

Spider (Ordo Araneae) as a Predator Arthropoda

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DOI: [10.36347/sjavs.2023.v10i07.001](https://doi.org/10.36347/sjavs.2023.v10i07.001)

Received: 29.05.2023 | Accepted: 05.07.2023 | Published: 14.07.2023

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Abstract

Review Article

Spiders are animals that belong to the class Arthropoda phylum Arachnida. Spiders are spread in almost all parts of the world. Spiders can be classified as soil arthropods which are soil-dwelling organisms. The role of arthropods in agro-ecosystems is divided into four, namely as herbivores, decomposers, predators and pollinators. Spiders act as predators. Predatory arthropods are arthropods that eat part or all of their prey's body directly.

Keywords: Arthropoda phylum Arachnida, Predatory arthropods, agro-ecosystems, Spiders.

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INTRODUCTION

Arthropoda was the phylum with the highest number of animals. Eighty-five percent or approximately 600,000, of animal species are arthropods (Djakaria and Sungkar, 2008). The name "arthropod" comes from two Greek words, arthros, "jointed," and podes, "foot." All arthropods had appendages in the form of joints. The number of appendages decreases in more developed limbs; individual appendages may be modified into antennae, mouths of various types, or legs. The body is segmented and has a hard shell composed of chitin which functions as an exoskeleton. The skin experiences exfoliation (ecdysis) at certain time intervals and breathing through the gills or trachea. Live in aquatic and terrestrial habitats (Lumowa, 2017).

The Arthropod phylum consists of ten classes, five of which are the main classes that play a large role in human life, namely Crustacea, Diplopoda, Chilopoda, Insecta, and Arachnida, while the other five classes, namely Trilobita, Merostoma, Pyenogonida, Pauropoda, and Symphyla, are classes that are less important in human life. Among the classes Crustacea, Diplopoda, Chilopoda, Insecta, and Arachnida, only the Crustacea class has an aquatic habitat, whereas the other four classes are generally terrestrial organisms, especially in special habitats in plantation ecosystems (Brotowidjoyo, 1990).

Arthropods can be found in a variety of habitats. Urban and suburban environments provide suitable habitat for small numbers of scorpions, spiders,

mites, millipedes, and centipedes, and other arthropods. Many of these arthropods live in stable populations in periodic habitats, such as grasses, flowers and shrubs, and ornamental trees. Some arthropods have adapted to live indoors in residential buildings. The population and body size of these arthropods are usually small (Robinson, 2005).

There are also so-called soil arthropods which are soil-dwelling organisms that play an important role in soil fertility. Soil arthropods in a habitat are strongly influenced by the conditions of the habitat. Soil arthropods will be abundant in habitats that are able to provide factors that can support the life of soil arthropods such as food availability, optimal temperature, and the presence or absence of natural enemies. Soil damage will have an impact on the existence of living things on the surface or below the soil surface, including arthropods. The loss of these soil arthropods will greatly affect the balance of the ecosystem (Syauфина *et al.*, 2007)

The role of arthropods in agro-ecosystems is divided into four, namely as herbivores, decomposers, predators and pollinators. The role of arthropods as herbivores is very important because they can maintain the balance of the ecosystem, but if the feeding activity of these arthropods reduces the economic value of crop production, they are called pests. The role of arthropods as decomposers is to help the decomposition process of dead plants and animals into nutrients. Decomposition (decomposition) is the process of changing complex organic matter into simpler molecules so that plants can

absorb them. The next role of arthropods is as natural enemies. These natural enemies are divided into two, namely predators and parasitoids. Predators are arthropods that prey on part or all of their prey's body directly, while parasitoids are arthropods that parasitize or live on other insects, causing death to the host they host (Leksono, 2017). Arthropods that are predators include dragonflies, beetles, wasps, ants, scorpions, centipedes, and spiders (Robinson, 2005).

SPIDER

A. Taxonomy and Morphology

Spiders belong to the Arthropoda phylum, the Chelicerata subphylum, the Arachnida class, and the Araneae order. Spiders are a large and widespread group with more than 3,700 described species in North America and more than 38,000 worldwide. Spiders occur in many types of habitats and are often very

abundant. Typical non-desert habitats can reach up to 800 spiders per square meter (Borror *et al.*, 2005).

This order of spiders is further divided into three major groups at the suborder level, namely: a. Mesothelae, which are primitive spiders, b. Mygalomorphae or Orthognatha, is a group of spiders that make burrows and traps in the ground, c. Araneomorphae is a group of 'modern' spiders. Most of the spiders encountered belong to this suborder, (Lumowa, 2007).

