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THE CARNIOLAN BEE

(Apis mellifera carnica)

IN SLOVENIA



THE CARNIOLAN BEE IN SLOVENIA

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1. THE HONEY BEE

Among representatives of the genus *Apis* mainly four species are the most widespread. They are found from Europe to India and farther towards southeastern Asia. The largest amongst them is the Giant or the Rock bee (*Apis dorsata*). Its colony builds a single huge comb in the open air, usually attached to the rock surface. The smallest representative is the tiny Indian bee, the Little bee (*A. florea*), which likewise makes combs in the open air. Slightly



Bees are not just an economic factor, they are also a significant part of life style and cultural heritage of Slovenian people.

larger is the Indian bee (*A. indica* = *A. cerana*), which is used for honey harvesting in some places. Africa and a considerable part of Europe is the native habitat of the Honey bee (*A. mellifera*). Today there are 25 subspecies of Honey bee known in Europe, Asia and Africa.

In Europe 5 Honey bee subspecies are prevalent: (1) Italian bee (*A. mellifera ligustica*, Spinola 1806), originally spread mainly on the Apennine peninsula (2) Caucasian bee (*A. m. caucasica*, Gorbachew 1916), on the territory of Caucasus, (3) Black bee (*A. m. mellifera*, Linnaeus 1758), which originally extended on a part of Central Europe and in the west and north of Europe (4) Macedonian bee (*A. m. macedonica*, Ruttner 1988) and (5) Carniolan bee or Kranjska sivka/Carniolan grey bee (*A. m. carnica*, Pollmann 1879), originally extended on the territory of Slovenia and neighbouring Carinthia and eastwards as far as Rumania and Bulgaria. Its stripes on buttock are dark, with light gray to yellowish hair. Because of these markings it appears more gray in color than other European species. This is the reason that it is sometimes referred to as the Carniolan gray bee. The Carniolan bee and the Italian bee are most commonly used for production of honey worldwide.

2. HISTORICAL REVIEW OF THE DEVELOPMENT AND RECOGNITION OF THE CARNIOLAN BEE

Life of Slovenian people is closely connected to bees and beekeeping. Our ancestors were very successful in beekeeping with the Carniolan bee. Beekeeping was as much part of clergy and schoolmasters as it was of peasants and country people. To each farm building and garden always belonged a small bee-house. The fact that this trade has been deeply rooted in our people is obvious in works of past time authors like J. V. Valvasor (1641–1693) who was the first to write about bees and beekeeping in his famous *Slava vojvodine Kranjske (Die Ehre des Hertzogthums Krain/In Praise of the Duchy of Carniola)*, 1689. Later on the naturalist from Idrija, J. A. Scopoli (1723–1788) wrote the *Treatise on bees (Dissertatio de apibus)*, in the 4th volume of *Annus historico – naturalis*, Leipzig, 1769–1772.

Among beekeepers there were individuals, who put great efforts for the progress in this trade. A true supporter of the trade and a great beekeeper in the 18th century was Peter Pavel Glavar (1721–1784), who sacrificed a lot of time and money for the progress of beekeeping. In 1768 the government of Vienna sent the *Proposal for the improvement of beekeeping in Carniolan hereditary provinces*. P. P. Glavar gave a detailed reply to the proposal as a pioneer among Slovenian beekeepers, describing the methods and beekeeping circumstances in our country. He suggested the establishment of beekeeping schools, adoption of appropriate regulations instrumental in farther development and growth of this trade. He made an appeal for publication of much needed manuals in native language. Eventually he was the only one in years 1776/78 to who wrote such a manual in slovene language.

In the time of P. P. Glavar there was a beekeeper, whose influence extended far beyond the frontier of Carniola. This was Anton Janša (1734–1773), native of Breznica at the Upper Carniola. He became by order of the Empress the first teacher of beekeeping at Austrian royal court. Although he was only 39 year old when he died, he left a great legacy of knowledge for the future. He wrote a treatise on bee swarming (*Abhandlung vom Schwärmen der Bienen*, 1771) and also left a handwritten reference *Vollständige Lehre von der Bienenzucht* (Complete Guide to Beekeeping), which was published as late as 1775, after his death.

Blooming beekeeping on the territory of current Slovenia and the example of famous predecessors encouraged more and more beekeepers to write about it. This paper is limited only to publications of those who played an important role in promotion of the Carniolan bee at home as well as worldwide.

The first person who informed the world about this special type of bee from Carniola, was Filip Rotschütz, the father of bee trader Emil Rotschütz (1836–1909), a Carniolan baron (also known as Ravenegg or Rožič) from Podsmreka near Višnja Gora. In an article published in 1857 in the magazine from Eichstedt, called *Bienenzeitung* and titled “*Aus Unterkrain*”, (“From the Lower Carniola” – Dolenjsko) he talked about a local bee which he called “*krainische*”, (which means Carniolan). The news aroused great interest on this newly discovered bee in spite of negative opinion of baron Berlepsch, who was in those times the undisputed German authority on beekeeping and one of publishers of the above mentioned magazine. The beekeepers all over Europe started to show great interest for this bee. On first favorable experience they literally bombarded Rotschütz with orders. They were more than satisfied with the bees they had received. Approximately 1863 parish priest Morbitzer from Moravia on the basis of his own experience reminded the Moravian Beekeepers’ Association on the bee from Carniola. Dr. Ziwanski from Brno recommended the establishment of a commercial beekeepers center in Podsmreka near

Višnja Gora which happened very soon. During the first three years of its existence they distributed some 3000 colonies with queen bees. The association distributed in total more than 100.000 colonies of bees. The basis for this successful trade was a simple rustic beehive later named “kranjič” (the Carniolan beehive). It was suitable for stacking and transportation.

