

THE AMAZING UNIVERSE *of* ANTS





Welcome and Thank You!

Thank you for supporting our Ant Biology division at Evviva Sciences! Our mission is to make science fun and enjoyable, and we hope to encourage a passion and love for this field. We hope you love this complimentary Ant eBook, which includes several amazing ant facts, links to videos, and even some experiments you can try out. We truly appreciate your support! Please let us know what you think by emailing support@evvivasciences.com, or contact us if you have any questions whatsoever!

Disclaimer and Warnings

Some of the experiments in this ebook (such as the molten aluminum experiment) are meant to demonstrate features of ant biology and are not meant to be attempted at home. If you decide to do these experiments, use significant caution and make sure an adult is present. In fact, we recommend adult supervision when performing any experiment in this eBook. Always be careful when handling ants, and never handle them with your bare hands as they can inflict painful bites or even stings in some species. Always wash hands thoroughly after handling ants. Lastly, we try to verify all ant facts in this eBook, but not all have yet been verified, so please take some of these with a grain of salt!

Introduction

Just like bees and wasps, ants belong to a group of organisms known as Hymenoptera. Amazingly, it is estimated that up to 22,000 species of ants exist on the planet, of which more than 12,500 have been studied and characterized. Ants have colonized nearly every landmass on Earth, with only Antarctica and a few remote islands lacking indigenous species. Incredibly, it has been estimated that the total mass of all ants in the world is about equal to the mass of all humans in the world, even though a single ant is just a fraction of our size. This would mean that there are about 1 million ants for every human being on Earth!

One of the most fascinating characteristics of ants is their ability to cooperate and work together to form complex and highly organized colonies. In fact, some “supercolonies” may even stretch up to several miles in length (see Ant Fact #3) and may contain of millions of inhabitants. Within a colony, individual ants have different roles including worker ants, soldiers, and of course queen ants. Aside from a few male drones in each colony, all other ants are generally female!

Ant Defense!

Ants have evolved to have tremendous fighting abilities to defend their colonies. Ants can bite, and some species can even sting or spray chemicals such as formic acid! The most painful sting of any insect in the world (yes more painful than bees and even wasps) comes from an ant in Central and South America known as the Bullet Ant. Its sting has the highest rating on the Schmidt Sting Pain Index, which ranks the pain of insect stings! Check it out here:

https://en.wikipedia.org/wiki/Schmidt_sting_pain_index.

Ant bites and stings are generally not fatal to humans. However, one exception to this rule is the sting from the Jack Jumper ant in Australia. There have been rare human fatalities from the sting of this ant, and an antivenom has even been created for it.



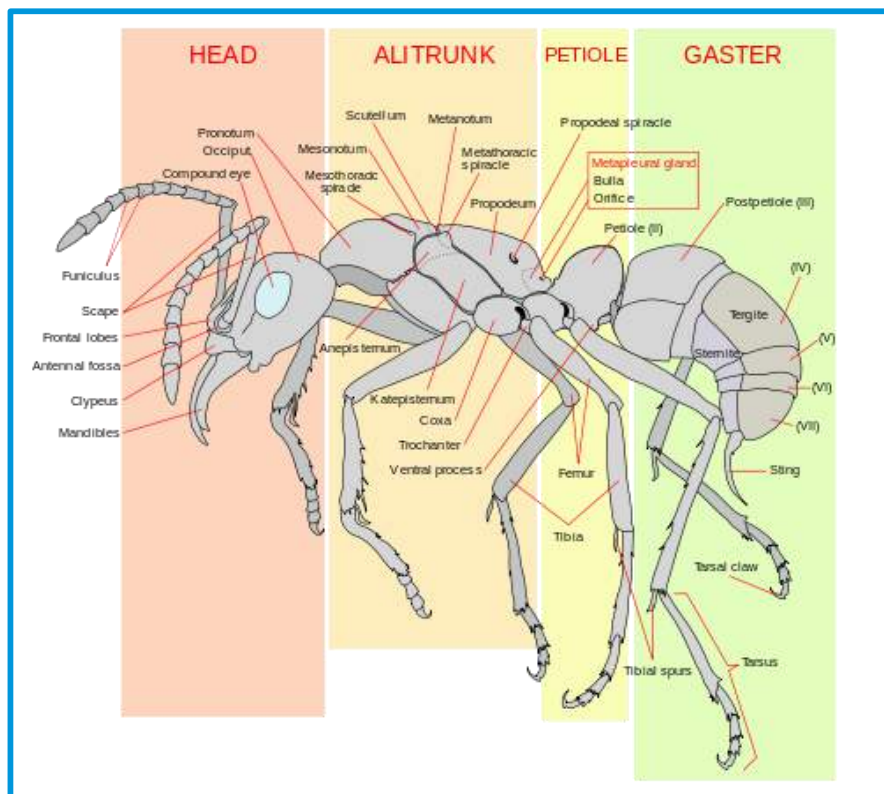
Figure: Jack Jumper or Bull Ants are characterized by extreme aggressiveness and painful stings. Some species are capable of jumping when agitated. As you can see from the picture above, these ants have elongated, powerful mandibles, and they have large compound eyes with excellent vision.

