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# ARANYAM

Forest Wildlife  
Environmental Magazine

Life within  
Small lives



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**മനുഷ്യ വന്യജീവി സംഘർഷ ലഘൂകരണത്തിന് വനം വകുപ്പിന്റെ അടിയന്തര പ്രതികരണ സംവിധാനം**

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## editorial

Our state is truly blessed with a unique landscape, ranging from dense, biodiverse forests, mangroves and lush green hillsides to tranquil villages that still preserve traditional sacred groves. Despite this abundance, our knowledge of the countless minute creatures that inhabit our environment is still incomplete. The ongoing discovery and documentation of new species by scientists every year is strong evidence of how much still remains hidden.

Sometimes, when we see butterflies dancing around our backyards, a sense of wonder awakens within us. The animal world is filled with such tiny marvels—from lines of ants carrying their eggs before the rain and fireflies glowing in the darkness, to the captivating Praying Mantis that leaves everyone amazed. Even though they are small, these creatures carry out their life's tasks with remarkable precision. Yet, this curiosity seldom goes any further; it is quite uncommon to find people who move beyond the first sense of wonder to truly observe, study and understand their world.

While we have abundant data on the giants in the animal realm like blue whales, elephants, tigers, leopards, and bears, our knowledge of small beings like fireflies, cicadas, scorpions and millipedes remains profoundly scant. Though diminutive in stature, their contributions to ecological services are utterly indispensable.

The October edition of Aranyam spotlights these micro-organisms and their distinctive traits. Even as most of these species coexist closely with humans, their lifestyles stay enigmatic to many. This issue seeks to fill that void in awareness.

Every organism on Earth serves as a steward of the planet. We all should have this insight. Moreover, our core duty involves safeguarding every life form within its native surroundings (In situ conservation). This itself forms the Forest Department's paramount objective.

**Rajesh Raveendran** IFS

Chief Editor

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Every conversation on biodiversity begins with the same enduring question-how many lives share this Earth? Estimates drift from 8.7 million to anywhere between three and a hundred million, and even calling it "countless" may not be wrong. What we truly know is only what we have discovered so far. Among them, invertebrates-estimated at nearly 8.5 million species- form the overwhelming majority.

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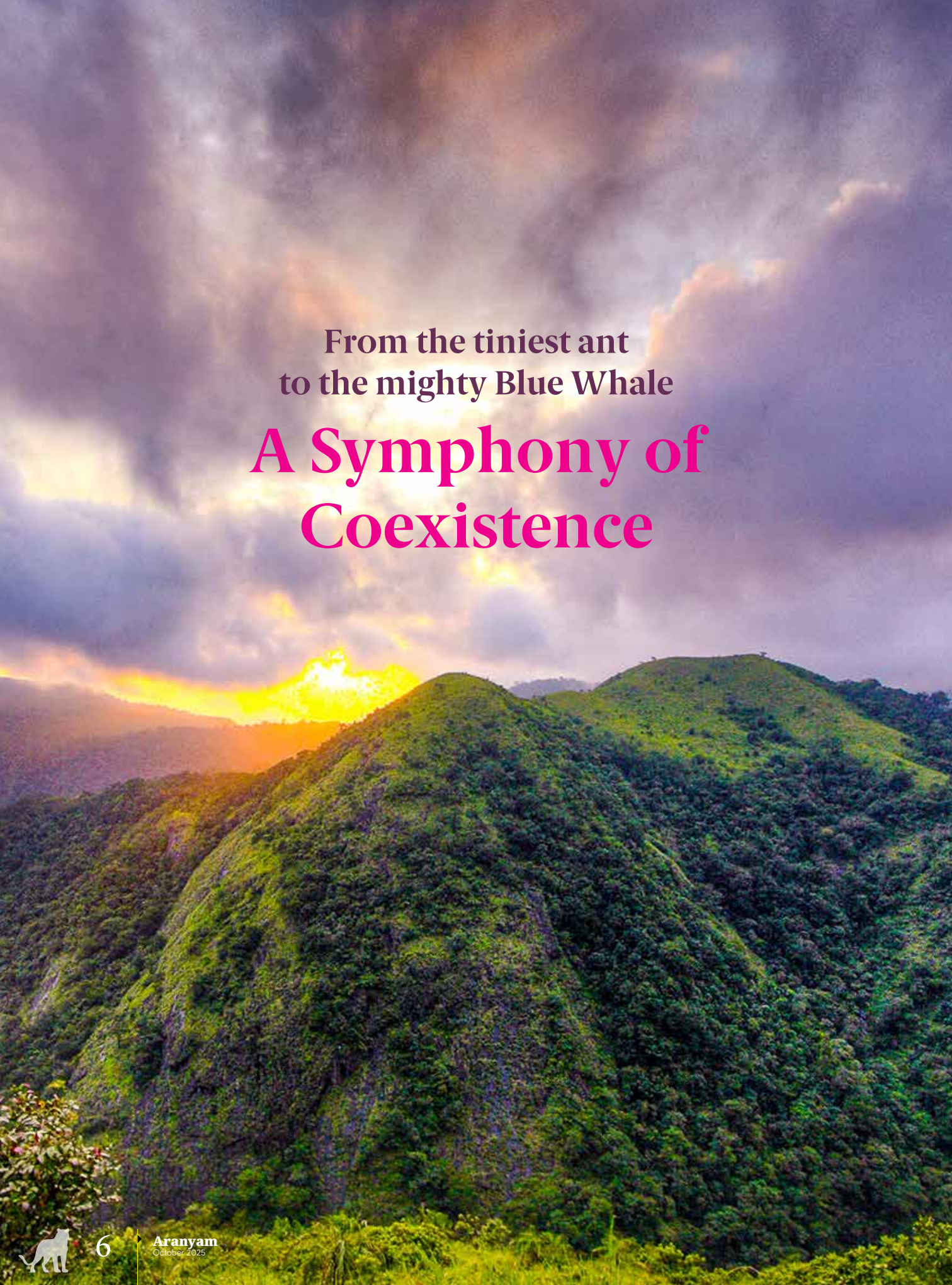
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- A.P. Thomas



Though insects make up more than half of all invertebrates, our attention rarely moves beyond butterflies. This is an attempt—to notice, to observe, and to understand the many lives around us, quietly woven into the fabric of our own.



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From the tiniest ant  
to the mighty Blue Whale  
**A Symphony of  
Coexistence**





## A.K. Saseendran

Minister for Forest and Wildlife

Every animal not tamed by humans qualifies as wild. The list extends infinitely, from the smallest ant to the enormous blue whale. India proudly ranks among the "megadiverse" countries, harboring some of the planet's most profound biodiversity. This diversity culminates in areas like the Western Ghats which encompasses Kerala, Eastern Himalayan foothills and the Andaman and Nicobar Islands. Annually, researchers discover fresh species of butterflies, ants and reptiles in these zones. As such, Kerala forests, which are part of this biodiversity, has to be protected at all cost.

Though discovering new species is an excitement, we must also realize the harsh truth that many others are fading or facing extinction. This alarming pattern arises from multiple causes such as swift population growth, forest conversion to non-forest purposes, wetland and grassland loss, wildfires and persistent climate emergency.

The loss or decline of



Part of the ever-revealing Western Ghats, Kerala remains a living treasury of biodiversity, where new species emerge into knowledge each year. These continual discoveries gently remind us of an urgent truth—the forests of Kerala are not just landscapes, but legacies that must be protected.

any wild animal, be it a colossal beast or a minuscule insect, wreaks severe damage on our ecosystem. These beings fulfill vital functions in key cycles like pollination and seed distribution. In essence, every organism around us helps the humanity, linking their persistence directly to our welfare.

Kerala has 25 protected areas, encompassing wildlife sanctuaries and national parks. The state also forms a key segment of the Agasthyamala and Nilgiri Biosphere Reserves. Periyar and Parambikulam stand as Tiger Reserves, whereas Mangalavanam, Choolannur and Thattekad are vital bird sanctuaries. The Kadalundi-Vallikkunnu region in Kozhikode has the recognition of being Kerala's sole Community Reserve.

Each living being has an important function in fostering and maintaining the ecosystem. Hence, the extinction of even one wildlife species poses a direct threat to humanity's own future. This vital truth demands our collective embrace. ■



# The Tiny Creatures That Move The World

Though the vast majority of life belongs to the realm of invertebrates, our gaze lingers almost entirely on the slender three percent that bear a backbone.

Beyond the fleeting charm of butterflies, the world of insects remains a quiet, overlooked universe- alive, abundant and largely unseen.





### Dr. P.S. Esa

National Wildlife Board member,  
Former Director, Kerala Forest Research Institute

Every discussion on biodiversity begins with the same question: precisely how many species inhabit our planet? Estimates vary wildly. Some scientists say 8.7 million, while others say that the species could be anywhere from three to a hundred million. Even labeling the total as "countless", there isn't enough evidence to prove you wrong. But the only thing we are sure about is the number of species we have actually found so far. Among the species, invertebrates that counts to 8.5 million species make the largest numbers. However, only about 1.5 million stand identified. Of the estimated 2.5 million varieties of Fungi, roughly 1,50,000 have been found.

Plant species are estimated at 4,50,000 of which nearly 4,00,000 appear in records. When talking of vertebrates, of the 80,500 estimated numbers,

only 74,420 have been discovered.

Data shows most animals are actually invertebrates, but our attention and protection only go towards the tiny three percent with backbones. The ignorance about spineless creatures is just an excuse. But the real truth is that nobody really tries to learn about them.

Dr. E.O. Wilson, father of biodiversity, called invertebrates

as "little things that run the world." He also stressed how these minuscule beings prove essential for Earth's very existence. Even though insects make up most invertebrates, our interest have not gone beyond butterflies. We

Invertebrates, vast yet overlooked, sustain the planet's delicate balance. While we focus on the visible few, these unseen lives quietly weave the fabric of Earth's survival and continuity.

hope the articles in this edition will inspire you to observe and understand the many creatures living around us daily. May it motivate many more active nature lovers. ■





# The World of Millipede



**Aswathy M D**

Researcher, Christ College, Iringalakuda

**M**illipedes were rear sights that monsoons brought with the earthy aroma during childhood. These small beings creep across gardens and damp corridors like trains, their tiny legs rippling like waves. Poke one out of curiosity? They swiftly turn to spirals and curl up. It holds Earth's mysteries and past. Coiled within lie tales millions of years ancient, from eras predating dinosaurs.

Millipedes are among Earth's earliest terrestrial dwellers, genuine trailblazers who first ventured onto land. They have quietly observed the ascent and demise of myriad species and endured catastrophic extinctions and ecological cataclysms that erased titans from the earth. They survived mass extinctions and environmental upheavals that wiped giants. Today, however humble they seem, they remain living fossils—gentle reminders of our planet's vast, ancient history.

Their story commenced around 400 million years ago in the Silurian era, as terrestrial life emerged. Researchers acknowledge roughly 13,591 species globally. India has over 290 varieties and Kerala numbers 75. They thrive across nearly all Earth's realms, from lush tropics to cool gardens, on every continent except Antarctica.

Millipedes fall under Phylum Arthropoda in Class Diplopoda. Most of the millipedes have elongated, cylindrical or flattened bodies with over 20 segments. Most of these can coil into protective spiral discs and pill millipedes roll into compact, unbreachable balls. In Malayalam, they go by the name of Theratta, Kachatta, Sundari puzhu and Mannenna kudiyan. The English term "millipede" stems from Latin "milli" (thousand) and "ped" (feet). However, Eumillipes persephone is the only millipede species



that has over 1,300 legs, truly embodying its name.

Millipedes has an ancient heritage. Their forebears were colossal prehistoric beasts; the Arthropleura species stretched as long as a compact car, wandering vast ancient woodlands beneath oxygen-laden atmospheres. The present day millipedes measure far smaller but their habits are unchanged. They still pursue the damp, shadowy surface soil, where they quietly devour rotting vegetation (saprophagous). Through this, they restore essential nutrients to the ground, helping in soil formation and fertility. They stand as nature's relentless recyclers, unobtrusively upholding life's cycle directly underfoot.

Millipedes' reproduction is really fascinating. In order to attract partners, males emit a delicate fragrance called pheromones. Upon pairing, their mating extends over hours. Notably, males possess specialized legs called gonopods on the seventh segment, employing them to deliver sperm to females.

After mating, female centipedes seek moist earth, fallen leaves or rotting timber to deposit eggs, often encasing them in small mud chambers for protection. Upon hatching, nymphs

emerge with merely a few pairs of legs. Each molt adds new body segments and extra legs until they reach adulthood. Depending on the specific species and their environment, these little creatures can live anywhere from one to ten years.

