BEEKEEPING EUROPEAN ENVIRONMENTAL SUSTAINABILITY

'BEES' PROJECT

LdV **2010-1-TR1-LEO05-16698**

HANDBOOK ON BEEKEEPING

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Preface

The importance of bee role in plant propagation is well-known since antiquity. However, many people don't realize the vital role bees play in maintaining a balanced eco-system. According to experts, if bees were to become extinct then humanity would perish after just four years. "If the bee disappeared off the surface of the globe then man would only have four years of life left. No more bees, no more pollination, no more plants, no more animals, no more man," said Albert Einstein. Others would say four years is alarmist and that man would find other food sources, but the fact remains that the disappearance of bees is potentially devastating to agriculture and most plant life. Therefore,beekeeping projects are important related to environmental protection, sustaniability and humanity.

Unfortunately, there has never been much prestige in beekeeping and beekeepers and there is a lack of accredited training possibilities for beekeeping in Europe. The LdV TOI project BEES intends to develop a curriculum for beekeeping in Europe and project also aims to finding solutions to problems related to bees. Temporary,reports that bee populations are declining at rates of up to 80 % in areas of the U.S. and Europe should set alarm bells ringing and demand immediate action on behalf of environmental organizations. Experts are calling the worrying trend "colony collapse disorder" or CCD. Similarly, bee populations throughout Germany have simultaneously dropped 25% and up to 80% in some areas. Poland, Switzerland and Spain are reporting similar declines. Scientists from different countries should provide solutions for this dangerous trend.

In recent years a general change in bee behaviour, with difficulties in normal relationship to life and bearing loss, in many countries at the same time, suggested that something terrible is about to happen. Nature will not be the same without bee pollination and agriculture could loose one of its oldest friends and partners. Nicotine neo-pesticides, considered before harmless, are now suspected to be responsible of some of the bee mortality. A change in human culture and science is necessary and studies on present bee emergency cases could be useful to avoid future terrible consequences on earth safety due to the human errors. In the production of vegetable and animal products, industry lost as a result of some of the old and re-tested techniques and methods have emerged and they should be used in conjunction with the new technological possibilities in this sector should have the qualifications of employees regarding the new gave birth to some demands. Defined by the EU member states in each of the common occupational profiles reflect different situations today. In this context, only certain types of plants or animals as defined profiles as well as animal or plant species, there are profiles of the general covering.

Bees have played a great role in landscape management, nature conservation, in regional economies and in rural culture in nearly all European countries. This type of projects will contribute to sustainability. Beyond the contribution of bees to landscape management and nature conservation beekeeping farming has a potential for the regional economy. In remote and rural areas beekeepers can make a considerable contribution to sustainable agricultural production. The regional economy could benefit by the emergence of new sources of income, e.g. from nature conservation, from funding for land. But to exploit this potential new skills are needed. It will help to Apicultural industry, also beekeeping is a much easier type of agricultural because it requires less tiring labor. Children could take responsibilities with beekeeping. Women and children will benefits of bee products and also make a living by receiving income.

BEES is a Transfer of Innovation project aiming at further developing a module from the Leonardo da Vinci ENSA project on organic and biodynamic agriculture education. The main objective of the project is to create completely updated teaching materials on bee behaviours and relevant importance as indicators of agriculture sustainability. Biodiversity is directly linked to this approach. The main targets of the handbook are farmers' associations, environmental associations, agriculture professional schools, agriculture and veterinary medicine universities, bee keepers associations, policy makers, institutions at European, national and local level, elementary and secondary schools.

This handbook is one of the main products of BEES project for target groups and other readers.

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August, 2012
Çanakkale, Turkey

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1. Honey bees family

Honey bees, like ants, termites and some wasps, are social insects. Unlike ants and wasps, bees are vegetarians; their protein comes from pollen and their carbohydrate comes from honey which they make from nectar. Social insects live together in groups, cooperate in foraging tasks and the care of young, and have different types, or "castes," of individuals. Most of the bees in a colony are workers. Some are drones whose function is to mate with a virgin queen. However, usually there is only one queen in a colony.

