

# the Travelling Beehive

*teacher's guide*

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Illustrated by Juan Hernaz

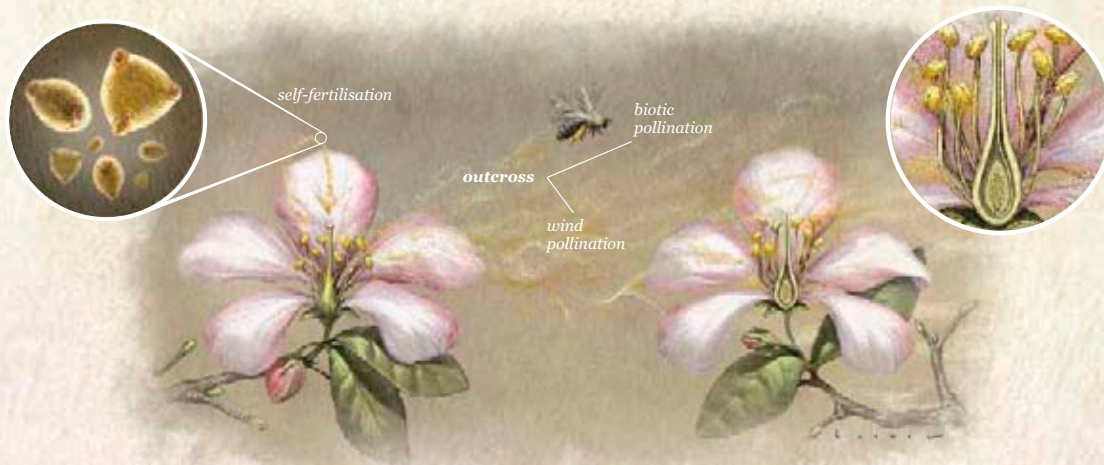


# teacher's guide

There are many children publications about honey bees, explaining the caste organisation: queen, workers and drones, the tasks they are responsible for in the beehive. They also highlight the undoubted benefits they provide us, such as the production of honey, beeswax, pollen, propolis and other products. Honey bee is, no doubt, a good model to teach the youth useful and necessary values for the 21<sup>st</sup> century, as, for instance, foresight, perseverance and team work.

Nevertheless, this publication goes beyond that and tries to show the importance of a process that honey bees as well as many other wild animals (mostly insects) implement and which is rarely appreciated: **plant pollination**.

Pollination, moving pollen from the stamens of one flower to the stigma of the same or another flower, is a vital process in nature. Most plants can reproduce asexually, but **without pollination** (sexual reproduction), ovum fertilisation does not occur and **fruits and seeds are not produced**, directly altering plant dispersal strategies and, indirectly, the diet of many animals.



**Outcrossing**, transferring pollen between flowers of different plants (usually of the same species), is very important for **genetic exchange**, which is essential in **evolution**. **Pollinators** play their role in outcrossing, becoming the actual **foundation of biodiversity**.

Several advices and recommendations are noted below, aiming to facilitate **the use of this publication in school**. It could be said that this is a children's story with illustrations for all ages, illustrations that show much more detail than what is specified in the text; some of those details are summarised in this guide, others are left to free analysis:



1- Some of the **main characters** of this story are represented on the book cover: **flowers, insects** and **humans**. Comparing the book cover with the title page (which could be presented as a game where the students would have to find the differences between both images), may be a good way to rise their interest on **nature observation**, where everything is on the move, even if we cannot always appreciate it.



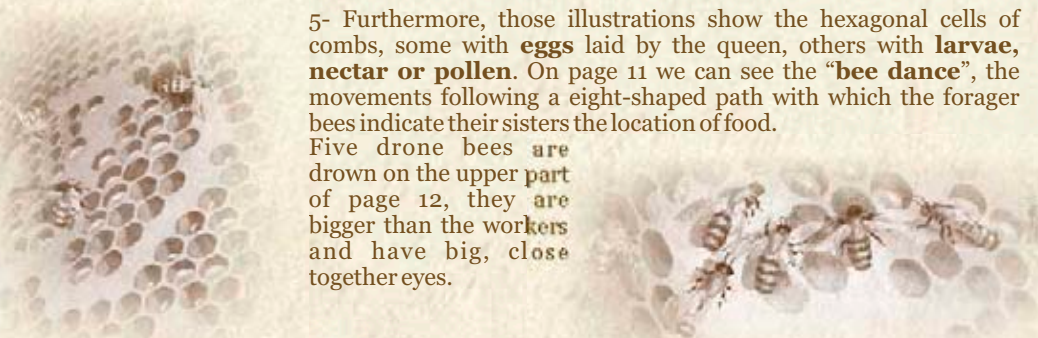
2- An overview of the front endpaper, where an apple tree and a bee are shown, and the back endpaper, with the same bee and the same tree but loaded with apples, aims to show the **importance of pollinators on the process of seed and fruit production of many plant species**.

