

Status of crop raiding by Assamese monkeys (*Macaca assamensis*) along the Budhigandaki river, central Nepal

Suvas Chandra Ghimire¹ and Mukesh Kumar Chalise²✉

¹Amrit Science Campus, Tribhuvan University, Kathmandu, Nepal

²Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal
mukesh57@hotmail.com

ABSTRACT

Crop depredation study was done on Assamese monkeys (*Macaca assamensis*) in Budhigandaki river basin lying on Dhading and Gorkha districts of central Nepal. The field study was conducted from February 2015 to January 2016 spending 1804 hours to explore the ecology and feeding behavior of Assamese monkeys. The study mainly focused at Kalleri village of Salang village development committee of Dhading district and Baseri, Majhitar and Siurenitar villages of Ghyalchok village development committee of Gorkha district. A total of 16 individuals of Assamese monkeys were counted at Rigdi khola of Sigrepakha community forest of Salang village development committee of Dhading district whereas a total of 13 individuals of Assamese monkeys were counted at Sandkhola of Benigam community forest and a total of 14 individuals of Assamese monkeys counted at Siurenitar of Ghyalchok village development committee of Gorkha district. Crop raiding data were collected by questionnaire survey method to local households in the nearby villages and also by direct observation. It was found that maize (58.43%) was the highest raided, followed by rice (11.34%), lentil (8.74%), peanut (4.35%), soyabean (4.18%), wheat (3.22%), fruits (2.97%), black pulses (1.87%), potato (1.67%), sesham (0.92%), tomato (0.79%), millet (0.67%), mustard (0.36%), broad beans (0.25%), brown lentil (0.18%) and pumpkin (0.06%).

Keywords: *Macaca assamensis*, crop raid, questionnaires, local villagers, Budhigandaki riverside

INTRODUCTION

Human non-human primates conflict are increasing to the developing countries than developed countries due to greater biodiversity and lack of prevention measures such as farm fences, livestock guard (Seoraj-Pillai & Pillay, 2016). In addition, behavioral adaptability of the macaques facilitates to invading human settlement, and as a result conflicts occur. However, the interaction between the primates and people is referred to as human primate's conflict, which has negative impact on the resources, habitats of both primates and people (Hill *et al.*, 2002; Hockings & Humle, 2009; Khatun *et al.*, 2013; Ahsan & Uddin, 2014).

Crop raiding primates is the example of human-primates' conflicts, where most of the local people are subsistence farmers (Hill, 1988). Crop raiding is a major issue for human-primates' conflict and conservation of primates (Hill, 1988; Ahsan & Uddin, 2014). Human primates conflicts are increasing because of conversion to agricultural lands to human settlements as a

result primate invade human settlement for food and damage crops that are mostly eaten by them. In some cases, primates especially baboons damage unpalatable crops that they don't eat but destroy as their own entertainment (Hill & Webber, 2010).

Assamese macaques (*Macaca assamensis*) of Nepal are considered as 'Nepal Population' by Conservation Assessment and Management Plan (CAMP) workshop 2002 due to taxonomic confusion. This population is different from Assamese monkeys described so far from south and east Asia (Jolly, 1985; Sanjay *et al.*, 2003) in respect to the head-body length, tail length, T/HB ratio and weight. The body coloration also differs than so far described one. This population is considered as a new subspecies and needs further taxonomic investigation. Assessment was carried out at the population level to highlight the status of this unique form endemic to Nepal. However, a distinct difference in color is also found in higher and lower elevations of the country, as it is recorded from the altitude of 284 m in Abukhaireni, Tanahu to 2350 m in Langtang, Rasuwa of Nepal.

Local people are more aggressive towards primates when they find economic loss due to crop damage by primates (Beisner *et al.*, 2015). Palatable and unpalatable crops are damaged by primates and it depends on the availability and scarcity of food in the areas. Also, the aggressive human behaviors influence the primates to damage unpalatable crops (Khatun *et al.*, 2013; Beisner *et al.*, 2015). In Nepal, conflict between human and primates are increasing due to increased population and primates tried to coexist with human settlement areas. So human primates' conflicts are increasing. The present study reveals the crop damage by Assamese monkey (*Macaca assamensis*) of the human settlement areas during conflict with local people in Budhigandaki river basin village of Dhading and Gorkha districts of central Nepal.

MATERIALS AND METHODS

Study area

The study area lies at Kalleri village of Salang village development committee of Dhading district and Baseri village as well as Majhitar and Siurenitar villages of Ghyalchok village development committee of Gorkha district. This is the confluences of Budhigandaki river with Trishuli river. According to the new constitution of Nepal 2015, Dhading district lies in Province No.3 and Gorkha district lies in Province No.4.



FIG. 1. Location of research site in the map of Nepal.

