



# Bees vs wasps

Bees get all the good PR compared with wasps, but how do their talents really measure up? **Chris Simms** stages the ultimate insect showdown



**I**T IS a beautiful, sunny day. The smell of a barbecue is in the air and a bee is bumbling from flower to flower. Everything feels perfect. Then a wasp appears, stirring up rather different feelings: fear, loathing, anger.

Our widespread dislike of wasps – and love of bees – goes back a long way. “Hornets and wasps... are devoid of the extraordinary features which characterise bees,” wrote Aristotle more than 2000 years ago. Was he right, or is there more to wasps than most people think?

It is hard to fairly compare different animals, but we enjoy a challenge, so here we pit the talents of bees against those of wasps in eight categories, from cognitive skills to stings, architecture to navigation. Which of these insects should we be buzzing about?

## Communication

“Most social insects communicate with a vocabulary of chemicals and vibrations,” says Fred Dyer at Michigan State University. This includes bees and wasps.

Honeybees use their abdomens to drum up vibrations to create a “get to work” signal. Wasps also engage in gastral drumming, banging their abdomens against the walls of the nest when there is food nearby.

Bees and wasps emit hisses, buzzes and chirps, and wasp larvae make a popping sound to alert adults that they need food.

On the chemical front, individual social bees and wasps release substances to communicate and provoke responses, such as recruiting others to join them in getting food or inciting them to defend their home. Queen honeybees produce a chemical mix called the “queen signal” that physiologically alters the development of other bees, suppressing reproduction and keeping all the insects working together.

But nothing rivals the honeybee dance language. The waggle dance is incredible, says Seirian Sumner at University College London, author of *Endless Forms: The secret world of wasps*. The insects move in a figure of eight to recruit other bees and indicate in what direction something is and how far away it is.

L: JAVIN CLAY BOLT/NATUREPIXL; R: STEPHEN DALTON/NATUREPIXL

Wasps just don't have that level of communication, because their prey moves quickly and so there is often little point in going back to recruit others, says Sumner.

The waggle helps the bees win this round.

### Bees 1 – 0 Wasps

## Cognition

Despite having a brain the size of a poppy seed, bees have a basic grasp of numbers and can understand the concept of zero, carry out addition and subtraction and solve a complex navigation conundrum known as the travelling salesperson problem. Some bees demonstrate a basic level of metacognition – thinking about thinking – by assessing their performance on a task and avoiding it next time if it is too difficult.

Honeybees can even distinguish between human faces and remember them for at least two days. There is also evidence of simple tool-use in bumblebees, says Lars Chittka at Queen Mary University of London, who was part of a team that has shown that these insects will pull a string to get a reward. (See our review of Chittka's latest book on page 34 for more on the inner lives of bees.)

Can wasps touch that? Many more studies have been carried out on bees than wasps, so it is hard to tell for sure. But given that their prey (other insects and spiders) are hard to catch, while bees just navigate between stationary flowers, it is likely that the cognitive abilities of wasps are at least equal to those of bees, says Sumner.

We know that wasps are capable of a type of logical reasoning called transitive inference. Elizabeth Tibbetts at the University of Michigan and her colleagues have revealed that *Polistes* paper wasps can grasp that if A is greater than B, and B is greater than C, then A is greater than C. "These wasps are the only non-vertebrate shown to do it so far," says Tibbetts. They can also recognise and remember the faces of other hive-mates.

"Bees and wasps are both masters of their craft," says Andrew Barron at Macquarie University in Sydney, Australia. "Foraging is hard. You have to continuously solve an optimisation test and bring back more than you use."

Both show great smarts for such small creatures: it's a draw.

### Bees 2 – 1 Wasps

## Building skills

"Architecture is important for both bees and wasps," says Chittka. Both have mastered the art of making hexagonal cells in which to lay their eggs. "Hexagonal honeycomb doesn't just have beautiful symmetry, it is also mathematically optimal," he says. Square chambers leave wasted space in the corners and round ones have gaps between them.

When honeybees make their cells, they secrete wax from their own bodies, and leave a space between different sheets of honeycomb that is exactly two bees wide, so individuals can pass each other.

Yet wasps are more efficient builders. "Wasps use antennae to set the size of the cell, and the first one they build is a hexagon," says Sumner. "In bees, the first is a circle and then the ones built around become hexagonal."

Wasps use different building materials, too. They gather water and wood supplies and make paper to create their cells. And they use different types of wood for specific jobs, choosing rotting wood, preserved dead wood or fresh wood as necessary, says Sumner. They produce a material that is so strong a human can't bend it easily, yet is incredibly light and capable of holding the heavy brood. Wasps also build an envelope around the nest, enlarging it as the nest inside grows. Social wasps' nests, including those of hornets – which are a type of wasp – can also come in extraordinary shapes, ranging from balls to dresses or even tennis rackets, says Sumner.

Wasps have this one nailed.

### Bees 2 – 2 Wasps

## Bees at work, visiting a flower and executing a waggle dance



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## Usefulness (to us)

It is hard to overstate the usefulness of bees. Honey-making is just the start. The global honey market was valued at about \$8.5 billion in 2021, and beeswax pops another \$500 million on top of that. But the biggest economic contribution of bees is in pollinating flowers, thought to improve the global crop output by hundreds of billions of dollars every year.

