

# The Amazing World of Insects

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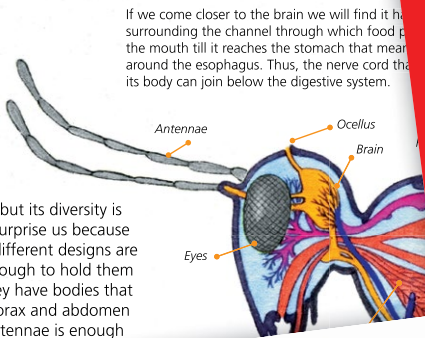
The Amazing World of Insects, a work that introduces you to the universe of the tiniest animals.

# The Amazing World of Insects



## Insect Anatomy

All insects share a common anatomy but its diversity is almost infinite. Surely, this does not surprise us because they are so many of them. So many different designs are known, that a book would not be enough to hold them all. As we have mentioned earlier, they have bodies that are divided into three parts: head, thorax and abdomen that with its six legs and its pair of antennae is enough to tell them apart from the rest of the animals. Often it has wings and if so then there is no doubt, it is an insect. Among the invertebrates only insects have wings. They are covered by armor, the cuticle consisting of chitin. It is its external skeleton, and to be able to move the cuticle is thinner and more flexible at the joints. Now, let us go inside an insect. We will find out how it is surrounded by a liquid, the hemolymph which is the name of its blood and it occupies every part of its body. And floating on this liquid we will also find that the distribution of its organs is similar to the arthropods.

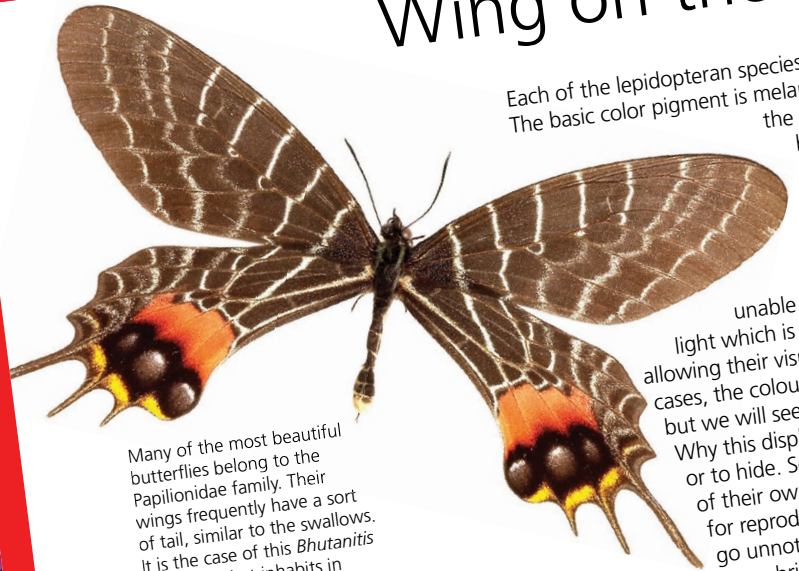


If we come closer to the brain we will find it is surrounded by the channel through which food passes from the mouth till it reaches the stomach that is located around the esophagus. Thus, the nerve cord that runs through its body can join below the digestive system.

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## Wing on the m

Each of the lepidopteran species has its own color. The basic color pigment is melanin, which gives the dark shades. Some beings also possess other pigments or take on colors that they find. Some have colors that are unable to see. Light which is perceived allowing their visual communication. In some cases, the colour is not bright but we will see this in the wings. Why this display of color is for or to hide. Sometimes it is of their own species for reproduction. Some go unnoticed by predators. Some have bright colors to say "Danger!"



Many of the most beautiful butterflies belong to the Papilionidae family. Their wings frequently have a sort of tail, similar to the swallows. It is the case of this *Bhutanitis lidderdalii* that inhabits in countries of South East Asia like Thailand. Here we see that it has not only one, but two tails on each wing.

Surely you know **scorpions**. They live almost everywhere around the world and one of the largest is the *Pandinus imperator* which reaches twenty centimeters in length and inhabits much of Sub-Saharan Africa.

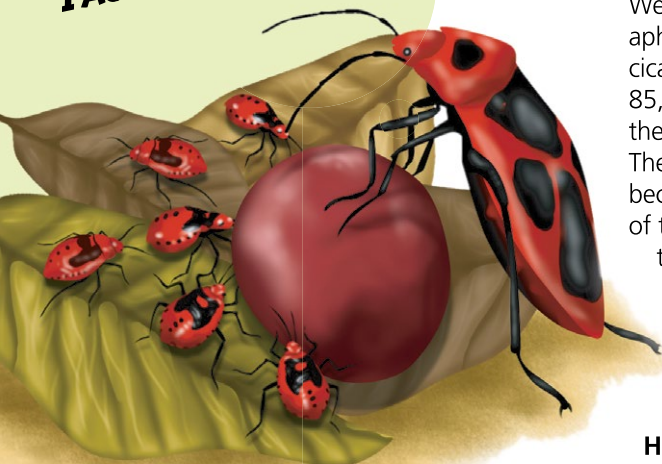


## Bedbugs

Well, there are bedbugs, aphids, crickets, or cicadas, and up to about 85,000 species that form the Hemiptera order. They are called this because some members of the order have wings that are partly hard, such as the elytra of the beetles, but in other parts they are membranous.

They are called **Hemelytra**, as in the case of bedbugs. In this order the wings form as the nympha develops because its

head, **FASCINATING!**



The **pseudoscorpions** (order Pseudoscorpionida) look like small scorpions because of their pedipalps as tweezers, but they do not have a tail with a stinger. They are not bigger than one centimeter long.



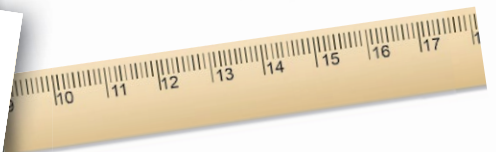


Decide to learn great life lessons  
from the tiniest teachers!

# The Amazing World of Insects



## Giants



## Flies and family



Which do you prefer, a panda bear or a fly? Well, for sure you would choose the panda. However, although they might be very annoying and transmit illnesses, they perform very important tasks in nature, some actually benefit human beings. There are some flies that destroy insects that cause pests. Some others recycle waste; some pollinate plants as bees do.

The eyes of this *Eristalinus taeniops* fly are huge, as fly eyes should be, and they are not bad. They live around the Mediterranean Sea, the tropical East Africa, Near and Middle East. By the way, it is one of the many pollinating flies.



On the contrary, the *Nannophya pygmaea* is the smallest of dragonflies. It inhabits Southeast Asia, China, and Japan. Its wingspan is two centimeters and the male has a red abdomen, so the one in our illustration is a female.

