

= Myrmecia ( ant ) =

Myrmecia is a genus of ants first established by Danish zoologist Johan Christian Fabricius in 1804 . The genus is a member of the subfamily Myrmeciinae of the family Formicidae . Myrmecia is a large genus of ants , comprising at least 93 species that are found throughout Australia and its coastal islands , while a single species is only known from New Caledonia . One species has been introduced out of its natural distribution and was found in New Zealand in 1940 , but the ant was last seen in 1981 . These ants are commonly known as " bulldog ants " or " jack jumper " ants , and are also associated with many other common names . They are characterised by their extreme aggressiveness , ferocity , and painful stings . Some species are known for the jumping behaviour they exhibit when agitated .

Species of this genus are also characterised by their elongated mandibles and large compound eyes that provide excellent vision . They vary in colour and size , ranging from 8 to 40 millimetres ( 0 @. @ 31 to 1 @. @ 57 in ) . Although workers and queens are hard to distinguish from each other due to their similar appearance , males are identifiable by their perceptibly smaller mandibles . Almost all Myrmecia species are monomorphic , with little variation among workers of a given species . Some queens are ergatoid and have no wings , while others have either stubby or completely developed wings . Nests are mostly found in soil , but they can be found in rotten wood and under rocks . One species does not nest in the ground at all ; its colonies can only be found in trees .

A queen will mate with one or more males , and during colony foundation she will hunt for food until the brood have fully developed . The life cycle of the ant from egg to adult takes several months . Myrmecia workers exhibit greater longevity in comparison to other ants , and workers are also gamergates , that are able to reproduce with male ants . Myrmecia is one of the most primitive group of ants on earth , exhibiting differentiated behaviours from other ants . Workers are solitary hunters and do not lead other workers to food . Adults are omnivores that feed on sweet substances , but the larvae are carnivores that feed on captured prey . Very few predators eat these ants due to their sting , but their larvae are often consumed by blindsnakes and echnidnas , and a number of parasites infect both adults and brood . Some species are also effective pollinators .

Myrmecia stings are very potent , and the venoms from these ants are among the most toxic in the insect world . In Tasmania , 3 % of the human population are allergic to the venom of *M. pilosula* and can suffer life @-@ threatening anaphylactic reactions if stung ; many human deaths have been recorded . People prone to severe allergic reactions can be treated with allergen immunotherapy ( desensitisation ) .

= = Etymology and common names = =

The generic name Myrmecia derives from Greek word Myrmec- ( + -ia ) , meaning " ant " . In Western Australia , the Australian Aborigines called these ants kallili or killal , meaning " lion @-@ ant " .

Ants of this genus are popularly known as bulldog ants , bull ants or jack jumper ants . This is due to their ferocity and the way they hang off their victims using their mandibles , and also due to the jumping behaviour displayed by some species . Other common names include inch ants , sergeant ants and soldier ants . The jack jumper ant and other members of the *Myrmecia pilosula* species group are commonly known as " black jumpers " , " hopper ants " , " jumper ants " , " jumping ants " , " jumping jacks " and " skipper ants " .

= = Taxonomy and evolution = =

Genetic evidence suggests that Myrmecia diverged from related groups approximately 100 million years ago . The subfamily Myrmeciinae to which Myrmecia belongs , is believed to have been found in the fossil record of 110 million years ago . However , one study suggests that the age of the most recent common ancestor for Myrmecia and Nothomyrmecia is 74 million years ago , and the

subfamily is possibly younger than previously thought . Ants of the extinct genus *Archimyrmex* may possibly be the ancestor of *Myrmecia* . In the Evans ' vespid scala , *Myrmecia* and other primitive ant genera such as *Amblyopone* and *Nothomyrmecia* exhibit behaviour which is similar to a clade of soil @-@ dwelling families of vespid wasps . Four species groups form a paraphyletic assemblage while five species groups form a monophyletic assemblage . The following cladogram shows the phylogenetic relationships within *Myrmecia* :

