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Medical Importance of Vinegaroon or Whip-scorpion (Uropygi or Thelyphonida) in Natural Atmosphere

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Abstract

In this article, our focus is on giant vinegaroons or giant whip scorpion *Mastigoproctus giganteus* (Lucas) [Arachnida: Thelyphonida (Uropygi): Thelyphonidae]. The giant whip scorpions are more closely related to spiders than scorpions. While called a scorpion, this arachnid has neither venom-filled stinger as found in scorpions nor the venomous bite set up as in some spiders. One very distinct and curious feature of whip scorpion is its long thin caudal appendage, which is directly related to their common name ‘whip-scorpion’. The common name 'vinegaroon' is related to their ability to give off a vinegar-like spray of concentrated (85%) acetic acid from base of whip-like tail. They can accurately spray acetic acid from a pore at base of caudal filament out to a distance of from a few inches to one foot. This defensive spray is not dangerous to skin, but wounds severely if it gets into an animal's eyes or nostrils. The substance can cause mild chemical burns on some people, and liquid acidic substance may result in pain, skin irritation and blistering. They usually do not secrete this substance unless these are provoked otherwise are typically extremely docile. Large pedipalps (pincer-like appendages) help whip scorpions to catch and kill their prey by crushing them. When threatened, vinegaroons seek refuge of their burrows or put on a bluff display of rearing up and spread their pedipalps. While mishandled, these pedipalps can give a noticeable pinch to a person. The giant vinegaroon is a predator and therefore helps to keep the populations of its prey in check. This carnivorous arachnid eats slugs, worms and insects such as crickets, termites and cockroaches. It is a prey to coatis, raccoons, armadillos and skunks, as well as other carnivorous animals. If someone has never heard of giant whip scorpion, its name may sound rather terrifying and can become even more afraid when seen outside of home or business. Whip scorpions are nocturnal and spend their daylight hours hidden under debris or wood piles on soil or within clutter in storage areas of structures. In the direction of control to whiptail scorpions, removing their source of hiding places is a necessity. The first defence against scorpions is natural pest control, which is accomplished by removal of habitat around structures. Points of entry into home such as cracks in foundation or around windows should be sealed. Depending on severity of condition, healthcare provider may give proper treatment and rehabilitation to treat a person by following safety procedures and taking precautions.

Keywords

Vinegaroon, Whip-scorpion, Medical Importance, Poison Gland, Defensive Secretion

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1. Introduction

The arachnids (class Arachnida) are an arthropod group belonging to the subphylum Chelicerata that lack antennae and typically have six pairs of appendages [1-12]. The first pair of appendages is chelicerae found in front of the mouthparts and look like modified pincers. The second pair is pedipalps, which function as sensory organs in spiders and as pincers in scorpions. The remaining four pairs of chelicerates, are the walking legs [13-25]. Amblypygi (whip spiders), Uropygi = Thelyphonida (whip scorpions or vinegaroons), Schizomida (short-tailed whip scorpions) and Palpigradi (micro-whip scorpions) are all small, unfamiliar arachnid groups that closely relate to each other and to spiders. Species in the clade have a highly conserved morphology, including a pair of strong raptorial pedipalps and a pair of antenniform first legs, which no longer function in locomotion, but instead have evolved a sensory function. Within the pedipalpi, the orders Thelyphonida and Schizomida together form the clade Uropygi, largely characterized by a segmented pygidium and a pair of defensive glands (also known as acid glands, anal glands and pygidial glands) [26-27].

Vinegaroons or whip scorpions *Mastigoproctus giganteus* (Lucas) (order Thelyphonida, formerly Uropygi are large, scorpion-like arachnids with a ‘whip-like tail’. They are often called uropygids in the scientific community based on an alternative name for the order, Uropygi (which may then also include the order Schizomida). They have no venom glands, but when disturbed, will spray acid (acetic and octanoic) from glands at the base of their tail, thus the common name referring to the vinegary smell. Vinegaroons can be quite large, up to 85 mm (3.3 inches) counting legs and the tail, and they run about 6 inches long, but are harmless to humans. About 100 species of vinegarrons are known globally; including *M. giganteus* has also been discovered. They live in tropical and subtropical areas worldwide. Giant whip scorpions are dark brown and have eight eyes. Two eyes are positioned at the front of the head and the sides of their head house the other six eyes [28].

