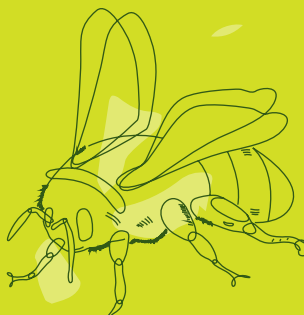




How
bumblebees
can do the hard
work for you



**A guide to biological pollination
with bumblebees**

Personalised solutions,
trusted advice
Biobest, naturally!

Biobest bumblebees: your best partners for pollination

Biobest, bumblebee pioneer since 1987

Higher fruit production and quality



In crops, such as tomatoes, peppers, blueberries, etc. bumblebee pollination results in higher yields as well as larger fruit with a higher quality compared to pollination without bumblebees.



Versatile workers

Bumblebees excel in pollination in open air, greenhouses and plastic tunnels.

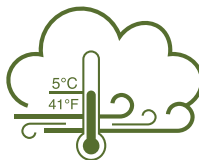
Excellent pollinators

Thanks to their large body size and hairy bodies bumblebees can carry very high pollen loads and make optimal contact with the flowers' reproductive organs. This results in a highly efficient plant pollination. Compared to honey bees, they visit more flowers during a single foraging trip. On top they have a secret talent: bumblebees can "buzz pollinate" plants such as tomato and eggplant: they grab on to the anthers of the flower and vibrate their wings to ensure that pollen is released.



Less flower discrimination

Bumblebees are less focused on nectar collection, unlike honey bees they will show equal focus on pollen collection. Therefore they are less likely to fly further looking for flowers with high nectar content, and will stay closer to their hive.



Work under difficult circumstances

Bumblebees are active at low temperatures (5°C/41°F), as well as under windy and/or cloudy conditions. That is why bumblebees are excellent pollinators for year-round crops, even early and late season crops.



Tremendous labour savings

Bumblebees can completely replace manual pollination and the use of hormones, reducing manual labour to a minimum.

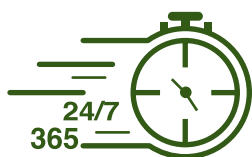


Available around the globe

Biobest supplies bumblebees in over 45 countries globally and has the widest offering of local species in the world of bumblebee rearing.

Available all year round

Thanks to Biobest's extensive experience with bumblebee rearing, a high security of year-round supply of bumblebee colonies is guaranteed!



