

Bee Queen Breeding Methods - Review

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Abstract

The biological potential of a bee family is mainly generated by the biological value of the queen. Whether we grow queens widely or just for our own apiaries, we must consider the acquisition of high-quality biological material, and also the creation of optimal feeding and caring conditions, in order to obtain high genetic value queens. Queen breeding technology starts with the setting of hoeing families, nurse families, drone-breeding families – necessary for the pairing of young queens, and also of the families which will provide the bees used to populate the nuclei where the next queens will hatch. The complex of requirements for the breeding of good, high-production queens is sometimes hard to met, under the application of artificial methods. The selection of breeding method must rely on all these requirements and on the beekeeper's level of training.

Keywords: bee queen, breeding methods.

1. Introduction

The productivity of a bee family is generated by queen's quality and age, colony's health and maintenance status, collecting sources and climatic conditions.

Young queen growth is conditioned by certain springing factors present within the bee family. The relationships between the queen and the working bees are especially complex; the queen is the central reference point of the colony and the working bees conduct and meet the vital functions for the bee family. These functions related to collectivity are exerted only in the presence of the queen. [1] considers that the interaction queen - working bees involves workers' nervous system, too.

After about one hour of queen's absence, a weakening of family cohesion occurs, materialized in the ceasing of comb construction and the reduction of gathering [2]. After several

hours of absence or disappearance of the queen, the nanny bees feed abundantly with royal jelly some cells with young worker bees; after this, they will build these cells, changing them into queen-cells, in 2-3 days.

After 3-4 days of queen's absence, successive to the abundant intake of royal jelly, we may observe the first visible signs of oocyte development in a part of the working bees [3]. The first completely developed eggs appear after 10 days. This development of workers' ovaries affects deeply the bee family structure, so that they do not gather reserves anymore, do not defend themselves (or become aggressive) and hardly accept a new queen.

The bee family remained orphan after the lost of the queen will build queen cells of emergency, which will lead to small-size queens, with reduced prolificacy [4]. The same author considers that good-quality queens may be achieved when the bee family has superior attitudes and replaces its queen peacefully. For this, the bee family thoroughly prepares the replacement of the improper queen (old or injured), by building

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queen cells whose larvae are adequately fed with royal jelly.

The queens resulted successive to the forced launching of swarming fever are preferred due to the fact they come from queen cells that are especially built for this, from eggs laid by family's queen, and the larvae feeding is adequately performed. With the help of this method, we may achieve high-quality queens, and not only in terms of growth conditions.

In order to achieve high-quality queens, the apiarist should take into consideration the qualitative value of the genetic material used for reproduction. The selection of the biological material used for queen production must be carried out in concordance with the following criteria: honey and wax production, queen prolificacy, resistance to hibernation, resistance to diseases, bee gentleness, predisposition to swarming, honey storage methods, honeycomb capping methods, bee longevity, bee behavior on combs during manipulation, bee flight intensity during gathering and under bad weather conditions, comb building, and also in concordance with bee morphological features [5]. The utilization of programs for queen growth and selection, in order to improve reproducers' quality, represents a very important measure in order to obtain important queens in terms of bioproductivity and resistance to diseases [6].

According to [7] beside the value of the biological material, the size of the queen cell in which the future queen will develop plays a major role in the achievement of high-quality queens. This author considers that the 9-mm diameter artificial queen cells are the most adequate.

A special importance in the achievement of high-quality queens may be also attributed to the following factors: the power of the colony and its disposition for growth; the number of queen cells /growing colony; the number of series growth; the method applied for queen growth; season and gathering conditions; food supply. [7] recommends that the volume of a series should be 30-60 queen cells /colony, depending on the presence of the uncapped young bees and apiarist's experience. The action should be carried out during the period that corresponds to the natural reproduction process (spring-summer), and the bee family must be permanently fed. Nectar availability and quality [8], and also the introduction of food supplements in the

nourishment of bee families used for queen production exert a positive influence on queen quality [9-11].

1. Queen breeding methods

1.1. Queen natural breeding

1.1.1. Queen breeding in bee families which prepare themselves to swarm consists in the stimulation of these families to start the swarming fever. For this, at willow flowering, the families selected are fed with sugar syrup, yeast and pollen, as stimulation, and this will determine the queen lays its eggs. The limited egg-laying area makes the bee families start the swarming fever at the end of April [12]. In this situation, the bee families build queen cells in which the future queens (Figure 1) will develop, and, at maturity, these will be cut out and used in the apiary [13].