Millipedes lack prominent legends or myths. Yet they are like Persephone from the Greek lore. They dwell mostly underground, emerging only when the conditions are suitable. In myth it is said that Persephone lingers in Hades' dim, rejoining the sunlit world afterward. Her ascent heralds spring's renewal. Millipedes mirror this pattern, withdrawing into moist earth amid dry periods and surfacing when rains fall. During wet seasons, they reproduce and wander, then retreat when surface life turns severe. Their cycle binds tightly to nature's seasonal signals.

Millipedes are considered as symbols of fortune and rain in several cultures. For instance, certain African tribes consider seeing millipedes inside homes as a sign of impending rain and plentiful crops.

Millipedes carry a strange, ancient story of evolution. In primordial ages, their ancestors- Arthropleura- were giants, stretching as long as a small car. Today's millipedes are far smaller, yet their way of life endures almost unchanged, a quiet echo of a colossal past.



In rural Japan, millipede's entry into homes signals good luck, especially for nuptials or births. South American lore claims that grasping a coiled millipede during curses repels malevolent spirits. Across the globe, millipedes claim a cherished spot in folklore and rites, transcending mere biology. Though non-aggressive, they have potent defense mechanisms against enemies, exuding chemicals like Benzoquinone, Hydrogen cyanide and Phenols. These provoke eye irritation, dermal rashes or toxicity. While odorous, they pose no danger to humans unless exposed for a long time. Such fierce odors and bitter flavors deter avian and other predators from eating them.

### Friends of the Soil

Millipedes are essential for maintaining health of the soil and the existence of forest. The millipedes consume fallen leaves and plant debris and transform them into nutrient-rich soil. They can be seen everywhere from forests and fields to home gardens. Additionally, they live under decaying logs on the ground and tucked between small rocks. Much like earthworms, they play a vital role in forming soil and ensuring proper soil aeration.

They play a vital part in nitrogen cycling and as such they are also called "soil engineers." Much like earthworms, they are truly farmer's best friends. Some scientists also call them "the silent friends of the forest" and "nature's recyclers."

### Millipedes as Pets

In Europe, America and Japan, millipedes are kept as rare and beautiful pets. Big, bright tropical kinds such as the African Giant Millipede or Bumblebee Millipede make great picks. As they have no venom, they are safe for kids to learn with.

They just need damp soil, dry leaves and bits of veggies or fruit to eat. Put them in a sealed terrarium but make sure air flows well and it's humid enough. Most of these are active at night since they're nocturnal, which is cool to watch if you like that sort of thing.

Several educational institutions across the world also use millipedes for scientific study and environmental education. Living for years with very little care, they become calm and beautiful companions for those who love unique creatures.

Though we often feel afraid, millipedes do not actually harm humans. Instead, their slow-paced life teaches us that the beauty of a journey lies in steadiness, not speed. The next time when it rains and you see a little crawler in your



Across many cultures, millipedes are seen as symbols of fortune and rain, quiet harbingers of life and renewal.

yard, try not to touch it. Remember, it is an ancient friend of the earth—a silent biological flow that has lived alongside us for thousands of years.



ചിത്രങ്ങൾ:  
അശ്വതി എം.ഡി





Lemurs and Millipedes

## Natural Mosquito Repellent

Some lemur species in Madagascar (for instance, the Brown Lemur) have a fascinating habit. They pick up millipedes, chew them and rub them onto their fur. The chemicals released when the millipede is frightened, such as Benzoquinone, act as a natural pesticide that keeps mosquitoes and other annoying insects away.

# Termite Colony



**Dr. Amina Poovoli**

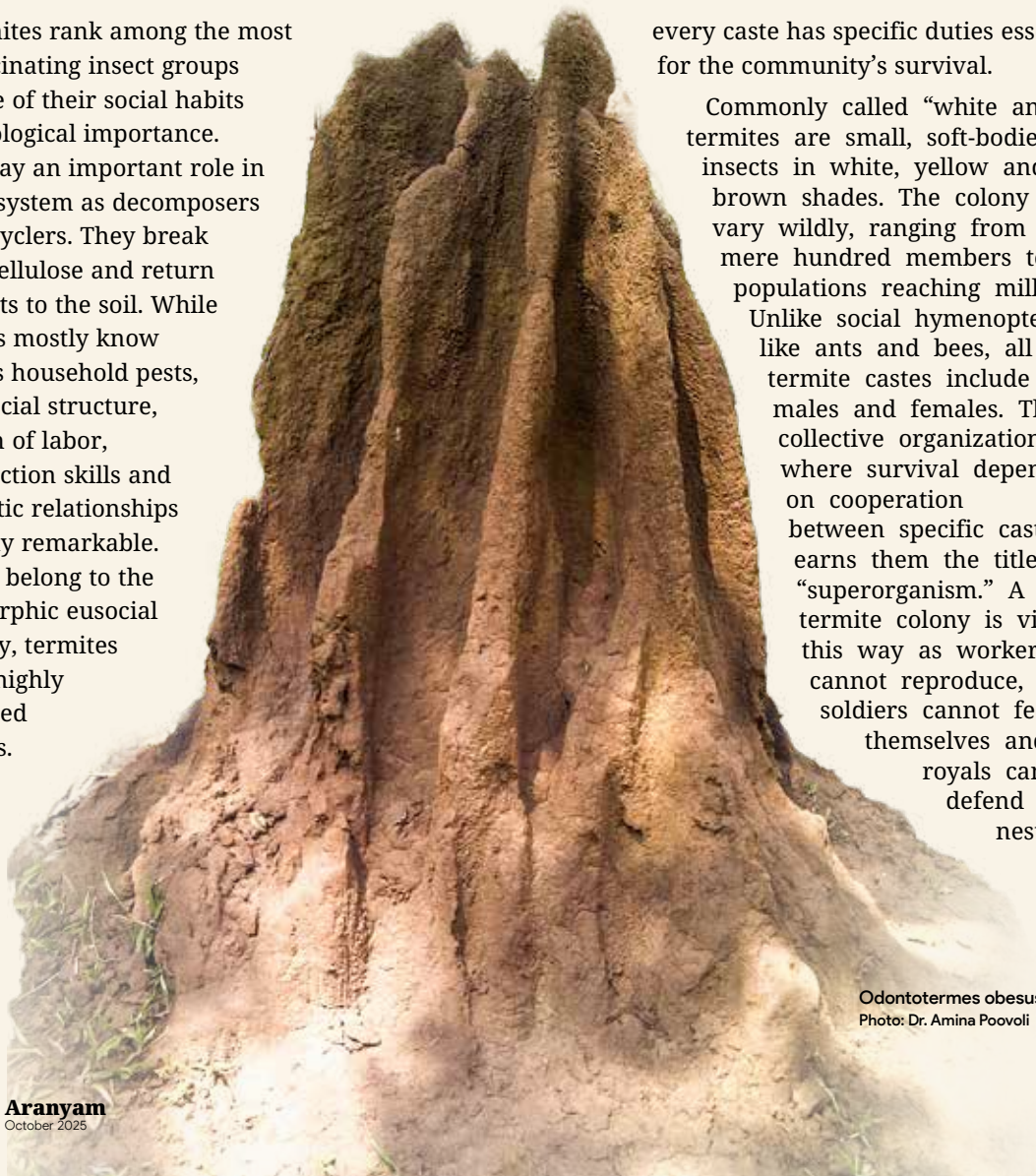
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**T**ermites rank among the most fascinating insect groups because of their social habits and ecological importance. They play an important role in the ecosystem as decomposers and recyclers. They break down cellulose and return nutrients to the soil. While humans mostly know them as household pests, their social structure, division of labor, construction skills and symbiotic relationships are truly remarkable. As they belong to the polymorphic eusocial category, termites live in highly organized colonies. Within these,

every caste has specific duties essential for the community's survival.

Commonly called “white ants,” termites are small, soft-bodied insects in white, yellow and brown shades. The colony sizes vary wildly, ranging from a mere hundred members to populations reaching millions.

Unlike social hymenopterans like ants and bees, all termite castes include both males and females. This collective organization, where survival depends on cooperation between specific castes, earns them the title “superorganism.” A termite colony is viewed this way as workers cannot reproduce, soldiers cannot feed themselves and the royals cannot defend the nest.



*Odontotermes obesus* mound  
Photo: Dr. Amina Poovoli



Instead, everyone functions interdependently, acting together as if they were a single living being.

Termites, according to fossil evidence, is said to have emerged as eusocial insects toward the end of the Jurassic period, roughly 150 million years ago. This means they existed as social insects about 30 million years before ants did. Termites are categorized into "lower termites" and "higher termites" based on their gut symbionts and digestive methods. Lower termites (all families except Termitidae) are an ancient group that houses protozoa in their guts to help digest the cellulose in their diet. In contrast, higher termites (family Termitidae) are a group that lacks protozoa and they rely instead on specialized bacteria or external fungi to break down cellulose.

Termites are categorized based on their distribution, feeding habits and specific moisture requirements. Within the lower termites group, there are three main types: drywood, dampwood and subterranean.

#### Drywood Termites

These termites typically feed only on dry wood with very low moisture levels. They don't need much water as they are capable of reabsorbing fluids from their own waste. They are often identified by dry fecal pellets known as "frass." Their main source of nutrition is the cellulose found in wood. Within their guts, symbiotic protozoa and bacteria produce the enzymes needed to break down and digest the cellulose. Examples of drywood termites found in Kerala include *Cryptotermes dudleyi* and *Cryptotermes domesticus*.

#### Damp Wood Termites:

Living in wet or moist timber, these termites have no direct contact with soil. Instead, they are mostly found in logs, stumps and rotting wood touching the wet ground (Example: *Glyptotermes*

*chiraharitae*).

#### Subterranean Termites:

These termites stay underground and target damp wood, keeping a steady moisture supply for their feeding. To hide from ants and heat, they build long tubes out of mud and waste. These tubes are quite distinct, making it easy for anyone to spot a hidden infestation. They can travel long distances through these tubes and have food storage facilities in them.

#### Colony Structure:

A termite colony functions like a single living community. It includes the physical nest (nest) and living castes. These mounds provide shelter from weather shifts and also keep their internal climate stable. The colony mainly houses royals (king, queen, alates), workers, soldiers and nymphs. Their overall efficiency relies on strict division of labor across the members.

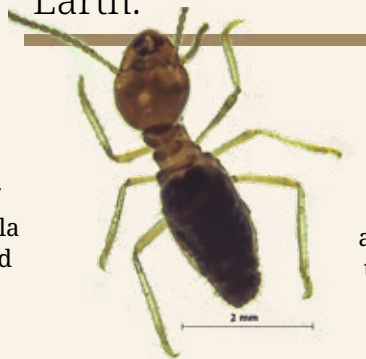
#### Reproductives:

Reproductives come in two types: primary and supplementary. The primary ones are the winged "alates." When right time comes, they fly off in a swarm, shed their wings and mate to become the king and queen of a new colony. This mass exit from the nest is what is called as "swarming." The queen is the main egg-producer. In some species, the queen can lay thousands of eggs daily for several years. This is made possible by "physogastry," where her abdomen expands significantly. The king and queen stay in royal chambers and the workers feed and protect them. Sometimes, supplementary reproductives emerge to ensure the colony's continued survival.

#### Workers:

Workers are the true backbone of a colony. They are responsible for food gathering, nest building, repairs, feeding the young and grooming other

Fossil evidence reveals that termites emerged as eusocial insects toward the end of the Jurassic Period, nearly 150 million years ago—an ancient society etched into the deep time of Earth.



members. It is the workers who look after and nourish the soldiers and the royals. Occasionally, these workers can even transition into supplementary breeders. In some groups (lower termites), one won't find "true workers." Instead, immature forms known as "pseudergates" take over these roles and perform all the necessary tasks.

### Soldiers

They are specially groomed for combat. With oversized heads, tough armor and powerful jaws or chemical-spraying snouts, they are the guards. Their primary role is shielding the colony from enemies like ants. Their population and appearance vary depending on the specific type.

### The Young

Nymphs cannot find food by themselves. They rely completely on workers for nourishment. They receive pre-digested meals through trophallaxis, a direct hand-off from workers. Lower termites swap gut protozoa through back-end feeding. Higher species share bacteria via mouth-feeding. This gives the young the microbes required for breaking down wood.

### Termite Mounds

Built from soil, clay, chewed wood and saliva, termite mounds are truly impressive structures. Some may tower up to 8-10 meters high. Inside, the space is neatly organized into chambers for nurseries, food storage, fungus farming and a royal cell for the king and queen. A complex network of tunnels and vents regulates the temperature, humidity and airflow, ensuring the colony survives even in harsh weather. Beyond being homes, these mounds enrich the soil, recycle vital nutrients and provide shelter for many other creatures, highlighting their massive ecological importance.