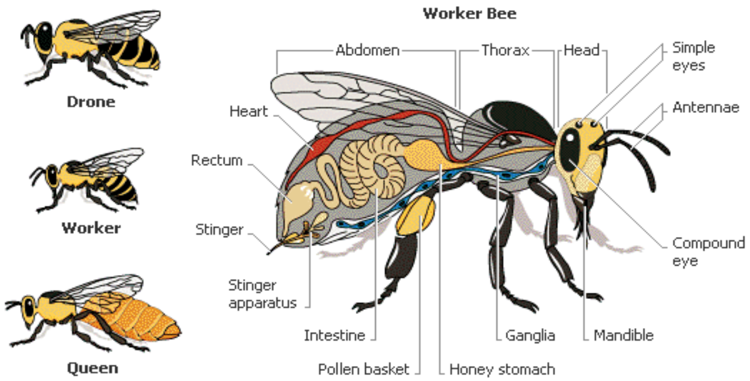

Photo 1. The types of bees and the general physiology of a worker bee.

Workers

Reproductively under developed females that do all the work of the colony. A colony may have 2,000 to 60,000 workers. Worker bees are sexually underdeveloped females. The population of a colony depends on a number of factors such as: the egg laying ability of the queen, the space available in the hive and the incoming food supply. They are called workers because that is what they do. They collect food and water for the colony, build wax comb, do the housework, maintain the interior temperatures of the hive and guard the hive against intruders (in other words: they can sting). Female worker bees under certain conditions can lay eggs but because they are not mated, they produce eggs that only develop into drones.

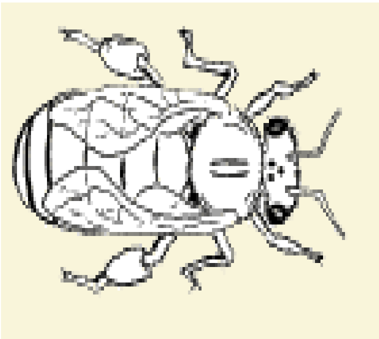

Photo 2. Workers

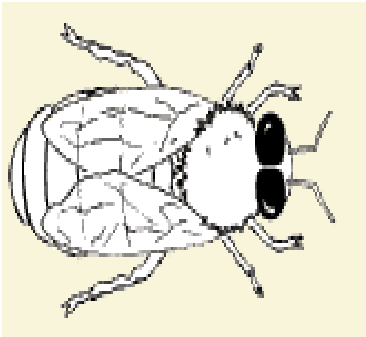

Photo 3. Drones

Drones

Drones are male bees. A colony may have 0 to 500 drones during spring and summer. Drones fly from the hive and mate in the air with queens from other colonies. The general shape of the drones have two things: the head is large and the eyes predominate the head and - the rear end of the drone is rounded (they have no stinger and can not sting). Although they are usually considered worthless, they contribute to the continuation of one generation to the next generation. The worker bees usually determine the number of drones that can be found in a colony. A strong healthy colony may have as many as 300 or more drones. As winter approaches, the workers drive the drones from the hive to starve.

Queens

The queen is a mature female. She lays thousands of eggs during her life time. A good queen may lay over 2000 eggs in a single day. A queen has the longest live span in the colony living for up to five years. She is larger than the other bees in the hive and has a slim torpedo shape. She does have a stinger, but uses it to kill other queens. When a queen dies or is lost, workers select a few young worker larvae and feed them a special food called "royal jelly." These special larvae develop into queens. Therefore, the only difference between workers and queens is the quality of the larval diet. There is usually only one queen per colony. The queen also affects the colony by producing chemicals called "pheromones" that regulate the behaviour of other bees. The queen lays all her eggs in hexagonal beeswax cells built by workers. Developing young honey bees (called "brood") go through four stages: the egg, the larva, the inactive pupa and the young adult.