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The ceiling of the caves they inhabit in New Zealand and Australia look like a starry sky with the light they produce.

## Mayflies

Mayflies are also a major group in this chapter. They belong to the order, Ephemeroptera, containing about 3,000 species. The name of the order says it all: their life as adults is very short, although some species live several days, most of them live for less than a day and some do not even reach an hour. As adults they do not have the chance to feed due to time and also because their mouthparts do not work.



We might not love them but they have their little hearts too. Males of the European *Cyrtopogon ruficornis* perform a nuptial dance, as some species of birds do, moving their abdomens up and down before the female.



It looks like a worm but it is not. It is one of the metamorphosis many experience (all diptera are holometabolous). The larvae have fake feet. And if you can see the larvae.

There are diving beetles such as the carnivorous dytiscus (in the picture male and female *Dytiscus marginalis*). Some of these aquatic beetles need to breathe constantly on the surface but others have a water bubble attached to their bodies and can breathe from it indefinitely. This is because Carbon dioxide escapes from the bubble into the water and from the water enters oxygen that is breathed by the beetle. We wish we could do the same!





Invertebrates will show you how their effective design allow them to live in particular environments. You will also get to know the invertebrates which can be harmful to human beings.

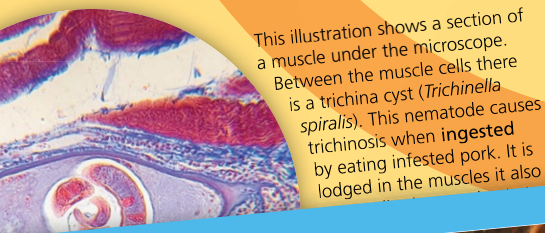
# 1 Animals without Bones

## Parasitic Worms



There are a few invertebrates that can be harmful to human beings so we need to be careful. There are some that are poisonous, and what is more, there are some that can penetrate and infest our bodies causing serious diseases. These parasites are the group of invertebrates found among worms producing diseases known as helminthiasis. There are other unicellular "little bugs" (microbes) that infest us and are transmitted by different groups of insects that you will get to know about all throughout the book.

An animal from a science-fiction movie, but it is there in the real world, especially in humid tropical zones. It is another type of parasitic worm, the *Ancylostoma*. It can measure up to one centimeter long and causes the **ankylostomiasis**, which causes diarrhea, weakness, and causes the **anemia** (blood loss) and, due to the bleeding, anemia.



This illustration shows a section of a muscle under the microscope. Between the muscle cells there is a trichina cyst (*Trichinella spiralis*). This nematode causes trichinosis when **ingested** by eating infested pork. It is lodged in the muscles it also

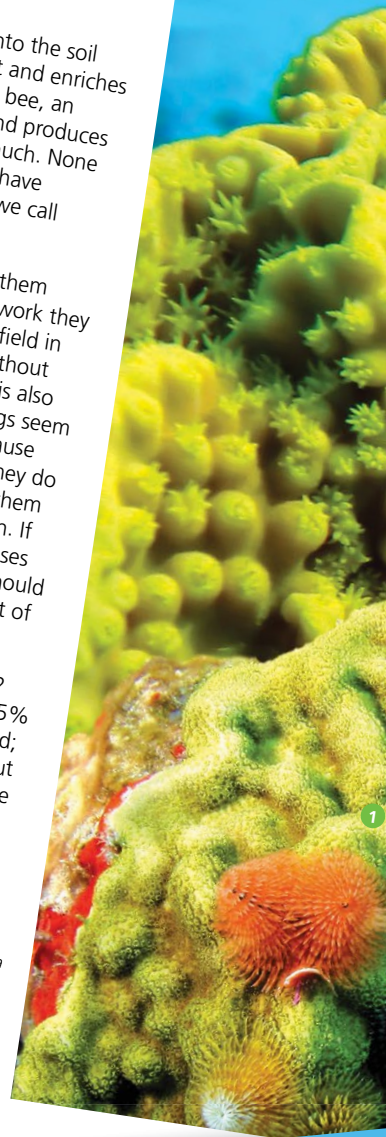
The disease called **ascariasis** is caused by a nematode worm, the *Ascaris lumbricoides*. It can affect us in any part of the world. The same happens with the **oxyuriasis** or enterobiasis caused by another nematode that measures several millimeters long: the *Enterobius vermicularis*, like the one in the

The earthworm lets air into the soil when it moves through it and enriches it with its excrement. The bee, an insect, pollinates plants and produces honey, which we like so much. None of these two little animals have bones; those of their kind we call **Invertebrates**.

Sometimes, we might think them disgusting but what a great work they do! What would it be of the field in which our food is produced without the earthworm or the bee? It is also possible these invertebrate bugs seem unpleasant and ugly to us because of what they do and the way they do it, but we need to learn to see them in the roles they have been given. If they feed on other animals' corpses they are recyclers and we should understand that they are also part of the cycle.

Many invertebrates are there? Of the animals we know: 95% of the animals scientists have named; species approximately. But there may be ten times more! There are many to be discovered.

1. Annelid
- 2 y 3. Chidaria
4. Arthropod
5. Mollusk
6. Polífera



## FASCINATING

This Mantis Shrimp (*Stomatopoda*) is a crustacean found in the Indo-Pacific Ocean. It can grow up to twenty centimeters long. It is an unwary swimmer, but it is very powerful. It is unaware of the danger of one of his fingers being crushed by one of his appendages shaped like a hammer with a force thousands of times its weight.



Hitting clubs



Discover the interesting anatomy of the insects and how some of them go through metamorphosis.

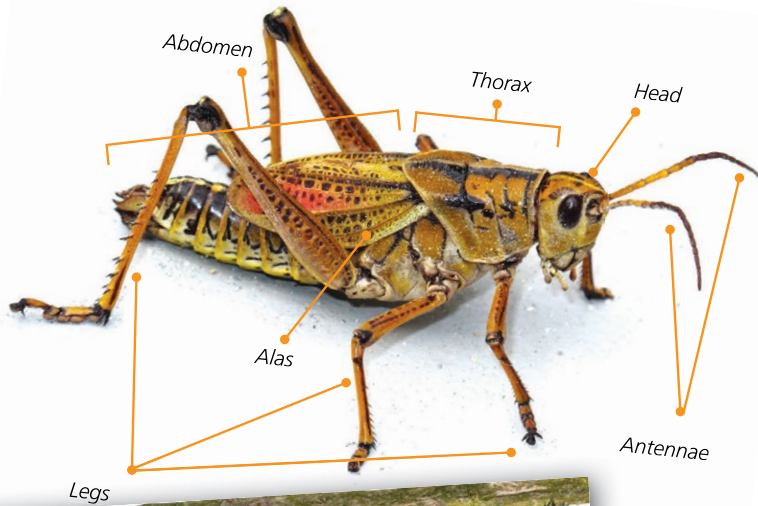
# 2 Insect Planet

Surely you have tripped over an ant formation. An anthill is home to thousands of ants or even millions of them. And surely you have walked through a cloud formed by hundreds or thousands of mosquitoes. We come across insects everywhere. There are hundreds of them for each of us and there are even more for each of them, although there

could be between five or ten times more. Alone, there are more species than all the rest of the animals together, including all the invertebrates. Every year about 7,000 different insects are named. Also, they occupy many of the ecosystems of the planet, including polar zones and oceans. But they are mainly terrestrial.