The study area lies about 3 km north from Benighat bazaar of Prithvi Highway. Benighat bazaar is located at about 85 km west from Kathmandu, the capital of Nepal. The study area is situated between 27° 48' 54.48" N latitude and 84° 46' 33.63" E longitude. The altitude is 401m above the sea level. The area is rich in biodiversity. Mixed type of forest especially tropical deciduous riverine forest, sub-tropical grassland and sub-tropical evergreen forest are the major types of forest along the Budhigandaki river basin (fig. 1).

Data collection

Data of crops raiding were collected from local household villagers as per the pre-set questions format as well as by direct observation of the researcher. Stratified random sampling method was used to select respondent for the questionnaire survey. Questionnaire survey was carried out to estimate the crop damage by the macaque with the local inhabitants in the Budhigandaki river basin VDCs. The main habitats of the Assamese monkeys were along the Budhigandaki river basin. More than 200 respondents were selected as sample size from the study area. The respondents were interviewed separately to ensure the independence of the individual response. The questionnaires were designed to obtain the people’s perception on Assamese monkey population change in Budhigandaki river basin area and different aspects of crop raiding by the monkeys such as frequency, time of the day, types of the crop damaged, amount of annual loss due to crop raid and methods adopted to prevent the crop raid. To minimize the bias, questionnaires were asked to the villagers on the expected production of crops without crop raiding and the amounts of crops after raiding. The data were compiled together and calculated in terms of percentages as well as in quintals.

RESULTS AND DISCUSSION

The Kalleri village, Ratmate village, Tarebhir village, Chalise village, Basanta village, Kostar village and Jharlanditar village of Salang village development committee of Dhading district and Baseri village as well as Majhitar village of Ghyalchok village development committee of Gorkha district were found affected by monkey species (Rhesus, Langur and Assamese). Among all these village areas, the Kalleri village and Baseri village as well as Majhitar village were found the most affected areas by the Assamese monkeys. As shown in table 1, according to 23 respondents of Kalleri village, the total crop damage by the monkeys in this village was found 54.6 quintals in which the highest crop loss (6 quintals) was of household person Kashai Ram Darlami. The proximity of his damaged crop field to the forest is about 200 m. It was recorded 4.5 quintals loss in Ratmate village responded by 2 people. In Tarebhir village, the total loss of 9.6 quintals according to 3 respondents was found. The Chalise village crop loss was recorded 1.5 quintals responded by 2 people. It was recorded 4.8 quintals crop loss in Basanta village, 5.7 quintals crop damage in Kostar village and 0.9 quintal crop loss in Jharlanditar village. According to 25 respondents, the total crop damage by the monkeys in Baseri village was found 70.5 quintals in which the highest crop loss was recorded at Sabitri Gurung's crop field which was 7.5 quintals. The main reason of the huge amount of crop loss by the monkeys in her crop field is the proximity of damaged crop field to the forest is about 100 m. In the Majhitar village, the total crop damage by the monkeys was found 82.04 quintals which was responded by 42 local household people. In this village, the highest crop loss was recorded in two household persons' crop field namely Resham Lal Shrestha and Bir Bahadur Gurung which was 5.4 quintals each. The main reason of this huge amount of crop loss by the monkeys in both the household persons' crop field is that the proximity of damaged crop field to the forest is about less than 100 m.

TABLE 1. Village-wise crop damage in quintal by Assamese monkeys.

S.N.	Name of village	Quintals
1.	Kalleri village	54.6
2.	Ratmate village	4.5
3.	Tarebhir village	9.6
4.	Chalise village	1.5
5.	Basanta village	4.8
6.	Kostar village	5.7
7.	Jharlanditar village	0.9
8.	Baseri village	70.5
9.	Majhitar village	82.04

From the study it was found that maize (*Zea mays*) was the highest raided crop, then it was followed by rice (*Oryza sativa*), lentil (*Lens culinaris*), peanut (*Arachis hypogaea*), soyabean (*Glycine max*), wheat (*Triticum aestivum*), fruits, black pulses (*Vigna mungo*), potato (*Solanum tuberosum*), sesham, tomato (*Solanum lycopersicum*), millet (*Pennisetum glaucum*), mustard (*Brassica nigra*), broad beans (*Vicia faba*), brown lentil and pumpkin (*Cucurbita pepo*). The crop raided percentage was calculated as maize 58.43%, rice 11.34%, lentil 8.74%, peanut

4.35%, soyabean 4.18%, wheat 3.22%, fruits 2.97%, black pulses 1.87%, potato 1.67%, sesham 0.92%, tomato 0.79%, millet 0.67%, mustard 0.36%, broad beans 0.25%, brown lentil 0.18% and pumpkin 0.06%. The total crop raided percentage was calculated as 24.62% and the average loss of crop items was calculated as 29.24% (fig. 2).

