3 · TYPE AND QUALITY OF FOOD AND IMPORTANCE OF FLORAL DIVERSITY

3 · 1

Influence of nutrition on wintering bees

An intensive agricultural production has a negative impact on overwintering the bee colonies, when there is sufficient and available pollen only in a certain period of the year and/or it has a poorer quality or is affected by pesticides (typically corn and rape pollen). In the pictures below, you can see how intensively cultivated landscape is changing over most of the season into a desert for bees.

When bees are under stress, as e.g. invaded by Nosema Ceranae, the lifespan of bees is directly proportional to the possibility of consuming various types of pollen. It is not possible to compensate divers pollen with those from the monocultures, be that type of pollen highly nutritious and rich in protein, carbohydrates and antioxidants, such as for e.g. from raspberries and blackberries. Mountain meadows are ideal for this purpose in today's world.

Bees prepare themselves for the winter period from the summer solstice. Gradually, winter bees are born, and should not be involved in any work in the hive. These long-living honeybees have the character of nursing bees at an early stage, but from the consumed pollen the body of the winter bees can create a protein-fat organ, called as a fat body.

Winter bees look like the summer bees, but they have a much lower level of the juvenile hormone in the hemolymph, in contrary, they have high levels of vitellogenin — a protein that affects a bee lifespan. The shorter days at the end of the summer, decreased, especially night temperature as well as decreasing reproductive activity of the queen contribute to changes in the biology of the winter bees. If the colony does not have enough food at this time, or the queen is not healthy enough, the colony remains active and produces less winter bees of the corresponding quality. It is a similar situation when the mites parasite brood and the colony cannot produce a sufficient number of healthy winter bees which are able to survive over the winter.

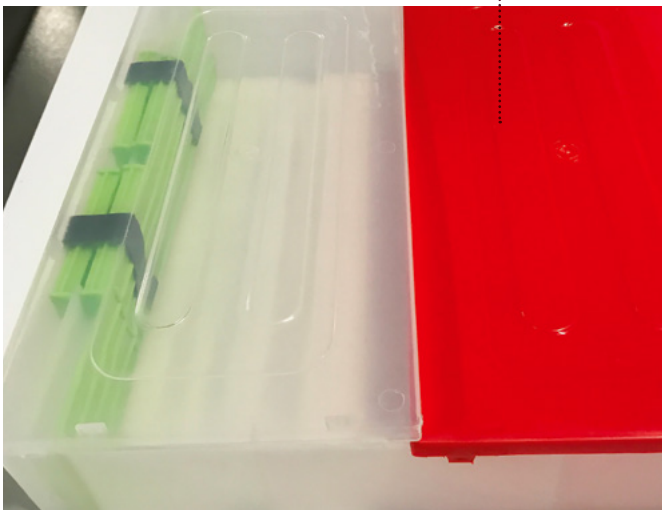
If long-living bees are reared under the conditions of the lack of pollen, they are malnourished and insufficiently resistant to diseases. Winter bees live from July to the end of April.

3 · 2

Save way of feeding in summer with no influence on honey quality

FOOD DOUGH

FEEDER FOR LIQUID FOOD



During the summer, nectar and pollen pauses may occur and the beekeeper is forced to feed the colonies in such a way that the quality of honey is not impaired. In this section you will learn how to proceed safely.

It is necessary to maintain a minimum of 8–10 kg of food reserves so that the bee colony does not need to switch into "the saving mode". It is also necessary to remember that the pollen consumption in July and August is only slightly lower than in April and May, when the colony passes through the fast growing development phase.

8 – 10 kg

MINIMUM QUANTITY OF HONEY STOCKS

An intensive feeding prior to the expected nectar flow is not appropriate in order to avoid deterioration of honey with the syrup or any other non-honey type of food. The food for bees must always be a little less than their daily consumption, so the food cannot be attractive or accessible to a large number of bees at the same time. It is best to use a high quality dough without any not digestible substances *(polysaccharides, such as starch and lactose)*, and the HMF value must be comparable to honey. The location of the dough is most effective and safe if it is placed near by the brood nest, which can be ensured by a well-placed frame-type feeder. Experience shows that a more comfortable solution is to place 2.5 kg of food dough with a 5 x 5 cm hole on the wooden inner cover. This dough is taken in smaller doses than the daily consumption of the colony and in the case of rediscovering of nectar it is less frequently visited by bees *(picture on the left side)*. Recently, a feeder for liquid food has been developed, where it is possible to open the entrance for as little as just a one single bee. It is possible to place it on the inner cover and to fill it without contact with bees and the supers *(picture to the right down)*.