## How are they...?

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Butterflies, flies, and beetles are some of the insects that during their life cycle go through a complete metamorphosis and are called **Holometabolous**. From the egg hatches a larval form that does not resemble an adult at all.

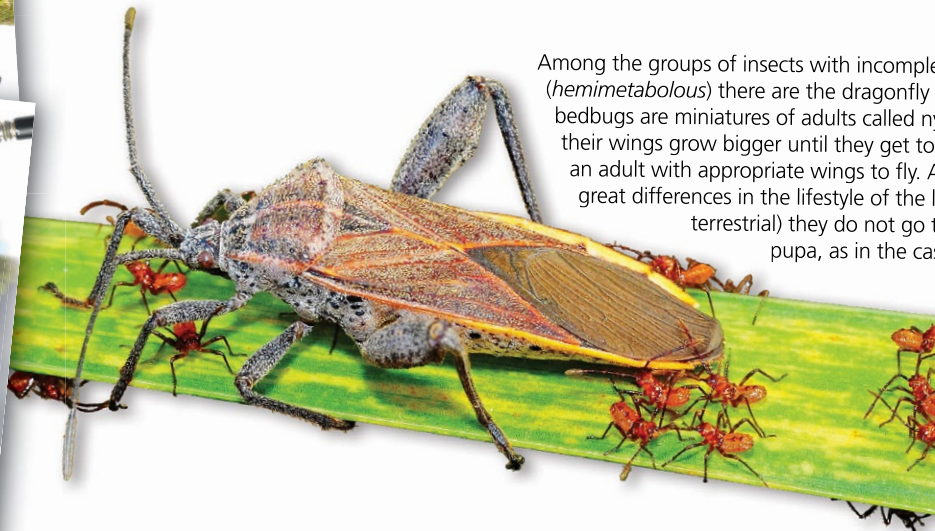


## Metamorphosis

*"Very truly I tell you, no one can see the kingdom of God unless they are born again." Mission impossible! This is what Nichodemus might have thought of this passage of the Bible. Nevertheless, the miracle is there, within our view. It is the performances of nature. It is metamorphosis.*

It occurs in several types of animals and it is well-known in amphibians, such as, starfish. But, the "being born-again" occurs in many of the different groups of insects. Before and after the change are generally very different.

Among the groups of insects with incomplete metamorphosis (hemimetabolous) there are the dragonfly and bedbugs are miniatures of adults called nymphs. Their wings grow bigger until they get to be an adult with appropriate wings to fly. Although there are great differences in the lifestyle of the insects (some are terrestrial) they do not go through a pupa, as in the case of holometabolous insects.



## To know them better

Collection of bugs



You can also catch invertebrates

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There is an immense diversity of insects according to their size, physiology and behaviour. Some of them can transmit illnesses, however, others perform very important tasks in nature, which actually benefit human beings.

3

# An Immense Diversity

## All kinds of Insects

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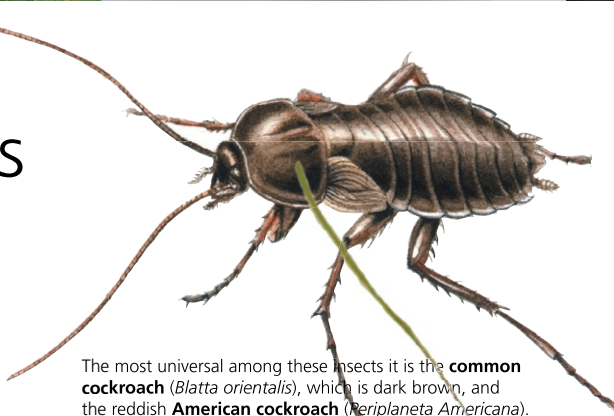


So, how many insect groups are there? Well, it depends on how we gather them. However, they are so many and so diverse that in this book we will see them grouped by orders, which is the way zoologists, who study animals, call these groups. You will be able to see that there are many species put together under the same order and there are many insect orders.



## Cockroaches

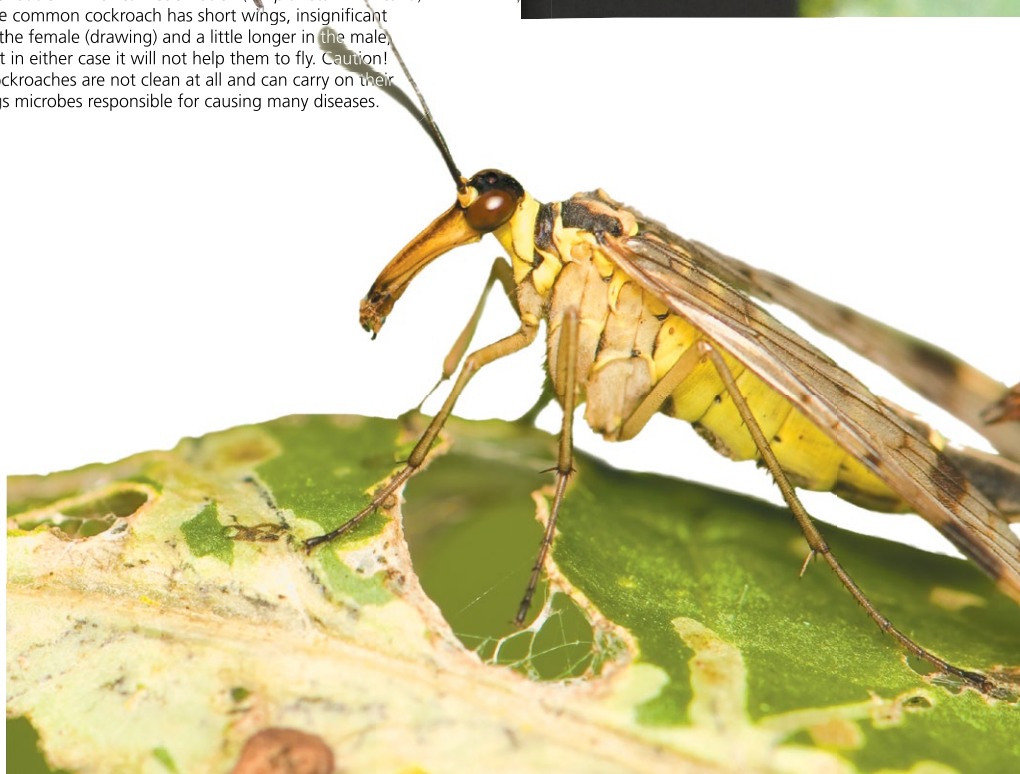
*"I know what it is to be in need, and I know what it is to have plenty. I have learned the secret of being content in any and every situation, whether well fed or hungry; whether living in plenty or in want"* (Philippians 4:12). These biblical words of the apostle Paul show an unusual virtue among human beings: to be content and to take advantage of what one has. Among insects, in the same way, cockroaches stand out. They do not disregard anything. They eat everything and you can find them anywhere. Besides, they are very resilient and can adapt to almost any environment. They can withstand a dose of radioactivity fifteen times higher than humans can. Some species love to live with humans, although this is not reciprocal. Even so, many of them are among the best and most surprising mothers in nature.



