

*Journal of*  
**Threatened**  
**Taxa**

*Building evidence for conservation globally*

10.11609/jott.2021.13.14.20143-20310  
[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

26 December 2021 (Online & Print)  
Vol. 13 | No. 14 | Pages: 20143-20310

ISSN 0974-7907 (Online)  
ISSN 0974-7893 (Print)

*Open Access*







ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher  
**Wildlife Information Liaison Development Society**  
www.wild.zooreach.org

Host  
**Zoo Outreach Organization**  
www.zooreach.org

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Caption: Large Indian Civet *Viverra zibetha*, Tricoloured Munia *Lonchura malacca* and *Hoya wightii* (Medium—pencil crayon on watercolour paper) © Supriya Samanta.



## Crop and property damage caused by Purple-faced Langurs *Trachypithecus vetulus* (Mammalia: Primates: Cercopithecidae)

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Sri Lanka is an excellent area to study the relationships between Humans *Homo sapiens* and commensal primates: the island is home to slender lorises, macaques and langurs and, for the last 40,000 years or so, humans (Nekaris & de Silva Wijeyeratne 2007; Nijman & Nekaris 2013). The extensive presence of home gardens, mimicking the forest structure by adopting different layers, allows primates to come into close contact with humans, and the predominant religions adopted by Sri Lankans may facilitate a peaceful co-existence (cf. Rudran 2008; Rudran et al. 2021). Repeated crop-raiding and conflict over space, however, may cause people to become increasingly intolerant to primates.

Wijethilaka et al. (2021) lamented the small number of reports on conflicts between Humans and Western Purple-faced Langur *Trachypithecus vetulus nestor*. In their introduction and discussion Wijethilaka et al. (2021) refer to a large number of studies that report on Human-primate conflict and crop-raiding involving a wide range of primate species, including Chimpanzees *Pan troglodytes*, Olive Baboons *Papio anubis*, Red-tailed Monkeys *Cercopithecus ascanius*, Vervet Monkeys *Chlorocebus pygerythrus*, Rhesus Macaques *Macaca mulatta*, Hanuman Langurs *Semnopithecus entellus*, and Bonnet Macaques *Macaca radiata*. What they

overlooked were those studies that had been conducted on Western Purple-faced Langurs. To rectify this and to provide the reader of the *Journal of Threatened Taxa* with a more complete (chronological) overview I here give brief summaries of the outcomes of these studies and how they concur or contrast with that reported by Wijethilaka et al. (2021).

Wijethilaka et al. (2021) evaluated the intensity of Human-langur conflict through the identification of the crop and property damages caused by these langurs. Their assessment was based on interviews with 80 households in villages bordering Danawkanda Forest in western Sri Lanka collected over a six-month period in 2014-2015. They also quantified the loss (financial and otherwise) reportedly incurred to these households. Over 90% of the interviewees indicated that the damage had been done to commercially important plants (primarily Banana *Musa paradisiaca*, Papaya *Carica papaya*, Rambutan *Nephelium lappaceum* and Mango *Mangifera indica*). Three-quarter reported damage of roof tiles and over 40% reported having had frightful encounters with the langurs. Wijethilaka et al. (2021) found a strong negative correlation between the amount of money spent on firecrackers (a proxy for the intensity of crop raiding and used by 99% of the interviewees)

**Date of publication:** 26 December 2021 (online & print)

**Citation:** Nijman, V. (2021). Crop and property damage caused by Purple-faced Langurs *Trachypithecus vetulus* (Mammalia: Primates: Cercopithecidae). *Journal of Threatened Taxa* 13(14): 20302–20306. <https://doi.org/10.11609/jott.7401.13.14.20302-20306>

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**Competing interests:** The author declares no competing interests.

**Acknowledgements:** Thank Lilia Bernede, Alex Boulton, Richard Moore, Anna Nekaris, Will Westwood, and Gehan da Silva Wijeyratne for sharing their experiences with Sri Lanka's primates. I thank the editor and a reviewer for constructive comments and suggestions for improvement.

