

= Earwig =

Earwigs make up the insect order Dermaptera and are found throughout the Americas , Africa , Eurasia , Australia and New Zealand . With about 2 @, @ 000 species in 12 families , they are one of the smaller insect orders . Earwigs have characteristic cerci , a pair of forceps @-@ like pincers on their abdomen , and membranous wings folded underneath short forewings , hence the scientific order name , " skin wings . " Some groups are tiny parasites on mammals and lack the typical pincers . Earwigs rarely use their flying ability .

Earwigs are mostly nocturnal and often hide in small , moist crevices during the day , and are active at night , feeding on a wide variety of insects and plants . Damage to foliage , flowers , and various crops is commonly blamed on earwigs , especially the common earwig *Forficula auricularia* .

Earwigs have five molts in the year before they become adults . Many earwig species display maternal care , which is uncommon among insects . Female earwigs may care for their eggs , and even after they have hatched as nymphs will continue to watch over offspring until their second molt . As the nymphs molt , sexual dimorphism such as differences in pincer shapes begins to show .

Some earwig specimen fossils are in the extinct suborders Archidermaptera or Eodermaptera , the former dating to the Late Triassic and the latter to the Middle Jurassic . Many orders of insect have been theorized to be closely related to earwigs , though the icebugs of Grylloblattaria are most likely .

= = Etymology = =

The scientific name for the order , " Dermaptera " , is Greek in origin , stemming from the words *derma* , meaning skin , and *pteron* (plural *ptera*) , wing . It was coined by Charles De Geer in 1773 . The common term , earwig , is derived from the Old English *ear* , which means " ear " , and *wicga* , which means " insect " , or literally , " beetle " . Entomologists suggest that the origin of the name is a reference to the appearance of the hindwings , which are unique and distinctive among insects , and resemble a human ear when unfolded . The name is more popularly thought to be related to the old wives ' tale that earwigs burrowed into the brains of humans through the ear and laid their eggs there . Earwigs are not known to purposefully climb into external ear canals , but there have been anecdotal reports of earwigs being found in the ear .

" To earwig " is a slang verb meaning either " to attempt to influence by persistent confidential argument or talk " or " to eavesdrop " .

= = Distribution = =

Earwigs are abundant and can be found throughout the Americas and Eurasia . The common earwig was introduced into North America in 1907 from Europe , but tends to be more common in the southern and southwestern parts of the United States . The only native species of earwig found in the north of the United States is the spine @-@ tailed earwig (*Doru aculeatum*) , found as far north as Canada , where it hides in the leaf axils of emerging plants in southern Ontario wetlands . However , other families can be found in North America , including Forficulidae (*Doru* and *Forficula* being found there) , Labiidae , Anisolabididae , and Labiduridae .

Few earwigs survive winter outdoors in cold climates . They can be found in tight crevices in woodland , fields and gardens . Out of about 1 @, @ 800 species , about 25 occur in North America , 45 in Europe (including 7 in Great Britain) , and 60 in Australia .

= = Morphology = =

Most earwigs are flattened (which allows them to fit inside tight crevices , such as under bark) with an elongated body generally 7 ? 50 millimetres (0 @. @ 28 ? 1 @. @ 97 in) long . The largest certainly extant species is the Australian giant earwig (*Titanolabis colosseus*) which is approximately 50 mm (2 @. @ 0 in) long , while the possibly extinct Saint Helena earwig (*Labidura herculeana*)

reached 78 mm (3 @. @ 1 in) . Earwigs are characterized by the cerci , or the pair of forceps @-@ like pincers on their abdomen ; male earwigs generally have more curved pincers than females . These pincers are used to capture prey , defend themselves and fold their wings under the short tegmina . The antennae are thread @-@ like with at least 10 segments or more .

The forewings are short oblong leathery plates used to cover the hindwings like the elytra of a beetle , rather than to fly . Most species have short and leather @-@ like forewings with very thin hindwings , though species in the former suborders Arixeniina and Hemimerina (epizoic species , sometimes considered as ectoparasites) are wingless and blind with filiform segmented cerci (today these are both included merely as families in the suborder Neodermaptera) . The hindwing is a very thin membrane that expands like a fan , radiating from one point folded under the forewing . Even though most earwigs have wings and are capable of flight , they are rarely seen in flight . These wings are unique in venation and in the pattern of folding that requires the use of the cerci .

= = = Internal = = =

The neuroendocrine system is typical of insects . There is a brain , a subesophageal ganglion , three thoracic ganglia , and six abdominal ganglia . Strong neuron connections connect the neurohemal corpora cardiaca to the brain and frontal ganglion , where the closely related median corpus allatum produces juvenile hormone III in close proximity to the neurohemal dorsal aorta . The digestive system of earwigs is like all other insects , consisting of a fore- , mid- , and hindgut , but earwigs lack gastric caecae which are specialized for digestion in many species of insect . Long , slender (extratortory) malpighian tubules can be found between the junction of the mid- and hind gut .

