ZOO'S PRINT

Communicating science for conservation

ISSN 0971-6378 (Print); 0973-2543 (Online)
Vol. XLI, No. 4, April 2026

Magazine of Zoo Outreach Organisation
www.zoosprint.org

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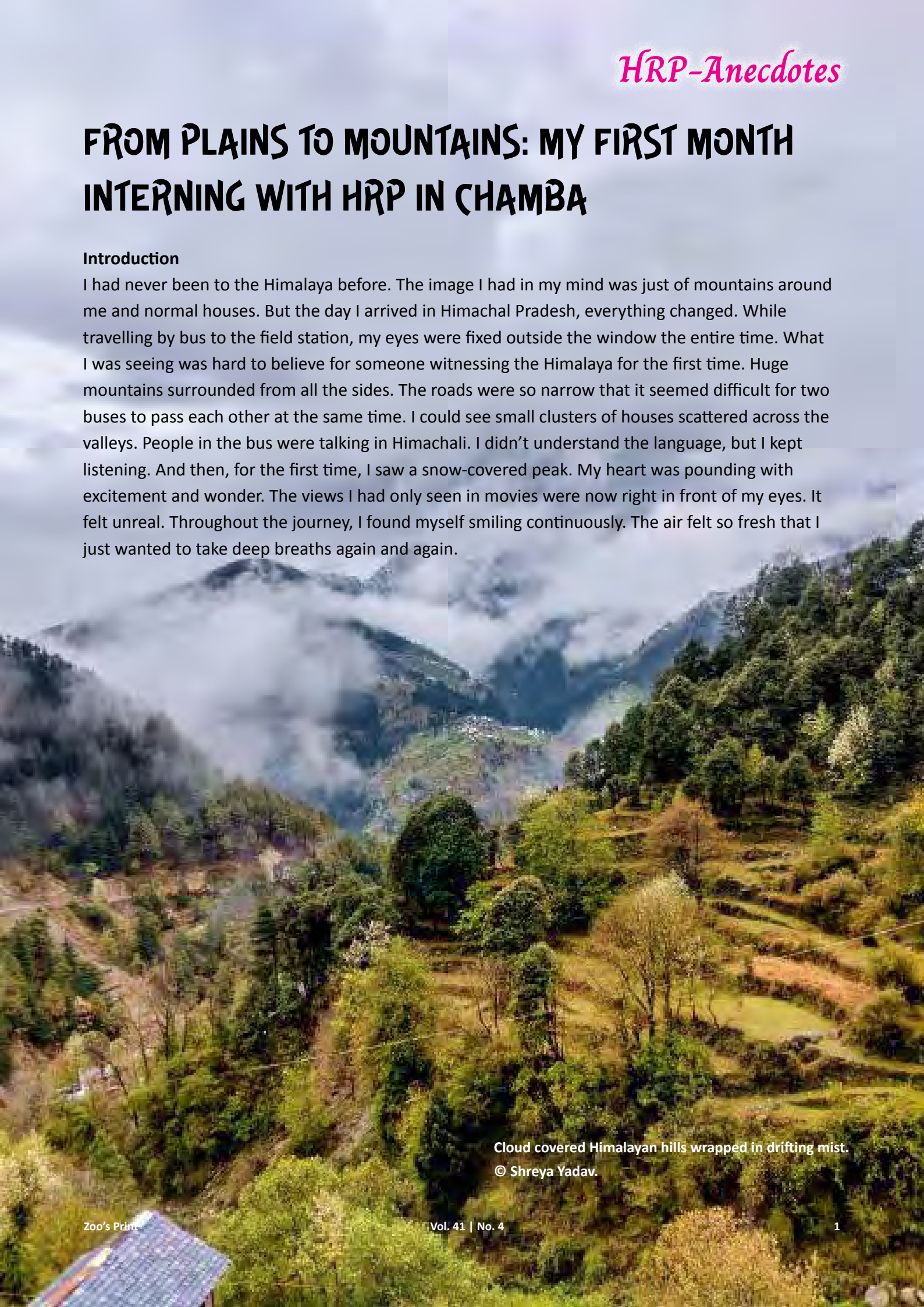
Cover photo: The Rusty-spotted Cat *Prionailurus rubiginosus*.

FROM PLAINS TO MOUNTAINS: MY FIRST MONTH INTERNING WITH HRP IN CHAMBA

Introduction

I had never been to the Himalaya before. The image I had in my mind was just of mountains around me and normal houses. But the day I arrived in Himachal Pradesh, everything changed. While travelling by bus to the field station, my eyes were fixed outside the window the entire time. What I was seeing was hard to believe for someone witnessing the Himalaya for the first time. Huge mountains surrounded from all the sides. The roads were so narrow that it seemed difficult for two buses to pass each other at the same time. I could see small clusters of houses scattered across the valleys. People in the bus were talking in Himachali. I didn't understand the language, but I kept listening. And then, for the first time, I saw a snow-covered peak. My heart was pounding with excitement and wonder. The views I had only seen in movies were now right in front of my eyes. It felt unreal. Throughout the journey, I found myself smiling continuously. The air felt so fresh that I just wanted to take deep breaths again and again.



Cloud covered Himalayan hills wrapped in drifting mist.
© Shreya Yadav.

At the same time, I was a little nervous, as I had no idea how working here was going to be. But in that moment looking at the landslide area I realised how beautiful our planet is and how often we ignore and destroy it without thinking about the consequences.

First day Experience

The day before, I was very excited to go into the field and start work. I slept early so that I could wake up on time. The room I was staying in had two windows, one in front and the other on the right side of my bed.

When I woke up in the morning, I looked outside and saw that the valley in front of my room was completely covered with clouds. It was extremely cold that day. As I got out of bed, I noticed it was raining. Soon, I got to know that there would be no fieldwork because of the rain.

My co-workers told me that this is one of the common difficulties they face while working in Chamba. Whenever it rains, they have to stay at the base and work from home due to the risk of landslides. That day, I didn't work. I just wandered around the field station and kept looking out of the window, experiencing the rain in the Himalaya for the first time. The valley in front of my window looked incredibly beautiful. I spent the whole day simply admiring the beauty of the Himalaya.

The next morning, I saw snow on the distant mountain, and it looked absolutely stunning. However, for the next few days, it continued to rain. During that time, I experienced the intense cold and kept admiring the raw beauty of nature around me.

Collecting grass specimen. © K. Gokul.

Seed sowing of *Punica granatum*. © K. Gokul.

Recording the co-ordinates of new land. © Lakshay Tyagi.

About the Internship

My internship in Chamba is based on ecological restoration. It includes doing different types of work every day - visiting restoration sites, collecting monitoring data, measuring new lands and recording co-ordinates for

Talking to community during outreach program. © K. Gokul.

restoration, collecting herbs, shrubs, and grass specimens, seed collection, filling polybags, sowing seeds, and conducting outreach programs with communities and schools. This one month was full of learning and getting new experiences. Every day witnessing new sights was thrilling.

My Daily Work

My daily routine mainly involves monitoring previously restored lands. I monitor 28 restored sites. During monitoring, I record how many saplings have died, how many tree guards have fallen or are missing, and how many are in good condition. This data helps in understanding the survival rate and planning replantation. I also work on measuring new land areas. Using Geo Tracker, I record the latitude and longitude, and then using QGIS to calculate the total area. This helps in identifying the exact land area that needs restoration.

Additionally, I go for seed collection, fill polybags, and sow seeds properly. I also learn plant propagation through cuttings, taking cuttings from trees, removing excess leaves, dipping them in root-enhancing hormones, and planting them in polybags.

Challenges I Faced

Working in the Himalaya is physically demanding. Walking long distances on uneven and steep slopes is very difficult. For someone coming from the plains, working in mountainous terrain is not easy. I faced many difficulties in my initial days. During monitoring, I had to take long routes and climb mountains filled with thorns and stones. Sometimes I had to use my hands for support while climbing, which left thorns stuck in my palms. In some areas, loose pebbles, stones, and dry leaves made the ground very slippery and risky. These challenges built my endurance. At the end of the day, it feels worth it when you realize you are contributing to restoration and doing something good for the planet.

Some members of the HRP team taking a selfie break while monitoring. © Lakshay Tyagi.

What I Learned

This internship helped me understand the complexities of restoration in the Himalaya. Before coming here, I thought it would be easy but in the field I realized it requires a lot of effort, courage, and dedication.

Working here improved my field skills, patience, and adaptability to mountainous terrain. I learned real fieldwork techniques, time management, and how to endure physical challenges. Most importantly, I developed a deeper understanding of the Himalayan ecosystem.

Special Experiences / Moments

One special experience was connecting with locals. It was lovely to talk to them even without fully understanding their language, we could still understand each other's emotions.

Another memorable moment was my first land measurement. It was extremely difficult, and I had severe leg pain that day, yet I went for monitoring the next day. Later, I realized how rewarding it felt to work in this region.

One of our nursery workers invited us for 'Dham' (feast). Trying local food was also a great experience. There is a Chambyali dish named 'Madra', which is made using Rajma, Ghee and curd and that was very delicious. During treks and fieldwork, the beautiful landscapes often made all the tiredness disappear. Those moments truly felt worth living.

When our team went to document plants, one of my team members saw the Himalayan Yellow-throated Marten and showed everyone.

Flowering of *Pyrus pashia*. © Shreya Yadav.

Tree of *Pyrus pashia* in full bloom. © Shreya Yadav.

I was so happy to see the first wild animal of the Himalaya. That sighting made my day. In greed I waited and looked around to sight again but I failed.

Witnessing *Rhododendron arboreum* for the first time. © Lakshay Tyagi.

My first Encounter with Himalayan Flora

The most eye-catching plant I saw for the first time was *Prunus cerasoides*, also known as the Himalayan Cherry. As someone who admires cherry blossoms, seeing the Himalayan Cherry felt truly amazing. The petals and the overall structure of the flower closely resemble cherry blossoms, which left me fascinated.

Another plant that caught my attention was *Rhododendron arboreum*, locally known as Burans. Its deep red, vibrant flowers were truly mesmerizing. In Chamba, chutney and juice are prepared from the Rhododendron petals. I also tried it, and it was really tasty. I also observed *Pyrus pashia*, locally known as Kainth, whose flowering was equally beautiful.

Apart from these, I learned about many other plant species found in Chamba, such as *Berberis lycium*, *Juglans regia*, *Punica granatum*, *Quercus leucotrichophora*, *Morus serrata*, and *Albizia chinensis*.

Conclusion

Overall, the experience has been wonderful. I have learned many new things and gained valuable exposure. Working here is helping me to grow professionally, daily movement in mountainous terrain has helped me develop personally. It has built my confidence and stamina. What initially felt difficult now feels manageable. This one month has been an amazing and unforgettable experience.

What looks like a quiet mountain landscape is actually a place where restoration, resilience, and real fieldwork come to life. This one month has given me experience in many different types of work. It has been exciting to learn about so many aspects within such a short time. I have a great team of colleagues who have helped me along in my initial days and I look forward to an exciting year of restoration, community outreach, and associated works.

Shreya Yadav, Himalayan Restoration Project, Zoo Outreach Organisation

Citation: Yadav, S. (2026). From Plains to Mountains: my first month interning with HRP in Chamba. Zoo's Print 41(4): 01–05.

Penguins in a snowstorm

Any ideas on the best time to go on a trek? I know you are thinking of a bright sunny day in the middle of spring or a pleasant evening by a flowing stream. We expected the same when we had planned a trip from Dainkund to Jot, the highest peaks of Dalhousie and Chamba, respectively.

Usually, the month of April meant bright blue skies, pretty flowers, and butterflies. This was not the case this year in Chamba, as dark clouds and heavy downpours took over the first two weeks of the month. Rain was frequently accompanied by hailstorms and sometimes snow, especially in the higher elevations. While most people chose to play it safe with the weather, the HRP team, however, chose to go against the rules of nature to experience its wonderfulness and were lucky enough to escape its rage. We also had a joyful company of Dipal and Mitesh Damania, the founders of Naturefuture, an initiative focused on environmental conservation by integrating NGOs and funders.

Our journey from the field station started after a warm breakfast, followed by a drive to Lakkadmandi, the last point in Kalatop Wildlife Sanctuary. As we ascended the mountains, the amount of snow on either side of the road increased gradually, but the actual adventure began once we reached the entrance to Polani Temple. The temple steps easily had five inches of snow muddied by the footprints of all the previous visitors. As all of us wore nothing but a bunch of clumsy trekkers with regular trekking shoes, slipping and sliding became normal. Our attempts to take careful steps on the snow made us look like awkward penguin chicks who were learning to walk. Half an hour into the trek, and all of our shoes had already been wet by the melting snow. As we were feeling overwhelmed by our numb feet, we encountered something magical.

It started snowing! Neither snowflakes nor crystals, but round airy pearls that looked exactly like thermacol. As many of us were experiencing snowfall for the first time, we started screaming and dancing with joy. We rolled on the fresh snow to make

The HRP team. © Sanjay Molur.

snow fairies and a snowman. Truly, our inner child had taken control. Slow and steady, we took almost two hours to reach the beautiful temple on the top of the mountain.

But our journey had just begun; in order to reach our destination, we still had 6.5 kms more to cover. The thought of it gave us cold feet, literally! as all of our shoes were already drenched by then. Despite shivering in the cold, nobody ever thought of going back. Fuelled by a cup of hot tea and a plate of 'pahadon wali maggi', we resumed our trek. As most of the tourists were heading back from the temple itself, the crest walk that we were going on was completely vacant and undisturbed. Vishal took the lead as he is well-versed in all the forest trails in Chamba, but the rest of us made sure to slow him down with our constant slipping and falling.

Along the way, we spotted beautiful flowers like *Bergenia ciliata* and *Primula denticulata*. Shrubs like *Viburnum*

Primula denticulata peeping out of the snow. © Sanjay Molur.

The serene snowscape. © Amrin Ansari.

grandifolium and *Daphne papyracea* were covered in snow. Fresh snowfall settling on the Deodar *Cedrus deodara* trees made the landscape look magical.

Trekking further, we had reached an elevation of about 2,700 m, and the clouds had now surrounded us, limiting visibility to 5 m. The heavy winds converted the pleasant snowfall into a snowstorm. Our team still didn't give up and continued fighting against the snow hitting us harshly on our faces, until something shocking happened. A loud noise of thunder followed by a rumbling of the clouds. It hit us so close that we felt excruciating pain in our heads. All of us were extremely shocked to understand what happened. I looked around in utter confusion to see everyone equally confused; the ones behind me were sitting on the ground, huddled like pups. A few minutes later, we realised that we were in fact, hit by a compression wave. The deadly

combination of high elevation and dark clouds had led to the formation of a heavy compression wave due to the presence of high electrical charge in the clouds.

Awkward penguins in the snow. ©Amrin Ansari.

It was the moment we realised we were lucky to have survived the wrath of mother nature. Immediately, we all turned off our phones and sprinted forward. Thunder followed the snowstorm, and it was getting difficult for us to go on. That's when Vishal spotted a Shephard's hut at a distance, and all of us raced up the trail to reach it. The cosy, muddy hut gave us warmth and protected us from the snowstorm. We waited for a couple of minutes for the weather to clear. Turning back was not an option as we were right in the middle of the trek, too far to turn back and not quite close enough to the finish to stop.

The incident had shaken us, but our adrenaline rush helped us move forward despite the cold weather and numb feet. Hurriedly, we crossed over the forest fragment and reached a beautiful grassland on the fringe of the valley. We stopped to admire the beauty of the meadow, which had little snow. Descending to a lower elevation, rain had replaced the snow now, which made the rest of the journey relatively easier for us.

Four hours and 8.5 km later, we finally reached Jot, one of the passes to Chamba Valley. At this point, we were exhausted and hungry, so we crammed into the nearest shop and gobbled up whatever we could find. The cold, the confusion, the laughs, and the small moments in between will forever stay with us. I am sure if you ask any of us again, we would all still choose the same, because chaos and cold are when the magical stories are told.

Amrin Ansari, Himalayan Restoration Project
Zoo Outreach Organisation

Citation: Ansari, A. (2026). Penguins in a snowstorm. *Zoo's Print* 41(4): 06–08.

