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Cover: Nilgiri Large Burrowing Spider *Haploclastus nilgirinus*. Acrylic on canvas. © Aakanksha Komanduri.

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COMMUNICATION

Distribution, perception, and conservation challenges of endemic Madras Hedgehog *Paraechinus nudiventris* in Tenkasi District, Tamil Nadu: insights from questionnaire surveys

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Abstract: The distribution patterns, recent sightings and people's perception of the endemic small mammal, Madras Hedgehog *Paraechinus nudiventris* of Tenkasi District, Tamil Nadu were identified through questionnaire surveys. This study gathered insights into the perceptions and interactions with 1,141 participants from 38 villages in Tenkasi District, Tamil Nadu. A total of 867 respondents provided valuable information, revealing that 34% had observed hedgehogs in their villages. Notably, 38% people reported night as the optimal time for sighting and while only 11% reported sighting in the afternoon. The rainy season, chosen by 53% of respondents, emerged as the key period for hedgehog sightings, likely associated with hedgehog breeding and increased foraging opportunities. Therefore, the traditional medicinal applications of using various hedgehog body parts, raising critical concerns regarding hunting practices and the ethical treatment of these animals. The combined pressures of increased urbanization, habitat loss, and hunting are contributing to a potential decline in populations of the Madras Hedgehog. Reports of roadkill and poaching urges the need for conservation efforts. The reliance on hedgehogs in local remedies, particularly for conditions such as coughs and rheumatism, exacerbates the threats to their survival. Therefore, these factors necessitate immediate action to implement effective conservation strategies that address both the preservation of this endemic species and the ethical considerations surrounding its use in traditional practices.

Keywords: Biodiversity, community engagement, conservation strategies, ecological awareness, human-wildlife interaction, traditional knowledge, wildlife protection.

Tamil: தமிழ்நாட்டின் தென்காசி மாவட்டத்தில் காணப்படும் சிறிய பாலூட்டியான தென்இந்திய முள்ளெலியின் (பராச்சினஸ் நுடிவென்ட்ரிசி) பரவல் முறைகள், வெவ்வேறு இடங்களிலும் அவற்றைப் பார்க்கப்பட்ட பதிவுகள் மற்றும் மக்களின் கண்ணோட்டம் ஆகியன கேள்வித்தாள் ஆய்வுகள் மூலம் வெளிக்கொணரப்பட்டது. இந்த ஆய்வில், தென்காசி மாவட்டத்தில் உள்ள 38 கிராமங்களைச் சேர்ந்த 1,141 பங்கேற்பாளர்களின் கருத்துக்கள், பட்டறிவுகள், கலந்துரையாடல் மூலம் சேகரிக்கப்பட்டது. மொத்தம் 867 நபர்கள் இந்த கணக்கெடுப்பில் பங்கேற்று மதிப்புமிக்க தகவல்களை வழங்கினர். 34% பேர் தங்கள் கிராமங்களில் முள்ளெலியைப் பார்த்ததாகத் தெரிவித்தனர். குறிப்பாக, 38% பேர் இரவு நேரத்தில் கண்டதாகவும், 11% பேர் நண்பகல் வேளையில் பார்த்ததாகவும் தெரிவித்தனர். 53% பேர் மழைக்காலத்தில் முள்ளெலிகள் கூடுதலாகத் தென்பட்டதாகத் தெரிவித்தனர். மழைக்காலமானது முள்ளெலிகளின் இனப்பெருக்கத்துடன் தொடர்புடையதாகவும், உணவு தேடிக் கூடுதலாக இங்கும் அங்கும் செல்வதாலும் அதனைப் பார்க்கும் வாய்ப்புகள் அதிகரித்திருக்கலாம். பாரம்பரிய மருத்துவத்தில் முள்ளெலியின் பல்வேறு பாகங்களையும் இவர்கள் பயன்படுத்துவதாக தெரிய வந்தது. பாரம்பரிய மருத்துவத்திற்காக இந்த விலங்குகளை வேட்டையாடும் நடைமுறைகளும், நெறிமுறைகளும் கவலை அளிப்பதாக உள்ளன. நகரமயமாக்கல், வாழ்விடச்சிதைவு மற்றும் வேட்டையாடுதல் ஆகியவற்றின் ஒருங்கிணைந்த அழுத்தத்தால் முள்ளெலிகளின் எண்ணிக்கை சரிவை நோக்கி சென்று கொண்டிருக்கின்றது. வாகனங்களில் சிக்கி சாலையில் அடிபடுதல், வேட்டை போன்ற காரணிகளும் இவற்றின் பாதுகாப்புக்கு அச்சுறுத்தலாக உள்ளன. இருமல் மற்றும் வாத நோயைப் போக்கும் மருந்து என நம்பப்படுவதால் முள்ளெலிகள் வேட்டையாடப் படலாம். இதனால் அவை அழிந்து போவதற்கான அச்சுறுத்தல்கள் மேலும் அதிகரிக்கிறது. மேற்கூறிய காரணிகள் யாவும் இந்த ஓரிடவாழ் உயிரினத்தின் பாதுகாப்பு மற்றும் அதனைச் சார்ந்திருக்கும் பாரம்பரிய நடைமுறைகளையும் காக்கும் வகையிலான மேம்பட்ட செயல்திட்டங்களை உடனடியாகச் செயல்படுத்த வேண்டும் என்பதை இந்த ஆய்வின் முடிவுகள் உணர்த்துகிறது.