The reproductive system of females consist of paired ovaries , lateral oviducts , spermatheca , and a genital chamber . The lateral ducts are where the eggs leave the body , while the spermatheca is where sperm is stored . Unlike other insects , the gonopore , or genital opening is behind the seventh abdominal segment . The ovaries are primitive in that they are polytrophic (the nurse cells and oocytes alternate along the length of the ovariole) . In some species these long ovarioles branch off the lateral duct , while in others , short ovarioles appear around the duct .

= = Life cycle and reproduction = =

Earwigs are hemimetabolous , meaning they undergo incomplete metamorphosis , developing through a series of 4 to 6 molts . The developmental stages between molts are called instars . Earwigs live for about a year from hatching . They start mating in the autumn , and can be found together in the autumn and winter . The male and female will live in a chamber in debris , crevices , or soil 2 @. @ 5 mm deep . After mating , the sperm may remain in the female for months before the eggs are fertilized . From midwinter to early spring , the male will leave , or be driven out by the female . Afterward the female will begin to lay 20 to 80 pearly white eggs in 2 days . Some earwigs , those parasitic in the suborders Arixeniina and Hemimerina , are viviparous (give birth to live young) ; they would be fed by a sort of placenta . When first laid , the eggs are white or cream @-@ colored and oval @-@ shaped , but right before hatching they become kidney @-@ shaped and brown . Each egg is approximately 1 mm (0 @. @ 04 in) tall and 0 @. @ 8 mm (0 @. @ 03 in) wide .

Earwigs are among the few non @-@ social insect species that show maternal care . The mother will pay close attention to the needs of her eggs , such as warmth and protection , though studies have shown that the mother does not pay attention to the eggs as she collects them . The mother has been shown to pick up wax balls by accident , but they would eventually be rejected as they do not have the proper scent . The mother will also vigorously defend the eggs from predators , not eating unless an egg goes bad . Another distinct maternal care unique to earwigs is that the mother continuously cleans the eggs to protect them from fungi . Studies have found that the urge to clean the eggs persists for days after they are removed ; when the eggs were replaced after hatching , the mother continued to clean them for up to 3 months .

The eggs hatch in about 7 days . The mother may assist the nymphs in hatching . When the nymphs hatch , they eat the egg casing and continue to live with the mother . The nymphs look similar to their parents , only smaller , and will nest under their mother and she will continue to protect them until their second molt . The nymphs feed on food regurgitated by the mother , and on their own molts . If the mother dies before the nymphs are ready to leave , the nymphs may eat her .

After five to six instars , the nymphs will molt into adults . The male 's forceps will become curved , while the females ' forceps remain straight . They will also develop their natural color , which can be anything from a light brown (as in the Tawny earwig) to a dark black (as in the Ringlegged earwig) . In species of winged earwigs , the wings will start to develop at this time . The forewings of an earwig are sclerotized to serve as protection for the membranous hindwings .

= = Behavior = =

Most earwigs are nocturnal and inhabit small crevices , living in small amounts of debris , in various forms such as bark and fallen logs . Species have been found to be blind and living in caves , or cavernicolous ; reported to be found on the island of Hawaii and in South Africa . Food typically consist of a wide array of living and dead plant and animal matter . For protection from predators , the species *Doru taeniatum* of earwigs can squirt foul @-@ smelling yellow liquid in the form of jets from scent glands on the dorsal side of the third and fourth abdominal segment . It aims the discharges by revolving the abdomen , a maneuver that enables it simultaneously to use its pincers in defense .

= = Ecology = =

Earwigs are mostly scavengers , but some are omnivorous or predatory . The abdomen of the earwig is flexible and muscular . It is capable of maneuvering as well as opening and closing the forceps . The forceps are used for a variety of purposes . In some species , the forceps have been observed in use for holding prey , and in copulation . The forceps tend to be more curved in males than in females .

The common earwig is an omnivore , eating plants and ripe fruit as well as actively hunting arthropods . To a large extent , this species is also a scavenger , feeding on decaying plant and animal matter if given the chance . Observed prey include largely plant lice , but also large insects such as bluebottle flies and woolly aphids . Plants that they feed on typically include clover , dahlias , zinnias , butterfly bush , hollyhock , lettuce , cauliflower , strawberry , blackberry , sunflowers , celery , peaches , plums , grapes , potatoes , roses , seedling beans and beets , and tender grass shoots and roots ; they have also been known to eat corn silk , damaging the corn .