One very distinct and curious feature of whip scorpion is its long thin caudal appendage, which is directly related to their common name ’whip-scorpion. The common name 'vinegaroon' is related to their ability to give off a spray of concentrated (85%) acetic acid having vinegar-like scent from the base of the whip-like tail. As a group, whip scorpions are found worldwide in the tropics and subtropics. While more commonly encountered in arid areas, *M. giganteus* can also be found in grassland, scrub, pine forests and barrier islands [29].

Vinegaroons have two major body segments, head (cephalothorax or prosoma) and abdomen (opisthosoma, including the whip-like flagellum). Their second set of appendages, the pedipalps, are very large and frightening, and are used to catch and chew prey. The thick front legs are actually pedipalps, the first pair of legs is extremely long and used like antennae, while the last three pairs of legs are used for walking [30].

2. Morphological Description

Vinegaroon is a fairly large creature, up to 5 cm long, which does not include the caudal flagellum or telson. Large pincer-like appendages (pedipalps) help whip scorpions to clasp and kill their victim by crushing them. A pair of long, thin, front legs acts almost like antennae as they feel about for their prey in the dark. The whip-like telson also functions as a sensory organ. These three structures apparently help to compensate for their eight weak eyes. The first pair of legs is elongate and used as sensory devices, and only their last three pairs of legs are used for walking. The walking legs of vinegaroons are covered in sensory hairs. Giant vinegaroons range from 25 to 85 mm (1.0 to 3.3 in) in length, with most species having bodies no longer than 30 mm (1.2 in), whereas the largest species of the genus Mastigoproctus can reach 85 mm (3.3 in). Because of their legs, claws and whip, they can appear much larger, and the heaviest specimen weighed as 12.4 grams [31].

Vinegaroons resemble to scorpions in many aspects, but are actually more closely related to spiders. Their pedipalps are modified into two large claws, and they have two front legs that are held aloft and six legs that are used for locomotion. They have a thin, flexible tail extending from the end of their abdomen, giving them the common name 'whip scorpions'. Their body is divided into two parts, the cephalothorax (prosoma) and the abdomen (opithosoma). Both sections are flat and oval-shaped. Their walking legs have 7 segments and tarsi have 3 parts, ending in 2 claws. There is one pair of eyes located on the front of their head, while there are 3 more eyes on each side of the head. The *M. giganteus* is one of the largest species of vinegaroons, growing to lengths of 40 to 60 mm, not including the tail. The body is typically black, with some sections or appendages brown or reddish-brown. Males have larger pedipalps and a movable finger on the palps. Nymphs resemble to adults, though they lack secondary sexual characteristics, such as spines on the palpal trochanter and the movable finger on the male pedipalps. Nymphal males and females have identical claws [32].

General features of uropygids include [33] as given under: -

1) One pair of eyes at the anterior of the cephalothorax and three on each side.

2) A long whip-like flagellum on the pygidium, which is a small plate made up of the last three segments. The function of this structure is unclear, but it is possible that it may be used to detect air movement and or may have a chemosensory function.

3) Only six of the eight legs are used for walking, as the first legs are elongated and held out horizontally as the animal walks. These first legs function as sensory organs (this similarity is shared by Schizomida, Amblypygi and Solifugae).

4) Most species have robust pedipalps, which are raptorial and move on a horizontal (lateral) plane.

3. Life History and Habitat

Whip scorpions are nocturnal predators of other arthropods. During the day time these remain out of sight in burrows they dig with their pedipalps. They can often be found under logs, boards, rotting wood, rocks and other natural dark places. Most whip scorpions occur in moist or seasonally moist forested habitats in tropical or subtropical environments. The *M. giganteus* occurs in more arid habitats with well-drained soil. They spend the driest periods underground and become active on the surface during rainy season. Giant vinegaroons typically live in arid, desert habitats in the southwest and scrub forests and grasslands. They have also been found in dry mountainous areas, as high as about 6,000 m. They can be found taking shelter beneath plant debris, in rock crevices or in burrows dug by other animals or themselves [34].

The primary prey of *M. giganteus* is soft bodied insects like termites, cockroaches and crickets. One of the common preys of adults in is the woods roach *Eurycotis floridensis* (Walker). Live food such as crickets and roaches are crushed between special teeth on the inside of the second segment of the pedipalps. Vinegaroons are nocturnal and have poor vision, relying on sensing vibrations to locate prey. Giant vinegaroons hide in burrows or beneath rocks and logs during the day, and hunt prey during the night. They are most active during the rainy season and stay underground during the driest seasons [35].