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INTRODUCTION

Small mammals are an important part of the global ecosystem, but there is a lack of data on their populations and the threats they face. This is partly due to their small size, nocturnal habits, and cryptic lifestyles, which make them difficult to study (Molur et al. 2005). Additionally, small mammals are often overlooked in conservation efforts, which tend to focus on larger, more charismatic animals. The lack of data on small mammals makes it difficult to assess the full extent of their decline for conservation strategies. Climate change, habitat fragmentation, and invasive species are some of the factors influencing their decline (Bertolino et al. 2015).

Tenkasi District, which was bifurcated from Tirunelveli District in the year of 2019 and emerged as the 33rd district in Tamil Nadu (Revenue Administration Jurisdiction, Bifurcation of Tirunelveli District (2019)), is located at the southern tip of the Western Ghats, serving as a haven for both flora and fauna. Adjacent to Tenkasi District, the Kalakkad Mundanthurai Tiger Reserve (KMTR), Nellai Wildlife Sanctuary, Periyar Tiger Reserve (PTR) and small pockets of reserve forest in the plains such as Uttumalai, Sivalar Kulam, and Mayamankurichi provide thriving habitats for faunal communities. The open grasslands and savannah in the region are characterized by tropical dry forests, tropical thorn forest and plains of vast expanses of low-lying vegetation, providing crucial habitats for a variety of wildlife. The tropical thorn forest exhibits an environment with petite, prickly trees that typically lose their leaves during the dry season. The ground level is comprised of lush, water-retaining plants, grasses adapted to arid conditions, and shrubs adorned with thorns. This region primarily receives its annual rainfall during the northeastern monsoon season (October–December) and faces dry from April to September. Notable species found in the tropical thorn forest area of this region include *Acacia, Chloroxylon, Commiphora,* and *Dalbergia* (Jha & Singh 1990). Historically, the Cheetah *Acinonyx jubatus venaticus* and Blackbucks *Antilope cervicapra* were recorded from the plains of this district, and now they are completely extinct (Rangarajan 1998). These grasslands not only support numerous plant and animal species but also provides a feeding ground for the cattle and livelihood for the communities (Image 1a). The mix of grasses and scattered trees, creating a unique ecosystem, is home to a rich assortment of flora and fauna, including grazing herbivores and the predators that rely on them for sustenance. These regions receive less rainfall, and vegetation tends to be adapted to the scarcity of water. Despite the challenging conditions, these areas still host an array of resilient plant species and wildlife specially adapted to the semi-arid climate, mainly small mammals.