Foreign experts became interested in Carniolan bees. In 1879 Pollmann published the booklet “*The value of different races and their variations according to reputable beekeepers*” (*Wert der verschiedenen Bienenrasen und deren Varietäten, bestimmt durch Urteile namhafter Bienenzüchter*). In this book he talks among other things, about the Carniolan bee and refers to it by the scientific name *Apis mellifica carnica* and ger-



Two traditional Carniolan beehives called “kranjič” with illustrated beehive front boards.

man one *Die krainische Biene* or *Die krainer Biene*. Presenting it, he quotes different contemporary experts on bees and their opinion, being almost without exception favourable. He came to the conclusion that baron von Rothschütz supplied the best Carniolans.

Rothschütz was the first exporter of the Carniolan bee and soon he was followed by many others. One of these exporters and certainly the largest and most known was Mihael Ambrožič (1846–1904) from Mojstrana, who expanded his business worldwide. One of his orders went as far as Far East Russia to Vladivostok. From 1872 to 1904 he sent away close to 40,000 beehives, according to some sources the number was even as high as 74,343 Carniolan beehives with queen bees.

Jan Strgar (1881–1955) from Bitnje later became our largest breeder and exporter of Carniolan bees. Beside him there were many other beekeepers trading in that period. In 1906 only in Carniola there were 21. In the period between 1858 and the end of WW I, the export of at least 170,000 swarms is documented, with some estimates claiming even the number as high as 500,000.



Jan Strgar's commercial bee-house in Bitnje by Bohinjska Bistrica.



A container for transport of bee swarms (Museum of Apiculture in Radovljica).

The newspaper *Slovenian Bee*, first published in 1873, was also very important in promotion of the Carniolan bee. At the same time the German newspaper, *Die Krainer Biene*, edited by Rothschild himself, was published. Monthly Magazine *Slovenian Beekeeper* has been performing an outstanding mission in promoting an informative outlook about the Carniolan Bee. In this jubilee year of the Apimondia Congress in Ljubljana it has reached its 106th year of publication. From a large selection of contemporary literature on the Carniolan let us mention two books: Josip Verbič's *Raising the best honey bees*, 1947, and Jože Rihar's *Let's raise better honey bees*, 1972.

In the mid – 19th century beekeeping with promotion of



Antique queen cages (Museum of Apiculture in Radovljica).

swarming was very profitable. In addition to honey the beekeeper also made profit with the sale of swarms. Beekeepers encouraged propensity to swarming in order to acquire as many colonies as possible to take to pastures of buckwheat, the blooming of which starts as late as in august.

After WW I, trade in honeybees almost ceased. Introduction of large leaf hives made it possible to harvest larger amounts of honey than with beekeeping with smaller traditional hives. Suddanly swarming became an unwanted feature. Later on there were several attempts in this area to make an organized selection of bees within the realm of the beekeepers' association, by following several foreign examples. The great Slovenian beekeeper, Anton Žnidaršič played a big part

in these activities. WW II put stop to all these promising endeavours. After WW II several large projects financed by the beekeepers association failed, which made the attempt of collectivization unsuccessful. The organized selection of the Carniolan bee within the beekeeping association was not realized inspite of several attempts to restart it.

After WW II there were many attempts to revitalize a systematic queen bee breeding, especially after 1979. In 1984 a national level service for the selection of the Carniolan bee was established within the Agricultural Institute of Slovenia, which improved the quality as well as the extent of queen breeding.

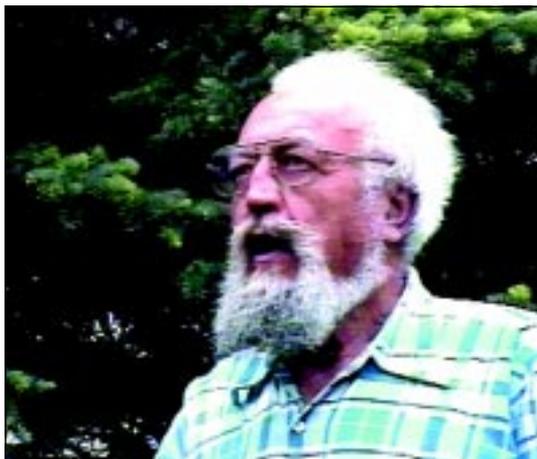
The Ministry of Agriculture, Forestry and Food has appointed a commission in charge of inspection and approval of mating and queen breeding points for the Carniolan Bee.



An expert group from a licenced breeding organization examining adequacy of a candidate for the registration of a queen breeding point

The commission reviews the mating and queen breeding points annually, with the participation of a specialist in selection from the Agricultural Institute of Slovenia, an expert in bee diseases from the Faculty of Veterinary Medicine in Ljubljana and representatives from the government and the Beekeepers' Association of Slovenia.

