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Professional paper

SELECTION OF QUEENS BY IMPLANTATION WITH THE SEMI-CONTROLLED METHOD OF BREEDING MALES FROM SELECTED SOCIETIES

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ABSTRACT

The study of the selection of local queens, with the semi-controlled method, is very easy to apply due to the conditions required by the isolated selection as well as the laboratory one. The results of several years of study are very satisfying. We have created a quality queen that fulfils our needs in terms of yield flow, the instinct of keeping the swarm inside the bee box, reducing the aggressively of the bees, and its hygiene. Due to the natural and climatic conditions of our territory, it is necessary to cultivate the local queen as much as possible. In North Macedonia, this queen is protected by law and is called "Apis Mellifera Makedonika". The cultivation of this queen in our territory brings yield. Our queen winters well and in the spring develops about the flow of nature. When needed, it saves food until nature has an abundant flow for it to develop to its maximum. In this semi-controlled method, we mostly worked with the selection of beetles from selected societies. As a queen is bred with many beetles, she receives genes from all of them, which must be of good quality, so that the offspring will be of better quality. The selection of bees is a complicated process because the breeding of a queen takes place during the flight in the air while the beekeeper cannot influence it. Therefore, emphasis should be placed on the addition of selected beetles to increase the likelihood that the queen will be fertilized by the selected beetles. So far, our results are very satisfying. Selection in beekeeping proceeds in slow steps, so results are seen after a few years when a higher percentage of desirable parameters are achieved.

Keywords: queen, selection, Apis Mellifera, yield, breeding, population, parameter.

INTRODUCTION

In our territory recently, the beekeeping sector has started to grow a lot, both by beekeepers who have it as a passion and by those who are professionals, hobbyists keep from 5 to 20 hives, while professionals have more than 100 beehives. Passionate beekeepers deal only with the production of honey, while professionals, in addition to food products, also deal with the increase of bee colonies and their breeding, because the more hives are spread over different territories, the better it will be a population of the country with bee societies that would help the agricultural sector on a larger scale. In addition to the importance of collecting bee products, of greater importance is breeding or multiplying bee colonies so that in the future we have a larger number to achieve as much as possible to obtain the quantity of these products.

In our country, there is a sub-race of the honey bee, which is internationally called Apis Mellifera Makedonika, and which extends throughout the territory of North Macedonia, the eastern part of Albania, the northern part of Greece, most of Bulgaria, and as far as Romania.

HISTORY OF APIS MELLIFERA MACEDONIKA

According to a brochure published by Mac Bee, Apis Mellifera Macedonika was first detected in 1988 by the German scientist Friedrich Ruttner, who, according to the morphometric measurements of many samples taken from the entire Balkan peninsula, concluded that this subspecies differs from its neighbours Apis Mellifera Carnica of Slovenia and Apis Mellifera Cecropia of Greece.

According to Ruttner, in Apis Mellifera Macedonika, the body, wings, and hairs are smaller compared to Apis Mellifera Carnica, while in particular, the legs are longer. Other authors from earlier years have found that Apis Mellifera Macedonika has a lower sensitivity of the temperament of protection and swarming, while in the summer it reduced the brood, to save the food that goes into the winter in as much quantity as possible. It also has the characteristic of using propolis. During the winter, this bee hive consumes about 8 kg of honey, while its productivity ranges from 13.1 to 17.4 kg, and it is sensitive in winters with difficult conditions.

PURPOSE, ADVANTAGES AND DISADVANTAGES OF SELECTION

The purpose of the selection is that in rich years such as 2022, the colonies bring products in very large quantities. Such years are rarely repeated, and the main purpose of the selection is that in years with difficult times and unstable climates, the colonies will bring any little product. The most precious thing is for the colony to manage that product well, to save it for its needs, to manage to get through the coming winter, until the next spring. The idea is for the colony to show itself as best as possible in difficult times, and then when there are years that nature is suitable for flow fill us in the other years as well.