The most universal among these insects it is the **common cockroach** (*Blatta orientalis*), which is dark brown, and the reddish **American cockroach** (*Periplaneta Americana*). The common cockroach has short wings, insignificant in the female (drawing) and a little longer in the male, but in either case it will not help them to fly. Caution! Cockroaches are not clean at all and can carry on their legs microbes responsible for causing many diseases.



In Africa there lives one of the biggest cockroaches,





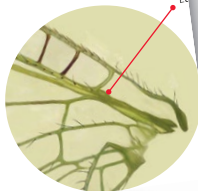
Butterflies are some of the most beautiful insects; for that reason, they are known as flying flowers. Here you will learn some of their great life secrets.

# 4 Flying Flowers

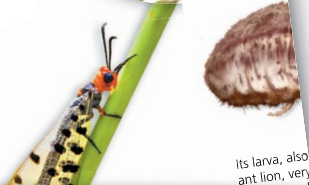
## Lacewings

They are beautiful and fascinating insects! They group around five thousand species in the order Neuroptera and they have a great variety of shapes and sizes, with wingspans ranging from less than a millimeter to fifteen centimeters. They are little animals with complete metamorphosis (holometabolous); carnivores, both larva and adults. The wings and the lack of the ovipositor tube as cercus stand out from their bodies.

Among lacewings, green lacewings, *Chrysoperla carnea*, is the most common. It lives in many places of America, Europe, and Asia. Ah! And if you get close enough to see its eyes you will find out they are of a beautiful golden color.



This neuropteran look like a little mantis. Hence its name Mantispa, is small measuring up centimeters and a



Its larva, also ant lion, very

Butterflies and moths are among the most beautiful insects. Few animals compare to their beauty. Their wings are similar to delicate and colourful flower petals.

But they are not the only ones with beautiful wings among insects. There is another group called "lacewings" (order Neuroptera) due to its resemblance to the elaborate fabrics to which its named, is related, and of which we will learn in this chapter.

For now, here is the impressive Emperor Butterfly. The **Atlas Moth** (*Attacus atlas*) is a giant moth indeed. It lives in tropical forests of India, Southeast Asia, and southern China. Its wings have a colorful design, simply spectacular! And the size of these reaches 30 centimeters!



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## Scaring the Enemy

Many caterpillars also use the tactic of "disguising" themselves with huge "eyes" on their backs in order to intimidate predators. This is what happens with this *Deilephila elpenor* moth larva. Actually, caterpillars have in their heads only ocelli that do not become eyes like the ones of the winged adults.

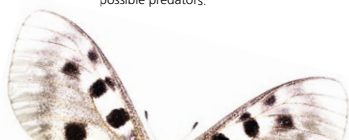


Species of the genus *Caligo* are known as **owl butterflies**. They live in the forest of Mexico, Central and South America. The fact that they are known as owl butterflies is because they like to move at night and have huge "eyes" drawn on the undersides of their enormous wings. Some species reach 20 centimeters in wingspan. So what are the eyes drawn for? They are common in many butterflies and can intimidate possible predators.

The **regal moth** caterpillar (*Citheronia regalis*) is an amazing creature and the appendages, like horns, located on its back are intimidating but harmless. In other caterpillars these spikes can be dangerous and even sting. In any case, they are a defense against the ones who want to eat them. Caterpillars are not very fast and are a nutritious

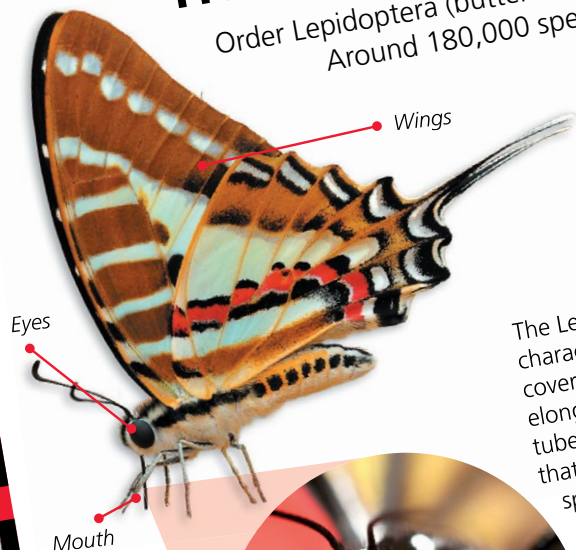
mouthful. Others defend themselves by accumulating poison or any other unpleasant substance they take from the plants they feed on.

The **Parnassius nomion** butterfly has a soft beauty. It inhabits steppe forest areas in a geographical band



## How are they...?

Order Lepidoptera (butterflies and moths).  
Around 180,000 species.



The Lepidoptera are characterized by scale-covered wings and an elongated mouth like a tube that coils spirally, that is why it is called spirotube. Except some masticatory mouth moths. Their larval form a caterpillars and the metamorphosis is complete (they are holometabolous).

Spirally





There is another species of insects with a kind of armor that function like a shield. This is the case of the beetles that can carry 1,141 times their own weight.

## Beetles

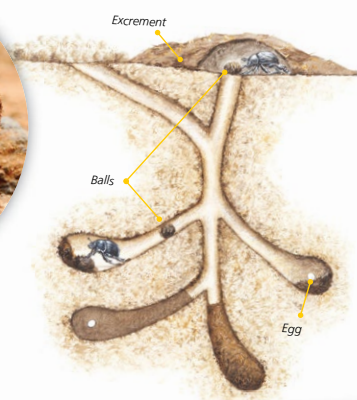
They can carry 1,141 times their own weight. Can you imagine a person of 70 kilograms taking 80,000 kilograms on his back! It is one of the living creatures with water relative strength. This wonder nature is an Australian Dung beetle. The shape of a beetle's legs, body, of the prominences of its jaws, its thorax, its antennae... or its many sizes, make beetles incredibly diverse. They feed on almost anything. Their sensory organs are mainly on their heads although their bodies are covered with hairs that help them perceive vibrations and certain structures of their legs help them to capture sounds. The strongest animals is an invisible mite.