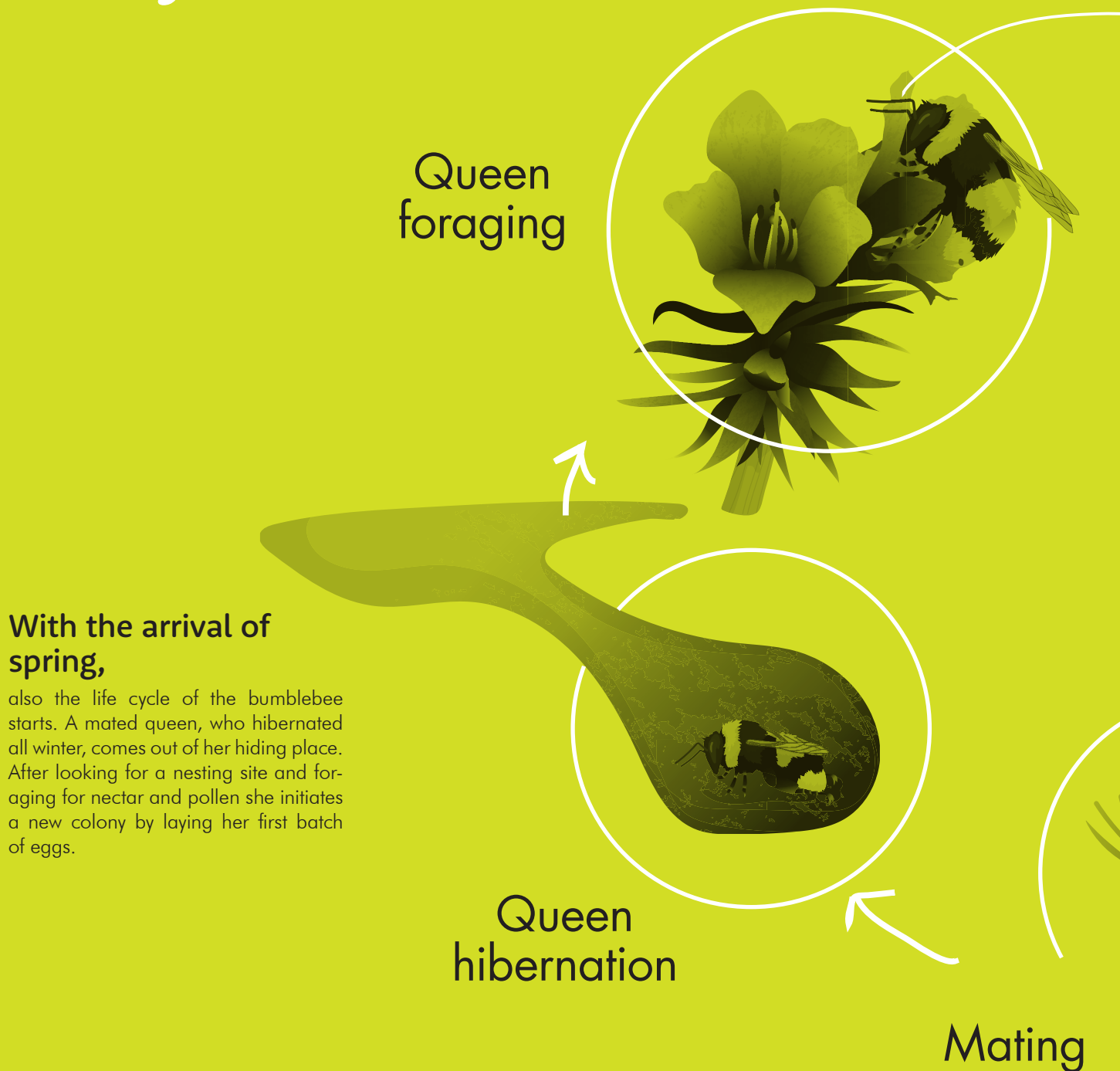
Bumblebee quality guaranteed

With over 30 years of experience, Biobest bumblebees offer the best quality in market to pollinate your crops.



Did you know bumblebees can carry up to 50% of their own body weight in pollen and still fly!

The bumblebee life cycle



Development stages of a bumblebee

Egg

Larvae

Pupae

Nest
initiation

Worker
production

**The first eggs will typically
develop into workers.**

When these eggs hatch, larvae emerge. the larvae will grow and moult a couple of times before they spin a cocoon. Inside the cocoons, pupae develop into bumblebees with hair, wings, and legs. Where the queen does all the foraging herself at the beginning, she will no longer leave the nest once the first workers emerge and take over the foraging. The workers will also take care of the brood so the queen can focus on laying eggs.

Colony
growth

**After the production of
150 to 400 workers,**

the bumblebee queen starts to produce young queens and drones (males). From that moment onwards the activity of the colony decreases. The old queen stops laying eggs and eventually dies.

With a young, mated queen, who will again hibernate alone, a new cycle begins in a new hive.