### Life Cycle

The life cycle is consistent across most

of the termite species. When conditions are right such as start of the rainy season, the winged reproductives or alates, swarm out of their colony in large numbers. Once they land on the ground, they shed their wings. The females then release pheromones to attract a mate and begin searching for a place to start a new colony. Once they pair up, they find a spot, dig a tunnel with a private chamber and seal it off. The female lays eggs and the first to hatch are workers who take over building and feeding. Eventually, soldiers are produced and as the colony matures, new alates are born to repeat the cycle.

A termite's diet is very high in cellulose. "Lower" termites cannot digest this on their own and rely on protozoa in their gut, which are passed from workers to the young through back-end feeding. However, "higher" termite family (Termitidae) lacks these protozoa and uses bacteria instead. These bacteria are shared through mouth-to-mouth feeding known as stomodeal trophallaxis. To get enough nitrogen, termites turn to fungi, stored uric acid and specialized gut bacteria. Some species like *Coptotermes formasanus* even conserve nitrogen by recycling colony members. The workers might bite the legs off injured alates and then consume them to keep nutrients in the group.



Termites, often dismissed as household pests, are in truth quiet guardians of ecological balance—powerful agents of decay and renewal, shaping the living rhythms of the Earth.

### Symbiotic Association

One of the most complex and fascinating symbiotic relationships found in the insect world is the bond between fungus-growing termites (Macrotermitinae) and their specific fungal partner, *Termitomyces*. These termites actively cultivate this fungus, which works by breaking down collected plant matter to keep the entire colony thriving. They keep partially digested plant remains in several specialized underground chambers within sponge-like structures often called fungus combs. It is inside these combs that the actual breakdown of the material takes



place. The termites effectively regulate the nest's temperature, humidity and gas exchange through engineering beautiful ventilation systems. This ensures that the fungus has perfect growing conditions all throughout the year. In return, the fungus gives the colony members tiny spherical nodules and essential enzymes. These enzymes allow the termites to efficiently digest tough wood fibers and other complex biopolymers. This specific fungal relationship is only seen in the Macrotermitinae subfamily.

### Communication and Social Bonding

The real reason termites succeed as a group is how well they communicate. Interaction happens in a colony through touch and chemical cues. Pheromones are the main way they share data across castes, which they pick up using antennae and mouthparts. These chemicals guide everything from swarming and mating to finding food, sounding alarms and even marking trails.

As social insects, their complex setup, division of work and symbiotic bonds make them one of nature's most efficient systems. The colony becomes a "superorganism" because of the each member's specific role and their total dependence on each other. As decomposers, they play a huge part in nutrient cycling. Their knack for digesting cellulose—thanks to partners like bacteria and fungi—makes their impact truly unique.

Though people see termites as pests, they are actually guardians of ecological balance. They are powerful agents of environmental change. Looking deeper into their life cycles and social behaviors will surely enrich the future of environmental and pest sciences.



Odontotermes obeseus fungal comb  
Photo: Dr. Amina Poovoli





Termites, through their intricate colonies, division of labor, symbiotic bonds, and subtle modes of communication, stand as one of nature's most complex and successful social systems.

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# Scorpions

## Night-dwelling venomous creatures



### Dr. Aswathy K

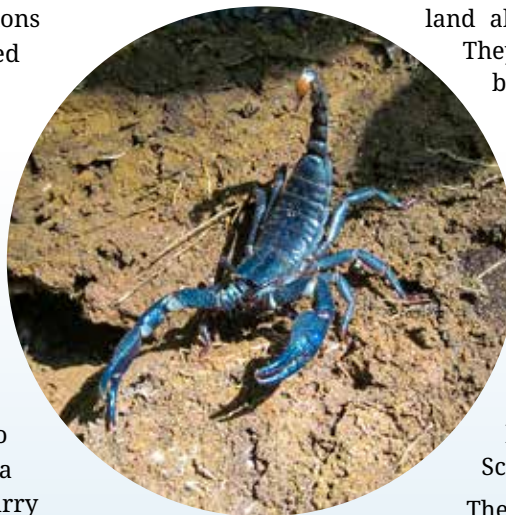
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In the human psyche, scorpions have always been considered villains. But are they truly as terrifying as we make them out? With their crab-like pincers (pedipalps) and the venomous sac (telson) perched at the tip of their tails, it's rare to find someone who doesn't feel a shiver of fear at the sight of one. People often wonder if scorpions bite or do they sting. They also doubt if a single sting is such fatal. A flurry of such questions usually races through our minds the moment we hear their name. Despite their small size, their intimidating appearance is enough to spark instant hatred in almost anyone. But are they really such 'vile' creatures? In reality, just like any other animal, their aggression is simply a survival tactic—a way to hunt for food and ward off potential threats.

Scorpions had walked from the sea to



land about 450 million years back. They were around here much before human beings lived here. Though they were here for a long time, their bodies haven't changed much over time. That's why scorpions are called "living fossils." One can spot scorpions everywhere except Antarctica. They share the arachnid family with spiders and mites but have their own group called Scorpiones.

Then there is another creature that looks same as scorpions. It is the whip scorpion or vinegaroon. It got the "whip" name from its scorpion shape and skinny, whip-style tail. When scared, it sprays a smelly acetic acid liquid that reeks of vinegar—that's where the name "vinegaroon" comes from. But the good thing is that these are not harmful like scorpions.

Around the world, 2,888 kinds of scorpions have been found. India is home



to 153 and Kerala has 32 species. These range from little "mani-thelu" (dwarf ones) to big scary black scorpions. It has been seen that the little scorpions have stronger poison than the giant ones. They hunt with crab-like claws and then swing their tail for a knockout sting. Their diet is diverse, including roaches, lizards, spiders, mice and a lot more. Sometimes they turn on each other and eat their own kind. Once the scorpion spots danger, it lifts its claws and tail high, a posture that makes people freak out and want to smash it.

But should we fear these creatures? In Kerala, just one out of 32 posses venom enough to kill a man, with sightings of these scorpions around Kollam. Though other scorpions are also venomous, they are not fatal. A Scorpions venom is a mixture of proteins, enzymes, serotonin and histamine, all aimed at the nervous system.

#### Fascinating Body

A scorpion's body has 16 parts divided into three main regions. The front part - cephalothorax - is a mix of head and chest. Then comes the abdomen that narrows back into the tail, ending with telson—a bulbous sac packed with venom. They have eight legs in four pairs along the belly sides, but they are known for their big front pincers.

What makes the scorpions fascinating is their exoskeleton of tough chitin with beta-carboline inside. This chemical causes scorpions to glow in bright blue-green under Ultra Violet rays. As such researchers use blacklights to spot them at night, but why they glow is still a puzzle scientists are figuring out.

Located in the center of the head are two primary eyes, supplemented by three to five additional pairs situated at the front corners, giving them a panoramic view of their surroundings. Furthermore, their pincers are covered in specialized sensory hairs called trichobothria. These

sensory hairs emerging from tiny circular pits. These hairs are so sensitive that they can detect the minute vibrations of a moving prey from up to a meter away, allowing the scorpion to strike with much accuracy.

Scorpions come in all sorts of colours, from white and black to deep green or bright orange. They also differ in size from little to bigger ones. Though the scorpions belonging to Sahyadrimetrus are bigger, they are not that venomous as the little ones. This is because their pincers are strong enough to catch a prey.

They only use their venom to hunt down large preys. Little scorpions with puny claws need super-strong poison to target their prey. At the front of the mouth, the scorpions have a pair of small, specialized appendages called chelicerae. These are essential for their unique feeding process. Unlike most animals, scorpions perform much of their digestion externally. They regurgitate digestive enzymes onto their prey to break down tissues into a liquid form before consuming it. As this 'external liquefaction' is a slow process, it can take anywhere from several hours to a few days for a scorpion to finish a single meal. Since they consume their food in liquid form, their waste

production is minimal, consisting primarily of nitrogenous compounds like uric acid. After one substantial meal, a scorpion can survive for months without eating again. In fact, some species are known to endure up to a year of starvation.

As the scorpions are true creatures of the night, they possess a heightened sensitivity to even the most microscopic traces of light. They emerge from their hideouts only after dusk to begin the hunt. Their homes—often referred to as 'microhabitats'—include everything from narrow burrows and the underside of fallen logs to the crevices of tree bark and the gaps between stacked stones. By remaining tucked away during



Scorpions, among the earliest to journey from sea to land over 450 million years ago, have changed little in form. Their enduring design has earned them a timeless name - 'living fossils of the Earth.'

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the day, they avoid the scorching sun and stay safely out of sight from potential predators.

Normally scorpions are seen as single beings. The exception is only during the early stages of life. When the young are born, they immediately climb onto their mother's back for protection. They remain there until they have undergone at least three rounds of 'molting' (shedding their outer shells). Until this process is complete and their new exoskeletons have hardened, the mother and her offspring stay together as a single, protective unit.

Once a male finds a partner, the two lock their pincers together in a rhythmic movement that resembles a dance, stepping forward and backward in unison. This can last anywhere from a single hour to an entire day. To soothe a restless female, the male might occasionally deliver a gentle, sedative sting to her abdomen. During this dance, the male deposits a sperm packet on a suitable surface, which the female then draws into her body using her forelegs.

Unlike many other invertebrates, scorpions are viviparous—they give birth to live young. After the eggs hatch inside the mother, the tiny scorpions emerge one by one, dropping into a 'birth basket' she forms with her legs. From there, they instinctively scramble up her limbs to settle in a dense cluster on her back and head. A single brood can sometimes number in the hundreds. At birth, these infants are translucent white; they only gain their characteristic pigment after undergoing several molts.

The mother provides all the necessary nourishment until the young have completed their first three molts, at which point they typically strike out on their own. However, nature can be harsh; if a young scorpion lingers too

long or refuses to leave the mother's back, she may turn on it—exhibiting cannibalistic behavior to reclaim her resources. Interestingly, some rare species are capable of parthenogenesis, a unique biological process where females can produce offspring without ever mating with a male."

A scorpion reaches adulthood after undergoing seven to eight molts. Depending on the species, their lifespan ranges from five to twenty-five years. In our region, the most common variety is the Giant Black Scorpion (*Sahyadrimetrus*), which grows between 10 to 21 centimeters

in length. They are usually black or orange-brown and some exhibit a distinct greenish hue. As mentioned earlier, despite their big size, these giants aren't highly venomous. Their massive pincers are their primary weapons for hunting and defense, with venom serving only as a secondary tool. In contrast, the *Isometrus thurstoni* is a smaller one frequently seen inside homes and bathrooms. Another common variety is the *Lychas* species, often found hiding under tree barks. These are much smaller, measuring only three to seven centimeters, with slender, delicate pincers.

As they lack physical strength, they have more potent venom to neutralize prey or ward off predators. Scorpions also have fascinating defense mechanisms beyond just stinging. Some species can spray venom directly at an attacker's eyes to temporarily blind them, providing a window to escape. Even more remarkable is a group of scorpions that, much like lizards, can detach their own tails (autotomy) to distract a predator while they make a quick getaway.

The sting of a scorpion typically triggers intense, agonizing pain and a throbbing sensation, often accompanied by swelling

Photo: Aswathi K



Tail less whip scorpion Credit Photo: Bright Roy



and itching. In some people, these can persist for several hours. Some individuals may also develop severe allergic reactions. It is important to note that stings are often far more dangerous for children than for adults. The very last segment of the scorpion's body is telson, which is a sophisticated delivery system consisting of a bulbous venom gland and a sharp, needle-like stinger. By driving this point into a victim, the scorpion injects its venom with precision. Interestingly, scorpions begin producing venom just a few months after birth. Another noticeable thing is that scorpions do not always inject poison. In many defensive encounters, scorpions deliver what is known as a 'dry bite' (or dry sting). This is a warning strike where the stinger penetrates the skin but no venom is released, allowing the scorpion to conserve its toxic resources while still warding off a perceived threat.

The scorpion mainly uses venom as a primary tool for subduing prey. The reaction of venom in human beings may vary from one individual to another. The symptoms can range from numbness spreading through the limbs, or even excessive salivation. If symptoms escalate, one should never hesitate to seek medical help, as severe cases can lead to significant health crises. Much like antivenom for snakebites, antivenom for scorpion bites are also now available. Scorpion antivenom isn't commonly seen in our region. In contrast, it is widely available in parts of Africa and various desert regions where the lethal species are common.