3 · 3

Risks linked with feeding using various sugar substitutes

There are some risks associated with feeding bees to different types of food for bees, which requires maximum care in their choice. In this section we explain what type of feeding is the most apropriate and what needs to be considered before feeding bees?

In the long run, the best type of food is still crystal clean sugar, but the companies also offer ready-to-use, liquid food that needs to be considered very carefully in the Central European conditions from three aspects:

WHAT TO WATCH OUT FOR?

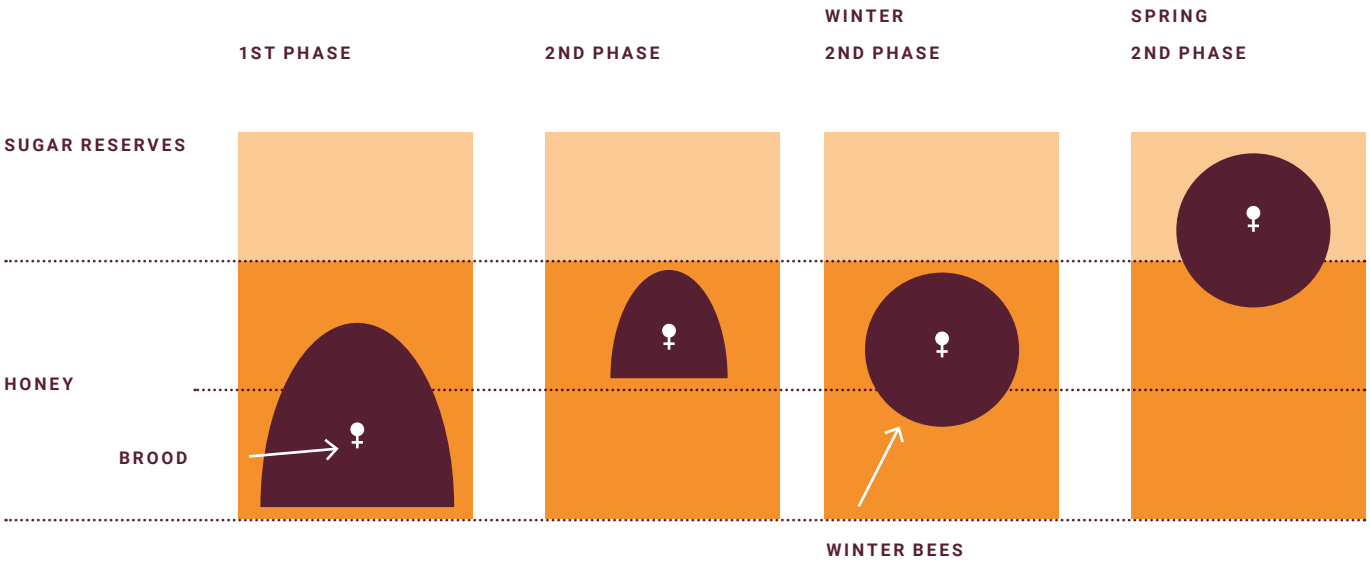
① Origins of food – food from sugar beet contains poorly digestible ingredients such as fructose, glucose and sucrose in a concentration of about 75 %. Ideally, there should be a higher fructose than glucose concentration in order to avoid crystallization of food supplies.

② Cereal food contains maltose and polysaccharides which are substances not digestible for bees and which may lead to bad wintering of the bee colonies over a longer winter period.

③ Aliquot weight — 1 kg of invert to the crystal sugar — from the perspective of creation of winter reserves, it is only 0.75 kg of the crystal sugar for the best quality food. In other type of food, it is even significantly lower.

3 · 4

Winter feeding strategies



Natural and the best quality of food for bees is pure honey. In case we feed bees for the winter with some other type of food (other than with honey from our own bees), it is important to ensure that the large part of the winter period bees overwinter on their own honey reserves.

In principle, bees keep honey as detached as possible from the entrance to the hive — most probably for the strategic reasons. In the case of a warm positioning of frames, the first frames are without food reserves, followed by the brood nest and only behind it there are the honey reserves. In the vertical hives, at the bottom of the hive there is a brood nest and honey is on the top of it. This is the case in a natural honeybee habitat. The reserves should be above the brood nest, because it heats them up and it's easier to reach it than to go backwards. The winter cluster could even split from honey reserves during the cold frozen days and die. In autumn, it is therefore better to place the brood frames under the reserves frames.