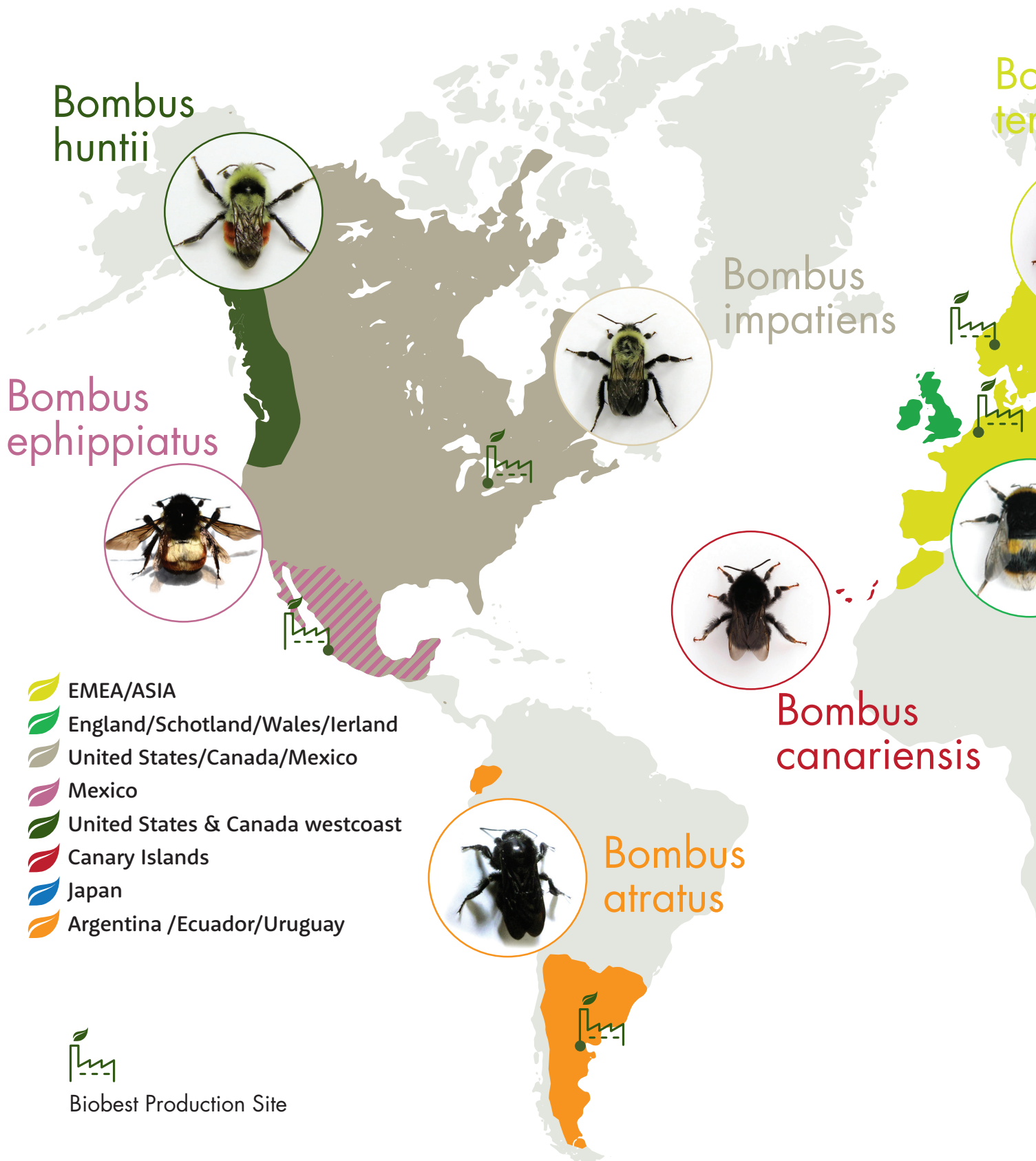
Young queen
and male
production

Males
die

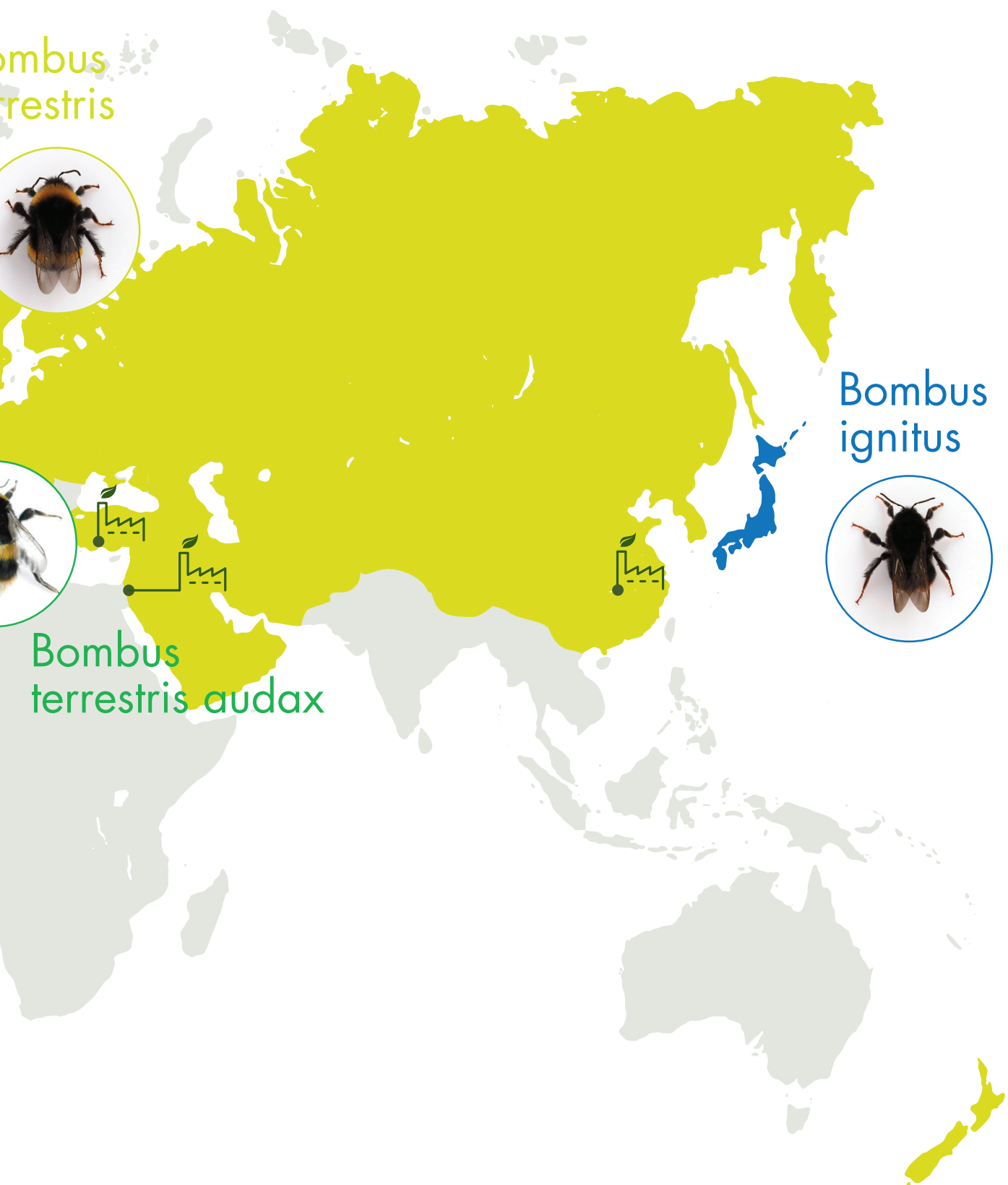
DID YOU
KNOW?

Did you know once bumblebees emerge from their cocoon, they do not grow anymore!

Biobest bumblebees: A global adventure!



Biobest supplies bumblebees in over 45 countries globally and has the widest offering of local species in the world of bumblebee rearing. With currently 8 local species and more under development we strive to support local biodiversity.





The Biobest bumblebee hive

Biobest's bumblebee hive is a maintenance-free, easy to monitor, safe and simple hive. Applying the latest technologies it optimizes the efficacy of Biobest bumblebees. As such it fully meets the wide range of requirements for application in a variety of crops.

The hive consists of 4 main elements:

O1



O1 Nest box

The nest box or brood box contains the actual hive with the brood (eggs, larvae and pupae). This plastic box has several ventilation openings in the walls, lid and bottom. The honeycomb structured grid of the lid provides improved ventilation and prevents condensation. An integrated ridge in the interior of the frame amplifies the sound of the colony which helps bumblebees find the way back to their hive.

O2

O2 Feeding system

Bumblebees mainly forage for two food sources:

- Pollen as a protein source for larvae and queens, and therefore indispensable for colony growth.
- Nectar as a carbohydrate (sugar) source for energy.

In particular crops, the flowers produce insufficient or even no nectar (e.g. tomatoes). In these cases the colony needs to be provided with a supplementary sugar solution. Biogluc®, a ready-to-use food solution developed by Biobest, is a sugar solution.

A Biogluc® container, sufficient for the entire life of the colony, is situated underneath the plastic nest box. Thanks to the capillary action of the feeding system, bumblebees can feed on the Biogluc®.