The purpose of the selection is the highest yield and the best quality, due to the increase in global food demands, the world is looking for something more concrete, and scientists have been encouraged to do research in this direction, where for a short time they have been considerable progress in this direction.

The selection of queens and keeping the local race under control has become necessary and very important, especially recently since the arrival of queens from other countries, such as the bringing of Italian queens and the hybrid called Bukfast, which are from countries with other climates and probably have a higher yield, but in the country of origin and not here with us who have a continental climate, because their adaptability is not that good, let alone those with over time, they also cause great damage in mass, because the beetles of that race will fertilize the queen of the country and there will be a crossing of genes, from which we do not know what will come out.

These have been done mostly for commercial purposes, not knowing the consequences, because the bees are not like animals that we can control their breeding. Here there is no control because it is bred in nature.

The selection of queens in a primitive form has always existed, alongside the natural one made by nature itself. The need appeared especially in the last three decades with climate changes and with the appearance or arrival of the Varoa parasite in the European continent as well as the Balkans after the 80s, where in addition to selection for productivity, selection was also introduced as a parameter of resistance to Varoa and other diseases, the queens which in their genetics had the most developed detection of this parasite as well as other diseases in the first steps of their development.

CATEGORIES OF BREEDING A QUEEN

Regarding the breeding of queens, the breeding categories are:

-completely natural uncontrolled breeding,

- controlled natural termination (or isolated in areas where there are no other natural bees, nor beekeepers in a radius of at least 5 kilometers, such as in islands

- semi-controlled insemination where we cultivate a large number of selected beetles, where we increase the theory of the probability that the queen will be inseminated with the males we want, even though the possibility is not excluded that she will also be impregnated with males without desirable for us

-laboratory fertilization (insemination).

WORK DURING THE SELECTION

I have been dealing with selection for almost several years. From year to year, I've been very satisfied with the flow of work which goes very well in a positive aspect. I also have information that even those who have the queens that we cultivate are also satisfied. This selection process is very slow and requires great dedication and precision, The error and tolerance in this process is zero, because one mistake can set you back a lot, and the return of this work is not hours and days but years all in question. In these cases, we need very good and precise evidence to know from which line the males will be cultivated and from which line the queens will be cultivated, a confounder can send us all the work away. If we cultivate beetles from the same line of queens, then those beetles that will breed the future queen or those eggs that will be fertilized with that sperm, the bees in the frame will clean them and will not let them develop because they are of their line and in this case we beekeepers see the egg frame in an irregular shape or as we call it mosaic, and here we find that the queen is not qualitative, well breed, and we must eliminate it immediately in order not to let male descendants to continue these problems in other descendants.

SELECTION PARAMETERS

The selection is done according to the needs of the market because not all the parameters included in the selection can be achieved with maximum desirable performance.

There are somewhere over seven parameters in the selection, while somewhere over half of them can be reached with desirable dimensions.

The parameters that must be followed during a selection process are:

Swarming - swarming parameters are controlled in such a way that an equal proportion of work is given space to all the bees that are in the test, and see which ones will have the greatest instinct of keeping even though they had space to work, while the extreme method where those colonies must be sacrificed, is when we will leave them without a working space and then the bee which has not started the fever of keeping, then it has zero instinct to keeping, this method is not applied. I think that the beekeeper's job is to make the bees expand in time, because in that other method if they are left without expansion then the other parameters of society's development cannot be observed, as well as productivity.

Aggressiveness: Aggressiveness or calmness of that colony can be seen in good times with the sun and flow from nature, as well as when we open the colony and take the frame outside. If that colony flies out of the frame and attacks the beekeeper, in this case, this colony is attacking or aggressive, because the beehive is opened with a lot of noise and in unsuitable climatic times. In these circumstances, the beekeeper will be attacked, as well as the opposite of what we mentioned above. The time when it is good and with the flow, the bee attacks again, then it is aggressive, and the worst of this is when we work on another beehive, and it attacks the neighboring bee, then the queen bee of that attacking company, in this case, must be eliminated at all costs because in that case is nearly impossible to work in the apiary because it will follow the beekeepers all day.