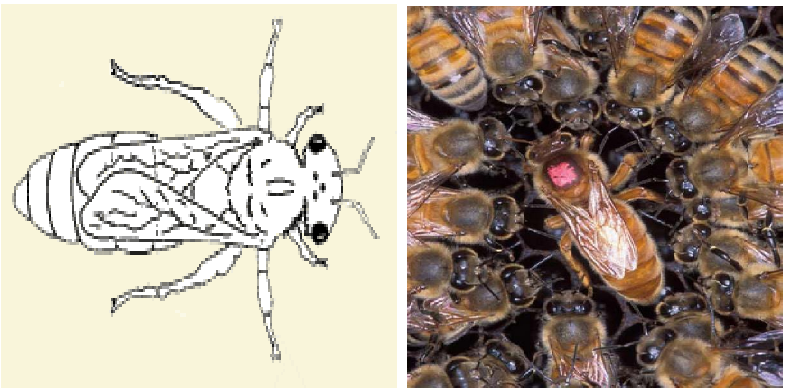

Photo 4. Queen with identification mark on thorax

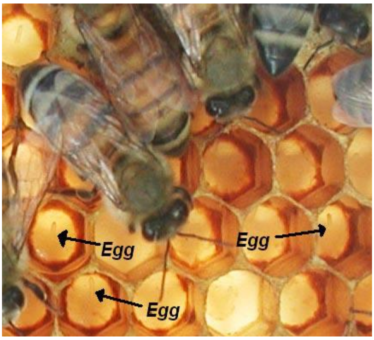

Photo 5. Close up

Photo 6. Larvae and eggs

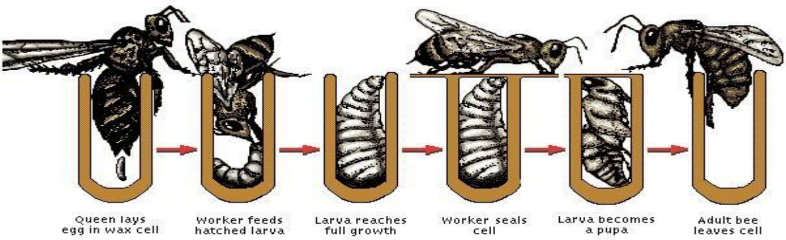

Photo 7. Life cycle of honey bees

Photo 8. *Bee pupae*

Photo 9. Queen cells with larvae and royal jelly

Table1. Average growth cycle of the honey bee (days)

Stage	Queen	Worker	Drone
Egg	3	3	3
Larva	5½	6	6½
Cell capped after	8	8	10
Becomes a pupa after	10	11	14
Pupa	7½	12	14½
Becomes an adult after	15	20	22½
Total at emergence	16	21	24

Newly emerged workers begin working almost immediately. As they age, workers do the following tasks in this sequence: clean cells, circulate air with their wings, feed larvae, practice flying, receive pollen and nectar from foragers, guard hive entrance and forage. Unlike colonies of social wasps and bumble bees, honey bee colonies live year after year. Therefore, most activity in a bee colony is aimed at surviving the next winter. During winter, bees cluster in a tight ball. In January, the queen starts laying eggs in the centre of the nest. Because stored honey and pollen are used to feed these larvae, colony stores may fall dangerously low in late winter when brood production has started but plants are not yet producing nectar or pollen. When spring "nectar flows" begins, bee populations grow rapidly. By April and May, many colonies are crowded with bees, and these congested colonies may split and form new colonies by a process called "swarming." A crowded colony rears several daughter queens, then the original mother queen flies away from the colony, accompanied by up to 60 percent of the workers. These bees cluster on some object such as a tree branch while scout bees search for a more permanent nest site - usually a hollow tree or wall void. Within 24 hours the swarm relocates to the new nest. One of the daughter queens that was left behind inherits the original colony. After the swarming season, bees concentrate on storing honey and pollen for winter. By late summer, a colony has a core of brood below insulating layers of honey, pollen and a honey-pollen mix. In autumn, bees concentrate in the lower half of their nest, and during winter they move upward slowly to eat the honey and pollen.

Section II:
Bee races and bee breeding

1. Wild bees

Honeybees (*Apis mellifera*) occur widely throughout Europe, Africa and eastwards into Asia. There are similar related species elsewhere in the world. Honeybees occur naturally in the wild, where they normally live in hollow spaces in trees or buildings. The lower face of the branch was removed to expose the bees' wax combs, hanging side by side in vertical sheets in the hollow space inside the branch. Other species of bee are found, including solitary species. Perhaps the most conspicuous however are the bumblebees. These are social bees, like honeybees, but do not collect honey in sufficient quantity or quality to be of any commercial importance.