The bee selection project was financially as well as in other ways supported by The Ministry of Agriculture, Forestry and Food on the basis of the Animal Husbandry Act (1978) and the regulation on conditions for breeding and marketing of queen bees and managing of mating points (1981). Among other things, the regulation includes the provision that only breeding of the Carniolan Bee is allowed within 30 km of registered mating points. A permit issued by the Ministry of Agriculture, Forestry and Food was required. Thus, to this day, with the aid of appropriate professional measures, we have succeeded in maintaining the autochthonous population of the Carniolan Bee in most parts of Slovenia. This has been confirmed by the results of recent genetic research of mtDNA, in which, on the basis of bees sampled on the territory of the Republic of Slovenia surprisingly matched haplotypes were found.



*The doyen
of Slovene
queen breeders,
Ciril Jalen*

3. DESCRIPTION OF THE CARNIOLAN BEE

The Carniolan Bee is autochthonous over a wide area of Central Europe – in a small part of north Italy, in the eastern part of the Carnian Alps, the entire territory of Slovenia, a considerable part of Austria (Carinthia, Styria, Lower Austria, the Province of Burgenland, most of Hungary, part of Rumania, FR of Yugoslavia, Bosnia and Herzegovina, as well as Croatia. The evolution of the subspecies



A beehive in a winter setting

dates back to the time after the end of the last ice age, i.e., some 10,000 years ago. Under this general subspecies of the Carniolan Bee there are three main ecotypes – Alpine Carniolans (Slovenia, Austria, Slovakia), Pannonian Carniolans (the Danubian area) and Mediterranean Carniolans.

The alpine ecotype of Carniolans has larger wings than the bees of some other strains. Its body is smaller than the body of the Black bee. The size of the body in the Carniolan bee depends to a large extent on its natural habitat – the further southeast the slimmer are the bees and the more their temperament is pronounced.



Compared with Honey bees of some other races, the Carniolan bee is able to take full advantage of pollen forage



The main body of the bee colony is concentrated in the rear of the hive. The beekeeper is slightly out of step with measures.

The regions where the alpine and the pannonian ecotype of the Carniolan Bee are found are characterized by long and harsh winters. Spring is comparatively short, which requires prompt and vigorous expansion of the bee colonies. The entire area is characterized by considerable daily and seasonal temperature fluctuations.

The Carniolan Bee has a long tongue reach, which is important for seed production in red clover. The cycle of building up of the colony is closely adapted to foraging conditions. Carniolans overwinter in small colonies, for the

most part the queens do not lay from October to the end of January. The first brood appear at the beginning of February. Thereafter, a fast spring build up of the colonies follows in preparation for the first major forage, which usually starts at the end of April or beginning of May. An irregular development is sometimes observed with the spring build up (colonies developing either ahead of time or too late), which means an additional possibility of survival in unstable circumstance, at least for certain parts of the colonies. During extended dearths of pasturage in hot summer weather, the queen substantially reduces laying. The adaptability of the Carniolan Bee allows it to take full advantage of



Father Bukovšek, painting hive frontboards in the middle of a spring day at the peak of foraging flights. The calm bees are not troubling him at all.

all natural source of food, while in any adverse circumstances the queen promptly reduces or even stops laying.

The method of overwintering of the Carniolan bee is not much different from that of the Black bee. Unlike Carniolan bees, Italian bees overwinter in a large cluster, and the queen hardly ever stops laying, which increases the amount of food required during the winter time. During fast spring colony growth, there is a risk of a propensity to swarm. It is possible to suppress swarming by adequate beekeeping technology and equipment as well as by taking advantage of honeydew forage, and thus increasing honey production.



Setting equipment at a honey dew flow observation station

Carniolans are very gentle. They are quiet on the combs and are not aggressive towards the beekeeper. In terms of this feature, it is superior to all other races of bees.

The Carniolan bee is a great deal less active in the collection of pollen than the Black bee or the Caucasian bee. This makes hive management much easier.

Its honeycomb cappings are formed level with the comb cell or embossed, which considerably increases the amount of stored honey in the combs. It has a highly developed sense of orientation. It is an advantage with the pavilion style of beekeeping, where there is hardly ever drifting of bees into neighbouring hives and the possibility of transmission of diseases and parasites. Its sense of direction relies more on the shape than the colour of the



Varroa has changed beekeeping technology as well as selection objectives.

surroundings. In this it far surpasses the Italian and the Black bee. It locates the honey dew flow much easier than other races of bees. It is therefore perfectly adapted to pasture on conifers.

The dance of the Carniolan Bee describes much more exactly the direction and distance to a food source than that of other races of bees. When a pasture is finished the Carniolans are quicker to search for new territory and locate it. The occurrence of laying workers, i.e. worker bees producing a drone brood is much later (30 days) than with the Black bee (22 days). This indicates that the social structure in the Carniolan bee colony is stronger than in some other breeds.

In comparison with other races the Carniolan bee is much more resistant to brood diseases.

Numerous studies of individual ecotypes of the Carniolan bee have shown that there is no sense in looking for the best bee. The selection objective can be set only within individual ecotypes.