**Table 1. Non-exhaustive overview of research conducted on Purple-faced Langurs (sometimes in addition to other primates or vertebrates). Researcher(s) only list one of the main persons involved, but it is acknowledged that the team often comprised more people. Dates in Italics indicate periodic monitoring or intermittent studies with gaps of up to two years. Ethnoprimatology includes studies on crop-raiding and human-wildlife conflict. Methods for ethnoprimatological studies: A—direct observation of langurs and people | B—interviews and questionnaires | C—workshops.**

Period	Researcher(s)	Location	Topics studied	Methods	Example reference
ii 1968–iv 1970	R. Rudran	Horton Plains, Polonnaruwa	Ecology, behaviour		Rudran 1973
iii 1969–ii 1970	C.M. Hladik	Polonnaruwa	Ecology		Hladik 1977
ii 1985–ii 1987	J.D.S. Dela	Piliyanadala, Panadura	Ecology, behaviour		Dela 2007
<i>iii 1987–xii 2006</i>	J.D.S. Dela	Piliyanadala, Panadura	Ecology, behaviour, ethnoprimatology	A, B	Dela 2011
<i>1998–2018</i>	W.P.J. Dittus	Polonnaruwa	Ethnoprimatology	A, B, C	Dittus et al. 2019
<i>vi 2000–xii 2001</i>	P. Jayasekara	Sinharaja	Behaviour		Jayasekara et al. 2007
<i>v 2001–vii 2010</i>	K.A.I. Nekaris	Island-wide	Ethnoprimatology	A, B, C	Nekaris et al. 2013
<i>? 2004–ii 2007</i>	C.A.D. Nahallage	Island-wide	Ethnoprimatology	A, B	Nahallage et al. 2008
<i>vi 2004–vii 2008</i>	R.S. Moore	Talangama, Masmullah	Ecology, behaviour, ethnoprimatology	A, B	Douglas et al. 2008
<i>vi–vii 2007</i>	R. Rudran	West	Ethnoprimatology	A, B	Rudran 2008
<i>vii 2008–xi 2009</i>	R.P. Vandercone	Kaludiyapokuna	Ecology, behaviour		Vandercone et al. 2012
<i>vi 2009–xii 2010</i>	R. Rudran	Waga	Ecology, behaviour		Rudran et al. 2008
<i>vii 2014–i 2015</i>	S. Wijethilaka	Danawkanda	Ethnoprimatology	B	Wijethilaka et al. 2021
<i>i 2015–ix 2016</i>	C.A.D. Nahallage	Mihintale	Ecology, behaviour, ethnoprimatology	B	Kumara et al. 2019
<i>ii 2015–iii 2019</i>	R. Rudran	Island-wide	Ethnoprimatology	B, C	Cabral et al. 2018
<i>iv–xi 2016</i>	W.A.D.S.N. Weerakkody	Delkanda, Homagama	Ecology		Weerakkody et al. 2018
<i>v–vii 2018</i>	C.A.D. Nahallage	Mihintale	Ethnoprimatology	B	Westwood 2018

and the distance between Danawkanda Forest and the interviewees' residence or fields. The research I refer to that also reports on crop and property damage caused by Western Purple-faced Langurs was based on interviews, similar to Wijethilaka et al. (2021), workshops, direct observations, and often a combination of these methods (Table 1).

In their 'Primates of Sri Lanka', Nekaris & de Silva Wijeyeratne (2007), based on extended periods of fieldwork in western Sri Lanka, noted specifically for the Western Purple-faced Langur that because the animals eventually come into contact with people, conflict is inevitable. This conflict mainly involved crop raiding (primarily of fruit trees) and using rooftops as 'runways' and thereby damaging the tiles. Interviews with local people showed that conflict was greatest in areas with the largest populations (of langurs), and in particular with those people who came into daily contact with the langurs. They noted that conflict can be so severe that landowners may shoot the langurs (Nekaris & de Silva Wijeyeratne 2007).

Parker et al. (2008) conducted 735 interviews throughout the range of the Western Purple-faced

Langur. At the village level, estimates of local langur population size (by means of counting langurs directly as well as interviews) did not correlate with positive or negative perceptions towards langurs but the proportion of interviewees that held negative views towards the langurs was correlated with the time the langurs spent in their gardens and farmland (more time equates to more negative feelings). A quarter of all interviewees considered the langurs a nuisance, primarily because, just as in Wijethilaka et al.'s study, of the langurs raiding on Jackfruit *Arctocarpus heterophylus*, Rambutan, Banana and Mango. Destruction of roof tiles was reported as a problem. Several deterrents were used by the interviewees to drive langurs from their land, including throwing stones, shouting or setting dogs on them, and using firecrackers. Nijman & Nekaris (2008) noted that the Western Purple-faced Langur appeared to be largely dependent on fruit grown in traditional home gardens, making the langurs almost wholly dependent on the tolerance of local people. With increasing urbanization, perceptions by local people of the langurs had changed for the worse. Negative attitudes towards the langurs increased with the amount of time langurs spend in

close proximity to people. Besides the loss of habitat, attacks on langurs by landowners' and stray Dogs *Canis familiaris* add another source of mortality, and the need for arboreal continuity has put them into lethal contact with electric power lines in this urban domain.

