= Antlion =

The antlions are a group of about 2 @,@ 000 species of insect in the family Myrmeleontidae , known for the fiercely predatory habits of their larvae , which in many species dig pits to trap passing ants or other prey . The adult insects are less well known , as they mostly fly at dusk or after dark , and may be mistakenly identified as dragonflies or damselflies ; they are sometimes known as antlion lacewings , and in North America , the larvae are sometimes referred to as doodlebugs because of the strange marks they leave in the sand .

Antlions are worldwide in distribution . The greatest diversity occurs in the tropics , but a few species are found in cold @-@ temperate locations , one such being the European Euroleon nostras . They most commonly occur in dry and sandy habitats where the larvae can easily excavate their pits , but some larvae hide under debris or ambush their prey among leaf litter .

Antlions are poorly represented in the fossil record . Myrmeleontiformia is generally accepted to be a monophyletic group , and within the Myrmeleontoidea , the antlions ' closest living relatives are thought to be the owlflies (Ascalaphidae) . The predatory actions of the larvae have attracted attention throughout history , and antlions have been mentioned in literature since classical times .

= = Etymology = =

The exact meaning of the name " antlion " is uncertain . It has been thought to refer to ants forming a large percentage of the prey of the insect , the suffix " lion " merely suggesting destroyer or hunter . In any case , the term seems to go back to classical antiquity . The antlion larva is often called a " doodlebug " in North America because of the odd winding , spiralling trails it leaves in the sand while relocating , which look as if someone has been doodling .

The scientific name of the type genus Myrmeleo ? and thus , the family as a whole ? is derived from Ancient Greek léon (????) " lion " + mýrmex (??????) " ant " , in a loan translation of the names common across Europe . In most European and Middle Eastern languages , at least the larvae are known under the local term corresponding to " antlion " .

= = Description = =

Antlions can be fairly small to very large neuropterans , with wingspans ranging from 2 to 15 cm (0 @.@ 8 to 5 @.@ 9 in) . The African genus Palpares contains some of the largest examples . Acanthaclisis occitanica is the largest European species , with an 11 cm (4 @.@ 3 in) wingspan , and most North American species approach this size .

The adult has two pairs of long , narrow , multiveined , translucent wings and a long , slender abdomen . Although they somewhat resemble dragonflies or damselflies , they belong to a different infraclass of winged insects . Antlion adults are easily distinguished from damselflies by their prominent , apically clubbed antennae which are about as long as the head and thorax combined . Also , the pattern of wing venation differs , and compared to damselflies , the adults are very feeble fliers and are normally found fluttering about at night in search of a mate . Adult antlions are typically nocturnal , and rarely seen by day .

Males of most species have a unique structure , a bristle @-@ bearing knob known as a " pilula axillaris " , at the base of the rear wing . The abdomen in males is usually longer than in females and often has an extra lobe . The tip of the abdomen of females shows greater variation than that of males , depending perhaps on oviposition sites , and usually bears tufts of bristles for digging and a finger @-@ like extension .

The antlion larva is a ferocious @-@ looking animal with a robust , fusiform body , a very plump abdomen , and a thorax bearing three pairs of walking legs . The prothorax forms a slender mobile " neck " for the large , square , flattened head , which bears an enormous pair of sickle @-@ like jaws with several sharp , hollow projections . The jaws are formed by the maxillae and mandibles ; the mandibles each contain a deep groove over which the maxilla fits neatly , forming an enclosed canal for injecting venom to immobilise the victim , and enzymes to digest its soft parts . The larva is clad

in forward @-@ pointing bristles which help it to anchor itself and exert greater traction , enabling it to subdue prey considerably larger than itself . Antlion larvae are unusual among insects in lacking an anus . All the metabolic waste generated during the larval stage is stored , some is used to spin the silk for the cocoon and the rest is eventually voided as meconium at the end of its pupal stage .

= = Distribution = =

There are about 2 @,@ 000 species of antlion found in most parts of the world , with the greatest diversity being in warmer areas . The best known species are those in which the larvae dig pits to trap their prey , but by no means all species do this . Antlions live in a range of usually dry habitats including open woodland floors , scrub @-@ clad dunes , hedge bases , river banks , road verges , under raised buildings and in vacant lots .