3- **The flyleaf shows a rosemary branch, often visited by insects, and a grass with its pollen being transported by the wind**. This story revolves around animal pollination, a vital process representing one of the finest examples of mutualism observed in nature (both plant and pollinator are benefited), but **not all plant pollination depends on animals**. Some of the **anemophilous** (wind pollinated) **plants** are oak, beech, birch, grass and most conifers (pine, fir, cypress).



4- In chapter 1, Polli, the main character, explains **life inside a honey bee hive**. The illustrations in this chapter (pages 10-13) are a continuous picture showing the **evolution of combs**. The first winding and irregular combs represent the ones made by **wild swarms**, adapting to conditions on the available space. We can appreciate how the combs slowly get rounder shapes, similar to the combs the bees build inside the **beehives that humans have traditionally used**. Finally, we can see combs on **modern wooden frames** inside one of the widely used boxes. Nowadays most beekeepers use these boxes since they are easier to manage for both honey extraction and other activities (beehive supervision, illness treatment application, etc).

5- Furthermore, those illustrations show the hexagonal cells of combs, some with **eggs** laid by the queen, others with **larvae, nectar or pollen**. On page 11 we can see the “**bee dance**”, the movements following a eight-shaped path with which the forager bees indicate their sisters the location of food. Five drone bees are shown on the upper part of page 12, they are bigger than the workers and have big, close together eyes.



6- In chapter 2 Dorian, the farmer, realises that something goes wrong in his orchard and talks to the apple tree, who explains the reasons behind the decline in apple production. That happens in real life, where **environmental problems often become apparent after they have impacted our economy**. In fact, the awareness about the possible consequences of a pollinator decline rises earlier this century after losing thousands of honey bee hives (*Apis mellifera*) in the US (where it is an introduced species) and Europe. Beekeepers move many of those beehives from crop to crop for pollination; an example being the large almond orchards in the US, where the disappearance of the pollinator insects involves the decline of almond production and therefore, economic damage.



7- Illustration on pages 18 and 19 is very important. Most of the insufficient information regarding plant pollination refers to honey bees and crops. However, it is becoming more obvious that we must consider the **role of other pollinators and their importance for wild flora**, as well as for crops. This means that honey bees also pollinate wild flora as well as wild pollinators are involved on crop pollination too. As pollinators are basically insects at this latitude, the four main groups performing pollination are represented on different species of wild flora: **Hymenoptera** (bees, wasps and ants among them), **Lepidoptera** (moths and butterflies), **Diptera** (flies) and **Coleoptera** (beetles).



8- **The main factors affecting distribution and abundance of pollinators** are illustrated on pages 20 and 21.

8.1- **Land use changes**; roads stand here for all sort of environmental disturbances caused by human beings. The consequence of those disturbances is usually **habitat loss or habitat fragmentation**, which unevenly affect the different taxa of pollinators. Although **habitat loss or fragmentation has**, in many cases, **a negative impact on pollinator populations** (reduction of nesting areas, destruction of food sources, ...), some species benefit from our activities (such as, for instance, some insect that nest in urban areas).



8.2- **Chemicals**; probably the greatest threat to pollinators. They are represented by three lorries that carry “hazardous chemicals” and a plane illustrating a common practise for pesticide treatment in intensive farming. Today we use many lab-synthesised chemicals for many different purposes. There are obviously regulations governing their use, but **most of those chemical substances do not appear in nature** and in many cases their effects are unknown. Even in cases where their effects have been studied, **we know the effect of each substance in isolation but not the interaction between the used chemicals**, something much more difficult to predict and that can have very serious consequences.

8.3- **Introduction of exotic species**; illustrated by some plants, such as the Pampa grass (*Cortaderia selloana*), closely associated with human activities (responsible, directly or indirectly, for most introductions) and by the Asian predatory wasp (*Vespa velutina*). The later is a 3cm long wasp, native to China, northern India and Indonesia, that seriously damages apiaries. It arrived to France in 2004 inside a container from China and has already appeared in the Basque Country and Cantabria.



