

## Tomato

### Flower biology

- The flower of the tomato (*Lycopersicon esculentum*) is hermaphroditic, self-pollinating, and hangs from the plant. The flower does not produce nectar.
- The stamens grow together to form a closed tube around the pistil, and inside this staminal tube is found the pistil. The tube has longitudinal openings. If the pistil protrudes beyond the staminal tube, cross-pollination may also occur.
- A slight movement of the flower is sufficient for the pollen from the stamens to fall onto the stigma or out of the flower. Bumble bees can cause movement by hanging upside down on the flower, fastening their jaws onto the staminal tube, and then setting the flower into vibration by activating their flight muscles. They do this without making flight movements with their wings. (This is called buzz pollination.)
- The jaw marks will soon show a brown discoloration, which will give the grower the assurance that the flower in question has been visited and is therefore "set" (under normal circumstances). The discoloration occurs after some hours, depending on the time of the year and the climate conditions. Control is therefore easier in the evening than on the day. In spring flowers open longer (2-3 days) than in summer (<1 day). Take this into account when checking pollination. In spring 80-90% of the open flowers should show jawmarks; in summer 30% is enough. In summer the effectivity of the pollination is best checked on the flowers that are closed (should be 100%).
- When there is a shortage of flowers, the available flowers may be visited so often that in fine-flowered varieties such as cherry tomato, the fastening behaviour of the bumble bees causes damage to the receptacle. This will lead to corklike spots on the pericarp.



### NATUPOL hive

- Because the tomato flower does not produce nectar, the hive is supplied with sufficient sugar syrup for the total life expectancy of the bumble bee population.

### Introduction schedule

- For pollination of tomato, MEDIUM colonies are normally used. On delivery, a MEDIUM colony consists of 50 to 70 worker bees. It has an expected life span of 4-6 weeks.
- Bumblebees can be introduced from when the first flowers open. In winter minimum three hives per hectare are used at the start of a round tomato crop. Followed by two weekly introductions of approximately two hives per hectare. For other crop or smaller surfaces Koppert can provide a tailor made pollination plan.
- When a crop starts in summer, more hives are needed at the start, minimum 8-10 per hectare.
- It is recommended to place some extra hives in spring when the outdoor vegetation starts to flower, since this flowering makes a proportion of the workers leave the glasshouse.

### Use instructions

- Colonies should be introduced when the first flowers are open.
- Colonies should be placed on a sturdy support, about 50 cm above the ground; in spring in a sunny place, and later in the season in the shade.
- Secure the hive so that ants cannot enter it.
- After placement of the hive, let the bumble bees settle down for a while (½ - 1 hour) before opening the flight hole.
- Following their initial orientation flights the bumble bees will immediately start pollinating the crop.
- Bumble bees are active at temperatures between 10 and 30 degrees Celsius. They function best at temperatures between 15 and 25 degrees Celsius.

### Crop protection

- Combining the use of bumble bees with natural enemies does not present any problems.
- Agricultural chemicals may have direct or indirect effects on the bumble bees. Direct effects occur when worker bees and larvae die as a result of contact with or digestion of a chemical product, and indirect effects occur when the smell of the treated flower puts off the bumble bees, causing visits to stop.
- Systemic pesticides (pesticides that are absorbed through the roots) often have a long-lasting residual effect. If a flower produces nectar in addition to pollen (e.g. sweet pepper), the damage to the bumble bee population may be much more serious than in a crop that only produces pollen (e.g. tomato).
- You will find detailed information about persistence and compatibility of pesticides with bumblebees and most other beneficials in **Zonda's Side Effects Guide** or online at Koppert's website: [www.koppert.nl](http://www.koppert.nl)
- In all cases the BEEHOME option of the hive must be activated before the crop is treated. This option ensures that bumble bees can enter, but not leave the hive. After about an hour the hive can be closed completely, so that it can either be covered or removed from the crop.
- If the hive is temporarily removed from the crop, it should be stored at 18 to 20 degrees Celsius.