Another fascinating ant species is one called the trap-jaw ant. Their mandibles are called trap-jaws because they can snap shut with incredible force and speed. One study estimated that the jaws can move between speeds of 78 to 143mph, which is faster than any other predatory appendage in the animal kingdom. These ants often use their jaws to fling themselves in the air to escape threats. See Ant Fact #5 for a link to a YouTube video to watch these amazing animals in action.

Ants use bites and stings to protect their colonies against predators and to hunt for food. However, they also have mechanisms to protect their colonies from other dangers. For example, some worker ants have the job of disposing and burying dead ant bodies outside the nest to prevent disease from spreading throughout the colony. In fact, you may observe this behavior in your Ant Cosmos kit.

Ant Anatomy

Whereas humans and other vertebrates have internal skeletons, ants like other insects, have “external” skeletons or exoskeletons. The exoskeleton is a hard protective casing around the body, with softer tissues such as muscles and organs located on the inside. Ants do not have lungs. However, they have tiny holes in their exoskeletons known as spiracles that allow gases to pass through into the body. In addition, ants lack closed blood vessels, and instead have a long thin tube along the top of the body known the “dorsal aorta”. This structure acts like a heart and pumps nutrient rich fluid to the head and other regions of the body. You may notice that some ants have wings! These winged ants are usually only the reproductive ones such as male drones or queen ants. However, the queen ant will usually shed its wings when it starts a colony. Check out the picture below to learn more details about ant anatomy.



Ant Communication

One of the major way that ants communicate with one another is through the use of chemical signals called pheromones. For example, ants may travel long distances even as far as 700 feet from their nests to search for food. How can they find their way back? You guessed it, pheromones! Ants will leave a trail of pheromones back to the nest so that they can find their way even in the dark. A similar tactic is used when an ant discovers food. Have you ever noticed that when one ant finds food lying around, pretty soon hundreds (or more!) or ants are suddenly there? This happens because the first ant that found the food left a trail of pheromones for other ants from the colony to follow.

In addition to marking trails, pheromones can relay other types of messages. For example, when an ant's body gets crushed, it releases an alarm pheromone that sends nearby ants into an attack frenzy. This signal also attracts other ants from further away to come to help out if there is a fight. Some species even use "propaganda pheromones" to confuse enemy ants into attacking one another.



Figure: Ants may travel hundreds of feet from their nests when foraging for food and water. However, they are always able to find their way back because they use a trail of pheromones to mark the way



Figure: Ants using their antennae and pheromones to communicate with one another

Amazing Ant Facts

ANT FACT
#1

The total weight of all ants in the world is the same as, if not larger than that of all humans.

This means that for every human being on the planet there are about one million ants.

ANT FACT
#2

Some ants can support up to 100 times their own weight, even when hanging upside down!

Check out this video of the Asian Weaver Ant. This ant can carry more than 100 times its own body weight while hanging from a piece of glass using its “sticky feet”.

<https://www.youtube.com/watch?v=hd5upt3lrWM>

ANT FACT
#3

The largest ant colony ever discovered was approximately 3750 miles wide!!

That’s right! In 2000, an enormous supercolony of invasive Argentine ants was discovered in Southern Europe, which measured approximately 3750 miles wide. A supercolony means that several ant colonies have merged to create one massive colony. This particular supercolony posed a major threat to crops and even livestock. Although not nearly as massive as this colony, check out this youtube video showing another large ant colony:

<https://www.youtube.com/watch?v=lFg21x2sj-M>

ANT FACT
#4

Ants are the longest living insects. Some can live up to 30 years.

In some ant species, the queen ant can live for up to 30 years, which is 100 times longer than most other similarly sized insects. In some species the ant workers can also live a long time from 1 to 3 years. Sadly, male ants have the shortest lives, surviving for only a few weeks to months.

