and it contributes to the understanding of human related social and psychological problems. Biologically, evolutionary and culturally, primates are closely related to humans. They are good indicators of the general health of ecosystem and are helpful in planning of conservation strategies. India has an exceptionally rich heritage of non-human primates. It includes 17 species and about 30 subspecies. *Macaca mulatta* is one of the species of non-human primates, which is commonly known as Rhesus monkey and Rhesus macaque. Six subspecies of Rhesus macaque are found in Asia viz.; *Macaca mulatta ssp. vestita*, *Macaca mulatta ssp. lasiota* and *Macaca mulatta ssp. santijohannis* are found in Western, Central and Eastern China respectively. *Macaca mulatta ssp. breviceauda* is another species of Rhesus monkey, which is found on Hainan Island of the South coast of China. The Indian derived Rhesus monkeys have two sub species, *Macaca mulatta ssp. villosa* which is found in Kashmir and Punjab region of India, Afghanistan and Pakistan. *Macaca mulatta ssp. mulatta*, is found in India, Bhutan, Burma, Nepal, Bangladesh, Thailand, Laos and Vietnam, belong to family Cercopitheidae of order Primate. These sub species are significant components of the Indian biota and its culture.

Rhesus macaques are found in diverse habitats and in India thrive in eight diverse habitats viz. temple, urban, village, village cum-pond, roadside, canal side, and forests having varying human interactions (Seth *et al.*, 1992). In Chitrakoot area, they are found in temples, urban, roadside, riverside, near human settlements and forests. Rhesus macaques seem to choose their environments carefully with respect to food resources. Rhesus macaques are exceptionally adapted to coexisting with humans and thrive near human settlement in agricultural as well as urban areas. Regarding the

food habits they are omnivorous as they eat leaves, buds flowers, fruits and seeds.

Malik and Johnson (1994) reported that Rhesus macaques were so abundant in and around the Hindu temples of Vrindaban. They entered houses, stole food, clothing and other goods, uprooted vegetables and garden plants, pulled on electric wires and TV antennae, threatened and attacked people, often causing serious bites. Srivastava (1999) reported that damage and harassment caused by macaques is very common feature that can be seen in many parts of India. In India, Rhesus macaques cause significant damage to crops and gardens therefore responsible for economic loss. A study on the management of rhesus macaque's problem in AMU campus, U.P. was carried out by Imam & Yahya (2002) and reported that several rhesus macaques bites people in AMU campus.

A study on the crop raid by hanuman langur in around Aravallis (India) was carried out by Chhangani and Mohnot (2006) and reported that troop of hanuman langur eats part of 73 natural food plants. Besides these, 73 natural plants, it also eats, 13 crops, 22 types of vegetable and 8 types of flower and fruit grown in vegetable and crop fields, gardens and orchards around. The cultivated plant consumption was 40.8% in the month of September and 19.25% in the month of June. The annual economic loss to farmers in the study area is about \$ 1800-2400 from all the 12 farms. In addition to this cost of crop protection for each farm ranged between US \$ 2400 to 3000 annually for all the 12 farms. Beside the direct loss, they also cause indirect loss like feeding upon the fruiting trees and the flowers, which reduce the fruit production considerably, which farmer cannot visualize.

Engerman *et al.* (2011) carried out study on the economic impact to commercial farms from invasive rhesus macaques and patas monkeys in Puerto Rico. According to the

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Puerto Rico Department of Agricultural surveyed about 90% of commercial farmers in the range of the macaques to begin quantifying damage by macaques and the associated economic losses during the years 2002-2006. During that time, total economic losses due to farmers to macaques increased from \$1.13 million USD to over \$ 1.46 million per year. The losses reported from the survey represents only a portion of economic losses to the invasive monkeys. Subsistence and other smaller farms and agriculture were not included in the survey. They also discuss many other economic issues surrounding the impacts of the invasive monkeys but for which sufficient data are not available for economic analyses. The review of literature reveals that no work on general economic loss caused by rhesus macaques in Chitrakoot area has so far been carried out therefore the present study was carried out.