A wonder of nature, an incredibly strong animal is the **Dung beetle** *Onthophagus taurus*. However, this enormous strength of some tiny animals is due to its small size.



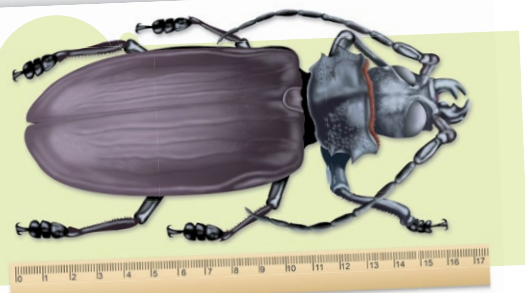
catanga in the Andes line and everywhere is the dung beetle. Actually, 50 of species and though m make balls of this is their most common



Those that make balls take them to their nests, away from the original excrement, burying them and putting their eggs inside. In other cases, as the one in the illustration, they have the nest under the excrement, and make the balls there, and then put them inside the nest. Then, they lay the eggs in the balls. When the larva hatches it feeds on the fecal matter that is why they are said to be coprophagous. Wow! Disgusting? But, what will it be of us if they did not take the excrement away?

## FASCINATING!

It is the greatest of beetles. It can be up to seventeen centimeters long. The female is rarely seen and its larvae are unknown. It is the **Longhorn beetle** (*Titanus giganteus*). It lives in the Amazon jungles of Brazil, Ecuador, Peru, Colombia, and Venezuela. Ah! And it can break a pencil with its jaws.



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Fireflies or light bugs are actually a family of beetles with more than two thousand species. They are known for courting at night with cold light pulses produced by bioluminescence emitted from the abdomen of male and females. In Europe it is common to see the *Lampyrus noctluca* species, which is in the picture as a bright adult male.



Some coleoptera are endowed with chemical weapons. There are several species of beetle known as gunners or bombers that shoot dangerous chemical compounds. That is the case of the *Brachinus expulsores* that shoots a boiling poisonous substance against anyone who bothers them.



Surprise! There is a fossilized beetle in the rock identical to a modern one. Scientist found it in Russian Siberia and identified it as *Helophorus sibiricus*. This fossil, according to evolutionism, is not younger than sixteen million years. If evolutionism were true, how can it be that these animals have

# Armored

They are not only armored. Sometimes they have defensive weapons with distant action. They have two pairs of wings. The first pair is in front and hardens becoming a shield. It is the cuticle, made out of chitin, that hardens and becomes a resistant and lightweight armor.

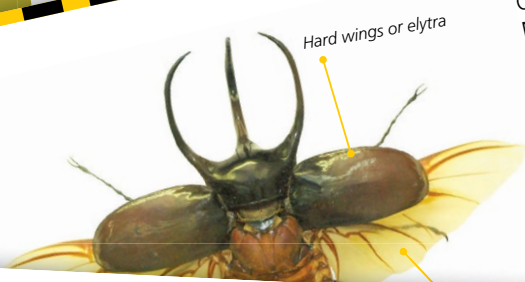
But these are not the only armored insects. Many species of bedbugs also have this armor. Nevertheless, there is something that makes these two groups of insects very different from each other. Both groups are very diverse in terms of shapes and behavior, the beetles stand out for being the most diverse.

Once they asked the biologist John Haldane what was his conclusion after having studied the creatures made by God and he answered: "I think the Creator has a special fondness for beetles". Why did Haldane say so? Because one out of every four animals, approximately, is a beetle. That fondness of God is manifested through the many species with the most varied shapes, some as surprising as the **Giraffe weevil of Madagascar** (*Trachelophorus giraffa*). Males, as the one in the photograph, have a long neck, an extension of the head actually.

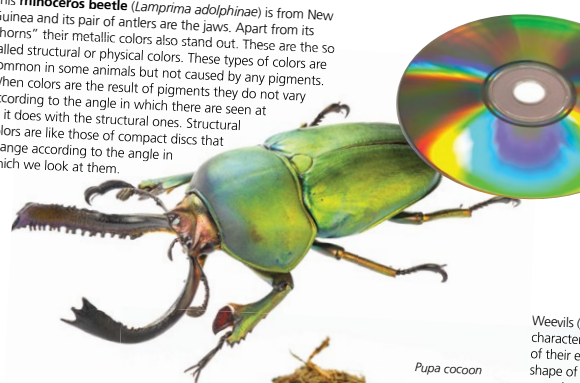
## How are they...?

Order Coleoptera (beetle)  
More than 350,000 species

Coleoptera or beetles have hard forewings called **elytra**. They have a masticatory mouth and experience complete metamorphosis (holometabolous). Larvae have different types, some of them to caterpillars, even legless ones of flies. On the other hand, larvae have long legs and are fast.



This **rhinoceros beetle** (*Lamprina adolphinae*) is from New Guinea and its pair of antlers are the jaws. Apart from its "horns" their metallic colors also stand out. These are the so-called structural or physical colors. These types of colors are common in some animals but not caused by any pigments. When colors are the result of pigments they do not vary according to the angle in which there are seen as it does with the structural ones. Structural colors are like those of compact discs that change according to the angle in which we look at them.



Light hits the surface and the irregularities cause it to decompose and scatter the colors that form. In other occasions this dispersion occurs when the light goes through many layers and each one of them reflects different colors.

Weevils (family Curculionidae) are characterized by the toughness of their elytra and the peak shape of their mouth. That is the case of the **Red Palm Weevil** (*Rhynchophorus ferrugineus*), one of the largest. It measures up to 5 centimeters long and feeds on palm trees. It is originally from Southeast Asia but has invaded other continents extended by human beings. Its invasion has caused the palm grove of Elche (Spain), one of the world's largest and heritage of humanity, to be endangered because of its attacks.



The **colorado potato beetle** (*Leptinotarsa decemlineata*) is not welcome. The female lays about 30 yellow-orange eggs deposited together on the underside of the potato leaf.



The eggs hatch into larvae, and then they leave the plant, like this. They are a real plague.

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In this section you will get to know the great masters of camouflage, which manage to hide from the rest of the animals. It is fascinating to observe them taking the shape of tree leaves, rocks, or sand. They are almost unnoticeable!

6

# Camouflaged Lives

The main characters of this chapter are "masters of camouflage". They are not the only ones, but among them the masters with capital letters stand out. They are the order of **phasmids** (Phasmida) and are called stick insects. Also, many of them are among the longest ones. *Phasmodon kibi* has the record of being more than half a meter long. *Phasmodon ponderosa* shown in this illustration is not so big, though it can grow up to twenty centimeters.