HRP Outreach activities in April

Education and outreach is the stepping stone for any conservation project to bridge the gap between local communities, project stakeholders and the researchers. The Himalayan Restoration Project which aims to ecologically restore the degraded habitats of western Himalaya in Chamba, Himachal Pradesh works closely with the local communities to foster long term relationships and shared responsibilities for the project. So far this month we have successfully conducted three outreach activities.

Collaborate to Conserve

On 3 April 2026, the HRP team met with Mr Ratan Chand Sharma the founder of Paryavaran Chetna Evam Gramin Vikas Prashikshan Kendra (PCEGVK), an NGO based in Saho Village in Chamba, Himachal Pradesh. We were also accompanied by Mr Gajendra Verma, who is also a member of that NGO and helped us build connections. PCEGVK has been actively working in Chamba since the last 21 years and focuses on a lot of environmental aspects like waste management, tree planting drives, awareness campaigns and school outreach activities. Mr Sharma explained the history and significance behind setting up the organisation which was majorly inspired by the increased flash floods in the village. Due to lack of trees and grasses around the valley, their village used to get flooded every year causing huge financial and emotional loss to the local communities. In order to deal with the issue, Mr Sharma started the NGO by planting trees in 2005.

The HRP team discussed the similar nature of efforts being put in the Rathiyar Panchayat area. Earlier in October 2025, HRP had collaborated with PCEGVK to conduct an outreach activity with the school kids to celebrate the wildlife week. Mr Sharma was happy to know about our project and was very enthusiastic to collaborate with our team for future outreach activities. With his support and engagement, we see promising opportunities to strengthen our outreach efforts and create a more meaningful impact within the community.

We also had the company of Mr Vinod Rathore, Mr Hem Singh, and Mr Jairam Thakur, members of PCEGVK who were also cooperative and

HRP team discussing with Paryavran Chetna Evam Gramin Vikas Prashikshan Kendra.
© Ravichandran

showed a keen interest in understanding the objectives of the project and appreciated its focus on restoration and community involvement. Their enthusiasm was especially evident in their willingness to participate in the 2026 planting activity.

Through collaborative efforts of HRP and PCEGVK, our team aims to build and nurture long-term relationships in the landscape by fostering trust, shared responsibility, and active participation. The project seeks to create a collaborative network dedicated to conserving and restoring the landscape in a sustainable and inclusive manner.

Additional read- https://paryavarnchetnasahoo.com/zoo-outreach-organization/

Outreach in Chanjui Village

Our next outreach visit was in Chanjui Village, where we met a group of about 40 people, mostly women, along with 10 children, watching everything with curiosity. To explain our mixed native tree restoration work in a simple and engaging way, we performed a small skit. It told the story of a young girl named Megha and her family. Through her story, we showed how she slowly began to understand the problem in her village like crop loss, the changing environment, raiding by animals and decided to do something about it. Later, she started her own movement named “Van Shakti”.

She started planting different kinds of wild, native trees and encouraged others to join her. The dialogues were kept easy and relatable, so everyone could connect with the message about why planting a mix of native species

HRP team interacting with the community members. © Ravichandran

matters for the health of the landscape. The skit brought smiles, laughter and thoughtful reactions from the audience. At the end, we shared stickers of local plants and animals with everyone, which the children especially loved, carrying them home as a small reminder of the day.

When Students Truly Felt the Power of Native Trees

HRP Team visited Odda School for an outreach program with students from classes 6 to 10. The teachers and the principal were also present, along with our guests from Mumbai Mitesh and Dipal, co-founders of Naturefuture Organisation.

We started with a short introduction and then performed a skit based on a village girl named Megha, who noticed her parents were worried about decreasing snowfall and irregular rainfall patterns, which were affecting their agricultural income. It showed how Megha, with the guidance of her grandfather and support from her village friends, brought positive change by planting native trees, shrubs, and herbs. Slowly, she helped make the Chamba Valley greener again with a mix of native species.

One of my favorite moments was watching the students sit so quietly and attentively during the skit. You could really feel that they understood the importance of growing native plants instead of non-native ones like apples.

We also interacted with the students and asked them what black bears eat. Almost all of them answered together, “corn” which made us laugh a little. It reflected what they usually see and hear about animals like langurs, macaques, black bears etc. This helped us start a deeper discussion.

Using posters, we explained how ecological restoration can bring change. We talked about

Raising restoration awareness through skit.
© Trisa Bhattachajree

Students identifying native wildlife through stickers. © Trisa Bhattachajree

how planting native fruiting trees can provide food for wildlife, reducing their dependence on agricultural fields. We also showed them how forests can recover over time and explained that these animals are naturally adapted to eat wild food, not crops. Their perspective was quite surprising, but it gave us a good opportunity to clear misconceptions.

We made it clear that change won't happen overnight. It takes time but it can transform the entire landscape in the long run. To support this, we showed a documentary on Himalayan restoration, explaining the process, challenges, and scientific methods involved.

At the end, we distributed stickers of five native animals and five native trees to help them start recognizing local biodiversity. We encouraged them to learn their common names and even told them we'd conduct a small test when we meet again.

Finally, the principal kindly offered us a traditional "dham" meal, and the food was absolutely delicious. It truly felt like a perfect and happy ending to a meaningful day.

Amrin Ansari, Lakshay Tyagi & Lakshya Raj Singh Rathore, Himalayan Restoration Project
Zoo Outreach Organisation

Citation: Ansari, A., L. Tyagi & L.R.S. Rathore (2026). HRP Outreach activities in April. *Zoo's Print* 41(4): 09–12.

HRP team interacting with Students. © Trisa Bhattachajree

A squeaky adventure

Sometimes, insight arrives as chaos; this is what I have learnt in 2 years working as a researcher in the Himalayan Restoration Project, Chamba. I had a lot of opportunities for amazing wildlife sightings, but I had never imagined that this story would reshape my thoughts about small mammals.

It was just another gloomy evening, amid peak monsoon, when my colleague Sushanth & I were returning from one of our birding adventures. We were discussing the beauty of the Kalij Pheasant, which had bestowed upon us its magical presence and soothing calls. Our conversation was so engaging that we walked past a creature that initially appeared to be a piece of cloth. It was the twitch of the fabric that brought our attention to find out it was not trash but a cute little rodent. Drenched in the rain, the poor creature had been shivering on the roadside for I don't know how long.

Two things came into my mind at that time - should I let nature take care of it, or should I take care of it? Both of us mutually decided that we should not intervene and let the rodent be, and then it struck our mind- it's a wild rodent from the Himalaya, a landscape where small mammals have not been extensively studied at all. Who knows what species it was, for we could clearly tell it did not appear to be a common house rat.

We wrapped it gently in a handkerchief and took it to our field station. As neither of us was expecting a visitor, we were completely clueless

***Rattus pyctoris* (Mousu) posing in the limelight.**
© Amrin Ansari.

about how to host our new guest. We found a transparent plastic jar and placed the creature inside. We made some holes for ventilation and gave it a few pieces of bread and grains.

The rat, for sure, might have been confused as to why it was captured and observed by two geeky humans. I think it must have been shy or traumatised or a combination of both because it was very docile, not feeding or moving at all. Heavy downpour followed its arrival, and amid the advent of darkness and rainfall, we decided to extend its stay overnight and release it in the morning. An hour later, our little guest was feeling better, its fur was dried out, and it had nibbled a few bites from the sad piece of bread lying beside it. Despite being a rat, the big, round ears and pink nose made it look very much like 'Jerry' from 'Tom & Jerry', therefore I named him 'Mousu'.

As young researchers, we were very keen on its identification, so we decided to take a few photographs. A cardboard box was arranged and placed on the edge of a table, safely secured using cello tape. I waited patiently with my camera focused in place while my roommate slowly released our supermodel into the cardboard. The next 10 minutes were just a light, camera & photo session for our furry guest. After we were satisfied with the pictures, we escorted Mousu straight to its jar, whose lid had apparently been tightened by my colleague (spoiler alert: it wasn't).

The photographs were immediately sent to our guide, Dr .Sanjay Molur, who is an expert in small mammals. He informed that Mousu was indeed a rat and most probably represented the species *Rattus pyctoris* based on the photographs and approximate measurements provided.

Commonly known as the Himalayan Rat, a species native to central and southeastern Asia, is presently distributed in Afghanistan, Bangladesh, Bhutan, China (Yunnan, Guangdong, Sichuan), India, Iran, Kazakhstan, Kyrgyzstan, Myanmar, Nepal, Pakistan, Tajikistan, and Uzbekistan, ranging from 1,200 to 4,250 m (Corbet & Hill 1992). Although it's listed as least concern on the IUCN Red List, Mousu's species still faces a lot of threats, including habitat loss and continuing decline of mature individuals (Smith & Johnston 2016).

I don't know if it was the limelight, attention or the stress for poor Mousu, but his eyes were determined to take revenge. Just after having another meal of bread & grains, Mousu bit open the lid of the plastic jar and stretched his tiny paws into independence. For all it could find was a house full of endless options to explore, and he went off for his adventure. The open lid caught my attention and sparked chaos, a free rodent in a home full of electronics, wires, clothes, cardboards, edibles, all nibbleable items for a rat. As my colleague and I searched the whole house like freaks, we heard faint little squeaks coming from the kitchen. Apparently, Mousu might have been on a gluten-free diet and had fixed himself with a healthier dinner, as we found him nibbling on an apple peel.

For three hours, we chased the poor creature while it stayed thoroughly traumatised. I hadn't

realised my colleague was terrified of rodents—he jumped every time Mousu ran. The night turned into a mix of laughter, chaos, and our failed attempts to catch one tiny rat.

Finally, we cornered the rat in the kitchen, and my colleague came up with a brilliant idea of catching the rat with his bare hands, but he let his fears get the best of him, and he insisted, "You do it!" and then said "wait" as he ran off to the hall. He came back with a pair of his stinky socks straight from the laundry bag, fully convinced that wearing them on my hands would somehow stop the rat from biting me.

We laughed like maniacs, and the socks smelled so much that I am sure Mousu would have been disgusted as well. Maybe that's why I was able to finally catch it and place it in a sturdier jar. The next morning, the first thing we did was to release Mousu back to the place we got it from, and I hope he continues to live happily.

Somewhere between the chaos and the laughter, I caught myself rethinking everything about rodents in general. Like many others, I had always seen rats as a menace, but this incident made me pause and wonder how these small mammals quietly hold ecosystems together—dispersing seeds, feeding predators, reshaping habitats through burrowing, and keeping nutrient cycles alive. It is very sad how often the smallest creatures are misunderstood and treated as vermin. It is very important to study their ecology, distribution, and population trends because, despite their size, they're the ones who balance the ecosystem.

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Amrin Ansari, Himalayan Restoration Project
Zoo Outreach Organisation

Citation: Ansari, A. (2026). A squeaky adventure. *Zoo's Print* 41(4): 13–15.

GREEN GRENADE

Not a solution yet, just an experiment we hope will hold

Last year, the hills gave way.

After the monsoon, we kept returning to the same slopes- watching, noticing, trying to understand what had changed. The soil was loose, unsettled. Even a careful step would sink in too easily. It didn't feel like land that could hold on for long.

We spent days just observing- how the soil shifted, where the cracks widened, how water might move when the rain returned. We also noticed a few native saplings quietly peeping through the debris. We saw long grass roots exposed , still hanging onto the slope. Their

An experimwnt that you can hold.
© Lakshay Tyagi.

Showing the long roots of a hill grass
© Arpan Joshi.

This is where the question began
© Amrin Ansari.

dense tufts seemed to grip the rocks tightly, holding them in place.

Somewhere in those quiet observations, a question stayed with us: What could help this slope hold together again?

The answer didn't come as something big or certain. It came small- and honestly, a little unsure. Seeing those, we began to wonder- what if we could cover the slope more completely with grasses? Maybe their roots could bind the soil and hold the rocks in place more firmly.

The idea was straightforward: if grasses could establish, their roots might begin to bind the soil -holding it, slowing runoff, giving the slope a chance to recover.

In my hand was a compact ball of soil holding a cluster of grass. Simple, almost ordinary. We started calling them "Green Grenades." Not because they destroy- but because we hoped they might help rebuild. So, we tried.

As we tried to place the green grenades, the slope pushed back. Beneath the loose debris lay rocks and boulders, turning what seemed like a simple task into something far more effortful. We installed these green grenades across the most vulnerable patches-into cracks, onto loose soil, wherever the land seemed like it might give way again. It felt experimental, uncertain. This was the first time we were trying something like this. We didn't know if this would work.

We still don't, completely.

But we are watching. Waiting. Hoping. Not with certainty, but with small attempts, repeated with care.

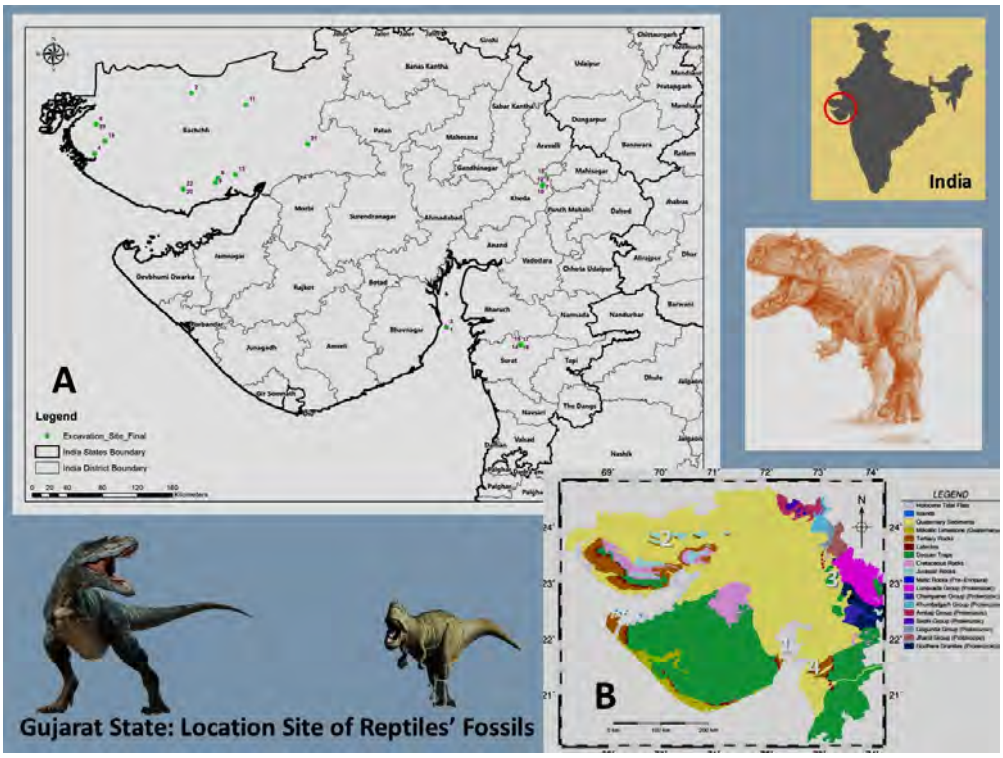
For now, these aren't solutions.
They are experiments.
They are hope, shaped in soil and roots.

Lakshay Tyagi, Himalayan Restoration Project, Zoo Outreach Organisation

Citation: Tyagi, L. (2026). Green Grenade. *Zoo's Print* 41(4): 16–17.

Grenades ready to defend Hill slopes © Lakshay Tyagi.

Review of prehistoric reptiles of Gujarat, India from the Mesozoic and Cenozoic eras



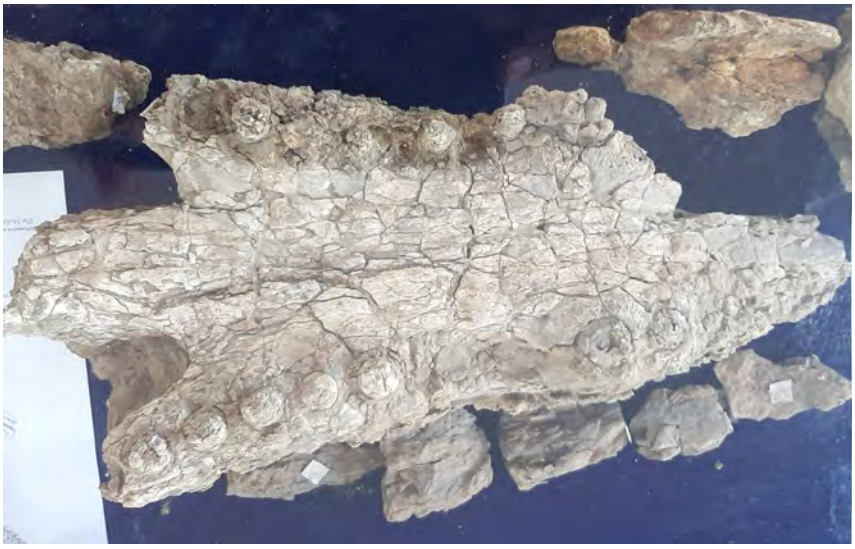
Map of Gujarat State showing the various excavation sites of reptilian fossils. Numbers from 1 to 23 correspond with Table 1, showing the detailed locations of each identified fossil and its study (A), Map of Gujarat State showing the locations of four 'Hotspots' and different geological land formations (B).