Photo 1. Wild bees

Photo 2. A bumble bee in the wild.

2. The European honeybee races (Apis mellifera)

The different climate zones and geographical regions of Europe have produced different subspecies of the European honeybee, as nicely illustrated on a map found (Figure 1).

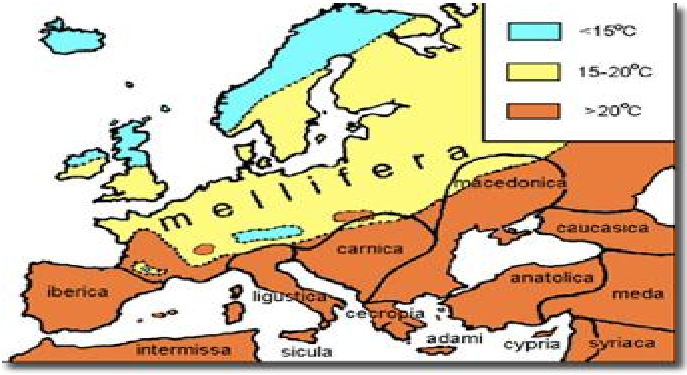

Figure 1. Map of European honey bee races

Italian Bee ***(Apis mellifera ligustica)***

The most commonly kept sub-species throughout the world. They are very gentle, not very likely to swarm, and produce a large surplus of honey. Hard workers and fairly prolific breeders. The Italian bee is light coloured and mostly leather coloured, but some strains are golden. Queens vary in colour from leathery brown to orange, which makes them comparatively easy to find in the hive. They have few undesirable characteristics. Colonies tend to maintain larger populations through winter, so they require more winter stores (or feeding) than other subspecies.

Photo 3. Italian bee

Photo 4. Caucasian bee

Photo 5. Carniolan bee

Italian bees (*Apis mellifera subspecies ligustica*) develop large, populous colonies with a large brood nest.

Caucasian (*Apis mellifera caucasica*)

Second most popular breed worldwide, but far behind the Italians (Photo 4). This sub-species is regarded as being very gentle and fairly industrious. Some strains are excessive propolizers, in some cases building walls of propolis at the entrance to modify the size to their liking. They keep a fairly strong hive and are not very likely to swarm. It is a large honeybee of medium, sometimes greyish colour (Mountain Grey). Caucasian bees (*Apis mellifera subspecies caucasia*) have queens that are usually black, but some have yellow or red colouring on the side and underneath the abdomen. Workers are grey to black, depending on age. Silver-grey bands on young workers are bands of dense hairs which wear off with age, revealing the dark colour beneath.Cauc asians are docile bees that form strong colonies. They winter as small colonies, breeding very rapidly in early spring. They are alleged to drift and rob more than Italians, they use more of the gummy bee glue called propolis, and they work better in cooler conditions. Their whiter wax on new combs is favoured for comb honey production.

Table 1. Main honeybee subspecies of the countries participating in the project and related protection institutions.

Country	**Subspecies considered as autochthonous**	**Imported subspecies**	**Hybridization Processes**	**Breeding Protection Areas**	**Institutions for the protection and safeguarding of native subspecies**
ITALY	*Apis mellifera ligustica*; *Apis mellifera siciliana*.	Reintroduction of *Apis mellifera ligustica* (from Australia, New Zeland and China, et al.country)	*Apis m. ligustica* x *Apis m.* siciliana in Sicilia Island *Apis m.* ligustica x *Apis m. carnica* in the foothills of the Alps and in the border regions with Austria, Slovenia and Croatia	There are some fertilization stations on the islands and insemination stations controlled and saturated with selected drones.	(Mi.P.A.A.F.) : Ministry of Agricultural with section of CRA-API; (A.I.A.A.R.): Farmers Association Italian queen bees.
POLAND	*Apis mellifera mellifera;* *The local population of native bees are:* *Apis mellifera Kampinoska;* *Apis mellifera* Augustowska; Apis mellifera *Północna* (*Apis m. Mazurka* x *Apis m. Pomorska*).	Influx of imported bees over the last 40 years resulted in the crossing of the population and the elimination of local bees.	*Apis mellifera mellifera x local native bees.*	Kampinos Forest; Augustów Forest.	The genetic resources conservation programme covers four lines of the Central European bee: M Kampinoska, M Augustowska, M Północna and M Asta. Two of them, M Augustowska and M Kampinoska were preserved in their original form in the

