



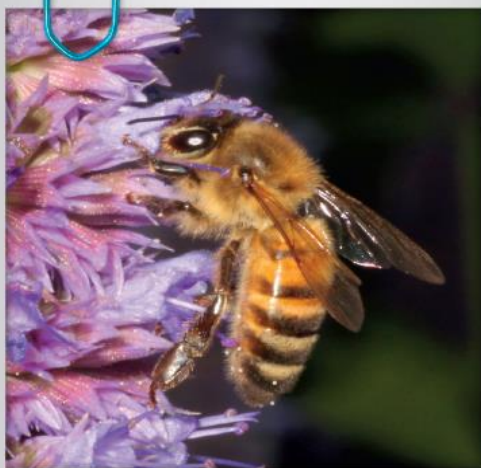
INTERNATIONAL BEE
RESEARCH ASSOCIATION

Registered Charity No. 209222

THE BEEWORLD PROJECT

EDUCATION PACK UNDERSTANDING BEES





Honey bee

Image © W. D. J. Kirk

What is IBRA?

Established in 1949, IBRA (International Bee Research Association) is an information and advisory service on all species of bees and beekeeping. IBRA has links to hundreds of universities and research programmes around the world.

IBRA is a UK registered charity, relying on funding from grants, subscriptions, sales of publications and other services.

After the human race, the honey bee is probably the most studied creature. For over 65 years, IBRA has gathered information on bees that is used by scientists and beekeepers all over the world. Its knowledge base is unique and it publishes some of the world's leading journals and books in this field.

For more information on IBRA and its range of publications and services, visit:-

<http://www.ibra.org.uk/>

<https://www.facebook.com/IBRAAssociation>

https://twitter.com/ibra_bee

IBRA



INTERNATIONAL BEE
RESEARCH ASSOCIATION

About this Pack

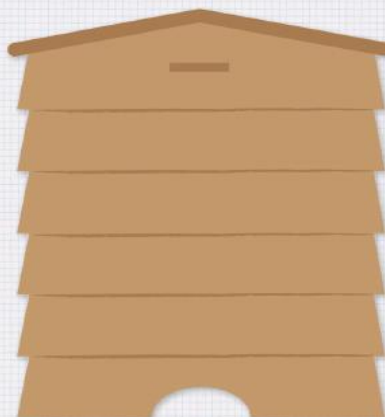
The Beeworld Project aims to promote the value of bees in schools and communities.

This education pack has been produced to help teachers and other educators introduce bees, their activities and their relationship with humans. It provides basic information for the study and understanding of bees, and offers ideas for bee-related activities across the curriculum and in support of Education for Sustainable Development and Global Citizenship (ESDGC).

Using this resource is an effective way to get children interested in bees and pollination, and help them discover how important these are to our daily lives. More detailed information about bees and additional educational resources are available on the IBRA Beeworld Project website.

Julian Rees,
Operations Director, IBRA

This pack was designed and illustrated by
Joanne Hawker. www.joannehawker.co.uk



What's in the Pack

This pack contains useful information about bees, pollination and honey followed by curriculum-linked activities and other resources to help bring the Beeworld Project to life in the classroom.

Useful information about bees

- Why are Bees Important?
- What's Happening to Bees?
- Parts of a Bee
- Bees in the UK
- What about Wasps?
- Life in a Hive
- Bees and Flowers
- Pollination and Bees
- The Waggle Dance
- All about Honey
- How to Help Bees

Curriculum-linked activities

- Bees and the Curriculum
- The Great Bee Debate
- Bee Poetic
- Acrostic Poem
- The Buzzy Bee Game
- A Hexagonal World
- Solitary Bee Hotel
- Make a Crafty Bee
- Cooking with Honey
- Waggle Dance Game

Other resources

- Amazing Bee Facts and Figures
- Bee Dictionary
- Bee Word Search
- Bee Maze



Bee to the blossom

Image © Sherry White



Solitary bee

Image © W. D. J. Kirk

BEEWORLD Day

IBRA's BEEWORLD Day is a sponsored fun day for children to raise money to help support bee education and planting projects in this country as well as other developing countries. The International Bee Research Association has been supporting bee science for over 65 years and is committed to global bee projects .

Schools and Community groups can all take part in the BEEWORLD Day. Activities such as buzzing about in the school groups, using the resource pack, planting for pollinators (using native 'flower bombs'), performing a waggle dance or simply wearing black & yellow clothing / dress up as a bee to school can all be fun. You can hold an event whenever and wherever you like. It's up to you if you want to make it a class, whole school or community event. Try to learn about some plants that are good for bees and look around the school grounds or park to find if bees are buzzing around them.

Help make a difference to the future of our bees, support bee education, planting projects or help children in the developing world learn how to become sustainable through beekeeping.

How you help

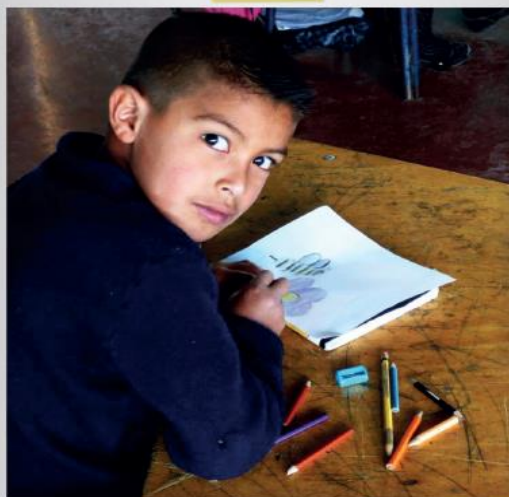
The money raised will support the BEEWORLD Projects in this country through pollinator planting schemes in the local community and schools and overseas by helping children/ young adults learn the skills to become self-sustainable / financially independent through beekeeping.

Your support enables us to continue our work in South America, Africa and across the world.

Please find the sponsorship form at the back of this pack.



BEEWORLD Day



Guatemalan Bee Project

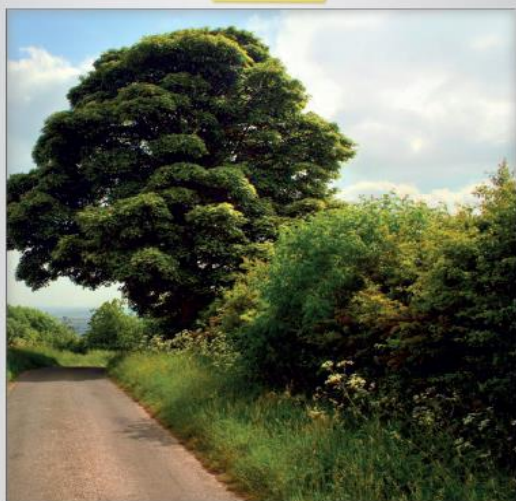
Why are Bees Important?

Bees are vital members of the natural world. Many of the world's food crops rely on pollination by bees. In fact, it has been estimated that a third of what we eat worldwide involves pollination by bees. Examples include strawberries, apples, tomatoes, other fruit, seeds and nuts.

Bees also pollinate plants that we use for medicines and plants that wild animals and livestock feed on.

Humans have benefited for hundreds of years from bee products such as honey and beeswax. Honey is not only a source of food but has been shown to have medicinal properties too. Honey and beeswax are also used to make cosmetics and cleaning products.

Bees make a huge contribution to the economy and communities all around the world and play an important role in many cultures and traditions.