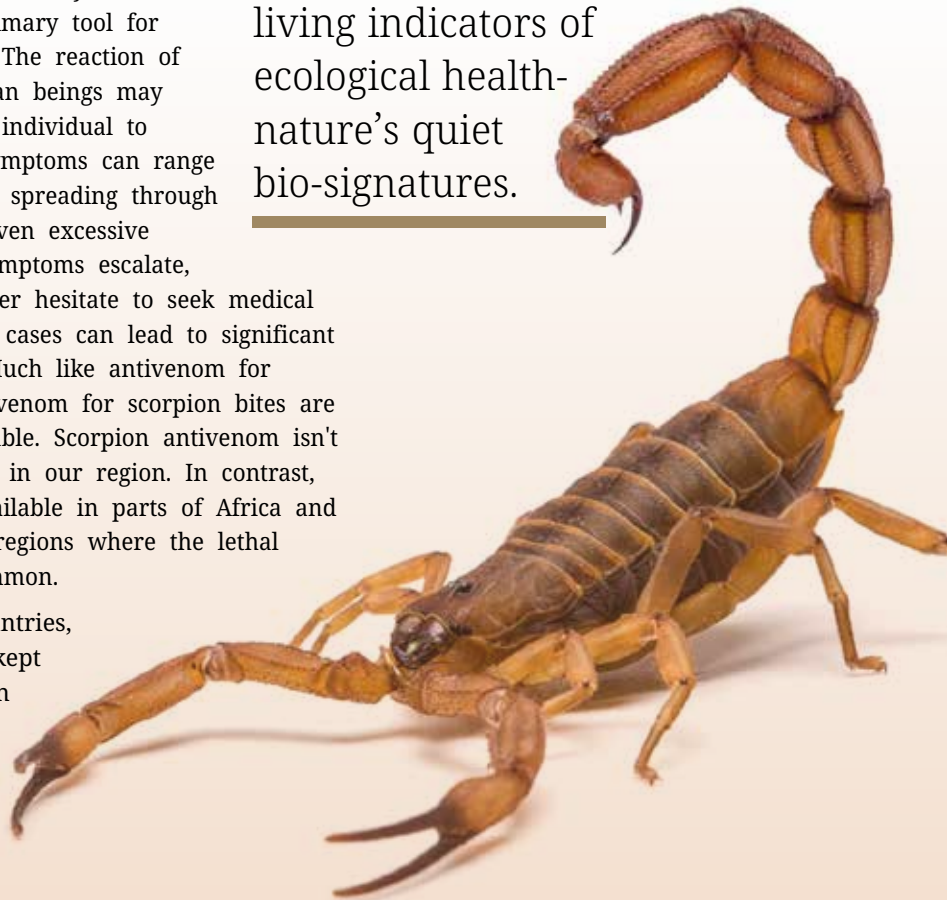
In some countries, scorpions are kept as pets or even considered as a delicacy.

But in our country, they are a protected group under environmental laws.

By clearing forests for agriculture and destroying sacred groves and other protected habitats, we are effectively wiping out their homes and erasing them from the planet. This is because scorpions, often called 'bio-indicators', is tied to a very specific habitat. Their long generation gaps and slow growth rates make them incredibly vulnerable to habitat loss. They are a vital link in the terrestrial food web, playing a massive role in controlling soil-dwelling insect populations. Simultaneously, they serve as a crucial food source for birds, reptiles and small mammals.

If scorpions disappear, it would trigger a collapse in the food chain, eventually destabilizing the entire ecosystem. It is, therefore, our collective responsibility to ensure the survival of these ancient creatures.

“ Each species of scorpion inhabits a distinct and specialized niche, making them living indicators of ecological health—nature’s quiet bio-signatures. ”



# Fireflies

## 'NATURE'S LIVING LANTERNS



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Deeply etched into our childhood memories, fireflies occupy a truly special place. There is an undeniable sense of wonder in watching their tiny, flickering lights dance through the darkness. For many, the sight of these creatures drifting through the twilight of a summer evening, glowing with a soft green hue, is the very essence of rural nostalgia. Some of us might even remember the simple joy of catching them in glass jars just to marvel at their luminescence in the dark. Such sights of a firefly for today's children has become a rare luxury. A scene that was once a common part of our nightly landscape has slowly faded away. Why have these glowing companions, who once flew around us in such abundance,

Fireflies-the tiny green flickers that once lit our childhood nights-are now fading from urban skies. Belonging to the Lampyridae family, their bioluminescent glow is a remarkable language of courtship. Moving through egg, larva, pupa, and adult, they complete a wondrous cycle of transformation, a quiet magic of the night.

vanished so suddenly? Before we search this, let us first take a look at what fireflies actually are.

Fireflies are known by various names like glow-worm or lightning bug. But these creatures are technically none of those things. In reality, fireflies are insects belonging to the beetle family Lampyridae. Globally, there are over 2,400 species spread across 144 genera. While research in India remains somewhat limited, studies suggest that our country is home to approximately 50 different species. These are nocturnal beings with a profound love for the dark. While both adult males and females typically possess fully developed wings, there are certain species where



the female remains wingless, retaining a larva-like appearance even in adulthood. Interestingly, not every member of the firefly family is capable of producing light; there are 'dark' species within the group that do not glow at all.

### Life Cycle

Fireflies are fascinating insects that undergo complete metamorphosis. They have four distinct life stages such as egg, larva, pupa and adult. They only reach their full growth after passing through the initial three phases. Remarkably, they can produce light during all four stages of their life. Female fireflies lay eggs in moist soil, damp moss or on fallen leaves. After about ten days, these eggs hatch into worm-like larvae. One interesting thing is that fireflies spend the largest portion of their lives in this larval stage. They thrive in humid environments, often hiding under decaying leaves. Their glow serves as a clever anti-predator strategy, warning hunters to stay away. These larvae feed on snails and earthworms, acting as a biological control agent that keeps snail populations in check. The larval stage last from four to seven months. Once the larva transforms into pupa, it takes about a week for the winged, fully-grown adult firefly to emerge. These adults have a very short lifespan, usually living for only three to four weeks. Their primary mission during this brief time is to find a mate and reproduce. Another intriguing fact is that adult fireflies generally do not eat. While some studies suggest a few rare instances of them sipping nectar but most of them live with the energy they store as larvae. However, there is a notable exception in North America: the female Photuris firefly, known as the "Femme Fatale," which hunts and eats



Light pollution, excessive use of chemical pesticides, habitat disruption, urban expansion, and unchecked tourism now cast long shadows over the survival of fireflies, dimming their delicate glow from our nights.



males of the Photinus genus. The lifespan of fireflies varies by species. While most of them complete only one generation per year (univoltine), some species found in our region are known to complete two generations within a single year (bivoltine).

### Bioluminescence


In biology lessons, everyone knows a firefly's glow goes by bioluminescence. For producing this light, they use special cells at their lower belly's end called photocytes. These have a protein named luciferin. When this protein meets oxygen, the bright light is produced. What's really amazing is this acts as "cold light," giving brightness with no heat released. To control the glow, photocytes cluster into a special organ dubbed a lantern. One can see that two light organs mean a male firefly and one signals a female.



Fireflies thrive most at twilight and wind down by around 10 PM. As night settles, they set off to locate mates, relying on light flashes for main contact. Each firefly's blink pattern, count, timing, glow length serves as a distinct marker for its kind. These lights function as signals to draw partners. Males usually hover four feet up, flashing set sequences from their lanterns. Females below, on the grass, observe these shows. When one likes a male's cue, she fires back a brief, precise reply glow. True darkness proves vital for such precise exchanges.

In summer, just after initial rains and prior to monsoons, fireflies assemble by the millions. They cluster on particular "display trees" in prime habitats, staging a dazzling light performance called a mating congregation. This synchronous






flashing, where the whole group pulses as one, offers a stunning visual treat. Such spectacles occur distant from urban glare, tucked in hillsides and dense woods with pitch-black nights. Iconic global spots include Great Smoky Mountains National Park in the USA and Kuala Selangor in Malaysia. In India, Bhandardara in Maharashtra and Anamalai Tiger Reserve in the Western Ghats draw crowds for these vivid natural displays.

### Where did you go firefly?

It is now time to come back to our core question. Lately, fireflies have turned scarce. What's causing this? Are they genuinely vanishing? Global research shows fireflies are indeed dwindling fast. Though detailed local studies lack, numbers in our areas have plunged sharply for sure. Threats like light pollution, rampant chemical pesticides, lost habitats, urban sprawl, and rampant tourism endanger them deeply. Light pollution stands out as their biggest foe. Man-made "sky-glow" from today's nights throws off their life cycles entirely. These matter hugely in ecosystems, so for kids tomorrow to catch their magic twinkles, everyone must fight to dim artificial lights.

Photos: Dr. Bojoy C. ✓



The touching 1988 Japanese anime Grave of the Fireflies paints them as lost spirits' emblems. We're nearing a time when fireflies linger just as nostalgic pangs in one era's youth. True, cities rarely host them now, yet villages still see flashes in peak seasons. Our shifting habits likely hide them from view. Crave a glimpse? Just seek out some real darkness nearby. The poet's line—"Light brings grief, little one; dark delivers joy"—rings so true today. ■



# Cicadas

## The Musical Emperors of Nature



**Dr. Kalesh Sadasivan**  
**Anjana Anilkumar**

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In our countryside and forests, nestled in the shadows of Sahyadri ranges and beside flowing streams, an endless musical trance breaks the silence. This timeless music emerges from nature's deep roots. Living on trees, plant stems and hidden behind leaves, a unique community of creatures - cicadas - creates this sonic empire, representing a hidden facet of Kerala's natural wealth. For those travelling through the rural landscapes, this sound might first feel like a curiosity or an uncertain question. Later, as the rhythmic vibration strikes the ears continuously, it can feel captivating on one hand and perhaps slightly unsettling on the other. However, our wonder only reaches its peak when we realize the true source of that sound and its biological significance.

### Biological Characteristics

While the name *cicada* is often generally used to describe various insects, the true cicadas belong to the order Hemiptera. Their physical structure is a direct reflection of their lifestyle. They possess unique mouthparts adapted to suck sap from plant stems and leaves. They also undergo a life cycle known as incomplete metamorphosis. Unlike periodical cicadas found in other parts of the world, most species in our region

are annual cicadas. This means they complete their entire life cycle within a single year. However, nature always holds surprises; a fascinating species found in Meghalaya, known as *Chremistica ribhoi*, appears only once every four years, earning it a unique place in biological studies.

### Life Cycle

A cicada's tale unfolds like a poem, a wild saga split into three clear acts. Spanning egg, nymph and adult phases, their lives weave time with nature's intricate dance. The journey begins with eggs laid on plant branches. Once they hatch, the tiny young ones immediately descend into the womb of the earth, where their life becomes shrouded in mystery. Living underground for months or even years, these nymphs grow by drawing nutrients from tree roots. They wait patiently until environmental factors like temperature and humidity are just right before making their move toward the surface. There is more primal drama in this transition than one can imagine. The process where hundreds of cicadas emerge from the earth simultaneously to attain their adult form is one of nature's most magnificent spectacles.

Purana cheevee  
Photo: Kalesh

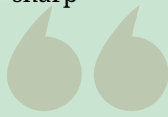


## Science of Sound Production

The way cicadas produce sound is one of the most sophisticated and wondrous mechanisms in the natural world. In this musical empire, the true maestros are the male cicadas. The source of this incredible noise lies in a specialized organ called tymbal, located on both sides of their abdomen. The tymbal is a stiff, circular plate with a surface composed of tiny segments called "ribs." Through the rapid contraction of powerful muscles, this plate is pulled inward. As each rib buckles, it produces a sharp "click," creating a fast-paced series of micro-sounds. When the muscle relaxes, the plate snaps back to its original shape, generating even more noise. However, this is where nature's clever engineering truly shines. On its own, the vibration of the tymbal isn't actually that loud. The secret lies in the cicada's hollow abdomen, which acts as a resonance chamber. Functioning like a natural speaker, this empty space amplifies the initial vibrations manifold, projecting the sound across vast distances.

## Diversity of Sound Patterns

Different species of cicadas possess their own unique acoustic signatures. While some species produce a steady and continuous drone, others create rhythmic pulses or chirps. These variations depend entirely on the physical structure of their tymbals and the specific characteristics of their internal resonance chambers. The more fascinating thing is that though female cicadas lack the ability to produce these sounds, they possess incredibly sensitive hearing. They use a



The life of cicadas unfolds like a poem—nature's verse written in three quiet chapters. Passing through egg, nymph, and adult, their existence reflects a delicate harmony between time and the rhythms of the natural world.

specialized organ called the tympanum, located on their bodies, which allows them to distinguish between different species and pinpoint the exact male that belongs to their own kind, ensuring they find the perfect mate.