MATERIAL AND METHODS

The study area of Chitrakoot region lies between 80°44'-48.042" to 80°54'-51.53" E latitude and 25°12'-13.0823" to 25°2'-19.952" N longitude. The total area of study site is 17,803.26 hectare. In which 191.52 hectare is human settlement, 2815.29 hectare is waste land, 5317.47 hectare is agricultural field, 9318.87 hectare is forest, and 160.11 hectare is water bodies. The forest types of Chitrakoot predominantly consist of tropical dry deciduous mixed types. The *Boswellia serrata*, *Acacia catechu*, *Bamboo*, *Anogeissus latifolia* are sub types occur as small patches within the mixed

forest. Average annual temperature in Chitrakoot ranges 25.19 to 32.19°C. Annual average rainfall is about 1100 mm.

Chitrakoot is a most famous holy place of Hindus in India. Rhesus macaques are widely distributed in Chitrakoot area. Abundance of rhesus macaques in certain areas is related to the local topography, vegetation patterns and agricultural practices. The presence of Rhesus macaques in Chitrakoot area has been mentioned in Ramayana and Ramcharitmanas. Culturally they are closely associated with Hindu religion and assumed as the incarnation of heaven deities.

A survey was conducted to find out estimated annual economic loss during the year 2009-2011. During survey shopkeepers, farmers and individual people were interviewed randomly. The estimate of average annual economic loss was assessed on the basis of the information gathered from farmers, shopkeepers, pilgrims and other local people. For estimation of agricultural loss, 150 farmers were interviewed randomly with the help of questionnaire. The kind of loss directly or indirectly brought about by rhesus macaques raids were estimated.

For estimation of unscheduled loss, 150 owners of shops like refreshment, vegetables, fruits, cooked food items, kirana stores were interviewed randomly and 150 houses for recording of domestic loss. Besides, for calculating pilgrim's loss, 150 pilgrims were interviewed randomly from Chitrakoot region.

Table. 1 Showing general estimated annually economic loss caused by rhesus macaques in 2009-2010.

Study site	1	2	3	4	5	6	7	8	9
S1	152	167	351	293	129	77	110	1109	0
S2	93	306	368	258	117	48	65	1270	0
S3	119	203	198	279	113	74	86	1257	0
S4	195	109	193	255	135	88	150	1247	0
S5	112	67	73	57	127	53	67	1276	0
S6	176	106	137	119	129	48	85	1102	0
S7	503	108	479	403	328	95	380	1689	4528
S8	495	399	437	491	387	96	450	1536	4858
S9	240	385	453	338	139	27	250	1196	0
S10	346	184	357	387	113	47	50	1156	0
S11	256	286	368	398	134	38	60	1145	1096
S12	278	179	378	283	165	65	170	1169	2269
S13	495	402	487	386	178	87	230	1157	1092
S14	296	352	296	297	179	76	310	1185	0
S15	170	199	261	223	125	63	156	1135	0
S16	454	201	329	323	189	147	495	1179	2058
S17	198	128	345	253	115	83	78	1608	0
S18	551	359	453	329	198	41	150	3389	0
S19	367	201	346	369	209	147	250	1104	0
S20	195	103	217	168	158	169	36	1098	0
S21	631	489	748	734	298	196	160	1106	915
S22	552	328	453	269	279	268	255	1095	0
S23	231	329	432	338	158	186	99	1065	0
S24	679	438	709	634	178	185	106	1117	1579
S25	219	145	231	269	121	139	385	1193	995
Total	8003	6173	9099	8153	4401	2543	4633	32583	19390

RESULTS AND DISCUSSION

During the study in Chitrakoot area, twenty five troops of rhesus macaques were found in temple, urban, roadside, riverside and forests and near human settlements. These 25 troops of rhesus macaques are found in Mukharbind Second (S1), Sitaram baba (S2), Tulsidas (S3), Sakshigopal (S4), Birja kund (S5), Suragau (S6), Mukharbind Third (S7), Barha (S8), Pilikothi,(S9), Saryudhara (S10), Kamad vatika (S11), Hanumanjee (S12), Biharimandir (S13), Mukhyadwar (S14), Shabri ashram (S15), Arogyadham (S16), Sphatickshila (S17), Satianusuiya (S18), Guptgodavari (S19), Raghuveer Mandir (S20), Jankikund (S21), Pramodvan (S22), Siyaramkuteer (S23), Ramghat (S24) and Hanumandhara (S25).

Out of 25 troops, 15 troops of rhesus macaques live around the Kamadgiri hill; 5 troops live in the famous places of Chitrakoot region viz Guptgodavari, Satianusuiya (forest area), Sphatickshila, Ramghat and Hanumandhara; 1 troop in Raghuveer Mandir and rest 4 troops in Arogyadham, Jankikund, Pramodvan and Siyaramkuteer.