Hedgerows

Image © Alan Green



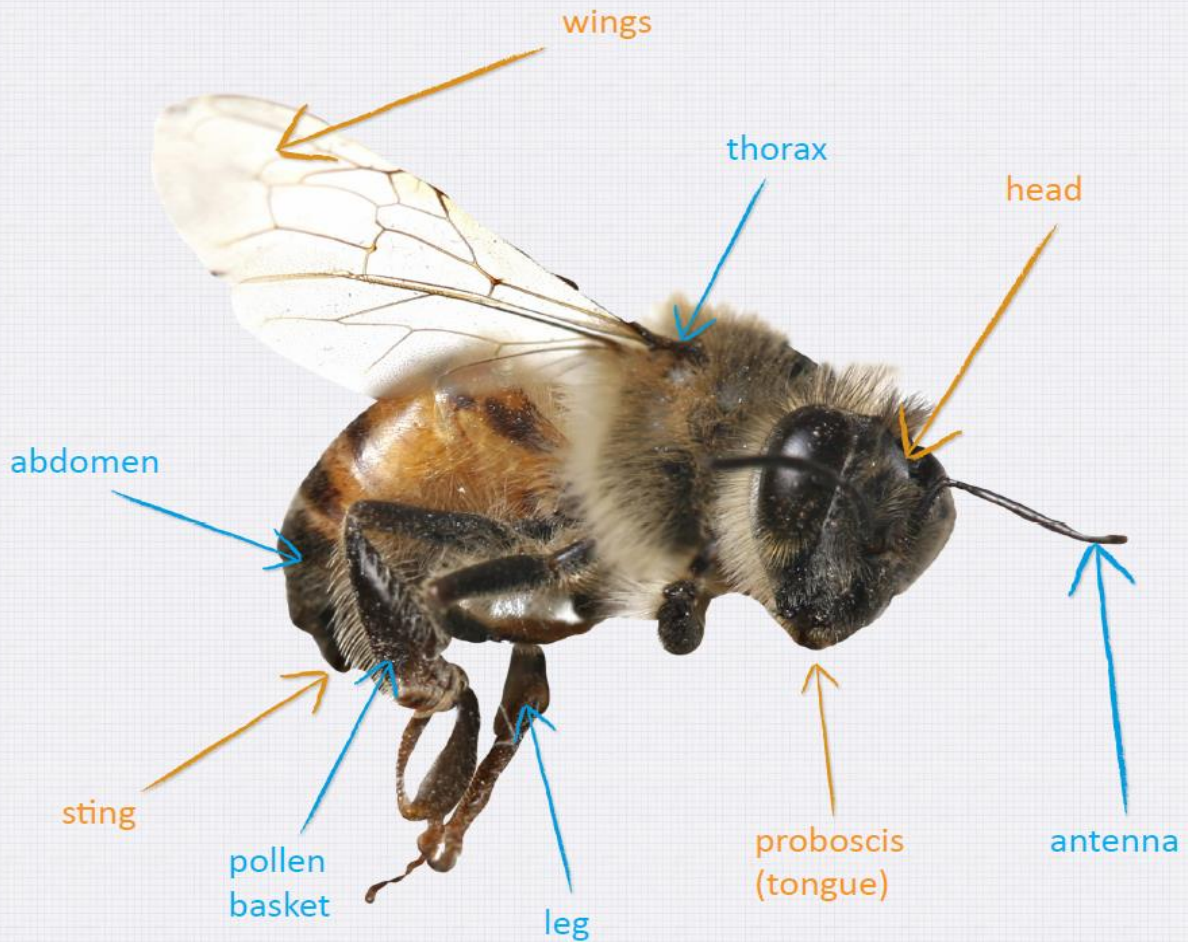
Honey dipper

What's Happening to Bees?

Bees in many parts of the world are under threat and their numbers have been declining. Honey bee numbers have fallen by 30% over recent years and there is still uncertainty about the cause. Many suggest it is down to the use of pesticides and modern farming practices. A loss of habitat that supports bees is also a key factor. For example, 90% of the UK's wildflower meadows have been lost since 1930 and large scale agriculture has resulted in many hedgerows being removed.

Climate change disrupts weather patterns and the timing of seasons. Changes to when plants flower could affect pollinators. Honey bees have also been greatly affected by a disease caused by the Varroa mite.

Losing bees altogether is a real possibility and this would have a huge impact on the ecosystem, food production, the economy and our health and well being. Continuing research into bees and the problems they face is extremely important if we are to find a lasting solution to these problems.



Parts of a Bee

A bee is an insect and has:

- a body made up of three parts: head, thorax and abdomen.
- six legs: three on each side of its thorax.
- four wings: two large and two smaller ones underneath.
- two antennae (feelers) used for feeling and smell.
- a long tongue (proboscis) to suck up nectar and water.
- a sting at the tip of its abdomen used to defend itself.
- pollen baskets (stiff hairs) on the hind legs for carrying pollen.

Did you know that a bee has five eyes – two large compound eyes and three small simple eyes!



Bees in the UK

There are over 250 different species of bee in the UK. These can be either solitary bees or social bees, such as bumblebees and honey bees.

Solitary Bees

Solitary bees are found from the Arctic Circle to South America. Common species in the UK include mason, mining and leaf cutter bees. Solitary bees vary considerably in size and shape but do not swarm and are unlikely to sting unless they are disturbed.

Solitary bees are to be found in many gardens and are active in spring and summer. A female solitary bee constructs a tunnel in lawns, woodwork or walls. She lays a single egg in the tunnel, puts in food made from nectar and pollen, and then seals it up again. She will often have died before the new adult emerges. Tunnels may sometimes be repossessed by another bee the following year.



Solitary bee

Image © Lindsey Bowes

Bumblebees

Bumblebees are social insects and usually live in nests of around 50–150. They are generally bigger than honey bees but can vary in size and colour. Bumblebees have hairy bodies with blocks of colour rather than lots of stripes. Bumblebees do make honey but not in large quantities.

The queen bumblebee starts a new nest in spring after building up her energy with plenty of pollen and nectar. She first rears a group of female workers to feed and nurture the colony. Towards the end of the summer the queen produces male offspring and new queens. The males die off after mating, as do the old queens and workers. Only new queens survive to hibernate through winter and establish their own nests the following year.



Bumblebee

Image © C. Stevens

What about Wasps?

Wasps are closely related to bees but do not collect pollen. Instead, they prey on other insects and spiders. They also like sweet things and bite fruit such as pears and plums. Wasp nests are made of paper-like material, whereas bees produce wax honeycomb structures.

Honey bees

Honey bees live as a colony in a nest or hive. Each colony contains three types of bees: the queen, the workers and the drones. Each of these has its own special function to fulfil within the colony. In the middle of summer a typical honey bee colony will consist of one queen bee, around 75,000 workers and several hundred drones.

The queen is head of the colony and responsible for laying eggs. She has a longer abdomen than the other bees. The queen can lay up to 2,000 eggs every day – more than her own body weight. She leaves the nest building and gathering of food to the worker bees and is fed by attendant workers. Queen bees live longer than workers and drones, and may survive for five years or more.

Worker bees maintain the honey bee colony by caring for eggs and developing larvae, producing wax and building it into comb, processing honey within the hive, feeding the queen, guarding the colony from intruders, and collecting pollen and nectar. All worker bees are female, but they do not lay eggs.



Queen bee

Image © D. Magnier

Workers are the bees we are most likely to see in our gardens and school grounds as at the height of the season, most will be making trips outside the hive looking for food. Each worker can carry 40–50mg of nectar in her honey sac. It has been calculated that to produce one pound of honey, foraging bees must fly the equivalent of three times around the Earth.

Drones are male bees and have the sole purpose of fertilizing the queens. They are only reared by the colony when young queens are likely to be present. Drones are larger than workers and take a few days longer to develop. Adult drones are fed by workers but also help themselves to honey stores.

Drones are powerful flyers and may be seen on warm, still afternoons hovering about 10m above ground with drones from other colonies. At the end of the summer the workers throw the drone bees out of the colony and they die.