If you are unfamiliar with fossils, they are sedimentary petrified stones. However, if you know it's a fossil, it's part of the remains of a preexisting living organism that once lived on Earth and is preserved within rocks or layers of sediments and is known as a fossil. According to its formal definition, a fossil (from the Latin 'focus,' meaning 'obtained by digging') refers to any preserved remains, impression, or trace of a plant or animal that existed in a past geological age, embedded in rock, and maintained in a petrified form. Examples of fossils include bones, shells, exoskeletons, stone imprints of animals or microbes, objects preserved in amber, hair, petrified wood, oil, coal, and DNA remnants. The totality of fossils is collectively known as the fossil record.

Fossils are encrypted evidence of natural history and the evolution of mother earth, and research in Paleontology decodes them. Fossil studies reveal the biodiversity of the era and the evolution of flora and fauna. Here, I took the liberty of emphasizing and reviewing the literature on the fossilized reptilian fauna of Gujarat State. The geological history and paleontological studies indicate that the land of Gujarat had more diverse flora and fauna in the earlier periods than in the present (Bajpai 2009; Prasad & Sahni 2014).

The research literature on the subject highlights, as once upon a time, Gujarat (in the past) was land for highly diversified and rich animal life, including numbers of reptilian species, but within time, it vanished, and some majority of them became extinct. The recent geological exploration and palaeontologic research in the country and the Gujarat State opens an entirely new vision for the earth's

Dorsal surface of turtle shell of unidentified testudin fossils from the Kutch, housed at the Private Fossils Museum, Kutch, Gujarat, India. © Raju Vyas.



Ventral surface of the fossil skull of an unidentified crocodylomorph excavated by Dr. Hansh Thewissen from Julrai Village, Lakhapat, Kutch District, and now exhibited at Bharatiya Sanskruti Darshan Museum, Bhuj, Kutch, Gujarat, India. © Raju Vyas.

origin and the continent's history, providing a new theory for the landmass of Gujarat.

The study of geological formation and fossil evidence supports the phenomenon that once upon a time, the Indian plate separated from "Gondwana" (see: Merh 1995), and it was lastly connected with Africa along Madagascar and Seychelles (Chatterjee & Bajpai 2016). Several examples support the idea that Indian fauna and flora have some common affinities with the fauna and flora of Africa and the Seychelles (Prasad & Bajpai 2016). A recent supporting evidence is the discovery of two new species of frogs (Sahyadri Purple Frog *Nasikabatrachus sahyadrensis* and Bhupathy's Purple Frog *N. bhupathi*) belonging to the family Nasikabtrachidae from Western Ghats (Biju & Bossuyt 2003; Janani et al. 2007), which evidently supports that in the past, the Indian subcontinent had a connection with Seychelles Island and the African continent in 150 mya.

The output of paleontological research opened a new sight of the Earth's history, and new opinions established a new hypothesis on the revival of the area's natural history.

The finding of the fossils (chronologically excavated), the locations of the state, and its source of details are mentioned in Table 1. As per systematic classification, there were 33 taxa of reptiles, including dinosaurs (Sauropoda [= pillar-like four thick legs herbivorous dinosaurs, with non-hollow bones], Therapoda [= carnivorous dinosaurs with three toes' limbs,

Unidentified egg fossils of Dinosaurs at the Fossils Park, Indroda, GEER Foundation, Gandhinagar, Gujarat. This dinosaur's oospecies fossils were excavated at Raiyoli Village, Mahi Sagar District, Gujarat, India. © Raju Vyas.

claws and hollow bones]), and Ichthyosauria (fish like primitive reptile), and four living groups of reptiles that are described up to date, contains 21 species-level (four dinosaurs, one crocodile, four turtles, two lizards, and 10 snakes) and remaining unconfirmed genus-level fossils recorded and identified by various paleontologists. The systematic list of fossils from Gujarat is mentioned in Table 2. This list indicated that Gujarat once had a very diverse and rich biodiversity, especially reptilian fauna.

The fossil eggs of various species of dinosaurs were found at different locations in Gujarat, including Kutch, Kheda, Mahi Sagar, Panchmahal, and Dohad districts. All these sites are formations from the Jurassic and Upper Cretaceous periods of Lameta (limestone) formation and inter-trappean beds, broadly during the Mesozoic era. Published literature surveys show nine eggshell species, excluding two indeterminable forms Problematica? *Megaloolithus* (Waniawao, Dohad district), *Trachoolithus sp*. (Lavariya Muwada, Dohad District), and an Incertaesedis (Dolidungri, Mahi Sagar District) recognized from Gujarat (Table 3) and update review presented (Vyas 2019).

As of today, various paleontology fossil studies indicate that a good number of reptiles have roamed in the past on the land of Gujarat. Few are found as remains of fossils from the state's various land formations and strata. These fossils are evidence of that species' inhabitation in the earlier Permian to Tertiary periods. During the last two decades, several paleontologists from various agencies worldwide have carried out several fossilized inventions and explorations in the state. A huge collection of fossils has been dug out from the various land formations of the state for further paleontology and geological research. However, various groups of fossils found in Gujarat are only from four areas.

Fossil hotspots in the state

Four major areas in the state, 1) Piram Island, near Bhavnagar; 2) Kutch (entire district); 3) Mahi Sagar (Balasinor, Doli Dungri, and Raiyoli); and 4) Vastan, near Surat, have been identified as rich fossil areas or fossils hotspots. However, geological land formation shows all these four 'hotspots' are the Quaternary sediments with a few scattered Jurassic rocks (Image 1B), especially in the Kutch region of Gujarat.

These areas are not just ordinary locations, but they hold a treasure trove of well-preserved fossils from various groups of flora and fauna. The most notable fossils, spanning various animal groups, are found in the Cambay Shale Formation of the state's Vastan, Surat District

Table 1: Details for fossils chronologically excavated in various locations in Gujarat State, India

No.	Fossils Excavation Site Location	Geo coordinates	Fossils	Sources
1	Piram Island, Nr. Bhavanagar District	21.5937; 72.3581	*Colossochelys atlas* Now=*Megalochelys sivalensis*	Falconer & Cautley 1837; Falconer 1845
2	Khur Is., Kutch	21.3997; 69.7412	*Dinosaurs*	Moor 1962
3	Piram Island, Bhavanagar, District	21.5937; 72.3581	*Piramys auffenbergi* *Lisseymys piramensis*	Prasad 1974
4	Sukhpar, Abdasa, Kutch District	23.3736; 68.7486	*Tomistoma tandani*	Sahni & Mishra 1975; Vijayasarathi & Sabale 1985
5	Viri (=vidi), Anjar, Kutch District	23.0760; 69.9885	*Dinosaurs* (Sauropod)	Ghevariya 1988
6	Anjar, Kutch District	23.1187; 70.0139	*Indophis sahnii*	Rage & Prasad 1992
7	Raiyoli, Kheda (=Mahi Sagar District	23.0463; 73.3379	*Indosuchus sp.* (Theropoda)	Chatterjee & Rudra 1996
8	Raiyoli, Mahi Sagar District	23.0558; 73.3435	*Ellipsoolithus khedaensis*	Loyal et al. 2000
9	Panandhro Mine, Kutch District	23.6726; 68.7633	*Pterosphenus katchensis* *Pterosphenus biswasi* *Pterosphenus sp.*	Rage et al. 2003
10	Temple Hill, Raiyoli, Mahi Sagar District	23.0572;73.3418	*Rajasaurus narmadensis*	Wilson et al. 2003
11	Cheriya Bet / Khadir Is., Kutch District	23.8708; 70.3012	*Dinosaurs* (Sauropod) *Camarasauromorpha*	Moser et al. 2006
12	Dholi Dungri, Mahi Sagar District	23.1333; 73.3833	*Megaloolithus dhoridungriensis*	Anon 2007
13	Pasuda, Kutch District	23.1583;70.1916	*Acrochordus hornstedt*	Head et al. 2007 Singh et al. 2021a
14	Vastan Lignite Mine, Surat District	21.4167; 73.1224	*Palaeophis vastaniensis*	Bajpai & Head 2007
15	Vastan Lignite Mine, Surat District	21.4167; 73.1224	*Indophis sahnii*	Rage et al 2008
16	Vastan Lignite Mine, Surat District	21.4120; 73.1008	*Vastanagama susani* *Tinosaurus indicus*	Prasad & Bajpai 2008
17	Vastan Lignite Mine, Surat District	21.4120; 73.1008	*Palaeophis sp.* *Peterosphenus sp* *Russellophis crassus* *Procerophis sahnii* *Thaumastophis missioaeni*	Rage et al. 2008
18	Dholi Dungri, Mahi District	23.1333; 73.3833	*Sanajeh indicus*	Wilson et al. 2010
19	Samda, Kutch District	23.4994; 68.8544	*Tomistominae*	Patnaik et al. 2014
19A	Lodai village, Nr. Bhuj, Kachchh	23.3731; 69.9115	*Ophthalmosauridae gen. et sp. indet*	Prasad et al. 2017
20	Tappar, Kutch	23.0087; 69.6573	*Ahaetuliinae* indet	Singh et al 2021a
21	Palasva, Kutch	23.4693; 70.9339	*Python* sp. *Acrochordus* cf. *dehmi*; *Acrochordus* sp.	Singh et al.2021a
22	Tappar, Kutch	23.0087; 69.6573	Colubrinae" indet	Singh et al. 2021b
23	Panandhro Mine, Kutch District	23.6726; 68.7633	*Vasuki indicus*	Datta & Bajpai 2024

Table 2: List of fossilized reptiles described and reported from various locations of Gujarat State, Western India

No	Groups / Family / Species – Authority	Type Locality / Fossils Site	Geo coordinates	Hot Spot Area	Source / Reference
	Dinosaurs (Sauropoda)				
1	**Titanosaurus Raiyoliensis* Mathur & Srivastava, 1987	Raiyoli, Mahi Sagar	23.0572; 73.341	3	Mathur & Srivastava 1987
2	**Titanosaurus indicus* Lydekker, 1877	Raiyoli, Mahi Sagar	21.4120; 73.1008	3	Chatterjee & Rudra 1996
	Dinosours (Theropoda)				
3	*Rajasaurus narmadensis* Wilson, Sereno, Srivastav, Bhatt, Khosla & Sahni 2003	Raiyoli, Mahi Sagar	23.0572; 73.3418	3	Wilson et al. 2003
4	*Raiyolisaurus gujaratensis* Novas, Chatterjee, Rudra & Datta, 2010	Raiyoli, Mahi Sagar	23.0572; 73.341	3	Novas et al. 2010
5	*Indosuchus sp.*	Balasinor, Mahi Sagar	23.0569; 73.3386	3	Chatterjee 1978 Chatterjee & Rudra 1996
	Ichthyosauria (Ophthalmosauridae)				
6	*Ophthalmosauridae gen. et sp. indet*	Lodai village, Nr. Bhuj, Kachchh	23.3731; 70.0916	2	Prasad et al. 2017
	Crocodile				
7	*Gavialis sp.*	Piram Island	21.5787; 72.3628	1	Falconer 1859; Martin 2018
8	*Crocodylus sp.*	Harudi, Kutch	23.5554; 68.6742	2	Sahni & Mishra 1975
9	*Tomistoma tandani* Sahni & Mishra, 1975	Nareda (=Naredi), Kutch	23.3736; 68.7486	2	Sahni & Mishra 1975
10	*Tomistoma* affinities	Sukhpar, Abdasa, Kutch	23.3736; 68.7486	2	Vijayasarathi & Sabale 1985
11	*Tomistoma sp.*	Samda, Kutch	23.4994; 68.8544	2	Vijayasarathi & Sabale 1985; Patnaik et al. 2014
	Turtles/Tortoise				
	Family: Testudinidae				
12	*Megalochelys sivalensis* Falconer & Cautley, 1837	Piram Island, Bhavnagar	21.5937; 72.3581	1	Falconer & Cautley 1837 (see: Vlachos 2019)
	Family : Chelonidae				
13	*Piramys auffenbergi* Prasad 1974	Piram Is., Bhavanagar	21.5937; 72.3581	1	Prasad 1974 Ferreira et al. 2018
	Family: Trionychidae				
14	*Lissemys piramensis* Prasad 1974	Piram Is, Bhavanagar	21.5937; 72.3581	1	Prasad 1974
	Family: Pelomedusidae				
15	*Carteremys leithi* Carter 1852	Lakshmipur (Tara), Nakhatrana, Kutch	23.2467; 69.3981	2	de Lapparent de Broin et al. 2009; Prasad & Sahni 2014
	Lizards				
	Family: Agamidae				
16	*Vastanagama susani* Prasad & Bajpai 2008	Vastan Lignite Mine, Surat	21.4120; 73.1008	4	Prasad & Bajpai 2008
17	*Tinosaurus indicus* Prasad & Bajpai 2008	Vastan Lignite Mine, Surat	21.4120; 73.1008	4	Prasad & Bajpai 2008
	Snakes				
	Family: Palaeophiidae				
18	*Pterosphenus katchensis* Rage, Bajpai, Thewissen & Tiwari, 2003	Panandhro Mine, Kutch District,	23.6726; 68.7633	2	Rage et al. 2003
19	*Pterosphenus biswasi* Rage, Bajpai, Thewissen & Tiwari, 2003	Panandhro Mine, Kutch District	23.6726; 68.7633	2	Rage et al. 2003
20	*Pterosphenus* sp.	Panandhro Mine, Kutch District	23.6726; 68.7633	2	Rage et al. 2003
21	*Palaeophis vastaniensis* Bajpai & Head, 2007	Vastan Lignite Mine, Surat	21.4167; 73.1224	4	Bajpai & Head 2007
22	*Palaeophis sp.*	Vastan Lignite Mine, Surat	21.4120; 73.1008	4	Rage et al. 2008
23	*Peterosphenus* sp.	Vastan Lignite Mine, Surat	21.4120; 73.1008	4	Rage et al. 2008
	Family: Pythonidae				
24	*Python* sp.	Palasva, Kutch	23.4693; 70.9339	2	Singh et al 2021a
	Family: Madtsoiidae				
25	*Sanajeh indicus* Wilson, Mohabey, Peters & Head, 2010	Dholi Dungri village, Mahi Sagar	23.1333; 73.3833	3	Wilson et al. 2010
26	*Vasuki indicus* Dutta & Bajpai 2024	Panandhro Lignite Mine, Kutch	23.6726; 68.7633	2	Datta & Bajpai 2024
	Family: Nigerophiidae				
27	*Indophis sahnii* Rage & Prasad 1992	Viri, near Anjar, Kutch	23.1187; 70.0139	2	Rage et al. 2004

No	Groups / Family / Species – Authority	Type Locality / Fossils Site	Geo coordinates	Hot Spot Area	Source / Reference
	Family: Russellophiidae				
28	*Russellophis crassus* Rage, Folie, Rana, Singh, Rose & Smith, 2008	Vastan Lignite Mine, Surat	21.4120; 73.1008	4	Rage et al. 2008
	Family: Colubroidea				
29	*Procerophis sahnii* Rage, Folie, Rana, Singh, Rose & Smith, 2008	Vastan Lignite Mine, Surat	21.4120; 73.1008	4	Rage et al. 2008
30	*Thaumastophis missiaeni* Rage, Folie, Rana, Singh, Rose & Smith, 2008	Vastan Lignite Mine, Surat	21.4120; 73.1008	4	Rage et al. 2008
31	*Ahaetuliinae* indet	Tappar, Kutch	23.0087; 69.6573	2	Singh et al. 2021b
	Family: Acrochordiae				
32	*Acrochordus* cf. *dehmi* Hoffstetter, 1964	Pasuda, Kutch	23.1583; 70.1916	2	Head et al .2007
33	*Acrochordus sp.*	Palasava, Kutch	23.4693; 70.9339	2	Singh et al. 2021a

Table 3. Dinosaur egg fossils (oospecies) and their records from different locations in Gujarat State, India.