Mandakini river is permanent water source in Chitrakoot area. Troops of rhesus macaques of Sati anusuiya, Sphatik shila, Arogyadham, Raghuveer mandir, Pramod van, Siyaram kuteer and Ramghat are live near the Mandakini river. Water taps are the major source of water for rhesus macaques in Chitrakoot area. 15 troops of rhesus macaques live around the Kamadgiri hill, fulfill their drinking requirement from water tanks.

Table. 2 Showing general estimated annually economic loss caused by rhesus macaques in 2010

Study site	1	2	3	4	5	6	7	8	9
S1	149	156	319	289	118	97	129	1290	0
S2	93	299	373	248	113	53	76	1307	0
S3	203	197	207	269	126	78	99	1275	0
S4	192	118	213	298	95	93	161	1174	0
S5	114	73	98	98	96	65	76	1736	0
S6	169	112	118	128	93	59	95	1097	0
S7	471	117	449	387	269	103	274	2543	3875
S8	499	368	453	478	387	103	429	1985	4375
S9	259	355	429	397	139	54	269	1098	0
S10	368	196	386	379	113	48	98	1087	0
S11	248	274	310	408	136	43	102	1907	1839
S12	265	167	389	276	138	67	197	1691	2698
S13	467	393	519	368	157	77	243	1075	1185
S14	378	375	289	298	179	85	297	1765	0
S15	175	208	278	268	125	78	103	1178	0
S16	482	213	354	352	257	178	467	975	1985
S17	158	137	356	248	143	56	197	1291	0
S18	569	351	438	329	198	57	167	3369	0
S19	387	183	329	387	209	126	273	1038	0
S20	241	132	203	198	246	173	78	993	876
S21	593	491	719	634	298	232	156	1023	0
S22	523	335	539	349	279	258	239	1193	0
S23	209	346	419	369	158	194	115	1093	0
S24	719	463	669	683	193	167	113	1875	2535
S25	257	159	269	261	121	116	296	1295	867
Total	8188	6218	9125	8399	4386	2660	4749	36353	20235

1 - Refreshment-shop, 2 - Vegetable shop/hawkers, 3 -Fruits shop/hawfers, 4 - Cooked food, shop/hawkers
5-Kirana Store, 6 - Domestic loss, 7 - Vehicles loss, 8 - Pilgrims loss, 9 - Agricultural loss

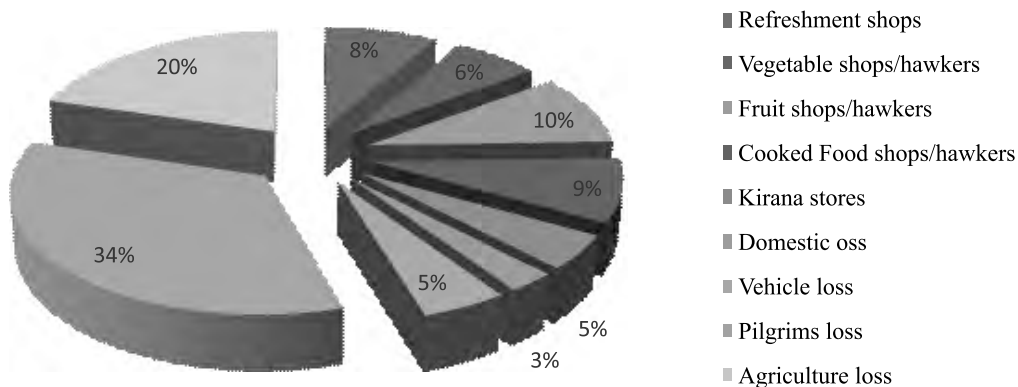


Fig. 1 Estimated economics loss in year 2009-2010.

Each troop comprised multi-male, multi-female and their immature offspring. Rhesus macaques live in multi-male, multi-female troops that have an average of 18 to 160 individuals, regardless of habitat type in Chitrakoot area. On an average 1811 rhesus were documented in 25 troop's habitats in Chitrakoot. Among 1811 rhesus macaques, 13.85% were adult males, 34.63% were adult females, 6.90% newborn, 8.81% were infants, 14.96% were juveniles, 4.90% sub were adult males, 5.94% were sub adult females were recorded during the study.