Whip scorpions can and will defend themselves when threatened. Special glands at the base of its tail enable the whip scorpion to produce and spray a defensive fluid. Usually, a combination of acetic acid and octanoic acid, the whip scorpion's defensive spray gives off a distinctive vinegar-like smell. Owing to this unique odour that is why the whip scorpion is also known by the nickname vinegaroon [36].

The male vinegaroons are often encountered in the desert during the summer rainy season. They tend to come out at night in search of prey and mate. They make burrows and can also be found under rocks and logs. Vinegaroons are predacious and eat insects and other small prey. Males transfer spermatophores to females during a long mating dance. Males secrete a spermatophore (a united mass of sperm), which is deposited on the ground and picked up by the female using her genital area. In some courtship behaviour, the male holds the ends of the female's first legs in his chelicerae and then uses his pedipalps to push the spermatophore into her body. The female protects her eggs until they hatch and the young cling to her back until they are ready to moult again. Vinegaroons grow by moulting and may take up to four years to reach adulthood. They may live up to two years after that stage [37].

4. Reproductive Behaviour

Vinegaroon’s mating occurs in the fall during the night, wherein the courtship and mating combined may last up to 12 hours. In the event that a female is unwilling to mate, the male and female will fight and push each other away. However, if the female is willing, the pair will do a courtship ‘dance’ which can last for hours. It consists of the male, having grabbed the female’s atenniform legs with his chelicerae, dragging her back then stroking her with his pedipalps. In response, the female will move backward and open her pedipalps, all the while the male still stroking her. This is repeated until the next stage, in which the male lays a sperm sac on the ground. This may take two hours to harden and during that time the pair remains motionless. After it hardens, the female will pick it up and the male will push it inside her gonopore. This last part of the process may last up to two hours [38].

For *M. giganteus,* mating typically takes place at night, during the fall season. To initiate mating, the female first cautiously approaches the male. If the female does not want to mate, pairs often get into fights, where they push against each other with their pedipalps, until both back away from each other and rock back and forth. Typically, the male is the first to leave. However, if the female is willing, the male aggressively grabs at the female with his palps, struggling with her, until he is able to grab onto her first pair of legs, the antenniform legs used for sensory purposes. He then grabs the tips of her antenniform legs with his chelicerae. The male walks backwards, dragging the female with him. After several steps, he stops, and moves towards her, stroking her antenniform legs and pedipalps with his

pedipalps. In response, the female moves backwards by opening her pedipalps. He moves towards her again, touching her and the surrounding area with his antenniform legs. The female continues to move backwards until the male also begins to move backwards in the other direction, pulling her towards him and beginning the series of motions all over again. This courtship "dance" may continue for several hours, until the male eventually releases the female's antenniform legs with his pedipalps, but not his chelicerae. He turns so they are both facing the same direction and the female grasps the male's abdomen with her pedipalps. The male moves forward, secreting the spermatophore on the ground as he does so. The spermatophore takes 2 or more hours to form, during which the pair remains motionless. When it is fully formed, the male pulls the female forward towards the spermatophore. The gonopore of the female takes up the sperm carrier from the spermatophore and the pair releases each other. The male then turns around, and climbs partially over the female so he can use his palpal chelae to manipulate the sperm carriers and her gonopore, pushing the sperm carriers inside her. The male may do this manipulation for two hours or more and eventually the pair separates [39].

After mating, females carry the fertilized eggs internally for a few months. They then lay the eggs in a fluid filled sac, with each sac containing 30 to 40 eggs. The eggs are protected from desiccation by a moist membrane. The sac is carried by the female, held from her abdomen. Females remain in their burrow during this process for an additional two months, staying motionless and holding her abdomen and the egg sac off the ground while the eggs develop. Once eggs hatch, the nymphs climb aboard the back of the female and remain there for about a month, until their first moult. After their first moult, the nymphs disperse. Giant vinegaroons have 4 nymphal stages, with 4 moults, before reaching adulthood. Moults occur about once in a year, usually during the summer. Preparing to moult can take months, during which, vinegaroons construct a moulting chamber that they do not leave, not even to feed. The opithosoma visibly inflates, until the skin splits and the newly moulted instar emerges from the skin. The new instar is white and stays white for 2 or 3 days. Complete pigmentation and sclerotization takes 3 to 4 weeks. After the fourth and final moult, the adult is sexually mature, with secondary sexual characteristics that are not present in the nymphal stages. By this time, the female is usually so weak and starved that she falls into a state of lethargy and eventually dies. Because of this, females only produce one egg sac in their lives. The *M. giganteus* reaches to sexual maturity in 3 to 4 years. Their lifespan is 4-7 years for both males and females, but when kept in captivity they can live longer [40].

