



JONATHAN LEEMING

SPEAKER • AUTHOR • CONSERVATIONIST

Scorpion Nature Explorer





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This Scorpion Nature Explorer can be presented as part of a practical activity or presentation. For online resources associated with this Scorpion Nature Explorer, please visit www.Scorpions.co.za/Nature-Explorer. The Scorpion Nature Explorer is part of the One World Ecosystem (www.JonathanLeeming.com).



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Dedicated to
Rachel and Roy Leeming

To my parents who gave me the gift of appreciation
for the smaller things in life, the vision to see the
wonders that nature has to offer, and the
wisdom to question why, when and how.

Thank You!

Venomous animals represent the furthest point of our disconnection from the natural world. If someone can recognise or understand the value of a venomous animal and the direct contribution that they offer mankind, then conservation follows. Some call this conservation leadership because this mind-set is good for the environment. However, I call it responsible leadership because what is good for the environment is ultimately good for us as an individual and also as a society. We share the same basic requirements for life as every other animal. I see efforts to conserve the natural environment as a direct endeavour to save ourselves. This project contributes to saving ourselves through understanding and identifying value in one of the most misunderstood creatures in the world.

This project could never have been completed in a vacuum. It could not have been possible without the contribution and efforts of others.

I wish to express deep and sincere gratitude to Ray Spencer and Claire de Muelenaere for meticulously sifting through the manuscript and making suggestions, comments and highlighting my abuse of the English language.

A big thank you must also go to Lee Douglas, and Karin Spottiswoode for their time and effort in providing comments and suggestions that have made the final project a more rounded and valuable proposition for the reader.



Free Resources

Posters depicting all of the scorpions mentioned in the Scorpion Nature Explorer, additional activities and puzzles are available for free download. A lesson plan is available for teachers and facilitators. Feel free to share these resources with anyone who may benefit from them!

www.Scorpions.co.za/Nature-Explorer



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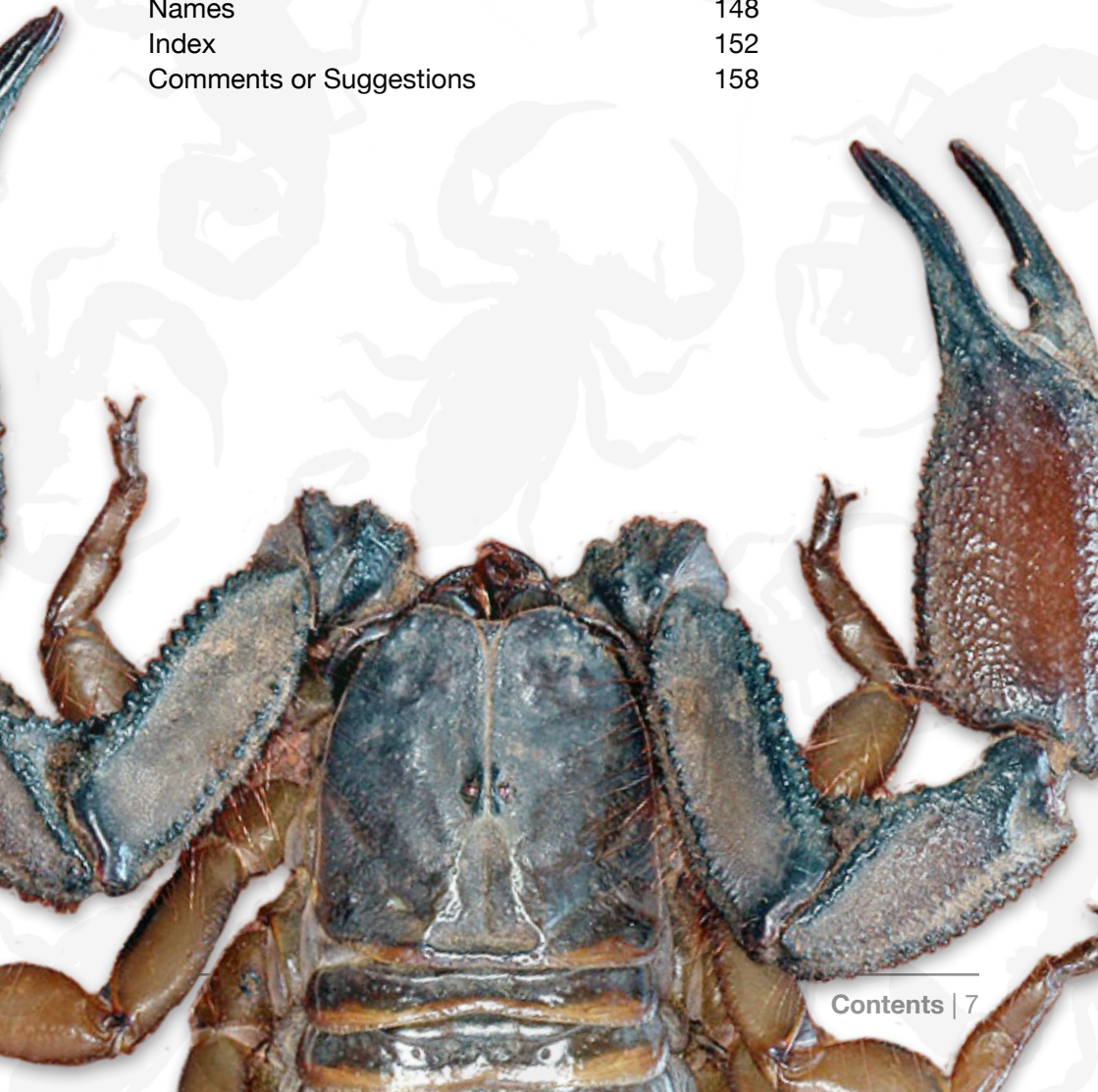
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SCORPIONS

