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SHORT COMMUNICATION

SMALL CARNIVORES OF THE MONTANE FORESTS OF ERAVIKULAM NATIONAL PARK IN THE WESTERN GHATS, INDIA

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Small carnivores of the montane forests of Eravikulam National Park in the Western Ghats, India

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Abstract: The study of small carnivores of the montane forests of Eravikulam National Park in the southern Western Ghats, India recorded nine species of small carnivores using the camera trapping technique. These include three species of Mongoose (Herpestidae), two species each of lesser cats (Felidae) and civets (Viverridae), one species each of Otter and Marten (Mustelidae). They are Stripe-necked Mongoose *Herpestes vitticollis,* Brown Mongoose *Herpestes fuscus,* Indian Grey Mongoose *Herpestes edwardsii,* Jungle Cat *Felis chaus,* Leopard Cat *Prionailurus bengalensis,* Common Palm Civet *Paradoxurus hermaphrodites*, Small Indian Civet *Viverricula indica*, Asian Small-clawed Otter *Aonyx cinereus*, and Nilgiri Marten *Martes gwatkinsii*. It is interesting to note that the felines (lesser cats) are the more common small carnivores in the montane forests. *Felis chaus* was the most abundant small carnivore, which is followed by *Prionailurus bengalensis* and *Herpestes vitticollis*. Two species are Vulnerable as per the IUCN Red List, viz., *Martes gwatkinsii* and *Aonyx cinereus*.

Keywords: Camera trapping, endemism, Eravikulam National Park, Felidae, Herpestidae, Idukki, IUCN Red List, Kerala, Mustelidae, Viverridae.

The montane landscape (>1500m) in the Western Ghats, a biodiversity hotspot, is situated in the hills of Nilgiris, Anamalais, Palni, High Wavies and Agasthyamalai Hills. The natural vegetation in these montane landscapes is dominated by the grasslands, classified as 11A/C_1-Southern Montane Wet Grasslands (Champion & Seth 1968). These grasslands are interspersed with isolated, compact and sharply defined stunted evergreen trees, locally known as sholas (Images 1 & 2) and classified as 11A/DS_2 - southern wet temperate forests (Champion & Seth 1968). The sholas are confined to the sheltered valleys, while the mountain tops are occupied by grasslands (Ranganathan 1938; Meher-Homji 1965; Jose et al. 1994; Thomas & Palmer 2007). Of the 16 small carnivores of Western Ghats, all except the Honey Badger *Mellivora capensis,* are known to occur in Kerala (Mudappa 2013; Nameer 2015); the small carnivore community shows a high degree of endemism in the Western Ghats. The Brown Palm Civet and the Nilgiri Marten are endemic to the Western Ghats at species level while the Stripe-necked Mongoose and the Brown Mongoose are endemic to the Western Ghats at the sub-species level (Pocock 1941; Menon 2014).

Small carnivore species diversity studies were reported from different landscapes and protected areas in southern India. For example, eight species of small carnivores were reported from Kalakad-Mundanthurai Tiger Reserve (Mudappa 2002), 11 species from Karnataka State (Kumara & Singh 2006a,b), seven species from the southern Western Ghats (Pillay 2009), nine species from the Biligiri Rangaswamy Temple Tiger

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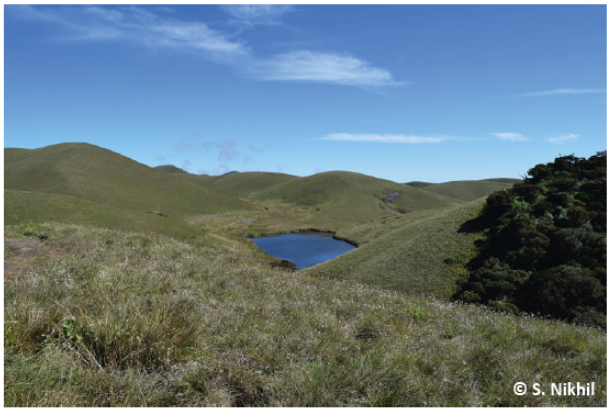

Images 1 & 2. The montane grassland-shola habitat at Eravikulam

Reserve, Karnataka (Kumara et al. 2014), and 11 species from Parambikulam Tiger Reserve (Sreehari & Nameer 2016).