## Stick and Leaf insects

They are the ghosts among insects due to their invisibility. They are there, before our eyes, but we can't see them. Maybe a slight move of their body can give them away. Then, there they are! It seems to us it is a piece of a plant that moves and walks.

Stick and leaf insects are mainly nocturnal and feed on leaves. In this order the species can reproduce sexually male and female. However, they can also reproduce without a male. This seems to be an emergency plan in case both sexes don't come across each other. This is what in biology is called **parthenogenesis**. In this case, from the female reproductive cells called the ova, the offspring develops, usually more females. This phenomenon is known in other animals and is very common in insects.

The American phasmid *Anisomorpha buprestoides*, defends itself by hiding, but it also squirts a toxic liquid that can damage our eyes.

Not all of these insects produce toxic substances although it is common. They tend to segregate it and keep it in its body. You should always be careful with them.



The leaf insect *Phyllium westwoodii* has its habitat in Southeast Asia. It is not simply a leaf; it can be any types of leaf.



The Australian stick insect *Extatosoma tiaratum* has a body length of approximately twenty centimeters. It can bend its belly as if it were a scorpion. It is not the only species that does this and again they seek camouflage and imitation because it is not as fierce as it seems.

This is an extreme case of parthenogenesis. Among stick insects *Sipyloidea sipyloidea* there are only females found. A male has never been found not even when they are bred in captivity. In the African island of Madagascar it can measure up to twenty centimeters. Although they fly very little, or they simply don't fly, this species has the ability to make short flights.

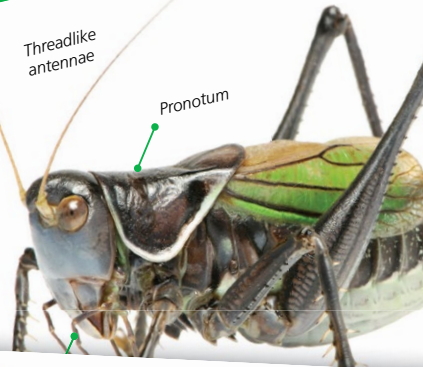
## How are they ...?

Order Orthoptera (crickets and grasshoppers or tree hoppers). Around 20,000 species.

The Orthoptera are characterized by having threadlike antennae (like crickets). It has a masticatory mouth and the head is large.

Threadlike antennae

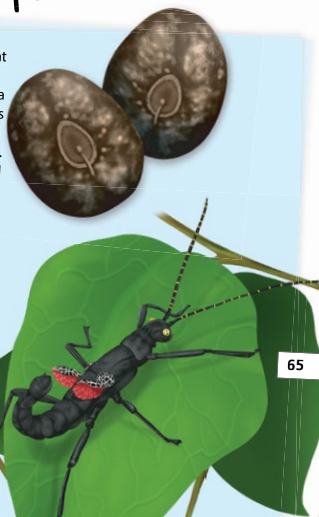
Pronotum



## To know them better

A ghost in the terrarium

Although there are many species that are commercialized as pets, the best thing to do is collect some that live in your area and once you studied them take them back to their original place, unless you commit to look after them for the rest of their lives... and their offspring's. However, you must be careful not to take protected species. Phasmids are not difficult to breed. The terrarium must be ample; a good measurement is 40 x 40 centimeters base and 50 centimeters high, but the higher, the better. Inside there must be plants, as the leaves are their food. You can put some little branches of their food, with the roots, inside jars with water so the leaves are kept edible. It is usually very easy to find the plants from which they feed. If you live in the zone of Peru or get some samples of *Peruphasma schultzei* their food could be the privet (*Ligustrum vulgare*) and olive (*Olea europaea*) but you can try different plants. If you have caught it yourself try with the plants near where you found it. Make sure the humidity is appropriate because it is always important, especially when the insect molts. With the *Peruphasma*, humidity should be 70% or slightly higher, and temperature of 25 °C. These conditions are appropriate for hatching eggs of this species; they are about four millimeters and are camouflaged as seeds. Phasmids let go of their eggs and they have to be found, or deposit them on land. The *Peruphasma* usually lay one egg a day and drops it to the ground. Pick them up and put them on paper towels in a covered plastic box, and next to it, a bottle with water and a cotton plug to release moisture. After four months they will hatch and the nymphs will come out. After five changes you will have the adults, which will measure between five and six centimeters in length.



Listening to, watching, and paying attention to everything that...

mid, the nymphs of the desert locust (*Schistocerca gregaria*) are green so as to be unnoticed by predators. But if there is shortage of water, their colors are a warning that they are toxic due to the alkaloids, and that they are ready to form the dreaded "hoppers". They go from being lonely to forming groups.

This is not the only species that meets in big groups, but the Desert locust is the most harmful to crops. The adult, as the other grasshoppers, but differently from nymphs, has a horizontal and elongated shape and due to its size they are greater eaters. A swarm of these insects can have tens of thousands of millions of them from all ages! They are a real scourge in North Africa.

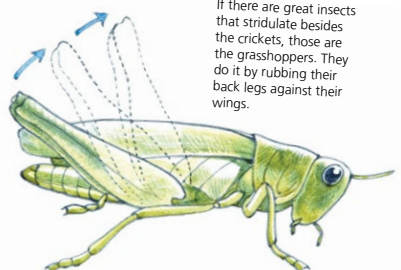


Locusts blend in with the environment they live in and some are truly amazing.

Jump or exceed, a meter of distance. All Orthoptera are jumpers, and the group of them that is known for this is the Zoniopoda. The *Zoniopoda elegans* lives in the East and South America and is a pest for several crops. Their colors are a warning: "You are me and I am toxic, so don't eat me!"



If there are great insects that stridulate besides the crickets, those are the grasshoppers. They do it by rubbing their back legs against their wings.





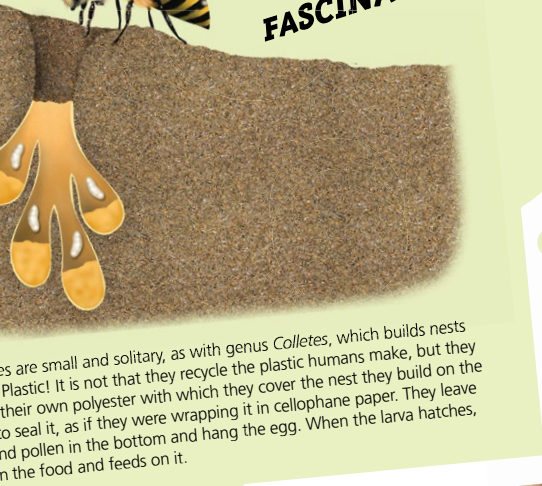
Bees are insects that teach us the value of work, cooperation, and ability to forecast. Discover how these fantastic insects live.