No.	Oospecies	Fossils location site in Gujarat	Geo coordinates	Hot Spot Area	Source/ reference
1	*Megaloolithus jabalpurensis* Khosla &Sahni, 1995	Waniawao, Dohad		3	Mohabey & Mathur 1989; Fernández & Khosla 2014
		Dhoridungi, Mahi Sagar	23.1319; 73.3847	3	Mohabey 1998
2	*M. cylindricus* Khosla &Sahni, 1995	Khempur, Lunawada, Mahi Sagar	23.2486; 73.3868	3	Khosla & Sahni 1995
		Raiyoli, Mahi Sagar	23.0477; 73.3388	3	Mohabey 1998
3	*M. mohabeyi* Khosla &Sahni, 1995	Balasinor, Mahi Sagar Waniawao, Dohad	22.95; 73.3308	3	Khosla & Sahni 1995
		Phensani=Felsani, Mahi Sagar	23.0252; 73.3222	3	Mohabey 1998
4	*M.khempurensis* Mohabey, 1998	Khempur	23.1038; 73.3872	3	Mohabey 1998
		Werasa, Mahi Sagar	22.9902; 73.331	3	
5	*M. megadermus* Mohabey, 1998	Dholidhanti, Dohad & Paori, Dohad		3	Mohabey 1998
		Daulatporia (=Dolatpoyda), Mahi Sagar	23.0922; 73.3925	3	Mohabey 1998
6	*M.dhoridungriensis* Mohabey, 1998	Dholidungri, Mahi Sagar	23.1319; 73.385	3	Wilson et al. 2010
7	*Fusioolithus baghensis* Khosla &Sahni, 1995	Anjar, Kutch	23.1188; 70.0138	2	Khosla & Sahni 1995
		Balasinor, Mahi Sagar	22.95; 73.3308	3	Mohabey 1998
		Jetholi, Mahi Sagar	23.0716; 73.3508	3	
		Dhuvadiya, Mahi Sagar	23.0311; 73.3494	3	
8	*Ellipsoolithus khedaensis* Loyal et al. 1998	Kevadiya, Mahi Sagar	23.07; 73.3186	3	Mohabey 1998 Loyal et al. 1998
		Raiyoli, Mahi Sagar	23.0477; 73.3388	3	
9	*Subtiliolithus kachchhensis* Khosla &Sahni, 1995	Anjar, Kutch	23.1188; 70.0138	2	Khosla & Sahni 1995
10	? Megaloolithidae-problematica	Balasinor, Mahi Sagar	22.95; 73.3308	3	Mohabey 1998
		Phensani, Mahi Sagar	23.0255; 73.3222	3	
		Sonipur, Mahi Sagar	22.8441; 73.4366	3	
11	cf. *Trachoolithus*	Raiyoli, Mahi Sagar	23.0477; 73.3388	3	Mohabey 1998
12	Incertaesedis (of uncertain placement)	Dhoridungi, Mahi Sagar	23.1319; 73.385	3	Mohabey 1998

and Panandhro Lignite Mines, Kutch (Sahi et al. 2006; Datta & Bajpai 2024). The lithology and overall fossils assemblage of the Cambay Shale suggest a freshwater to brackish water and inner shelf deposition. Let's delve into the fascinating history of these geological formations and their fossil contents. Overall, a higher number of fossils of different taxa were found beneath lignite-deposited areas; this reflects Gujarat State's Palaeo-environmental (ancient environment) conditions.

1. Piram Island, Bhavnagar District

Piram Island (Bhavangar District) is located in the Gulf of Khambhat (previously Gulf of Cambay), and is known to support multiple fossil records, including crocodilians (Vyas 2022). The island covers an expanse of about 7.5 km^2 across an intertidal zone, with 1.5 km^2 of unsubmerged land area. It is surrounded by rocky reefs that run 3–5 km to the north and south-east and are exposed to low tides. The geology of Piram is complex, and it appears to have been formed during the Pliocene and Holocene periods. The vertebrate bonebed and round pebble conglomerate surfaces were formed prior to this period, during the Upper Miocene to Lower Pliocene. The thickness of these rocks vary 1–15 m; the strata represent mammalian bones and bone fossils of other non-mammalian vertebrates (Sakhawala 1990).

The vertebrate fossils at Piram Island have attracted attention for over 175 years (Falconer 1845; Ferreira et al. 2018). Fossils representing most living groups have been discovered, along with many fossils representing extinct groups. The common fossil species are Probocidia, Ungulata, Chelinia, Pisces, Turtles and Crocodilia (Prasad 1974). The oldest fossil representative of the genus *Gavialis*, from the late Miocene, is also from Piram Island (Falconer 1859; Martin 2018).

2. Kutch District

The geology of Kutch is a captivating tapestry, spanning from the Jurassic era to the present day (Moser et al. 2006). Its Mesozoic rocks have captivated geologists worldwide, thanks to their extraordinary fossil wealth from the Jurassic period (Čerňanský et al 2022). Kutch is a prime location for paleontological studies, offering a unique window into the evolution of various ages and periods. The fossil history and the vast paleontological knowledge accumulated over the years paint a vivid picture of western Kutch's past. It was once a mosaic of diverse habitats, with numerous swamps teeming with a rich variety of flora and fauna (Tiwari 1995; Vyas 2022). Kutch's reputation as a treasure trove of Neogene vertebrates, established since the mid-18th Century (Grant 1840; Wynne 1872; Lydekker 1880), commands respect and awe and continues to grow with recent discoveries of a fish-like reptiles *Ophthalmosauridae* gen. et sp. indet (Prasad et al. 2017), and a giant serpent *Vasuki indicus* (Dutta & Bajpai 2024).

In recent years, our understanding of Kutch's fossil wealth has been enriched by numerous discoveries. More fossil specimens have been unearthed from various sediments, particularly from the late Miocene sites of Tapar and Pasuda (Singh et al. 2021a,b). These include teleosts, batoids, turtles (Image 2), crocodylians (Image 3), lizards, snakes, suids, equids, giraffids, rhinocerotids, and elephants. Notably, a giant madtsoiid snake was discovered in the Naredi Formation of Panandhro Lignite Mine, Kutch, Gujarat State, adding to the growing body of knowledge about this fascinating region (Bajpai

A real-life size model of Sauropod Dinosaurs Rajasorus narmadensis at the 'Fossils Park', Raiyoli Village, Mahi Sagar District, Gujarat, India. These dinosaur fossils were excavated in the Narmada River Valley area. © Raju Vyas.

& Thewissen 2002). The entire Kutch District is a treasure of fossils; you can find molluscan fossils everywhere (Tiwari 1995; Nail & Pal 2004). Recently, the government established a wooden fossil park at Dhola Vira (Harappan Civilization site), Khadir, Kutch. Numerous large wooden fossils are naturally found there.

3. Balasinor, Doli Dungri & Raiyoli, Mahi Sagar District

All these localities of Mahi Sagar District (before 2013, it was a part of Kheda and Panchmahal), north of the Mahi River, are rich in fossils. The fossils are found preserved in "infra trappean" sediments of the Lameta Formation exposed in Doli Dungari (Temple Hill) and Raiyoli villages. Both localities are well known for dinosaur fossils, including eggs; especially noteworthy are *Raiyolisaurus* and *Rajasaurus*, which are among the most important discoveries from the area (oospecies: Image 4) (Srivastava et al. 1986; Vyas 2019), as well as large Madtsoiidae snakes and predators of dinosaur hatchlings (Wilson et al. 2010).

4. Vastan, Surat District

The early Eocene Cambay Shale Formation at Vastan, Tadkeshwar (Surat), and Rajpardi (Bharuch) Lignite Mine, located north-east of Surat District in Gujarat, western India, has recently received attention for its rich vertebrate assemblage (Rana et al. 2004, 2005; Bajpai et al. 2005; Rose et al. 2006; Bajpai 2009). The terrestrial vertebrates come from continental thin lenses (< 0.5 m thick) of dark, clayey silt and shale with abundant plant matter, situated about 1m above the lower of the two major lignites occurring in the mine (Sahni et al. 2006; Rose et al. 2009b).

The vertebrate-bearing part of the section is estimated to be middle Ypresian in age, corresponding to the shallow benthic zone SBZ 10, based on the large foraminifer *Nummulites burdigalensis* (type of bivalve mollusk) that has been identified about 10 m above the continental lenses (Rana et al. 2005; Sahni et al. 2006).

The mammal fauna from Vastan has important palaeo-biogeographic implications and includes the earliest modern mammals from the Indian subcontinent, with a high diversity of bats (Smith et al. 2007), the first Asian ailuravine rodents (Rana et al. 2008), the oldest lagomorphs (Rose et al. 2008), primitive adapoid and omomyid primates (Rose et al. 2009a), the first Indian tillodont (Rose et al. 2009b), and basal artiodactyls (Kumar et al. 2010). Besides mammals, other vertebrates include fishes (Rana et al. 2004), snakes (Rage et al. 2008), lizards (Prasad & Bajpai 2008), and birds (Mayr et al. 2007, 2010). Amphibians have also been reported (Bajpai & Kapur 2008; Folie et al. 2008) and are described in detail based on hundreds of well-preserved three-dimensional isolated frogs remaining, including diagnostic ilia and vertebrae.

However, scientists from the Geological Survey of India (GSI) accidentally discovered fossils in the sedimentary rocks of Raiyoli Village in Balasinor, in 1981. Since then, researchers have uncovered fossils of about 1,000 dinosaur eggs, belonging to at least 13 species of dinosaurs, making Raiyoli in Balasinor the third-largest dinosaur hatchery in the world (Loyal et al. 2000). The site is also where *Rajasaurus narmadensi*s, the first dinosaur species (the gigantic, horned, 30-foot-long carnivore: Image 4) unique to India, was identified in 2003 (Wilson et al. 2003). A rare example of non-dinosaurian predation on dinosaurs was also found in the form of a fossilized dinosaur-eating snake named Sanajeh indicus (Wilson et al. 2010). Recently, the Government of Gujarat has identified a large area, and developed it as a tourist destination site, 'Fossils Park' (Vyas 2019), and a fossils museum near Balasinor (23.054; 73.337).

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Raju Vyas
1-Shashwat Apartment, 23 Anandnagar Society, BPC Road, Alkapuri, Vadodara, Gujarat 390007, India.
Email: razoovyas@hotmail.com.

Citation: Vyas, R. (2026). Review of prehistoric reptiles of Gujarat, India from the Mesozoic and Cenozoic eras. *Zoo's Print* 41(4): 18–28.

Plumage aberrations in the House Crow

Plumage aberrations have always evoked considerable interest, and much literature has been published regarding them. Plumage aberration in birds have been reviewed by van Grouw (2006), who addressed the common inherited colour aberrations involving the melanin pigments, namely, albinism, leucism, ino, brown, dilution, and melanism. Several of these have been observed in the House Crow, *Corvus splendens*, an almost ubiquitous corvid from the Indian subcontinent (Mahabal et al. 2015; Ashwin et al. 2022).

On 25 June 2024, at approximately 1545 h, the author had an incidental sighting of a House Crow in Mumbai (19.00° N, 72.84° E). The sighting occurred in an urban setting with tree cover in the form of *Ficus*, *Azhadirachta*, and *Mangifera*, among others. There were other House Crows in the immediate vicinity, which were seen and heard. This individual was seen on the ground, manipulating a plastic bag containing a fried snack. Strikingly, it bore bilaterally symmetrical white bands on its primary coverts and primary feathers. No other external abnormality was evident, including in the eyes and other feathers. Presumably being unable to access the food within the bag, and perhaps disturbed by the human foot-traffic, it flew away after a few minutes.

In birds, albinism refers to a complete absence of melanins in feathers, eyes and skin, whereas leucism refers to the partial or total lack of melanins in feathers and skin (but with normal eyes). Some reports also use the term partial albinism. This, van Grouw (2006) points out, is a contradiction in terms since albinism, by definition, is a state of complete absence of pigment. Partial leucism does exist.

Plumage aberration may also be acquired by inappropriate diet, injury, stress or infection. In such cases there may be focal areas with lack of pigmentation, as in partial leucism. However, unlike in partial leucism, even the feathers are partly coloured instead of being entirely devoid of pigmentation.

The individual reported here, with normal coloured, predominantly normal plumage, normal eye colouration, and partial loss of pigment in the affected feathers is most consistent with aberrant plumage due to dietary imbalance. Juvenile corvids have been known to manifest transverse white bars in their flight feathers, a pattern known as white wing-barring. Adult individuals typically manifest less regular patterning, which van Grouw (2018) indicates is better referred to simply as a "lack of pigment". Most observations of dietary plumage aberrations have been made almost exclusively in Hooded Crow, *Corvus cornix* and Carrion Crow, *Corvus corone*. Indeed, the prevalence of white plumage in Carrion Crows has been estimated to be 7.2%, and it is reasonable to assume a similar proportion in House Crows.

It is speculated that corvids are susceptible to plumage aberrations from dietary causes as compared to other taxonomic groups due to a greater protein requirement for the development of healthy plumage. The amino acids required for melanin pigment formation, namely tyrosine and methionine, are dependent on dietary intake. Affected juveniles have been reported to stunted growth, smaller thyroid glands and increased mortality within the first year of life (van Grouw 2018). However, surviving individuals have been observed to display normal plumage after their first moult, suggesting this condition is reversible.

The individual House Crow discussed here has most probably been consuming a nutritionally poor diet, as has been observed in corvids in urban environments (van Grouw 2018). This is corroborated by its sighting in the middle of a major metropolitan city attempting to consume human food. With the ever-expanding state of urbanization today, it may be speculated that more individuals of various species may become accustomed to surviving on inappropriate diets. In such a case, it is likely that dietary plumage aberrations will be more commonly observed in the future. This will pose implications not just for birders, but also conservation efforts, and ought to be borne in mind.

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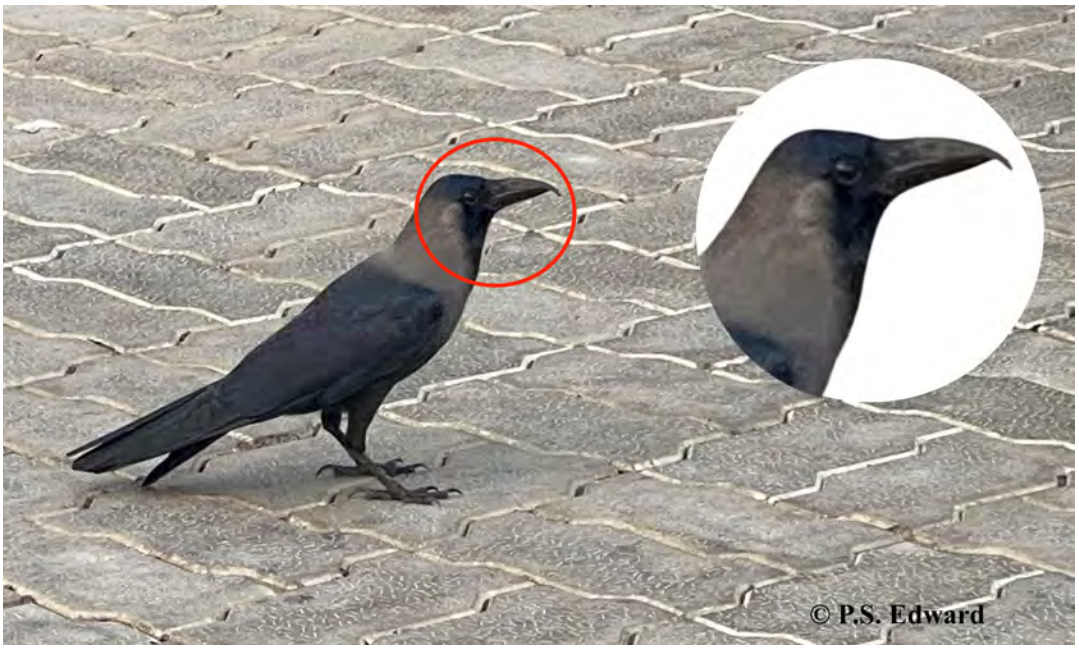
Rahul Kothari
Modern Villa, 7th Road, Santacruz East, Mumbai, Maharashtra 400055, India.
skotharirahul@gmail.com.