#### = = = Classification = = =

*Myrmecia* was first established by Danish zoologist Johan Christian Fabricius in his 1804 publication *Systema Piezatorum* , in which seven species from the genus *Formica* were placed into the genus along with the description of four new species . *Myrmecia* has been classified into numerous families and subfamilies ; in 1858 British entomologist Frederick Smith placed it in the family *Poneridae* , subfamily *Myrmecidae* . It was placed in the subfamily *Ponerinae* by Austrian entomologist Gustav Mayr in 1862 . This classification was short @-@ lived , as Mayr reclassified the genus into the subfamily *Myrmecinae* three years later . In 1877 , Italian entomologist Carlo Emery classified the genus into the newly established subfamily *Myrmeciidae* , family *Myrmecidae* . Smith , who had originally established *Myrmecidae* as a family in 1851 , reclassified it as a subfamily in 1858 . He would again treat it as a family in 1871 . Swiss myrmecologist Auguste Forel initially treated *Poneridae* as a subfamily and classified *Myrmecia* as one of its constituent genera , but later placed it in *Ponerinae* . William H. Ashmead placed the genus in the subfamily *Myrmeciinae* in 1905 , but it was later placed back in *Ponerinae* in 1910 by American entomologist William Morton Wheeler . In 1954 , *Myrmecia* was placed into *Myrmeciinae* ; this would be the last time the genus would be placed into a different ant subfamily .

In 1911 Emery classified the subgenera *Myrmecia* , *Pristomyrmecia* and *Promyrmecia* , based on the shape of the mandibles . Wheeler established the subgenus *Halmamyrmecia* , and the ants placed in it were characterised by their jumping behaviour . The taxon Wheeler described was not referred to in his later publications , and the genera *Halmamyrmecia* and *Pristomyrmecia* were synonymised by John Clark . At the same time , Clark reclassified the subgenus *Promyrmecia* as a full genus . He revised the whole subfamily *Myrmeciinae* in 1951 , recognising 118 species and subspecies in *Myrmecia* and *Promyrmecia* ; five species groups were assigned to *Myrmecia* and eight species groups to *Promyrmecia* . This revision was rejected by entomologist William Brown due to the lack of morphological evidence that would make the two genera distinct from each other . Due to this , Brown would classify *Promyrmecia* as a synonym of *Myrmecia* in 1953 . Clark 's revision was the last major taxonomic study on the genus before 1991 , and only a single species was described in the intervening years . In 2015 , four new *Myrmecia* ants were described by Robert Taylor , all exclusive to Australia . Currently , 94 species are described in the genus , but as many as 130 species may exist .

Under the present classification , *Myrmecia* is the only extant genus in the tribe *Myrmeciini* , subfamily *Myrmeciinae* . It is a member of the family *Formicidae* , belonging to the order *Hymenoptera* . The type species for the genus is *M. gulosa* , discovered by Joseph Banks in 1770 during his expedition with James Cook on the HMS *Endeavour* . *M. gulosa* is among the earliest Australian insects to be described , and the specimen Banks collected is housed in the Joseph Banks Collection in the Natural History Museum in London . *M. gulosa* was described by Fabricius in 1775 under the name *Formica gulosa* and later designated as the type species of *Myrmecia* in 1840 .

#### = = = Genetics = = =

The number of chromosomes per individual varies from one to over 70 among the species in the genus . The genome of *M. pilosula* is contained on a single pair of chromosomes ( males have just one chromosome , as they are haploid ) . This is the lowest number possible for any animal , and workers of this species are homologous . Like *M. pilosula* , *M. croslandi* also contains a single

chromosome . While these ants only have a single chromosome , *M. pyriformis* contains 41 chromosomes while *M. brevinoda* contains 42 . The chromosome count for *M. piliventris* and *M. fulvipes* is 2 and 12 , respectively . The genus *Myrmecia* retains many traits that are considered basal for all ants ( i.e. workers foraging alone and relying on visual cues ) .

#### == Species groups ==

*Myrmecia* contains a total of nine species groups . Originally , seven species groups were established in 1911 , but this was raised to 13 in 1951 ; *Promyrmecia* had a total of eight while *Myrmecia* only had five . *M. maxima* does not appear to be in a species group , as no type specimen is available .

#### == Description ==

*Myrmecia* ants are easily noticeable , due to their large mandibles , and large compound eyes that provide excellent vision , and a powerful sting that they use to kill prey . Each of their eyes contains 3 @, @ 000 facets , making them the second largest in the ant world . Size varies widely , ranging from 8 to 40 millimetres ( 0 @. @ 31 to 1 @. @ 57 in ) in length . The largest *Myrmecia* species is *M. brevinoda* , with workers measuring 37 millimetres ( 1 @. @ 5 in ) ; *M. brevinoda* workers are also the largest in the world . Almost all species are monomorphic , but *M. brevinoda* is the only known species where polymorphism exists . It is well known that two worker sub @-@ castes exist , but this does not distinguish them as two different polymorphic forms . This may be due to the lack of food during winter and the fact they could be incipient colonies . The division of labour is based on the size of ant , rather than its age , with the larger workers foraging for food or keeping guard outside the nest while the smaller workers tend to the brood .