The Madras Hedgehog belongs to the order Eulipotyphla of family Erinacidae, is one of India's small mammals, and is known to occur in plains and semi-arid parts of southern India. Although it was widely distributed in the plains of Tamil Nadu and has restricted distribution in Kerala and Andhra Pradesh, rigorous hunting of this species over a century throughout its range has led to a rapid and ongoing population collapse. It prefers open grasslands to forage; thorny scrubs and hedgerows to reproduce and nesting. Despite its ecological significance, this species faces numerous challenges, including habitat loss and illegal trade (Kumar & Nijman 2016; Kumar et al. 2018a,b). On the other hand, it is threatened by anthropogenic degradations, habitat loss and deforestation. Despite the widespread conversion of *P. nudiventris* habitat into agriculture, some small patches of grassland habitat still exist in agricultural fields as they are important for the population to survive (Kumar et al. 2018b). Nearly 70% of small mammal species in the Western Ghats of India are declining due to anthropogenic activities such as habitat loss, fragmentation, deforestation and mining (Nameer et al. 2001). Therefore, understanding their presence, perception and awareness in their habitat is crucial for future conservation efforts.

METHODS

Questionnaires have been valuable in assessing the presence and absence of hedgehogs (Hof 2009; Hof & Bright 2012; Williams et al. 2015). Specific geographic surveys were used to identify regional distributions and historical sightings, aiding in presence determination. While negative responses are equally important (Sjöström et al. 1999) as when people report absence, it confirms where the species isn't found, enhancing distribution mapping. Semi-structured questionnaires cover behaviour and activity, offering insights into ecological roles.

The results of a questionnaire survey were analysed that was conducted in 38 villages in Tenkasi District, Tamil Nadu, involving 1,141 participants and aimed to assess various aspects, like the presence of Madras Hedgehogs and also their activity patterns. These locations include human-dominated areas, to gauge the local population's perception of Madras Hedgehogs (Figure 1).