Worker bee

Image © W. D. J. Kirk



Life in a Hive



Hive

Image © Elliott Brown

Winter is the quiet period for the colony. At this time the colony will consist of the queen, 10,000 to 20,000 workers and no drones. The bees move about within the cluster gradually consuming honey stored the previous summer. When the temperature falls below 18°C, bees huddle together to conserve heat. Bees die if their body temperature falls below 8°C.

As the days begin to lengthen and the weather improves, brood rearing begins. The brood refers to the eggs, larvae and pupae that mature into fully-grown bees. For brood rearing to be successful, bees must be able to obtain pollen and water from outside the hive. As spring advances, the queen lays more and more eggs. Any worker bees which have survived the winter die and are replaced by newly reared workers.

In May and June, drones are raised and as the number of bees in the colony increases, swarming may take place. The old queen leaves the hive with up to half the worker population and the swarm will settle in a new location to build a new nest.



Swarming bees

Image © Jonathan Proud



Drone

Image © Gabriel Serafini



Feeding on honey

Image © W. D. J. Kirk

Bees and Flowers

Bees are completely dependent on flowering plants for food for themselves and their young. In turn, some plants depend upon bees (and other insects) for pollination. Nectar and pollen are gathered from both wild and cultivated flowering plants. Bees also obtain honeydew and propolis from plants and trees.

Hedgerows are a particularly good habitat for bees, supporting a wide variety of flowering plants and providing suitable places for bees to nest. Gardens and school grounds can also provide a good supply of food from spring bulbs and early flowering trees through to autumn flowering shrubs. Attracting bees to the garden or allotment can help the pollination of fruits and vegetables.

Nectar attracts bees to plants as it provides bees with the energy (carbohydrates) they need. It is a sugar solution and is often scented or has a spicy taste. The time of day and weather conditions can also affect the concentration of sugar in the nectar.

Pollen is a highly nutritious food eaten by many insects and is a vital source of protein for bees. In the UK, sources of pollen are found from early spring through to autumn. A honey bee can carry 50,000 to 75,000 pollen grains on her body.

Honeydew is a sugary liquid excreted by insects such as leafhoppers and aphids. If nectar from flowers is in short supply, bees will collect and store honeydew.

Propolis, also known as bee glue, is a sticky substance collected from plants and used by bees to block up holes in their hive or nest. This ensures the hive is waterproof and windproof and helps protect it from natural enemies such as mice and wasps. Bees sometimes use propolis to 'mummify' intruders, that have entered the hive.



Collecting nectar

Image © C Stevens

The **stigma** catches pollen grains from the hairs of passing bees.

Anthers make pollen.

The **pistil** is where the pollen grows through to reach the ovaries.

Hairs on a bee's body trap the pollen.

Brightly coloured **petals** attract bees and other insects.

Stamen bends for pollen grains to drop onto the bee's back and has the anther at the end.

Pollen basket where the honey bee packs the pollen.

Proboscis (tongue) is used to suck up nectar.

The **sepals** protected the bud.

Ovaries contains ovules which become seeds.

Nectaries produce nectar.

Pollination and Bees

Pollination is the transfer of pollen from one flower to another and is an important part of reproduction for many plants. Bees and other insects are called pollination agents when they carry pollen on their bodies and help pollination. The wind and, in some countries, nectar-seeking birds and bats, are also pollination agents.

The Waggle Dance

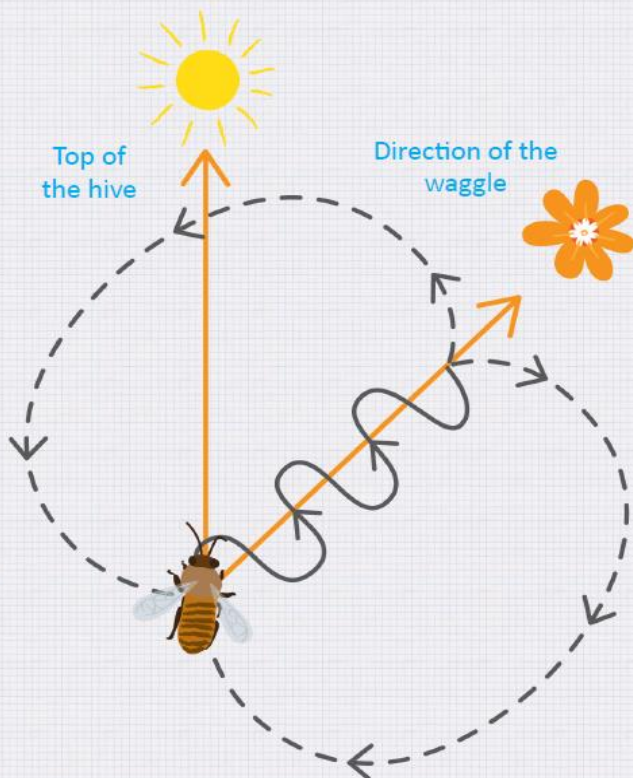
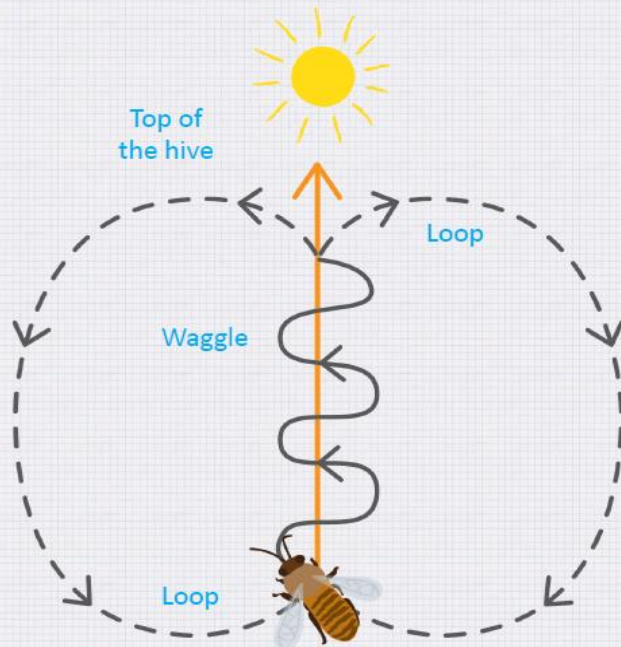
When a honey bee finds flowers with lots of nectar it will often return to the nest or hive and perform a dance to show other bees how to find the food source.

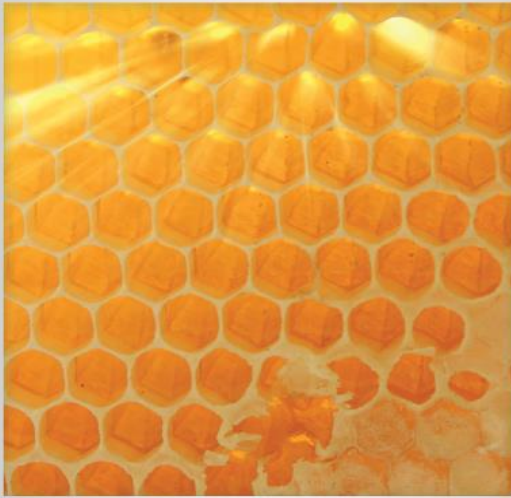
This amazing 'waggle dance' usually takes place on a vertical surface within the hive. If the food source is in the direction of the sun the bee dances in a straight line upwards towards the top of the hive, wagging its tail as it does so. It will then turn to the right and loop back to the start and repeat the dance. Then it will turn to the left to loop back to the start and keep repeating this sequence.