The spider's body is divided into two regions, the cephalothorax and abdomen. The abdomen, usually soft and non-elastic, is connected to the cephalothorax by a narrow pedicel. The cephalothorax contains the eyes, mouth, feet, pedi palps and abdomen. The abdomen contains the primary reproductive structures, the respiratory system, testicles, anus, silk glands, and spinnerets (Borror *et al.*, 2005).

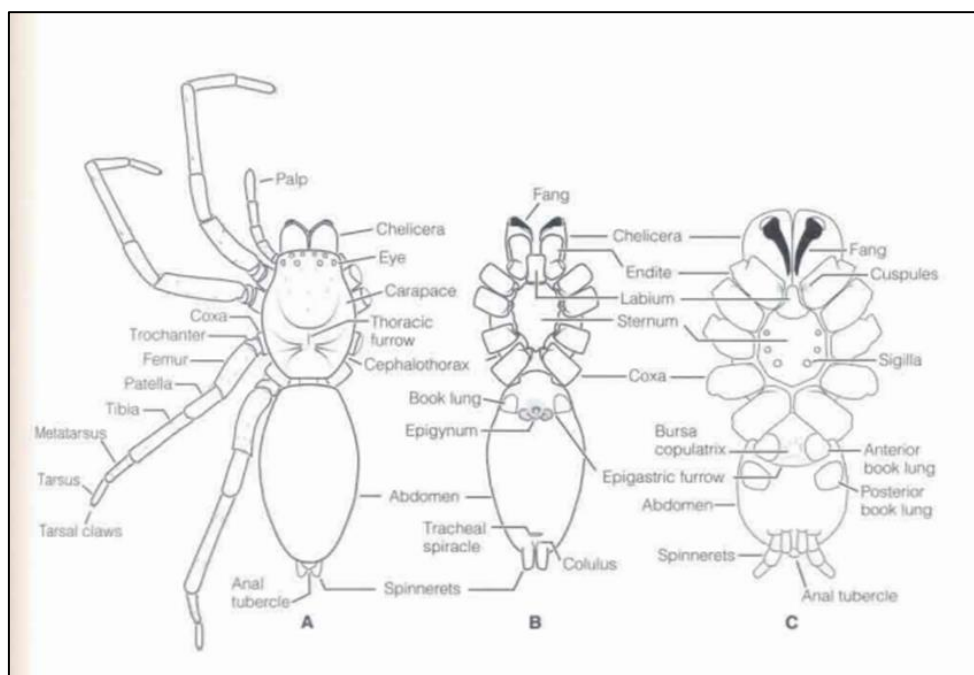


Figure 1: Structural characteristics of the spider. A: Back view (general); B: Ventral view; C: Ventral view, mygalomorph (Borror *et al.*, 2005)

The cephalothorax is covered dorsally by the bases of the legs and ventrally by the sternum. In front of the sternum is a small sclerite called the labium which is fused with the sternum. Spiders primitively have eight simple eyes, but some taxa have fewer. The number and arrangement of the eyes are important in identifying a spider. The area between the anterior eye and the carapace edge is the clypeus. The first pair of appendages are called chelicerae. Chelicerae have two segments, a solid base and articulated which can be moved. The opening for the venom gland is located near the end of the fango. In some families, the cheliceral bases can be united by lamella membranes (Borror *et al.*, 2005). The chelicera are not only for

subduing prey or defense, but also function as "pliers" for all kinds of grips. That's why they are referred to as spider hands, for example for digging holes, for carrying egg cocoons, and for transporting small prey. In front there is also a tool in the form of a pedipalpus. Pedipalps are often used during prey capture to continuously touch and manipulate prey (Foelix, 2011). In some types of spiders, the pedipalps in adult males enlarge and change their function as an auxiliary tool in mating (Koneri, 2016).

The abdomen and cephalothorax are connected by a thin connector called the pedicel or pedicellus. According to Koneri, (2016) in the abdomen there are

organs of digestion, circulation, respiration, excretion, reproduction and production of threads or spinnerets. The abdomen consists of 11 segments. Two pairs of book lungs open between the sternites of abdominal segments 1 and 2. The abdomen has specialized glands for producing and manipulating silk, which play an important role in foraging and dispersal of this arthropod (Robinson, 2005).