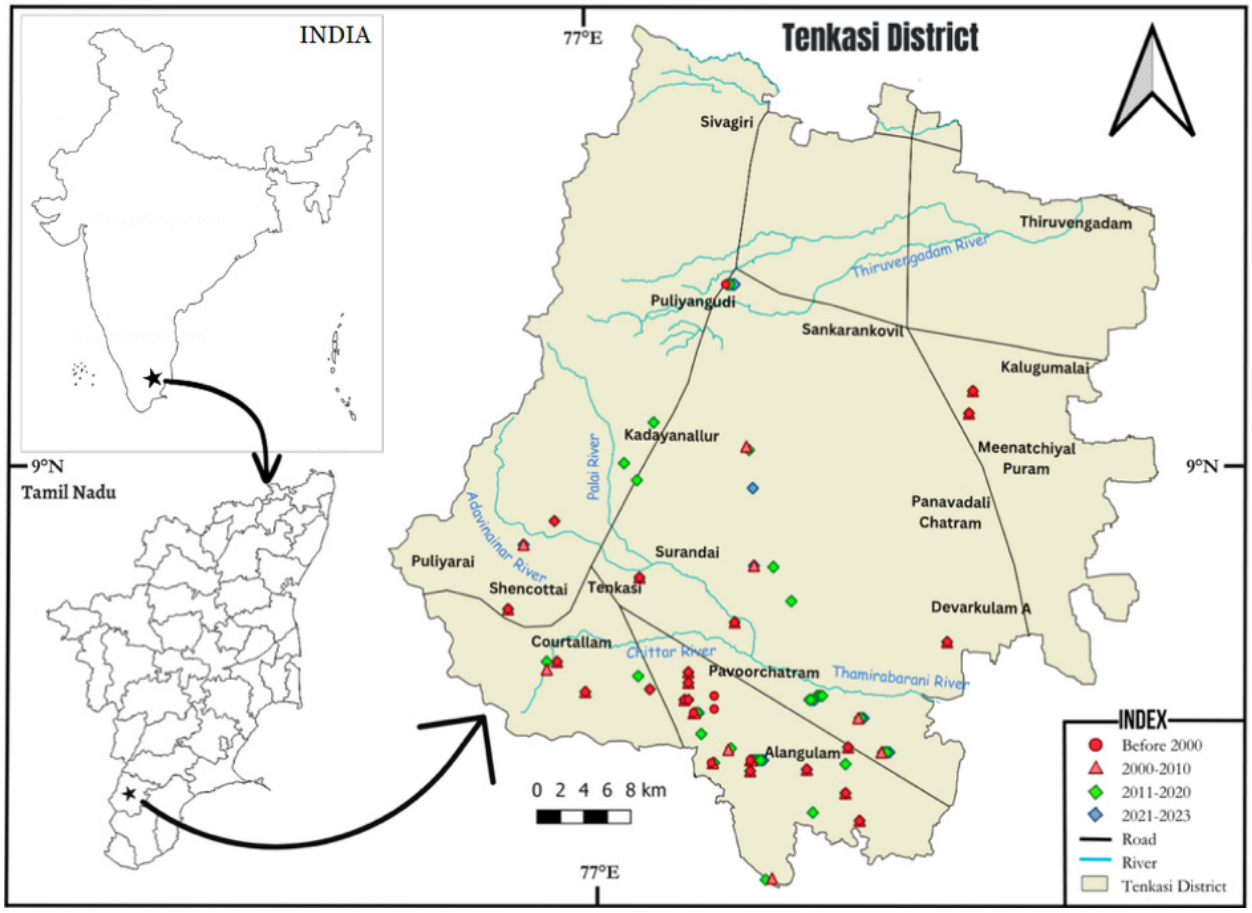

Figure 1. A Comparison of the *Paraechinus nudiventris* sighting between the current decade and previous years in Tenkasi District, Tamil Nadu. (Map source: https://www.istockphoto.com).

Questionnaire surveys efficiently gather insights from local communities (Kitchenham & Pfleeger 2002; Sirivongs et al. 2012) from their extensive experience in the hedgehog's habitat, which provides valuable data (Roopa & Rani 2012). The study area was classified into zones, such as villages and carried out random sampling surveys. Face-to-face interviews in the local language (Tamil) ensured effective communication, with prior informed consent from all respondents. The questionnaire covered respondent demographics, behavioural observations, traditional beliefs, presence and absence of hedgehogs, population changes, hunting, and recent sightings (pre- and post-2000). Microsoft Excel 2016 was used to analyse the data, while QGIS 3.32 LIMA was used for mapping the reported sightings in the listed villages.

RESULTS

In this survey, 1,141 respondents from 38 villages participated between July 2021 and September 2023. It's important to note that the data relies on self-reports, potentially influenced by recall bias. Filtering responses revealed that out of 867 participants, 295 (34%) reported Madras Hedgehog presence and 399 (46%) could distinguish Madras Hedgehogs from porcupines. As for preferred observation times, 104 (17%) suggested the early morning (0000–0600 h) in line with hedgehogs' nocturnal habits, meanwhile, 125 (20%) favoured morning hours (0600–1200 h), 70 (11%) opted for afternoons (1200–1600 h), and furthermore, 78 (12%) preferred early evenings (1600–1800 h), capturing the transition from rest to activity. A majority of 233 (38%) chose night-time (1800–0000 h) to see hedgehogs, aligning with their nocturnal nature. The rainy season received the highest response (53%), possibly due to mating and the abundance of invertebrate prey. Winter (25.3%) also exhibited favourable conditions, with the

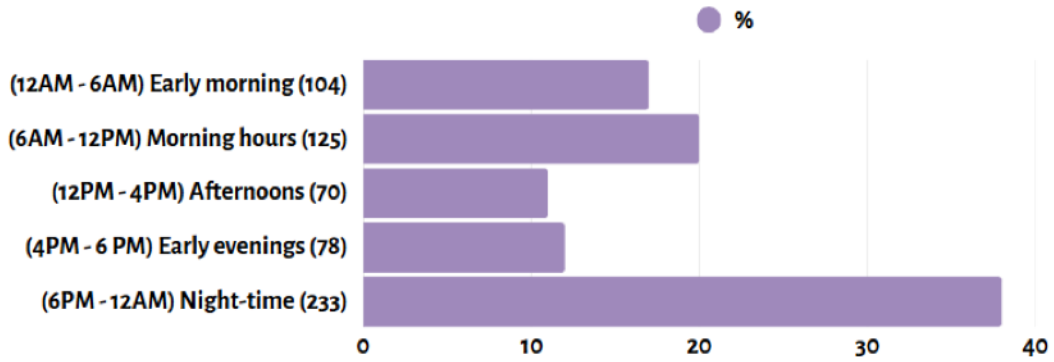

Figure 2. Temporal patterns of Madras Hedgehog sightings.