					regions of their natural habitat (the Augustów Forest and the Kampinoski National Park), while M Północna and M Asta were improved using the most valuable traits of native bees.
TURKEY	*Apis mellifera Anatolic;* *Apis mellifera caucasica;* *Apis mellifera meda;* *Apis mellifera anatolica'snin ecotypes,* *Apis mellifera Syriaca*	No subspecies imported	Only in the border line, between *Apis mellifera Syriaca and Apis mellifera meda.*	East Anatolia	Ministry of Agricultural; National Beekeepers Association
HUNGARY	*Apis mellifera carnica*		*Occurs spontaneously with Apis m.* ligustica	National Bee Unit of the Institute for Small Animals Research	Hungarian Bee-breeders Association; Institute for Small Animals research

Carniolan (*Apis mellifera carnica*)

Popular with beekeepers due to its extreme gentleness. The Carniolan tends to be quite dark in colour. They keep a moderate strength hive and are not very likely to swarm. The colonies are known to shrink to small populations over winter and build very quickly in spring. It is a mountain bee in its native range (Carniola region of

Slovenia, the southern part of the Austrian Alps, and northern Balkans) and is a good bee for colder climates. Workers have grey-white bands round the abdomen. Queens are black and so more difficult to find. Carniolan bees (Apis mellifera subspecies carnica) are similar in colour and temperament to Caucasians. Queens are generally brown with yellow bands on some segments. Workers are grey, turning black with age. They are the most docile of the three races, with early imported strains having a strong swarming tendency. Carniolans winter as small colonies, breeding fast in early spring to form large colonies in summer. Hybrids are a combination of races of honey bees. Most hives have some degree of crossing between races (hybrids).

3. Other bee races

Some bees that live in colonies and can be kept for their honey production. Some other bee species, most are very beautifull and most of these do not live in large groups or colonies but are solitary.

Photo 6. *Apis dorsata*

Photo 7. *Apis Andrena sp.*

Photo 8. Cuckoo bees

Photo 9. *Stelis-breviuscula*

Photo 10. *Nomada imbricata*

Photo 11. Golden Northern bumble bee (*Bombus fervidus)*

Photo *12. Meliponula ferrugine*

Photo 13. Blue-banded bees *(Amegilla cingulata)*

Photo 14. Carpenter bee (male)

Photo 15. Digger bee (*Synhalonia sp.*)

Photo 16. Tricolored Bumble Bee (*Bombus_ternarius*)

Photo 16. Giant Killer bee

Photo 17. Giant Resin bee

Photo 18. Another

Photo 19. Blue Orchard Mason Bee (*Osmia lignaria*)

Photo 20. Leafcutter Bee (*Megachile sp.)*

Then there is another interesting story about building a nest for the solitary bee *Osmia avosetta* which is recently found in Turkey and Iran. Osmia Avosetta lines her nest by sandwiching two layers of petals together with mud. She then fills the nest with pollen mixed with nectar and caps everything off with a mud plug.

Photo 21. The solitary bee (*Osmia avosetta*)

Mason bees

While honeybees are native in Europe, mason bees are native to both Europe and North America. These bees live in small holes in wood and other objects. They do not live together in hives. The female bee creates a nest by adding a mud plug to the back of a hole. Then she collects up to twenty loads of pollen and nectar in her hole and deposits an egg in the hole. She then seals the cavity with mud and deposits another egg. The female Orchard Mason Bee can lay one to two eggs every day for a month. When she is finished placing eggs in a hole, she adds a thick mud door at the entrance to the hole and begins to place eggs in another hole. The female bee lives for about a month. After ten days, the baby bees emerge and eat through their stock of pollen and nectar, then they emerge from the hole. First the males come out, since they are first in line in the tunnel. Then the females come out of the hole. Mason bees will nest in commercial nesting blocks drilled with holes or in natural holes in trees.