# Social and flying

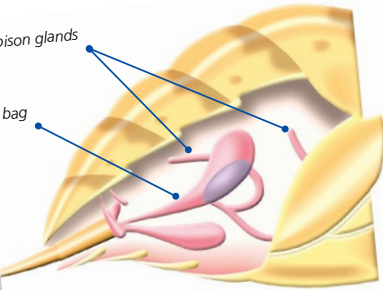
"Sluggards do not plow in season, so at harvest time they lack but find nothing" (Proverbs 20:4). It's the sad reality expressed in this Bible verse; before him, the lesson of many insects and undoubtedly bees is a truth! These laboring Hymenoptera have been qualified as appreciated for the sweet honey, propolis, is not a short list but the most important is missing: they help lots of plants to reproduce. As plants with flowers cannot move they need help to put into contact pollen (male) with ovules (female). The wind, water, and different major beings involved in pollination. The value of this task can exceed up to fifty times that which they produce to which we gain, by beekeepers have an essential work for the wild plants, sometimes their hives are moved in trucks to places in which their work is very necessary, it is a gift.



**FASCINATING!**



Bees are small and solitary, as with genus *Colletes*, which builds nests in Plastic! It is not that they recycle the plastic humans make, but they use their own polyester with which they cover the nest they build on the ground to seal it, as if they were wrapping it in cellophane paper. They leave the egg in the bottom and hang the egg. When the larva hatches, it finds the food and feeds on it.



It is not only bees and bumblebees that join to form colonies. Wasps too. They often make their nests by chewing some vegetable matter making it into a sort of paper. -That is the case of the common European wasp (*Vespula vulgaris*) hanging a nest that will grow and be successful.

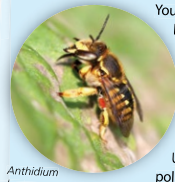
## To know them better

### Observing tapestry and mason bees

Certain bees, especially of the family Megachilidae, use cavities, often tube-shaped that they cover with different vegetal materials or mud. They are called tapestry and mason bees and in a simple way you can study their life cycle.

You can prepare a room for them in lots of simple ways: by making tubes with paper, drilling wooden blocks, or with plastic tubes. The length should not be less than twenty five centimeters and the diameter can be between two millimeters and five centimeters. If you prepare a box with transparent tubes (for example, a methacrylate) you can discover more secrets of the life of these bees, that used to live mainly in Eurasia and Africa, that now have spread throughout the world with humans.

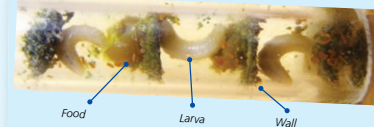
A wooden box made by you, or one of those used to dispense napkins, can become an ideal place. It should be closed, the tubes on the inside and only the entries will remain open to them.



Anthidium bee

You will see how they cover the walls with petals and leaves, if they are the *Megachile* bee, or other vegetal materials, as the *Anthidium* bees do. If it is a mason bee, it can add clay to condition the walls and there are some, which only make partitions between the cells so you can see what is inside.

Usually they leave in the cell a mixture of honey and pollen, which will be the food of the larva that will emerge from the egg they lay there.



Food Larva Wall



Honeybees do all kinds of jobs in the hive and go back to them if necessary, from the work of cleaning, to the enviable explorer for the collection. What bee would be jealous of another one given the fact that all of them have done all types of jobs? Any honest worker is worthy of consideration and bees teach us to work with humility.

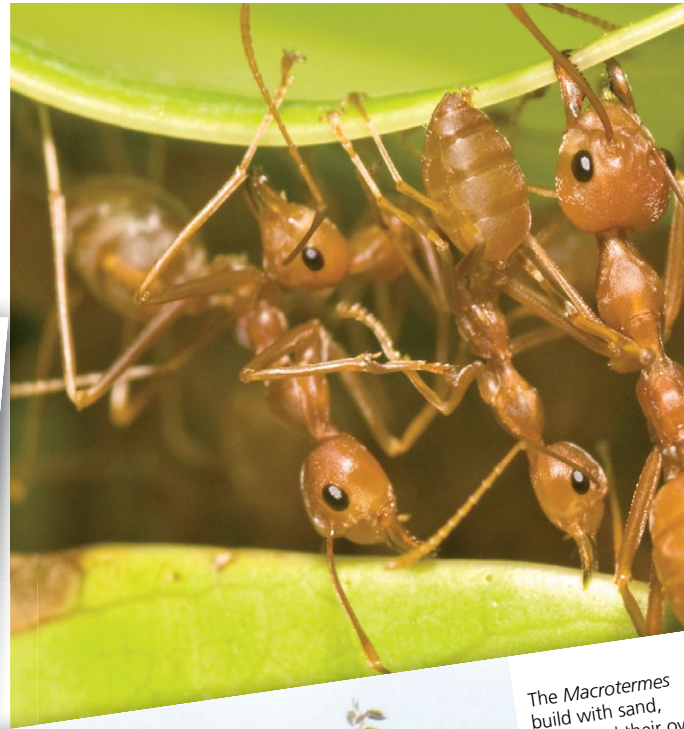


Some of the greatest builders of this world are very tiny. Ants have an extraordinary ability of organising themselves in order to carry out important projects. In this chapter, you will also learn about the termites, other insects that build colossal constructions.

# 8 Superbuilders

One, two, three! All ants put up their super buildings at the same time. Well, not all of them because there are colonies that only have a dozen workers and one queen. But there are others formed by millions of workers and one or several queens.

Weaver ants belong to *Oecophylla* genus. They build big tree cities in the center of Africa, Northern Australia, and Southern Australia. They fold leaves to make nests and



## Insects with no Limits

all. It is the secret of advanced societies. Generations remain in the care of each other. New comers. This allows termites to build imperial empires. Only in a rainforest, the dry is four times heavier than vertebrates (mammals, amphibians and fish) here. Some species colonies with many queens. In the case of ant (*Linepithema*) its super colonies 6,000 kilometers tall, extending to through France believed to be the colony in the world.

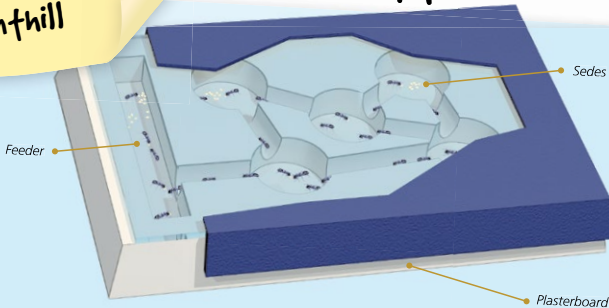


In dry places there lives some species of ants which workers can become authentic li storerooms for food (honey) hanging from the ceiling of the anthill. This is the case of the Australian *Camponotus inflatus*.

The *Macrotermes* build with sand, saliva, and their own feces. With these ingredients they form a paste that once dried becomes hammer proof.