## cicada diversity

Though Kerala's vibrant cicada diversity mirrors global cousins, these insects evolved uniquely within our landscapes. Though 3000 species are known worldwide, the Indian subcontinent records nearly 211. In the Western Ghats, only fifty species are documented, with twenty-three species inhabiting Kerala.

## Recent Discoveries

Recent scientific discoveries into Kerala's diverse cicada populations have opened up some truly exciting new horizons. A massive milestone was reached back in 2021 with the discovery of a new species - *Poponia pseudolinia* - in Idukki's Swargam Medu. This specific insect stands out from all its relatives thanks to the very distinct structure of its male reproductive organs and a truly unique song. In April 2023, researchers identified another species called *Sahyaderterpnosia leavospina* in Ponnudi,

Thiruvananthapuram. Its name serves as a beautiful tribute to local heritage; the genus name actually blends "Sahyadri"—the ancient title for the Western Ghats—with the existing genus "Terpnosia". Finally, in July 2023, *Indopurana cheeveeda* was found in Pala, Kottayam. Interestingly, its unique scientific title is deeply rooted in Malayalam, with "cheeveeda" taken directly from the word "Cheeveedu," which is the local name for Cicadas.

## Colorful Families

The cicadas in Western Ghats is

da Cicada  
Sadasivan ▼



distinct with their vivid hues and physical traits. One of the most impressive is *Gaeana atkinsoni*, a beautifully tinted cicada living deep in the woods. Being the sole South Indian member of its genus, this species took an evolutionary path quite different from its relatives in the Himalayas or Southeast Asia. Another titan of the insect realm is *Pomponia cyanea*, one of Asia's largest cicadas. It's easily spotted by its blue-toned abdomen and the bold red veins crossing its wings. Furthermore, *Cryptotympana* cicadas are known for their dark, black bodies highlighted by deep green wing veins. Their name comes from Greek, translating to "hidden drum," which refers to how their hearing organs are tucked away.

### Ecological Significance

Cicadas are an indispensable part in nature's intricate machinery. Every stage of their lifecycle is tied to the world around them—soil quality, plant health and weather shifts. These are all critical for their continued existence. Right now, clearing forests and shifting climates are massive threats to these insects. Rare species only found in isolated forests are most at risk from these changes. That iconic cicada song is more than a mating cry; it's an indicator of the health of the entire forest. Their presence, which lives years underground, showcases a healthy soil a balanced ecosystem. This tight bond with host plants is really the foundation of their life. If these homes are destroyed, their numbers will plummet. These species matter because they actively maintain the environment. While moving underground, they help to naturally aerate the soil. When they finally emerge and die, they are a source of nitrogen boost to the forest floor. A booming cicada population generally signals a

healthy, quiet habitat, while also providing a rich, high-protein feast for birds, squirrels and various other forest predators. This confirms their status as indispensable members of the natural world we share together today in harmony.

### Cultural Heritage and Modern Science

Cicadas are far more than a simple biological wonder; they have a unique position in human culture across the globe, serving as both spiritual icons and scientific blueprints. In the traditions of Java and Bali, their persistent hum is viewed as a celestial herald of the coming rains, while in Japan, their song is the definitive calendar of the natural world, marking the peak of summer and the end of monsoon season. For farmers and nature lovers, this rainforest chorus acts as a rhythmic clock, signalling the shifting of seasons and the inevitable passage of time. From the perspective of modern science, the cicada's sound mechanism is a subject of intense study. Researchers are



The story of cicadas in the Western Ghats is more than a biological account—it is a reminder of nature's infinite complexity and quiet beauty. Shaped over millennia of evolution, this remarkable system reveals the profound interconnections that bind every element of the natural world.

analyzing their "natural speakers" to unlock new technological frontiers. Scientists are studying the efficiency of the tymbal organ and the way a cicada's hollow abdomen amplifies vibrations to create better sound systems. They are also for designing the next generation of high-output micro-speakers and energy-efficient devices through biomimicry. This synergy of biology and technology proves that these insects are not just relics of the past but sophisticated architects of



our future. Ultimately, whether viewed as harbingers of weather or templates for innovation, cicadas represent a profound connection between the wisdom of the ancient world and the progress of the modern era.

### New Horizons in Research

Research within the Western Ghats is still in its fancy. The melodies and biographies of many cicada varieties remain shrouded in mystery because of the sheer cliffs and dense overgrowth. Yet, the integration of cutting-edge acoustic sensors and DNA sequencing is opening new doors. By decoding unique sound waves, experts are finally pinpointing species and tracking their habitats with much accuracy. In an age of climate change and habitat loss, these preservation efforts are more than academic. We have to explore the possibility of using cicadas as vital indicator species for conservation projects. Their presence shows the health of the forest.

Beyond the data, the story of the Western Ghats' cicada is one of elegance and complexity. These creatures, shaped by millions of years of evolution, highlight the deep-seated connection between all living organisms. After spending a lifetime underground, they surface for a brief moment to perform their life's aria, prompting us to ponder the deeper nature of time and existence. When you next walk through the rainforests and hear that rhythmic song, stop and listen. It is not mere noise; it is an ancient fragment of a song that has vibrated through the ages.

If we have to ensure this natural symphony to continue, then we require intentional and urgent intervention. Preserving old-growth forests protects the essential "display trees" and host plants, while healthy soil conservation keeps developing nymphs safe during their years-long stay underground. Furthermore, global climate action is necessary to maintain the precise

temperature cues that govern their delicate life cycles. If we value this natural orchestra, we must safeguard the wild spaces and intricate ecosystems they call home, ensuring future generations can experience the sweetness of this eternal chorus. ■

Photos: Kalesh Sadasivan ▼



Cicada



*Pomponia cyanea* Cicada

◀ Photo: Anoop Paul



# Centipede Unspoken truths

*Cormocephalus Centipede* ▶  
Photo: Hareesh K.C



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If you were to ask a child about their favorite animal, its diet or where it lives, you'd likely hear stories of elephants or tigers. We all know about the vibrant, charismatic creatures that dominate our television screens and fill the pages of school textbooks. But what happens when you ask about centipede, earthworm or the millipede? Usually, the conversation ends with a simple shrug or a look of indifference. Yet, nature is much like a captivating book that reveals more wonder with every page turned; every living creature, no matter how small, thrives on a collection of fascinating, hidden secrets.

The centipede is a perfect example of this hidden complexity. While most people dismiss them as mere household pests, these predators are far from insignificant; some are even revered enough to have temples dedicated to them, and they display a surprising degree of maternal affection toward their young.

## Centipede and Its name

In the world of scientific classification, centipedes belong to the class Chilopoda. The name "centipede" itself is rooted in Latin, combining 'centi' (meaning hundred)

and 'pedis' (meaning feet). However, the truth is that no centipede actually possesses exactly one hundred legs. By looking closer at the five distinct orders of centipedes within the Chilopoda class, we can understand the reality behind their leg counts and the true nature of these misunderstood creatures.

The common centipedes we often spot in our homes and backyards belong to the Scolopendromorpha order. These are the most frequent visitors to our living spaces, characterized by their 21 to 23 pairs of legs that are perfectly designed for high-speed movement. Another centipede that you might encounter in your backyard are the Geophilomorpha, or soil centipedes, which can be shockingly long. These leggy wonders can have anywhere from 31 to 181 pairs of legs, and some even possess the ethereal ability to glow in the dark. Despite their fascinating bioluminescence, they remain largely unstudied in India, with very few formal research projects dedicated to them. Tucked away in damp leaf piles or beneath forgotten objects are the Lithobiomorpha, commonly known as garden centipedes. They are more modest in stature, navigating their world with



exactly 15 pairs of legs. In contrast, the Scutigermorpha, or feather centipedes, stand out due to their bizarrely long and delicate leg structures. Finally, there is the Craterostigmomorpha, a group so unique it has been dubbed the "Platypus of the centipede world". This rare and ancient lineage consists of only two species, found exclusively in the remote landscapes of New Zealand and Australia.

### Centipedes in India

Building on our exploration of these fascinating many-legged creatures, the scientific landscape of India reveals an incredible diversity that often goes unnoticed. According to official records, India is home to a vast array of species: 87 varieties of Scolopendromorpha, 28 Geophilomorpha, 5 Scutigermorpha and 6 Lithobiomorpha.

In Kerala specifically, researchers have documented 27 different species of the common centipede (Scolopendromorpha). Among the findings, one of the most intriguing finds occurred in 2012, when the Zoological Survey of India's Kozhikode center discovered a species of blind centipede (Cryptopidae) within the Malabar Wildlife Sanctuary.

### The Giants

While many centipedes are small, some grow to truly intimidating proportions. The Amazonian Giant Centipede (*Scolopendra gigantea*) is widely considered the largest in the world. A study published in 2025 highlights these "monsters" of the undergrowth, noting they can reach up to 30 centimeters in length and are powerful enough to hunt and eat bats. Interestingly, while they are typically associated with South America, unconfirmed reports from 1997 suggest a similar giant species have been spotted right in India.

### "Tigers of the Soil": The Ultimate Predators

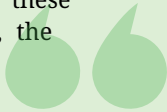
It is no exaggeration to call centipedes the "Tigers of the Soil." As nocturnal wanderers, they are apex predators of the micro-world, maintaining a diet that ranges from tiny insects, larvae and termites to larger prey like frogs, lizards, mice, snakes and even bats. Unlike many other small creatures, centipedes are not scavengers; they show no interest in dead remains and prefer the thrill of the chase, pursuing their prey with a speed fueled by their unique leg arrangement. To take

down larger targets, they use a specialized weapon: forcipules. These are actually modified front legs equipped with venom glands used to paralyze their victims. While this venom is a deadly tool in the wild, it has been a staple in traditional Chinese medicine for centuries. Life for a centipede is a constant battle for survival, sometimes even against its own kind. When food is scarce, they are known to turn cannibalistic, attacking and eating one another. This harsh reality begins at birth; newly hatched centipedes often have their very first meal by eating their own shed skin (molt).

### Devoted Mothers and Mother Killers

Centipedes are bisexual. The mating ritual of a centipede is a slow, methodical dance that reveals a surprisingly complex side to these leggy predators. A male typically begins the process by weaving a delicate silken web on the ground to deposit his sperm. Then, using the antennae, he gently taps the female's hind legs, coaxing her toward the web in a courtship that can last for several hours. Once she makes contact with the web, she takes the sperms into her reproductive organs to begin the cycle of life.

While some species lay their eggs individually, many others are far more meticulous architects of the next generation. A female will often retreat into



At the very mention of centipedes, one might first imagine a troublesome, unsettling creature. Yet these predators-known for their fierce grace- are far from trivial: capable of maternal care, and in some cultures, even honored with temples in their name.

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a hidden chamber carved from damp soil or rotting wood to lay a cluster of eighty or more eggs at once. It is here that the centipede's legendary—and perhaps unexpected—maternal instinct truly shines. The mother protects the eggs with much care from the damp earth and potential infections. As such the mother coils her body around the sticky egg cluster, physically lifting them so they never touch the ground. She will remain tucked away in this "brood chamber" for nearly a month, often completely abandoning food to ensure her children's safety. However, the natural world is rarely without a dark side, and the life of a centipede is no exception. If a mother feels excessively threatened or her nest is disturbed, her protective instinct can turn into a survival reflex, leading her to abandon or even devour her own young. In some cases, the offspring have been known to survive by feeding on their own mother.

### From temples to food

This article cannot be concluded without mentioning their strange and striking place in human culture—ranging from ancient literature to modern-day cuisine. In the classic Indian collection of legends, the 'Kathasaritsagara', some believe the creeping creature described as bringing illness to King

Vasudatta was, in fact, a centipede. In Seremban, Malaysia, stands the remarkable Then Ze Koon Temple, where devotees offer prayers to a centipede deity. The temple features a statue of a centipede. However, you will find a starkly different relationship in China and Taiwan with these predators. Rather than being worshipped, centipedes are often treated as a culinary specialty. In local markets, it is common to find them crispy-fried with ginger and garlic or even infused into bottles of vodka.

Despite their presence in our myths and on our plates, scientific understanding in India is yet to be explored. While

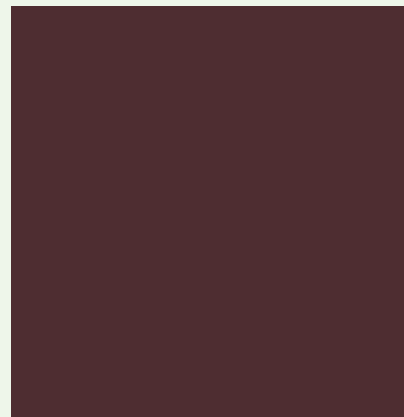
we have successfully categorized many species, there is a significant lack of research regarding their behavioral patterns and the specific ecological roles they play within our soil. Studies are now underway in India to trace the ancient lineage of our local centipedes and determine how they are linked to species found across other continents. These "Tigers of the Soil" are far more than just household pests; they are complex creatures with a history as long as their many legs.. The next time you find a centipede scurrying across your bathroom floor or lurking in your backyard, take a moment to pause before you strike. ■



Fierce by nature, these hunters-true 'tigers of the soil'-feed on creatures ranging from tiny insects to lizards, frogs, and even mice. With venom glands in their front limbs, they subdue prey with precision. Yet, in striking contrast, they are devoted guardians-fastening if needed, to protect their eggs and young.