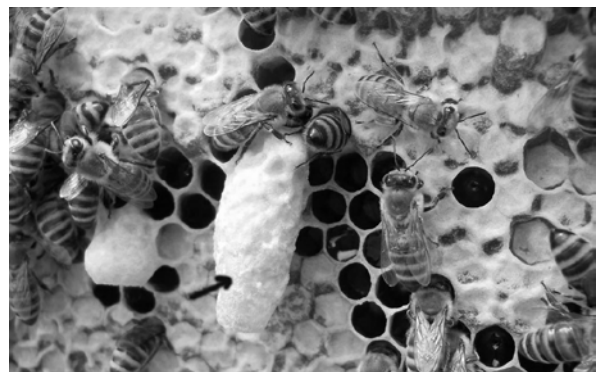


Figure 1. The future queen produced on natural way

1.1.2. Queen breeding in bee families which change their queen peacefully

There are bee families which breed queens to replace the old ones without generating the swarming instinct. When the queen cells reach their maturity, they will be cut out and used in the apiary. This method presents some disadvantages, namely: a small number of queens; queen quality cannot be controlled; queens may be obtained only in the swarming season and only from families with predisposition to swarming.

1.2. Queen artificial breeding

The artificially-obtained queens present high prolificacy, materialized in a good bee family development correlated with the capacity of honey production. They also record a reduced swarming

tendency and good resistance to parasitical diseases, compared with the naturally-obtained queens [14]. The artificial growth of queens involves two methods:

1.2.1. Queen breeding without larvae grafting (the method of larval cells cut out)

This method consists in the determination of bee family to build queen cells of cells sectioned from a comb with 24-36 hour young larvae. For this purpose, we need the following grafting tools: a knife to cut out the larval cells, supports to fix the larval cells on the growing frame sticks, frames for growth, a vessel for wax melting, grating for queen cell protection, cages for hatching and frames to support the hatching cages.

In order to obtain queens with this method, we should introduce two sections of artificial comb in the strong donor family, to fill it with eggs. After 24-48 hours, if the family is powerful, the introduced comb should contain eggs. This will be pulled out; we should section stripes of larvae cells and fix them on a frame, then introduce them in a nucleus including two frames with honey and pollen, together with the corresponding bee. After 9 days, we should take out the frame with queen cells from the nucleus and introduce it in the donor family, successive to the removal of its queen. In the 13th day, the queen cells should be cut out from the frame for growing and introduce them in the bee families whose queen should be replaced or in cages.

1.2.2. Queen breeding with larvae grafting

consists in the transfer of 24-36 hour larvae from the cells of an artificial comb in artificial queen cells. According to larva placement directly in the artificial queen cell cup or on royal jelly, the grafting may be dry or wet. Some apiarists apply the double grafting, the first one being the dry one and the second – the wet one, and this helps in the achievement of high-quality queens [15].

The researches performed by several research teams highlighted the importance of the withdrawal method and the month when it is carried out. The studies performed by [16], in Turkey, showed that the best queens were obtained in the month of July, successive to wet grafting with addition of royal jelly. The researches performed by [11], in the Republic of Moldova, led to the conclusion the queen growth in the second part of the summer, towards autumn,

generates body mass reduction, and the best results were achieved from the end of May until the middle of June.

Larva grafting should be performed with special attention (Figure 2), by introducing the spatula under the larva, in the dorsal side, in such a way that the two extremities should remain free, out of this [15].

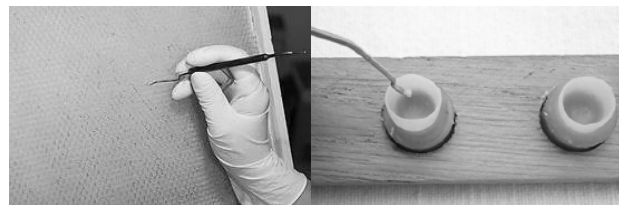


Figure 2. Harvesting larvae (left); Transferring larvae (right)

After larvae grafting, the frames with queen cells will be introduced, for 24 hours, in starter bee families and fed with royal jelly.

After 24 hours, the frame with artificial queen cells will be removed from the starter, introduced in a growing family, and left there for 9 days. After capping (Figure 3), the queen cells will be introduced in Zander-type hatching cages.



Figure 3. Frame with artificial queen capped cells

4. Conclusions

Queen artificial growth should be performed in specialized apiaries, in concordance with well-determined selection and growth programs. Apiarists may develop queens for their own apiaries, according to the methods described in this paperwork, by paying attention to all the conditions of biological material selection and to the requirements of growth and feeding, in order to obtain high-quality queens.

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