“Venomous animals represent our furthest point of our disconnection from the natural world. We have become afraid of them, not because of what we know, but because of what we do not know.”

Jonathan Leeming
One World

Introduction

There are over 2500 species of scorpion worldwide, with about 150 species living in southern Africa. These fascinating and surprisingly common creatures can be found in a wide variety of habitats such as forests, savannah, deserts, mountains, wetlands, coastal forests, the sea shore, in your back garden and sometimes, even inside your home! They inhabit just about every terrestrial habitat on Earth except for extremely high mountain peaks and very cold regions of the world.

There are few places in Southern Africa where scorpions do not inhabit. These areas include highly urbanised and industrialised areas, and the high mountain peaks of the Drakensberg and Lesotho. Most areas are inhabited by at least 4 species of scorpions. Areas of high scorpion diversity include the West Coast, Cape Fold Mountains, Kalahari Desert, and the Soutpansberg Mountains. There are also places in southern Africa that are home to high populations of scorpions. In the Josini Dam area of Northern KwaZulu-Natal there can be as many as 4 scorpions per square meter!

The diversity of scorpions and their populations, are a result of each species having solved the challenges of life on Earth in their own unique way. These challenges include where they live, what they eat, what eats them, how they make a shelter, and other aspects of their lives. They can go without food or water for over a year, and simply wait out harsh conditions. Their lifestyles, physiology and anatomy allow them to live in harsh, dry and hot environments.

The study of scorpions is called arachnology.



In order for us to understand scorpions better, scientists have studied them closely, classified them into groups and given them names. These groups help us understand how each species is different from another, and also the relationship between scorpions.

Scorpions are classified according to a formalised hierarchy, with each level of classification narrowing down from a larger group into smaller and smaller groups. The same classification applies to all other animals and plants. Being aware of how animals and plants are classified and how they relate to each other, gives us a better understanding of the natural world.

Scorpions are classified as follows:

Domain	Animalia: Animals such as insects, lions, snakes, elephants, fish and bats.
Kingdom	Invertebrates: Animals without a backbone such as insects, octopus, earth worms, flat worms, crabs and jellyfish. About 95% of animals on Earth are invertebrates.
Phylum	Arthropoda: Animals with a segmented body, external skeleton and jointed legs such as cockroaches, spiders, scorpions and crabs.
Class	Arachnida: Land living animals with 8 legs, 2 body regions such as spiders, amblypygids and solifugids.
Order	Scorpiones: Animals that are characterised by 8 legs, grasping pedipalps and a sting.

An important differentiation between scorpions and other animals such as birds, fish and dogs, is that scorpions are invertebrates; birds, fish and dogs are vertebrates.

The body plan, internal organs, behaviour and lifestyles of scorpions are very different from any of the vertebrates. Even though vertebrates

As a result of their venom, scorpions have captured our imagination for thousands of years.



and invertebrates are very different in appearance, invertebrates are no less complex in anatomy, behaviour or intelligence. They are different, but no less. The sheer number and biomass of invertebrates make them a vital part of the ecosystem. Without them, the environment would not be able to function optimally and we would suffer greatly.