B. Reproduction and Development.

The two sexes of spiders often differ greatly in size, the female is larger and heavier, and the male is smaller but with relatively long legs. The male usually does not live long after mating. The fertilized eggs are stored in a silk sac. These pouches vary according to their construction. They may be laid in nets, kept in some protected location, or carried around by the female. The number of eggs in a bag varies from 1 to more than 2,000. The eggs usually hatch soon after being laid, but if the eggs are laid in autumn the young may remain in the sac until the following spring. Spiders generally molt anywhere from 3 to 15 times during their growth to maturity; males usually experience fewer molts than females. Most spiders live 1 or 2 years, and some females can live as long as 20 years (Borror *et al.*, 2005).

C. Ecology

Spiders are organisms that can be found almost all over the earth's surface, especially in land areas from the polar regions to dry desert areas. Spiders can also live in caves, mountain peaks, tunnels, even under water. Based on habitat selection and foraging behavior, spiders are grouped into three main functional groups: 1) ground hunter spiders, 2) plant hunters, 3) web makers. Spiders are usually found in abundance in places with dense vegetation because they have relatively stable environmental conditions and are ideal places for nesting and there are more food sources (Koneri, 2016).

All spiders are predators and feed mainly on insects. Some spiders occasionally eat small vertebrates. Prey is usually killed or paralyzed by venom injected into it by the spider's bite. Different spiders catch their prey in different ways. Some actively forage and pounce on their prey, others sit and wait for their prey. Many spiders catch their prey with webs. Some spiders are kleptoparasites, living in the webs of other spiders and stealing prey from them. A small number of spider species have a certain degree of social organization. Social spiders can work together to build webs of several cubic meters and eat prey they conquer together. Spiders play an important role in almost all terrestrial ecosystems. They are generally quite numerous, and have an impact on the predation of other animals, especially insects (Borror *et al.*, 2005).

D. Anatomy

Spiders The anatomical structure of the spider is a very unique structure, in which the anatomical structure of this spider has its organs spread over the two main parts of the spider's body, namely the cephalothorax and the abdomen. The anatomical structure of the spider consists of internal organs which are physiologically very important in the survival of the spider itself, these organs have a role in the respiratory system, digestive system, circulatory system, nervous system and reproductive system (Foelix 2011).

E. Life Cycle

Spiders undergo incomplete metamorphosis; gradually, namely the eggs hatch into juveniles (young spiders) and experience several instars until they develop gradually into adult spiders. The number of instars depends on the spider species, namely 5-10 instars. Small spiders only have 5 instars, while large spiders have up to 10 instars. After fertilization, the female produces an egg sac, which varies in size and shape depending on the species. The egg sac generally consists of a collection of silk threads that wrap around the egg. Some species leave these pouches near their habitat or in burrows. Male spiders generally die after copulation. Spiders' diet includes a variety of other arthropods, including sowbugs, millipedes, pseudoscorpions, harvestmen spiders, and other spiders. As predators their potential food varies, but most species are adapted to the size and frequency of prey present in their habitat. The food is insects and other small animals which are caught in their nests and killed with their toxins (Robinson, 2005).

F. The Role of Spiders in the Ecosystem

Spiders in an ecosystem have a very important role both as biological control agents (biocontrol) against pests and can also be used as bioindicators of environmental changes. Spiders are able to consume 40-50% of the insect biomass that attacks apple plants. Spiders are even able to suppress the population of insect pests more than birds or other insectivorous animals. Spiders have a very high sensitivity to environmental changes (Koneri, 2016).

Most spiders are ambush predators, waiting for prey to pass nearby while hiding behind camouflaged leaves, layers of petals, rock crevices, or holes in the ground. Some types have color patterns that camouflage their bodies on the ground, rocks or tree bark, so they don't need to hide. As soon as the insect is caught in the web, the spider immediately approaches and thrusts its fangs into the prey to paralyze and simultaneously send digestive enzymes into the prey's body. The venom that the spider injects through its fangs usually simultaneously digests and destroys the inside of the prey's body. Then slowly the body fluids along with the destroyed internal organs are sucked up by the predator (Lumowa, 2007).

Spider venom is a mixture of substances, mostly neurotoxic polypeptides with a molecular weight of 5–13 kDa. Biogenic amines and proteolytic enzymes are also present. Venom glands are a feature of almost all spiders, and they are all potentially dangerous, at least to their prey (Robinson WH, 2005). In general, spiders contain poison/toxin to kill their prey, but only a few species are dangerous to humans (*Latrodectus mactans*, *Loxosceles laeta*, *Lycosa tarantula*) (Djakaria & Sungkar, 2008).