Their colouration is variable ; black combined with red and yellow is a common pattern , and many species have golden @-@ coloured pubescence ( hair ) . Many other species are brightly coloured , which warns predators to avoid them . The formicine ant *Camponotus bendigensis* is similar in appearance to *M. fulvipes* , and data suggests *C. bendigensis* is a batesian mimic of *M. fulvipes* . The number of malpighian tubules differs between castes ; in *M. dispar* , males have 16 tubules , queens range from 23 to 26 , and workers have 21 to 29 .

Worker ants are usually the same size as each other , although this is not true for some species ; worker ants of *M. brevinoda* , for example , vary in length from 13 to 37 millimetres ( 0 @. @ 51 to 1 @. @ 46 in ) . The mandibles of the workers are long with a number of teeth , and the clypeus is short . The antennae consist of 12 segments and the eyes are large and convex . Based on a study on the antennal sensory of *M. pyriformis* , the antennal sensilla is known to have eight types of sensilla . Large ocelli is always present .

Queens are usually larger than the workers , but are similar in colour and body shape . The head , node and postpetiole are broader in the queen , and the mandibles are shorter and also broad . *Myrmecia* queens are unique in that particular species either have fully winged queens , queens with poorly developed wings , or queens without any wings . For example , *M. aberrans* and *M. esuriens* queens are ergatoid , meaning that they are wingless . Completely excavated nests showed no evidence of any winged queen residing within them . Some species have queens which are subapterous , meaning they are either wingless or only have rudiments of wings ; the queens can be well developed with or without these wing buds . *M. nigrocincta* and *M. tarsata* are " brachypterous " , where queens have small and rudimentary wings which render the queen flightless . Dealated queens with developed wings and thorax are considered rare . In some species , such as *M. brevinoda* and *M. pilosula* , there are three forms of queens , with the dealated queens being the most recognisable .

Males are easy to identify due to their perceptibly broad and smaller mandibles . Their antennae consist of 13 segments , and are almost the same length as the ants ' bodies . Ergatandromorph ( an ant that exhibits both male and worker characteristics ) males are known ; in 1985 , a male *M. gulosa* was collected before it hatched from its cocoon , and it had a long but excessively curved left

mandible while the other mandible was small . On the right side of its body , it was structurally male , but the left side appeared female . The head was also longer on the female side , its colour was darker , and the legs and prothorax were smaller on the male side . Male genitalia are retracted into a genital cavity that is located in the posterior end of the gaster . The sperm is structurally the same to other animal sperm , forming an oval head with a long tail .

Among the largest larvae examined were those of *M. simillima* , reaching lengths of 35 millimetres ( 1 @. @ 4 in ) . The pupae are enclosed in dark cocoons .

= = Distribution and habitat = =

Almost all species in the genus *Myrmecia* are found in Australia and its coastal islands . *M. apicalis* is the only species not native to Australia , and is only found in the Isle of Pines , New Caledonia . Only one ant has ever established nests outside its native range ; *M. brevinoda* was first discovered in New Zealand in 1940 , and the ant was recorded in Devonport in 1948 , 1965 and 1981 , where a single nest was destroyed . Sources suggest the ant was introduced to New Zealand through human activity ; they were found inside a wooden crate brought from Australia . While no eradication attempt was made by the New Zealand government , the ant has not been found in the country since 1981 and is presumed to have been eradicated .

Ants of this genus prefer to inhabit grasslands , forests , heath , urban areas and woodland . Nests are found in Callitris forest , dry marri forest , Eucalyptus woodland and forests , mallee scrub , in paddocks , riparian woodland , and wet and dry sclerophyll forests . They also live in dry sandplains , and coastal plain . When a queen establishes a new colony , the nest is at first quite simple structurally . The nest gradually expands as the colony grows larger . Nests can be found in debris , decaying tree stumps , rotten logs , rocks , sand , and soil , and under stones . While most species nest underground , *M. mjobergi* is an arboreal nesting species found on epiphytic ferns of the genus *Platyserium* . Two types of nests have been described for this genus : a simple nest with a noticeable shaft inside , and a complex structure surrounded by a mound . Some species construct dome @-@ shaped mounds containing a single entrance , but some nests have numerous holes that are constantly used and can extend several metres underground . Sometimes , these mounds can be half of a metre ( 20 in ) high . Workers decorate these nests with a variety of items , including charcoal , leaves , plant fragments , pebbles and twigs . Some ants utilise the warmth by decorating their nests with dry materials that heat quickly , providing the nest with solar energy traps .