■ The Centipede Temple in Seremban, Malaysia

Paracryptops Centipede ▼  
Photo: Umesh P.K.



# Praying Mantis

## Weird Creature among Insects



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Recent studies suggest that nearly 40 percent of Earth's insect species are already lost, while many others stand on the brink of extinction. Among those facing serious decline are mantids—enigmatic predators of the order Mantodea. Their name, rooted in Greek, evokes the image of “praying prophets,” a quiet illusion that belies their fierce, predatory nature.

Feeding entirely on other insects—grasshoppers, moths, ants, and flies—mantids play a vital role in natural pest control, emerging as silent allies of farmers. Yet, despite their ecological importance and fascinating behaviors, scientific understanding of these remarkable creatures remains surprisingly limited in our regions.



Scientists have recently uncovered an astonishing reality that approximately 40 percent of the world's insect species have already vanished and the survivors face a grave and growing threat of extinction. Among those on the most threatened list is a group of insects known as Mantids or Praying Mantises. These creatures belong to the order Mantodea, a name derived from the Greek for "Praying Prophet". These insects are strictly carnivorous, playing a crucial role in the biological control of pests. They also serve as invaluable allies to farmers by hunting down grasshoppers, moths, crickets and flies. Despite their importance, scientific knowledge regarding Mantids is strikingly low.

One of nature's most captivating species, the praying mantid are famously known for their serene, prayer-like posture, a characteristic that earned them their name. In many cultures, the arrival of a mantid in one's home is viewed with reverence. Some believe they are prophets close to God, while others see them as harbingers of wealth and good fortune. This mystical reputation has even led to them becoming popular exotic pets in various parts of the world.

They are strictly carnivorous and pose no threat to the crops or garden plants. Moreover, their ability to mimic the world around them is astounding. They take on the appearance of vibrant flowers, brittle twigs or lush green leaves and can even shift their color to match their surroundings. When it comes to hunting, the mantid does not chase or run after preys but waits. They can remain motionless for hours, poised for the perfect moment. When an unsuspecting insect wanders too close, the mantid strikes with its raptorial legs, a movement so lightning-fast it is almost invisible to the naked eye. These front legs are lined with sharp, needle-like spines that

lock the prey in a lethal grip from which there is no escape. Once caught, the mantid uses a powerful pair of mandibles to instantly tear into its meal.

Mantids can swivel its head a full 180 degrees to survey its surroundings. This extraordinary flexibility, combined with a sophisticated visual system consisting of two bulging compound eyes and three smaller eyes (ocelli) on top of its head, provides them with unparalleled sight. Even the faintest sound doesn't escape them, thanks to a specialized "ultrasonic ear" located on their belly that can detect even the most subtle vibrations in their environment. Their movements and vision are so precise that they have even become blueprints for modern robotics, where scientists study them to design more efficient machines.

Despite the common myth that they are venomous or dangerous to humans, mantids are harmless to human beings. Though they might resemble grasshoppers or crickets, their close relatives are cockroaches and termites. Their lineage is ancient, appearing on Earth roughly 195 million years ago and establishing dominance across the globe between 145 and 65 million years ago.

Mantids are most likely to be found in grasslands, bushes and gardens. They always prefer areas near farmlands over rainforests. The mantids reach these lands following the pests. In the world of ecology, the presence of mantids is an indicator of a balanced ecosystem. However, as we noted previously regarding the 40% decline in insect populations, these ancient guardians are in trouble. Uncontrolled pesticide use, extreme heat and excessive rainfall caused by climate change are currently threatening the survival of the very "prophets" that help keep our farms healthy.

The reproduction of mantid is a bizarre and macabre spectacle where life and



Praying mantids-graceful, enigmatic hunters-now stand under serious threat of extinction. With a diet devoted entirely to other insects, they serve as nature's own 'biological control systems,' silently maintaining balance within fragile ecosystems.



death walk hand in hand. Many female mantids kill and devour their partners during the mating process. This is to get necessary nutrients for producing healthy eggs. Because of this, males are incredibly selective, seeking out the most robust females and they approach with extreme caution, creeping up from behind. Nature has equipped the male mantids with a startling physiological quirk: even if the male loses the head during the act, the body is capable of completing the mating process. In the absence of a brain, the male cannot decide when to finish the process. As such the process stretch on for two to three hours. This results in a more

sturdy fortress for anywhere between 15 and 400 eggs as they await their turn to hatch into the wild.

Female Mantids often stand a silent, steadfast vigil over their egg sacs until hatching. The eggs hatch in about fifteen to twenty days. Though the young ones (nymphs) look like their parents, they lack the wings and reproductive organs needed for adult life. They reach full maturity after shedding their outer skins through six or seven times over a span of roughly eighty to ninety days. The egg sacs are remarkably resilient, acting as natural fortresses that can withstand harsh environmental conditions.



Mantis

▲ Photo: Sandeep Das

thorough transfer of sperm, ensuring a more successful fertilisation. After mating is complete, the females deposit the eggs in a thick, frothy secretion. During this process, she will not abandon her task or fly away until the eggs are safely placed on a leaf, a twig or a window frame. This fluid hardens into a protective, weather-resistant egg sac on contact with the air. These cases come in various shapes and colours, acting as a

If the weather condition is not suitable, the mantid even has the extraordinary ability to delay the hatching process. By sticking to logs, plants, or vehicles, egg sacs reach various locations, helping some species spread across the globe. While females generally survive for seven to eight months, the males often live for nearly a full year. The nymphs are expert hunters and their main diet consists of soft-bodied mosquitoes,



flies and aphids. The role of mantid nymphs in pest control is immense. Abroad, mantid egg sacs are commercially reared and distributed to farmers. Placing them in fields greatly aids natural pest management. Such studies are yet to begin in our country.

Globally, over 2,500 species have been identified. However, India, which is a true treasure house of biodiversity, has officially recorded only about 170 of these fascinating insects. By identifying more



Still and patient, mantids become creatures of wonder—folding their forelegs like a quiet prayer as they wait to strike. With the uncanny ability to turn their heads nearly 180 degrees, they seize and subdue prey using powerful, spined limbs. Keen vision and specialized organs for sensing sound further sharpen these remarkable hunters.

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species and truly understanding their unique behaviours and reproductive cycles, we can achieve effective pest control. There is a need to provide more information about mantids to the farmers and the general public. By cultivating a diverse range of plants and greenery near our farmlands, we can naturally draw these elegant hunters, letting them serve as silent guardians of our harvests and restoring a sense of natural authenticity to our farming traditions. ■



# BATS

## Flying Wonders



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Twilight had settled over the surroundings and the backyard was a flurry of activity as the local Jungle Babblers, the area's most cheerful residents, hurried back home to their nests. As the lights in the house came to life, small insects and lizards that lurked behind wall calendars leap out. But suddenly something flew into the room. My first thought was that a bird had lost its way, but I quickly saw it was something else: a bat. That single, fleeting moment of childhood wonder eventually became the foundation of my entire research career.

Despite roaming the Earth long before humans arrived, bats have been trapped in a narrative of shadow and malice since time immemorial. From Bible to folktales and to modern cinema, these creatures have been painted as harbingers of the dark or companions to the demonic. Whether we look at the 1980s craze for Bram Stoker's *Dracula* or the recent obsession with *Stranger Things*, the story remains the same, leaving generations of us conditioned to view them with a sense of disgust. This, often irrational fear we carry is known



to science as Chiroptophobia, a testament to just how misunderstood these ancient inhabitants of our world truly are.

### Bats; the mammals that flying

What are bats exactly beyond the myths and phobias that surround them? They are one of nature's most incredible evolutionary success stories. Far from being birds, these creatures are actually mammals that give birth to young ones and nurse them, making them the only mammals on the planet that have mastered the art of true flight. The thin, expansive membrane known as patagium, which stretches between their limbs to catch the air, helps them to fly. The ability to fly and also to adjust to all natural surroundings has allowed them to thrive in almost every habitat across the globe, excluding only the frozen expanse of Antarctica and a few isolated islands like the Chagos archipelago. Of the 1498 mammals known, over 22 percent of them are Bats. In India, one can come across 135 species. Kerala has about 48 species. Coming in the order Chiroptera, they are divided into two groups. The relatively large-sized ones with big eyes and fox-like faces are "Megachiroptera," primarily fruit-eaters. Smaller-bodied ones with tiny eyes, including insect-eaters and nectar-sippers are "Microchiroptera," commonly called bats. Now, based on genetic structure, they are divided into two suborders: Yinpterochiroptera and Yangochiroptera. The Yinpterochiroptera group includes fruit bats and some small bat families like Rhinolophidae and Hipposideridae. Yangochiroptera contains the remaining small bat families. This classification, based on molecular biology, provides

a more accurate understanding of bat evolution. It helps researchers track how these unique flying mammals adapted to various environments over millions of years. While we used to classify them by their appearance—grouping larger, fox-faced fruit eaters as Megachiroptera and smaller insect hunters as Microchiroptera—modern molecular biology has reshaped our understanding. By studying their genetics, scientists now divide.

One of the fascinating questions asked is about their lives dangling upside down. They live for about 30 to 40 years and their life is incredibly intriguing. Their legs are underdeveloped to support their weight to jump into flight like birds. As such they have perfected a "drop and fly" mechanism that allows them to take to the air instantly. Many doubt that the blood would rush to their heads in such a position. But for this also they have a mechanism. They have evolved to tuck their heads close to their hearts, effectively regulating their blood pressure even during the intense process of giving birth. They also possess the intelligence to recognise their kin and will often share food with a relative who has struggled to hunt during the night. They also have an imaginable control over their reproduction, holding the ability to coordinate their birthing time to ensure their young arrive when environmental conditions are most favourable. A bat normally gives birth to only one baby bat a year. Another question comes up. Do Bats stand upright? They do only during excretion. For bats, personal hygiene is also very important.

Another doubt about Bats is whether they can see. Contrary to the popular

Bats, the nocturnal allies of the wild, play a vital role in pollination alongside birds, butterflies, and bees. They are indispensable to seed dispersal in tropical rainforests, carrying life across dense canopies. Feeding on insects in quantities greater than their own body weight each night, they stand as tireless custodians of ecological balance.



myth that bats are blind, many species actually possess a level of visual clarity that can be significantly more effective than human beings. This is especially in low light. Human eyes rely on photoreceptors known as rods and cones to interpret the world. The cones are for colour and rods are for detecting the intensity of light, allowing us to see shapes in the dark. Bats are nocturnal species and as such their eyes are incredibly dense with these light-sensitive cells. While a human eye typically contains around 1,50,000 rods per square millimetre, a bat's eye is packed with anywhere from 3,00,000 to 8,00,000. This superior night vision, paired with an acute sense of smell, is the primary tool fruit-eating bats use to navigate the forest and pinpoint their food sources with remarkable precision.

Another unique feature of Bats is echolocation, a biological sonar that allows them to "see" with sound by emitting ultrasonic pulses and reading the echoes that bounce back.

This system is so precise that they can pinpoint and catch tiny insects in total darkness within seconds. However, the true miracle is their flight, a high-energy "superpower" that alters their biology. This staggering amount of energy and the high metabolic rate keeps their

immune systems distinct from other animals. As such they hold dangerous viruses in a dormant, sleeping state. This incredible internal balance allows bats to live alongside pathogens that would be fatal to most other species, marking them as some of the most resilient and misunderstood survivors in the wild.

Many of the environmental services rendered by Bats go unnoticed. In schools when learning about pollination, we

have only learned about bees and butterflies. But who are the pollinators of plants that bloom in the nights? Bats are responsible for pollinating over five hundred species of plants that only bloom after sun set, including the flowers of the Southeast Asian durian fruit. The bats support a durian industry worth over 230 million US dollars every year. Bats are also the lifeblood of tropical rainforests, where nearly 90 per cent of

the trees rely on animals to spread their seeds. Unlike most creatures that stay close to home, a single bat can cover up to 50 to 80 kilometres in a single night, scattering seeds across the landscape as they fly. This wide-reaching aerial delivery is the reason one might suddenly



find a sapling from a rare, distant forest giant sprouting in the backyard, far from its parent tree.