Citation: Kothari, R. (2026). Plumage aberrations in the House Crow. Bird-o-soar #286, In: *Zoo's Print* 41(4): 29–30.

Observation of beak deformity in a House Crow in Chennai, India



A House Crow showing an elongated and downcurved upper beak. © P.S. Edward.

Beak deformities in birds are generally rare, but when they occur, they can significantly impact a bird's survival and fitness (Handel et al. 2010). In recent decades, an alarming increase in such deformities has been documented across various species and regions. Affected birds often exhibit an overgrown, elongated beak (particularly the upper mandible) that may curve abnormally or cross over the lower mandible (Pomeroy 1962). This condition is referred to as Avian Keratin Disorder (AKD). AKD has been observed in various bird families, with corvids, parids, and raptors being among the most affected. Such deformities have been documented in several bird populations globally (Pourlis 2011).

On 2 April 2025, an individual House Crow *Corvus splendens* exhibiting an apparent beak deformity was observed in an urban locality of Chennai, Tamil Nadu, India (13.004, 80.238).

The most striking feature was its overgrown upper beak, which extended well beyond the tip of the lower beak and curved slightly downward. The lower mandible of the observed crow appeared normal in length, whereas the upper mandible was disproportionately long.

No other obvious physical abnormalities, such as plumage discoloration or injured limbs, were noted in this individual. The crow was observed foraging on the ground, picking at food scraps on a paved surface. Despite the deformity, it could peck and grasp food, albeit with noticeable difficulty. In the present case, the upper beak's curvature was downward (hook-like). Importantly, such deformities

usually involve the keratin layer rather than the underlying bone structure of the beak. The possible cause of such avian beak deformities has been investigated by researchers but remains only partially understood. Early hypotheses centred on factors such as genetic defects, injuries, or exposure to pollutants, but many cases did not fit these explanations neatly (Pourlis 2011; Handel & Hemert 2015). House Crows often forage in garbage dumps and sewage outlets, potentially ingesting or contacting these contaminants. While direct evidence linking pollutants to beak deformities in House Crows is not yet available (Hemert & Handel 2010), the polluted water body where deformed crows in Nagpur were feeding was suspected as a factor (Kasambe et al. 2009).

Additionally, malnutrition or specific nutrient deficiencies could conceivably lead to poor beak condition or abnormal growth (Demir & Özsemir 2021). Birds subsisting on imbalanced diets, such as predominantly human refuse with low nutrient content, might develop abnormalities. However, conclusive evidence links nutritional deficiency alone to AKD (Burt et al. 2021). This rare observation shows how urban wildlife can adapt to physical impairments. It also highlights the importance of monitoring urban bird populations as indicators of environmental change.

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Phillmon Smart Edward1*, Jeyasubashini Regupathikannan[1] & Arockianathan Samson[2]

[1,*]Centre for Landscape Ecology, Research & Development Division, Fedstan GMC Registered Private Limited, Chennai, Tamil Nadu 600040, India.

[2]Bombay Natural History Society, Vulture Programme, Vulture Conservation Breeding Centre, Bhopal, Madhya Pradesh 462044, India.

*phillmonsmart@gmail.com (corresponding author)

Citation: Edward, P.S., J. Regupathikannan & A. Samson (2026). Observation of beak deformity in a House Crow in Chennai, India. Bird-o-soar #287, In: *Zoo's Print* 41(4): 31–32.

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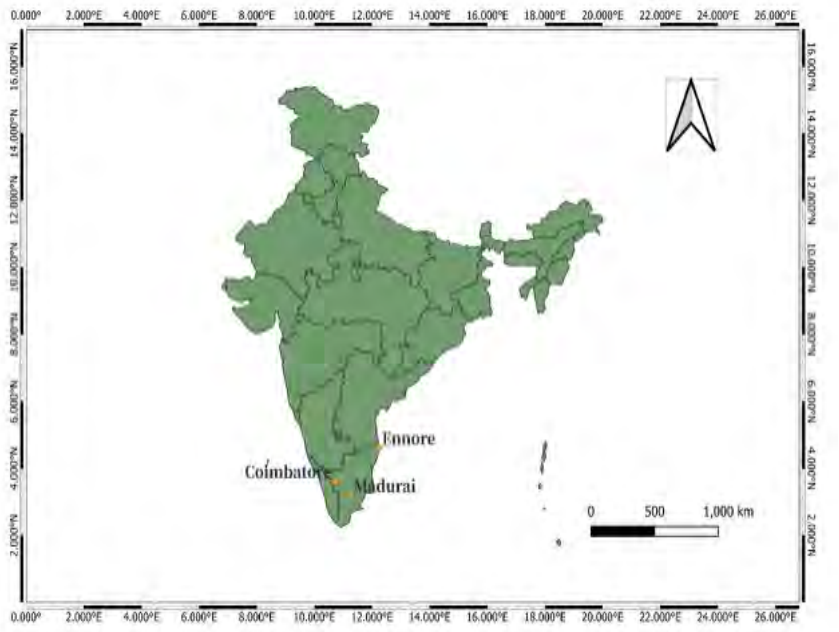
First record of the Redback Spider from Ennore Creek, Tamil Nadu, India

Widow spiders, belonging to the genus Latrodectus, are found worldwide (Graudins et al. 2001) and are recognized for their potent venom and their significant impact on human health. One such species, Latrodectus hasselti Thorell, 1870, commonly known as the Redback Spider or Australian Black Widow, is native to Australia, but has now spread to other regions, such as southeast Asia and New Zealand.



The occurrence of the Redback Spider in southern India.

According to the World Spider Catalog (2025), there are currently 52,984 documented spider species across 4,437 genera and 136 families. The Theridiidae family, which includes redback spiders, consists of 132 genera and 2,592 species. However, researchers estimate that the total number of spider species worldwide could surpass 120,000, indicating that a large portion remains undiscovered (Agnarsson et al. 2013; Framenau et al. 2022). In India alone, 1,971 spider species across 500 genera and 61 families have been recorded, with Tamil Nadu contributing 393 species from 214 genera and 46 families (Sen et al. 2024).

The presence of Latrodectus hasselti in India has been reported sporadically over the years, with relatively few documented occurrences. Initial records from Pune, Maharashtra, date to Simon (1897), who first noted the species, and were later confirmed by Pocock (1900). Further observations were reported from Thane, Maharashtra (Daniel & Soman 1961), and from Gujarat, specifically Bhavnagar (Patel 1973; Tikader 1987) and Vadodara (Siliwal & Kumar 2001). Additional sightings were reported in the Great Indian Bustard Sanctuary at Nannaj and in Yedshi Ramling Ghat Wildlife Sanctuary, both in Solapur, Maharashtra (Hippargi et al. 2012), as well as in Chinnar Wildlife Sanctuary, Kerala (Adarsh & Nameer 2016), and in Zaheerabad, Medak District,

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Habitat of the Redback Spider *Latrodectus hasselti* at Ennore Creek, Tamil Nadu, India. © Anbarashan.

Telangana (Pravalikha & Srinivasulu 2014). Ennore Creek, located along the coast of Tamil Nadu (13.262° N, 80.313° E), supports a diverse range of plant and animal life. Its ecological composition including mangroves, mudflats, salt marshes, and backwater systems provides essential habitats for numerous species. However, the region has experienced significant ecological degradation in recent decades due to increasing industrial activities such as thermal power generation, fertilizer production, and port operations. Estuarine systems like Ennore Creek play a critical role in maintaining biodiversity by offering breeding grounds and food resources for birds, fish, and other wildlife, including migratory species (Chitrarasu et al. 2013).

In our most recent observation in 2025, during a survey of flora and fauna diversity in the Ennore Creek area near Chennai, Tamil Nadu, we recorded the presence of Redback Spiders in an old fly ash dump pond characterized by salt marsh and grassland habitats. These areas were predominantly vegetated with Fimbristylis ferruginea, F. dichotama, and Aeluropus sp., indicating the species' adaptability to coastal estuarine environments.

In south India, this species has been recorded previously in Tamil Nadu. The Redback Spider was first identified in Coimbatore, marking an extension of its known range into the southern Western Ghats (Kumar & Siliwal 2005). Subsequent records include Madurai and Kiluvamalai in the Eastern Ghats (Roopha et

Latrodectus hasselti Redback Spider from Ennore creek, Thiruvallur District, Tamil Nadu. © Anbarashan.

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al. 2021). These observations suggest that its distribution in India spans several hill ranges, from the Western to the Eastern Ghats in the southern peninsular region (Kumar & Siliwal 2005). This report represents the first record of the Redback Spider from Chennai and the first from a coastal area in Tamil Nadu. Previously, the species was known only from hilly regions; this is the first time it has been documented in a low-lying coastal plain.

The observation of Latrodectus hasselti at Ennore Creek, Chennai, in October 2025 represents the first record of the species from the coastal lowlands of Tamil Nadu, the Chennai metropolitan region, and a fly ash dump habitat in India. The population appears established, with multiple adult females bearing egg sacs and at least one adult male recorded. The disturbed, warm, and dry conditions of the decommissioned fly ash pond are consistent with the species' known habitat preferences and may support its persistence in this novel setting. Targeted surveys of similar industrial coastal habitats in peninsular India are needed to determine whether this occurrence represents an isolated introduction or part of a broader coastal range expansion.

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M. Anbarashan[1],[2*], P. Sridhar [1,3], K. Ilangovan[1] & M. Praveen Kumar[1]

[1]Innovotek Private Limited, Chennai, Tamil Nadu 600020, India.

[2]Department of Ecology, French Institute of Pondicherry, Puducherry 605001, India.

[3]CAS in Botany, University of Madras, Guindy campus, Chennai, Tamil Nadu 600025, India.

*Corresponding author: anbarashan.m@ifpindia.org

Citation: Anbarashan, M., P. Sridhar, K. Ilangovan & M. P. Kumar (2026). First record of the Redback Spider from Ennore Creek, Tamil Nadu, India. Bugs R All #301, In: Zoo's Print 41(4): 33–35.

#302 21 April 2026

Bugs r all Newsletter of ICINSA Invertebrate Conservation Information Network of South Asia SAsISG South Asian Invertebrate Specialist Group IUCN SSC

New records of the tarantula *Haploclastus nilgirinus* sharing microhabitats

On our regular field visit on 17 July 2025 at 1332 h (11.320° N, 76.792° E) we observed *Raorchestes signatus* commonly known as the Star-eyed Bush Frog, a rhacophorid, resting inside a tree hollow of *Celtis tetrandra.* We were amazed to see that just above the tree hollow we noted the presence of the wood burrow of a juvenile *Haploclastus nilgirinus* (Pocock, 1899) a mygalomorph under the family Theraphosidae, whose burrow was internally connected to the hollow.

Burrow of *Haploclastus nilgirinus* (Left) and *Raorchestes signatus* (Right) just below sharing the microhabitat in *Celtis tetrandra*. © Rishi Kesavan & Elangovan Vignesh.

The following month on 8 August 2025 at 1426 h (11.320° N, 76.801° E), we observed a juvenile Rock Agama *Psammophilus dorsalis* Gray, 1831 and an adult *H. nilgirinus* in close proximity, sharing the tree cavities on an *Acacia mearnsii* tree (burrows not connected), with the *H. nilgirinus* retreating into its burrow upon our approach. The next month on 14 September 2025 at 1221 h (11.334° N, 76.802° E), we

***Bipalium* sp sharing the burrow of adult *Haploclastus nilgirinus*. on the tree *Vernonia arborea*. © Rishi Kesavan.**

Burrow of *Haploclastus nilgirinus* (Left) and *Psammophilus dorsalis* (Right) sharing the microhabitat tree cavity in *Acacia mearnsii*. © Rishi Kesavan.

noted that a juvenile tarantula parasitized by the Mesostigmata. On 05 April 2026 at 2357h (11.34895° N, 76.81182° E), we observed the *Bipalium* sp. sharing the burrow of an adult *H.nilgirinus* on the tree Vernonia arborea.

Globally, numerous instances of symbiosis have been documented, which is extensively revised by Zamani et al. (2024) and reported association across 17 countries in different sub families of theraphosids such as Theraphosinae, Harpactirinae, Thrigmopoeinae, Poecilotheriinae, Ischnocolinae, Avicullariinae, Selenocosmiinae, and Psalmopoeinae with anuran families such as Leptodactylidae, Bufonidae, Microhylidae, Craugastoridae, Strabomantidae, Hylidae, Dendrobatidae, and Eleutherodactylidae and with snakes, and several invertebrates such as whip spiders, ants, and termites. In India notable examples include

Parasitism of Mesostigmata mites on *Haploclastus nilgirinus*. © Rishi Kesavan.

commensalism between *Poecilotheria hanumavilasumica* Smith, 2004 and *Uperodon taprobanicus* Parker, 1934 (Siliwal & Ravichandran 2008), association between *Poecilotheria rufilata* Pocock, 1899 with *Oecophylla smaragdina* Fabricius, 1775 and an unidentified species of *Microhyla* Tschudi, 1838 entering the burrow of *Haploclastus kayi* Gravely, 1915 (Siliwal & Ravichandran 2008; Zamani et al. 2024).

Furthermore, commensalism between *Haploclastus nilgirinus* and the Triangular Spotted Frog *Uperodon triangularis* was reported by Abinesh & Moinudheen (2024) from the Nilgiris. Sympatry between *Cnemaspis* sp. and *Dravidogecko* sp. (now identified as *Dravidogecko coonoor*; Abinesh et al. 2025) along with *H. nilgirinus*, during which the spider was observed capturing a *Cnemaspis* sp. individual and retreating into its burrow.

Association between mites and spider dates back at least 50 million years ago from Baltic amber fossil evidence (Wunderlich 2004; Dunlop et al. 2012; Masan et al. 2012), since then numerous studies such as those by (Durkin et al. 2021) and (Hernández-Corral & Moraza 2025) have continued to explore this association. This study is first of its kind reporting the spatial microhabitat sharing between *H. nilgirinus with Raorchestes signatus*, *Psammophilus dorsalis and Bipalium* sp. and parasitized by Mesostigmata. Future studies should be carried out and should focus on long term ecological and behavioral aspects.

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Saran Moorthi[1], Rishi Kesavan[2], Elangovan Vignesh[2], Anbazhagan Abinesh[3] & Nizamudheen Moinudheen[4]

[1]*Department of Wildlife Biology, Government Arts College, Ooty, Tamil Nadu 643001, India.
[2]Department of Zoology, Government Arts College, Ooty, Tamil Nadu 643001, India.
[3]Lakshmi Nanjan Nivas, Stanley Park, Coonoor, The Nilgiris, Tamil Nadu 643105, India
[4]Nilgiri Hills, Tamil Nadu 643001, India.
*sharanmoorthy2@gmail.com

Citation: Moorthi, S., R. Kesavan, E. Vignesh, A. Abinesh & N. Moinudheen (2026). New records of the tarantula Haploclastus nilgirinus sharing microhabitats. Bugs R All #302, In: *Zoo's Print* 41(4): 36–38.