= = Behaviour and ecology = =

= = = Foraging = = =

The genus *Myrmecia* is among the most primitive of all known living ants , and ants of the genus are considered specialist predators . Unlike most ants , workers are solitary hunters , and do not lay pheromone trails ; nor do they recruit others to food . Tandem running does not occur , and workers carrying other workers as a method of transportation is rare or awkwardly executed . Although *Myrmecia* is not known to lay pheromone trails to food , *M. gulosa* is capable of inducing territorial alarm using pheromones while *M. pilosula* can attack en masse , suggesting these ants can also induce alarm pheromones . *M. gulosa* induces territorial alarm behaviour using pheromones from three sources ; an alerting substance from the rectal sac , a pheromone found in the Dufour 's gland , and an attack pheromone from the mandibular gland . Despite *Myrmecia* ants being among the most primitive ants , they exhibit some behaviours considered " advanced " ; adults will sometimes groom each other and the brood , and distinct nest odors exist for each colony .

Most species are diurnal , and forage on the ground or onto low vegetation in search of food , but a few are nocturnal and only forage at night . Most *Myrmecia* ants are active during the warmer months , and are dormant during winter . However , *M. pyriformis* is a nocturnal species that is active throughout the whole year . *M. pyriformis* also has a unique foraging schedule ; 65 % of

individuals who went out to forage left the nest in 40 ? 60 minutes , while 60 % of workers would return to the nest in the same duration of time at dusk . Foraging workers rely on landmarks for navigation back home . If displaced a short distance , they will scan their surroundings , and then rapidly move in the direction of the nest . *M. vindex* ants carry dead nest @-@ mates out of their nests and place them on refuse piles , a behaviour known as necrophoresis .

#### = = = Pollination = = =

While pollination by ants is somewhat rare , several *Myrmecia* species have been observed pollinating flowers . For example , the orchid *Leporella fimbriata* is a myrmecophyte which can only be pollinated by the winged male ant *M. urens* . Pollination of this orchid usually occurs between April and June during warm afternoons , and may take several days until the short @-@ lived males all die . The flower mimics *M. urens* queens , and so the males move from flower to flower in an attempt to copulate with it . *M. nigrocincta* workers have been recorded visiting flowers of *Eucalyptus regnans* and *Senna acclinis* , and are considered a potential pollination vector for *E. regnans* trees . Although *Senna acclinis* is self @-@ compatible , the inability of *M. nigrocincta* to appropriately release pollen would restrict its capacity to effect pollination . Foraging *M. pilosula* workers are regularly observed on the inflorescences of *Prasophyllum alpinum* ( mostly pollinated by wasps of the family *Ichneumonidae* ) . Although pollinia are often seen in the ants ' jaw , they have a habit of cleaning their mandibles on the leaves and stems of nectar @-@ rich plants before moving on , preventing pollen exchange . It is unknown whether *M. pilosula* contributes to pollination .

#### = = = Diet = = =

Despite their ferocity , adults are nectarivores , consuming honeydew ( a sweet , sticky liquid found on leaves , deposited from various insects ) , nectar , and other sweet substances . The larvae , however , are carnivorous . After they reach a certain size , they are fed insects that foragers capture and kill . The workers also regurgitate food for other ants to consume . Young ants are rarely fed food regurgitated by adults . Adult workers prey on a variety of insects and arthropods , such as beetles , caterpillars , earwigs , *Ithone fusca* moths , *Perga* saw flies , and spiders . Other prey include invertebrates such as bees , cockroaches , crickets , wasps and other ants ; in particular , workers prey on *Orthocrema* ants ( a subgenus of *Crematogaster* ) and *Camponotus* , although this is risky since these ants are able to call for help through chemical signals . Slaters , earthworms , scale insects , frogs , lizards , grass seeds , possum feces and kangaroo feces are also collected as food . Flies such as the housefly and blowfly are consumed . Some species , such as *M. pilosula* , will only attack small fly species and ignore larger ones . Nests of the social spider *Delena cancerides* are often invaded by *M. pyriformis* ants , and nests once housing these spiders are filled with debris such as twigs and leaves by the workers , rendering them useless . These " scorched earth " tactics prevent the spiders competing with the ants . *M. gulosa* attacks Christmas beetles , but workers later bury them .

*Myrmecia* is one of the very few genera where the workers lay trophic eggs , or infertile eggs laid as food for viable offspring . Workers laying trophic eggs have only been reported in two species ; these species are *M. forceps* and *M. gulosa* . Depending on the species , colonies specialise in trophallaxis ; queens and larvae eat eggs that are laid by worker individuals , but the workers do not feed on eggs . Neither adults nor larvae consume food during winter , but cannibalism among larvae is known to occur throughout the year . The larvae only cannibalise each other ; this is most likely to happen when no dead insects are available .