A study was conducted between 2014 and 2015 on the small carnivores of the montane landscape of Eravikulam National Park in the southern Western Ghats. We report the findings on the occurrence and abundance of small carnivores in this paper, which is expected to serve as baseline information on these lesser-known taxa from a hitherto unexplored habitat.

Study area and Methods

Eravikulam National Park (ENP) extends to 97km^2 and lies within the latitudes 10^{0}05'–10^{0}20'N and longitudes 77^{0}E–77^{0}10'E in Idukki District of Kerala State (Fig. 1), the southern Western Ghats. The average elevation of ENP is 2,000m, with the altitude ranging from 1800–2685 m, constituting an excellent example of a montane landscape. Anamudi (2695m), the highest peak in peninsular India, is located in ENP, which is surrounded by Chinnar Wildlife Sanctuary and Marayur Sandal Forest Division in the north-east, Anamudi National Park to the east, Mankulam Forest Division to the west, and Munnar Forest Division to the south.

The mean maximum temperature is 24^{0}C and the mean minimum temperature is 10.5^{0}C. January is the coolest month with the maximum and minimum temperatures varying between 15.3 to -3 ^{0}C (Rice 1984). The mean annual rainfall is 5,238mm, with its peak during June to August. The hills also experience fog

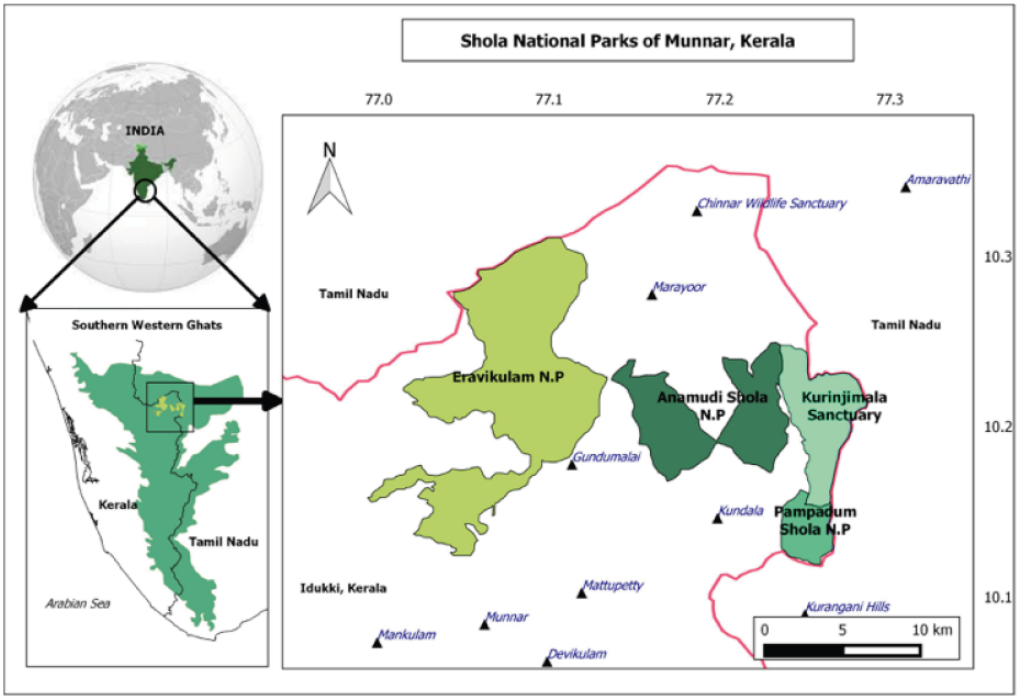

Figure 1. Location Map of montane landscape of Eravikulam National Park

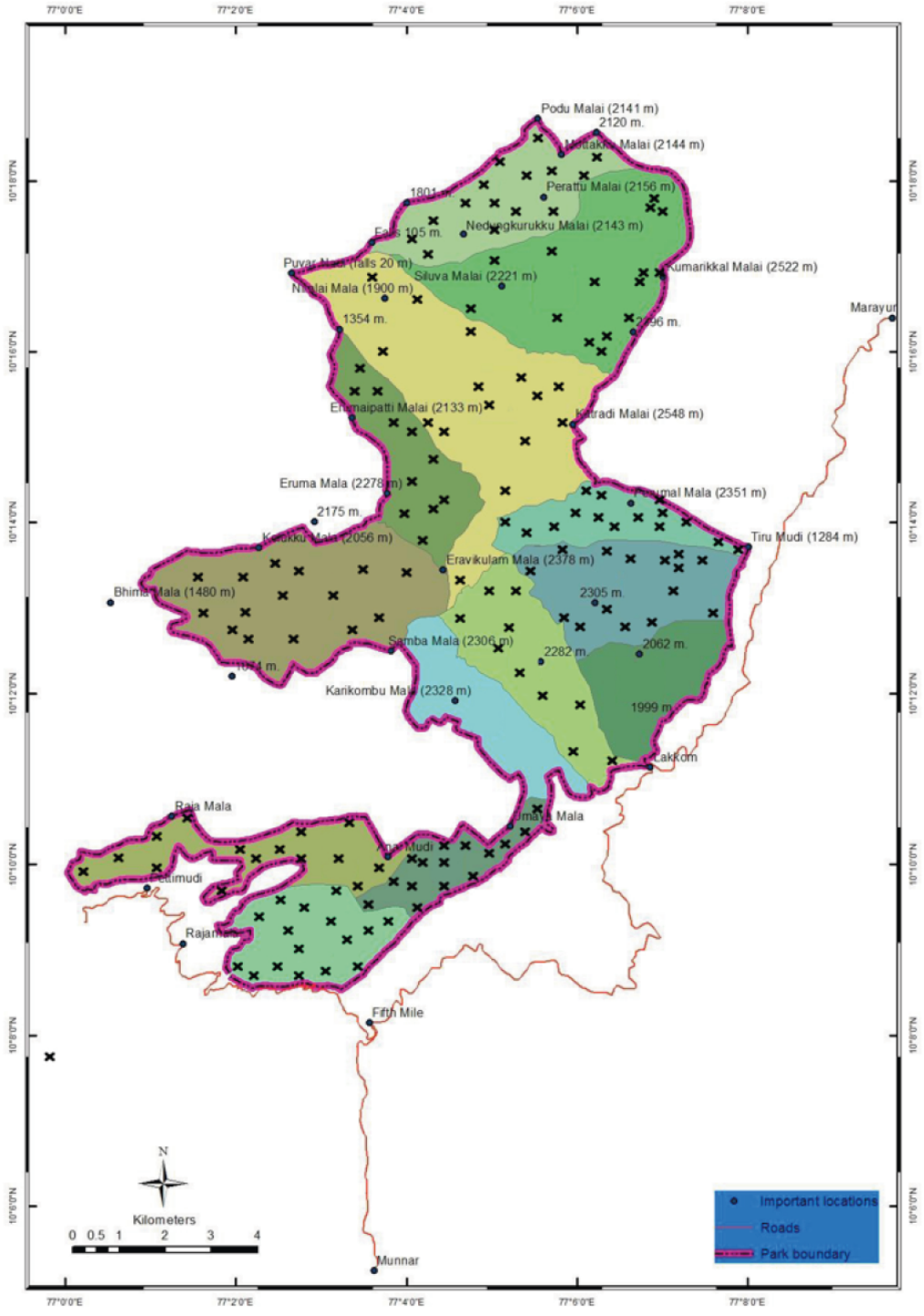

Figure 2. Camera trap locations in the montane landscape of Eravikulam National Park