Species of the suborders Arixeniina and Hemimerina are generally considered epizoic , or living on the outside of other animals , mainly mammals . In the Arixeniina , family Arixeniidae , species of the genus *Arixenia* are normally found deep in the skin folds and gular pouch of Malaysian hairless bulldog bats (*Cheiromeles torquatus*) , apparently feeding on bats ' body or glandular secretions . On the other hand , species in the genus *Xeniaria* (still of the suborder Arixeniina) are believed to feed on the guano and possibly the guanophilous arthropods in the bat 's nest , where it has been found . Hemimerina includes *Araeomerus* found in the nest of Long @-@ tailed pouch rats (*Beamys*) , and *Hemimerus* which are found on Giant *Cricetomys* rats .

Earwigs are generally nocturnal , and typically hide in small , dark , and often moist areas in the daytime . They can usually be seen on household walls and ceilings . Interaction with earwigs at this time results in a defensive free @-@ fall to the ground followed by a scramble to a nearby cleft or crevice . During the summer they can be found around damp areas such as near sinks and in bathrooms . Earwigs tend to gather in shady cracks or openings or anywhere that they can remain concealed during daylight . Some people erroneously believe that earwigs burrow into people 's ears ; that is mostly a myth , although earwigs may crawl into ears and some can bite , as other insects do . Picnic tables , compost and waste bins , patios , lawn furniture , window frames , or anything

with minute spaces (even artichoke blossoms) can potentially harbour them .

= = = Predators and parasites = = =

Earwigs are regularly preyed upon by birds , and like many other insect species they are prey for insectivorous mammals , amphibians , lizards , centipedes , assassin bugs , and spiders . European naturalists have observed bats preying upon earwigs . Their primary insect predators are parasitic species of Tachinidae , or tachinid flies , whose larvae are endoparasites . One species of tachinid fly , *Triarthria setipennis* , has been demonstrated to be successful as a biological control of earwigs for almost a century . Another tachinid fly and parasite of earwigs , *Ocytata pallipes* , has shown promise as a biological control agent as well . The common predatory wasp , the yellow jacket (*Vespa maculifrons*) , preys upon earwigs when abundant . A small species of roundworm , *Mermis nigrescens* , is known to occasionally parasitize earwigs that have consumed roundworm eggs with plant matter . At least 26 species of parasitic fungus from the order Laboulbeniales have been found on earwigs . The eggs and nymphs are also cannibalized by other earwigs . A species of tyroglyphoid mite , *Histiostoma polypori* (*Histiostomatidae* , *Astigmata*) , are observed on common earwigs , sometimes in great densities ; however , this mite feeds on earwig cadavers and not its live earwig transportation . Hippolyte Lucas observed scarlet acarine mites on European earwigs .

= = Evolution = =

The fossil record of the Dermaptera starts in the Late Triassic to Early Jurassic period about 208 million years ago in England and Australia , and comprises about 70 specimens in the extinct suborder Archidermaptera . Some of the traits believed by neontologists to belong to modern earwigs are not found in the earliest fossils , but adults had five @-@ segmented tarsi (the final segment of the leg) , well developed ovipositors , veined tegmina (forewings) and long segmented cerci ; in fact the pincers would not have been curled or used as they are now . The theorized stem group of the Dermaptera are the Protelytroptera . These insects , which resemble modern Blattodea , or cockroaches owing to shell @-@ like forewings and the large , unequal anal fan , are known from the Permian of North America , Europe and Australia . There are no fossils from the Triassic when the morphological changes from Protelytroptera to Dermaptera took place . The most likely , and most closely resembling , related order of insects is Grylloblattaria , theorized by Giles in 1963 . However , other arguments have been made by other authors linking them to Phasmida , Embioptera , Plecoptera , and Dictyoptera .

Archidermaptera is believed to be sister to the remaining earwig groups , the extinct Eodermaptera and the living suborder Neodermaptera (= former suborders Forficulina , Hemimerina , and Arixeniina) . The extinct suborders have tarsi with five segments (unlike the three found in Neodermaptera) as well as unsegmented cerci . No fossil Hemimeridae and Arixeniidae are known . Species in Hemimeridae were at one time in their own order , Diploglossata , Dermodermaptera , or Hemimerina . Like most other epizoic species , there is no fossil record , but they are probably no older than late Tertiary .

Some evidence of early evolutionary history is the structure of the antennal heart , a separate circulatory organ consisting of two ampullae , or vesicles , that are attached to the frontal cuticle to the bases of the antennae . These features have not been found in other insects . An independent organ exists for each antenna , consisting of an ampulla , attached to the frontal cuticle medial to the antenna base and forming a thin @-@ walled sac with a valved ostium on its ventral side . They pump blood by elastic connective tissue , rather than muscle .