When changes in honeybee nutrition have occurred and the pressure of diseases has been directly or indirectly associated with Varroa mites in the past few years, those colonies that **winterize on floral honey** are more resistant to diseases as they have a better developed immune system. For this reason, we have to adapt the winter feeding strategy. The condition is that the last honey harvest will not take out honeycombs from the brood chamber, and honey must remains for the bee colony. One part of the former honey super will be filled with sugar reserves as future food reserves. In this way, winter bees will emerge **in two phases**.

Phase 1

Is a quick feeding with sugar syrup at doses over 5 liters in order to store them in the free super above the brood nest. A complete capping of these reserves is ideal, in order that after a gradual reduction of brood, bees do not store the sugar reserves down in the brood chamber.

Phase 2

Is connected with a gradual decrease of brood at the end of summer and beginning of autumn, and when this is associated with a smaller nectar flow, then honey created in this period of the year is placed above the decreasing brood nest in several kilograms.

During winter, the sequence in consumption of winter reserves changes. First, bees consume honey reserves created in the phase 2 in the brood chamber and in early *(first)* spring they consume sugar reserves of lower quality from the phase 1, but this is already associated with collection of the first pollen from nature.

3 · 5

Role of insufficient winter storages

In this section, we point out the necessary conditions for successful wintering of the colony in terms of its strength, position of the hive entrance and air release of bees in the winter cluster.

WHAT TO WATCH OUT FOR?

① A strength of the wintering colony. At least 8 standard Langsthrot frames *(or Slovak B10)*, or exquivalent of 7 Jumbo Dadant frames are needed for a successful wintering of the colony. The volume of hive for the winter should always correspond to the strength of the colony and the necessary food reserves. Under this strength bees/frames should be reduced to one main chamber with thermosheet partition.

If the colony is extremely weak, the winter cluster will be split from the food reserve *(see the picture above)* when the temperature drops below minus degrees for a few days. This may happen in type of frames that are narrow and long. Less often, the colony deaths occur as a result of starvation in deep and shorter frames, where bees have enough reserves over their "heads" drung the winter period. The winter cluster must be in contact with honey reserves. The winter losses should be accepted by the beekeeper already in autumn during the last inspection of the colonies. The beekeeper must merge weak colonies together or place them over the strong colonies to merge them later.

② A position of the hive entrance and the place of winter reserves. The principles of the cold position of the frames were mentioned in the previous section, but in the case of a warm position of frames, it is necessary to keep the position of the hive entrance out of the center, because the winter cluser would have available only half of the reserves. It is also necessary to prevent entry of pests *(such as mouces)* into hives and to ensure protection against flying pests *(such as hornests or wasps)*.

③ Possibilities of ventilation of CO_2 released by bees during wintering. Although the cold winter principle is generally applicable in order to avoid the early start of brood rearing during winter warmth, it is important to keep in mind the heat insulation under the hive lid, and avoid the thermal bridges — a warm head of the hive and the ventilation of the CO_2 exhaust by breathing bees on top of the hive in case of the closed bottom board.

Water condensates on the frames and on the peripheral hive walls — not so covered with propolis — can cause mold. As a matter of fact, when wintering the colony with a closed bottom board, it is necessary that the lid is air-permeable, while when the bottom board is meshed and the colony is healthy and strong, or wintered in several supers, the lid does not need to be air-permeable.

3 • 6

Prevention of melecitose in winter reserves and impact of melecitose honey on the spring development

Due to climate change more melicitose honey is produced in nature. What melicitose is and what to do when it occurs is described in the next section.