What about wasps? Each species of fig tree (*Ficus*) has its own wasp species to pollinate its flowers, enabling a global market in figs worth some \$500 million a year. There are other wasps that pollinate, including male wasps lured to orchids because the plants grow flowers that look and smell like a female wasp, and the aptly named pollen wasps, which collect pollen to feed their brood. Still, the contribution of wasps is small compared with that of bees.

The big value of wasps to us lies in their pest-control services, says Sumner. Wasps kill and eat woodlice, spiders, caterpillars, aphids and flies. Sumner calculates that *Vespula* wasps are likely to be removing more than 23,000 arthropods per hectare per year, which goes a long way to protecting your fruit and veg.

Some wasps can also help against invasive species, says Dyer. For instance, in the US, parasitic wasps have been released to control the invasive emerald ash borer beetle, which is damaging valuable timber supplies by destroying ash trees.

Pollination services make it a win for the bees.

### Bees 3 – 2 Wasps



KIM TAYLOR/NATUREPL

**A hornet (a type of wasp) killing a bee, and a hornet nest**

## Cunning

Bees might look furry and cute, but honeybee queens begin life by murdering their sisters, says Chittka. Then there are tropical stingless bees in the *Lestrimelitta* genus that specialise in kleptoparasitism: they find nests of honey-making bees, kill or evict all the residents and steal their food. That's not to mention cuckoo bees, which will go to an existing colony, kill the resident queen and get the workers to raise their own young.

Wasps also exploit the work of others. Common wasps raid honeybee hives to steal honey, especially towards the end of summer. Asian giant hornets kill and decapitate a honeybee nest's guard bees, murder all the residents and take the honey, pupae and larvae to feed their own young – unless the bees can defend themselves by forming a bee ball, surrounding any hornets in huge numbers and overheating them until they die.

But all these are small fry when compared with the dementor wasp, *Ampulex dementor*. These puppetmasters inject venom into cockroaches, blocking neurotransmitter receptors, which stops the roaches from controlling their own movement. The wasps then lead their zombified prey by the antennae to their nests.

Charles Darwin was so affected by the antics of *Ichneumon* wasps – whose larvae hatch out of eggs laid on caterpillars and consume the living host from the inside before bursting out of them to pupate – that it made him question the existence of a beneficent and omnipotent god.

Wasps steal this round.

**Bees 3 – 3 Wasps**

## Navigation skills

Some of us need a map or an app to find even the most prominent of landmarks, but bees can gauge distance, work out where something is in relation to the sun and use landmarks to find their way, even to somewhere several kilometres away. For an insect just a centimetre or so long, this is an impressive feat.

Less is known about these talents in wasps. In the 1930s, it was discovered that a type of wasp called the European bee wolf (*Philanthus triangulum*) uses landmarks near its nest, such as pine cones, to find its way home, and now we know that other species of wasp can do this too.

Most navigational studies are done on bees, though, because they are easier to work with



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KIM TAYLOR/NATUREPL

and less hassle to keep in the lab, says Chittka. But he has anecdotal evidence of wasps' sense of direction. One of his team was studying how a bee navigated a maze when a wasp flew into the experimental set-up, so they decided to see how the wasp did. It turned out that the wasp was better at navigating the maze. Unfortunately, the experiment ended in tragedy when the wasp killed the bee.

Given the lack of data, another draw.

**Bees 4 – 4 Wasps**

## Biodiversity

Wasps and bees have a close relationship. "Bees are a vegetarian group within the wasps clade," says Dyer. About 120 million years ago, when flowering plants were diversifying, bees arose from wasps. There are now about 100,000 species of wasp compared with some 22,000 species of bee, says Sumner.

Wasps are the clear winners here.

**Bees 4 – 5 Wasps**

## Stings

Most people will be stung by a wasp or a bee during their lifetime, but given that many of us can't tell the difference between the two insects, reports of which caused the sting can be unreliable. This is why medical data relating to stings generally lump bees, wasps and other insects together.

For most people, a single sting will cause temporary localised pain, swelling and redness, but about 5 per cent of people will have a systemic allergic reaction, and about 32 per

cent of beekeepers will, as they can become hypersensitive after receiving repeated stings.

The venom of both wasps and bees contains chemicals such as phospholipase A, an enzyme that destroys cells and is also an allergen; hyaluronidase, which helps break down carbohydrates so the venom can get through tissues; and pheromones to alert other wasps or bees.

Bee venom also includes melittin, which is a peptide that kills cells and stimulates inflammation, and the neurotoxin apamin. Wasp venom contains wasp kinin, which affects inflammatory responses; phospholipase B, which can immobilise prey; and acetylcholine, which stimulates pain nerves.

Female honeybees have a barbed stinging apparatus that can inject between 50 and 140 micrograms of venom for up to a minute. However, they can't sting again, whereas wasps can sting many times, injecting around 3 micrograms of venom each time. Some argue that a bee is less likely to sting you unless it is in dire need, because its serrated sting will stick in an animal and rip out the bee's organs, dooming it to die. "Wasps' threshold for stinging may be lower, but we don't know," says Barron.

Both stings are unpleasant, so it's another draw. Which means it might be time to give wasps a little more love.

FINAL SCORE

**Bees 5 – 6 Wasps**



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