In this regard, it should be noted that the BOE no. 298 (Monday 12<sup>th</sup> of December of 2011) published the **Royal Decree 1628/2011**, 14<sup>th</sup> of November, which regulates the Spanish listing and catalog of the invasive alien species, including all those species of which there is “scientific and technical evidence indicating they pose a serious threat to native species, habitats or ecosystems, agronomy or economic resources associated to the use of natural heritage”.

**The introduction of alien species in ecosystems, both plants and animals, may cause serious ecological problems.** Regarding pollination, native and alien pollinators may compete for resources, native and alien plants may compete for pollinators. We must also include the problems caused by pathogen proliferation, often related to the introduction of alien species.



8.4- **Global change**; represented by a big sun and some snowflakes. Scientific data indicate that global warming is real; the controversy lies, however, in whether it is a natural phenomena or it is caused by human activities. It is being noted that increases in temperature may cause both plant and animal species to **reproduce earlier in the season**. Plants bloom earlier in spring, the odd autumn flowering is becoming common too. Not all species respond equally to these climate changes, thus the animal pollination service could be severely compromised in ecosystems if the life cycles of plants and their pollinators fail to adjust. And that would be only a part of a much larger problem; global warming would directly affect species distributions as well as other aspects of the organisms biological cycle, such as migratory patterns, prey - predator relationship, plant - seed dispersal agents relationship, etc.

Although not showed on the illustration, **genetically modified crops** are cultivated more often nowadays but, what are the impacts of those crops on pollinators? We are facing another controverted issue in which there is little information and would certainly require further research.

**All these factors** affecting biodiversity in general and specifically abundance and diversity of pollinators **rarely act in isolation**. This means that two factors acting on their own can be detrimental but not lethal, however when simultaneously working their impacts may increase exponentially, affecting wild and domestic populations of pollinators.



9- Illustration on pages 28 and 29 shows the **apiary** of Ramon. Each beehive has a different colour and even some of them have geometric designs on the front side. This is usually done to help bees recognising their hive. On page 29, foreground, we can appreciate a honey bee, loaded with pollen, flying back to the hive. She carries it on her basket-like modified hind legs. It is easy to understand the **importance of honey bees in pollination** when considering that each hive can host about 60,000 bees, most of them go searching for and bring big amounts of pollen and nectar to feed the colony. Moreover they go back to forage from the same plant species while they are flowering.

Water is a precious resource for bees too, that is the reason to place beehives near a river. These page also illustrate an example of **traditional beehive**, contrasting with the modern and commonly used beehives. In the north of the Iberian Peninsula these beehives (called “truébanos, trobos, caxellos, cajas, cepos, cobos, dujos...”) are made out of hollowed logs, usually oak, chestnut or cork oak or using wooden planks held together with different sorts of staples (such as nails and horseshoes)

10- Pages 44 and 45 represent **Dorian's apple orchard after moving the beehives to ensure an adequate pollination of trees**. The idea is to show that, although we impose many pressures to plant and animal species in general and more specifically to pollinators, it is also possible for us to mitigate the negative impacts on the populations of such beneficial animals. Reducing the use of chemicals, using native plants in hedges, parks and gardens, or simply being aware of **the important role that these animals play in nature, appreciating them and respecting them** are some of the steps towards a sustainable development.



11- Illustration on pages 46 and 47 show honey bees carrying their own beehives (using an ornithopter, Da Vinci's flying design) paying tribute to the title of this publication, portraying these little creatures as **intelligent and highly organised animals**. And the question is, if you would choose ... where would you lead the beehives?

12- In times when everything seems to revolve around economy, many studies try to calculate the economic value of different **ecosystem services, pollination** among them. For instance, French researches from INRA (*Institut Scientifique de la Recherche Agronomique*) and CNRS (*Centre National de la Recherche Scientifique*) estimated the global economic value of pollinator insects for 2005 on 153,000 million euros, taking into account main crops only.

13- It is very difficult to give a market price to **biodiversity** (perhaps because it is invaluable), but biodiversity is a precious asset for both current society and future generations, and **preserving it is our responsibility**.

14- *The Travelling Beehive* is a children's story, however, if insects (pollinators, in general) would go on strike during a couple of weeks only, they would trigger a huge economic crisis. This, at least, is food for **though...**



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