and heavy wind. The major vegetation of the montane landscape is grassland-shola ecosystem. Around 60% of the area is covered by grasslands, about 25% by shola forests, about 8% by southern sub-tropical hill forest, and 7% by shrubs (Menon 2001). Jose et al. (1994) who studied the floristic composition of the montane forests of ENP reported a tree density of 1884 ha^{-1}. The shola forest is dominated by tree species such as *Pithecellobium subcoriaceum, Euonymus angulatus, Syzigium arnottianum, Ternstroemia japonica, Vaccinium leschenaultii, Maesa indica, Garcinia cambogia*, and *Ixora notoniana*. The grasslands are dominated by the species such as *Andropogon lividus, Arundinella vaginata, Digitaria wallichiana* and *Arundinella mesophylla* (Jose

et al. 1994).

Methods

a. Camera traps

Digital scout cameras having passive infra red sensors for heat and motion detection (Cuddeback Attack model 1149) were used for the survey. We laid 180 trapping stations at 12 blocks in the montane forests of ENP (Fig. 2) from September 2014 to March 2015, with 15 camera traps per block and kept open for five consecutive days, that amounts to an effort of 900 camera-trap days with 21,600 trapping hours. These trapping stations were selected based on the presence of the indirect evidence of the small carnivores. The camera traps were set at a height of 30-40 cm above the ground and 150m apart from each other (Mudappa et al. 2007). The cameras were set up in default mode with a time-delay of 10 seconds between the pictures. The camera trap locations were recorded with a Garmin GPS etrex 30.

b. Line transects

In each of the 12 survey blocks within ENP, five one-kilometer long transects were walked. Thus, a total of 60km was walked to record the indirect evidences as well as the direct sightings, to supplement the camera trap data. During the transect walk the scats of the small carnivores were recorded. The scats were identified to the small carnivore group such as civet, mongoose and small cats after Su (2005), as species level identification was difficult.

Results

a. Species richness of small carnivores' montane forest of ENP

The overall small carnivore camera trap success rate was 2.1%. Of the 84 photographs, the carnivores accounted for 35.7% (N=30) photographs, among that 60% (N=18) were seven species of small carnivores. The most common species recorded was Jungle Cat (27.8%) followed by Leopard Cat (22.2%), Stripe-necked Mongoose (22.2%) and Asian Small-clawed Otter (11.1%) (Table 1; Images 3–8). Nilgiri Marten, Common Palm Civet and Small Indian Civet were captured only once (5.5%) in the camera traps.

We had three direct sightings of small carnivores during the day transect that include Grey Mongoose, Stripe-necked Mongoose and Nilgiri Marten. The two species of mongooses were sighted from the grasslands of Naikkollimala and Erumapetti blocks respectively and the Nilgiri Marten was sighted from the shola forest in Naikkollimala block. The Stripe-necked Mongoose was sighted as a pair.

Thus, including the sighting of Indian Grey Mongoose at Naikkollimala, we recorded eight species of small carnivores from the montane forests of ENP, two species each from Viverridae, Herpestidae, Mustelidae and Felidae families (Table 1). Of that Nilgiri Marten and Asian Small-clawed Otter belong to the Vulnerable category (Mudappa et al. 2015; Wright et al. 2015).

Table 1. Small carnivores recorded from the montane forests of Eravikulam National Park along with their camera trap success rate (CTSR)

Family / Common name	Scientific name	Camera trap	Direct sighting	CTSR (%)
Viverridae				
1. Small Indian Civet	*Viverricula indica*	1	0	0.11
2. Common Palm Civet (Image 3)	*Paradoxurus hermaphroditus*	1	0	0.11
Herpestidae				
3. Indian Grey Mongoose	*Herpestes edwardsii*	0	1	0.00
4. Stripe-necked Mongoose (Image 4)	*Herpestes vitticollis*	4	2	0.46
5. Brown Mongoose	*Herpestes fuscus*	0	0	NA*
Mustelidae				
6. Asian Small-clawed Otter (Image 5)	*Aonyx cinereus*	2	0	0.23
7. Nilgiri Marten (Image 6)	*Martes gwatkinsii*	1	1	0.11
Felidae				
8. Jungle Cat (Image 7)	*Felis chaus*	5	0	0.58
9. Leopard Cat (Image 8)	*Prionailurus bengalensis*	4	0	0.46