O3



O3 Lid with integrated ventilation system

The nest box is placed in a sturdy cardboard box that provides protection from direct sunlight and water. It contains a well-designed ventilation system that is easy to set up when climatic conditions are unfavourable: when temperature or humidity is too high it helps the bees to regulate the climate inside the nest box and ensures the hive's activity and good brood development.

O4



O4 Flight opening and bee-lock

Each hive contains 2 flight openings which are opened and closed by a simple rotating knob. The standard flight opening on the right allows the bumblebees to freely exit and enter the hive. The left flight opening is a one-way opening, equipped with a tunnel and valve, through which the bumblebees can only enter. Thanks to the easy-to-use bee-lock system, the bumblebees can be 'collected' at any time during the day, e.g. when using artificial lighting. Its ingenious design makes the hive suitable for automatic lock-in systems.

Bumblebee pollination per crop

CROPS	BENEFITS OF BUMBLEBEES	HIVES PER HECTARE <i>(For Bombus terrestris)</i>
Tomato (truss, beef, cherry, ...)	Higher yield per plant Larger fruits and higher fruit weight More seeds Better flavour Higher firmness	5-15 standard hives at start & addition of additional hives during crop cycle depending on tomato variety
Blueberry	Higher yield per plant Larger fruits and higher fruit weight More seeds	3-5 Multi-Hives
Strawberry	Higher fruit weight More high quality fruits: reduced malformations Brighter red colour Higher firmness and increased shelf life	4-9 Standard Hives Or 3 Multi-Hives
Apple	Larger fruits More seeds	2-3 Multi-Hives
Blackberry/Raspberry	Higher yield per plant Larger fruits and higher fruit weight	3-10 Multi-Hives
Sweet Cherry	Improved fruit set	4-6 Multi-Hives
Eggplant	Higher firmness Higher yield per plant	4 Standard Hives
Sweet pepper	Higher quality fruits	2-4 Standard Hives
Seed production	Increased seed size and weight	1 Mini or Mini Seed Hive per 150m ²
Kiwi & kiwi berry	Use Biobest Flying Doctors for labour & cost savings	12 Flying Doctor Hives or 3-4 Multi-Hives 3 Multi-Hives
Melon/Watermelon	Higher fruit set Reduced rate of flower abortion	10 Standard Hives
And many more crops!		



Hives per hectare depend upon the crop, growing type (open field, tunnels or greenhouse) and size of your crop acreage. Biobest's technical advisors are always available to advise you on how many hives to apply for an optimal pollination rate.

Bumblebees are not only excellent pollinators, they can even be part of your integrated pest management! Biobest's Flying Doctors® are there to support you in your battle against post-harvest rot (*Botrytis*) in strawberries and many more vectoring solutions are under development.

How to use the Biobest bumblebee hive?

*Start using Biobest bumblebees as your new pollination employees today.
Follow these easy steps to ensure optimal flight activity.*

STEP 01

Opening of Biogluc® bottle

Upon arrival check if Biogluc® bottle is open. A red sticker will be present on the hive when the bottle is closed. To open Biogluc® bottle:



1.1 Remove the plastic nest box



1.2 Open the Biogluc® bottle



1.3 Place back the plastic nest box



1.4 Press the plastic nest box gently

STEP 02

Placing the Biobest hive in your crop

Make sure hives are placed in a horizontal position



Do not place hives above the crop
(exception: with artificially lit crops)

Do not place hives on the ground
Preferably place hives near the main pathway
to aid bumblebee orientation



Place the hives with their flight opening
towards the rising sun and make sure
nothing blocks the bumblebee exit/entrance.



Protect the hives against
direct sunlight



STEP 03 Opening / Closing of the hive



Cut/tear cardboard triangles before opening.



To open the hive put the bee lock in this position.



To collect the bumblebees put the bee lock in this position. After 2 hours all bumblebees will have returned to the hive.



To close the hive put the bee lock in this position.