In observations made by Suana IW and Haryanto H from May to August 2009 on a cashew plantation in Jugil Hamlet, Sambik Bangkol Village, North Lombok, eight species were observed carrying out predation, out of 19 spider species, namely Phintella sp., *Chosmophasis estrellensis*, *Plexippus paykulli*, *Neoscona theisi*, *Neoscona nautica*, *Misumena tapyasuka*, *Agelena limbata* and *Tetragnatha maxillosa* (Suana & Haryanto, 2013).

In research conducted by Hasyimuddin *et al.*, on soil insects in plantations, 14 species were found included in 13 families, including the species *Xysticus fervidus* which is included in the araneae family. Soil insect species found are soil insect species that act as pollinators, decomposers, predators, parasitoids and bioindicators (Hasyimuddin *et al.*, 2017).
Some Spider Species:

1. *Xysticus fervidus* (Garden spider)

The female *Xysticus fervidus* has a total body length of 6.15 mm. The color is pale yellowish brown, mottled with dark brown. On the posterior with small black spots on each side. Legs pale yellowish brown, speckled with small brown spots. The belly is mostly gray above, with an indistinct pattern on the back and three pairs of small black blotches (Gertsch, 1953).

This spider is slightly flattened and lacks a scapula and claw tufts. The lateral eyes are often larger than the median and are located on the tubercles. Chelicera are almost always toothless, or have two serrated margins. Legs I and II are longer and thicker than legs III and IV. This spider is a predator that sits and waits for its prey. This spider actively walks on the ground and can change color, for several days, depending on the color around it (Borrors, 2005).

Xysticus fervidus has an important role in human life, especially in agriculture. *Xysticus fervidus* is a polyphagous predator so it plays an important role in controlling insect populations. *Xysticus fervidus* preys on small animals. to maintain ecological balance or as a natural controlling agent in the ecosystem. In agriculture, this species is able to control ladybug attacks and is an effective aphid predator (Hasyimuddin *et al.*, 2017).

2. *Latrodectus mactans* (black widow spider)

The female *Latrodectus mactans* measures 13 mm, is black and has a red hour glass appearance on the ventral abdomen. Males are 6 mm in size, have a red median stripe and 3 white transverse stripes on the dorsal side of the abdomen. Usually the male spider is killed by the female spider after copulation. The venom is neurotoxic to peripheral nerves. At the site of the bite, a red, blue lump appears, surrounded by a white circle. The bite causes intense pain. The pain radiates to the chest and abdomen and symptoms such as acute abdomen arise. Shock and respiratory paralysis may occur causing death within 18-36 hours. Psychiatric disorders can also occur. *L. mactans* causes systemic arachnidism (Djakaria & Sungkar, 2008).

3. *Loxosceles laeta*

Loxosceles laeta is found in the Americas. The shape is small (uk. 8 – 15 mm), dark yellow in color. These spiders are also called ‘violin spider’ because of the characteristic violin like marking on the dorsal surface of cephalothorax in many species, or ‘brown spider’ because of their dull brown coloration. They are mainly nocturnal and since they seek dark places to shelter, they are commonly attracted to human habitation. If accidentally handled they bite with their inwardly pointing fangs, at the same time actively ejecting venom. Causes necrotic arachnidism. At the site of the bite it causes edema and pain, and when the edema disappears necrosis will occur (starting in the middle) until the skin peels off and a large and deep ulcer forms. Severe conditions arise systemic symptoms and even death due to heart failure and usually occurs in children (Djakaria & Sungkar, 2008; Peters & Pasvol, 2007).

4. *Tarantula*

This large spider is dark brown. The species is *Lycosa tarantula*. Big shape and scary look. The bite causes local pain and is not dangerous (Djakaria & Sungkar, 2008).

CONCLUSION

Spiders in an ecosystem have a very important role both as biological control agents (biocontrol) against pests and can also be used as bioindicators of environmental changes. Several species of spiders have an important role in human life, especially in agriculture. Spiders are predators that play an important role in controlling insect populations in this case preying on small animals. to maintain ecological balance or as a natural controlling agent in the ecosystem. Venom glands are characteristic of almost all spiders for killing their prey. There are several species that are dangerous to humans, namely *Latrodectus mactans*, *Loxosceles laeta*, and *Lycosa tarantula*.

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