Leafcutter ants are the farmers of America, from southern United States to central Argentina, the termite *Macrotermes* cultivates fungi in a similar way and South

To know them better  
Watch into an anthill



Would you dare to build an anthill? If so, it is better if you choose small ants. One option is that you dig into an anthill until you find the queen and take it to your anthill. The other option is to start with a winged female that has been fertilized. The reproductive queens and kings have wings. If you decide to dig up a queen you will distinguish it because of its prominent abdomen. Be careful, it is very sensitive to light. Take it to your anthill with some workers, and if possible, with larvae and pupae. The other option is that you find a winged female that has been fertilized. You can collect winged ants from several nests and watch if some of them get rid of their wings. That might be the queen you are looking for. You must put it inside your anthill and leave it alone with some damp cotton. Some drops of water with honey or sugar will be fine to feed it. It is important that you know what they feed on. Usually, they eat seeds and insects but a leafcutter ant or saava will need some leaves to cultivate the fungi it feeds on. You can make an anthill with plaster. You can ask for help from someone who knows how to use and prepare the right amount to make a plasterboard of 20x30 centimeters approximately. You put the plaster in a box with those measurements and wait for it to begin getting hard. Before it gets completely hard, those

Winged reproductive



- 1 Hum
- 2 Ro
- 3 Roy
- 4 Lar
- 5 Air
- 6 Air
- 7 Ve



9

## A close-up photograph of a dragonfly, likely a Zygoptera species, perched on a white, crumpled surface. The dragonfly has a yellow and black striped body and wings. The wings are transparent with prominent black veins and bands. The dragonfly is facing left, and its long, segmented abdomen is visible. The background is a soft, out-of-focus green.

A photograph of a yellow dragonfly with dark markings on its abdomen and thorax, perched on a white, cone-shaped structure that resembles a flower or a piece of coral. The dragonfly's wings are transparent with visible veins. To the left of the dragonfly, there is a map of Southeast Asia, outlined in red, showing the region's location. The background is a soft, out-of-focus green.

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We could not miss the spiders, insects known due to the perfection of their webs. In this chapter, the arachnids, from which we have lots to learn, are also presented.

10

# Spiders

Just the name of them can give someone the creeps. But it is not that bad. Although, there are really dangerous ones, it is also true that most of the time they are running away, avoiding problems. What it is likely to happen is that both parties may come across unexpected \_\_\_\_\_ at the same time. But it will only know where the person is once it has



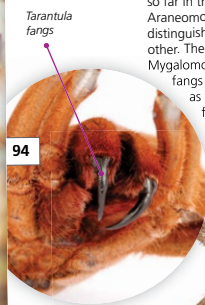
The **flower crab spider** belongs to the family Thomisidae. They have two pairs of front legs, larger than the rear ones, and they usually place them open, as you see in this *Misumena vatia* that lives in Asia, North America, and Europe.

**FASCINATING!**



Diving. That is the way the *Argyroneta aquatica* spends its life. It lives in areas of Africa, Asia, and Europe. It makes a web shaped like a hammock in the aquatic vegetation and under it; it places the bubbles of air that it carries in its abdomen. The big bubble that is being formed under the web gives it a bell shape. In its house, under the water, it will hunt and reproduce.

Before this tarantula, all the spiders you have seen so far in this book belong to the large group of Araneomorphae (90% of the spiders) which are distinguished by having fangs that oppose each other. The other major group is formed by the Mygalomorphae that includes the tarantulas. Their fangs are parallel to the axis of their bodies, as you see in this *Citharischius crawshayi* from Kenya and Tanzania. Impressive, isn't it?



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It measures 26 centimeters from the end of their extended legs. It is the **Goliath Birdeater tarantula** (*Theraphosa blondi*) the largest of the spiders living in the jungles of Venezuela, Northern Brazil, and Guyana.

**ALERT!** You will have the chance to realize... *Ixodes ricinus* (order Acari), a blood-sucking parasite that, as you can see, is made up of its abdomen and a tank. Ticks can transmit diseases, such as, the Rocky Mountain spotted fever.



They look like daddy-long-legs spiders but the division in their body between the cephalothorax and abdomen is not seen, even if there is. They are the **opiliones** (order Opiliones), as this *Rilaena triangularis* that throws smelly liquid or get soaked in it as a means of defense.



The **amblypigi** (order Amblypigi) called whip spiders and tailless whip scorpions look like spiders with a flattened body and long pedipalps ending in sort of combs. They move laterally and live in the tropical zones of America, Africa, and Asia. They seem threatening, but are harmless.

**FASCINATING!**



Microscopic **mites** also belong to the order Acari which feed on our dead skin. Their droppings can cause skin allergies. Well, one of these tiny bugs is probably the strongest of all bugs. The name is almost as amazing as his strength: *Archegozetes longisetosus* and it can drag 1,182 times its weight. Can you imagine person like you dragging 1,182 times their own weight? Stunning!

Surely you know **scorpions**. They live almost everywhere around the world and one of the largest is the *Pandinus imperator* which reaches twenty centimeters in length and inhabits much of Sub-Saharan Africa.



## Arachnids

They place themselves one in front of the other with their front "arms" (pedipalps), like tweezers, with threatening attitude. They are like two sumo wrestlers looking for a place to grab. And if we add tails ended in poisonous stingers, directed toward the "opponent", we can think that this will not have a good end. However this scene among scorpions, impressive to those who have witnessed it, is not a fight but a courtship dance. Scorpions are also arachnids, like spiders, but they belong to a different group (order Scorpiones). As all arachnids they have eight legs and two pedipalps that, in this case, end in grippers. They also have the division of body into cephalothorax and abdomen, although there are cases like another group of arachnids, opiliones, in which the distinction between the two parts is not as apparent. Well, more bugs. In this case the most similar to spiders.

The **pseudoscorpions** (order pseudoscorpionida) look like small scorpions because of their pedipalps as tweezers, but they do not have a tail with a stinger. They are not bigger than one centimeter long.





Easy to read, interesting,  
and full of attractive il-  
lustrations. Through this  
work you will immerse  
yourself into the amazing  
world of some of the in-  
habitants of this planet.

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With this book, Editorial Safeliz and the author give the reader a simple, but rigorous, introduction to the universe of insects and other little animals.

Taking a few minutes to observe to the naked eye any of them, insects, spiders or worms, we begin to understand that they are beings wonderfully complex, authentic mini “stars”.

Again, we put at your disposal the wonderful teachings and virtues of the nature’s beings:

- The extraordinary maternal (and paternal) cares of many insects.
- The “intelligent” behavior of the bee and many other bugs, instead of their reduced dimensions.
- The incredible miracle of metamorphosis. . . and much more.

We invite all the family to enjoy an extraordinary adventure that will take us to penetrate in the mysteries of Creation and His Designer. Those mysteries do not leave anybody indifferent. Have a nice adventure!