Don't be fooled by their small size; the work done by these insect-eating bats is immense. They devour pests that would destroy harvests and even spread illness. Studies show that a bat on any given night consume more than a quarter of its body weight in insects. But during Lactation, a Little Brown Bat that weighs 7.9 grams eats about 9.9 grams of insects, which means over 100 per cent of its weight. In Florida alone, the Southeastern Myotis Bats clears 50 tons of insects annually, including 15 tons of mosquitoes that carry threats like malaria. This biological pest control is a massive boon for farmers, saving the economy an estimated 3.7 to 53 billion US dollars by reducing the need for chemical pesticides. Understanding these benefits of bats and replacing our fear with understanding, it becomes clear that these bats are not monsters of the night, but allies whose presence maintains the delicate balance of our entire ecosystem.

Though Bats provide immense ecological as well as economic services, it is an irony that we often cast bats as villains carrying pathogens. While the arrival of the Nipah virus in Kerala is attributed to Bat, we lack clear answers when the media comes out with unscientific reports. The reality behind outbreaks in Malaysia, Bangladesh and Siliguri is clear that they are the direct consequences of man-made climate change and reckless unscientific development.

The 1998 Nipah outbreak stands as a haunting example of this ecological effect, where rampant deforestation stripped fruit bats of their homes and food, pushing them into the edges of human settlements and pig farms. Stressed and displaced, these bats dropped fruit scraps that were then consumed by

pigs, creating a bridge for a virus that eventually claimed over a hundred human lives. Our real failure lies in ignoring these scientific links; unless we stop and re-evaluate the destructive path of our own progress, we will continue to invite these zoonotic disasters into our backyards.

Kerala's unique landscape and diverse ecosystem serves as a perfect sanctuary for a wide variety of bats, with nearly fifty distinct species carving out lives across our varied terrain. Deep within the tropical evergreen canopy of the Southern Western Ghats, the rare Salim Ali's fruit bat and the Pomona leaf-nosed bat, both protected under Schedule I of the Wildlife Protection Act, are found exclusively.

More than ten species live in close proximity to us from the Indian flying fox silhouettes in the tallest trees to the short nosed fruit bat on garden fruits and the Fulvous Fruit Bat. Others include Beddome's and Rufous horseshoe bats, the Dusky leaf-nosed bat, and various tomb bats. Smaller species like the Indian Pipistrelle hide in roof tiles or tree hollows, while the Greater Asiatic yellow house bat and the Lesser false vampire bat frequent attics. The colorful Painted woolly bat is often found in dried banana leaves.



Holding such a wealth of biodiversity in a small region brings a heavy responsibility. We must abandon the unscientific impulse to solve the issues by just killing bats. Reaching for firecrackers or axes only creates a dangerous cycle of environmental stress that can trigger the very diseases we fear. True safety for our communities lies not in relocation of the millions of bats but in a commitment to coexistence and local planning that respects the millions of years of service these animals have given our shared ecosystem. ■

The author's study on Salim Ali's fruit bat of the Western Ghats earned recognition with the Conservation Leadership Programme Award in 2021, marking a significant contribution to conservation research.



# Countless Mosquitoes



**Dr. P.K. Sumodhan**

Associate Professor (Retd.), Zoology

**H**ow many mosquitoes actually exist on Earth? Nobody has truly counted them all. However, estimates suggest there are roughly 110 trillion of these buzzing insects on Earth, a number so massive it works out to about 1,350 mosquitoes for every person on the planet. Just not in numbers, they are also remarkable in their species diversity. They are split into some 3,570 species across 41 different genus or genera, but even scientists still have some lively disagreements about where those lines should be drawn.

## Mosquito Diversity in Kerala

Kerala's vibrant ecosystems aren't just home to larger wildlife; they also support a dense and often overlooked world of mosquitoes. They are members of the Culicidae family within the insect order Diptera. This family comprises of two subfamilies: Anophelinae and Culicinae. Both these subfamilies are present in Kerala. Globally, Anophelinae contains three genera while Culicinae includes thirty-eight. Interestingly, the Anophelinae group in Kerala is represented solely by the Anopheles genus, which boasts forty distinct species. Recent scientific detective work has even shown that Anopheles

subpictus has adapted into two separate forms—one thriving in freshwaters and another, Anopheles subpictus-B, claiming the brackish lagoons. The rest of

Kerala's mosquito diversity falls under the Culicinae subfamily, a bustling group led by the well-known Aedes with 33 species and Culex with 31. This group also includes dozens of others like Armigeres (7), Coquillettidia (1), Ficalbia (1), Heizmannia (5), Hodgesia (1), Lutzia (1), Malaya (1), Mansonia (4), Mimomyia (3), Orthopodomyia (2), Uranotaenia (13), Topomyia (1), Tripteroides (2), Toxorhynchites (2), and Verrallina (7). These classifications highlight the dense biological variety found within Kerala's unique environment.

## Life of Mosquito

Mosquitoes are essentially water demons. Without water, they simply cannot exist. They require water to complete their developmental journey from eggs to larvae and then to pupae. Habitat preferences differ greatly across species: Anopheles mosquitoes typically



seek clean, unpolluted water, whereas Culex and Armigeres varieties often thrive in murky, stagnant drains. Others like Aedes, seek small containers or tree hollows, while Mansonia mosquitoes inhabit areas with dense aquatic vegetation. Unlike others, their larvae cannot breathe atmospheric air directly; instead, they tap into air sacs within the roots of these plants. While most of the mosquitoes thrive in freshwater, a few adapt to brackish conditions. None inhabit the open sea. A female typically lays two hundred eggs at a time. In tropical regions like Kerala, this occurs every other day, with the aquatic cycle lasting about a week. Interestingly, only females suck blood to gain proteins for egg production. Males are vegetarians. Females live a month, mating just once and storing sperm for life.

### Feeding Patterns

Mosquitoes don't just target humans; they also feed on animals. Different species prefer for specific types of blood. While most rely on warm-blooded mammals and birds, some uniquely hunt amphibians, reptiles or even certain fish. How do they exactly locate a potential prey? They utilize several sensory organs to detect various biological cues. By analyzing colors, scents, body heat and exhaled carbon dioxide, they pinpoint their targets.

### The Song and Dance

Have you ever spotted a group of mosquitoes moving up and down in one place in the evenings? This is a special dance where males use chemicals to attract females. How can one identify males? If you want to tell which ones are males, just look at their antennae. They are far hairier than those of the females. Usually, these male dances

happen right above a particular object.

These mosquito swarms frequently gather over tree stumps, mounds of earth, or even people's heads. At the same time, some females might huddle near animals to feed. This behaviour is known as swarming and the group itself is called a swarm. Not all mosquito species perform this dance. This behavior is mainly done by those that mate while flying. Females fly into these male crowds to find a partner. Scientists believe that

the females find these groups by using visual clues and by smelling pheromones (special chemicals) that the males release. While they dance, both the males and the females joining in are essentially singing to one another.

Mosquitoes don't sing with their mouths. The buzzing sound we hear comes from vibrations during flight, and the frequency changes depending on the species. To listen, they use special sensors called Johnston's organs in their antennae. Surprisingly, males have much better hearing than females. Moreover, males and females have different frequency. Males are usually higher-pitched. During mating, the male drops his pitch while the female raises hers until they create

a harmonic duet. This musical match-up ensures they have found a partner from the correct species. Once they have paired up, they fly away from the swarm together. However, not every mosquito is a singer. Some species cannot hear sound and use chemical scents to find a mate instead. Others simply do not mate mid-flight, so they never join in these swarming dances at all.

### Non-Blood-Sucking Mosquitoes

There are a few mosquito species that never drink blood. While we usually



Mosquitoes are creatures of water-  
without it, they cannot exist. Their entire early life unfolds in its depths: eggs laid on still surfaces, hatching into wriggling larvae, and transforming into pupae before rising into the air.



think of these insects as pests, certain species like the Elephant Mosquito (*Toxorhynchites*) and the Malaya genus—both of which are found in Kerala — don't bite humans or animals at all.

As their name suggests, Elephant mosquitoes are much larger than their cousins, but they are actually herbivores that stick to a plant-based diet. The Malaya mosquito has a much sneakier way of getting a meal; it steals food that has already been digested directly from the mouths of ants. So one might wonder how the elephant mosquitoes produce eggs without the proteins usually found in blood. As larvae, these species are predatory carnivores that hunt and eat other mosquito larvae. This allows them to store all the protein they need to lay eggs later in life, making a blood meal completely unnecessary.

## Mosquitoes and Diseases

Throughout history, mosquitoes have been incredibly dangerous, with estimates suggesting they have caused the deaths of 52 billion people—nearly half of every human throughout history. This tragic list includes legendary figures from all walks of life, such as Alexander the Great, Mother Teresa, and Vasco da Gama. Even today, they remain the deadliest killers on Earth, causing approximately one million deaths every year according to the World Health Organisation. While there are over 3,500 species of mosquito, only a small number are known to carry the 300 viruses and various other germs that make people sick. These insects are linked to 78 distinct diseases; for example, the *Anopheles* mosquito spreads malaria, while the *Aedes* variety carries dengue and Zika and the *Culex* mosquito transmits the West Nile virus. ■

▼ Photo: Dr. P.K. Sumodan



Anopheles mosquito



Aedes mosquito



Culex mosquito



Toxorhynchites mosquito



# Earthworm Farmers' friend



**S. Prashanth Narayanan**  
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**E**arthworms are some of the most common and important creatures living in our soil today. They are actually one of the oldest animal groups still surviving on the planet. An earthworm's body is shaped like a simple tube, with its digestive system tucked inside a shell of ring-like muscles. Interestingly, they do not have a distinct head, mouth or eyes. Throughout history, people in ancient civilisations have studied these creatures closely. In India, it is said that

Prince Siddhartha began his spiritual journey after watching a bird eat an earthworm near a plough. Some groups, like the Santal tribes, even have legends about a "King of Earthworms" who created the land we live on by building it upon the back of a giant turtle.

Known as "farmer's friend," earthworms are familiar to everyone in Kerala. They live in the soil wherever they can find enough food, water, and the right temperature. This



is why they show up everywhere in the countryside, backyards, gardens, kitchen drains, compost pits, farms, meadows and forests. While most earthworms stay underground, some prefer living in very wet places, and a few rare species have even adapted to live up in trees. Earthworms are incredibly important for the environment as they improve soil fertility and help build healthy landscapes, earning them the nickname "ecosystem engineers" and also considered as ecological indicators. Today, their global importance is growing because of their role in organic waste management, animal feed and even in medicines. In fact, some indigenous tribes even consider them a good source of food.

Generally earthworms are not that large. Most of the earthworms we see are only five to ten centimetres long. However, they exist globally from tiny one-centimetre worms to giants that stretch over a metre long. In our own region, species like *Drawida nilamburensis* and *Drawida grandis* are famous for reaching these massive sizes. It is reasonable to assume these larger varieties take considerable time to grow, though natural lifespan data remains scarce. Some "giant" species need several years just to reach adulthood and only reproduce every two or three years. On the other hand, smaller worms that live on the surface of the soil often have much shorter lives. Some only survive for a single season, spending the harshest times safe inside protective cocoons, while most live for about one to two years. However, some earthworms can be surprisingly long-lived. The *Criodrilus*



Earthworms are among the planet's most ancient and influential beings—true ecosystem engineers that shape soil structure, enrich fertility, and sustain its living health. Emerging quietly from cocoons, they embody nature's renewal, symbols of regeneration and the soil's endless rebirth.

*laccum*, a species from Europe, can live for decades; one was reported to have lived forty-four years in an Estonian aquarium.

In 1972, a French scientist named Bouché studied in depth earthworms' colour, size, habitat, diet and life cycles, and divided them into three unique groups based on their lifestyles -- epigeic, endogeic, and anecic.. The epigeic group consists of small, colourful species that live on the surface and eat rotting leaves, making them perfect for composting. They have high reproductive rates but shorter lifespans. The endogeic group includes pale, medium-sized worms that live in horizontal burrows and consume soil, extracting energy from associated microorganisms. Lastly, the anecic group are the "giants" that live in deep, vertical burrows and only come out at night. These giant worms slow reproduction and are the most at risk of dying out if forests are cut down.

While most earthworms follow a standard diet, five species from the West African genus *Agastodrilus* break all the rules. They hunt and eat other earthworms for food.

They are recognized as the only carnivorous species of earthworms.

As ancient creatures, earthworms are quite unique as they don't have separate male or female sexes. Instead, both reproductive organs exist within a single individual, a condition known as hermaphroditism. Even so, two earthworms usually come together to exchange sperm.