= = Life @-@ cycle = =

Apart from pit @-@ trap @-@ forming taxa , the biology of members of the family Myrmeleontidae , to which the antlions belong , has been little studied . The life @-@ cycle begins with oviposition (egg @-@ laying) in a suitable location . The female antlion repeatedly taps the prospective laying site with the tip of her abdomen and then inserts her ovipositor into the substrate and lays an egg .

Depending on the species and where it lives , the larva either conceals itself under leaves , debris or pieces of wood , hides in a crack or digs a funnel @-@ shaped pit in loose material . As ambush predators , catching prey is a risky business because food arrives unpredictably and , for the species that make one , maintaining the trap is costly ; the larvae therefore have low metabolic rates and can survive for long periods without food . They can take several years to complete their life @-@ cycle ; they mature faster with plentiful food , but can survive for many months without feeding . In cooler climates they dig their way deeper and remain inactive during the winter .

When the larva attains its maximum size , it pupates and undergoes metamorphosis . It makes a globular cocoon of sand stuck together with fine silk spun from a slender spinneret at the rear end of the body . The cocoon may be buried several centimetres deep in the sand . After the completion of its transformation into an adult insect in about one month , it emerges from the case , leaving the pupal integument behind , and works its way to the surface . After about twenty minutes , the adult 's wings are fully opened and it flies off in search of a mate . The adult is considerably larger than the larva and antlions exhibit the greatest disparity in size between larva and adult of any type of holometabolous insect ; this is by virtue of the fact that the exoskeleton of the adult is extremely thin and flimsy , with an exceptionally low mass per unit of volume . The adult typically lives for about 25 days , but some insects survive for as long as 45 days .

= = Ecology = =

Antlion larvae eat small arthropods ? mainly ants ? while the adults of some species eat pollen and nectar , and others are predators of small arthropods . In certain species of Myrmeleontidae , such as Dendroleon pantherinus , the larva , although resembling that of Myrmeleon structurally , makes no pitfall trap , but hides in detritus in a hole in a tree and seizes passing prey . In Japan , Dendroleon jezoensis larvae lurk on the surface of rocks for several years while awaiting prey ; during this time they often become coated with lichen , and have been recorded at densities of up to 344 per square metre .

The larva is a voracious predator . Within a few minutes of seizing its prey with its jaws and injecting it with venom and enzymes , it begins to suck out the digestion products . The larva is extremely sensitive to ground vibrations , the low @-@ frequency sounds made by an insect crawling across the ground ; the larva locates the source of the vibrations by the differences in timing of the arrival of waves detected by receptors , tufts of hairs on the sides of the two hindmost thoracic segments .

In trap @-@ building species , an average @-@ sized larva digs a pit about 2 in (5 cm) deep and 3 in (7 @.@ 5 cm) wide at the edge . This behavior has also been observed in the Vermileonidae (

Diptera) , whose larvae dig the same sort of pit to feed on ants . Having marked out the chosen site by a circular groove , the antlion larva starts to crawl backwards , using its abdomen as a plough to shovel up the soil . By the aid of one front leg , it places consecutive heaps of loosened particles upon its head , then with a smart jerk throws each little pile clear of the scene of operations . Proceeding thus , it gradually works its way from the circumference towards the center . As it slowly moves round and round , the pit gradually gets deeper and deeper , until the slope angle reaches the critical angle of repose (that is , the steepest angle the sand can maintain , where it is on the verge of collapse from slight disturbance) . When the pit is completed , the larva settles down at the bottom , buried in the soil with only the jaws projecting above the surface , often in a wide @-@ opened position on either side of the very tip of the cone . The steep @-@ sloped trap that guides prey into the larva 's mouth while avoiding crater avalanches is one of the simplest and most efficient traps in the animal kingdom . Since the sides of the pit consist of loose sand at its angle of repose , they afford an insecure foothold to any small insects that inadvertently venture over the edge , such as ants . Slipping to the bottom , the prey is immediately seized by the lurking antlion ; if it attempts to scramble up the treacherous walls of the pit , it is speedily checked in its efforts and brought down by showers of loose sand which are thrown at it from below by the larva . By throwing up loose sand from the bottom of the pit , the larva also undermines the sides of the pit , causing them to collapse and bring the prey with them . Thus , it does not matter whether the larva actually strikes the prey with the sand showers .