Productivity (productivity in the quantity of honey) In terms of productivity, the assessment is made only of the amount of honey that will be brought and which for a certain time it will be able to seal so that we have the opportunity to extract it in time to go to the second nature of flows. In this case, there is a colony that brings nectar but they didn't seal it and so we are left with unextracted honey because we can't extract it if it hasn't sealed at least two-thirds of the frame, otherwise this year I experimented with the colony which also sealed the other frames from other colonies that I have placed on this.

Saving or preserving honey (in times when there is no flow, to save products so that they do not go into unnecessary development, as well as early preparation for winter, regulation of the nest where they will winter) In the case of saving, I will emphasize this year's (2022) case when the bees prepared for the winter on August 15 with the necessary amount of honey and with the regular nest since then, with the interruption of the natural flow, the queen’s release of eggs has been stopped. So with no further release of eggs, she has saved food for the number of bees she has, and according to the bee's natural calculations, with that amount of food and with the number of bees she has, she can get through the winter and arrive until March - April with the new arrivals of nectar, on the contrary, it should be emphasized that the colony should not be fed either with stimulus food or with quantitative food after the interruption of the flow from nature, because in this case, we force it to expand the brood artificially where it will consume the food given and their food. After all, we give them a new signal that there is a flow coming from nature. With the checks I made at the beginning of October 2022, the bee societies have neither sealed nor new brood, and significant amounts of food to spend the winter comfortably.

Cleanliness or hygiene (how much it is self-cleaning of larvae infected with Varroa and other diseases, as well as how much it is cleaning the floors in the spring from unwrapped honey waste) The hygienic bee is the bee that is observed in early spring in March, with the first opening

of the colonies where we clean the floors by removing the wax, there you can see which colony has cleaned the base itself (for the test it is about closed base, not Antivarro with a network), then this parameter it is also observed throughout the year where we have come across frames with unsealed brood where the bee has detected that something is not right in that brood that it has sealed and has unsealed it again, if there was a Varro, which entered inside to release her eggs, her nest must be destroyed and not to be able to release its offspring (we have come across such frames).

The other method of sanitization testing is done using the pin test which is applied to a frame with completely closed eggs, using a rhomboid which has the dimensions to include a surface of exactly 100 closed larvae, which are pierced and damaged in a precise way with a needle of the size to be able to damage the larva, but without opening it. In this method, after the application, the first control must be done after six hours, the second after 12 hours and the third after 24 hours, That colony which has de-exfoliated the damaged larvae in less than 12 hours, then means that it is a very good hygienist, and if even after 24 hours the damaged larvae are not detected or very few are detected, then that colony is not a hygienist.

DETERMINATION OF THE VALUE OF THE PARAMETERS

According to Dr. Marin Kovačič, the evaluation of the parameters is assigned from 1 to 4. This type of evaluation depends on the beekeeper himself, but I liked this method because we don't get stuck in guessing because this is where we should be strictly in assessment, there is no average assessment here, so the calculation is like this, e.g. with grade 1 it is very poor, with grade 2 it is poor, with grade 3 it is good and with grade 4 it is very good. So there is no average number to say that it is average, and in this case, the beekeeper must be very strict in the evaluation. There are either weak or very weak queens, or there are good and very good queens.

PROBLEMS DURING THE SELECTION

Selection is not an easy job. There are problems that you have to face and you want an immediate decision, and all this requires a detailed sniff. According to M.Sc. Ratko Pavlović, the selection is like a double-edged sword, because we must be clear about what we want, we can never win everything. For example, if we want calm, non-aggressive colonies, then we have the risk of robbery, because it has not developed the instinct of protection, and this society can often be prey to robbery by other colonies in the spring and autumn when there is no flow from nature. If it is resistant to diseases, then it concentrates entirely on cleaning the larvae that give signs of disease, and in this case, we do not have a productive society. If we want to have a society with rapid development in the spring, then the consequences are that the Varroa will also develop a lot, together with the colony, and there is a risk that it will use up all the reserves, which can lead to its starvation if we don’t notice time to help them. In a few words, we must be very clear about what we want, and decide on it, while we then fix the problems ourselves, we treat Varroa, feed if needed, protect from robberies, and so on.