Eschmann et al. (2008) and Moore et al. (2010), over a seven-month period, studied five groups of Western Purple-faced Langur and Humans in a suburban area in Talangama, where the langur's homeranges completely overlapped with Human living space. Twelve of the thirteen trees most used for feeding by the langurs were also used by Humans, with Jack Fruit, Mangos and Rambutans topping the list. They noted that when langurs crossed rooftops of occupied houses, the owners often chased them away or complained about damage the langurs caused. The most common methods to chase the langurs out of feeding trees or off rooftops were using firecrackers followed by throwing stones. Eschmann et al. (2008) reported that to the meagre canopy continuity in Talangama exposed much of the langurs' homeranges to direct sunlight. While this in turn led to the langurs to start calling earlier in the morning compared to groups living in forests, overall Eschmann et al. (2008) found the langurs to be remarkably desensitised to the effects of most Human activities.

Nijman & Nekaris (2010) analysed data from 48 interviewees from villages with and without forest in its vicinity and found that the intensity of conflict, and especially reports of the killing of langurs, was higher in villages where the forest was no longer present. The amount of forest and trees buffers against the need to feed on Human-grown foods or the use of man-made structures as arboreal pathways.

Of all the studies reported here, the one by Dela (2011) is most closely aligned to that of Wijethilaka et al. (2021) in terms of methodology, results, and conclusions. In 1987, she conducted a questionnaire survey with 112 participants in Panadura and Piliyandalawhere where she also studied the langurs (Dela 2007). Roof and crop damage were the most frequently cited damage (64% and 23% of interviewees, respectively) and conflict was most prominent when the langurs fed on Mango, Banana and Bread Fruit *A. incisus*. Two-thirds of the interviewees resorted to making loud noises (firecrackers, shouting) and one third to throwing stones or using slingshots or catapults to deter crop raiding. When corrected for inflation to June 2021, the distribution of household income in Dela's (2011) study was similar to that of Wijethilaka et al. (2021), with ~80% of people earning less than US\$160–180 month<sup>-1</sup>. While the desire to destroy langurs was higher in households with an income of over

US\$160 month<sup>-1</sup> compared to those that earned less (i.e., 12.5% vs 6.2%) the difference was not statistically significant (Dela 2011). Dela's (2011) is one of the most comprehensive study on how the perceptions and real day-to-day experiences of people have an effect of on both the langur's habitat and the langurs themselves and her findings and conclusions, despite being partially based on a survey conducted over three decades ago, ring true to this day.

Nijman and Nekaris (2013) advocated the adoption an ethnographic perspective as this would allow for mitigation policies to be defined with regard to a local cultural context in which traditions and religious parameters often exist for the preservation or to the detriment of wildlife. Based on 182 days of observations of langurs (and Toque Macaques *M. sinica*) and an interview survey of 1,036 people they assessed levels of conflict between Humans and primates both in an agricultural and urban context. With respect to the Western Purple-faced Langur they found generally high levels of tolerance in both settings, but high levels of crop-raiding along the forest edge and frequent use of roofs as part of arboreal pathways caused discontent. They concluded that a heavy reliance on fruit by otherwise folivorous langurs may compromise their dietary needs and parasite loads of commensal primates were suspected to be unhealthily high.

Weerakkody et al. (2018) found that in urban and semi-urban landscapes the homerange size of Western Purple-faced Langurs is both determined by the resource base (e.g., the number of fruiting trees) and impassable boundaries (rice fields, houses); these anthropogenetic factors hinder the movement of the arboreal langurs across the landscape, and may explain the proximate causes of Human-langur conflict.