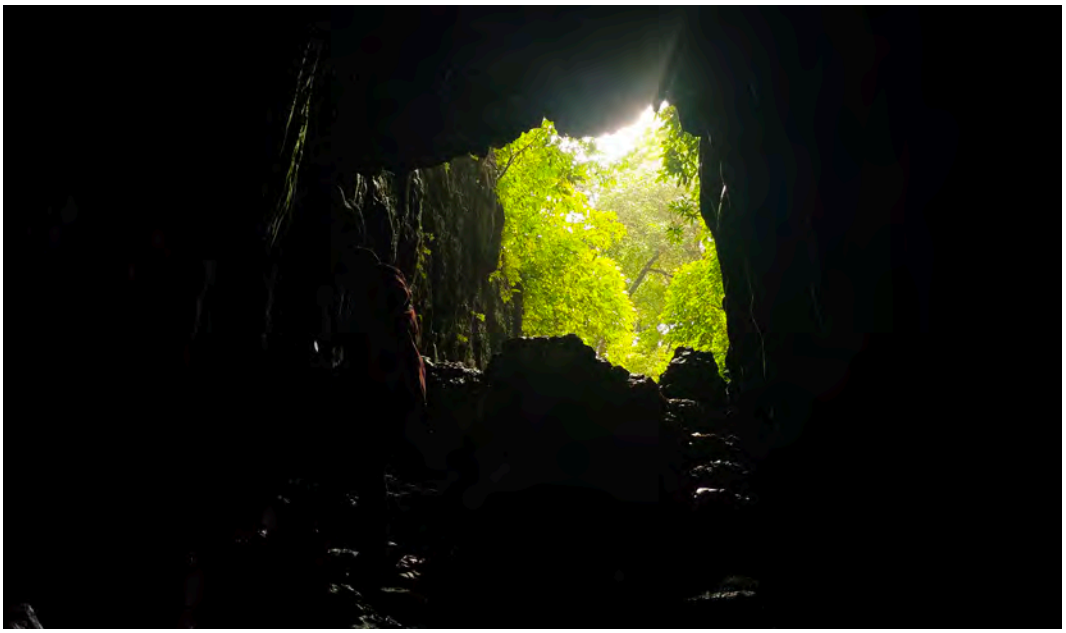
Record of *Amolops siju* from Syndai Cave in Meghalaya, India

Syndai Cave (25.1815° N; 92.1375° E) nestled in the picturesque East Jaintia Hills District of Meghalaya in northeastern India is a fascinating geological wonder that showcases the region's rich natural heritage. This limestone cave, located near the scenic village of Syndai, is known for its striking stalactites and stalagmites, which have formed over thousands of years of erosion, creating a mesmerising unique subterranean landscape (Daly 2013).

The cave once offered an adventurous exploration opportunity for tourists and speleologists but has long been abandoned for a couple of decades providing an opportunity for local biodiversity to thrive. Additionally, surrounding the cave, the lush greenery and serene environment add to its allure, making Syndai Cave a hidden gem for faunal documentation.

A recent visit to Syndai Cave in the month of October 2025, for documentation of various biota of this unique ecosystem led to the observation of a large-sized green frog belonging to

Entrance of Syndai Cave. © Bankerdonbor Kharbisnop.



View of the entrance of Syndai Cave from inside. © Bankerdonbor Kharbisnop.

An adult female of *Amolops siju* from Syndai Cave. © Bankerdonbor Kharbisnop.

the genus *Amolops*. The frog was observed and photographed ¬*in-situ* (no collection was made) which was sitting atop the cave wall at ca. 1.5 m from the cave floor, ca. 50 m from the cave entrance. The frog exhibited distinct morphological characters of *Amolops siju*, such as large-sized body; dorsal and lateral colouration olive-green with irregular blotches; limbs distinctly banded with alternating greenish-yellow and brown bands, all of which are in accordance with the original description of the species by Saikia et al. (2023).

Most notably, Saikia et al. (2023) distinguished *A. siju* from its congeners by the presence of an extremely small tympanum (one-fifth of the eye diameter), which is distinctly visible in the photographed specimen from Syndai Cave. Saikia et al. (2023) highlighted that in females of this species the tympanum is separated from the eye by a distance of less than twice its diameter, as observed in the image.

Contrastingly, in males the tympanum is separated from the eye by a distance greater than twice its diameter. Based on this

distinguishing character, the individual was identified as an adult female of *A. siju*.

The genus *Amolops* is made up of rheophilic, stream-dwelling frogs that are found throughout the Indo-Burma biodiversity hotspot, the Himalaya, and southern & eastern China (Frost 2025). However, Saikia et al. (2023) described *A. siju* from Siju cave, a limestone cave located in the south Garo Hills district of Meghalaya, separated from Syndai by ca. 200 km aerial distance with no known subterranean connectivity. Despite being a cascade dwelling genus, Saikia et al. (2023) did remark that *A. siju* lacked any cave adapted modification and raised the possibility that it would have a much wider distribution. As of now, its range is restricted to its type locality.

Besides this frog, we also observed other cave biota such as Huntsman Spider *Heteropoda* sp., Potamid Cave Crab, Rhaphidophorid Cave Cricket and Cave Millipede during the field visit. Further biospeleological explorations are needed to understand the cave biota of Syndai.

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Acknowledgements:
The second author would like to acknowledge the director, Zoological Survey of India, Kolkata, for proving research facilities. The authors would like to extend their sincere gratitude to Dr. Shngainlang Khongsti, Rivel Snaitang, and William Nongkhlaw for their valuable support during the fieldwork; to the editor for the prompt initiation of the review process and to the anonymous reviewer for insightful and constructive comments that strengthened this note.

Bankerdonbor Kharbisnop[1] & Bhaskar Saikia[2]
[1]Department of Zoology, College of Science and Commerce, Mawphlang, Meghalaya 793121, India.
[2]Zoological Survey of India, North Eastern Regional Centre, Shillong, Meghalaya 793003, India.
[2]bhaskarsaikia7@gmail.com (corresponding author).

Citation: Kharbisnop, B. & B. Saikia (2026). Record of *Amolops siju* from Syndai Cave in Meghalaya, India. frog leg #151 In: Zoo's Print 41(4): 39–41.

Photographic record of Ruddy Mongoose from Melghat Tiger Reserve, Maharashtra

Ruddy Mongoose at Melghat Tiger Reserve, Maharashtra. © Sachin Ranade.

The Ruddy Mongoose *Urva smithii* Gray, 1837 has wide distribution in India as well as in Nepal and Sri Lanka (Sreehari et al. 2013; Menon 2014; Subba et al. 2014; Samanta et al. 2020; Anver et al. 2023; Mudappa & Choudhury 2024). It's known from peninsular India as a forest dweller.

On 19 December 2025, during my visit to the Vulture Release Center at Somthana range, Melghat Tiger Reserve (21.406º N, 77.148º E), I came across a mongoose near a nullah. It was about 1630 h and we were passing by the nullah in a vehicle. The mongoose noticed the vehicle, yet sat in open boldly, staring at the vehicle for about five minutes. It was identified as the Ruddy Mongoose by characteristic dark tail tip and dark brown legs. These characters are missing in the similar looking species, the Grey Mongoose *Urva edwardsii* (Menon 2014).

The Melghat Tiger Reserve is located in Amaravati, Akola and Buldhana districts of Maharashtra. It represents the typical central Indian landscape with tropical dry deciduous forest (Champion & Seth 1968). It boasts the presence of Tiger Panthera tigris the apex predator along with rich biodiversity in flora and fauna. During this visit, I witnessed grasslands with standing dried grasses and the deciduous trees had already started shedding leaves. The monsoon receded long time back and due to limited water sources available, the mongoose could be sighted.

The species was mentioned in the two decades of Melghat Tiger Reserve report (Gogate et al. 1992), yet missing from other publications on Melghat Tiger Reserve. Hence, it could be an important record of the Ruddy Mongoose with photographic evidence from the region.

Acknowledgements:
The author is thankful to the Forest Department of Maharashtra and the authorities at the Melghat Tiger Reserve. Thanks are due to the Director, Bombay Natural History Society for constant support and provision of references on the fauna of Melghat.

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Sachin Ranade
VCBC, Rani, Belguri, Assam, India.
s.ranade@bnhs.org

Citation: Ranade, S. (2026). Photographic record of Ruddy Mongoose from Melghat Tiger Reserve, Maharashtra. Small Mammal Mail #458, In: *Zoo's Print* 41(4): 42–43.

A note on Royal Bengal Tiger cub reunion in Kaziranga Tiger Reserve

Temporary separation and subsequent reunion of young animals with their parents in the wild is a common phenomenon. Such separation may last from a few hours to several days and, in some cases, may be permanent (Sparks & Casey 1998). Separation can occur due to several reasons, including parental movement in search of food or water, straying into human- dominated landscapes, poaching, hunting, intra- and inter-specific conflicts, or predation affecting either the young or the parent. In several felid species, including tigers and leopards, mothers often leave their cubs concealed in secure locations while they hunt, returning later to nurse or relocate them (Laurenson1993; Sunquist & Sunquist 2002). Similarly, in many deer species, mothers hide their fawns for extended periods, returning periodically for nursing while minimizing predation risk.

Biswanath Wildlife Division forms the northern buffer area of Kaziranga Tiger Reserve comprises the Brahmaputra River and its dynamic riverine islands. Kaziranga Tiger Reserve recorded 148 tigers, including 27 individuals in Biswanath Wildlife Division (Gogoi et al. 2024). The landscape is highly dynamic, with continuous changes due to flooding and erosion (Gogoi et al. 2025). These riverine islands serve as critical corridors facilitating tiger movement between Kaziranga and adjacent habitats such as Nameri–Pakke, Laokhowa–Burachapori, and Orang.

Observation

During routine patrolling on 29 April 2025, staff of Lahorijan Anti-Poaching Camp sighted two Royal Bengal Tiger *Panthera tigris tigris* cubs inside a bush in the 10th Addition of Kaziranga National Park & Tiger Reserve, with no immediate sign of the mother nearby. Prior to parturition, a tigress typically selects a secure and secluded den to protect her litter from predators and conspecific threats (Singh & Kumar 2022). Such dens may include rock crevices, caves, or shallow depressions within dense vegetation (Sunquist & Sunquist 2002). The incident was reported to the field director and divisional forest officer. Following expert consultation, staff was instructed not to touch or disturb the cubs, as it was unclear whether they had been temporarily left by the mother or were truly orphaned. Tiger cubs may become separated due to maternal mortality caused by poaching, intra-specific conflict, or natural causes. In some cases, cubs may also be abandoned due to congenital weakness, illness, or injury (Nigam et al. 2016).

Entrance of the hideout . © Nayan Jyoti Gogoi.

Plan to reunion

In Assam many cases related to leopard cubs revealed that many cubs rescued under the assumption of being orphaned were, in fact, not abandoned by their mothers (Ali 2017). Reuniting cubs with their mothers is therefore considered the most appropriate management option when cubs are healthy, as it ensures proper social development and acquisition of natural survival skills (Gupta et al. 2020). Accordingly, it was decided to leave the tiger cubs undisturbed and monitor the site. Rescue and rehabilitation were to be considered only if the mother failed to retrieve the cubs within a stipulated period. A committee was constituted to provide technical guidance and conduct daily monitoring in accordance with the National Tiger Conservation Authority (NTCA) Standard Operating Procedures for abandoned or orphaned cubs.

Methods of evidence collection

On 30 April 2025 at 1000 hrs during a period of minimal tigress activity (Pusparini et al. 2018) a team visited the site to assess the condition of the cubs. The hideout was located within woodland habitat with approximately 75% canopy cover, comprising trees, woody shrubs,

Photographic evidence from camera trap showing the tigress retrieving her second cub. © KNPTR Camera Trap.

The Team fully equipped and ready, before entering the field © Khirud Hazarika.

and thick leaf litter. The hideout consisted of a dried *Lantana camara* bush shaped like a hemisphere, with a dimension of approximately 4–5 m radius. Upon inspection, one cub was found missing while the other remained at the site. The absence of one cub suggested possible relocation by the mother, as tigresses frequently shift cubs between locations (Sunquist & Sunquist 2002), although predation could not be ruled out (Nigam et al. 2016).

The team searched for pug mark of tiger or any other predator nearby but failed as the underground is covered by leaf litter and vegetation. A semi-decomposed livestock carcass was detected approximately 15 m from the hideout, though pugmarks were not discernible due to dense leaf litter. Livestock depredation by tigers in fringe areas of Kaziranga has been previously documented (Borah et al. 2018). The remaining cub appeared healthy and was attempting to crawl within the hideout.

Based on physical characteristics, the cub was estimated to be 6–14 days old, as its eyes had recently opened (WWF 2025). To monitor movement, camera traps were installed along three approach routes to the hideout to capture any activity of the mother tigress or other predators. After installing the camera traps,

Two cubs sighted by staff of Lahorijan Anti-Poaching camp in a hideout while patrolling. © Jalindra Tangla.

Semi-decomposed livestock carcass near the hideout. © Nayan Jyoti Gogoi

Forest staff placing camera trap near the hideout to record evidence. © Nayan Jyoti Gogoi.

The Assam Tribune Date 11 May 2025

Tigress retrieving abandoned cub caught on camera in KNP

SIVASISH THAKUR

GUWAHATI, May 10: In probably the first ever documented case of a tigress reuniting with her cub after it was left abandoned for over a day, a tigress was filmed retrieving her cub from a 10th Addition area of Kaziranga National Park and Tiger Reserve bordering human habitation.

The entire exercise was done by the Kaziranga National Park authorities in coordination with Wildlife Trust of India (WTI) and residents of Bihpukhuri, a fringe village along the southern boundary of the 10th Addition.

"This is a successful case of a tigress coming back to retrieve her cub and reunite, which is certainly the first such documented case in the Northeast, if not in the country," Dr Panjit Basumatary, wildlife veterinarian with WTI, who supervised the exercise, told *The Assam Tribune*.

After the tigress – which had also killed a cow – was noticed with two cubs in the area, a joint team of Forest and WTI led by Range Officer Nayan Jyoti Gogoi found one cub inside the 10th Addition area on April 30 but the tigress and the other cub were missing.

"We found one cub resting under a dense bush undergrowth, and thick leaf litter. There was no sign of the second cub. A carcass of a cow was also there, suggesting the tigress may have stockpiled food prior to giving birth. The tigress had already shifted one cub and was likely to return for the other," Range Officer Nayan Jyoti Gogoi said.

The team identified three approach routes to the bush and installed one camera trap per route to document any movement of the tigress.

SEE PAGE 5

Tigress retrieving the abandoned cub news published in "Assam Tribune" daily English newspaper. © Assam Tribune

Honorable Chief Minister of Assam shared this incident in his "X" handle. © X handle of CMO Assam.

the team vacated the site. Following expert advice, the area was left undisturbed for 48–72 hours. Fringe villages were informed about the presence of the tigress and advised not to venture near forest areas to avoid potential human–wildlife negative interaction.

Results

On 2 May 2025, the team revisited the site at 1000 hrs, carrying a plastic basket cage in case rescue became necessary. Electrolytes, glucose

solution, and a baby milk bottle fitted with small kitten nipples were also carried to rehydrate the cub if it had not been retrieved by the mother. Previous records indicate that tiger cubs may die of starvation following prolonged separation from the mother (Nigam et al. 2016).

The team cautiously scanned the area and approached the hideout, where it was observed that the cub was no longer present. An impression was noticed at the entrance of the hideout, suspected to have been made by an animal. Camera trap data were subsequently reviewed. Of the three camera traps installed, one captured photograph of the tigress approaching the hideout at 1300 h and leaving at 1302 h on 1 May 2025, carrying the cub in her mouth. This event represents the first documented case of successful tiger cub reunion in northeastern India.

Discussion

Reunion is the most appropriate management strategy when a wild animal cub is found in healthy condition, and clinical intervention should be minimized. Reuniting cubs with their parents facilitates the development of normal behavior and survival instincts essential for functioning in the wild (Gupta et al. 2020). A tigress may leave her cubs in a secure hide out for several days while searching for food and frequently shifts them from one location to another by carrying them in her mouth. Therefore, a tiger cub found alone should not be immediately rescued under the assumption that it is orphaned or abandoned. A reunion attempt should always be prioritized before considering rescue and rehabilitation.

Acknowledgements

The authors express sincere gratitude to Dr. Ridhima Solanki, program manager, SAWEN, Kathmandu and Arun Vignesh, DFO, EAWL Division for their valuable guidance. The authors also thank Champak Neog, Diganta Tisso, Pranjal Patgiri, Mridul Deka, Jolly Tangla, Budheswar Bharali, Pinku Saikia, Digjoy Hanse, Khirud Hazarika, Anirudha Nath, and Suresh Dutta of Biswanath Wildlife Division for their tireless field efforts. Special thanks are extended to Monabari Tea Estate authorities and residents of Bihpukhuri and Kathanibari, particularly Sambu Sundi and Robin Sahani, for their cooperation and support.

