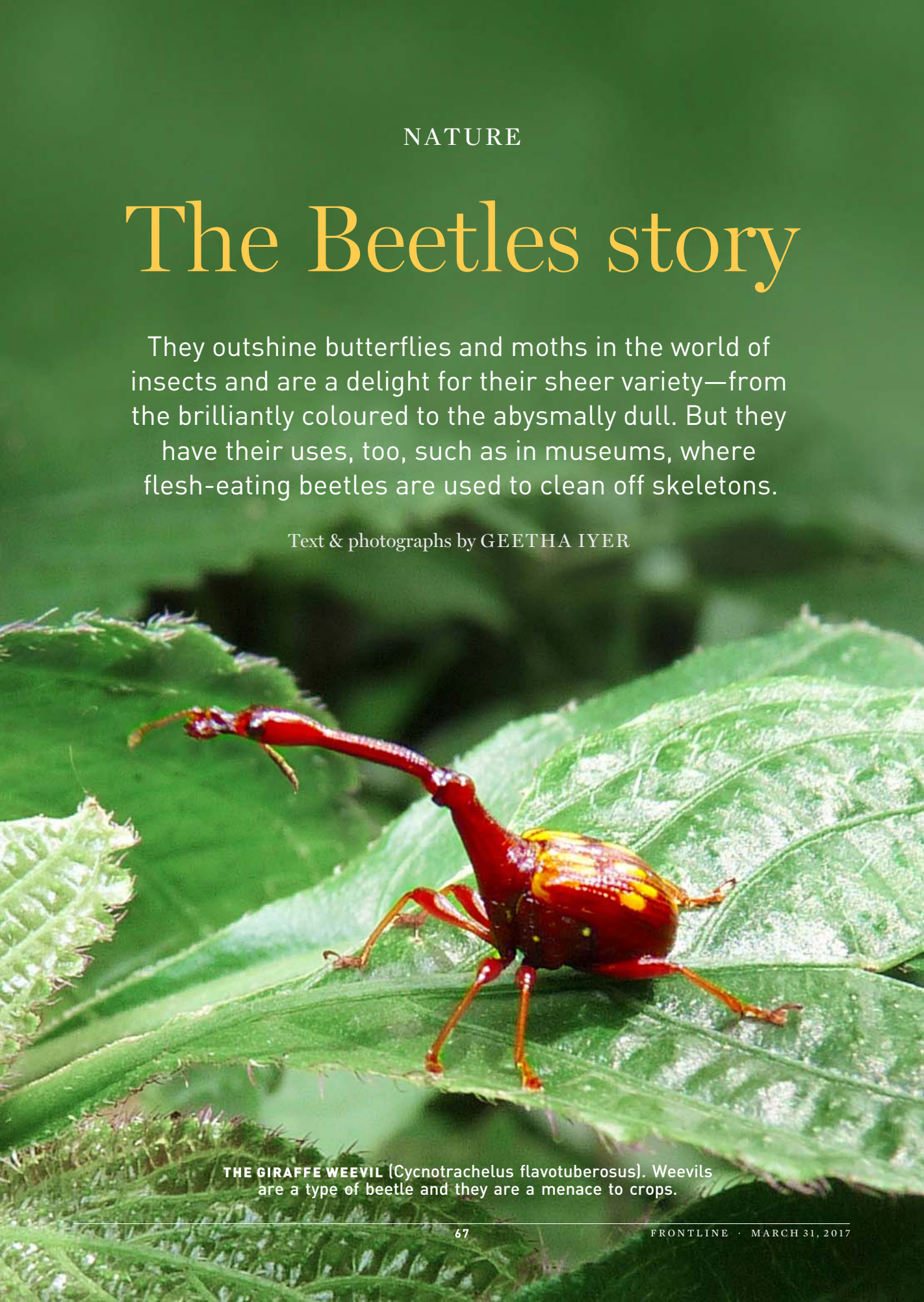
NATURE

The Beetles story

They outshine butterflies and moths in the world of insects and are a delight for their sheer variety—from the brilliantly coloured to the abysmally dull. But they have their uses, too, such as in museums, where flesh-eating beetles are used to clean off skeletons.

Text & photographs by GEETHA IYER



THE GIRAFFE WEEVIL (Cycnotrachelus flavotuberosus). Weevils are a type of beetle and they are a menace to crops.