Rudran et al. (2020b) addressed in detail and with great consideration how to deal the issue of engaging local communities in the conservation of Western Purple-faced Langurs at a time when the people are facing difficulties caused by the conflicts with the langurs. While they did not present new data on crop or property damage caused by the langurs, the solutions they offer are relevant to the challenges highlighted by Wijethilaka et al. (2021). Finally, for completeness I will discuss Rudran et al. (2021) who reported on a mitigating Human-primate conflict study by means of interviewing people from 11 districts in Sri Lanka. This paper appeared after the publication of Wijethilaka et al. (2021) but data collection for this study had commenced only one year after Wijethilaka et al. (2021) had finished collecting theirs (viz., it ran from January



2016 to June 2018). While Rudran et al. (2021)'s study covered all three diurnal primate species, some of their data can be attributed to Western Purple-faced Langurs as it specifies data for Colombo District. Of the 147 people interviewed in Colombo, 70% were Buddhist and 8% Hindu. In contrast to reports by Wijethilaka et al. (2021) levels of tolerance towards Western Purple-faced Langurs was high (ranked 4.3 on a scale from 1 to 6) something that Rudran et al. (2021) attributed to the majority of interviewees practising Buddhism which preaches compassion to all living beings. The reported monthly cost, corrected for inflation to June 2021, of damage due to Western Purple-faced Langur and Toque Macaques in Colombo ranged from less than US\$2.79 (19% of respondents), US\$2.80-5.59 (36%), US\$5.60-27.96 (28) to more than US\$27.97 (16%). This is within the same range as the monthly average of US\$10.05-18.10 reported by Wijethilaka et al. (2021).

The overview presented here demonstrate that a great deal is known conflict between Humans and Western Purple-faced Langurs. This is not surprising as arguably the Purple-faced Langur is among the most thoroughly studied colobine monkeys globally (Table 1). It is also clear that over time there has been a shift in research focus from purely ecology and behaviour of the langurs in the 1970s to 1990s to a mixture of ecology and behaviour, and ethnoprimateology during the last two decades (Table 1). There is a great level of concordance between the data from Danawkanda and that from Panadura, Piliyandala and Talangama, and indeed other sites. What remains unanswered are the possible underlying factors for the apparent differences. For instance, Wijethilaka et al. (2021) make no mention of langurs being electrocuted or killed by dogs, while this did come up prominently in the studies of Parker et al. (2008), Nijman & Nekaris (2008), Moore et al. (2010), Dela (2011) and indeed Rudran (2008), and Nahallage et al. (2008). It is possible that there are no dogs in Danawkanda (or no dog large enough to do harm to Purple-faced Langurs), and perhaps there are still enough natural arboreal pathways for the langurs to use so they can avoid powerlines (it is even possible that there are no powerlines), but a proper comparison by Wijethilaka et al. (2021) of their data with that collected by others could have made that clear. Shooting at Purple-faced Langurs with air-rifles or pellet guns is also commonly mentioned –Wijethilaka et al. (2021) pooled this with the use of catapults and reported that 18% of household in Danawkanda used this method– but there seems to be significant variations in its frequency. In 2011 the Ministry of Coconut Development and State Plantations

as well as local Directors of Planning, endorsed the idea of issuing air rifles to farmers and planters to ward off primates and Common Giant Squirrel *Ratufa macroura* from damaging their crops (Rodrigo 2011; Sugathapala & Wijeweera 2011; Dittus et al. 2019), but at present it is unclear what the uptake of this has been and the effects it has on Purple-faced Langurs.

In conclusion, despite the langur's small area of occupancy (2,000 km<sup>2</sup>) and its small population size (Rudran et al. 2020b) I find that over the last decades a number of studies have been published on the interactions between Humans and Western Purple-faced Langurs (Table 1), the perceptions that people have towards the langurs, especially in (semi-)urbanised areas, and how to best mitigate any negative effects of having langurs and people living in close proximity. For primate conservation to work in Sri Lanka sharing space with monkeys and ensuring levels of Human tolerance towards primates remain high is paramount (in addition to having enough areas set aside specifically for primates and other wildlife: Dittus et al. 2021). The findings by Wijethilaka et al. (2021) in terms of the proportion of people that report crop damage or damage to roofs is high in comparison with earlier studies, which may reflect a decrease in tolerance towards the langurs, differences in methodology or it may reflect random geographical differences.

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NAAS rating (India) 5.64

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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

December 2021 | Vol. 13 | No. 14 | Pages: 20143–20310

Date of Publication: 26 December 2021 (Online & Print)

DOI: 10.11609/jott.2021.13.14.20143-20310

[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

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