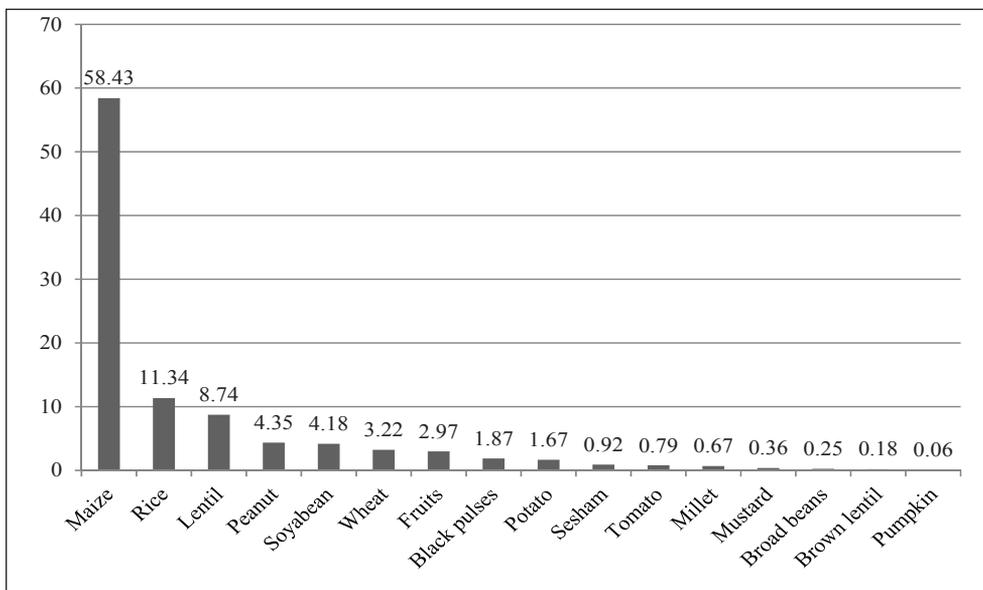


FIG. 2. Percentage of crop raids by Assamese monkeys.

In the study area, a total of 32.21 hectares of crop land was found affected by the monkey species. In that land area, total yield of crop was expected to be 951.15 quintals but 717.01 quintals was observed yield during the study period. It indicates simply that 234.14 quintals of crops was lost by the macaques. The individual crop loss in quintal is tabulated in table 2.

TABLE 2. Individual crop loss in quintal by Assamese monkeys.

S.N.	Crops	Quintals	S.N.	Crops	Quintals
1.	Maize	136.81	9.	Potato	3.91
2.	Rice	26.55	10.	Sesham	2.15
3.	Lentil	20.46	11.	Tomato	1.85
4.	Peanut	10.19	12.	Millet	1.56
5.	Soyabean	9.80	13.	Mustard	0.84
6.	Wheat	7.54	14.	Broad beans	0.58
7.	Fruits	6.95	15.	Brown lentil	0.42
8.	Black pulses	4.38	16.	Pumpkin	0.15

In Nepal, crop damage problem due to primate species especially monkeys species is acute. Crop raiding was found as a major cause of conflict though physical hurt and harassment, taking and grabbing of food materials were also reported as the problems caused by

monkeys. Upreti (1985) reported that buckwheat and barley were raided by wild animals in Langtang and Rara National Parks. Similarly, Jackson (1990) also recorded the damage to crops by monkeys in the southern boundary of the Makalu-Barun Conservation Area (MBCA). Hill (1997) reported that maize was a staple and preferred crop and was less vulnerable to other forms of damage. Chalise (2000b) reported that cereals, fruits and tubers are the most preferred and vulnerable for raiding by macaques in Makalu-Barun Conservation Area. Khatri (2006) also supports that maize is the prominently vulnerable crop for raiding by primates.

During the study in Langtang National Park (LNP) area, Chalise (2010) recorded that the crop depredation due to monkey species was highest in maize (43%) followed by potato (20%), millet (16%), wheat (13%), rice (7%) and buckwheat (1%). Ghimire (2000) recorded in Bandipokhara, Palpa that the highest crop loss due to monkey species was maize (34.12%) followed by potato (23.05%), rice (12.01%), fruits (11.68%), wheat (9.57%), millet (5.13%), buckwheat (2.38%) and pulses (2.06%). Paudel (2016) at his study in Kaligandaki river basin VDCs of Baglung and Parbat districts recorded the highest raided crop as maize 46.95% followed by 15.91% paddy, 15.11% potato, 10.84% millet, 6.88% wheat, 2.05% pulses, 1.59% fruits and 0.66% vegetables whereas Adhikari *et al.* (2018) at Ramdi area of Kaligandaki river recorded the raided crop as maize (35%), vegetables (20%), pulses (13%), fruits (13%), potato (6%) and rice (2%). In this study, it was found that the highest raided crop by Assamese monkeys was the maize 58.43% which was followed by rice 11.34%, lentil 8.74%, peanut 4.35%, soyabean 4.18%, wheat 3.22%, fruits 2.97%, black pulses 1.87%, potato 1.67%, sesham 0.92%, tomato 0.79%, millet 0.67%, mustard 0.36%, broad beans 0.25%, brown lentil 0.18% and pumpkin 0.06%. The average loss of crop items was found 29.24% and the total crop raided percentage was found 24.62%. Chalise (2001) collected the information of crop raiding by the interviews in Lakuwa village of Makalu-Barun Conservation Area and reported that Rhesus and Assamese macaques were the most crop raiders and Langurs visited the least and the villagers blamed that among the two species, Assamese monkey was the terrible than Rhesus. He stated that monkey raid heavily to the maize field 29% then followed potatoes 23% (tubers also), rice 13%, fruits 12%, and millets 12%. The tubers and fruits came to be 35% of the total loss and the total cereals came to be 65% loss in Lakuwa village. Adhikari (2013) found crop raiding by Assamese monkey in Lamjung area, 44% maize followed by 27% potato, 13% millet, 7% wheat, 4% paddy, 3% fruits and 2% vegetables. Regmi (2008) reported crop raiding in Langtang National Park by 62% for maize, 23% for potato, 7% for millet, 6% for buckwheat and 2% for other, which result (maize) is similar to the finding of the present study. The availability of natural edible food items as well as individual number of the monkeys affect the frequency of crop raid in the area.