HOW was this watery planet we so much love born? Was it created by God or born off the Big Bang? While arguments swing between science and religion, several ancient cultures had different and interesting perspectives on how the earth came to be. Their ideas about this planet stemmed from their observations of nature. People living in close proximity to nature develop a certain sensitivity towards living creatures. They have to protect themselves from many of these creatures and at the same time conserve the very environment that nurtures them. So there is constant observation and interaction with nature's denizens, especially insects, the most proliferate among all animal groups that stalk every step of their lives. The logic for creation thus revolves around different types of insects, especially the most abundant amongst them: beetles. Beetles though much detested by modern urban citizens are perceived quite differently by indigenous cultures.

The biologist J.B.S. Haldane's famous quip about the creator's "inordinate fondness for beetles", to questions posed by theologians on creation, speaks volumes about how these insects are perceived. Beetles are extremely diverse animals capable of living in a wide variety of environments. Not all of them are bad or to be detested. Would several indigenous cultures have accepted them as gods if they did not provide valuable services to the earth and to several species, including humans?

Many Native American cultures believed that beetles created the earth. The highly religious and spiritual Cherokees saw the earth as a floating island surrounded by seawater. They believed that the water beetle was responsible for building this island. This is how the story goes. A little water beetle called Dayuni'si came flying down from the sky and started exploring the water. It then found that there was no place to sit and rest. So it dug up the mud from below the water and brought it to the surface. Soon curious birds and animals from the sky came to explore the earth built by this beetle.

WATER BEETLE. The Cherokees believed that this beetle created the earth. (Right) Mehearchus dispar of the family Tenebrionidae. The Eleodes beetle of Mexico belongs to this family.

NET-WINGED BEETLE. Forty per cent of all animal life on the earth is beetles and weevils.


TIGER BEETLES, Cicindela catena and Cicindela (Cosmodela) cf. aurulenta.


STAG BEETLES, family Lucanidae and Odontolabis sp.


CHAFER, Dicronocephalus wallichii, and (right) a male rhinocerous beetle, Xylotrupes gideon. It hisses when disturbed but is harmless.

A BEETLE with its elytra, or forewings, open, exposing its inner membranous wings that are used for flying.

The Cochiti, a Native American Pueblo tribe of New Mexico, attributed the creation of the Milky Way to beetles. According to this myth, a tip beetle called *Eleodes* was given a bag of stars to be transported to the sky. These were to be carefully placed at select locations. But the careless beetle dropped the stars en route, which scattered to form the Milky Way. The *Eleodes* beetle has a tendency to stand on its head when disturbed. This, the tribes describe, is the result of the punishment it received for dropping the stars. It was cursed to become blind and so hides its head in shame. While *Eleodes* is a Mexican insect, several beetles belonging to the same family, namely Tenebrionidae, are found in India.