METHODS AND MATERIALS

Before we start with the work of the queens at the beginning of the season, which in our region starts from the second half of April, normally according to the climate and weather conditions, we must know in advance which colonies we will use them for, normally by

verification earlier according to their development that they have reached up to that time, but knowing which ones we have marked for certain jobs.

According to Dr.sc.Damir Šekulja, to reach the point of breeding a queen we need several types and categories of hives that have passed the preliminary tests of several years.

Colonies from which we will take the larvae, have been followed for two years or more in terms of their quality and if they have met the parameters that we have had to in the previous years. Even in that year, these colonies must be in the right condition for us to decide to take larvae from it.

Colonies to which we will release the production of beetles who have also been followed for two years or more and have met the necessary parameters that we need. The main condition of these colonies is that they are not of the same line as those that we will take the larvae, also These colonies must be a little more developed and at a little earlier time, because a beetle needs 24 days, after birth, he also needs about 14 days of their life, after which they become mature to breed a queen.

Male colonies should be helped a little earlier with auxiliary food from our side, such as honey and pollen so that they are more powerful to achieve development a little earlier because somewhere around 20 days earlier, you should start working with beetles. This type of colony should be provided with a construction frame without wax (in the market there is also wax with the dimensions of beetles) so that it can build its male genitals the queen will lay her eggs in it, and then after 24 days they will be born and 14 days that they are ripe for fertilization. The moment they are born, then we prepare to do the larval sowing for queens, because the queen is born on the 16th day, so it will be time after the queens are born, when the males are ready for mating. This work requires calculations of logical mathematics, plus we need to have time space for any kind of climate change that may occur.

Larva-starting colonies which will start the withdrawal of queen cells after we have planted the larvae. This society must be very powerful, both from the capacity of the bees that it has inside, as well as being well and qualitatively nutritious, because this is the key to the physical and chemical quality of that queen. Somewhere 10 days before we plant the larvae, this society should start to feed on protein food, such as honey mixed with pollen, also during those days we help it with sealed egg frames of more than 10 days, which we claim that they will be born after 10 days to populate that society with as many nutritious worker bees as possible, it would also be very preferable for that society to place a couple of frames with bee bread (perga) from other bees so that it can get as much quality food as possible have.

Developmental Society of Queen Cells. After the queens have started in the initiating society, we need another equally powerful society that will ensure their growth and maintain their temperature until day 10 before we place them in cages for mating, or if we intend to use them as such queens. In this case, we need this society because in the initiating society, once the queens have started, we remove them on day 3 and place them in this society, so that we can use the initiating society again to start other queens. We use the initiating society three times in a row with the help we provided earlier, and if we want to continue using it further, we must start with other assistance, including food as well as frames with closed cells. In the same initiating society,

we have the option to leave the queens there for mating and growth until day 10 without any problem, but we lose time because we need to prepare another initiating society.

Supplier Societies with Bee Numbers. Once the queen cells are withdrawn before the birth of the queen, several other equally strong societies with bee numbers are needed, from which we will take the bees to put in the box for breeding the queens. This is where the born queen will be placed for later mating. For the formation of feeders, I have applied two methods: one involves small feeders, also known as mini-feeders, with small frames, where we place a certain number of bees and the queen for mating, and the other involves feeders with larger frames that also include released eggs. These frames are placed in a large feeder.