Molecular studies suggest that this order is the sister to Plecoptera or to Ephemeroptera .

= = Taxonomy = =

== Distinguishing characteristics ==

The characteristics which distinguish the order Dermaptera from other insect orders are :

General body shape : Elongate ; dorso @-@ ventrally flattened .

Head : Prognathous . Antennae are segmented . Biting @-@ type mouthparts . Ocelli absent . Compound eyes in most species , reduced or absent in some taxa .

Appendages : Two pairs of wings normally present . The forewings are modified into short smooth , veinless tegmina . Hindwings are membranous and semicircular with veins radiating outwards .

Abdomen : Cerci are unsegmented and resemble forceps . The ovipositor in females is reduced or absent .

The overwhelming majority of earwig species are in Forficulina , grouped into nine families of 180 genera , including Forficula auricularia , the common European Earwig . Species within Forficulina are free @-@ living , have functional wings and are not parasites . The cerci are unsegmented and modified into large , forceps @-@ like structures .

The first epizotic species of earwig was discovered by a London taxidermist on the body of a Malaysian hairless bulldog bat in 1909 , then described by Karl Jordan . By the 1950s , the two suborders Arixeniina and Hemimerina had been added to Dermaptera .

Arixeniina represents two genera , Arixenia and Xeniarina , with a total of five species in them . As with Hemimerina , they are blind and wingless , with filiform segmented cerci . Hemimerina are viviparous ectoparasites , preferring the fur of African rodents in either Cricetomys or Beamys genera . Hemimerina also has two genera , Hemimerus and Araeomerus , with a total of 11 species .

== Phylogeny ==

Dermaptera (= Euplecoptera , Euplexoptera , or Forficulida) is relatively small compared to the other orders of Insecta , with only about 2 @, @ 000 species , 3 suborders and 15 families , including the extinct suborders Archidermaptera and Eodermaptera with their extinct families Protodiplatyidae , Dermapteridae , Semenoviolidae , and Turanodermatidae . The phylogeny of the Dermaptera is still debated . The extant Dermaptera appear to be monophyletic and there is support for the monophyly of the families Forficulidae , Chelisochidae , Labiduridae and Anisolabididae , however evidence has supported the conclusion that the former suborder Forficulina was paraphyletic through the exclusion of Hemimerina and Arixeniina which should instead be nested within the Forficulina . Thus , these former suborders were eliminated in the most recent higher classification . The following is from Engel & Haas (2007) :

Suborder Archidermaptera ?

Protodiplatyidae ?

Dermapteridae ?

Suborder Eodermaptera ?

Semenoviolidae ?

Turanodermatidae ?

Suborder Neodermaptera

Anisolabididae

Apachyidae

Chelisochidae

Diplatyidae

Spongiphoridae

Forficulidae

Karschiellidae

Labiduridae

Labiidae

Pygidicranidae

Hemimeridae

= = Relationship with humans = =

Earwigs are fairly abundant and are found in many areas around the world . There is no evidence that they transmit diseases to humans or other animals . Their pincers are commonly believed to be dangerous , but in reality , even the curved pincers of males cause little or no harm to humans . It is a common myth that earwigs crawl into the human ear and lay eggs in the brain .

There is a debate whether earwigs are harmful or beneficial to crops , as they eat both the insects eating the foliage (such as aphids) and the foliage itself , though it would take a large population to do considerable damage . The common earwig eats a wide variety of plants , and also a wide variety of foliage including the leaves and petals . They have been known to cause economic losses in fruit and vegetable crops . Some examples are the flowers , hops , red raspberries , and corn crops in Germany , and in the south of France , earwigs have been observed feeding on peaches and apricots . The earwigs attacked mature plants and made cup @-@ shaped bite marks 3 ? 11 mm (0 @.@ 12 ? 0 @.@ 43 in) in diameter .

= = In literature and folklore = =

Robert Herrick in *Hesperides* describes a feast attended by queen Titania through writing : " Beards of mice , a newt 's stew 'd thigh , A bloated Earwig and a fly : "

Thomas Hood discusses the belief of Earwig 's finding shelter in the human in the poem *Love Lane* by saying the following : " ' Tis vain to talk of hopes and fears And hope the least reply to wing , From any maid that stops her ears In dread of ear @-@ wigs creeping in ! "

In rural England the Earwig is called " battle @-@ twig , " which is present in Baron Tennyson 's poem *The Spinster 's Sweet @-@ Arts* : " ' Twur as bad as battle @-@ twig ' ere i ' my oan blue chamber to me . "