Cross-breeding of the Carniolan bee with other bee races results in a strong heterosis effect. The colonies are vigorous and honey yields above average. However, at the same time, this often leads to increased aggressiveness and disposition to swarming. It is especially the case with the second and third generations after input of foreign genes. Crossbreeds made between the Carniolan and the Italian bee breeds (although both are known as very gentle) are extremely aggressive.

4. BREEDING PROGRAMME FOR THE CARNIOLAN BEE

The following factors facilitate current implementation of the selection programme in Slovenia:

- We have the autochthonous Carniolan bee, there is no trace in it of other bee races, except for the influence of Italian bees in western Slovenia
- the Carniolan Bee is protected from the influence of the neighbouring Italian bee in the northwest by the Alps and in the southwest by the “burja“ (a cold north wind);
- Slovenia borders in the north and northeast on the Austrian federal provinces of Carinthia and Styria, where breeding of Carniolan bees is legally prescribed, and the Carniolan bee predominates in border regions with neighbouring Croatia and Hungary;
- There is a very rich tradition of breeding the Carniolan bee, and beekeepers are adequately qualified.

The Animal Husbandry Act (Official Gazette, RS 18/2002) in Article 61 gives all registered queen breeders special status in comparison with other beekeepers. In accordance with Article 62, these are entered in special records at the Ministry of Agriculture, Forestry and Food. In Article 68, the Carniolan bee is included in the list of autochthonous breeds of domestic animals in Slovenia. In Article 70, it is stated unequivocally that in order to protect the existence of the autochthonous Carniolan bee on the territory of the Republic of Slovenia, breeding of and trade in breeding material of other bee races are not allowed. The



Carniolan queen on a comb

Ministry of Agriculture, Forestry and Food is obliged within a prescribed time limit after adoption of the act, to determine conditions in relation to breeding, movement and trade in bees and other bee breeding materials of the Carniolan bee.

The system of conducting breeding activities in the sphere of beekeeping is within the jurisdiction of the authorised breeding organisation in the sphere of beekeeping, which is the Beekeepers' Association of Slovenia. This plans and implements a breeding programme in accordance with statutory provisions, in which is defined the breeding aims, the size of the population, breeding methods and the



The Beekeeping centre of Slovenia is at the same time also the registered office of the authorised breeding organisation for beekeeping

selection programme, developmental and research tasks for the needs of increasing the effectiveness of implementing the programme. It determines measures for better management of beekeeping and for ensuring the spread of genetic progress and quality of bee products, the annual programme of use of individual pedigree queen stocks and the method of publishing data, and determines the conditions for cooperation with and use of services of the breeding programme, in accordance, of course, with zootechnical standards in the sphere of beekeeping.

To date in Slovenia we have registered queen breeding centres each year anew. In accordance with the changed

legislation, we now carry out a uniform five-year registration.

Each registered breeding point is under permanent health control by the National Veterinary Institute. The National Veterinary Institute, on the basis of laboratory analyses and inspections in the field ensures that all registered breeding centres are free of serious American foulbrood, European foul brood, Nosema disease and Acariosis. The institute additionally ensures that there is no trace in breeding centres of the clinical appearance of Varroa mite.

The Agricultural Institute of Slovenia, in compliance with authority from the Beekeeper's Association of Slovenia, takes care of direct work in bee selection. It controls breed purity of the population in selection, and conducts direct selection activities for the authorised breeding organisation



Sites of registered queen breeding centres in Slovenia in 2003
(source: <http://www.sigov.si/svo/svo/kartogrami.htm>)

in the field. It provides queen breeders with all the necessary technical advisory activities in the sphere of selection and breeding of queens and carries out laboratory analyses of the morphological properties of bees and analysis of mtDNA. It also ensures the undisturbed operation of the information system.

Each year in Slovenia, we register 30–40 queen breeding centres. A total of more than 40,000 queens are bred annually, of which one third are bought by Slovene beekeepers.



Every queen breeder is obliged to select queens from his own resources.



Physokermes hemycriphus is one of the more important producers of forest honey.

Every registered queen breeding centre, in accordance with the new legislation, must consist of two apiaries with at least 20 colonies, which must be at least 3 km apart. One of the apiaries serves for the primary selection of colonies, and the other is physically devoted to the breeding of queens. Each breeder is obliged to select queens from his own sources, or to include queens from hives in the immediate vicinity. Any kind of exchange of queens between registered queen breeding centres is forbidden, because of the risk of increasing the level of relationship in whole population.

In the apiary for the primary selection of colonies, we select on the basis of their own productivity the best colo-

nies with two-year old queens. The colonies must correspond to criteria of breed purity, they must be calm. They must not have shown signs of swarming in the past year, and in addition, their honey production in the past year must have been above average. Each registered breeder is obliged to select at least three queens a year according to the aforementioned procedure and to transfer them to apiaries intended for queen production.

The breeding of daughters of these queens for the needs of progeny testing follows. Each queen provides at least 15 daughters for testing. The testing takes place in the apiaries of contract beekeepers who, in compliance with a contract with the authorised breeding organisation, must monitor the productivity of the colonies in the following year, and complete the relevant documentation.