These were the preparations of the societies in the field to reach a mated queen. There are several methods and ways to cultivate queens, and the materials used for this purpose are diverse. We will focus on our method of extracting queens by grafting larvae from the previously designated line and transplanting them into the previously prepared feeders. This method gives us more freedom to focus on our selection. The material needed to start the queen-rearing process is clean and sterilized wax, used to build the feeders. This wax must be natural because the bees sense it better and approach it faster. The feeders are constructed with melted wax and a wooden device with the exact dimensions of a hive, where the larvae will be placed.

Next, a wooden frame is needed where the built queens will be attached and where the larvae will be grafted. Attachment is done again with natural liquid wax, and depending on the needs, one or two bars are placed in this frame, on which approximately 15 to 20 built feeders are placed, ready for larval grafting. For larval grafting, we use a type of grafting tool known as a Chinese grafting tool, which is suitable for taking larvae from the cells.

After the larvae are grafted, the frame is placed in the initiating society, where the withdrawal of the bees begins. When the bees are withdrawn around day 10, cages are needed to isolate the emerging bees to prevent the destruction of the feeders by the queen that is born earlier. These cages protect the feeders and allow the newly hatched queen to carry on with her mating work uninterrupted.

After mating, the queens are marked with color and placed in cages for transport to the predetermined destination."

RESULTS AND DISCUSSION

After clarifying the manner and processes of selecting and improving queens in detail, I will now attempt to sequentially explain the steps that need to be undertaken to reach a queen who will fulfil our needs for parameter fulfilment that we desire. According to what we seek in these queens, first and foremost, they must be as productive as possible in the economic aspect. Following that, they should possess a low swarming instinct, as low as possible, because the swarming behaviour is inherent in bees and we cannot entirely prevent it. Next, they should be frugal in the expenditure of the accumulated product quantities, enabling them to overwinter effectively and emerge in spring with the planned quantities. Additionally, having a high level of hygiene would be highly beneficial; I believe that if society is hygienic and healthy, it will inevitably be productive as well. Once we have managed to select the female and male genetic material during early spring, following them over several subsequent years, we then proceed

primarily with the cultivation of the males from the other selected line for male cultivation. This requires more time for them to reach the necessary maturity for mating. Afterward, we prepare the starter colonies in which the larvae will be grafted into the wax cups. Subsequently, if the climatic conditions promise to be favourable for the next two weeks, we undertake the procedure of larval grafting. However, before grafting the larvae, we need to ensure, that the society in which we will start the cells, blocks the queen. If we have a strong society on two boxes, then we leave the queen on the second box with sealed cells and a frame of honey to minimize space for egg laying. This is because such a society should not have open cells so that young bees do not concentrate on their food. Instead, their focus should be entirely on the prepared queen cells to start and nourish them effectively. In the first box, we leave frames with honey and pollen as well as at least two frames with drone comb to build, since this society has a large number of worker bees that need to construct drone comb due to their energy and nutritional needs. This is also done to avoid constructing drone comb in the cell frames with prepared queen cells, as they have space, and instead, the bees construct drone comb there and block our queen cells. The next step in line is the isolation of the queen in an isolated frame where we insert a well-woven frame so that the queen can only lay eggs in that frame. This way, we know that by the end of the fourth day, those eggs have turned into larvae and are ready for grafting (transplanting). (If this frame has not been prepared, we can use another frame, but this takes a lot of time during the inspection and selection of larvae from the entire colony.) This task is done in the society selected to obtain female genetic material from another line, as opposed to male genetic cultivation.