**ANT FACT
#5**

One ant species holds the record for the fastest movement in the animal kingdom.

The jaws or mandibles of the trap-jaw ant have been recorded to shut close at a speed of up to 140mph, which creates a force that is 300 times the ant's weight. Trap jaw ants can use this powerful weapon to defend themselves against threats, but they can also use their fast jaws to fling themselves away from danger. Check out this video:

https://www.youtube.com/watch?v=_OHi_WcwObo

**ANT FACT
#6**

It is estimated that 22,000 different species of ants exist around the world, and about 12,000 species have been classified.

Check out the ant database “antbase” which provides access to all the recorded ant species in the world.

<http://antbase.org>

**ANT FACT
#7**

Ants are one of the world's strongest animals relative to their size.

Ants can carry 50 times their own body weight. This is equivalent to an average adult man weighing 150 lbs carrying a 7500 lb object, such as a large pickup truck.

<https://www.youtube.com/watch?v=rBVmJtQsGgM>

**ANT FACT
#8**

One ant species is the most venomous insect in the world!!

The Maricopa harvester ant has a sting that is equivalent to 12 honey bees and is considered to be the most poisonous insect on the planet! Luckily, it is a small animal so the sting is not deadly.

ANT FACT
#9

It is said that if you took the world's smallest ant, you could fit many of them into the "skull" of the world's largest ant.

The world's smallest ant is thought to be *Carebara atoma*, which measure approximately one millimeter in length. The largest ant is thought to be *Camponotus gigas*, and its head can be 7mm wide.



Figure: Camponotus gigas or the giant forest ant is found in Southeast Asia and is possibly the largest ant species worldwide, with soldiers measuring over 1 inch in length.

ANT FACT
#10

If you take all the soil moved by ants in one year, it would weigh 50 tons for every square mile!

ANT FACT
1 1

Fire ants cause an estimated \$5 billion worth of damage in North America every year.

The red imported fire ant (RIFA) causes significant damage to agricultural assets, including veterinarian bills, livestock loss and crop loss. They also frequently cause significant damage to electrical appliances and other technological devices.

<https://www.youtube.com/watch?v=3vVUh-194vU&feature=youtu.be>



Figure: Widely disliked for their painful stings, fire ants have spread across much of the southern United States.

ANT FACT
#12

All worker, soldier, and queen ants are female

Nearly all ants are female. The only male ants are called drones, and they only live for a few months during mating season. Once they fertilize a queen ant, they die.



Figure: Harvester ants in a gel habitat, similar to our Ant Cosmos Kit. All these ants are female!

ANT FACT
#13

Some ants can actually clone themselves and do not need a male ant to reproduce.

Not all ant species need queens and males to reproduce. Some leaf cutter ant species have been discovered that reproduce by cloning themselves.

ANT FACT
#14

Ants and humans are the only living animals that farm other creatures.

Check out the video below:

<https://www.youtube.com/watch?v=JcAUa6e3x0s&feature=youtu.be>

**ANT FACT
#15**

Ants actually have two stomachs, one to hold food for themselves, and one to hold food for other ants.

Ants actually feed each other from their “social stomachs,” which is a process called trophallaxis. Check out this video:

<https://www.youtube.com/watch?v=AnVn8KH9fq8&feature=youtu.be>

**ANT FACT
#16**

Some ant species will actually turn ants from other colonies into their slaves.

Slave-making occurs in two ways. A queen ant may go to a nest of a similar ant species and kill the resident queen. She takes over the nest and uses the workers to bring up her own eggs.

Another slave-making method occurs when workers from one ant colony steal larvae from other nests and raise them as slave workers.

<https://www.youtube.com/watch?v=BfuOzSWtxRw>

**ANT FACT
#17**

Most ants can survive underwater for around 24 hours.

As described, ants do not have lungs and rather breath through small holes found around their bodies known as spiracles. Even if an ant appears to have drowned in water (such as your bathtub), you may have noticed that they often come back to life if they have been in the water for less than 24hours.

ANT FACT
#17

Some ants do not have eyes and explore their surrounding world with only their antennae.

Most ants have very poor eyesight, but some species have developed such advanced communication through their antennae that they no longer even have a need for vision. Driver ants are an excellent example.



Figure: Driver ants have no eyes and rely entirely on their antennae to navigate through the surrounding world.

ANT FACT
#19

Ants sleep frequently and can actually be very lazy.