In this study, a total of 32.21 hectares of crop land was found affected by the monkey species. In that land area, total yield of crop was expected to be 951.15 quintals but 717.01 quintals was observed yield during the study period. It is indicated that 234.14 quintals of crops was lost by the macaques. Paudel (2016) at his study in Kaligandaki river basin VDCs of Baglung and Parbat districts recorded 61.18 hectares of land utilized for the cultivation of crops in which total yield of crop was expected to be 688.29 quintals but 567.74 quintals was observed yield during the study time and only 120.55 quintals of crops was lost by the macaques. This shows

the productivity of the land is higher in Budhigandaki river basin area as compared to that of the Kaligandaki river basin area of Baglung and Parbat districts. The much higher crop loss household person due to Assamese monkeys was Sabitri Gurung of Baseri village, Ghyalchok village development committee of Gorkha district, which was 7.5 quintals. The main reason of the huge amount of crop loss by the monkeys in her crop field is the proximity of damaged crop field to the forest is about 100 m. and only the women who were for gardening the monkeys in the crop fields. On the other hand the very little amount of crop loss due to Assamese monkeys was found on the household person Suku Maya Majhi of Majhitar village, Ghyalchok village development committee of Gorkha district, which was 0.04 quintal. The reason for very little crop loss is the nearer distance of crop fields with the human settlements which is less than 100 m. that help for gardening the monkeys.

Conflicts between people and macaques occur in three broad contexts, all stemming from the macaques' dependence on humans for food, whether directly (i.e. provisioning) or indirectly (crop-raiding, food-stealing). First, macaques damage subsistence and/or cash crops in rural locales (Chakravarthy & Thyagaraj, 2005; Chalise & Johnson, 2005; Hashim *et al.*, 2009; Priston, 2005; Riley, 2007; Supriatna *et al.*, 1992; Suzuki & Muroyama, 2010). Consequently, in agricultural areas, macaques may be viewed as serious vertebrate pests (Engeman *et al.*, 2010; Knight, 1999; Marchal & Hill, 2009; Wang *et al.*, 2006; Wheatley, 2011). In rural Morocco, macaques damage commercially valuable timber by stripping the bark (Camperio Ciani *et al.*, 2001). Second, macaques habituated to close interaction with people at temples and tourist attractions frequently show undesirable behaviors associated with provisioning, including human-directed aggression and food-snatching (Fa, 1992; Fuentes & Gamelr, 2005; Zhao, 2005). Third, in urban towns and cities, macaques are sometimes regarded as a worrisome, potentially dangerous nuisance. Typical problem behaviors include physical aggression towards people, snatching bags, entering and damaging property, stealing food and other items, fouling and raiding garbage (Chauhan & Pirta, 2010a; Cortes & Shaw, 2006; Imam *et al.*, 2002; Md-Zain *et al.*, 2011; Sha *et al.*, 2009; Shek, 2011; Southwick *et al.*, 2005). The 'monkey problem may reach such proportions that urban macaques are regarded as a serious menace (Southwick & Siddiqi, 2011; Southwick *et al.*, 2005; Srivastava & Begum, 2005). A further area of 'conflict' arising from close interaction between people and macaques concerns the potential for zoonotic disease transmission (Fuentes, 2006a; Jones-Engel *et al.*, 2006; Lane *et al.*, 2010).