Once we have prepared the frame with cells, on the fourth day, we extract the frame with larvae that we have ready and begin the process of larval grafting. When dealing with the larvae, we need to have great care and a keen sense of smell. We should strive to work with the youngest larvae, preferably those under 10 hours old after the eggs have been laid, so that when the feeding of the larvae by the starter society begins, they are provided with high-quality food for becoming queens. After we have grafted the larvae into the frame with queen cups, we send this frame to the starter colony where we have it more prepared, where it remains for approximately 72 hours. After this, we remove this frame and send it to the colony that will nurture these queen cells and build them. I emphasize that this society should have the queen blocked on the first box with a queen excluder to prevent the newly emerged bees from destroying the queen cells we sent there. The queen cells in the nurturing colony will remain for another 7 days, during which we place cages for protecting the emerging queens so that other queens are protected from the first-born queen. Once the new queens have emerged in the cages, it is necessary to have prepared the small introduction colonies 24-48 hours in advance with a number of bees collected from other societies that only have frames they need to build. When the bees are gathered from different colonies, they need a period without a queen so that they sense her absence. After two days, when we release the unfertilized queen to them, they will accept her immediately.

This was the method with small introduction colonies. In contrast, the method with large introduction colonies involves taking frames with eggs and bees. These need to be established 10 days earlier, before the queens emerge in cages. This allows the bees to raise their own queens, and by day 9, we remove all the queen cells that the colony has initiated, replacing them with cells from those queens that have not yet hatched in cages. This colony will accept the introduced queen because there are no longer open larvae from which they could raise a new queen, and they must accept this because there is no other solution.

I prefer the second method with larger colonies for several reasons:

Firstly, it involves a larger number of bees that were present and will be present during the queens' emergence.

Secondly, when the queen returns from mating and starts laying eggs, there is a substantial number of bees available to feed those eggs. Moreover, the most important aspect is that with a larger frame, we can better observe the progress of the new queen who has started laying eggs. In this case, we can monitor the regularity of egg laying and the quantity of eggs.

The third and most important advantage compared to small boxes for breeding the queens is that with large colonies, it's not necessary to remove the queen from the box for breeding. She can stay there longer, continuing her work. We only need to add new frames. In the case of small introduction colonies, the queen must be removed once she has sealed the first batch of eggs, as her space for continuing work is quite limited. There have been instances where queens have swarmed due to the limited space available, resulting in a small number of bees and a loss of the colony.

The best approach when conducting queen rearing is that when the mating nucs become populated with bees, they should be moved at least three kilometres away from the location where the bees were collected. This prevents the bees from returning to their original location. After we have taken these actions, until we successfully introduce the queen into the mating box or queen cell cups, the colony is not opened for the next 10 days. At that point, we see if the queen has been successfully breeding, and if so, we mark her with the designated colour for that year. If the queen is not present or has not emerged due to various factors or unsuccessful introduction, we need to take radical measures. If the weather conditions are not favourable, we provide an additional week. In all cases where there are problems and disruptions in the work rhythm, the queens’ transition to being second-class queens, and so on.

To achieve the desired quality, all these processes must proceed optimally to avoid being hindered by climatic factors, human factors, or negligence. However, the process of mating is something that is not easily controlled. The queen performs mating flights in nature, and in this case, we have limited control. Our only role is to ensure that at the time of mating, we have a significant number of drones that we previously cultivated in the mating area. These drones will populate the area when the queen goes for mating flights. This increases the chances of the queen mating with the drones we planned for.

Based on the work done so far, according to morphometric measurements conducted by Professor Miroljub Golub from the Faculty of Agriculture in Skopje, nearly 70% of the bees are of the local race we cultivate, Apis mellifera macedonica. I am very satisfied with these results. However, this doesn't mean we should stop here. Day by day and year by year, we need to work towards further refining the lineage.

It's not coincidental that a queen mates with 7 to 12, even up to 20 drones. The purpose of having more drones is to increase the quantity of sperm in the queen. This increases her reproductive capability for several years. To withstand the rigors of mating flights and the load placed on her during mating, the queen must be very strong. Her strength depends on her nutrition during the time she spent as a virgin in the queen cell.

According to various studies and analyses conducted on successfully mated queens, up to 30 different sperm types have been found in them. This implies that a queen can mate with up to 30 drones. This purposeful diversity in a hive's population is not by chance. Different types of bees are born for different roles within the hive. Some bees are more adept at specific tasks compared to others. This diversity is necessary to ensure that each bee is specialized in performing a particular role. In nature, things are perfectly regulated. The right task is assigned to the right specialist, not just any task assigned to anyone. This is because, without specialization and coordination, success cannot be achieved.