Photo 22. Mason bees

4. Bee breeding

Characteristics possessed by the colonies

Each subspecies of autochthonous honeybee (later called *Race*), has special adaptation features to the climate and flora of the country in which it has naturally adapted. The adaptation for the single *races* of bees involves:

1) to be able to feel when annual flowerings begin and, as a result, being able to raise broods that can

hatch and then to be able to give birth to a number of worker bees according to the seasonal pattern;

2) to be able to supply pollen and nectar to stow in the honeycombs of the nest and to give rich honeycomb productions and then to give birth to long-living worker bees;
3) to have no tendency to produce too many queen cells and consequently to swarm, as swarming tends to impoverish the colonies and jeopardizes the annual production;
4) to be docile during visits to the apiary/bee yard;
5) not to have tendency to plunder the neighbouring beehives, unless this is not caused by the beekeeper, even during periods of pasture shortage;
6) to have a good instinct in identifying sick larvae or an inappropriate chromosome count and to remove them from the brood cells.

What are the main problems connected with spontaneous hybridization or hybridization induced by the beekeeper

Each subspecies, if raised in genetic purity, is capable of expressing the peculiarities of its *race* at the utmost, so the beekeeper can more easily intervene (including through breeding programs) in order to correct for the better or at least mitigate some undesirable characters (spring balanced development, tendency to swarming, aggressiveness, resistance to some brood diseases, etc. ...).

1) The insemination of queens and the risk of hybridization in nature - Any subspecies of queen bees is inseminated during flight, through multiple mating (8-10 drones), the drones are able to travel for many miles from their original beehive (over 15 miles) because they are attracted to the pheromones emanated by the virgin queens. Each subspecies also has special needs related to mating: height from the ground, degrees (temperature) and different times during the day (late morning, early afternoon, late afternoon). In relation to this, some countries with different types of climate, could keep separate the different subspecies, in a natural way.

The drones of each *race*, to be able to mate, providing the presence of aberrations and/or genetic mutations, must be adult, sexually mature, they must first have flown a long time, in addition those peculiar conditions related to temperature, wind absence and altitude conditions, that "promote" their concentrating in places favourable to mating, where the virgin queens will periodically swarm as well. So, even if each subspecies requires climatic conditions and different daytimes, for many of them (subspecies) however, it occurs that some time fraction and temperature levels may partly coincide. Therefore, if the beekeeper has to manage his hives in the area of "racial boundaries", the hybridization phenomena can easily occur in a natural way for two causes: shortage or sexual immaturity of the drones of a particular subspecies which are in the mating area when the virgin queens of the same subspecies arrive to be fertilized; predominance of drones of a subspecies other than that to which the virgin queen belongs to.

2) Main issues related to the instrumental insemination for hybridization – Regarding the contribution that the instrumental insemination could give to the preservation and enhancement of the national indigenous genetic pool, it is believed that this technique could be of useful application, only temporarily and if carried out by specialized personnel, in those cases in which, during a two-year observation, some peculiar resistance characteristics to certain diseases of the hive (summarized in a highly hygienic behaviour) are found in some colonies, so much that there is a real concern that they might be lost through controlled insemination. Indeed, this type insemination should be applied using only the same subspecies. If, however, it is used to produce hybrids for strictly productive uses, it can be very dangerous for the preservation of individual subspecies, for the main following reasons:

- To be able to implement it, there is the necessity to breed - keeping them well genetically separated - the two or more subspecies which are meant to be crossed (2-way or 3-way cross);
- The breeder is allowed to choose the female line (colonies with queen mothers), but is not allowed to choose the best sexually endowed drones, even if they come from colonies with "queen fathers";
- Does not allow to evaluate from the functional point of view the drones to use for semen collection, which in nature are exclusively adult, sexually mature and able to reach and inseminate the queens during flight;
- The hybrids that are produced with this method will prove themselves more efficient than their subspecies deriving from the F1 generation, but they will show negative and interchanged characteristics in the F2 generation. Hybrid bee colonies cannot provide "queen mothers" nor "queens fathers" and must be kept entirely separate from pure genetic lines (to prevent spontaneous hybridization processes);

Hybrid colonies do not allow a rational and correct management and frequently give rise to undesirable phenomena for the beekeeper (increased aggressiveness, onset of typical diseases derived from the original subspecies, tendency to swarming, poor sealing of the honeycomb, struggling to overcome winter and/or periods of absence of flowering).