Considering their wide geographical distribution and taxonomic diversity, the macaques are perhaps the most notorious and successful of 'pest primates'. All species raid crops. Indeed, certain macaque species- the so- called weeds (Richard *et al.*, 1989)- show a preference for foraging in the mosaic of habitats created by human settlement, cultivation and pastoralism and derive a substantial portion of their diet directly or indirectly from people (Richard *et al.*, 1989). Unlike their 'pest' counterparts in Africa- the baboons and vervets-macaques have formed a commensal relationship with people in many Asian nations (Lane *et al.*, 2010; Sha *et al.*, 2009; Singh & Rao, 2004; Southwick *et al.*, 2005). Across Asia, macaques are found in proximity to villages and towns (Aggimarangsee, 1992; Southwick *et al.*, 1961; Watanabe & Muroyama, 2005); some even make a living in densely populated urban areas (e.g. *M.*

mulatta in Indian cities: Mathur & Manohar, 1990; Srivastava & Begum, 2005; *M. fascicularis* in residential Singapore: Lee & Chan, 2011; Sha *et al.*, 2009). This close association with people is facilitated by human cultural attitudes that imbue monkeys with religious and/or symbolic significance (Burton, 2002; Knight, 1999; Wheatley, 1999; Wolfe, 2002). For example, in Hindu mythology, monkeys are revered as representatives of Hanuman, the monkey god, following his key role in the Ramayana, a Hindu Sanskrit epic. Although Hanuman is usually depicted as a langur (*Semnopithecus entellus*), in many Hindu cultures, he has come to represent all monkeys, including macaques. Consequently, orthodox Hindus consider it their sacred duty to feed macaques (Pragatheesh, 2011). More generally, macaques are commonly found in association with Hindu and Buddhist temples throughout south and southeast Asia and southern China, where they are provisioned by devotees and, at some sites, tourists (Aggimarangsee, 1992; Jones-Engel *et al.*, 2006; Loudon *et al.*, 2006; Medhi *et al.*, 2007; Southwick *et al.*, 1961; Wheatley, 1999; Zhao, 2005). Whether the monkeys themselves are objects of worship or rather the sacred temples and shrines they often inhabit (Fuentes *et al.*, 2005), cultural beliefs held in many parts of Asia have traditionally provided a context for tolerance and a measure of protection for macaque populations. Nevertheless, this close coexistence between humans and macaques inevitably leads to conflicts. Moreover, conflicts are increasingly challenging traditional relationships between people and macaques (Knight, 1999; Southwick & Siddiqi, 2011).

Some Assamese monkeys are killed each year due to their crop raiding habit. The local villagers believe that after killing some, other monkeys would scare to raid crops. Though their anger seems natural but this is against the Law and such practice will ultimately hamper the population of endangered and protected wild monkeys of Nepal. If the villagers get chance to alter their crops instead of traditional one, there seems to be no crop raiding.

The highest raided crop by Assamese monkeys was found on maize (58.43%) i.e., 136.81 quintals among the raided crops along the Budhigandaki river basin of central Nepal. Crop damage in Budhigandaki river basin area was found to be a serious social problem which may be due to the proximity of the forest to the human settlements, availability of palatable crops, abundance of safe hiding sites on the rocky outcrops on the bank of Budhigandaki river. Crop damage by wildlife including monkey species is a common problem in the mid-hills of Nepal. Wildlife becomes pest whenever a natural system is weakened. Under a systematic management scheme, such intensity can be balanced. We should educate people on the importance of wildlife and over populated species should be cropped for the well being of people and wildlife themselves.

ACKNOWLEDGEMENTS

We would like to acknowledge sincerely to Prof. Dr. Tej Bahadur Thapa, Head of Department, Central Department of Zoology, Tribhuvan University, Kirtipur and the members of research committee for their kind co-operation. We would like to express our sincere thanks to the field helpers and local villagers of Budhigandaki river basin for their invaluable assistance during our field work. The respondents of the questionnaire survey are acknowledged for providing the valuable information. We would like to thank our parents and family members for their continuous support in the primatological research.