* This was not sighted during the present study, but was camera trapped in 2012 from ENP (Sreehari et al. 2013)

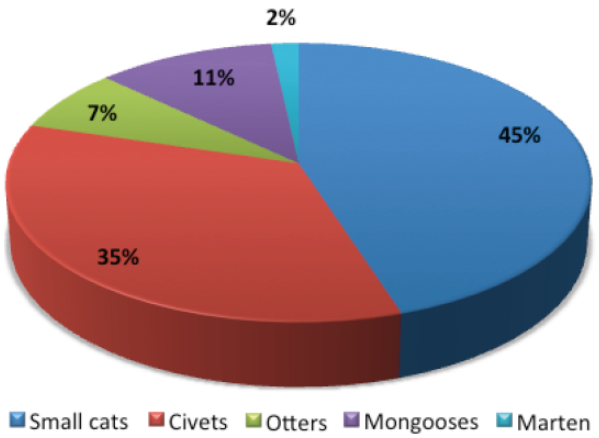

Figure 3. Relative abundance of small carnivores from pieces of indirect evidence in the montane forests of Eravikulam National Park

Images 3–8. Camera trap photographs: 3 - Common Palm Civet *Paradoxurus hermaphroditus;* 4 - Stripe-necked Mongoose *Herpestes vitticollis;* 5 - Asian small-clawed Otter *Aonyx cinereus;* 6 - Nilgiri Marten *Martes gwatkinsii;* 7 - Jungle Cat *Felis chaus;* 8 - Leopard Cat *Prionailurus bengalensis.* © S. Nikhil & P.O. Nameer

b. Indirect evidence for the presence of small carnivores in the montane forests of ENP

The day transects were walked along the existing trails, forest roads and streams, searching for indirect evidence of small carnivores. One-hundred-and-fifty-three indirect pieces of evidence including 138 scats and 15 tracks pertaining to small carnivores were identified from the National Park. The small cats (45%) and civets (35%) accounted for the majority of the indirect pieces of evidence (Fig. 3).

Discussion

When the small carnivore fauna in the lower elevation (<1,500m) in the Western Ghats is dominated by the viverrids such as *Paradaoxurus jerdoni* (Mudappa 2002) *Paradaoxurus hermaphrodites* (Kumara et al. 2014) and *Viverricula indica* (Sreehari & Nameer 2016), in the higher elevation (>1,500m) montane forests it is found to be dominated by the felids such as *Felis chaus* and *Prionailurus bengalensis*. Such a pattern on the greater presence of the lower felines in the montane forests has not been reported before. Though we cannot make any generalisations based on a single study, it can be assumed that the montane forests of the Western Ghats are dominated by felines than other forms of small carnivores.

Martes gwatkinsii has already been reported from the montane forests of ENP (Rice 1988; Madhusudan 1995). Thus, the present sighting of the Nilgiri Marten from ENP reconfirms the presence of this endemic and threatened mustelid in this montane protected area. There was a previous record of *Aonyx cinerea* from the montane forests of ENP (Perinchery et al. 2011) and the present sightings reconfirm its presence. Although the Brown Mongoose was earlier reported from ENP (Sreehari et al. 2013), the present study failed to record the species. It is surprising that the Brown Mongoose could not be sighted during the current study, in spite of the fact that the present study was a long duration study with greater camera trap effort than the previous study conducted in 2013.

The present findings once again highlight the biodiversity significance of the montane landscape of Eravikulam National Park, which is an adobe for several unique endemic and threatened biota (Rice 1988; Joseph et al. 2012; Praveen & Nameer 2015) of the Western Ghats.

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