#### = = = Predators , parasites and associations = = =

*Myrmecia* ants deter many potential predators due to their sting . The blindsnake *Ramphotyphlops nigrescens* consumes the larvae and pupae of *Myrmecia* , while avoiding the potent sting of the adults , which it is vulnerable to . The short @-@ beaked echidna ( *Tachyglossus aculeatus* ) also

eats the eggs and larvae . Nymphs of the assassin bug species *Ptilocnemus lemur* lure these ants to themselves by trying to make the ant sting them , by waving its hind legs around to attract a potential prey item . Body remains of *Myrmecia* have been found in the stomach contents of the eastern yellow robin ( *Eopsaltria australis* ) . The Australian magpie ( *Cracticus tibicen* ) , the black currawong ( *Strepera versicolor* ) , and the white @-@ winged chough ( *Corcorax melanorhamphos* ) prey on these ants , but few are successfully taken .

The host association between *Myrmecia* and eucharitid wasps began several million years ago ; *M. forficata* larvae are the host to *Austeucharis myrmeciae* , being the first recorded eucharitid parasitoid of an ant , and *Austeucharis fasciventris* is a parasitoid to *M. gulosa* pupae . *M. pilosula* is affected by a gregarines parasite that changes an ants colour from their typical black appearance to brown . This was discovered when brown workers were dissected and found to have gregarinasina spores , while black workers showed no spores . Another unidentified gregarine parasite is known to infect the larvae of *M. pilosula* and other *Myrmecia* species . This gregarine parasite also softens the ant 's cuticle . Other parasites include *Beauveria bassiana* , *Paecilomyces lilacinus* , *Chalcidura affinis* , *Tricoryna* wasps , and various mermithid nematodes .

*M. hirsuta* and *M. inquilina* are the only known species in this genus that are inquilines and live in other *Myrmecia* colonies . An *M. inquilina* queen has been found in an *M. vindex* colony . *Myrmecia* is a larval attendant to the butterfly *Theclinesa serpentata* ( saltbush blue ) , while some species , particularly *M. nigrocincta* , enslave other ant species , notably those in the genus *Leptomyrmex* . *M. nigriceps* ants are able to enter another colony of the same species without being attacked , as they may be unable to recognize alien conspecifics , nor do they try to distinguish nestmates from ants of another colony . *Formicoxenus provancheri* and *M. brevinoda* share a form of symbiotic relationship known as xenobiosis , where one species of ant will live with another and raise their young separately , with *M. brevinoda* being the host . *Solenopsis* may sometimes nest in *Myrmecia* colonies , as a single colony was found to have three or four *Solenopsis* nests inside . *Lagria* beetles and rove beetles in the genus *Heterothops* dwell inside colonies and skinks and frogs have also been found living unmolested within *Myrmecia* nests . *Metacrinia nicholli* , for example , has been reported living inside *M. regularis* colonies .

= = = Life cycle = = =

Like other ants , *Myrmecia* ants begin as an egg . If the egg is fertilised , the ant becomes a diploid female ; if not , it becomes a haploid male . They develop through complete metamorphosis , meaning that they pass through larval and pupal stages before emerging as adults .

During the process of founding a colony , as many as three to four queens cooperate with each other to find a suitable nesting ground , but after the first generation of workers are born , they fight each other until one queen is left alive . However , occasional colonies are known to have as many as six queens coexisting peacefully in the presence of workers . A queen searches for a suitable nest site to establish her colony , and excavate a small chamber in the soil or under logs and rocks , where she takes care of her young . A queen also hunts for prey instead of staying in her nest , a behaviour known as claustral colony founding . Although queens do provide sufficient amounts of food to feed their larvae , the first generation of workers are " nanitics " ( or minims ) ; smaller than the smallest workers encountered in older developed colonies . Several species do not have any worker caste , and solitary queens will raid a colony , kill the residing queen , and take over the colony . The first generation of workers may take awhile to fully develop into adults ; for example , *M. forficata* eggs take around three to four months ( 100 days or more ) to fully develop , while other species may take up to eight months .