In Chitrakoot area, rhesus macaques are unable to find enough food merely from irregular provision provided by pilgrims and local peoples. They steal food from pilgrims and shops. In residential area, they enter houses for stealing food and uprooted vegetables. Rhesus macaque threats and attacks the people sometimes causing serious injuries. Rhesus macaques not only attack people but they also destroy and damage valuable human property. The items they damaged were things such as clothes, vehicle-sheets and mirror and they pull the electric wires and dish antennae sometimes disrupting service. Estimated average annual losses in 2009-2010 and 2010-2011 various categories are given in Tables. 1&2.

Farmers stated that rhesus macaques spoiled more crops than they eat; infants and juveniles in particular brought about damage during play on the field. The estimated crop damage from 150 farmers was Rs. 19390 in 2009-10 and Rs. 20235 in 2010-11. Rhesus macaques also cause indirect loss by feeding upon the flowering and fruiting plant, which reduces the crop production considerably, which farmer cannot estimate.

Agriculture crops like Genhu (*Triticum estivum*), Jawar (*Sorghum vulgare*), Bajra (*Pennisetum typhloides*), Gram (*Cicer arietinum*), Matar (*Pisum sativum*), Arher (*Cajanus cajan*), Moong (*Vigna radiata*), Udad (*Vigna mungo*), Til (*Sesamum indicum*), Masoor (*Lens culineris*); vegetables like Potato (*Solanum tuberosum*), Ghuinya, Bhindi, Khumda, Loki, Torhi, Kheera, Tamatar, Began, Phool gobhi, Band gobhi, Gazar (*Daucas carota*), Mooli are cultivated by farmers in Chitrakoot area, in which, gram is the most affected crop raids by rhesus macaques in Chitrakoot. They damaged whole plant of gram.

In Khohi and Kamtan village, crop raiding by rhesus macaques was more than other villages.

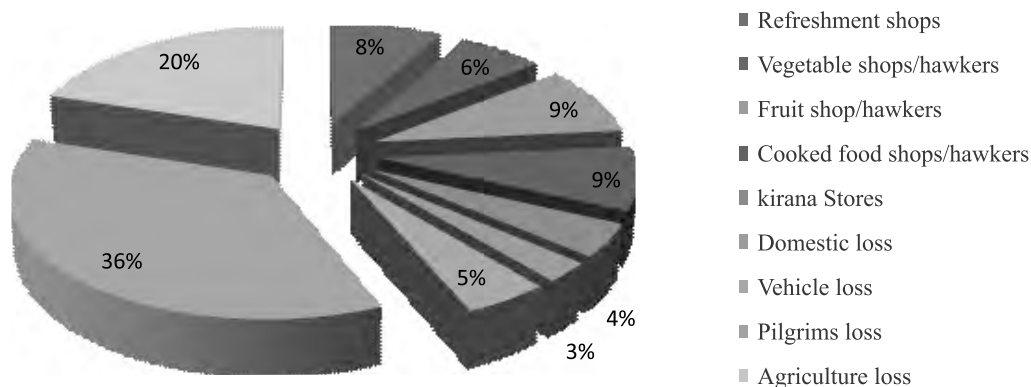


Fig. 2 Estimated economics loss in year 2010-2011.

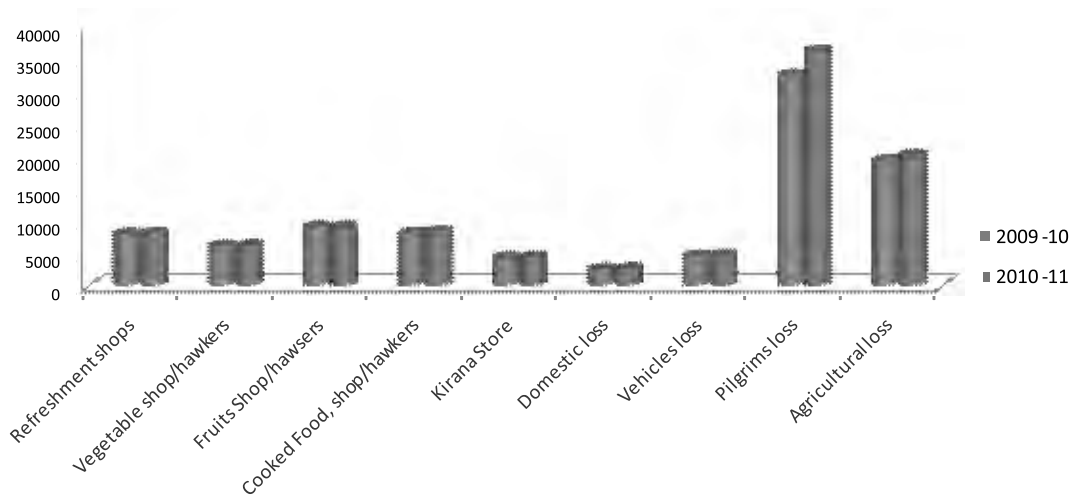


Fig. 3 Total economics loss caused by rhesus monkeys in 2009-10 and 2010-11.