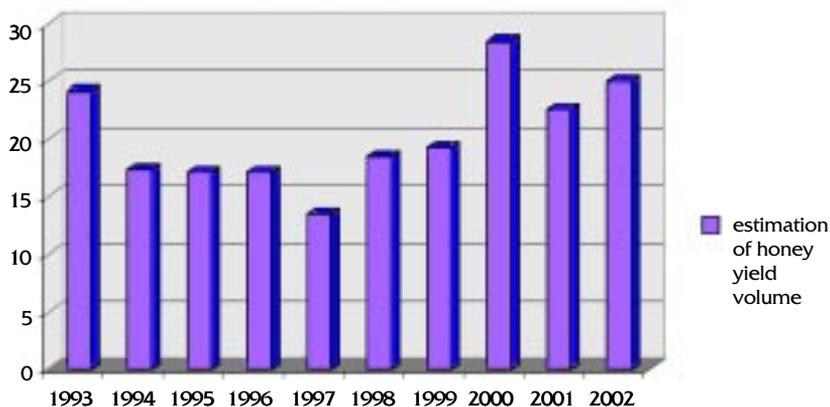


False acacia (Robinia) is one of the more important sources of honey each spring.

Contract beekeepers are an extremely important link in the overall system of bee selection. Their work contributes to the effective evaluation of breeding queens, and assists in orienting the breeding aims of selection. Each contract beekeeper accepts a series of 10 to 20 marked queens in the summer period, without knowing their origin. He introduces the queens to his production hives and then in the following year monitors the honey production, fertility and calmness of the bees in these hives. In the autumn, he reports the results to the republican service for the selection of Carniolan bees and, at the same time, receives all the required data on the origin of the queens and recommendations on the future selection of queens.

Associates of the authorised breeding organisation control each queen being tested three times:

– five months after introducing the queens into a production colony, in order to check the success of acceptance (purpose: to obtain information on the quality of the



LSMEAN assessment of honey produced, in kg, in production testing of 4,355 queens from 1993 to 2001.

breeding process in breeding centres and collecting samples of live bees for morphological and health analysis)

– nine months after introducing the queens into a production colony, in order to check the success of overwintering (purpose: to assess the resistance of groups to Varroa mite)

– sixteen months after introducing the queen, in order to check the production properties of groups of queens (purpose: to select the best original queen, insofar as she is still alive, or to select her best daughter for breeding needs the following year).

Each of the assessed queens in production testing must successfully survive the following decision-making phase of the selection procedure:

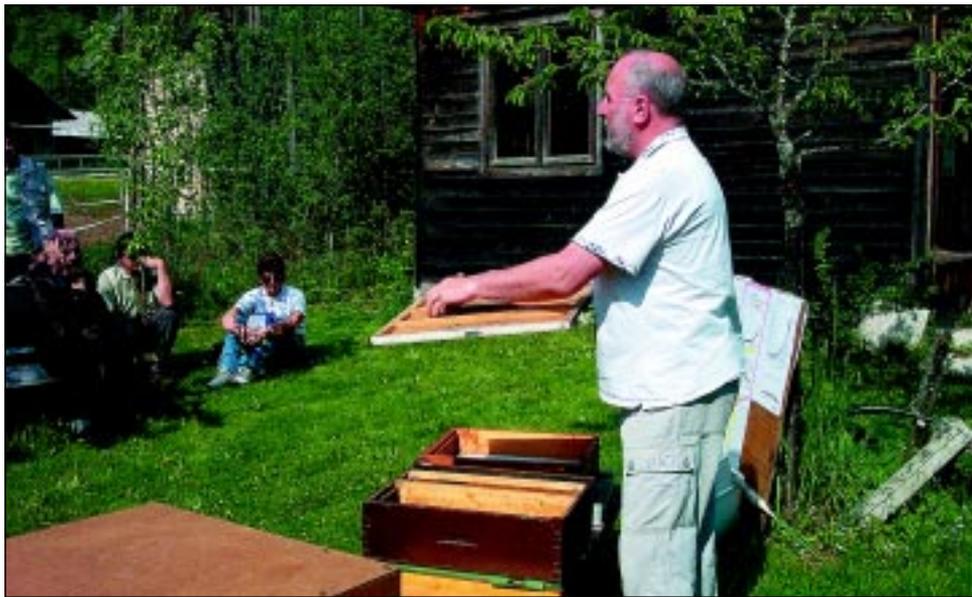
In the first two steps of the decision-making, we normally exclude around 25 % of introduced queens. On the basis of an evaluating of calmness, we then exclude around 10 % of introduced queens. Exclusion on the basis of swarming inclination greatly varies during a year, on average we thus exclude 20 % of introduced queens. In practice, around 45 % of queens introduced into testing “survive” to the final assessment of breeding value.

We have been testing queens in production testing since 1992. Of a total of 4,355 measurements of the productivity of bee colonies, the overall annual average has been approximately 20 kg of honey produced per hive. It is encouraging that the amount of honey produced per hive has been steadily increasing, on average by 0.41 kg per hive annually.

5. INTRODUCING QUEENS AND REQUEENING

The recognition by beekeepers that success in beekeeping depends on good young queens has led to greater demand for them. Registered breeders provide the majority of all the queens needed on the Slovene market.

Beekeepers often make the criticism that they are dissatisfied with queens they have bought. The reason for the criticism is simple – too high a percentage of queens are not accepted by the colony but destroyed. It also too



Knowledge is the foundation of progress in breeding queens, too.

often occurs that a colony soon supersedes the purchased introduced queen. Criticisms are always unpleasant for breeders and for the most part also unfair. Introducing queens and requeening is expert work that requires adequate practical knowledge from a beekeeper and understanding of the biology of bees.