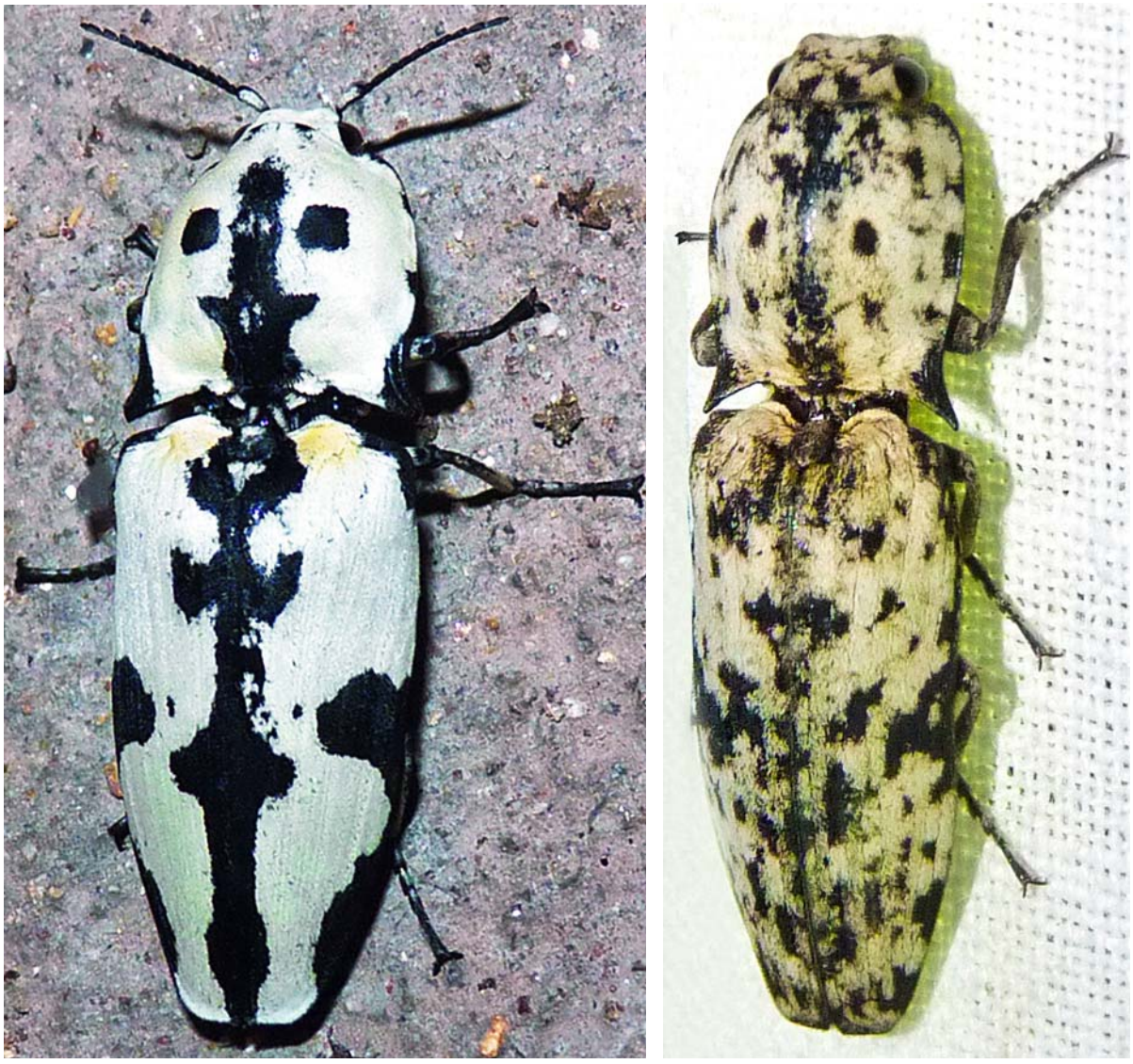
DIVERSITY

Insects are the single largest group of animals on the planet; 40 per cent of all animal life on the earth is beetles and weevils. One in every four named animal species is a beetle. According to the Australian entomologist Adam Dodd, the ratio of humans to beetles is approximately 1:300 million. Naturally, they are easily spotted, noticed for some of their unique behavioural traits and are not easily understood. No wonder then that beetles figure prominently in people's beliefs. They also happen to be a collector's favourite, easily outshining butterflies and moths. So sought after are some of them that there are several beetle species in India protected under the Wildlife Protection Act of 1972. There is much that can be written about them and still more to be learnt as new species get discovered.

BEETLE WINGS

The word "beetle" is derived from the ancient English word "bitula", which is a derivative of the word "bitan" that means to bite. However, very few

SCARABS were revered by various cultures, especially the ancient Egyptians. Some Indian scarabs (from left) Mimela sp., castor seed beetle (Anatona cf. stillata), and Melolontha sp.



CLICK BEETLES are generally nocturnal and are plant feeders. Here, two of the Cryptalaus species.

THE COLOURS OF JEWEL BEETLES (above and right, Chrysochroa sp.) are produced because of the phenomenon of interference of light when it falls on their elytra.

beetles bite humans. Beetles belong to the order Coleoptera, which means “sheath-winged”. The elytra, or forewings of beetles, are hard and not used for flight but for protection. Among other features, the iridescent elytra, which are present in different colours, forms and patterns, make beetles a priceless item for collectors. The hardness is due to the deposition of sclerotin in addition to cuticle on the wings. They are rarely of any use in flight, serving to protect the inner membranous wings that are used for flying.

This wing structure and a suite of other features have helped Coleopterans become the most successful group in the animal world. You will see them everywhere: infesting your food; living off the faeces of all living organisms, including humans; chewing wood or other insects, including carrion; and living in caves, bark galleries, freezing conditions, deserts and in water. While some beetles are spotted easily, several thousand others lead their lives without ever being seen. The diversity of their form and structure is fascinating and varies from brilliantly coloured to abysmally dull. There are big beetles with long arching antennae, while others are small and remain hidden. They love rice, wheat flour, pulses and nuts. Who would have thought that humans and beetles shared similar food tastes!