General Anatomy

The anatomy of a scorpion has not just happened by chance, there are good reasons why scorpions are designed in the way that they are. Their anatomical characteristics allow them to take advantage of where they live, how they catch prey and how they defend themselves from predators.

Scorpions, like spiders, are characterised by 2 body regions. It may seem like a scorpion has 3 body regions (head, body and tail), but the body and tail are considered 1 region by scientists because of the internal features. In this Scorpion Nature Explorer, anatomy is divided into 3 different regions.

The Head

Another name for the **head** is the **prosoma**. One top of the head is a hard shield-like plate of exoskeleton called the **carapace**. At the front of the head are the **mouthparts**, then pincers and legs. The mouthparts attach under the carapace, and look and function like small pincers, that are used to chew and extract the

body fluids of the prey. Behind the mouthparts is the scorpion's **mouth**. The mouth contains lots of hairs. As the liquid parts of the prey are sucked into the mouth, the hairs in the mouth strain out all the indigestible matter and only liquid enters the digestive system.

The **pincers** are used to grasp objects, catch prey and to defend themselves from predators. In some scorpions, the pincers are so strong that they are used to kill prey by crushing them to death. The pincers also perform a vital role during courtship. The pincers of the male are a slightly different shape than the female's pincers. These differences help the male to hold the female during courtship.

There are two eyes located in the centre of the carapace called the **medial eyes**, and two groups of three eyes located on the front corners of the carapace called **lateral eyes**. Even though they have 8 eyes in total, their eyesight is not good at all (see page 46).

Underneath the head are the attachment point for the pincers and 8 legs. The pair of legs at the front are referred to the **1st pair of legs**, the back legs are the **4th pair of legs**. Special sensory organs on the pincers and legs can sense vibrations and air currents. These organs help the scorpion to catch prey, detect predators and 'see' what is happening around them (see page 47).

Towards the back of the underside of the head is the **genital opening** and comb-like appendages called **pectines**. The pectines are used to feel and taste the ground underneath the scorpion. The pectines are very important for male scorpions as they allow him to find females.

Inside the head, are the **brain**, **mouth**, the **stomach**, the muscles that operate the legs, pincers and mouthparts, and the beginning of the digestive system.

The Body

Another name for the **body** is the **mesosoma**. On top of the body, are plates of exoskeleton called **tergites**, and underneath plates called **sternites**.

A thin flexible connective membrane of exoskeleton connects these plates together. This flexible membrane allows the scorpion to increase or decrease it's body volume depending on how much the scorpion has eaten or if the female's body contains developing embryos/eggs.

Inside the body are the digestive system, respiratory system, heart and reproductive organs. A **scorpion's blood** is not red like ours, but pale blue in colour because it contains copper. Our blood is red because it contains iron. The scorpion's blood is called **haemolymph** and functions the same way that our blood functions by transporting oxygen around the body to the muscles and internal organs, and removing waste.

All scorpions have 4 pairs of **booklungs** that are located underneath the scorpion. The openings to the booklungs can be see as pale oval slits. Book lungs look like a slightly open book. The scorpion's blood flows in the spaces between the pages of the book, while air from outside the body flows in the pages of the book. Oxygen passes from the air into the blood and carbon dioxide passes from the blood to the air. Our respiratory system works in much the same way.

The Tail

Another name of the **tail** is the **metasoma**. It is considered an extension of the body because of the internal features that it has in common with the body. The tail has 5 segments called **caudal segments**, ending in the **sting** or **telson**.

Internally the tail contains a continuation of the body's internal organs. The scorpion's **alimentary canal** runs through the length

Next time you see a scorpion, take a few minutes to observe it from a distance so as not to interfere with the animal's natural behaviour. Then, as you move closer, notice how the scorpion is aware of your presence, and changes its behaviour as it perceives you as a threat.

Responding To Threats

All animals, including scorpions, will defend themselves and their young from threats using whatever means is available to them. Although scorpions have venom, they do not always use it for defence.

Venom takes time and energy to produce! Therefore, scorpions would never waste this vital resource. Scorpions can regulate the amount of venom that they inject when stinging. It is common for a scorpion to sting in defence and not inject any venom at all. This is called a **dry sting**. If a scorpion's life is in danger, it will inject as much venom as it can.