5.1. WHAT SHOULD BE KNOWN DURING THE INTRODUCTION OF QUEENS?

Let us look at some general findings that must be considered before setting about introducing queens or requeening. A variety of information circulates among beekeepers about procedures, such as that the queen must be anointed or scented before being introduced, in order to equalise the smell of the queen with the odour of the colony into which the queen is being introduced. For successful introduction, the behaviour of the queen is even more important, as well as conditions at the time of introduction and the time of release from the queen cage

Newly emerged queens are very lively, move quickly over the comb, as if wanting to escape. They remain like that for a considerable time after mating. In this we can be sure that if we open a nucleus hive in which the queen is already laying, we must certainly be careful that she does not escape. The more she lays, the more she calms down, and is finally calmed when she is already surrounded by her own descendants. It can be said that a queen matures after approximately 4-5 weeks. No breeder can keep them in the nucleus hive for so long but almost always removes them after a few days laying, when they are not yet really mature. A buyer must count on that and act accordingly.



If a colony is queenless, it begins to construct emergency royal cells.

Carniolan queens are fertile for at least four years, and can also be for considerably longer. They are only at the height of their power for the first two years. So the majority of beekeepers do not allow older queens in their active hives, but replace them if possible every year.

The weather when queens are introduced and released from the queen cage is important. Success will be ensured in fine, calm weather, when there is at least some forage available. If there is not, we must start some days previously to add sugar syrup to the colony into which we are introducing the queen, and continue feeding for some days after the queen has already been released from the queen cage. In cold and windy weather, when there is no ava-

ilable forage for bees, it is wiser not to start the introduction.

A colony into which we introduce a queen must be reliably queenless and may not have any royal cells. With a colony in which we are requeening, we know with certainty that after removal it is queenless. We similarly know that a spare hive, which we have made in one of the known ways, is queenless. If for any reason we are not certain whether a colony is really queenless, we must check this. This is done in the following way. From a colony which has an unsealed brood, we take a comb of eggs with at least some eggs or young larvae, which we mark with a drawing pin and place in the centre of the brood chamber of the colony that we are checking, having previously removed its comb. After a few days, we check the introduced comb. If royal cells have formed, there is certainly no queen in the colony and we introduce a new one. We extract the queen cells and do not replace the comb but normally put it back where we took it from.

The age of the bees in a colony into which we are introducing a queen is very important. Old bees are not friendly to her and it is precisely they who are to blame if the colony does not accept her. So it is very difficult successfully to introduce a queen to a colony that has already been without one for a long time or in which laying worker bees have already appeared. We must also recognise that small colonies more easily accept a young queen than bee colonies in large hives.

The time of year of requeening is important. She is introduced to spare hives and those without a queen when this is necessary. Otherwise, in replacing a queen in pro-



All successful migratory beekeeping needs at least fifty percent additional reserve bee colonies. This is particularly important recently when bees are attacked by varroa mites

ductive hives, we must decide ourselves when to do this. Some beekeepers firmly advocate the replacement of queens in early spring. At the time of the first inspection, they assess the quality of the queen. If she is not suitable in all respects, they replace her irrespective of her age. If the colony is weak, they introduce an entire nucleus hive together with a queen.

Small colonies must be thoroughly prepared for such a method of requeening, and nucleus hives must be prepared the previous year. The young queens overwinter in them. Any colony prefers to accept them in spring, becau-

se the introduced queens are then already matured, and acceptance is that much more reliable. Remember how important it is that the beekeeper also has some bee colonies in reserve. When he introduces the queen in spring, he does not destroy the old queen that is removed but places her together with a few combs and bees in a reserve hive. The queen first lays there, the beekeeper as necessary takes the combs of brood and in summer replaces her with a young queen, which overwinters in that hive and is again available in spring for replacing any other exhausted queen.

5.2. REPLACING OR INTRODUCING QUEENS

Requeening is done in a number of ways:



A queen has just returned from the mating flight

5.2.1. With queen cells. Any queenless colony prefers to adopt mature queen cells, into which the queen is cutting the cap. Even a colony which has a queen will accept it. A queen cell is almost always a major unknown – a “pig in a poke”. We do not know what kind of young queen is in it, whether she may be injured or even dead. There follows the uncertainty connected with mating, when the queen can be lost. So for the most part, queen cells are used for emergency reserve colonies, where there is still later time for further selection of queens. Queen cells can also be used for the replacement of old queens in reserve bee colonies.

5.2.2. With unmated queens. A colony accepts them with difficulty, normally only when there are no longer



Royal cells on breeder bars

open broods in the hive. They prefer to accept a queen that has just emerged. Beekeepers normally introduce unmated queens when they want to stop a colony from laying for a time. Of course, we cannot forget introducing queens at the time of settling a mating nucleus with mature queens. If a beekeeper does not have sufficient experience with introducing unmated queens, it is best to leave this to a queen breeder.

5.2.3 With mated queens. This is the most widespread practice among beekeepers. It is necessary to ensure that there are the necessary conditions for acceptance in the queenless colony, and only then to introduce the queen.