5. Offspring

A few months after mating, the female will dig a large burrow and seal herself inside. Giant vinegaroons excavate their own burrows using their pedipalps to dig and carry the dirt out. A burrow can be used for several months at a time. Up to 40 eggs are extruded once in a female's lifetime, at first, the female will internally incubate them, and then she lays them within a membranous brood sac that preserves moisture and remains attached to the genital operculum and the fifth segment of the mother's ventral opisthosoma for two more months. The female refuses to eat and holds her opisthosoma in an upward arch so that the brood sac does not touch the ground for the next few months as the eggs develop into postembryos. After both internal and external incubation are complete, the young, or nymphs, will hatch. Young are white and stay on their mother's back until their first moult, which happens after one month. They will continue to darken and harden for up to 4 more weeks. The mother may live up to two more years. The young grow slowly, going through four moults in about four years before reaching to adulthood. They live for up to another four years. In Mastigoproctus, the young disperse after their first moult and the mother dies soon after. Fairly long-lived, whip scorpions can live at least seven years [41, 42].

Giant vinegaroons can be kept as pets, similar to tarantulas. They are typically kept in aquariums or similar habitats and are fed with insects such as crickets handled with care. Keep them single (do not house together), young specimens can be kept in a Kritter Keeper or a 2 to 5 gallon aquarium with an adequate ventilation. Their bedding can consist of coco fibre or peat with some mulch or peat moss added in to lend humidity. They like to burrow so make sure their substrate is nice and deep. Keep them between 75 and 80°F during the day, use a small heat pad or light to keep temperatures warm enough and hold at 45 to 55% humidity [43].

6. Communication and Perception

Giant vinegaroons walk on their posterior 3 pairs of legs and use their first pair of legs as sensory organs. The first pair of legs, often referred to as antenniform legs, is carried off the ground, and has receptors on them to detect chemical and tactile stimuli and also detect vibrations. They are used to find prey and mates, since they are nocturnal and their vision is weak. Their eyes can distinguish light and dark, but probably nothing more. They walk along slowly, with their antenniform legs moving along the ground and other substrates. If their antenniform legs come into contact with a prey item, they quickly snatch it with their pedipalps. The

antenniform legs can also be used to find water sources, such as moist sand. Their tail and modified pedipalps also act as sensory organs. The pairs of legs used for locomotion are covered in sensory hairs. Tactile connections are used throughout the mating process, as the male holds on to the female using his palps, chelicerae and antenniform legs [44, 45].

7. Roles in Ecosystem

Vinegaroons are carnivorous, nocturnal hunters feeding mostly on insects, millipedes, scorpions and terrestrial isopods, but sometimes on worms and slugs and small vertebrates. Giant vinegaroons are significant predators and their primary diet is many insects and other arthropods, amphibians and terrestrial non-insect arthropods. They are also occasionally preyed to small mammals such as deer mice (Peromyscus) and shrews (Soricidae) as well as larger mammals such as raccoons (*Procyon lotor*) and wild hogs, as well as southern grasshopper mice (*Onychomys torridus*), camel spiders (Solifugae), armadillos (Cingulata) and feral hogs (*Sus scrofa*). The *M. giganteus* is a carnivore and an efficient predator that feeds on a variety of arthropods, primarily insects such as cockroaches and crickets, as well as millipedes and other arachnids. It has even been recorded feeding on small frogs and toads. It uses its large pedipalps to hold prey, while the chelicerae tear and bite the prey. This is large enough to be a reasonable meal for mammals like raccoons, coatis, armadillos, skunks, and even bear, feral hogs and peccaries [44, 45].

8. Economic Importance for Humans

Vinegaroons are not poisonous and do not have a stinger, but they are capable of releasing acid from their tail that smells like vinegar (how they get their name). Whip scorpions use their antenniform legs carried off the ground to detect chemical and tactile stimuli, such as vibrations, water and finding of victims and mates. Additionally, the flagellum and pedipalps are used to obtain sensory information. Large pedipalps (pincer-like appendages) help to whip scorpions catch and kill their prey by crushing them. When mishandled, these pedipalps can give a noticeable pinch to a person [46].