Queens lay around eight eggs , but less than half of these eggs fully develop . Some species , such as *M. simillima* and *M. gulosa* lay their eggs singly on the colony floor , while *M. pilosula* ants may lay eggs in a clump . These clumps have around two to 30 eggs each with no larvae present . With this said , certain *Myrmecia* species do not lay their eggs singly and will form clumps of eggs instead . The larvae are capable of crawling short distances without the assistance from adult workers , and workers will cover the larvae in dirt to help them spin into a cocoon . If cocoons are isolated from a

colony , they are capable of shedding their skin before hatching , allowing themselves to advance to full pigmentation . Sometimes , a newborn can emerge from their pupa without the assistance of other ants . Once these ants are born , they are able to identify distinct tasks , a well known primitive trait . Myrmecia life spans vary in each species , but their longevity is greater than many ant genera : *M. nigrocincta* and *M. pilosula* have a life span of one year , while *M. nigriceps* workers can live up to 2 @. @ 2 years . The oldest recorded worker was a *M. vindex* , living up to 2 @. @ 6 years . If a colony is deprived of workers , queens are able to revert to colony @-@ founding behaviours until there is a sustainable workforce . A colony may also emigrate to a new nesting spot altogether .

### = = = Reproduction = = =

Virgin queens and males appear in colonies during January , before their nuptial flight . 20 females or fewer are found in a single colony , while males are much more common . The nuptial flight begins at different times for each species ; they have been recorded in mid @-@ summer to autumn ( January to early April ) , but there is one case of a nuptial flight occurring from May to July . Ideal conditions for nuptial flight are hot stormy days with windspeeds of 30 km / h ( 18 mi / h ) and temperatures reaching 30 ° C ( 86 ° F ) , and elevations of 91 metres ( 300 ft ) . Nuptial flights are rarely recorded due to queens leaving their nest singly , although as many as four queens may leave the nest at the same time . Species are both polygynous and polyandrous , with queens mating with one to ten males . Polygynous and polyandrous societies can occur in a single nest , but particular species are either primarily polygynous or primarily polyandrous . For example , nearly 80 % of tested *M. pilosula* colonies are polygynous while *M. pyriformis* colonies are mostly polyandrous . Nuptial flight takes place during the morning and can last until late afternoon . When the alates leave the nest , most species launch themselves into the air from trees and shrubs , although others launch themselves off the ground . Queens discharge a glandular secretion from the tergal gland , which males are strongly attracted to . As many as 1 @, @ 000 alates will gather to mate . A queen was once found to have five or six males attempting to copulate with her . The queen is unable to bear the weight of the large number of males trying to mate with her , and will drop to the ground , with the ants dispersing later on . *M. pulchra* queens are ergatoid and cannot fly ; the males meet the queen out in an open area away from the nest and mate , and these queens do not return to their nest after mating .

Both independent and dependent colony foundation can occur after mating . Isolation by distance ( IBD ) patterns have been recorded with *M. pilosula* queens , where nests that tend to be closer together were more genetically related to each other in comparison to other nests further away . Independent colony foundation is closely associated with queens which engage in nuptial flight in areas far from their home colony , showing that dependent colony foundation mostly occurs if they mate near their nest . In some cases , queens could seek adoption into alien colonies if there are no suitable areas to find a nest or independent colony foundation cannot be carried out . Other queens could try and return to their home nest after nuptial flight , but they may end up in another nest near the nest they originally came from . In multiple @-@ queen societies , the egg @-@ laying queens are generally unrelated to one another , but one study showed that it is possible for multiple queens in the same colony to be genetically related to each other . Depending on the species , the number of individuals present in a colony can range from 50 to over 2 @, @ 200 individuals . A colony with less than 100 workers is not considered a mature colony . *M. dispar* colonies have around 15 to 329 ants , *M. nigrocincta* have over 1 @, @ 000 , *M. pyriformis* have from 200 to over 1 @, @ 400 and *M. gulosa* have nearly 1 @, @ 600 . A colony can last for a number of years . Foraging behavior among smaller workers which never usually leave the nest can be a sign of a colony 's impending demise .

Workers are known to produce their own eggs , but these eggs are unfertilised and hatch into male ants . There is a chance of workers attacking a particular individual who has successfully produced male offspring due to a change in a workers cuticular hydrocarbon ; cuticular hydrocarbons are believed to play a vital role in the regulation of reproduction . However , this is not always the case . *Myrmecia* is one of several ant genera which possess gamergate workers , where a female worker is able to reproduce with mature males when the colony is lacking a queen . *Myrmecia* workers are

highly fertile and can successfully mate with males . A colony of *M. pyriformis* without a queen was collected in 1998 and kept in captivity , during which time the gamergates produced viable workers for three years . Ovarian dissections showed that three workers of this colony mated with males and produced female workers . Queens have bigger ovaries than the workers , with 44 ovarioles while workers have 8 to 14 . Spermatheca is present in *M. gulosa* workers , based on eight dissected individuals showing a spermatheca structurally similar to those found in queens . These spermathecas did not have any sperm . Why the queen was not replaced is still unknown .