If the flowers are to the right of the sun, then the bee will do its waggle dance at the precise angle to the right of vertical.

As the bee performs the waggle dance, the surrounding bees also smell the pollen on it so they not only know the direction to go but also the type of flowers to look for. The number of times the bee repeats the dance indicates how far away the flowers are.

Sometimes more than one bee will join in with the dance and if it is repeated many times then it suggests there is a lot of good nectar and pollen to be found on the flowers. As the nectar and pollen start to run out in that area then fewer bees will do the dance.





Honeycomb

All about Honey

Bees make honey mainly from the nectar of flowers but plant sap and honeydew may also be used. Bees collect the fluid in their honey sacs and when they arrive at the hive, it is passed from one bee to another before it is placed in a honeycomb cell. As the sugary liquid is passed along, chemicals in the bees changes it into honey.

The hive temperature and ventilation caused by bees flapping their wings makes water evaporate from the honey. When it is just right, the bees seal the cell with wax like a sealed storage jar.

Honey consists mainly of water and sugar but also has small amounts of other substances such as minerals, vitamins and pollen. Honey varies in taste, smell and colour according to its plant source.

Honey is a delicious food high in carbohydrates and adds useful variety to diets. In many societies honey has an important place in traditional food preparation and is also viewed as a source of special nutrition for children.

Honey is often used to treat coughs and throat infections and is regarded by many as a special tonic to be eaten at times of illness. Because of its antibiotic and sterile properties, honey has been used in the past, and in some countries is still used, as a wound dressing and first aid treatment for burns and cuts.

Honey is the only natural food that never goes off. Jars of honey which have been found in ancient Egyptian tombs is still edible.



Beekeeper inspecting colony

Image © D. Magnier

How to Help Bees

There are lots of things that schools and community groups can do to help bees. Here are just some ideas:

Bee Aware

1. Find out more about bees and their importance. Research the lives of bees and how we benefit from them. Investigate the threats facing bees and how we can help.
2. Promote bees to others. Organise an assembly, make a presentation or put up a display for everyone to see. Invite a local beekeeper to come into school with beekeeping equipment.
3. Organise a **BEE AWARE DAY** for the whole school and the local community to join in. Encourage everyone to wear yellow and black for the day. Every class could have at least one lesson or activity to do with bees. The school kitchen could prepare a lunch menu that includes honey.



Honey bee

Image © Marco Moretti

Bee Friendly

1. Carry out a wildlife audit of your school grounds to find out what wildlife lives in the grounds or visits for food and water. Note what flowers and plants are in the grounds and whether they are beneficial to bees.
2. Plant wildflowers and fruit trees in your school grounds to provide food for bees. Ensure that there is also a supply of water. Encourage those that cut the school playing fields to leave an area to grow wild.
3. Construct and install bee hotels to provide good places for solitary bees to live.

Bee Supportive

1. Develop links to a local beekeeping club and explore the opportunities for setting up bee hives in the school grounds. Visit other schools that have bee hives and share ideas.
2. Join the International Bee Research Association (IBRA) education programme and receive up-to-date information on bees. www.ibrabeeeworldproject.com
3. Organise a fund-raising event to help support the important research work being carried out by IBRA and its partners in the UK and around the world.



Honey biscuits

Image © Jane Jones

Bees and the Curriculum



A project on bees offers a wide range of learning opportunities across the curriculum, in both Foundation Phase and Key Stage 2, including support for the Literacy and Numeracy Framework (LNF) and Education for Sustainable Development and Global Citizenship (ESDGC).

Here are just some ideas for different curriculum areas:

Literacy: researching, writing, presenting and debating issues related to bees: imagining life in a colony and exploring the different roles bees play; comparing human and bee behaviour and our attitude to bees and other creatures (see **The Great Bee Debate** activity). Bees can also be a great stimulus for creative writing, poetry and song (see **Bee Poetic** and the **Acrostic Poems** activities).

Mathematics: working with the **Amazing Bee Facts and Figures** sheet, pupils can explore large numbers in distance, speed and weight. The bee hive structure offers a great starting point for investigating regular and irregular shapes and tessellation (see **A Hexagonal World** activity).

Science: examining the interdependence of organisms including adaptation, food chains, ecosystems, pollination and human effects on the environment. **The Buzzy Bee Game** provides a simple activity to underpin an understanding of the structure of insects and the **Waggle Dance Game** is a great way to engage pupils in an aspect of bee behaviour.

Geography, History and RE: investigating the way bee products are used around the world and the significance of bees to other cultures and religions, both past and present, and considering the moral and social significance of losing bees

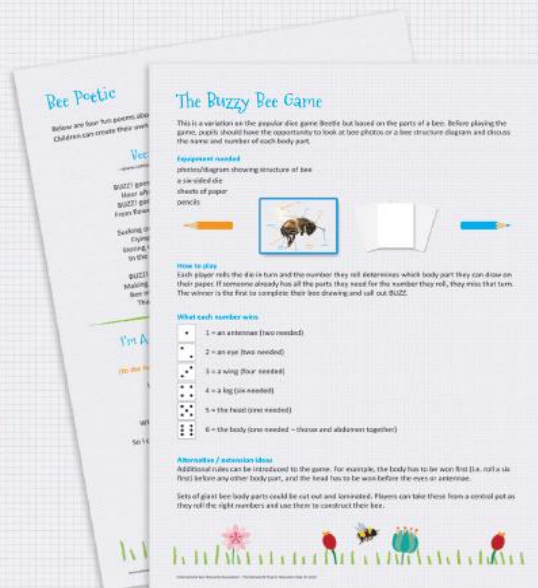
Design and Technology: an investigation of hive structures (see **A Hexagonal World** activity), the design and construction of insect homes (see **Solitary Bee Hotel** activity) and making things with bee products (see **Cooking with Honey**) all provide useful experiences in developing ideas, using tools and exploring the properties of different materials.

Art and Design: bees and honeycomb motifs have inspired imaginative designs from ancient times to modern marketing. These can provide ideas for work in a range of media from simple modelling activities (see **Make a Crafty Bee**) to printing patterns and creating elaborate murals or textile work.

PE: the **Waggle Dance Game** provides a rare opportunity to bring science into a dance or drama lesson. A day in the life of a bee, the texture of honey and the shape of a honeycomb can all be explored using movement and all the senses.

Music: the *Flight of the Bumblebee* by Rimsky-Korsakov is a great example of how music can reflect real life and can be used as the stimulus for pupils recreating the sounds of a hive, bees foraging for nectar or the waggle dance.

The following pages of this pack provide a selection of bee-related educational activities. Many of these activities can be adapted to suit the age and ability of the group and in some cases alternative and/or extension ideas are also included.



The Great Bee Debate



This is a rich task activity that involves a range of literacy skills (reading, oracy and writing) and can draw on other subject areas too, such as science and ICT. Where possible and practical, each phase should be pupil led.

Identifying the issue

Choose a bee-related issue or problem that pupils can explore e.g. which bee is most important for the colony; how to design a super bee; or how to save honey bees from extinction. This issue can be posed by the teacher or may emerge from initial research or a stimulus such as a film or story.

Reading and research phase

The pupils should be provided with access to a good breadth of information on bees; both physical (books and briefing sheets) and digital (through the Internet, videos and images). They should have a clear idea of the questions they need answering and use research strategies such as skimming texts, choosing relevant information and recording it effectively. They should also learn to differentiate between fact and fiction and recognise that they may discover different opinions.

Oracy phase

Working in small groups the pupils should discuss the issue they have researched and establish their case or side in the debate. They should be encouraged to talk about what they have discovered with enthusiasm and confidence; practising new vocabulary and concepts, and communicating their own ideas and opinions.