Main precautions for the genetic improvement of the colonies for production and resistance to diseases

It 's very important that every beekeeper who wishes to raise and preserve the autochthonous bees commit himself to a program of genetic selection to be implemented in his apiaries. This program cannot disregard the biennial assessment of a number of colonies having queens of the same age and preferably queen sisters (implementation of combined selection in a familiar pattern). It is also equally important that before starting the sampling of the larvae destined to become queens, the beekeeper verifies that in best colonies some drones are already born, the drones to be able to mate must be adults and sexually mature. If there are insemination stations sufficiently isolated (> 5 km from the other beehives), for each queen to be fertilized, there must be at least about 40-50 drones selected and sexually mature. If no isolated insemination station exists, it is necessary that for each queen to inseminate are available from 150 to 200 drones from the same autochthonous subspecies. To be considered as such, the drones must have a good body shape and the abdominal ends well covered with hair, when you take them into your hand and turn their endophallus outward, the drone must have good content in semen, in order to be able to mate the drones must have flown for a long time (usually the drones reach sexual maturity after about 20 days after birth). At the time of mating, each male involved in the insemination, gives its genetic pool in almost equal measure to all the others, thus leading to a greater or lesser genetic purity within the colony and in the future queens.

Assessment of belonging to the desired subspecies

To be sure not multiply colonies with unwanted characters, it is also necessary to let specialized and accredited laboratories perform the biometric analysis and if possible the molecular analysis on a sample sufficiently representative of worker bees (60-80 middle-aged worker bees) for each of the colonies of the apiary deemed the best. To be sure of having correctly assessed the colonies from which to obtain queens mothers and queen fathers, at least 2 years of observations are needed, after which you can decide which colonies are destined to become mother colonies and father colonies.

Time necessary for a correct assessment of the best colonies

During the 2 years of observations, it will be necessary to estimate for each queen (assigning a score from 1 to 5), the following parameters: spring start-up, tendency to swarming, attachment to the comb, vitality of the brood and kilograms of honey.

- Spring start-up: This should not be too early, but commensurate with the flowering in the territory, unless the beekeeper does not intend to produce queens to be allocated on different markets (the earliest colonies for the south, the late developed for the North of their country).
- Tendency to swarming: it must be evaluated on the basis of the actual number of cells produced (the colonies that should swarm due to a three year old queen, or for incorrect management techniques, or because they are confined to too small hives, but their production of real cells is around 5-6 cells, should not be considered prone to swarm, while they have to be excluded from the selection program).
- Attachment to the comb: it is assessed by extracting one or more brood frames covered in bees, against which we will proceed to blow in a strong way, the more the bees will tend to remain compact and to

protect the brood, the higher the score will be assigned to the colony (comb attachment = docility).

- Vitality of the brood: it indicates the quantity and quality of the brood, the more it is "extended", uniform and compact, the higher the score will be assigned (from 1 to 5). In particular, the brood frame will be virtually divided into six sixths and the (live)stocks should cover at least one sixth of the frame.
- Kilograms of produced honey: it shows the kilograms of honey extracted from the colony in a whole season without ever carrying out additions and withdrawals of combs in the nest and in the shallow box.

During the assessment, the scoring for each parameter taken into consideration must be reported into a special assessment form that will contain it, at the end of each year, it will be possible to judge from the index (**I**) obtained from the following formula to be applied for each of the measured parameters:

I = (average value queen sisters - average value apiary)

+

(individual value - average value apiary)

Following to the application of the formula to the different parameters taken into account, a merit classification list will be compiled so that, among our hives that have earned the highest score, there will be, at the end of two years of observations, a beehive ranking in first place and another in the second place, for all the remaining colonies from third place downwards, we will proceed to the replacement of queens in spring with new queens produced by colonies ranking in the first 2 places, at this point the observations will be resumed for the two following years and so on.

In particular, the <u>I ^ classified</u> (**A**): will be used for the production of drones and for the collection of larvae for the queens, while the <u>II^ classified</u> (**B**): will only provide larvae for the queens. We will have again two groups of queen sisters belonging to the strains (queens A x drones A) and (queens B x drones A) that we will monitor for 2 years.