The eggs are then deposited into the clitellum, which is the thick, fleshy band that can be seen near the worm's front. This



clitellum provides them with protection and nutrients. Eventually, it slides off the worm's head and hardens into a protective case called cocoon. These cocoons come in many shapes, from tiny balls to structures that look like dried shrimp, and they are incredibly tough, often surviving in the soil for several years. While most earthworms mate in pairs, some species are able to produce offspring all by themselves through a process known as parthenogenesis.

The scientific study of earthworms began in 1758 with Swedish taxonomist Linnaeus. According to a 2023 paper by Misirlioğlu and colleagues, there are currently 5,738 documented species or subspecies worldwide. However, experts believe this is less than 20% of all the earthworms actually on Earth. In the first half of the nineteenth century (1844), a British man named Templeton scientifically identified and named a South Asian species from Sri Lanka and French taxonomist E. Perrier described the first Indian earthworm in 1872. The early 20th century is considered the golden age of Indian earthworm history, as approximately 255 species were discovered—accounting for over half of India's currently known diversity.. Researchers including Bourne, Beddard, Michaelsen, Stephenson, Rao, Padmanabha Aiyer and Gates conducted extensive studies, discovering and describing numerous species across India. Although Indian earthworm taxonomy slowed post-independence, it was brought back to life in the 1970s by Dr. J.M. Julka of the Zoological Survey of India. It is in Northeast mountains and the Western Ghats that one can come across the most variety of earthworms in India.

Taxonomic studies of Kerala's earthworms began in the late nineteenth century. It started with the discovery of *Drawida nilamburensis*. Found in 1894 by a British researcher named Bourne along the banks of the Chaliyar River, this is India's longest earthworm, reaching an average length of one metre. Subsequently, scientists like Michaelsen, Stephenson, and Padmanabha Aiyer discovered numerous

species across Kerala. After independence, continued research became quite rare. Recently, taxonomic studies on Kerala's earthworms have been revitalized at Mahatma Gandhi University. In the last ten years alone, they have discovered one new genus and twelve new species in Kerala, as well as twenty-two other types of worms that had never been recorded in the state before. This ongoing work is a huge step forward in helping us understand the incredible variety of life living right beneath our feet.

India is home to 482 earthworm species across nine families. Even though Kerala is a small state, the state is home to 133 species, ranking second in the entire country for its variety of earth worms. This rich biodiversity is highly influenced because of the state's tropical climate, heavy rainfall, and its prime location within the Western Ghats. The most prominent families in Kerala are Megascolecidae and Moniligastridae. The *Drawida* genus that belongs to the later family, contains the largest number of species in the state. Other notable local genera include *Megascolex*, *Moniligaster*, and *Notoscolex*. However, four families found in Kerala -- Lumbricidae, Rhinodrilidae, Eudrilidae, and Benhamiidae -- are not natives. They actually arrived here thousands of years ago through ancient global trade. One well-known "immigrant" is *Pontoscolex corethrurus*, which originally came from South America but can now be found everywhere in Kerala, from the coastal beaches to the high mountain forests. In total, there are about twenty different foreign species in Kerala.

More research is essential to know how these species impact the world around them. Recent studies show that most of Kerala's earthworms live in forests, as the trees and woodland provide the perfect home for them to grow. Interestingly, several new species were lately discovered even in areas outside the protected forest areas. Ultimately, earthworms that help for the survival of soil and life on Earth, are an indicator of a healthy environment. ■





The presence of the Western Ghats and its rich mosaic of habitats has made Kerala one of the country's foremost centres of earthworm diversity. From giant natives like *Drawida nilamburensis* to introduced species such as *Pontoscolex corethrurus*, over 133 species have been recorded here. Across forests, grasslands, and fields, earthworms stand as quiet bioindicators—measuring the health of the soil, and in turn, the pulse of the land itself.

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*Drawida grandis* Earth worm



*Drawida nilamburensis* Earthworm



*Drawida* sp Earthworm



*Megascolex ratus* Earthworm

▼ Photo: S. Prasanth Narayan





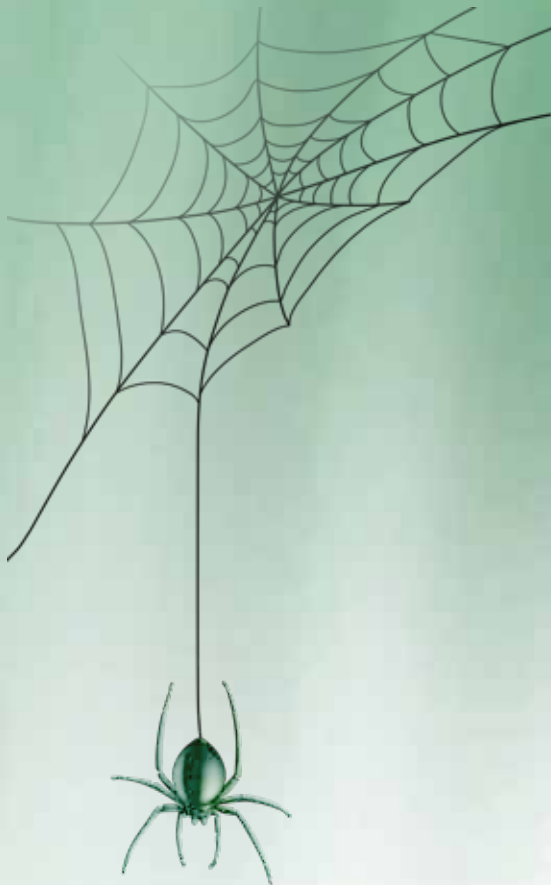
Among Indian states, Kerala ranks second in earthworm diversity. Its tropical climate, abundant rainfall, the presence of the Western Ghats, and a mosaic of varied habitats together nurture this remarkable richness beneath the soil.

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# Q&A

1. Which social insects, often called "white ants," are evolutionarily most closely related to cockroaches?
2. What is the primary purpose of the firefly's light?
3. What are baby spiders called in English?
4. Where was the world's largest spider web discovered?
5. *Ajareta sairandriensis*, a type of cicada, was recently discovered in which National Park in Kerala?
6. Which creature, scientifically named *Leiurus quinquestriatus*, is popularly known as the Deathstalker?
7. Which biological component is a spider web made of?
8. Which are the only mammals capable of true flight?
9. Name the Malayali scientist who discovered how male and female mosquitoes choose mates based on wingbeat frequency.
10. To which category does the "Red Wiggler," a key organism used in organic waste composting, belong?



**Reni R. Pillai**

Dy. Director, Wildlife Education



ഉത്തരങ്ങൾ: 50-ാം പേജിൽ



## School Forestry Club

# Write & Win

In an effort to foster a greater sense of responsibility and awareness, and encouraging young voices to engage with conservation and wildlife protection, articles are invited.

**The best submissions  
will be rewarded.**

Topic of the Month:

## The world of insects

Article should be sent to:

Director  
Forestry Information Bureau  
Vazhuthakkad, Thycaud P.O.  
Thiruvananthapuram. PIN 695014  
Email: forestmediacell@gmail.com

1. Termites
2. To attract mates or deter predators)
3. Spiderlings
4. Sulfur Cave located on the border of Albania.  
It stretches to about 1140 sq. feet and more than 1,11,000 spiders
5. Silent Valley National Park (A bark cricket, noted for its flattened body; once again breaks the false notion that the Park is devoid of crickets and cicadas)
6. Scorpion
7. Protein (Spider web protein, called spidroin, is a type of fibroin, a strong fibrous protein)
8. Dr Rajan Pikanadi (Researcher at Peechi Forest Research Institute)
9. Dr. Noushad Ali (based on recent research archives)
10. Earthworm (Eisenia fetida; Also known as manure worm, redworm, brandling worm, panfish worm, trout worm, tiger worm)



# പാമ്പിനെ ഭയക്കണ്ടതില്ല രക്ഷയ്ക്ക് ഇനി സർപ്പ ആപ്പ്

കണ്ടെത്തിയ പാമ്പിന്റെ ഫോട്ടോ സർപ്പ മൊബൈൽ ആപ്പിൽ അപ് ലോഡ് ചെയ്താൽ പലിശീലനം നേടിയ സന്നദ്ധപ്രവർത്തകർ ഞൊടിയിടയിൽ സ്ഥലത്തെത്തി പാമ്പിനെ പിടികൂടി സുരക്ഷിതമായി നീക്കംചെയ്യും. പ്ലേ സ്റ്റോറിൽ നിന്നും ഡൗൺലോഡ് ചെയ്ത് ഉപയോഗിക്കാം. കേരള വനംവകുപ്പ് ആവിഷ്കരിച്ച് നടപ്പിലാക്കുന്ന സർപ്പ ആപ്പിന്റെ മുഴുവൻ സേവനങ്ങളും തികച്ചും സൗജന്യമാണ്. വനംവകുപ്പ് സർട്ടിഫിക്കേഷൻ നൽകിയ അംഗീകൃത റെസ്ക്യൂവർമാർ എല്ലാവരും സർപ്പയിൽ രജിസ്റ്റർ ചെയ്തിട്ടുണ്ട്. പാമ്പുകളെ സംബന്ധിച്ച സംശയനിവാരണത്തിനും സർപ്പ ആപ്പ് ഉപയോഗപ്പെടുത്താവുന്നതാണ്.

## ആപ്പിന്റെ ആവശ്യകത

പാമ്പുകളും മനുഷ്യനുമായുള്ള സംഘർഷത്തിന് ചരിത്രത്തോളം പഴക്കമുണ്ട്. എല്ലാതരം ആവാസ വ്യവസ്ഥകളിലും പാമ്പുകളെ കാണപ്പെടാറുണ്ട്. എന്നാൽ കേരളത്തിൽ കാണപ്പെടുന്ന പാമ്പുകളിൽ ബഹുഭൂരിപക്ഷവും വിഷമില്ലാത്ത ഇനങ്ങളാണ്. പക്ഷെ ഭയംമൂലം മനുഷ്യൻ അശാസ്ത്രീയ മാർഗങ്ങളിലൂടെ പാമ്പിനെ പിടികൂടുന്നത് അതിന്റെ നില നിൽപ്പിന് ഭീഷണിയായി തീരുന്നുണ്ട്. ആവാസ വ്യവസ്ഥയിലെ മുഖ്യകണ്ഠിയായ പാമ്പുകളുടെ സംരക്ഷണവും വനംവകുപ്പിന്റെ ഉത്തരവാദിത്വമാണ്.

- ഒരു പാമ്പിനെ അപകടകരമായ തീരയിൽ കണ്ടെത്തിയാൽ പാമ്പിന്റെയോ കണ്ടെത്തിയ സ്ഥലത്തിന്റെയോ ഫോട്ടോ എടുത്ത് ആപ്പിൽ അപ് ലോഡ് ചെയ്യുക.
- സന്ദേശ സ്ഥലത്തിന്റെ ലൊക്കേഷൻ ജി പി എസ് മുഖേന കണ്ടെത്തി റെസ്ക്യൂവർമാർ സ്ഥലത്തെത്തും.
- വനംവകുപ്പ് പരിശീലനം നൽകിയ അംഗീകൃത റെസ്ക്യൂവർമാരുടെ മേൽവിലാസവും മൊബൈൽ നമ്പറും സർപ്പയിൽ ലഭ്യമാണ്.
- ജനവാസ മേഖലയിൽ കാണപ്പെടുന്ന പാമ്പുകളെ സംബന്ധിക്കുന്ന എല്ലാ വിവരങ്ങളും സർപ്പയിൽ ലഭ്യമാണ്.
- പാമ്പുകളെ പിടികൂടിയത് മുതൽ എല്ലാ വിവരങ്ങളും ആപ്പിൽ ലഭിക്കും.
- പാമ്പിന്റെ വിഷത്തിന് ചികിത്സ ലഭിക്കുന്ന ആശുപത്രികളെ സംബന്ധിച്ച പൂർണ്ണ വിവരങ്ങളും ആപ്പിൽ ലഭിക്കും.



കേരള വനം വകുപ്പ്



# പാമ്പിനെ ഭയക്കണ്ടതില്ല രക്ഷയ്ക്ക് ഇനി സർപ്പ ആപ്പ്

-  പാമ്പുകടിയേറ്റാൽ സമീപത്ത് ആന്റിവൈനം ലഭ്യമായിട്ടുള്ള ആശുപത്രികൾ
-  പാമ്പിനെ അപകടകരമായി കണ്ടാലോ, അനുബന്ധ സേവനങ്ങൾക്കോ സർപ്പ ബോളന്റിയനെ വിളിക്കുക
-  അംഗീകൃത പരിശീലനം ലഭിച്ചിട്ടുള്ള ബോളന്റിയർമാരുടെ ലിസ്റ്റ്



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