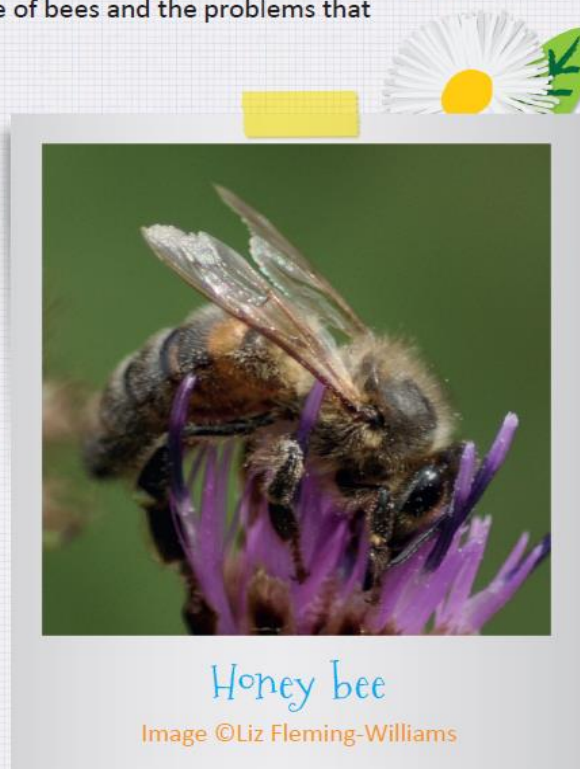
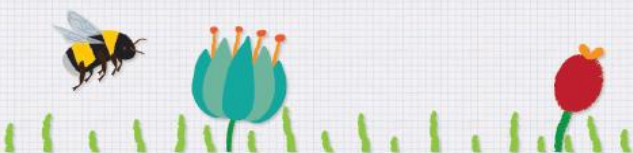
Writing phase

The children can respond to what they have found out and debated by producing a piece of creative writing e.g. 'My life as a super bee' or a bee diary; preparing an article for the school newsletter or giving a presentation in an assembly on the importance of bees and the problems that they face.

Alternative / extension ideas

Other debating issues include investigating the different attitudes people have towards bumblebees and wasps; exploring the pros and cons of being a solitary or social bee; or considering which attributes of a bee you would most like to have.

Pupils could role play in the oracy phase e.g. as different bees in a colony arguing the importance of the part they play. The writing phase might involve composing a letter e.g. to invite a beekeeper to visit the school, or to ask local organisations to help create more bee-friendly wildflower areas in the community.



Honey bee

Image ©Liz Fleming-Williams

Bee Poetic

Below are four fun poems about bees for young children to learn. Simple actions can also be added. Children can create their own bee poetry using the acrostic poems worksheet.

Bee:

- www.canteach.ca -

BUZZ! goes the bee,
Hour after hour,
BUZZ! goes the bee
From flower to flower.

Sucking out the nectar
Flying it home.
Storing up the nectar
In the honeycomb

BUZZ! goes the bee,
Making honey so sweet.
Bee makes the honey
That I love to eat!

Five Busy Bees

- www.canteach.ca -

Five busy honey bees were resting
in the sun.
The first one said, 'Let us have some fun.'
The second one said, 'Where shall it be?'
The third one said, 'in the honey tree.'
The fourth one said, 'Let's make some
honey sweet.'
The fifth one said, 'With pollen on our feet.'
The five little busy bees sang their
buzzing tune,
As they worked in the beehive all
that afternoon.
Bzzzzzz! Bzzzzzz! Bzzzzzz! Bzzzzzz! Bzzzzzz!

Do You Like To Buzz?

- www.canteach.ca -

(to the tune of 'Do Your Ears Hang Low?')

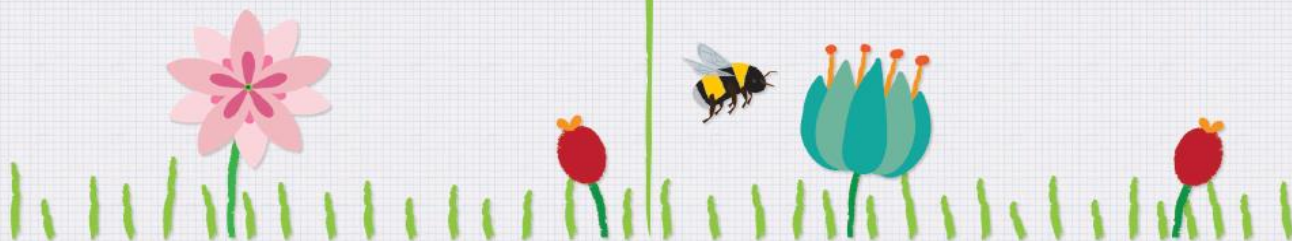
Do you like to buzz,
Are you covered all in fuzz?
Do you call a hive a home
In the garden where you roam?
Do you know how to make honey,
Are your stripes a little funny?
Do you like to buzz?

I'm A Little Honey bee

- www.canteach.ca -

(to the tune of 'I'm A Little Tea Pot')

I'm a little honey bee
Yellow and black
See me gather
Pollen on my back
What the queen bee tells me
I must do
So I can make sweet honey for you!



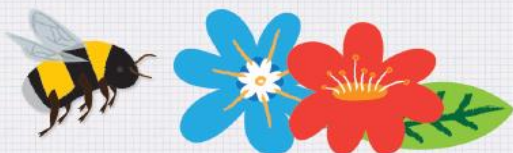
Acrostic Poems

An acrostic poem uses the first letter of each line as a starting point. All of the lines of the poem should relate to the word or be a description of it.

Have a go at creating your own acrostic poems using the two words below.

H	
I	
V	
E	

H	
O	
N	
E	
Y	
B	
E	
E	

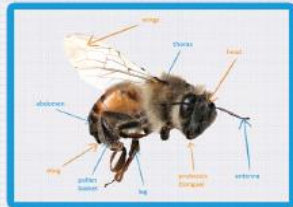


The Buzzy Bee Game

This is a variation on the popular dice game Beetle but based on the parts of a bee. Before playing the game, pupils should have the opportunity to look at bee photos or a bee structure diagram and discuss the name and number of each body part.

Equipment needed

photos/diagram showing structure of bee
a six-sided die
sheets of paper
pencils



How to play

Each player rolls the die in turn and the number they roll determines which body part they can draw on their paper. If someone already has all the parts they need for the number they roll, they miss that turn. The winner is the first to complete their bee drawing and call out BUZZ.

What each number wins

- | | |
|--|---|
| | 1 = an antennae (two needed) |
| | 2 = an eye (two needed) |
| | 3 = a wing (four needed) |
| | 4 = a leg (six needed) |
| | 5 = the head (one needed) |
| | 6 = the body (one needed – thorax and abdomen together) |

Alternative / extension ideas

Additional rules can be introduced to the game. For example, the body has to be won first (i.e. roll a six first) before any other body part, and the head has to be won before the eyes or antennae.

Sets of giant bee body parts could be cut out and laminated. Players can take these from a central pot as they roll the right numbers and use them to construct their bee.



A Hexagonal World

Honeycomb is made up of hundreds of wax hexagonal cells. The hexagonal shape is extremely efficient in terms of the use of space, the amount of material (wax) needed and the strength of the structure formed. Pupils can compare the qualities of various 2D and 3D shapes through the group activities.