In most fields of human endeavour, beetles are in step with, if not ahead of, us. Their unique and fascinating lifestyles have permitted them to occupy every niche and corner of the world. While plenty is known about scarabs and the way various cultures, especially the ancient Egyptians, revered them, there are other lesser talked about but equally fascinating beetles. A select few are discussed below.

CLICK BEETLES

Click beetles come in different sizes, are generally nocturnal and feed on plants. Their larvae are called wireworms, which may be saprophytes, parasites or predators. Click beetles will lie on their backs appearing to be dead. Many insects use this deceptive

YESHWANTH H. M.

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Beetles with iridescent elytra

JEWEL, or metallic wood-boring, beetle (Catoxantha opulenta).

SCARAB, Popillia cupricollis.

SCARAB, Mimela sp.

SCARAB, Anomala sp.

SCARAB, Anomala sp.

SCARAB, Anomala sp.

SCARAB, Popilllia cyanea.

LIGHT falling on the chitinous layers of a beetle's elytra produces shining colours, which are called structural colours, and they do not fade. This is a concept carmakers are studying for use in car paint. (Top to bottom) Popillia sp., Trignophorous sp. and a leaf chafer (Rutelinae family).

AUSTRALIAN JEWEL BEETLE
(Julodimorpha bakewelli) trying to copulate with a beer bottle. Researchers found that beetle numbers were declining because the male beetles were dying while trying to mate with the bottles, which they mistook for the female of the species. Australian beer companies solved the problem by changing the design and colour of the bottles.

STAG BEETLES, Prosopocoilus cf. occipitalis and (below) Hexarthrius sp.

A BEETLE (family Meloidae) showing reflex bleeding from a joint, that is, it produces the poisonous substance cantharidin. This is a defence mechanism in many beetles.

COURTESY: DARRYL GWYNNE

practice. But click beetles have taken this up a few notches. Just when you think that you are not going to be fooled by this deceit, they surprise you by jumping high up in the air with a click sound. Before you can say whatzzat, they will have somersaulted in the air to land on their legs and scampered away. The science behind their acrobatic jump has fascinated researchers.

The Egyptians were as charmed with the click beetle as they were with the scarab. They were impressed by its agility and energy. Protective amulets and golden boxes shaped like the click beetle were famous in ancient Egypt. Among the many goddesses Egyptians worshipped was Neith, the patron deity of the city of Sais (which the ancient Egyptians called Zau), who was variously believed to be the goddess of creation, war, weaving and wisdom and predominantly the one who guarded warriors and their weapons. The cult of Neith is so ancient that it is forgotten that the symbol displayed on her head is that of two click beetles on arrows and not shields and arrows. There is a temple in Sais known as Perbit, which means house of the bees. A variety of creatures are associated with Neith, the most ancient of them being click beetles.

Click beetles can entertain in more ways than one. They come in attractive colours and patterns. There is a light-emitting bioluminescent click beetle, which has two spots at the base of its thorax that glow as the insect flies at night. Males, females, larvae and in some species even the pupa emit light. Found distributed from Mexico to Brazil to the islands of the West Indies, these click beetles are called headlight beetles by local people. There are some amusing tales about how local people used them.

The bluish-green light the headlight beetle emits is intense and bright. In his book *The History of West Indies*, Peter Martyr describes how islanders tied a *cucuji* (the Spanish word for beetle) to each of their toes at night as it gave them more light than a candle. The German naturalist and explorer Alexan-

POLLINATOR BEETLES in an arum plant.

LEAF-CHEWING BEETLE.

DEFOLIATOR BEETLE, Calopepla leayana.

THE BEETLES of the family Chrysomeloidae (leaf beetles) also have iridescent elytra. Here, leaf beetles of the Merista species.

der von Humboldt reported that a perforated gourd with a dozen or more click beetles inside comfortably served as a reading light, nature's torchlight! Some islanders would smear a paste made from the beetle's light organs on their faces to make them glow like a ghost, a prank to scare others at night. Not just simple folk but even people like Sir Thomas Cavendish on his voyage to the West Indies hesitated to step ashore because he mistook the beetle's light for Spanish soldiers. Glowing termite hills have been reported in Brazil as the larvae and pupae developed within these mounds.