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Nayan Jyoti Gogoi[1], Sonali Ghosh[2], Panjit Basumatary[3], Khagesh Pegu[4] & Ritu Paban Borah[5]

[1*]Central Range, Biswanath Ghat, Biswanath Wildlife Division (KNP& TR), Assam 784177, India.
[2]Kaziranga National Park & Tiger Reserve, Bokakhat, Assam 785612, India.
[3]Centre for Bear Rehabilitation and Conservation, Seijosa, Pakke-Kesang, Arunachal Pradesh 790103, India.
[4]O/o PCCF (Wildlife), Assam, India.
[5]Biswanath Wildlife Division (KNP& TR), Panibharal, Biswanath Chariali, Assam 784176, India.
[*]nayanjgogoi5@gmail.com (Corresponding author)

Citation: Gogoi, N.J., S. Ghosh, P. Basumatary, K. Pegu & R.P. Borah (2026). A note on Royal Bengal Tiger cub reunion in Kaziranga Tiger Reserve. Mammal Tales #165, In: *Zoo's Print* 41(4): 44–47.

First photographic record of Rusty-spotted Cat with kitten from Delhi NCR, India

The Rusty-spotted Cat *Prionailurus rubiginosus* (Hindi: Rohit-Dweep Billi) is recognized as the world's smallest wild cat, distributed across India, Nepal, and Sri Lanka (Prater 1998; Kittle & Watson 2004; Appel 2016; Lamichhane et al. 2016). In India, its range extends from Tamil Nadu in the south to Jammu & Kashmir in the north, covering parts of central, western, and eastern regions including Madhya Pradesh, Gujarat, and Odisha (Chakraborty 1978; Patel 2006). Although primarily associated with moist and dry deciduous forests, scrublands, and grasslands, this species is also known to occur near agricultural fields and even human settlements (Kittle & Watson 2004). Rusty-spotted Cats prefer dense vegetation and rocky areas (Patel 2006).

Ecologically elusive and naturally low in density, the Rusty-spotted Cat has often been under-recorded in several landscapes (Mukherjee et al. 2016). Its conservation status reflects its vulnerability, being listed under Schedule I of the Wildlife (Protection) Act, 1972, and categorized as 'Near Threatened' on the IUCN Red List (Mukherjee et al. 2016). The species faces significant threats from habitat loss, agricultural expansion, and industrial development, with nearly 75% of its range under imminent risk (Mukherjee et al. 2016).

Recent observations and photographic evidence from different parts of India suggest that populations of this cryptic felid persist outside protected areas. A confirmed record from Kalesar National Park, Haryana highlighted its presence in sal-khair forests of the Shivalik foothills (Ghaskadbi et al. 2016), while the first state-level record from Takhni-Rehmapur Wildlife Sanctuary, Punjab, further filled gaps in its distribution along the outer Himalaya (Kanwar & Lomis 2020).

In this context, we record our observations on P. rubiginosus from Delhi NCR, which is a highly urbanized region. It draws attention towards ecological and conservation significance of the Rusty-spotted Cat as a component of surviving urban biodiversity.

Study area

Kot Village is situated in Faridabad district, Haryana, India (28.3° N, 77.3° E), within the Delhi National Capital Region (NCR). The site lies in the northern Aravalli Hill range, which represents one of the oldest fold mountain systems in India. The Kot village landscape forms a scrub–agriculture–settlement mosaic, which, despite heavy anthropogenic pressures such as urbanisation, grazing, quarrying, and encroachment, continues to harbour small mammals, reptiles, and birds.

The vegetation is primarily tropical dry deciduous and thorn scrub, consisting of Vachellia nilotica, Vachellia leucophloea, Prosopis juliflora, Ziziphus nummularia, Azadirachta indica and seasonal grasses.

The Rusty Cat was observed on a False Ashoka tree

Rusty-spotted cat with kitten in Kot Village, Faridabad

Nocturnal sightings including use of a False Ashoka tree. © Yatin Verma & Tejveer Mavi.

Methodology

Field observations were conducted regularly from August 2022 onwards as part of ongoing monitoring of mammalian diversity in the region. Surveys were conducted in the early morning (0530–0800 h) and evening (1700–2000 h) when small carnivores are typically most active. Upon encountering the animal, direct sightings and photographic documentation were made using DSLR camera.

Results and Observation

On 16 September 2023, a Rusty Cat was captured from its perch on a False Ashoka Monoon longifolium tree, which is a common ornamental species planted in gardens and along human settlements, showing how common ornamental plants can provide small microhabitats for animals. A Rusty-spotted Cat *Prionailurus rubiginosus* was photographed on 22 July 2025 in Kot Village, Faridabad District,

Haryana (Delhi NCR) during a field survey. This study presents the first confirmed record of the Rusty-spotted Cat.

The observation includes an adult individual with a kitten, providing the first photographic evidence of breeding activity of the species in both Delhi NCR and Haryana. The kitten appeared to be dependent on the adult, confirming active reproduction. Previously, only 4–5 opportunistic sightings had been reported from different parts of Delhi NCR, none of which established breeding.

This record, therefore, marks a significant extension of the species' documented breeding range and highlights the conservation importance of fragmented green spaces within the highly urbanized NCR landscape.

There is a need to formulate management plans that encompass both protected and non-protected landscapes, as viable populations of Rusty-spotted Cats may be persisting beyond reserve boundaries.

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Amit Kumar, Tejveer Mavi, Yatin Verma, Ram Kumar Rawat & Sohail Madan
Department of Zoology, Indira Gandhi University, Meerpur, Rewari, Haryana 122502, India.
*kdamit8@gmail.com

Citation: Kumar, A., T. Mavi, Y. Verma, R.K. Rawat & S. Madan (2026). First photographic record of Rusty-spotted Cat with kitten from Delhi NCR, India. Mammal Tales #166, In: *Zoo's Print* 41(4): 48–50.

Principal fauna of the Sikkim Himalaya from past to present

The Sikkim Himalaya was known for the diversity of fauna and flora (Cowan & Cowan 1929; Biswas & Chopra 1956). The bioresoures are augmented in the different regions according to the ranges of hills and mountains. The Sikkim Himalaya is bounded by the mountainous hill and at the top, it has the Tibetan plateau. It is acting as the buffer area for the tropical and sub-tropical belts of other Indian States and adjoining countries. Way back in 1909, some of the fauna were recorded from the Sikkim Himalaya (White 1909). Earlier to this, there was no such documentation of the faunal resources of Sikkim with remarks. Notably, in the record, there was the availability of following species in the Sikkim Himalaya.

At present, the few faunal species are not present and are extinct from the natural habitats of Sikkim Himalayan belt. Possibly, the reason of its extinction from natural habit is its habitat destruction. In later 19th century, there was rapid mobilization of resources from the Himalayan belt (Pradhan 2020). Although it was the step of the industrial revolution in the Himalayan belt, the massive destruction of the Himalayan forest resources for the timber and mining were noted. At the same point of time, the railway, in the Himalayan Darjeeling region, was set up for the transportation of the resources (Bell 1909, 1910–1911).

In terms of industrialization process, several species were cleared from the habitats of Sikkim Himalaya. Additionally, there was the policy of Game Law that allowed hunting in the regions (Pradhan 2020). Having said this background, several species were hunted which was prevalent till late 20th Century. High dignitaries and the state guests used to go for hunting for their adventures, which were reflected in several past documentaries. It was also noted that the array of hunters from the world renounced specialist of the gun makers to native hunters visited the Sikkim forest for their adventure trips (Pradhan 2024). Such facts created the cascading effects on the habitat destruction and therefore, might be responsible for the massive depletion of the principal faunal species in the Sikkim Himalaya.

The Sikkim Himalaya is geographical small state and was representing the diversity of species (Cowan & Cowan 1929). The data of the past 115 years depicted the existence of several principal animals in the Sikkim Himalaya, however, with the advent of time, Sikkim lost several valued species and are not found their natural habitat. Referring to this study, the author suggests that the prospective planning must focus on the research and development of the state for the conservation and prevention of the fauna and flora with the proper mitigation plant and the follow up mechanism.

Out of the recorded 15 principal animals by White (1909), six species are extinct from the natural habitat. Thus, the percentage rate of

Depicting some fauna of Sikkim Himalaya (White 1909).

	Principal fauna	Remarks on habitat and elevation (in 1909)	Present status
1	Asian Elephant *Elephas maximus indicus*	1. Lower hills and across the Doars of present West Bengal. 2. In the rainy season, it was penetrating towards the hills up to the elevation of 3,333 m (11,000 ft).	Currently, there is no movement of elephants toward the hills during the rainy season.
2	Rhinoceros *Rhinoceros unicornis*	1. Up to 900 m (3,000 ft) or lower valley 2. Status was not common or rare.	It is now confined to Kaziranga National Park & northern Bengal.
3	Gaur *Bos gaurus*	Up to 900 m (3,000 ft) or lower valley.	Uncommon. It has recently been reported in North Sikkim.
4	Gayal or Mithun *Bos frontalis*	Up to 900 m (3,000 ft) or lower valley.	In the past 10 years, only two cases have been reported, and in both instances, the trapped Mithun did not survive due to medical complications.
5	Tiger *Panthera tigris*	Outer hills, valleys and occasionally in the lower valleys up to 2,700 m (9,000 ft).	It is uncommon and nearly absent from the forest habitats of the Sikkim Himalaya. However, in some instances, the roaring of Tiger has been heard in Pangolakha Wildlife Sanctuary, which shares boundaries with Neora Valley National Park and Bhutan.
6 a	Common Leopard *Panthera pardus*	Throughout the hills up to an elevation of 2,400 m (8,000 ft).	It is not found in Sikkim and is now restricted to Mahananda Wildlife Sanctuary in northern Bengal.
6b	Black Leopard *Panthera pardus*	Rare. But met at the dense jungles at elevation of 900–1,200 m (3,000–4,000 ft).	This species is no longer found in its natural habitat.
7	Clouded Leopard *Neofelis nebulosa*	At elevation from 1,200–1,800 m (4,000–6,000 ft).	Rare
8	Snow Leopard *Panthera uncia*	It is rare and is found only at high elevations above 3,333 m (11,000 ft).	This species still exists in the alpine valleys and snowy belt of the Sikkim Himalaya.
9	Lynx *Lynx lynx*	Rare. Only at high elevation bordering on Tibet over 4,800 m (16,000 ft).	This species is no longer found in its natural habitat.
10	Wolf *Canis lupus*	Rare. Only at high elevation bordering on Tibet over 4,800 m (16,000 ft).	Endangered. Uncommon.
11	Jackal *Canis aureus*	It is introduced from the plains of India and is occasionally seen at elevations of up to 1,800 m (6,000 ft).	There is no introduction of this species, and it is observed at elevations of up to 1,800 m (6,000 ft).
12	Indian Wild Dog (Dhole) *Cuon alpinus*	It is not very common and is found in packs from the lower plains up to elevations of about 1,800 m (6,000 ft).	As it was creating panic across farmlands, it was reported that the population of Dhole declined due to food poisoning in Fambong Lho Wildlife Sanctuary during the 1990s. A small population of this species is still found in Kyongnosla Alpine Sanctuary.
13	Shau *Cervus affines*	Inhabits a tract to the north-east of the Chumbi Valley.	North-east of the Chumbi Valley and Alpine Valley.
14	Sambar *Rusa unicolor*	In all lower hills	Found in Fambonglho Wildlife Sanctuary and Pangalakha Wildlife Sanctuary

extinction from natural habitat of principal animals is estimated 40% from the date of 1909 A.D. till present date. It is alarming and this pace of extinction from natural habitat must be slowed down or stopped with the proper strategies and valuable measures. Therefore, this study warrants further research on the conservation of principal and ecologically supporting animals of Sikkim Himalaya.

Out of the 14 principal animals recorded by White (1909), six species—Asian Elephant, Indian Rhinoceros, Tiger, Leopard (common and black forms), Lynx—are no longer found in their natural habitats.

Thus, the rate of loss from the natural habitat of these principal animals is estimated at 40% from 1909 to the present. This is alarming, and the pace of such decline must be slowed or halted through effective strategies and conservation measures. Therefore, further research is urgently needed on the conservation of principal and ecologically significant fauna of the Sikkim Himalaya.

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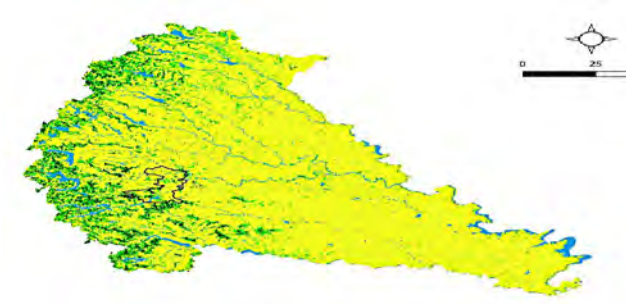
Durga Kumar Pradhan
Quality Control Laboratory-HARC- Sikkim State Forest Herbarium (SSFH)
Forests and Environment Department, Govt. of Sikkim, Deorali, Gangtok, Sikkim 777102, India.
E-mail: pradhansikkim@gmail.com).

Citation: Pradhan, D.K. (2026). Principal fauna of the Sikkim Himalaya from past to present. Mammal Tales #167, In: *Zoo's Print* 41(4): 51–53.

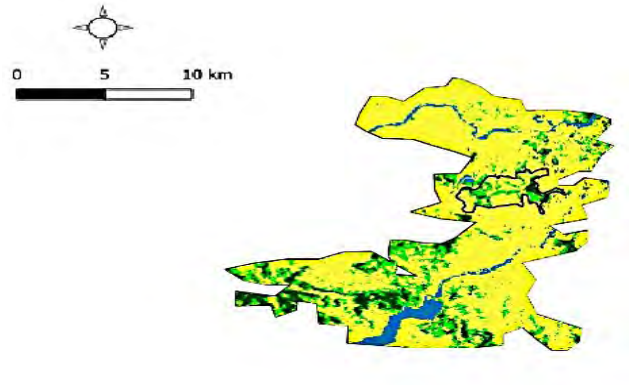
A note on the tale of elusive Jungle Cats from the dynamically changing urban hills of Pune City

The rapid urban expansion and infrastructure growth in India's megacities have severely fragmented natural habitats. Pune, in western Maharashtra, shaped by the outcrops of the Sahyadri ranges, retains its 'urban hills' as the city's last remaining natural refuges. Recent land use/land cover (LU/LC) analysis (Choudaj et al. 2024) highlights a continuous decline in natural vegetation and a rise in encroachments on hilltops and slopes, underscoring the adverse effects of urbanization. While vegetation change has received some attention, the broader land-use dynamics of Pune's hills remain poorly understood.

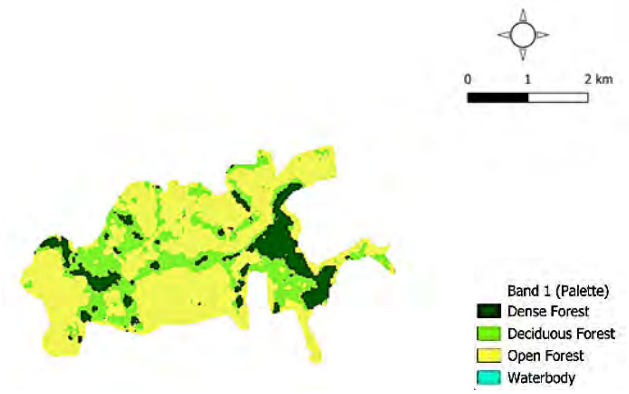
Historically, these hills supported rich biodiversity, with 79 mammalian species documented in the Pune District with at least 60 within city limits (Nalavade 1998, 2001). However, habitat fragmentation over the past two decades has significantly affected local fauna. Human-induced disturbances alter the behaviour, activity, and distribution of mammals in urban environments (Carricondo-Sanchez et al. 2019). The Jungle Cat Felis chaus, a mesocarnivore tolerant of human proximity (Prater 2015; Carricondo-Sanchez et al. 2019), was once common but later considered "critically affected" in urban Pune (Nalavade 2001). Subsequent studies reported habitat degradation (Nerlekar & Kulkarni 2015) and local species loss (Nerlekar et al. 2016), notably excluding F. chaus. Its present status on Pune's Vetal Hill Complex remains uncertain, with the last confirmed record being a kitten rescued in 2020 (Shah 2020).