== Vision ==

While most ants have poor eyesight , *Myrmecia* ants have excellent vision . This trait is important to them , since *Myrmecia* primarily relies on visual cues for navigation . These ants are capable of discriminating the distance and size of objects moving nearly a metre away . Winged alates are only active during the day , as they can see better . Members of a colony have different eye structures due to each individual fulfilling different tasks , and nocturnal species have larger ommatidia in comparison to those that are active during the day . Facet lenses also vary in size ; for example , the diurnal species *M. croslandi* has a smaller lens in comparison to *M. nigriceps* and *M. pyriformis* which have larger lenses . *Myrmecia* ants have three photoreceptors that can see UV light , meaning they are capable of seeing colours that humans cannot . Their vision is said to be better than some mammals , such as cats , dogs or wallabies . Despite their excellent vision , worker ants of this genus find it difficult to find their nests at night , due to the difficulty of finding the landmarks they use to navigate . They are thus more likely to return to their nests the following morning , walking slowly with long pauses .

== Sting ==

*Myrmecia* workers and queens possess a sting , which can be fatal to sensitive human beings . The sting has been described as " sharp in pain with no burning " , and the pain may last for several minutes . In the Starr sting pain scale , a scale which compares the overall pain of hymenopteran stings on a four @-@ point scale , *Myrmecia* stings were ranked from 2 ? 3 in pain , described as " painful " or " sharply and seriously painful " . Unlike in honeybees , the sting lacks barbs , and so the stinger is not left in the area the ant has stung , allowing the ants to sting repeatedly without any harm to themselves . The retractable sting is located in their abdomen , attached to a single venom gland connected by the venom sac , which is where the venom is accumulated . Exocrine glands are known in some species , which produce the venom compounds later used to inject into their victims . Examined workers of larger species have long and very potent stingers , with some stings measuring 6 millimetres ( 0 @. @ 24 in ) .

== Interaction with humans ==

*Myrmecia* is one of the best @-@ known genera of ants . *Myrmecia* ants usually display defensive behavior only around their nests , and are more timid while foraging . However , most species are extremely aggressive towards intruders ; a few , such as *M. tarsata* , are timid , and the workers retreat into their nest instead of pursuing the intruder . If a nest is disturbed , a large force of workers rapidly swarm out of their nest to attack and kill the intruder . Some species , particularly those of the *M. nigrocincta* and *M. pilosula* species groups , are capable of jumping several inches when they are agitated after their nest has been disturbed ; jumper ants propel their jumps by a sudden extension of its middle and hind legs . *M. pyriformis* is considered the most dangerous ant in the world by the Guinness World Records . *M. inquilina* is the only species of this genus that is considered vulnerable by the IUCN , although the conservation status needs updating .

Fatalities associated with *Myrmecia* stings are well known , and have been attested to by multiple sources . In 1931 two adults and an infant girl from New South Wales died from ant stings , possibly from *M. pilosula* or *M. pyriformis* . Another fatality was reported in 1963 in Tasmania . Between 1980



and 2000 , there were six recorded deaths , five in Tasmania and one in New South Wales . Four of these deaths were due to *M. pilosula* , while the remaining two died from a *M. pyriformis* sting . Half of the victims had known ant @-@ sting allergies , but only one of the victims was carrying adrenaline before being stung . Most victims died within 20 minutes of being stung , but one of the victims died in just five minutes from a *M. pyriformis* sting . No death has been officially recorded since 2003 , but *M. pilosula* may have been responsible for the death of a man from Bunbury in 2011 . Prior to the establishment of a desensitisation program , *Myrmecia* stings caused one fatality every four years .