REFERENCES

- ADHIKARI, K; KHANAL, L; CHALISE, M K (2018) Status and effects of food provisioning on ecology of Assamese monkey (*Macaca assamensis*) in Ramdi area of Palpa, Nepal. *Journal of Institute of Science and Technology* 22(2): 183–190.
- ADHIKARI, R K (2013) Population status, distribution and general behavior of Assamese macaque (*Macaca assamensis*, McClelland, 1840) in Taghring and Ghermu VDCs, Lamjung, Nepal. M. Sc. Dissertation, Central Department of Zoology, Tribhuvan University, Nepal.
- AGGIMARANGSEE, N (1992) Survey for semi-tame colonies of macaques in Thailand. *Nat Hist Bull Siam Soc* 40: 103–166.
- AHSAN, M F; UDDIN, M M (2014) Human-Rhesus monkey conflict at Rampur village under Monohardi Upazila in Narsingdi district of Bangladesh. *Journal of Threatened Taxa* 6(6): 5905–5908.
- BEISNER, B A; HEAGERTY, A; SEIL, S K; BALASUBRAMANIAM, K N; ATWILL, E R; GUPTA, B K; TYAGI, P C; CHAUHAN, N P; BONAL, B S; SINHA, P R; MCCOWAN, B (2015) Human-wildlife conflict: proximate predictors of aggression between humans and rhesus macaques in India. *American Journal of Physical Anthropology* 156(2): 286–294.
- BURTON, F D (2002) Monkey King in China: basis for a conservation policy? In: Fuentes A, Wolfe LD (eds) *Primates face to face: the conservation implications of human-nonhuman primate inter-connections*. Cambridge University Press, Cambridge; pp 137–162.
- CAMPERIO CIANI, A; MARTINOLI, L; CAPILUPPI, C; ARAHOU, M; MOUNA, M (2001) Effects of water availability and habitat quality on bark-stripping behavior in Barbary macaques. *Conserv Biol* 15: 259–265.
- CHAKRAVARTHY, A K; THYAGARAJ, N E (2005) Coexistence of bonnet macaques (*Macaca radiata radiata* Geoffroy) with planters in the cardamom (*Elettaria cardamomum* Maton) and coffee (*Coffea arabica* Linnaeus) plantations of Karnataka, South India: hospitable or hostile? In: Paterson JD, Wallis J (eds) *Commensalism and conflict: the human-primate interface*. American Society of Primatologists, Norman; pp 271–293.
- CHALISE, M K (2000b) Behavior study of Assamese monkeys (*Macaca assamensis*) of Makalu-Barun Area, Nepal. In *the proceedings of IIIrd National conference on Science and Technology* 2: 1323–1332.
- CHALISE, M K (2001) Crop raiding by wildlife, specially primates and indigenous knowledge of food conservation. In: *Asian Primates* 7(3-4): 4–9.
- CHALISE, M K; JOHNSON, R L (2005) Farmer attitudes toward the conservation of “pest” monkeys: the view from Nepal. In: Paterson JD, Wallis J (eds) *Commensalism and conflict: the human-primate interface*. American Society of Primatologists, Norman; pp 223–239.
- CHALISE, M K (2010) A study of Assamese monkey in Sebrubeshi of Langtang National Park, Nepal. *Journal of Natural History Museum* 25: 54-61.
- CHAUHAN, A; PIRTA, R S (2010a) Agonistic interactions between humans and two species of monkeys (rhesus monkey *Macaca mulatta* and hanuman langur *Semnopithecus entellus*) in Shimla, Himachal Pradesh. *J Psychol* 1: 9–14.
- CORTES, J; SHAW, E (2006) The Gibraltar macaques: management and future. In: Hodges JK, Cortes J (eds) *The Barbary macaque: biology, management and conservation*. Nottingham University Press, Nottingham; pp 199–210.
- ENGEMAN, R M; LABORDE, J E; CONSTANTIN, B U; SHWIFF, S A; HALL, P; DUFFINEY, A; LUCIANO, F (2010) The economic impacts to commercial farms from invasive monkeys in Puerto Rico. *Crop Prot* 29: 401–405.

Ghimire and Chalise: Status of crop raiding by Assamese monkeys.....303

- FA, J E (1992) Visitor-directed aggression among the Gibraltar macaques. *Zoo Biol* 11: 43–52.
- FUENTES, A; 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. *Am J Primatol* 66: 197–204.
- FUENTES, A; SOUTHERN, M; SUARYANA, K G (2005) Monkey forests and human landscapes: is extensive sympatry sustainable for *Homo sapiens* and *Macaca fascicularis* on Bali? In: Paterson JD, Wallis J (eds) Commensalism and conflict: the human-primate interface. *American Society of Primatologists*, Norman; pp 168–195.
- FUENTES, A (2006a) Human culture and monkey behavior: assessing the contexts of potential pathogen transmission between macaques and humans. *Am J Primatol* 68: 880–896.
- GHIMIRE, S C (2000) Study of Rhesus monkeys (*Macaca mulatta*) of Bandipokhara VDC Area, Palpa, Nepal. M.Sc. Dissertation, Central Department of Zoology, Tribhuvan University, Kirtipur.
- HASHIM, N R; ABDUL MANAN, M S; NAZLI, M F (2009) Using geographic information system to predict primate crop raiding in Peninsular Malaysia. *IUP J Environ Sci* 3(4): 39–46.
- HILL, C M (1988) Conflicting attitudes towards elephants around the Budongo Forest Reserve, Uganda. *Environmental Conservation* 25(3): 218–228.
- HILL, C M (1997) Crop-raiding by wild vertebrates: The farmer's perspective in an agricultural community in western Uganda. *International Journal of Pest Management* 43(1): 77–84.
- HILL, C; OSBORN, F; PLUMPTRE, A J (2002) Human-wildlife conflict: identifying the problem and possible solutions, vol.1, Albertine Rift Technical Report Series., New York: *Wildlife Conservation Society*.
- HILL, C M; WEBBER, A D (2010) Perceptions of nonhuman primates in human-wildlife conflict scenarios. *American Journal of Primatology* 72(10): 919–924.
- HOCKINGS, K; HUMLE, T (2009) Best practice guidelines for the prevention and mitigation of conflict between humans and great apes. Gland, Switzerland: IUCN/SSC Primate Specialist Group (PSG); pp 41.
- IMAM, E; YAHYA, H S A; MALIK, I (2002) A successful mass translocation of commensal rhesus monkeys *Macaca mulatta* in Vrindaban, India. *Oryx* 36: 87–93.
- JACKSON, R (1990) Threatened wildlife, crop and livestock depredation and grazing in the Makalu-Barun Conservation Area. Makalu-Barun Conservation Project, DNPWC, Nepal. Report No. 12.
- JOLLY, A (1985) The evolution of primate behavior. Second edition. MacMillan publishing company, New York, USA.
- JONES-ENGEL, L; ENGEL, G A; HEIDRICH, J; CHALISE, M K; POUDEL, N; VISCIDI, R; BARRY, P A; ALLAN, J S; GRANT, R; KYES, R C (2006) Temple monkeys and health implications of commensalism, Kathmandu, Nepal. *Emerg Infect Dis* 12: 900–906.
- KHATRY, P (2006) Study on monkey-human conflict in Vijayapur area, Dharan, eastern Nepal. M. Sc. Dissertation, Tribhuvan University, Kathmandu, Nepal.
- KHATUN, U H; AHSAN, M F; ROSKAFI, E (2013) Local people's perceptions of crop damage by common Langurs (*Semnopithecus entellus*) and human-langur conflict in Keshabpur of Bangladesh. *Environment and Natural Resources Research* 3(1): 111–126.
- KNIGHT, J (1999) Monkeys on the move: the natural symbolism of human-macaque conflict in Japan. *J Asian Stud* 58: 622–647.
- LANE, K E; LUTE, M; ROMPIS, A; WANDIA, I N; PUTRA, I G A A; HOLLOCHER, H; FUENTES, A (2010)