JEWEL BEETLES

The shiny, beautiful jewel beetles are also known as metallic wood-boring beetles. They range in length from a few millimetres to a few centimetres. As their name suggests, they are not the beetles that plant life would like to host for they bore through roots, eat leaves and generally leave plants in distress. But for humans, these beetles are collectors' cherished possessions. Although fairly well known, I include them here because most brightly shining beetles are passed off as jewel beetles. Many other families of beetles have iridescent elytra, especially those belonging to the superfamily Chrysomeloidea and Scaraboidea.

Jewel beetles belong to the family Buprestidae and have a body form different from scarabs and leaf beetles. The colours are produced because of what happens to light—a phenomenon described as interference—when it falls on their elytra. Insect "skin" is made of chitin. There are several layers of chitinous molecules on the elytra, and their arrangement determines what dazzling colour is displayed. When light rays fall on these chitinous layers, they produce bright shining colours. Physicists describe this as structural colour since it is the structure or arrangement of the layers of chitin, and not pigments, that is responsible for the iridescence. The structural arrangement of beetle wings has caught the eye of optical engineers. Carmakers are thinking of using iridescent paints, while currency designers are toying with the idea of shiny seals. Engineers are belatedly catching on to the simple fact that structural colours do not fade. From the headhunters of the Amazon basin to the artisans of the Mughal Empire in India, people used jewel beetle wings on textiles and for adornment because they

INSECTS are capable of adapting to changing habitats as their survival for millions of years has shown. Here, some leaf beetles.

knew these colours never faded. Moreover, the shiny wings can be cut, drilled and strung together to make a necklace or stitched on to textiles. Pom-poms and assorted hair decorations from Rajasthan continue to be made using beetle wings. A miniature temple shrine called Tamamushi Shrine within the Horyu-ji Temple complex in Nara, Japan, was once decorated with the iridescent wings of the jewel beetle the Japanese called Tamamushi.

Two researchers, Darryl Gwynne and David Rentz, won an Ig Nobel prize in 2011 for noticing and exploring, in 1981, the unique behaviour of the male jewel beetle *Julodimorpha bakewelli*. Working in Western Australia where these beetles are common, they noticed a jewel beetle trying to mate with a beer bottle (stubby). They found as many as six beetles on a single stubby with their aedegus (equivalent of penis) extended as they tried to copulate with the bottle. The beetles were not deterred from this exercise even when attacked by ants, which ate away part of their penis. The entomologist Gwynne observed that they suffered the ants and scorching heat of the desert sun and would not get off the beer bottles until the end, when they died either from the bites or the heat. The beetles were not attracted to the wine bottles the researchers provided them with or, it seemed, to the many females waiting nearby. The researchers concluded that the colour of the bottle and the rows of tubercles that reflected light made the male beetles mistake them for females of their species. I shared this story for a special reason. Australian beer companies took note of the research and the concern expressed about the declining numbers of the beetles and changed the bottle's design and colour and looked into the way the bottles were disposed of. The actions taken saved the beetle population.

Beetles are too diverse for their stories to be told in a few thousand words. There are tiger beetles, stag beetles, cantharidin-producing beetles and whirlgig beetles; there are divers, jumpers, skaters, swimmers, biters, suckers, squirters, pollinators, predators, chewers, diggers, tunnellers, miners, builders and then there are those with magnificent forms sporting horns, spikes, clubs and fascinating armour.

Some species of dung beetle, which perform the important role in nature of helping us deal with animal dung, may be on the decline. Two

STUDIES INDICATE that the diversity of dung beetles is on the decline in India and in Europe. The dung beetles (from left) Paragymnopleurus sp., Copris magicus, and Heliocopris dominus (elephant dung beetle).

DEAD PRAWNS cleaned up in 30 minutes by scavenging scarab beetles in a forest in Arunachal Pradesh. The site at 7:30 p.m. (above) and at 9 p.m. (right).

studies, one in northern India and another on the Malabar coast, indicate that the diversity of dung beetles is on the decline. Europe, too, is facing a similar situation. Will we awaken to the issue only when the animal is on the verge of extinction, as we did with vultures, or will we act now? Insects are capable of adapting to changing habitats as their survival for millions of years has shown. But can they adapt to the enormous and furious pace of habitat destruction? Only time will tell. Can we take actions like the Australian beer companies did? The elephant is an

WHITE BEETLE.