STEP 04

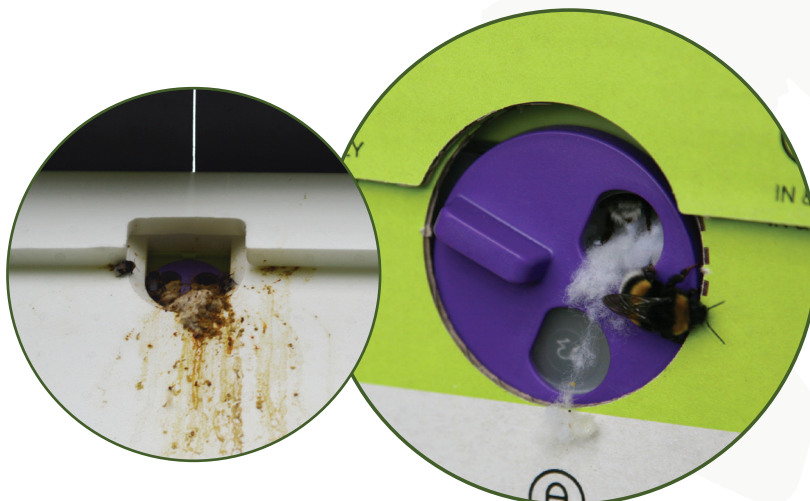
During the lifetime of the hive

Do not move the hive after placement to avoid disorientation.

Maintenance of the hive:

If you would like to clean or refill the Biogluc® bottle, first collect the bumblebees and then close the hive completely after 2 hours.

Consequently you can open the cardboard lid, gently lift out the plastic broodbox and clean, refill or replace the Biogluc® bottle. Place the broodbox back and wait at least 30 minutes before reopening the hive.



Do not worry about a dirty-looking hive entrance. This is a sign that the bumblebees are very active.

Do not push back or pull out cotton coming out of the flight opening. This is a sign that bumblebees are very active.

Factors that might influence good pollination

Bumblebees perform best at 8°C - 32°C and relative humidity of 50-80%. At temperatures above 26°C in the greenhouse, open the ventilation integrated in the lid of the cardboard box.



Avoid the use of harmful pesticides and hormones before hive introduction and during the hive lifetime. If there is no other option but to use pesticides, then collect the bumblebees and remove the hive for the duration of the treatment. Questions about a particular product? Consult the Biobest Side Effect List on www.biobestgroup.com or contact your Biobest advisor.

Bumblebees use UV light for orientation and navigation. Lowered UV light intensity might thus lower the bumblebees' flight activity. Make sure to choose a type of plastic cover or glass for your tunnels and greenhouses that does not lower UV light intensity.



When flower quality is low, bumblebees can not do their work and pollination can not be optimal. Ensure good flower quality by good climate control in your greenhouse.

STEP 05 Removal of the hive

Depending on the hive type you are using and greenhouse conditions the lifetime is 4 - 12 weeks.

A bumblebee hive contains plastic, cardboard and organic material. Please consult your local legislation to dispose of the hive in a correct way.



TOMATO

Checking for proper pollination

1.



2.



3.



4.



To check tomato pollination levels

Check the level of bite marks on recently closed flowers, but also on open flowers.

1. No bite marks; no pollination
2. Flowers are slightly marked; well pollinated
3. Brown marks; very well pollinated
4. Black marks; damage on the pistil possible; sign of overpollination

The majority of flowers should show brown marks as shown in image 3.

OVERPOLLINATED FLOWER

STRAWBERRY

Success of pollination can be checked by the brown discoloration of the pistils.

If the pistils are not pollinated, they remain yellow to green. In addition when the flowers are regularly visited by bumblebees, the anthers look brown and smooth. Overpollinated flowers will have damaged anthers.

POLLINATED FLOWER



UNPOLLINATED FLOWER



Biobest, a global player

Today you can buy our products in more than 70 countries on 6 continents. All over the world, they are introduced for pollination and biological control in greenhouses and orchards. With about eight strategical production locations and a fast and strong logistic network, we offer you our organisms on time and under the best circumstances.

Locally our advisors are ready to assist you as a grower. Depending on the country, we collaborate with distributors or we have our own technical advisors in one of our local subsidiaries.



FOR MORE INFORMATION,
CONTACT YOUR LOCAL BIOBEST ADVISOR

BIOBEST OFFERS DIFFERENT TYPES OF HIVES
FOR DIFFERENT CROPS.
PLEASE CHECK OUT OUR COMPLETE
PRODUCT RANGE ON WWW.BIOBESTGROUP.COM.



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