Study area: Pune District



Study area: Bhamburda Forest Range



Study area: Vetal Hill Complex

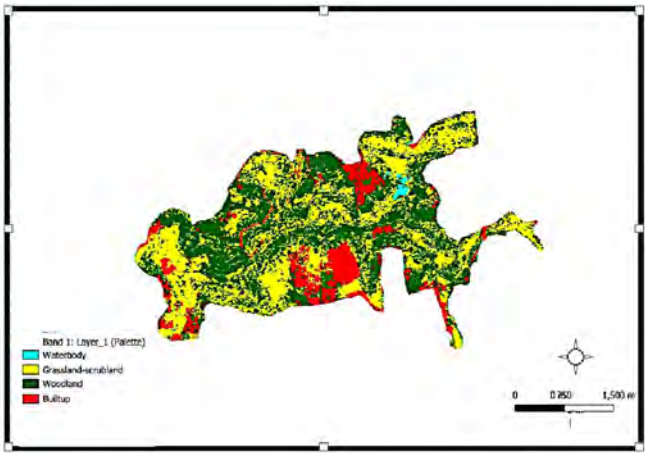
The rapid loss of Pune's green spaces poses a serious threat to the biodiversity sustained by its hills. Alterations in land use and land cover (LU/LC) patterns, along with increasing fragmentation, clearly demonstrate this decline. Over the past decade, built-up area within the study region increased by 4.16%, resulting in corresponding loss of 3.86% in scrub–grassland & 0.83% in woodland cover. Given the, landlocked extent of the study area (approximately 9.65 km²), even a 1% change substantially affects the biodiversity it supports. Notably, the surge in built-up expansion occurred predominantly on the western slopes of the hill, marking it most significantly.

Vetal Hill Complex (2014–2024)

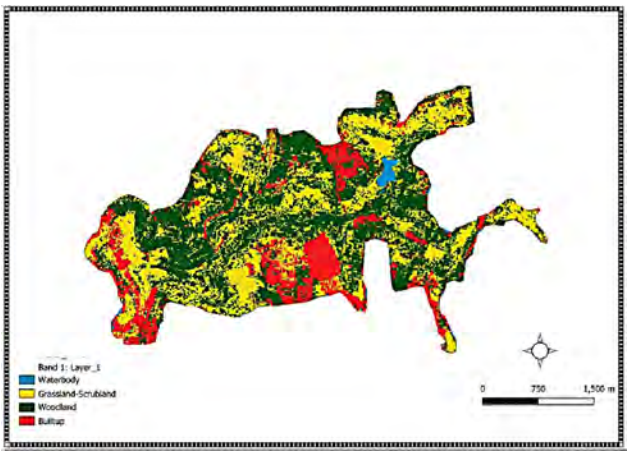
The Vetal Hill Complex (VHC) forms a crucial habitat for meso-mammals along Pune's expanding urban fringe. Land use and land cover (LULC) analysis reveals that built-up areas have steadily encroached upon scrubland and forest, intensifying habitat loss. A reconnaissance camera-trapping survey from March–May 2025 confirmed the presence of the Jungle Cat Felis chaus, emphasizing the ecological significance of this hill system as a refuge for meso-mammals & reinforcing the urgency of conserving its remaining natural patches amid rapid urbanization. On 2 April 2025, a Jungle Cat was photographed by a camera trap deployed at approx.18.5169 N, 73.7969 E, at an approximate altitude of 650 m. The site encompasses territorial forest and privately owned land, characterized by vegetation type 5A/C3/DS1 (Champion & Seth 1968). There were subsequent sightings of Jungle Cat from the VHC during the survey.

LU/LC changes over the study area (Vetal Hill Complex)

		km²		km²		
		Waterbody	**Scrubland**	**Woodland**	**Built-up**	**Total**
Vetal Hill Complex	2014	0.09038	3.70736	4.65060	1.20061	9.64
	2024	0.12980	3.33362	4.57096	1.60157	9.634
Change		0.0393	0.37	0.07964	0.39986	
Percent change		0.93%	-3.86%	-0.83%	4.16%	



LU/LC Vetal Hill Complex 2014



LU/LC Vetal Hill Complex 2024

Jungle Cat recorded on our camera trap, Vetal Hill Complex. ©Project Team

Direct sighting of Jungle Cat from Vetal Hill Complex. © Ketan Bhave.

Sighting records of Jungle Cat from Vetal Hill Complex

	Date of sighting	Location	Remark
1	September 2024	Vetal Hill Complex	Direct sighting no photo evidence
2	April 2025	Vetal Hill Complex	Camera trap record
3	May 2025	Vetal Hill Complex	Direct sighting photo record
4	November 2025	Vetal Hill Complex	Direct sighting Photo record

These photographic evidences substantiate the continued presence of the Jungle Cat on VHC despite its earlier classification as "critically affected" (Nalavade 2001).

The urban hills, increasingly subjected to encroachment, now offer only limited refuge for wildlife. Camera traps recorded the Jungle Cat Felis chaus, Indian Crested Porcupine Hystrix indica, and Asian Palm Civet Paradoxurus hermaphroditus, yet their population density and occupancy remain unassessed, warranting further study. Restricted dispersal caused by growing habitat discontinuity heightens the risk of local extirpation. Expansion of built-up areas at the expense of scrubland and forest further intensifies this concern. Nevertheless, camera-trap evidence confirms continued site use by these mammals, demonstrating resilience despite rising urban pressures. As scrublands provide essential cover and prey resources, their loss to infrastructure poses a critical threat to meso-mammal persistence in the Pune hill landscape. Protecting remaining natural patches and integrating habitat conservation into urban planning are vital for sustaining Pune's wildlife.

The decade-long presence of the Jungle Cat and other photographed species offers rare optimism, underscoring the need to preserve these last urban refuges to maintain ecological connectivity and the wild essence of urban Pune.

Acknowledgements
We would like to extend our gratitude to all the Divisional Officers of Pune Forest Division, for lending us the camera trapping permissions in the territorial forests of Pune City. Moreover, we would like to thank Mr. Rohit Khare, Mr. Arjit Jere & Mr. Ketan Bhave for their invaluable assistance and contribution during the data collection.

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Arnav Gandhe
Wildlife Biologist, Ganeshbaug, Azadwadi, Gananjay Society, Kothrud, Pune, Maharashtra 411038, India.
argandhe2029@gmail.com

Citation: Gandhe, A. (2026). A note on the tale of elusive Jungle Cats from the dynamically changing urban hills of Pune City. Mammal Tales #168, In: *Zoo's Print* 41(4): 54–57.

Addition of Indo-China Fingerroot as new record to flora of Manipur, India

The genus *Boesenbergia,* belonging to Zingiberaceae family, comprises ca. 102 accepted species distributed throughout India, Borneo, Cambodia, China, Laos, Malaya Peninsula, Myanmar, Philippines, Sumatra, Thailand and Vietnam (Lý et al. 2025; Saensouk et al. 2025; POWO 2026). In India, there are reports of 14 species reported from the genus (Das & Sikdar 1982; POWO 2026). While in Manipur, with the addition of *Boesenbergia kingii,* along with pre-reported *Boesenbergia rotunda* (Sharma et al. 2011) and *Boesenbergia longiflora* (Biseshwori & Rohinikumar 2008) updates the species documented to three.

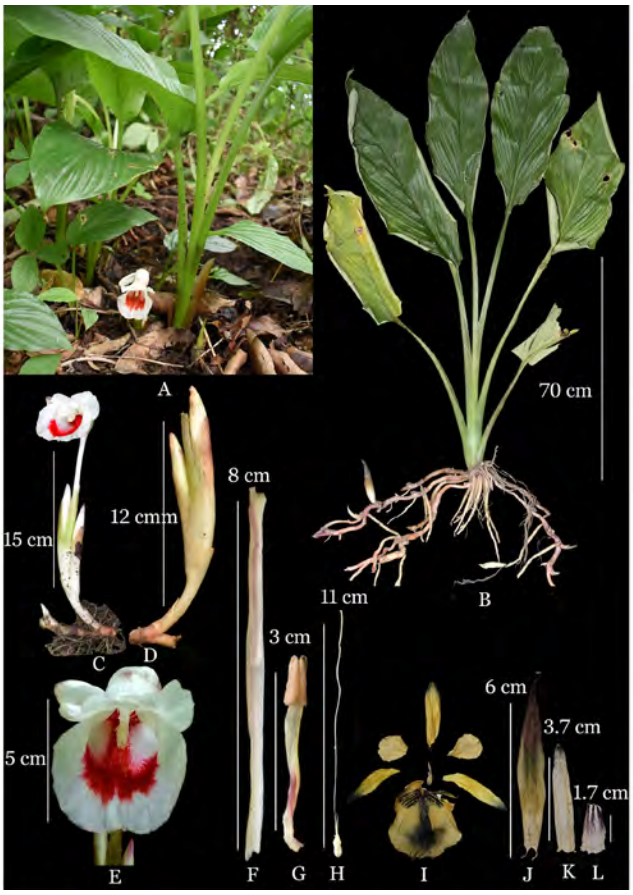
The genus is characterised by rhizomatous herbs, deciduous or perennials, fleshy aromatic rhizomes with fibrous roots, erect pseudostem with leafy shoots and terminal inflorescence (Chen & Xia 2019). *B. kingii* has been reportedly used in traditional medicine in treatment of respiratory ailments, inflammation, and gastrointestinal issues, also exhibits antioxidant, antibacterial and anti-HIV, due to presence of bioactive compounds such as flavonoids, chalcones and diterpenes (Primus & Choo 2025).

During a field survey at the Langol Hill range in Manipur the *Boesenbergia* species was found in its natural habitat. The identification of collected specimens was confirmed through consultation with the protologue and relevant literatures (Mood et al. 2013; Aishwarya et al. 2015; Chen & Xia 2019; Chowlu et al. 2022) as *Boesenbergia kingii* Mood & L.M. Prince. A herbarium specimen was prepared and deposited at BRIC-Institute of Bioresources and Sustainable Development, Manipur, India.

Taxonomic treatment

Type: Thailand, Kanchanaburi Province, Huai Kayeng, secondary forest margin, c. 200 m, 14°38.49’ N, 98°31.40’ E, 21.viii.2011, Mood & Vatcharakorn 3074, cultivated as M3074. [cf. Mood & Vatcharakorn 12P173, Cultivated in Hawaii, USA, 1.xi.2012] (holotype BK [BK065862!]).

Description: Herbs, deciduous, perennial, growing up to 70 cm tall, creeping rhizome 15 cm long; new shoots protrude horizontally, rhizome branched, outer skin maroon to light pink, transverse section of rhizome yellow to orange or brown, aromatic. Thin, white, root hairs extended from rhizomes. 1–2 leafless sheaths per pseudostem, oval, 5–15 cm long, longitudinally ridged, green or reddish, glabrous on both surface, hyaline margin. Leaves, 4–6 per pseudostem, 8–11.9 × 12–13.5 cm long; petiole glabrous, light green, 17–38.5 cm long; ligule bilobed, soft papery, translucent, glabrous, 3–5mm long; leaf blade 8–11.9 cm wide, eliptic or obovate, adaxial dark green, abaxial light green, base round or cordate, apex acute or attenuate. Inflorescence radical to terminal, one per pseudostem on separate shoots arising from rhizome, with symmetric cylindrical form; Flower Creamy white, 3 per inflorescence, 12–15 cm long; peduncle, 2.5 cm, white, glabrous; basal sheaths, 1.5–4 cm off-white, glabrous. Bracts ensiform, 1–2 × 4–6 cm, greenish-white, apex acute, red, glabrous on



Boesenbergia kingii **Mood & L.M.Prince: A— Natural habitat | B— Whole plant | C— Inflorescence | D— Flower bud | E— Flower | F— Flower tube | G— Stamen | H— Ovary with Style | I— Floral Dissection | J— Bract | K— Bracteole | L— Calyx. © Mayengbam Aldrin**

Herbarium specimen of Boesenbergia kingii (BRICIBSD/M322).

both side; bracteoles lanceolate, one each per flower 0.4–0.7 × 2–3.7 cm, apex acute, white glabrous; calyx tubular, 0.8 × 1.7 cm translucent white glabrous, apex dentate. Flower tube, 8–10 cm, white glabrous exterior and interior; corolla lobes (dorsal and lateral) oblong, 3.5 × 0.7 cm, creamy-white, apex obtuse or round, margin slightly involute, faintly pink, glabrous; Labellum saccate, elongate, 3.5 × 4.5 cm, lip white creamy, centre of throat bright red, with white dots, margin undulate, apex entire; lateral staminodes 1.3 × 1.5 cm creamy white, obovate. Stamen 3 cm, glabrous, white with a tinge of red filament base; anther basifixed, slightly bilobed. Ovary, white, 1 × 0.3 cm, trilocular with axile placentation, glabrous. Style, 11 cm, filiform; stigma elongate, white, ostiole vertical, rectangular, unciliated; epigynous glands linear, two, 7–9 mm, white.

Phenology: Flowering from July to August. Fruiting not observed.

Habitat: Moist, shade area, evergreen forests, loose soil, at an elevation 1,072 m.

Distribution: Bangladesh, China, Myanmar, Thailand, and India (Andhra Pradesh, Arunachal Pradesh, Assam, Manipur, Mizoram, Sikkim, and Tamil Nadu).

Specimens examined: India, Manipur, Langol Hill range, 24.846° N, 93.905° E, 1,072 m, 17.vii.2025, BRICIBSD/M322.

Diagnosis: The three species of *Bosenbergia* genus reported from the state of Manipur can be morphologically identified based on the structure of rhizomes, inflorescence, anther,

Morphological differences between the three *Boesenbergia* species found in Manipur.

Plant character	*B. kingii*	*B. rotunda*	*B. longiflora*
Rhizome	Creeping	Short, compact and central rather than creeping	Running
Inflorescence	Radical to terminal, separate shoots arising from rhizome	Terminal, clasped within leaf-sheaths	Radical, separate shoots from the side of rhizome
Flower	White to creamy white	Pink	White to yellow
Bracteoles	White, glabrous, apex acute	White with light coral tinge, sparsely hairy, apex acute.	White translucent, glabrous, apex acute.
Lateral staminodes	Creamy white	Pink	Light yellow
Labellum	Labellum saccate, 3.5 × 4.5 cm, lip white creamy, centre of throat bright red, with white dots.	Labellum saccate 3.0–3.2 × 1.5–1.7 cm, lip deep pink towards tip and white with crimson dots and bands emanating laterally in the throat.	Labellum saccate, semi-orbicular, 2.2–2.5 cm, pale yellow, dark red in the middle of the throat, maculate, with spots of yellow showing through, and red pattern spreads to the tip of the lip.
Anther	Crest absent	Crest anther	Crest anther small and recurved, or absent
Corolla lobes	Oblong creamy white, apex obtuse, glabrous	oblong, white with pink tinge, apex acute, glabrous	linear to lanceolate, yellowish-white, glabrous,

and flower. The flowers of *B. kingii* are white to creamy white colour which differs from the pink flowers of *B. rotunda* and white to yellow in *B. longiflora.* In depth differences can be observed in the detailed colouration of the labellum and other floral structures as summarized in the table.

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Peimichon Langkan[1], Ngasheppam Malemnganbi Chanu[2], Warepam Leisana Devi[3], Thongam Nourenpai Khanganba[1] & Biseshwori Thongam[4*]

[1-4]BRIC-Institute of Bioresources and sustainable Development, Imphal, Manipur, India.

[*]b_thongam07@yahoo.com (corresponding author)

Citation: Langkan, P., N.M. Chanu, W.L. Devi, T.N. Khanganba & B. Thongam (2026). Addition of Indo-China Fingerroot as new record to flora of Manipur, India. Plantasia #131, In: *Zoo's Print* 41(4): 58–60.

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Publication Information

ZOO'S PRINT, ISSN 0973-2543
Published at: Coimbatore

Owner: Zoo Outreach Organisation, 3A2 Varadharajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India.

Editor: Sanjay Molur
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Address
Zoo Outreach Organisation
3A2 Varadharajulu Nagar, FCI Road, Ganapathy,
Coimbatore, Tamil Nadu 641006, India
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