Tessellating Shapes

1. Cut 10-20 regular hexagons with sides of 4cm out of thin card. Younger children can be provided with the shapes or a template but older pupils can create their own template using a compass.
2. Fit as many shapes as possible onto a flat surface e.g. an A3 sheet of paper or a tray. How many shapes fit into the space and how much space is left around the edges?
3. Try the same with equilateral triangles and squares. So that each shape has approximately the same area as the 4cm-sided hexagon, the squares should have 6.5cm sides and the triangles 10cm sides.
4. Other regular shapes such as pentagons, octagons and circles can also be tested and the pupils will discover that hexagons, triangles and squares are the only regular shapes that tessellate i.e. fit together without spaces.
5. To investigate the amount of wax needed to create a frame of honeycomb, pupils can measure or calculate the total length of the sides of ten tessellating hexagons. Each touching side should only be counted once. This can be compared to the total length of sides for ten squares or triangles.

Alternative / extension ideas

Use cut-out hexagon shapes or hexagonal grid paper to create designs or images e.g. flowers and animals. These can be built into an effective frieze or replicated using textiles. Pupils can also investigate semi-regular tessellations (made up of two or more regular shapes) and explore the tessellation of irregular shapes e.g. the letters T and L.



Strongest Structures

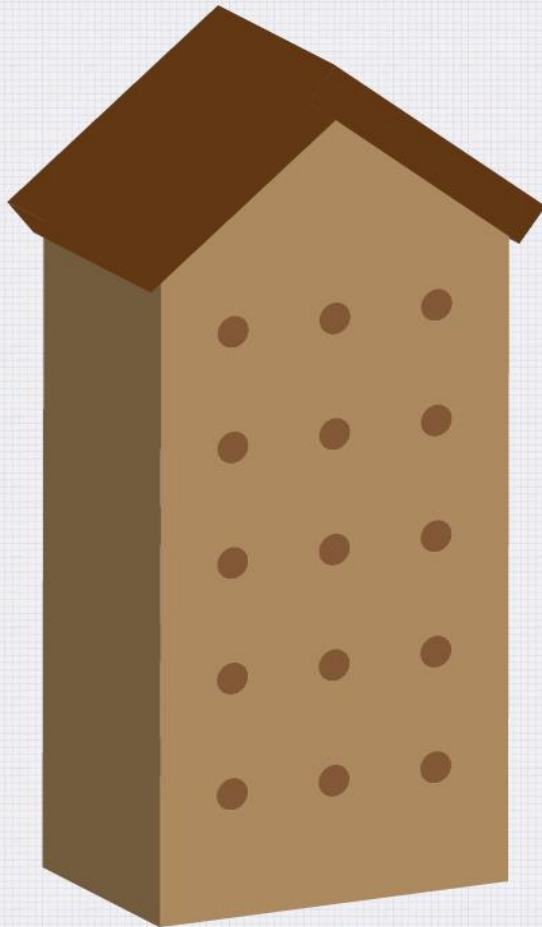
1. Create nine hexagonal-based prisms using thin card.
2. Use these to build a structure three prisms wide and three high.
3. Build similar structures using square-based prisms, triangular-based prisms and cylinders.
4. Each structure can be tested for strength by applying an increasing amount of weight or pressure. To ensure fair testing, each prism and structure must be made using the same amount of card and fixing material, and the weights must be applied in the same way.

Alternative / extension ideas

Pupils can research how hexagonal prisms and other 3D shapes are used in real life structures e.g. packaging and architecture. This could lead them to experiment with combinations of shapes such as adding sheets of card between layers of prisms.

Solitary Bee Hotel

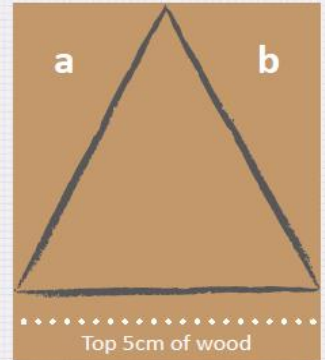
This is a simple design for a solitary bee hotel which can be hung in the school grounds or garden to be used by bees and other insects for several years.



Materials

Short length of fencing post (approx. 25cm)
2 short lengths of wood for the roof (not MDF)
pencil
ruler
saw
sand paper
nails
drill
wood varnish
hook

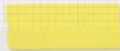
1. Draw a centre line along the top of the fencing post, from front to back. Measure about 5cm down the two sides of this wood block and draw a straight line horizontally across both sides. Join the edges of these lines to the centre line at the top of the block to create wedges.
2. With adult help, saw off the wedge sections (marked a and b on the diagram) and use the sand paper to smooth any rough bits.
3. With adult help, drill several holes of different sizes and depths in the front of the wood to create tunnels for bees to nest in.
4. The short lengths of wood can be used to create a roof. The pieces should be cut larger than the wood block so that they hang over the edge. They can be fixed together at right-angles using a simple butt joint or a mitred joint and then nailed to the wood block.
5. The hotel could be varnished to make it more weatherproof or left natural.



6. Add a hook or attach strong string so it can be fixed or hung in a warm south facing sheltered area where it will not be disturbed.

Alternative / extension ideas

Pupils could research other designs for insect hotels e.g. using hollow bamboo stakes, and adapt these to create their own 'luxury' designs. A diary could be kept to record how various designs are used by different creatures over a term or year e.g. which creatures use them, at what times of year and for how long. Care should always be taken not to disturb the creatures when making observations.



Materials

Make a Crafty Bee

Materials

- 1 small cardboard tube
- 8 pipe cleaners (4 black/brown and 4 blue)
- paint brush
- paint (black, yellow and white)
- pencil
- jar of water
- newspaper
- sticky tape
- string

1. Cover the work surface with newspaper.
2. Draw lines around the cardboard tube to mark where the bee's stripes will be.
3. You may have to paint the tube white first to make sure that the yellow is nice and bright. Once this is dry, paint the stripes with the black and yellow paints. Use the jar of water to clean your brush between colours.
4. Once the stripes have fully dried you can draw or paint eyes. Alternatively, you could use plastic googly eyes, if you have them.
5. Fold one of the blue pipe cleaners in half, twist the ends together and then pull it out again to form a loop. Do the same with the other three blue pipe cleaners to form the bee's wings.
6. With adult help, make holes in the top of your bee so that you can push the wings through. Once the wings are through fold the end inside the tube back on itself and tape it in place so the wings don't fall out.
7. The black/brown pipe cleaners can be cut in half and used for legs and antennae. Make holes and tape the pipe cleaners as with the wings.
8. String can be fixed to the bee so it can be hung on display.

Alternative / extension ideas

Create alternative bee designs using other scrap materials. Construct a flower for the bees to visit or a hive for lots of bees to live in



Crafty bees



Honey welsh cakes

Page 78 - Honey Recipes from a Welsh Kitchen © Jane Jones

Honey Welsh Cakes

pinch of salt

1 egg plus 1 yolk

150 g - 5 oz honey

350 g - 12 oz self-raising flour

175 g - 6 oz margarine

110 g - 4 oz sultanas

1 tsp mixed spice

Makes approximately 24

1. Place the flour in a bowl and rub in the margarine, mix until the mixture resembles fine breadcrumbs. Add sultanas, mixed spice and salt.
2. Add the beaten eggs. Finally add the honey and mix to a dough.
3. Roll out to 5 mm - ¼ inch thickness on a well floured board, cut into rounds with a 7.5 cm - 3 inch cutter.
4. Place a griddle or a heavy based frying pan on a moderate heat and grease lightly. Cook the Welsh Cakes for about 3 minutes on each side until golden brown and leave to cool on a wire rack.



Cooking with Honey

Honey is used in cooking and baking all around the world. Here are two simple recipes that can be used as part of a cooking lesson. These could be sold to raise funds for bee conservation projects.