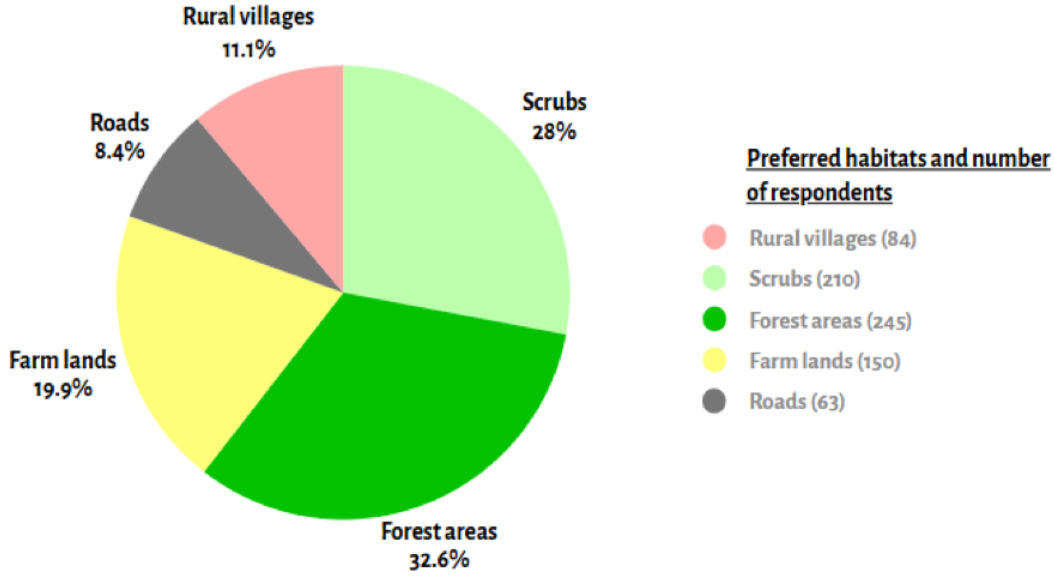

Figure 3. Madras Hedgehog sightings reported by the participants across different habitat types.

summer season (21%) being the least favoured.

Regarding habitat, the species is exclusively found in the lowlands of the eastern region of the southern Western Ghats (Kumara et al. 2023). The respondents identified potential sighting locations as follows: 84 (11.1%) in rural villages, 150 (19.9%) in farmlands, 210 (27.9%) in scrublands, 245 (32.5%) in forest areas, and 63 (8.4%) on roads.

The utilization of hedgehog body parts is believed to have various traditional and medicinal purposes, with certain body parts believed to possess specific properties to deal with whooping cough and other abnormalities. A significant number of respondents, 250 people (38%), indicated that hedgehogs are hunted for their skins, and 268 people (41%) for their spines. This practice is often associated with the use of hedgehog spines and skins in the production of traditional medicines, which are highly valued and not only available in black markets in Tenkasi, Tirunelveli, and Kanyakumari of Tamil Nadu State; but also traded both locally and across states. Cultural and traditional beliefs in the efficacy of hedgehog spines for medicinal purposes, which aids in treating various diseases like whooping cough, asthma, stomach aches, ear aches, and childcare medicines, as well as ritualistic purposes. Dried skin is believed to keep evil spirits from entering the home. A notable number of 123 people (19%) acknowledged that hunting hedgehogs for meat consumption is still practiced. Additionally, 79 (9%) reported keeping hedgehogs as pets, and 275 (31%) acknowledged using hedgehog body parts for traditional medicines. While it's essential to consider cultural and regional differences, this practice raises concerns about the ethical treatment of animals and potential impacts on local hedgehog populations (Figure 4).

Image 1. a—Open grasslands with sparsely distributed *Acacia* spp. and other thorny shrubs form one of the notable habitats of *Paraechinus nudiventris* | b—*Borassus flabellifer*, being the prominent tree found in these landscapes and people often sight hedgehog under piles of fallen Palmyra leaves | c—*Cereus pterogonus* are often used as live fences by local people where the hedgehogs are occasionally seen | d—they are often victims of road kill | e—they are rarely found in the daytime foraging near human settlements. © Abinesh Muthaiyan.