How do we introduce mated queens? Very varied methods are in use among beekeepers, one advocating



We first remove a queen from a bee colony, then immediately sprinkle the hive thoroughly with lukewarm water and whilst doing this we introduce the new queen.



The queen is released directly among the bees.

one and another, another. Two methods are recognised, direct and indirect introduction.

5.2.3.1. Direct introduction.

A queen is introduced directly among bees, normally in the place from which the old queen has been taken. This method is not questionable if a mature queen is added, which has been laying for at least three weeks and if the procedure of introduction is carried out with all-round favourable conditions for the acceptance of the queen. Some beekeepers remove the old queen, and after two hours introduce the new one at the hive entrance. The practice is known in direct introduction of coating the queen with honey or sugar syrup. In this case, while cleaning the queen, workers also remove some of the hairs from her

body, so the queen looks older, more “used” than she really is.

A slightly unusual, but still successful method of introducing queens into modern hives is with the aid of a garden hose with a spray in which there is slightly stale and not too cold water. The queenless hives are opened in fine weather and the queen is released in the centre while the cell surface, where there are the most bees, is sprayed. During the spraying, which signifies for the bees something similar to strong rain, they withdraw with the queen among the combs. The hive is closed, the water runs from the hive at the entrance, and we mark on the hive that it has a new queen.



The bees must not be disturbed immediately after the introduction of a queen.

5.2.3.2. Indirect introduction. This method is usually used by beekeepers. We can check in the added queen cages how favourably inclined the bees are to the queens and decide on their release. Various added queen cages are in use, what is essential is that the stopper that closes the exit is replaced as necessary with sugar candy for bees or sealed with a comb. The workers thus release the queen after a certain time.

In cases in which introduction is not in question, everything can be simplified. For introducing queens, we use a paper bag, about 7 x 7 cm in size. It is prepared from softened newspaper, and glued with natural glue (flour and water). The bag is pierced several times with a thin pin, and the lower corner slightly squeezed to extend the bag. The queen is placed in the bag, and it is then folded twice at the top and attached to a sealed brood comb with a drawing pin, where there are the most young bees. The workers liberate the queen, so that it is not necessary to do more than remove the drawing pin during a later inspection of the colony.

5.2.4. HOW DO WE PROCEED WITH A QUEEN OBTAINED FROM A BREEDER?

If the weather is favourable, the requeening is done by removing the old queen from the hive, and immediately introducing the young one in the queen cage in which we obtained the queen. It is placed in such a way that external bees have access to the openings or net, through which they come in contact with the queen. We check where in the queen cage the sugar candy for bees is located, and open the cage from the outside so that the hive bees

come in contact with the candy. The bees will soon come to the queen so that she can leave the queen cage.

When introducing a queen to a queenless colony, the transport queen cage is placed as possible among the combs. It is placed in such a way that access of the workers is enabled to the openings, through which they have contact with the queen. The following day, we check the mood in the colony. If the workers are laying siege to the queen, they fan their wings and can be easily removed from the queen cage, we quietly enable access to the bee candy and close the hive. If the bees are restless and are difficult to remove from the queen cage, we wait a day. If the state is no different the following day, it is best to remove the queen cage with the queen, and put in the hive an unsealed brood comb to check whether the colony is really queenless.

5.2.5. Some practical instructions with requeening

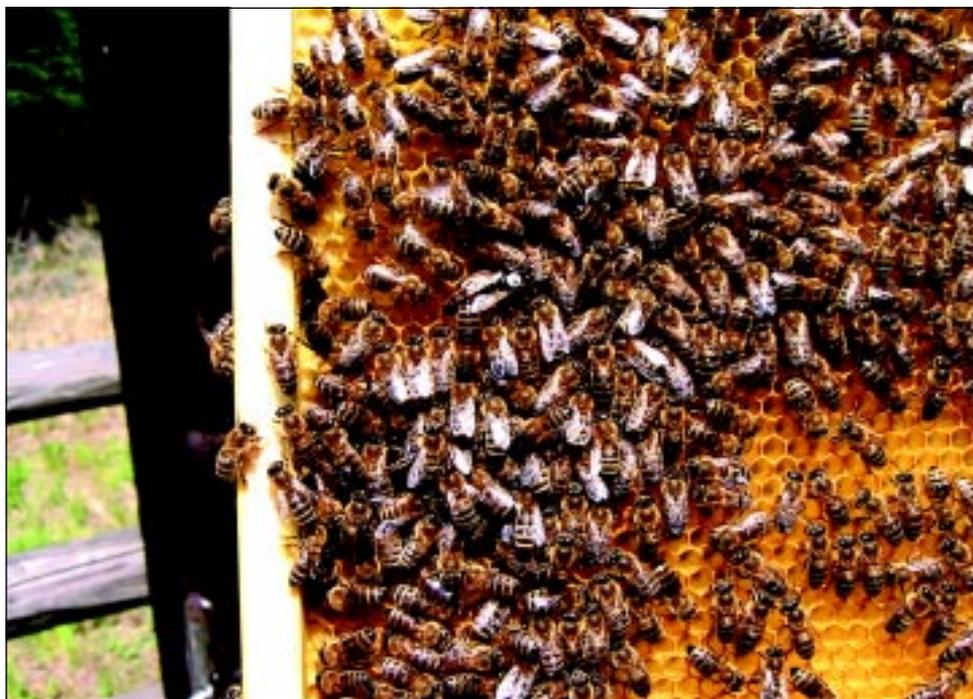
A queen will be most readily accepted if there are no old bees in the vicinity. That can be achieved in a number of ways:

5.2.5.1 Introducing the queen under a protective net.

The queen is introduced to the colony with the aid of a net frame, which is approximately 10 x 10 cm, covered on one side with a net and on the other pointed tacks by which the frame is attached to the comb. We look for a comb with an emerging brood in the colony, remove all the bees, drop the queen onto the brood and immediately cover her with the frame. The queen will be alone with the emerging workers. These will clean the comb, in which the queen will start to lay eggs. When we check this method of accep-

tance after a few days, we remove the frame. Usually the bees have themselves made space under the frame and released the queen. Various plastic nets can also be used for introducing queens.

5.2.5.2. Nucleus colony. In fine weather, we make a spare nucleus hive with a few brood combs to which we add bees from an additional brood comb. The nucleus hive is placed slightly to the side. All the old bees abandon the nucleus hive and towards evening, the queen can be introduced. Liquid food is added to the nucleus hive.



The queen has been readily accepted.

5.2.5.3. In multiple-storey hives. With multiple storey hives with at least two storeys, and the bees flying in through the entrance, getting rid of the old bees is very simple. In fine weather we separate the top storey with some combs of eggs from the lower storey, by means of a double net. Open a hole in the upper storey and wait for the old bees to fly out. These will return through the main entrance. All the old bees will have flown out by evening and the queen can be introduced without worry. The bees in the lower storey will sense her presence, so the confusion will not be great. The temporary colony in the upper storey must be given liquid food. When the young queen has already sealed the brood, the hive is again organised.

5.2.5.4. In leaf hives. With leaf hives (in Slovenia AŽ /Alberti - Žnidaršič/ hives), too, the old bees can be temporarily removed. Completely rebuild the hive and place some combs with broods and sufficient bees in the honey chamber. Open the honey chamber entrance and towards evening, when the old bees fly out, introduce the queen. It is best to employ the bees in the brood chamber with an open brood comb. When the laying young queen is already closed in the honey chamber, we again arrange the colony. The matter can be slightly simplified. Similarly, we place a brood in the honey chamber and open the entrance to the honey chamber, we separate it from the brood chamber with some sheets of paper. In the evening, add the queen and close the honey chamber entrance and the two parts of the colony slowly unite. We must take care that there is sufficient liquid food in both the brood chamber and the honey chamber.

5.2.5.5. In a reserve colony. A queen can be introduced initially into a hive with a reserve colony. When there



Sugar cake is prepared from powdered sugar and invert sugar syrup. Wait three days for the contents to leaven nicely without unnecessary hand mixing.

are some brood combs in it, the entire reserve colony can be introduced into a queenless operating hive. In multiple-storey hives, we separate the reserve colony in the added storey from the queenless production colony with some sheets of newspaper. The two units then slowly unite and, after a few days, we arrange the hive suitably. The reserve colony can also be overwintered and requeening started in early spring the following year.

5.3. MONITORING THE SUCCESS OF REQUEENING

It is often recommended in the literature that the acceptance of the queen be checked after three days. On the basis of experience, we recommend people not to do that, since it causes the death of many young queens. A young, still nervous queen will be disturbed during the period when the first larvae have not yet emerged from the eggs, and the queen has perhaps not even started to lay. We will stand surprised in front of an open hive without a brood, not knowing what to do. It is therefore better to wait at least ten days, and after twelve days there will pro-



A honey bee visiting a sage flower

bably also already be some sealed brood combs in the hive and the queen will be calmer. If there is no brood in the hive, we will know exactly what to do.

Even in a case of ready acceptance, the further development of the bee colony will be varied. Some queens are better than others, so the colony will also be more advanced. After a few weeks, some of the introduced queens can be superseded. The queens can be injured without us noticing this, perhaps were even injured during the introduction when the old bees did not accept them very hospitably. Injuries can be minor and the colony will not decide on requeening.



It has been shown that in the period immediately after the introduction of queens, the amount of honey stocks in a hive is very important, and the flow of new, fresh food. In a hive, in a colony, to which we introduce a queen, there must be at least a five-kilogram stock of honey. In addition, a minimum supply of new food must be enabled, at least 0.1 kg per day. If there is not this, add sugar cake to the colony before introducing the queen since the hive should not be opened for at least ten days. It is not excessive also to be additionally attentive to sources of pollen in this period. If there are insufficient sources, we must add pollen ourselves. The addition of pollen to the sugar cake in such cases is probably the best solution. Warning! Pollen should be produced at home. Buying pollen can also be buying many health problems with the bees.

Introducing queens and requeening is a demanding task. However, we are always inspired by the excitement of seeing that we have been successful, when the combs are covered with fresh broods over which reigns a calm young queen. An excitement with which only beekeepers are familiar. And if you have not been successful, don't take a shotgun into the cornfield, and restrain yourself from blaming others. Try to work exactly how you proceeded and where you perhaps made mistakes. Gradually you will also successfully rectify these mistakes and derive even greater satisfaction from your bees.