Antlion larvae are capable of capturing and killing a variety of insects and other arthropods , and can even subdue small spiders . The projections in the jaws of the larva are hollow and through this , the larva sucks the fluids out of its victim . After the contents are consumed , the dry carcass is flicked out of the pit . The larva readies the pit once again by throwing out collapsed material from the center , steepening the pit walls to the angle of repose .

Antlion larvae require loose soil , not necessarily but often sand . The larvae prefer dry places protected from the rain . When it first hatches , the tiny larva specialises in very small insects , but as it grows larger , it constructs larger pits , and thus catches larger prey , sometimes much larger than itself .

Other arthropods may make use of the antlion larva 's ability to trap prey . The larva of the Australian horsefly (Scaptia muscula) lives in antlion pit traps and feeds on the prey caught , and the female chalcid wasp (Lasiochalcidia igiliensis) purposefully allows itself to be trapped so that it can parasitise the antlion larva by ovipositing between its head and thorax .

= = Evolution = =

The closest living relatives of antlions within the Myrmeleontoidea are the owlflies (Ascalaphidae) ; the Nymphidae are more distantly related . The extinct Araripeneuridae and Babinskaiidae are considered likely to be stem groups in the Myrmeleontiformia clade . The phylogeny of the Neuroptera has been explored using mitochondrial DNA sequences , and while issues remain for the group as a whole (the " Hemerobiiformia " being paraphyletic) , the Myrmeleontiformia is generally agreed to be monophyletic , giving the following cladogram :

The subfamilies are shown below ; a few genera , mostly fossil , are of uncertain or basal position . The fossil record of antlions is very small by neuropteran standards . However , some Mesozoic fossils attest to the antlions ' origin more than 150 million years ago . These were at one time separated as the Palaeoleontidae , but are now usually recognized as early antlions .

The subfamilies in the Myrmeleontoidea , with select genera , are :

Acanthaclisinae

Brachynemurinae

Dendroleontinae

Bankisus Navás , 1912 (= Navasius)

? Dendroleon

Dimarinae

Echthromyrmicinae

Glenurinae
Myrmecaelurinae
Myrmeleontinae
Euroleon Esben @-@ Petersen , 1918
Euroleon nostras (European antlion)
Glenoleon Banks , 1913
Glenoleon falsus
Glenoleon pulchellus Australia
Hagenomyia
Hagenomyia tristis Africa
Nemoleontinae (sometimes in Myrmeleontinae)
Palparinae (including Araripeneurinae)
Pseudimarinae
Stilbopteryginae
Antlions of uncertain systematic position are :
? Palaeoleon (fossil)
Porrerus
? Samsonileon

= = In culture and folklore = =

In popular folklore in the southern United States , people recite a poem or chant to make the antlion come out of its hole . Similar practices have been recorded from Africa , the Caribbean , China and Australia .

The Myrmecoleon was a mythical ant @-@ lion hybrid written about in the 2nd century AD Physiologus , where animal descriptions were paired with Christian morals . The ant @-@ lion as described was said to starve to death because of its dual nature ? the lion nature of the father could only eat meat , but the ant half from the mother could only eat grain chaff , thus the offspring could not eat either and would starve . It was paired with the Biblical verse Matthew 5 : 37 The fictional ant @-@ lion of Physiologus is probably derived from a misreading of Job 4 : 11 .

The French naturalist Jean @-@ Henri Fabre wrote that " The Ant @-@ lion makes a slanting funnel in the sand . Its victim , the Ant , slides down the slant and is then stoned , from the bottom of the funnel , by the hunter , who turns his neck into a catapult . "