Defensive posture is exhibited by having the abdomen and pedipalps raised and the flagellum outstretched. When threatened, vinegaroons seek the refuge of their burrows or put on a bluff display of rearing up and spreading their pedipalps. They can also accurately spray acetic acid from a pore at the base of the caudal filament out to a distance of from a few inches to one foot. This defensive spray is not dangerous to skin, but stings severely if it gets into an animal's eyes or nostrils [47].

The pygidial glands are the most distinctive feature of uropygids, and give thelyphonids one of their common names called vinegaroons. These glands secrete an acid cocktail of mostly acetic acid (vinegar) and caprylic acid (octanoic acid) that can be directed at potential predators in the form of a spray. The substance can cause mild chemical burns on some people. They usually do not secrete this substance unless they are provoked and are typically extremely docile. Be forewarned that if anyone encounters a vinegaroon, it can hit with its defensive acid from a distance of a half-meter or more [48].

While they look frightening, whip scorpions cause few problems if left alone and are unable to bite or sting. When disturbed, the pests release an acidic substance from their tails that has a strong, vinegar-like smell. This liquid may result in pain, skin irritation and blistering. Some species also use their large pincers in self-defence as well as to capture and subdue prey. Whip scorpions do not produce venom and do not have a venom gland, so they do not sting or cause pain as true scorpions do. The defensive, acetic acid substance that *M. giganteus* sprays from the gland by its tail can cause irritation and pain to a handler or collector in the wild, especially if the substance gets into the eyes. There has been at least one instance of the spray causing blistering of the skin. Giant vinegaroons can also pinch with their large pedipalps, if they feel threatened or disturbed [49].

For defending of itself, *M. giganteus* can spray a substance, mainly comprised of acetic acid, from the pygidial gland at the rear of the body, by the base of the tail. This spray is what gives them the common name 'vinegaroons'. The spray is very effective at warding off predators and it lingers in the air. Giant vinegaroons are also very accurate with their aim and since they only spray when physically prodded or touched; predators are at a close range when sprayed. Once a predator has been sprayed, it is usually observed darting away, shaking its head and trying to clean itself, obviously in distress. Giant vinegaroons can discharge their spray as many as 19 times in a row before being depleted. Those that are depleted are able to spray again by the next day [50].

Some small mammals, such as grasshopper mice, deer mice, and shrews, can successfully prey on giant vinegaroons, despite of the vinegar spray. These small animals are often very aggressive and persistent, attacking the vinegaroons until they are depleted. Camel spiders are as well predators of vinegaroons. Larger mammals such as raccoons, armadillos and feral hogs are also likely predators [44, 45].

The glands of opilionids and whip scorpions are purely defensive devices, whose dischargeable contents serve to

repel enemies. The concentrations of the constituents of the defensive secretions vary individually; however, there are no age or sex differences between individuals. Although acetic acid is quite a wonderful defence on soft fleshy parts, it is water soluble and will roll off an exoskeleton of its attacker without harming it. So, it needs to employ another tactic. Mixed with the acetic acid is another acid, caprylic acid, which is able to move through the waxy cuticle of the exoskeleton. This mixture spreads to cover more area as well as actually getting under that exoskeleton, so it can do some damage. In the end, when the mixture is actually shot out of two storage compartments in the vinegaroon, it is composed of 84% acetic acid, 5% caprylic acid and 11% water [51].

Upon contact stimulation, a defensive spray may be discharged (up to 80 cm) by many subsequent ejections (maximal number of discharges: 19) and exactly aimed toward aggressors. Typically, acetic acid represents the main constituent (45-98%) of all six species from three thelyphonid genera (Mastigoproctus, Typopeltis, Thelyphonus) hitherto analysed. The watery secretion (11–26% water) may also contain minor amounts of further saturated C_6 to C_{10} acids and monounsaturated (E)- and (Z)-5-octenoic acids [51].

9. How to Get Rid of Giant Whip Scorpions

Vinegaroons are beneficial creatures and should be left undisturbed when found. Although this particular scorpion does not bite, that does not mean they cannot become a nuisance. They are predators that feed mostly on insects; they work at night and hide during the daytime. If giant whip scorpions is seen around home or business and become concerned, reach out to a pest control professional to use effective mechanical, chemical and environmental methods.. An expert with the proper training can provide the right solution to eliminate giant whip scorpions if control is necessary.