Total average estimated economic loss calculated was Rs. 94,978 in 2009-2010, in which Rs. 8003 (8%) loss in refreshment shops (1), Rs. 6173 (6%) in vegetables shops and hawkers (2), Rs. 9099 (10%) in fruits shops and hawkers (3), Rs. 8153 (9%) in cooked food shops and hawkers (4), Rs. 4401 (5%) in kirana store (5), Rs. 2543 (3%) domestic (6), Rs. 4633 (5%) vehicles (7), Rs. 32583 (34%), pilgrims (8) and Rs. 19390 (20%) agricultural loss (9) (Fig.1).

Total average estimated economic loss calculated was 1,00,313 Rs. in 2010-2011 in study area of which, Rs. 8188 (8%) loss in refreshment shops (1), Rs. 6218 (6%) in vegetables shops and hawkers (2), Rs. 9125 (9%) in fruits shops and hawkers (3), Rs. 8399 (8%) in cooked food shops and hawkers (4), Rs. 4386 (4%) in kirana store (5), Rs. 2660 (3%) domestic (6), Rs. 4749 (5%) vehicles (7), Rs. 36353 (36%) pilgrims (8) and Rs. 20235 (20%) were agricultural loss (Fig.2). The total loss caused by rhesus monkeys in Chitrakoot region during study period 2009-2011 was Rs. 1,95,291, out of which were Rs. 94,978 loss in year 2009-2010 and Rs. 100313 in year 2010-2011 (Fig.3).

Loss of bio-diversity by rhesus macaques : Bio-diversity play a significant role in life cycle of *Macaca mulatta* and provided shelter and food for their survival. Though the bio-diversity is highly favorable for rhesus macaques but they cause severe threat to loss of bio-diversity. It was observed during the study period that they destroyed bio-diversity a lot in following manner:

1. Rhesus macaques destroy the seedling of wild and cultivated plants in early stage. They pluck and uprooted the plants.
2. They eat unripe fruits of several plants therefore fruits not ripe on the tree for regeneration.
3. Rhesus macaques eat tender leaves and immature leaves of plants therefore the photosynthesis is seriously affected which ultimately affect the plant growth.
4. Seeds and kernel of several plants like *Ziziphus nummularia* and *Ziziphus mauritiana* plants are eaten by

rhesus macaques therefore regeneration is seriously affected.

5. Rhesus macaques destroy the twigs and branches of trees and shrubs during jumping and playing.
6. Kernel of *Buchanania lanzan* eaten by Rhesus macaques which is a threatened species.
7. They eat flower buds and flowers of several plants therefore the development of fruits and seeds are seriously affected.

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REFERENCES

- Chhangani, A. K. and Mohnot, S. M. (2006). Crop raid by hanuman langur, *Semnopithecus entellus* in and around aravallis (India) and its management. *Primate Report*, **69**: 35-47.
- Engerman, Richard; M., Laborde; Jose, E. Constantin, Bernice U. Schiff, Stephanie A., Hall, Parker, Duffiney, Anthony and Luciano, Freddie (2011). The economic impact to commercial farms from invasive monkeys in Puerto Rico. *Crop Protection* **29**: 401-405.
- Imam, Ekwal and Yahya, H. S. A. (2002). Management of monkey problem in Aligarh Muslim University Campus, Uttar Pradesh. *Zoo's Print Journal*, **17(1)**: 685-687.
- Malik, I. and Johnson, R. (1994). Commensal Rhesus in India: The need and cost of translocation. *Rev. Ecol. (Terre et Vie)*, **49**: 223-243.
- Seth, P. K.; Seth, S.; Reddy, G. L. and Chopra, P. K. (1992). Population trends in naturally occurring rhesus monkey populations in different habitats in India. *Primate Report*, **32**: 61-73.
- Srivastava, A. (1999). *Primates of Northeast India, Bikaner, Rajasthan*. Megadiversity Press, Bikaner.