Pests, pestilence, and people: the long-tailed macaque and its role in the cultural complexities of Bali. In: Gursky-Doyen S, Supriatna J (eds) Indonesian primates. Springer, New York; pp 235–248.

LEE, B P Y -H; CHAN, S (2011) Lessons and challenges in the management of long-tailed macaques in urban Singapore. In Gumert, MD; Fuentes, A; Jones-Engel, L (eds) Monkeys on the edge: ecology and management of long-tailed macaques and their interface with humans. Cambridge University Press, Cambridge; pp 307–313.

LOUDON, J E; HOWELLS, M E; FUENTES, A (2006) The importance of integrative anthropology: a preliminary investigation employing primatological and cultural anthropological data collection methods in assessing human-monkey co-existence in Bali, Indonesia. *Ecol Environ Anthropol* 2: 2-13.

MARCHAL, V; HILL, C (2009) Primate crop-raiding: a study of local perceptions in four villages in North Sumatra, Indonesia. *Primate Conserv* 24: 107-116.

MATHUR, R; MANOHAR, B R (1990) Density of *Macaca mulatta* and *Presbytis entellus* in the old city of Jaipur: a three year survey. *Appl Anim Behav Sci* 27: 351-361.

MD-ZAIN, B M; TARMIZI, M R; MOHD-ZAKI, M (2011) Campus monkeys of University Kebangsaan Malaysia: nuisance problems and students' perceptions. In Gumert, MD; Fuentes, A; Jones-Engel, L (eds) Monkeys on the edge: ecology and management of long-tailed macaques and their interface with humans. Cambridge University Press, Cambridge; pp 101–117.

MEDHI, R; CHETRY, D; BASAVDATTA, C; BHATTACHARJEE, P C (2007) Status and diversity of temple primates in northeast India. *Primate Conserv* 22: 135–138.

PAUDEL, P K (2016) Conflict due to Assamese macaques (*Macaca assamensis* McClelland 1840) and crop protection strategies in Kaligandaki river basin, western Nepal. *Our Nature* 14(1): 107–114. DOI: <http://dx.doi.org/10.3126/on.v14i1.16449>

PRAGATHEESH, A (2011) Effect of human feeding on the road mortality of rhesus macaques on National Highway-7 routed along Pench Tiger Reserve, Madhya Pradesh, India. *J Threat Taxa* 3: 1656–1662.

PRISTON, N E C (2005) Crop-raiding by *Macaca ochreata brunnescens* in Sulawesi: reality, perceptions and outcomes for conservation. PhD thesis. Cambridge University Press, Cambridge, U.K..

REGMI, G R (2008) Status of Assamese macaque (*Macaca assamensis*, McClelland 1840) in Langtang National Park. M.Sc. Dissertation, Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal.

RICHARD, A F; GOLDSTEIN, S J; DEWAR, R E (1989) Weed macaques: the evolutionary implications of macaque feeding ecology. *Int J Primatol* 10: 569–594.