Inadequate road signage and high-speed traffic elevate the risk of hedgehog roadkill due to their heat-basking behaviour, small size, and nocturnal habits (Image 1d). Anthropogenic activities in hedgehog habitats in Ayikudy, Alangulam, and Surandai areas, pushing hedgehogs closer to human settlements, windfarms, and roads in search of food and shelter (Image 1e). Moreover, 106 respondents (12%) acknowledged poaching in this district, highlighting the urgent need for increased protective measures. Additionally, 126 people (28%) perceived hedgehogs

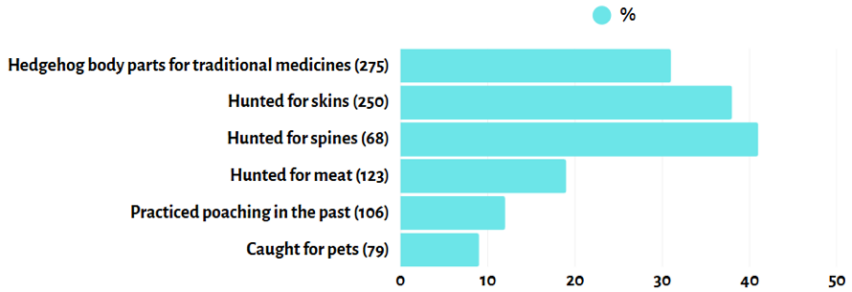

Figure 4. Consumption and use of Madras Hedgehog among people in and around the villages of the Tenkasi District.

Table 1. List of villages included in this survey.

	Surveyed villages in Tenkasi District, Tamil Nadu	GPS Co-ordinates
1	Ammaiyapuram	9.009, 77.447
2	Anavankudiyuruppu	8.720, 77.368
3	Arunachalapuram	9.101, 77.424
4	Avadaiyanoor	8.880, 77.386
5	Chinakumarpatti	8.856, 77.404
6	Chinanadanur	8.885, 77.399
7	Ilnaji	8.960, 77.278
8	Kalluthoor	8.902, 77.461
9	Kandapatti	8.815, 77.513
10	Karisalur	8.868, 77.405
11	Karumbanoor	8.855, 77.468
12	Karuthalingapuram	8.844, 77.405
13	Kulayaneri	9.006, 77.430
14	Gunaramanallur	8.931, 77.343
15	Malayankulam	9.146, 77.600
16	Mathalambaarai	8.906, 77.378
17	Mayamankurichi	8.893, 77.511
18	Mylapuram	8.779, 77.430
19	Nannagaram	8.945, 77.292
20	Nellaiyappurem	8.863, 77.417
21	Nettur	8.918, 77.531
22	Pa. Elanthakulam	9.126, 77.597
23	Pethanadarpatti	8.886, 77.408
24	Podiyunoor	8.881, 77.382
25	Poolangulam	8.861, 77.427
26	Pudupatti	8.835, 77.502
27	Salaiputhur	8.893, 77.422
28	Chellathayarpuram	8.872, 77.413
29	Sivalarkulam	8.868, 77.527
30	Sivalingapuram	8.913, 77.478
31	South Mylappuram	8.775, 77.431
32	Subramaniyapuram (Kattur)	8.985, 77.258
33	Thippanampatti	8.903, 77.375
34	Thirikoodapuram	9.125, 77.356
35	Thuppakudi	8.773, 77.445
36	Thuthikulam	8.910, 77.475
37	Vadamalaipatti	8.841, 77.425
38	Velliyammalpuram	9.015, 77.324

as rare, which may be influenced by factors like habitat loss, hunting, and environmental changes impacting hedgehog populations and biodiversity (Hof & Bright 2012). This indicates a decline in hedgehog sightings over the years from 2000 to 2023 due to various anthropogenic activities. The species is protected under Schedule II of Wildlife (Protection) Act, 1972 (amendment 2022); urgent conservation measures such as habitat protection, population research, prohibition of hunting and trading, as well as awareness campaigns for hedgehog conservation are necessary to reverse this declining trend.

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