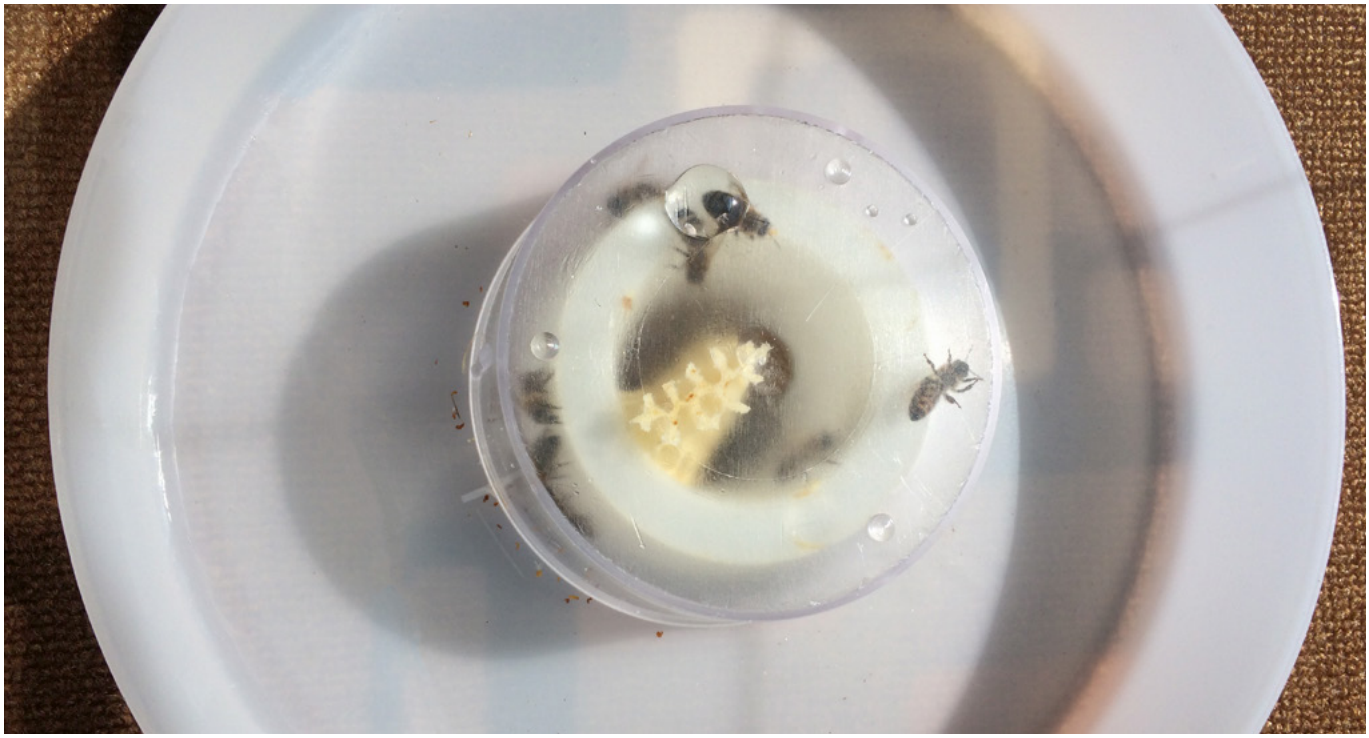
Melecitose is a triple sugar consisting of two molecules of glucose and one molecule of fructose. It is made by producers of honeydew. It quickly crystallizes and often bees take it out of the frames. It is most dangerous in the late summer, even on leaves trees, because it gets into winter reserves, and bees are not able to decompose it in time of the fly activity.

Unlike the spring time when bees can produce an enzyme to decompose it, which also has a significant positive effect on the spring development *(A. Roman – Poland)*. Consumption of melecitose can cause Black sickness *(Alopetia nigricans apis)*. It is often interchanged with viral diseases because it is manifested by hair loss and damaged wings as it is the case of deformed wings virus.

Bees infected with Nosema ceranae prefer flower honey to honeydew - during the experiment they preferred sunflower honey. Finally, they also had the smallest amount of *Apis ceranea* spores. *(The Self-curative Effect of Flower Honey - Silvio Erler, Deutscen bienen)*.

3 • 7

Importance of water for colony development and optimal relative humidity



In time of climate change and transportation of bees it is important to recognize the needs for water for the development of the colony and its optimal relative humidity. In this section we explain how to provide water for the colony without disturbing bees.

The need for water is greatest in early spring until first nectar appears. This is best to be done by providing water directly in the hive. The first dose of sugar syrop in concentration of 1:1 is put above brood. Placing water insight of the hive will secure the need for water also during the cold days. There are cases when from the end of February until the end of April the colony consumes up to 20 litres of water. Supplying the colony with water will save a large number of foraging bees during early spring.

In case of air-permeable hive wintering, it is necessary to replace the lid in spring by a non-permeable one so that the relative humidity around the brood nest reaches the optimal level in terms of the needs of larvae.

WATER NEEDS DURING THE SEASON

If nectar flow occurs, the need for water for brood is secured by the collected nectar. Bee hives placed in the sunshine during the summer midday must be cooled to prevent brood damage. Water supply during the season is also important for foraging bees bringing water from remote sources, but also due to problems with neighbours *(swimming pools, garden ponds, etc)*.