RILEY, E P (2007) The human-macaque interface: conservation implications of current and future overlap and conflict in Lore Lindu National Park, Sulawesi, Indonesia. *Am Anthropol* 109: 473–484.

SANJAY, M; DOUGLAS, B J; WOLFGANG, D; ARDITH, E; AJITH, K; MEWA, S; FEEROZ, M M; CHALISE, M K; PADMA, P S W; SALLY, W (2003) Status of south Asian Primates: Conservation Assessment and Management Plan (CAMP) workshop report, Zoo Outreach Organization/CBSG- south Asia, Coimbatore, India; viii+432 pp.

SEORAJ-PILLAI, N; PILLAY, N (2016) A meta-analysis of human-wildlife conflict: South African and global perspectives. *Sustainability* 9(1): 34.

SHA, J C M; GUMERT, M D; LEE, B P Y -H; JONES-ENGEL, L; CHAN, S; FUENTES, A (2009) Macaca-human interactions and the societal perceptions of macaques in Singapore. *Am J Primatol* 71: 825–839.

Ghimire and Chalise: Status of crop raiding by Assamese monkeys.....305

- SHEK, C T (2011) Management of nuisance macaques in Hong Kong. *In* Gumert, MD; Fuentes, A; Jones-Engel, L (eds) *Monkeys on the edge: ecology and management of long-tailed macaques and their interface with humans*. Cambridge University Press, Cambridge; pp 297–301.
- SING, M; RAO, N R (2004) Population dynamics and conservation of commensal bonnet macaques. *Int J Primatol* 25: 847–859.
- SOUTHWICK, C H; BEG, M A; SIDDIQI, M R (1961) A population survey of rhesus monkeys in villages, towns and temples of northern India. *Ecology* 42: 538–547.
- SOUTHWICK, C H; MALIK, I; SIDDIQI, M F (2005) Rhesus commensalism in India: problems and prospects. *In* Paterson, J D; Wallis, J (eds) *Commensalism and conflict: the human-primate interface*. *American Society of Primatologists*, Norman; pp 241–257.
- SOUTHWICK, C H; SIDDIQI, M F (2011) India's rhesus populations: protectionism versus conservation management. *In* Gumert, M D; Fuentes, A; Jones-Engel, L (eds) *Monkeys on the edge: ecology and management of long-tailed macaques and their interface with humans*. Cambridge University Press, Cambridge; pp 275–292.
- SRIVASTAVA, A; BEGUM, F (2005) City monkeys (*Macaca mulatta*): a study of human attitudes. *In* Paterson, JD; Wallis, J (eds) *Commensalism and conflict: the human-primate interface*. American Society of Primatologists, Norman; pp 259–269.
- SUPRIATNA, J; FROEHLICH, J W; ERWIN, J E; SOUTHWICK, C H (1992) Population, habitat and conservation status of *Macaca maurus*, *Macaca tonkeana* and their putative hybrids. *Trop Biodivers* 1: 31–48.
- SUZUKI, K; MUROYAMA, Y (2010) Resolution of human-macaque conflicts: changing from top-down to community-based damage management. *In* Nakagawa, N; Nakamichi, M; Sugiura, H (eds) *The Japanese macaques*. Springer, Tokyo; pp 359–373.
- UPRETI, B N (1985) Park people interface problems and new directions. Report of international workshop on management of national parks and protected areas of the Hindukush Himalayas, Kathmandu; pp 19–24.
- WANG, S W; CURTIS, P D; LASSOIE, J P (2006) Farmer perceptions of crop damage by wildlife in Jigme Singye Wangchuck National Park, Bhutan. *Wildl Soc Bull* 34: 359–365.
- WATANABE, K; MUROYAMA, Y (2005) Recent expansion of the range of Japanese macaques, and associated management problems. *In* Paterson, J D; Wallis, J (eds) *Commensalism and conflict: the human-primate interface*. American Society of Primatologists, Norman; pp 401–419.
- WHEATLEY, B P (1999) *The sacred monkeys of Bali*. Waveland Press, Prospect Heights.
- WHEATLEY, B P (2011) Ethnophoresy: the exotic macaques of Ngeaur Island, Republic of Palau. *In* Gumert, MD; Fuentes, A; Jones-Engel, L (eds) *Monkeys on the edge: ecology and management of long-tailed macaques and their interface with humans*. Cambridge University Press, Cambridge; pp 118–156.
- WOLFE, L D (2002) Rhesus macaques: a comparative study of two sites, Jaipur, India, and Silver Springs, Florida. *In* Fuentes, A; Wolfe, L D (eds) *Primates face to face: the conservation implications of human-nonhuman primate interconnections*. Cambridge University Press, Cambridge; pp 310–330.
- ZHAO, Q K (2005) Tibetan macaques, visitors, and local people at Mt. Emei: problems and counter-measures. *In* Paterson, J D; Wallis, J (eds) *Commensalism and conflict: the human-primate interface*. American Society of Primatologists, Norman; pp 377–399.