Chocolate Chip Biscuits

pinch of salt

½ tsp vanilla extract

125 g - 4 oz chocolate chips

50 g - 2 oz chopped nuts

175 g - 6 oz honey

110 g - 4 oz butter

1 small egg

175g - 6 oz self-raising flour

Makes approximately 14

1. Preheat the oven to 180°C or gas mark 4. Grease a large baking tray.
2. Cream the butter and honey until light and fluffy. Add the egg and mix well. Sift the flour and salt and add to the mixture. Add the vanilla extract, fold in the chocolate and nuts.
3. Using a teaspoon drop the mixture onto the baking tray allowing room for them to spread.
4. Place in the oven for 12 to 15 minutes. When cooked, cool on a wire rack.



Chocolate chip biscuits

Page 90 - Honey Recipes from a Welsh Kitchen © Jane Jones

Waggle Dance Game

Before playing this game, children should understand the relationship between bees and flowers and discuss how the 'waggle dance' works – perhaps viewing a video clip.

Setting Up

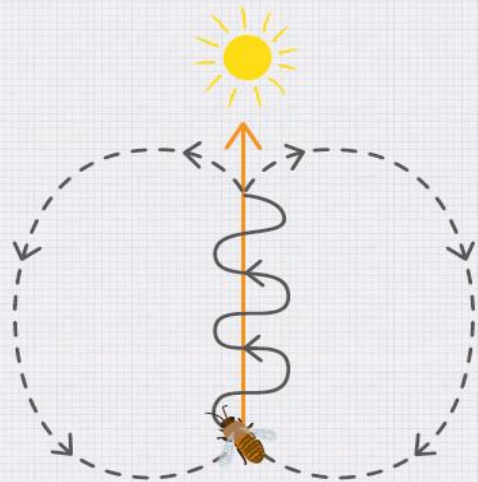
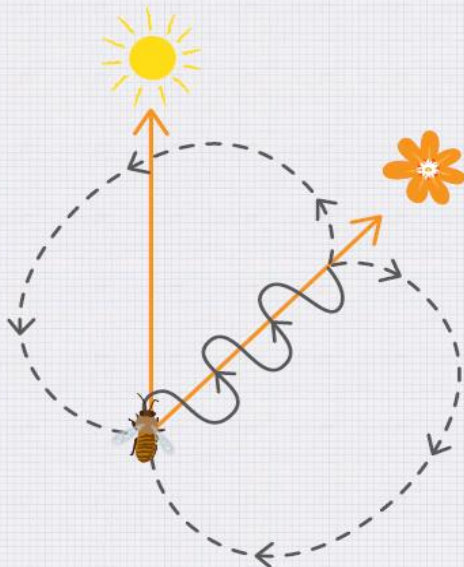
A large open space is needed for this game such as a hall or playground. Place a large mat in the centre of the space to represent a hive and mark one edge as the top. Put flower pictures around the space (or coloured cones to represent flowers) at different distances and directions away from the mat. Put a picture of the sun on one wall (or use the real sun if outside on a sunny day).

Playing the Game

Children can take it in turns to 'fly' around the space visiting several of the flowers. They should choose one but not say which it is. When they return to the hive (mat) they must perform the waggle dance to let others know which flower they have chosen.

Simple version

The top edge of the mat points towards the sun. Each child performs the waggle dance on the mat pointing towards their chosen flower. The other children go and stand by the flower they think has been chosen.



Harder version

The mat is turned so that the top edge is not pointing towards the sun. The 'bee' child must look at the angle between the sun, the hive (mat) and their chosen flower.

They then perform the dance on the mat using the same angle as though the top edge of the mat is the sun. The dance will not point directly to the flower this time so it will be trickier for the other children to work out which flower has been chosen.

Alternative / extension ideas

Several mats can be placed around the room at various angles and groups of children can try out the game using different 'hives'. Photos of flowers could be used and the children find out their names and which are most attractive to bees.

Amazing Bee Facts and Figures



- Honey bees have existed for millions of years.
- One third of all the food we eat would not be available if it was not for bees.
- Britain has more than 250 species of native bees.
- There are over 25,000 different species of bees known in the world.
- A bee's wings move at approximately 180 beats a second.
- A honey bee flies at about 15 miles per hour, depending on how much nectar they are carrying.
- Honey bees fly for up to six miles at a time to collect nectar and pollen from flowers.
- A honey bee visits 50 to 100 flowers during a foraging trip.
- It is estimated that it takes 10 million foraging trips to make the equivalent of a 1lb (454g) jar of honey. This involves visiting two million flowers and is equivalent to flying three times around the world.
- In its lifetime, each worker bee produces about 1/10th teaspoon of honey.
- It would take just one ounce of honey to give a bee enough energy to fly all the way around the world.
- A queen lays up to 2,500 eggs each day that's around 200,000 eggs each year.
- If you remove a queen honey bee from her hive, within 15 minutes all the bees in the hive know about it.
- Honey is almost 80% sugar and 20% water.
- The honeycomb is composed of hexagonal cells with walls that are only 1/10th mm thick, but can support 25 times their own weight.



Bee Dictionary

Anther: The part of the stamen that produces pollen.

Apiary: The location of a number of bee colonies.

Apiculture: The science of bees and beekeeping.

Beeswax: Wax produced by honey bees and used to build a comb.

Brood: All stages of immature honey bees; eggs, larvae and pupae.

Cell: A single hexagonal wax compartment in the honeycomb used to store honey and pollen, and where a new bee develops.

Colony: Honey bees are social insects and live in large groups. Each colony contains one queen bee, a few hundred drone bees and thousands of worker bees.

Comb: The wax structure made of hexagonal cells in which honey bees rear young and store food.

Drone: A male honey bee whose main function is to fertilise the queen.

Hive: Any container provided by man for honey bees to nest in.

Honey: Nectar or plant sap collected by bees, concentrated by them and stored in combs.

Honeydew: Plant sap excreted by insects such as aphids and collected by honey bees.

Nectar: A sweet liquid secreted by flowers.

Nectaries: Glands within plants that produce nectar.

Pollen: The fine dust-like substance used by flowering plants to reproduce. This is a source of protein for bees.

Pollen basket: Areas of stiff hairs on the hind legs of worker honey bees where they carry pollen.

Pollination: The transfer of pollen from one flower to another as part of the reproduction process.

Pollination agent: Bees and other insects act as pollination agents when they transfer pollen from one flower to another.

Proboscis: The mouth part of an insect.

Propolis: Plant resins collected by honey bees and used to seal cracks and gaps in the hive.

Queen: The female parent of the colony.

Stamen: The male part of a flower consisting of a stalk with the anther on the end.

Stigma: The female part of a flower which receives the pollen.