We often think of ants as machines that put in endless hours to tunnel and collect food and water. However, ants can actually be pretty lazy as you may notice in your Ant Cosmos Kit. Some worker ants are thought to have over 200 “sleep episodes” daily, each lasting about 1 minute. Some ants hibernate and may sleep for around 4 months.

ANT FACT
#20

In some parts of the world, ants are eaten by people and are actually considered a delicacy.

In parts of Mexico, the larvae of some ants are the basis of a dish called “escamoles.” Some native Australians eat ants that are mashed up in water to make an acidic tasting drink. Check out this video.

<https://www.youtube.com/watch?v=Acxbx-DUkL4&feature=youtu.be>



Figure: Traveler eats ants.

Ant Experiments

Experiment 1:

Create a “real” ant colony with a queen ant.

Unfortunately, it is generally not legal to sell and ship queen ants to different states because of the possibility that they might escape and establish a species of ants that does not belong in that location. However, it is possible to adopt an ant colony with a queen ant using locally caught and raised ant species. Check out [antscanada.com](http://www.antscanada.com) below, which connects ant suppliers with hobbyists like yourself to adopt colonies with a queen ant. Also, if you happen to have a colony of ants that includes a queen, you can sell it to other ant enthusiasts through [antscanada](http://www.antscanada.com).

<http://www.antscanada.com/queen-ants-for-sale/>

The other possibility is to catch your own queen ant. Here is a video from [antscanada](http://www.antscanada.com) with detailed instructions on how to catch your own queen.

<https://www.youtube.com/watch?v=WfaK8TvM0qA>

Note that if you start a colony with a queen ant, you will likely need a much larger ant habitat to host the entire colony, which can grow into the thousands or even millions depending on the species.

Experiment 2:

Preserving an ant colony's structure with molten aluminum.

This is definitely not an experiment you should try on your own. But did you know it is possible to make a cast of an ant colony using molten aluminum? Note that the molten aluminum is unfortunately going to kill any ants that are trapped inside the colony, which is another reason we do not recommend this experiment (we also don't recommend it because it is dangerous). But still the results are impressive! The experiment works by pouring molten aluminum into an ant hill and then letting the aluminum cool down and solidify. After that, it is a matter of digging up the hardened aluminum and cleaning it off to see the elaborate and beautiful structure of the colony.

<https://www.youtube.com/watch?v=IGJ2jMZ-gal>

Here is a picture of one of these casted ant colonies, which you can purchase from www.anthillart.com.



Experiment 3:

Creating multicolored ants.

This experiment cannot be performed at home because it requires an ant species from India, which are characterized by transparent abdomens. But the results and pictures are spectacular. Dr. Mohamed Babu of Mysore, South India, noticed a certain ant species turned white when they drank milk that had spilled on the floor. He realized that these ants' bodies were transparent and he got a great idea for a photograph. He simply mixed sugar water with food coloring and let the ants eat. Check out some of his amazing pictures:

<http://www.smithsonianmag.com/science-nature/these-rainbow-colored-transparent-ants-are-what-they-eat-25521112/?no-ist>

Experiment 4:

Test of the effects of light on ant behavior

There are a few different ways to do this experiment. One involves using two ant habitats. Keep one habitat in the dark for a period of time and keep one habitat in the light for the same period of time. Which ants dug more tunnels?

Another variation is to see whether light can control the direction in which ants build tunnels. Many insects are attracted to light. Just imagine moths flying around a lamp post late at night. Well what about ants? If you shine a small penlight or flashlight in your Ant Habitat Kit (such as the Ant Cosmos kit), do ants tend to dig towards the light or away from it? Check out this video to see this experiment in action.

<https://www.youtube.com/watch?v=1heLNGUDDol&feature=youtu.be>

Experiment 5:

Test the effects of temperature change on ants

Try placing your ant habitat in different temperatures to see how it affects ant activity. For example place your ants at room temperature, in the refrigerator, and under a desk lamp for around 10-15 minutes. Use a thermometer to keep track of the temperature. At which temperature are the ants most active. How about least active? Why do you think this happens?

Experiment 6:

Can ants dig better in wet sand, dry sand, or in a gel based habitat.

You will need multiple ant habitats for this experiment. Even a jar will work fine to test digging in dry versus wet sand. Each habitat should have a different “tunneling” substrate: wet sand, dry sand, or a gel based substrate. Monitor the ants and measure the time it takes for them to build a 1-inch tunnel. Test the stability of the tunnels by shaking the container or tapping on the outside. Note that gel based ant habitats were originally used by NASA because scientists believed that the ant tunnels could withstand the strong G-forces in an orbiting space shuttle. Were they right?