9.1. Prevention Measures

Yards with piles of firewood or other debris provide good hiding places for the pests. When searching for prey, they can wander inside homes through cracks in walls, doors and windows [52]. When any vinegaroons enter a structure, it should be captured and released outside. Eliminating of vinegaroons, like scorpions relies on investing in the right chemicals for the treatment. Control is handled best by removing of their habitat around structures. Whiptail scorpions hide during the daylight hours under debris or wood piles on the soil. For control, removing of their source of hiding places is a necessity. Whip scorpions are nocturnal, and spend their daylight hours hidden under debris or wood piles on the soil or within clutter in storage areas of structures. Another place they like to hide is within litter in storage areas of structures. The first defence against scorpions is natural pest control, which is accomplished by removal of habitat around structures [53].

They are attracted to moisture and light in lawns and landscapes, and once they settle into a structure their numbers grow. Damper areas may also be an attraction to many of them and will help in their prevention. Spreading of wet burlap bags on the ground in summer and control of moisture and exclusion efforts to prevent their entry to crawl spaces or basements will help to draw them to a location where they can more easily be eliminated [54].

9.2. Control Measures

Controlling of whip scorpions really amounts to several tasks as stated underneath: -

Carefully, find their hiding places both indoors and outdoors. Inside the home, someone can expect them to be hiding in dark areas. Carefully remove items from cabinets, under sinks and the floor of closets, and inspect the areas sensibly. If several scorpions have been found indoors, it is a good idea to wear garden gloves when removing of items for inspection. It can also be used glue boards (the same type used for mice) in closets and under sinks to monitor for scorpions. Outdoors, get rid of piles of debris outside where scorpions, spiders and other pests may hide. Check around rock piles and stones used for landscaping or bark mulches can occasionally harbour scorpions. It is a good practice to check firewood before bringing it indoors as well. Always wear gloves when handling firewood or cleaning up of debris piles [55-56].

Seal properly openings around plumbing fixtures with foam insulation, repair loose fitting doors and windows, caulk cracks in basement walls and foundations, remove stored building materials in the basement or crawl space, and remove debris, including firewood stacks away from the house. Control of scorpions by chemical methods can be difficult and thus is the least preferred route to take up. The reason insecticides do not work well is because scorpions can survive for several months without feeding. Scorpions have been known to live for six months without food and water and may hide for two months after feeding. Therefore, a product with a long residual action is needed to await their emergence. Several insecticides have some effectiveness against scorpions and are available for consumers use [57].

Healthcare professionals should understand chemical burns from exposure to acids (pH less than 7), alkalis (pH greater than 7), and irritants to recognize, manage and care for these types of

injury [58]. The skin pain and burns as well as skin irritation and blistering need to be evaluated every 2-4 days commonly found in the home, workplace and surrounding environment until there are signs of healing. Depending on the severity of condition, healthcare provider may use the succeeding methods to treat a person: antibiotics, anti-itch medications, debridement, which involves cleaning or removing dirt and dead tissue, and skin grafting, which involves attaching of healthy skin from another part of the body to the wound and intravenous (IV) fluids treatment [59-60].

10. Conclusion

Whip scorpions do look similar to scorpions, but are not true scorpions at all. These are arachnids, related to both spiders and scorpions, but they belong to their own taxonomic order, the Uropygi. They are more commonly found in desert areas, but have also been reported in grassland, scrub, pine forests and mountains. Vinegaroons have heavy mouthparts (pedipalps) that are formed into pincers. The first pair of legs is long and thin and used like antenna to feel their way around, while the next three pairs of legs are used for walking. The abdomen is attached widely to the head-thorax region (cephalothorax). The tail is long and thin suggesting a whip, which is where the common name, whip scorpion, originates for the order Uropygi. Species of whip scorpions range from small, light coloured kinds about 3 or 4 mm long to the huge, black *M. giganteus* that may be almost 3 inches long. Their abdomen is distinctly separated from the cephalothorax and the thin tail appendage, called a flagellum, which extends out from the anal area. In front of the head the pair of palps is modified as very large grasping devices. Though considered non-poisonous, but they can pinch and are capable of spraying a mist from scent glands at the base of the tail when disturbed. The mist produced by some species contains 85% concentrated acetic acid or vinegar, hence the name vinegaroon. If their control is necessary, an expert with the proper training can provide the right solution to eliminate giant whip scorpions indoor and outdoor. The authors expect that further, on-going study of genetics and geographical distribution will uncover even more information about these elusive arachnids and perhaps even more species.

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