PALM WEEVIL, Rhynchophorus ferrugineus.

endangered animal battling poaching, habitat fragmentation and destruction. Will elephant dung beetles meet the fate of the dodo as elephant populations decrease? Is anyone listening? Or will this thought of caring for an insect be dismissed as just a whim of a few nature lovers?

Back to the colours of beetles, here is an interesting thought for curious minds. The structural colours of the jewel beetle should not make us think that there can be no white beetle. But how does a beetle manage to be white if scattering and interference of light are taking place on its chitinous body and wings? That is an interesting story that will have to wait for another day to be told.

Finally, an ultra quick foray into the beetle's world to reveal a few quirks. Beetle watching can be a hobby.

NECROPHAGUS BEETLES

We were a group surveying Lepidoptera (butterflies and moths) inside a forest in Arunachal Pradesh. We were carrying a few dead crabs, fish and prawns to attract butterflies. By the end of the day, they were beginning to smell so strong that we simply left them at the base of a tree near our guest house. The significance of the presence of beetles there did not register in our tired minds. By the time it did, about half an hour later, it was all over and done with. For flesh-eating beetles, 30 minutes is a long, long time. We found that they had cleaned all the flesh off the sea creatures. There are places that welcome this beetle with open arms. Forensic science for one welcomes their presence. At the Museum of Vertebrate Zoology, University of California, Berkeley, curators use these beetles to clean the flesh off the mammalian skeletons they have to preserve, thereby reducing the use of chemicals.

SCULPTED BEETLES

Ask a farmer what his biggest headache is and the answer will promptly be "the weevil" for weevils are among the most proliferous pests of crops. The word "weevil" has its origin in the Germanic word *webila*, which means to move back and forth or to swarm. Weevils are a type of beetle whose elytra are so finely designed that a sculptor who sees them would

A WEEVIL pest on an okra (ladies' finger) plant.

LEAF-ROLLING WEEVIL, family Attelabidae.

WEEVILS. Their elytra are so finely designed that any sculptor who sees them would likely break into a dervish whirl.

likely break into a dervish swirl. While modern-day farmers deal with weevils using chemical sprays or by opting for genetically modified plants, there are some interesting anecdotes in history about how early European farmers handled them. There are many recorded examples from the ninth to the 19th century of Europeans prosecuting insects, ranging from locusts and flies to beetles such as the Spanish fly, the cockchafer and the weevil, in a court of law. For a good laugh, read about the absurd trials of insects in E.P. Evans' book *The Criminal Prosecution and Capital Punishment of Animals*.

WEEVILS' TRIAL

These absurd trials took place in ecclesiastical (religious) courts. One such trial in the 16th century took place after a devastating attack of a particular species of weevil in a small town, St. Julien, in France. The first complaint was made by grape growers. But after discussions, the official in charge declared that it was, in Evans' words, "unbecoming to proceed with rashness and precipitance against the animals now actually accused and indicted; on the contrary, it would be more fitting for us to have recourse to the mercy of heaven…". Public prayers were ordered to neutralise the sins of weevils and drive them away. To the relief of the grape growers, the weevils disappeared, at least, temporarily.

For the weevils returned as if with a vengeance 30 years later, and this time there was no escape for them and they had to stand trial. The comic process started with the appointment of Antoine Filliol as a lawyer to defend the weevils. He seemed to have done a good job. His argument was simple. His clients were present on the earth because God wanted them here. God would never keep them without providing food for sustenance. It was most unfortunate that their food was something that humans too wanted. The prosecution argued that weevils may have evolved before man, but they were his subordinates, hence, could not destroy his crops. This case went on for so long that the people of St. Julien decided to forge an out-of-court settlement. They officially declared a piece of land as weevil territory where the insects could live freely but also declared that humans or their cattle would be allowed to access it for their use. The weevils' lawyer refused to accept the compromise as he felt that the land was barren and that weevils would not be able to sustain themselves. The prosecutor rubbished the argument saying it was a land full of trees and shrubs where weevils could live and rest. The trial went on for eight months as both the prosecution and the defence refused to give in and wars and other disasters added to the delay. How did it end? We do not know what the judge finally pronounced. The pages from the records that contained the verdict, writes Evans, had been eaten up either by rats or insects. To quote Evans: "Perhaps the prosecuted weevils, not being satisfied with the results of the trial, sent a sharp-toothed delegation into the archives to obliterate and annul the judgment of the court." What an anticlimax! □

Geetha Iyer is an author, a nature enthusiast and an independent consultant in the fields of education and environment.

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