Experiment 7:

How do ants react to different foods?

Try placing different types of food into your ant habitat and see what the ants do. Some foods to try include sugar, salt, citrus fruit, green vegetables, meats, oatmeal. Which foods do ants prefer and why do you think this is the case?

Image Links and Licenses

Ant communication

<https://www.flickr.com/photos/dzipi/2542534108/in/photolist-4SF9NY-sEDpYm-pY9yMV-pSNaGV-oD6Ho2-a272Uq-6fVHz9-9Y51BL-3wGr3i-6FyRKs-6sJfKz-eXfmX9-bMmQBH-nJttup-6FyRLq-7QyyFk-7JD9RL-ccrg3Y-5rueY2-6o9yu6-8mfuAv-6K9QaB-69MiSx-nJtF1m-nHzf5N-b9kkAv-csZoP3-cwg6Go-oWLj8Y-4my6gC-nJeCBz-aaT5ju-cPtPU3-c2sdMy-3JMYfF-Dezds8-9LXbXX-6u8DM2-np217v-ymwTWx-8BYH3E-bGsWE6-4rmKKL-et3o94-etv8ma-ejgFsg-dY4w5B-5MhqRk-4UTtgr-6nbEV8>

Ant mandibles

<https://www.flickr.com/photos/garrettt/7877159340/in/photolist-et3o94-etv8ma-ejgFsg-dY4w5B-5MhqRk-4UTtgr-6nbEV8-efs66s-edSyzc-edSzKR-7g2xoD-et3nH8-d15v35-9ZdM7v-e6mUdZ-z1N9CL-9ZgHyQ-enJuKb-8PgfCA-3xRhg-9ZdNbD-ocs7rZ-oWmruV-8fjKRt-p1PfJZ-cPtPWE-9p5wgY-4KWFFQ-edSzqc-8YDcxJ-ruus2Z-br4tmD-e8ScQH-mianN2-bPdEUK-nYm1WY-edYggA-7Wack3-et3oFi-8rzokY-6Bnypz-edSyRn-5Kx51j-2hvZL-et6AF1-5SHKx8-gk9Qtu-gk9BvV-c2s8RW-8UheVz>

Ant Anatomy

https://commons.wikimedia.org/wiki/File:Scheme_ant_worker_anatomy-en.svg

Fire Ants

https://commons.wikimedia.org/wiki/File:Fire_ants.jpg

Bull Ant

<http://www.gnu.org/licenses/old-licenses/fdl-1.2.en.html>

https://commons.wikimedia.org/wiki/File:Australian_bullant02.jpg#filelinks

Fir0002/Flagstaffotos

Man Eating Ant

<https://www.flickr.com/photos/squirk/5319391480/in/photolist-ozKCHA-JWhBg-fDV74-95q3gc-mHiwe-dA1Q8-FLCDS1-FLCDSw-ETtWj1-FLCDUA-ETEuw8-p1neXi-j2sQkt-j2rwGB-j2vwPy-c9ye4q-j2ttPh-p1ncdF-p1ktiY-7KxKak-j2tLNs-btNQic-4rgr9Z-p16LHe-4rkv65-btNQac-6t4Hnw-okike4-oByNKC-Kru2a-974fW1-j2sFw6-am7vEV-j2vLb3-9huZ4m-pR9C75-mtmY95-G8M4JK-974g6m-974h33-971cNM-971ct8-ychAzv-974gLd-7LWbeX-971bLV-971cXv-971c86-971bVv-CHDjGF>

Ant Gel Colony

<https://www.flickr.com/photos/jurvetson/5268677/in/photolist-t1cg-eghREd-4xSvKk-62q8J6-m2SWHp-audjgC-auarsx-nWdiz2-9n1uT6-4KXK4u-dCwa9W-cZaCKA-4vxbC4-auar6z-7WxtyA-4KTvyK-eR9MG7-4Q4ETW-pJhS2C-oMmZtf-aRz1pF-5iixxs-4RWHTz-9n4xM1-a2iE8A-Davkm-9sPVfT-aQ6qMV-4YDeGb-pg3n6Q-nE9tGD-e7By7J-8RQjGZ-51VHbo-e7Bz1o-3eJn3B-o4KPV9-F9xU9Z-etwpeo-EqDVCL-qyqWep-m9aDMn-4TtPnD-71qysx-diYnBT-BCpFGy-ovfBnh-5w8p18-CJeV-fKVJK4>

Camponotus gigas

<http://flickr.com/photos/65695019@N07/6731241753>