= = = Venom = = =

Each *Myrmecia* species has different venom components , so people who are allergic to ants are advised to stay away from *Myrmecia* , especially from species they have never encountered before . Based on five species , the median lethal dose ( LD50 ) is 0 @. @ 18 ? 0 @. @ 35 mg / kg , making it among the most toxic venoms in the insect world . The toxicity of the venom may have evolved due to the intense predation by animals and birds during the day , since *Myrmecia* is primarily diurnal . In Tasmania , 2 ? 3 % of the human population is allergic to *M. pilosula* venom . In comparison , only 1 @. @ 6 % people are allergic to the venom of the western honeybee ( *Apis mellifera* ) , and 0 @. @ 6 % to the venom of the European wasp ( *Vespula germanica* ) . In a 2011 Australian ant @-@ venom allergy study , the objective of which was to determine what native Australian ants were associated with ant sting anaphylaxis , it was shown that 265 of the 376 participants taking part of the study reacted to the sting of several *Myrmecia* species . Of these , the majority of patients ( 176 ) reacted to *M. pilosula* venom and to that of several other species . In Perth , *M. gratio*sa was responsible for most cases of anaphylaxis due to ant stings , while *M. nigricap*a and *M. ludlowi* were responsible for two cases . The green @-@ head ant ( *Rhytidoponera metallica* ) was the only ant other than *Myrmecia* species to cause anaphylaxis in patients . Dogs are also at risk of death from *Myrmecia* ants ; renal failure has been recorded in dogs experiencing mass envenomation , and one dog was euthanised due to its deteriorating health despite treatment . Sensitivity is persistent for many years . Pilosulin 3 has been identified as a major allergen in *M. pilosula* venom , while pilosulin 1 and pilosulin 4 are minor allergens .

= = = Sting treatment = = =

The nature of treatment for a *Myrmecia* sting depends on the severity of the reaction . If there are no signs of an allergic reaction , an ice pack or commercially available spray are used to relieve the pain . Washing the stung area , stingose , or the use of antihistamine tablets are other methods to reduce the pain . Indigenous Australians use bush remedies to treat *Myrmecia* stings , such as rubbing the tips of bracken ferns onto the stung area . *Carpobrotus glaucescens* is also used to treat stung areas , using juices that are squeezed and rubbed onto the area , which quickly relieves the pain from the sting .

Emergency treatment is only needed if a person is showing signs of a severe allergic reaction . Prior to calling for help , it is suggested that a person should be laid down , and their legs elevated . An EpiPen or an Anapen is given to people at risk of anaphylaxis , to use in case they are stung . If someone experiences anaphylactic shock , adrenaline and intravenous infusions are required , and those who suffer cardiac arrest require resuscitation . Desensitisation ( also called allergy immunotherapy ) is offered to those who are susceptible to *M. pilosula* stings , and the program has shown effectiveness in preventing anaphylaxis . However , the standardisation of *M. pilosula* venom is not validated , and the program is poorly funded . The Royal Hobart Hospital and the Royal Adelaide Hospital are the only known hospitals to run desensitisation programs . During immunotherapy , patients are given an injection of venom under the skin . The first dose is small , but dosage gradually increases . This sort of immunotherapy is designed to change how the immune system reacts to increased doses of venom entering the body .

Before venom immunotherapy , whole body extract immunotherapy was widely used due to its

apparent effectiveness , and it was the only immunotherapy used for ant stings . However , fatal failures were reported and this led to scientists to research for alternative methods of desensitisation . Before 1986 allergic reactions were not recorded and there was no study on *Myrmecia* sting venom ; whole body extracts were later used on patients during the 1990s , but this was found to be ineffective and was subsequently withdrawn . In 2003 , ant venom immunotherapy was shown to be safe and effective against *Myrmecia* venom .

= = = Prevention = = =

*Myrmecia* ants are frequently encountered by humans , so avoiding them is difficult . Wearing closed footwear such as boots and shoes can reduce the risk of getting stung ; these ants are capable of stinging through fabric , however . There is also a risk of being stung while gardening ; most cases of stings occur when someone is gardening and is unaware of the ants ' presence . Eliminating nearby nests or moving to areas with low *Myrmecia* populations significantly decrease the chances of getting stung .

= = = In human culture = = =

Due to their large mandibles , *Myrmecia* ants have been used as surgical sutures to close wounds . The ant is featured on a postage stamp and on an uncirculated coin which are part of the Things That Sting issue by Australia Post , and *M. gulosa* is the emblem for the Australian Entomological Society . *Myrmecia* famously appears in the philosopher Arthur Schopenhauer 's major work , *The World as Will and Representation* , as a paradigmatic example of strife and constant destruction endemic to the " will to live " .

But the bulldog @-@ ant of Australia affords us the most extraordinary example of this kind ; for if it is cut in two , a battle begins between the head and the tail . The head seizes the tail in its teeth , and the tail defends itself bravely by stinging the head : the battle may last for half an hour , until they die or are dragged away by other ants . This contest takes place every time the experiment is tried . "

Notable Australian poet Diane Fahey wrote a poem about *Myrmecia* , which is based on Schopenhauer 's description , and a music piece written by German composer Karola Obermüller was named after the ant .