Being aware of a scorpion's body language can give you a good idea of the scorpion is feeling safe, stressed or threatened. This allows scientists to work safely with highly venomous species of scorpion, as they can recognise when the scorpion is likely to sting or not.

There are 2 different ways that a scorpion responds to a threat.

Primary Defensive Behaviour

Primary defence mechanisms do not involve the use of venom. This defensive behaviour is used when the threat is low such as when the scorpion detects your nearby footsteps. If a scorpion cannot retreat and hide away, it will stand its ground and put on quite a show in order to look intimidating.

The following are examples of primary defence strategies:

Venomosity Rule Of Thumb

Southern Africa is home to the Rough Thick-tail Scorpion which is the 12th most venomous scorpion in the world, but also some of the world's least venomous scorpions (Rock Scorpions). Unlike snakes and spiders, where an understanding of specific species is required to appreciate their venomosity, there is a simple method when it comes to scorpions.

In southern Africa, there is a reliable way to estimate the strength of a scorpions venom, just from its appearance. This is called this the venomosity rule of thumb. This method does not apply to all scorpions in the world but it does apply within the context of southern Africa.

Highly Venomous Scorpions



These scorpions are characterised by thin pincers and a thick tail. They often live in a temporary shelter and can be seen at night actively foraging for prey. These scorpions are quick to use secondary defensive behaviour in order to defend themselves.

Examples of highly venomous scorpions include:

- All Thick-tail Scorpions.
- All Lessor Thick-tail Scorpions.
- All Nomad Scorpions.

- It functions as a sunblock, protecting the animal in harsh sunny conditions.
- It allows the scorpion to “feel” light reflected by the moon so that the scorpion can avoid being active during bright moonlight nights.

These theories are just that... theories. Further research is necessary to determine the reason why scorpions have this strange ability. Whatever the reason, finding scorpions at night is easier by using an ultra violet light. On a dark night a small scorpion of only 2cm in length, can be seen over 10m away.

Importance In Ecosystems

In many areas of Southern Africa, scorpions are abundant, preying upon a variety of small animals, and in turn being preyed upon by other animals. This all year round abundance makes them an important component of an ecosystem.

Scorpions As Predators

Scorpions are opportunistic predators, preying upon just about any small animal that they encounter and can overpower. Although their diet consists of mainly insects, they will also catch and eat a wide variety of small animals. Scorpions have been observed preying upon worms and even baby birds that had

Scorpions are very nutritious and packed with water. Ideal food for predators!





The most effective way to avoid being stung by a scorpion is to be more aware and mindful of their presence.

Living With Scorpions

Scorpions are fascinating creatures that have captured the imagination of mankind for centuries. However, for many people - a scorpion represents an animal that the world would be better without, a creature that should be killed on sight!

It is interesting how two people can see the same scorpion and have completely different reactions! One person may be fascinated by the scorpion while, at the same time, the other person will be afraid of it. It is the same scorpion, the only difference is that these two different perceptions are being created by 2 different sets of values and beliefs.

Our values and beliefs are a lens through which we experience the world. It's interesting to note that those people who are afraid of scorpions are the same people who know the least about them. These individuals become susceptible to misinformation, questionable newspaper articles, social media hearsay and neighbourhood gossip. This creates a cycle of fear, which in turn generates more ignorance which in turn, creates more fear. This cycle of fear and ignorance can, however, be broken through deepening our knowledge and understanding.

French writer Anais Nin said “we don’t see things as they are, we see things as we are”. If the first question you ask when you see a scorpion is how dangerous is it, then I would suggest you re-evaluate

Test Your Knowledge

Test your knowledge of scorpions by answering the following multiple choice questions. All of the answers to these questions can be found in the Scorpion section.

1) What does arthropod mean?

☐

Many legs.

☐

Hard legs.

☐

Jointed legs.

2) What is the main characteristic of an invertebrate?

☐

They do not have a backbone.

☐

They live upside down.

☐

They are small in size.

3) In which phylum do scorpions belong to?

☐

Arthropoda.

☐

Mollusca.

☐

Chordata.

1) Find A Scorpion

Once you have found a scorpion, complete the following:

1.1) If you know the common name of the scorpion, write it below.

Common Name

1.2) Take a few minutes to observe the scorpion without disturbing it, and make some nature explorer notes under the following headings.

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