The sperms from all the drones in the sperm bank are mixed together. I've noticed this during the process of grafting larvae from a comb, there have been cases where a queen emerges with a different colour, indicating that the colour of the queen's offspring depends on the sperm source of the specific drones she mated with. According to Dr. Slobodan Dolasevic, this has been confirmed by author Koninger, who conducted experiments where sperms from different drones were coloured differently and then mixed in the sperm bank. In the end, the colours were not distinguishable, indicating that the sperms from different drones are indeed mixed. This experiment was conducted using a laboratory method called instrumental insemination, which allows for the isolation and colouring of specific sperm.

During the mating of a queen, if she mates with drones from her lineage – which is a possibility, and even likely – some of the eggs she lays will be fertilized by drones of her lineage. In such cases, worker bees detect these eggs and remove them from the cells. This can lead to a situation where some cells appear with unmatched colours after marking. This doesn't mean that the queen is not of high quality, but rather that the mating process is not of high quality. Although the queen lays eggs uniformly across the cells, worker bees recognize and remove the eggs that might lead to inbreeding.

To assess the quality of a queen, one should observe the uniformity of the sealed cells after she begins laying eggs. This can only be done after mating, and it's best to wait until around 10 days after the first batch of eggs has been laid. This period allows the queen's pheromones to develop sufficiently, which is crucial for acceptance in a new colony.

Another method for assessing queen quality, according to Dr. Slobodan Dolasevic, is by weighing the queen after mating. A mated queen typically weighs between 160 mg to 210 mg. A heavier queen is generally considered to be of higher quality. However, the quality of a queen can deteriorate over time, especially if she is kept for an extended period in a transport cage. It's estimated that a queen can lose about 1 mg of weight per day, and external factors like temperature, humidity, noise, and vibrations during transportation can exacerbate this weight loss.

I share the belief that even if queens are collected from distant locations, their quality can still deteriorate during transportation. This is why methods such as queen banks, where mated queens are kept after mating until they are ready to be shipped to customers or placed in colonies, are used to maintain the quality of queens over time.

In conclusion, several small factors play a significant role in queen quality. While they might seem insignificant individually, their combined effects contribute to the overall quality of the queens.

CONCLUSION

The queen bee is the key to success in beekeeping. If we have a high-quality queen, she will be highly productive and will fulfil our economic needs. Unfortunately, I have observed that the majority of clients (not all) primarily inquire about the price of a queen bee, and they rarely ask about the breeding method and its quality. They consider the queen bee as merely a necessity, rather than considering the impact she will have on our future endeavours.

It is better to unite a society rather than to sell just any queen bee. If we settle for an arbitrary queen, she might not be productive, resulting in wasted time and finances to maintain her. On the other hand, a strong society is more valuable than five weak ones. I emphasized all of this to stress the importance of valuing a high-quality queen bee. It should be understood that breeding a quality queen requires significant effort and sacrifice, and her value should reflect that. According to calculations by Friedrich-Karl Tesler from Germany, the cost of a commercial queen bee for production, to be sent to clients, should be at least equal to the average price of 3.5 kg of honey, based on the retail market price. With this calculation, even a small investment is worthwhile for the work and sacrifice involved in selecting and cultivating high-quality queen bees. Otherwise, the market is open and we can set prices as we please, but field tests in beekeeping cost at least one season. If we miss a season, the cost of loss will be significant.

Beekeeping is beautiful because it offers diverse ways of work. Depending on how one adapts to the work, beekeeping varies from field to mountain and even within the same city. It is not bound by specific dates but rather changes based on the area, climate, and surrounding vegetation. It's crucial to understand the nature of the environment where our bees operate. Within a radius of 5 km, we need to know the type of flora and their vegetation period, ensuring that the bees are well-prepared at the right time and place.

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