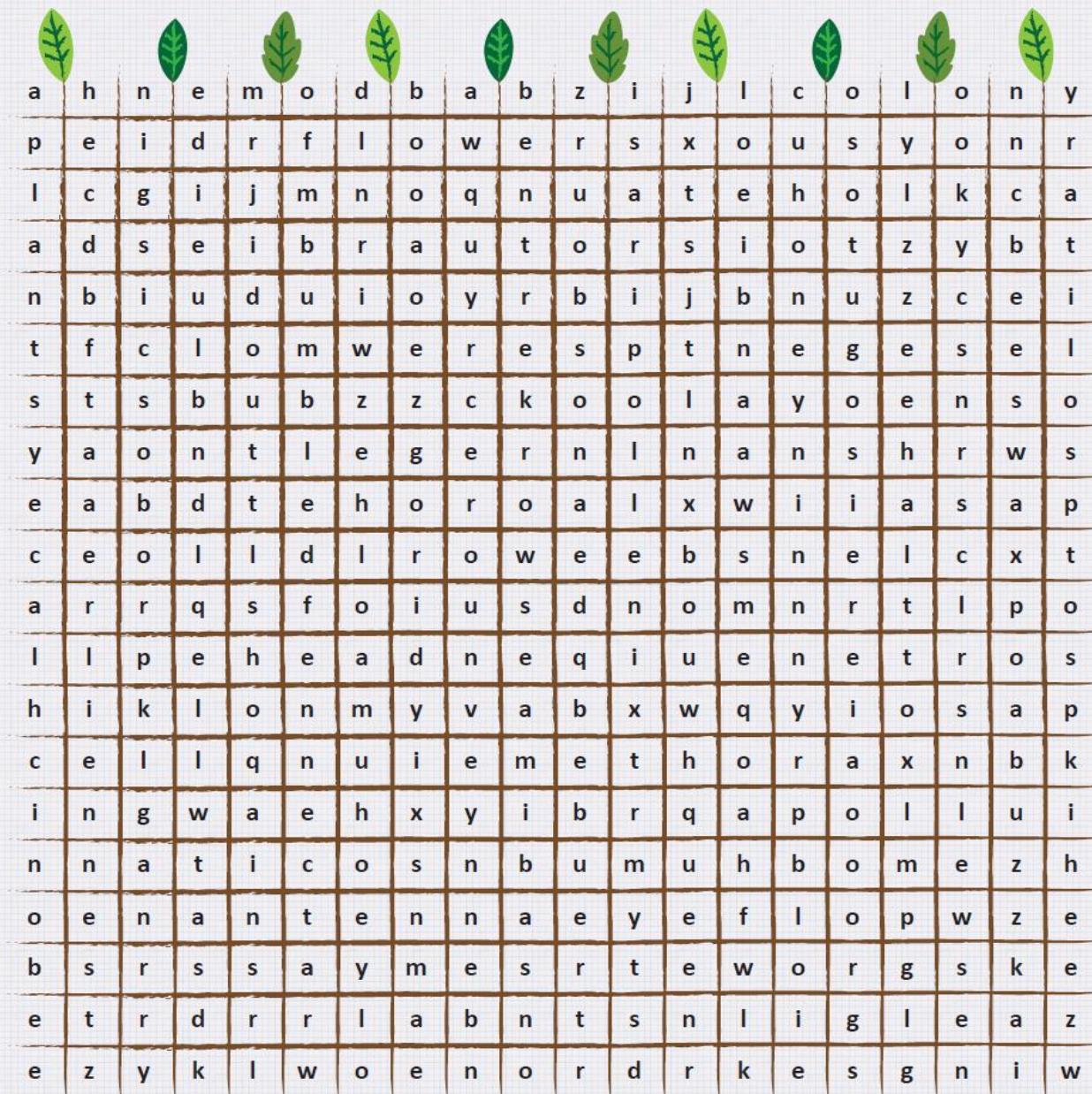
Swarm: This takes place when a bee colony divides in two and the queen and about half the workers leave their nest or hive to form another colony in a new location.

Worker bees: Female honey bees that make up the bulk of the colony and undertake all the work except for mating and egg laying.



Apis mellifera - European honey bee

Image © W. D. J. Kirk



Bee Word Search

How many of these 30 bee-related words can you find?

They are written backwards, forwards and diagonally!

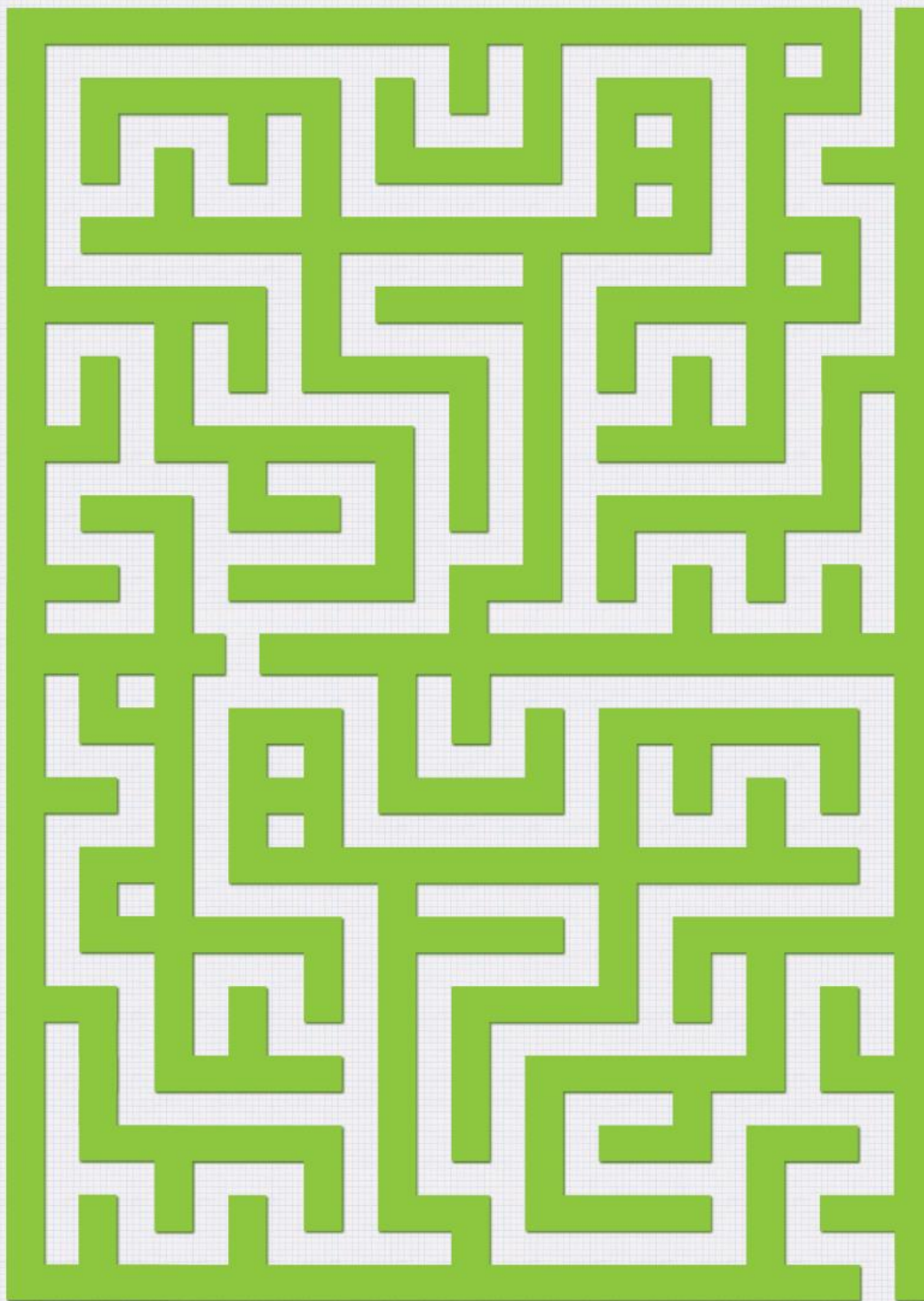
abdomen
antenna
bee
beeswax
beeworld
bumble
buzz
cell
colony
drone

flowers
head
hive
honey
ibra
leg
nectar
nest
plants
pollen

pollination
proboscis
queen
solitary
sting
symbiosis
thorax
wasp
wings
worker



Bee Maze



Can you guide the bee through the maze to the flower?



Sponsorship form



Please sponsor me (name)

To (event).....

In aid of

[illegible]



EDUCATION PACK

UNDERSTANDING BEES

The International Bee Research Association is a Company limited by Guarantee, Registered in England and Wales, Reg. No. 463819, Registered Office: 91 Brinsea Road, Congresbury, Bristol, BS49 5JJ, UK, and is a Registered Charity No. 209222.

Email: mail@ibra.org.uk

Website: <http://www.ibra.org.uk/>

FaceBook: <https://www.facebook.com/IBRAAssociation>

Twitter: https://twitter.com/ibra_bee