Size of the insemination nuclei to obtain good queens

The essential condition for good queens, in addition to their genealogy, is that the insemination nuclei are sufficient in size (at least 3-4 half combs for the nests) and are densely populated in order to ensure the necessary care to the young queens that come back from insemination flights and are start the deposition, for each production cycle is necessary that the nuclei present a number of empty cells, sufficient to verify the quantity and quality of the brood hatched before the marking and caging of the queen. In fact, too small insemination nuclei push the young queens to take the insemination flight too quickly and do not provide enough cell deposition quantities to a queen of high genetic value.

It 's important to finally acknowledge the different reasons that make the extremely the complex process of selection in beekeeping, e.g.:

- The natural mating of queens is free and multiple:
- Males are derived from parthenogenesis;
- The response to selection is masked by the peculiar adaptation of the colony to the local climate and grazing conditions;
- Most of the phenotypic characteristics is the result of numerous behavioural processes;

- The individual behaviour (single colony) is strongly influenced by social context;
- The reproductive value tends to decrease with the increasing of its inbreeding coefficient;
- The production of honey is the result of many causes and effects that make it difficult its assessment: the selection of this trait may lead to the improvement of many other characters that are positively correlated to it or vice versa.

Combined selection in a familiar pattern

The application of the genetic selection practices described above, refers to the method of "combined selection in a familiar pattern", which takes into account the individual and the group value of some hives with queen sisters, assigning a merit index calculated according to the above formula. Nevertheless it would be good, once identified queen mothers and queen fathers of great value, that their offspring were subjected to controlled insemination (officially recognized and well insulated insemination stations), to ensure in the shortest time possible the production and dissemination of genetic material of great value (especially drones and inseminated queens), in the widest possible distribution areas, as a barrier to pollution caused by hybridized drones or not related to any genetic selection program.

In fact, the instrumental insemination of queen bees precludes them to be fertilized by drones that are older, more sexually mature and with more vigour, bearers of characteristics of resistance and rusticity. In laboratory, in fact, the operator can rely on the choice of the drones from which to withdraw the semen, solely through phenotypic evaluations, as well as the haploidy (arrhenotokous parthenogenesis: drones like the mother), but not on their actual mating capacity. Therefore, using mostly or exclusively this technique, whose main aim should be to produce highly selected individuals, you can instead run the risk of reproducing "blood lines" I which the drones, as is the case for other animal species, are characterized by a low degree of natural mating imprinting, such phenomenon that undoubtedly would compromise the ability to preserve, enhance and disseminate the biodiversity that still exists in the autochthonous populations of different subspecies of *Apis mellifera*.

Autochthonous bees and the territory

Compared to the past, with the passing of time and the intensification of production, trade and exchange of bees, there has been a depletion of the autochthonous gene pool of bees, also due to inappropriate imports at very low prices from foreign countries, which had once imported that subspecies in the past. Today, too often the phenomenon of genetic impoverishment and hybridization is becoming so widespread that it could threaten the unique characteristics of many of the autochthonous honeybees with serious behavioural, productive, managerial and pathologic rebound.

Genotype and phenotype

- All living organisms are composed of cells that constitute the units of structural organization.
- Animals, and therefore bees, are eukaryotic multicellular organisms because their body is made up of many cells and in each of these you can find a nucleus in which is contained the genetic information necessary to the formation of the individual. This information is contained in the structure of DNA molecules organized into chromosomes.
- When an individual is taken into account, it must be remembered that its features are not due only to its

genetic pool, but also to the environment in which it lives. The term environment is to be understood in its broadest meaning.

- We define as PHENOTYPE all the characteristics of an individual that can be observed, whatever the method of observation adopted, for GENOTYPE is meant the set of genes, or genetic information that are transferred from the parents to its offspring (children), through the reproductive cells and that manage, in coordination with various environmental factors, the formation and functioning of individuals. All this can be highlighted by the equation:

P = G + E where: P = phenotype, G = genotype, E = environment.

Thus, the characteristics of a colony result from the interaction between the genotype of the queen and worker bees and between them and the environment, the characteristics that an autochthonous queen bee must possess can be summarized as: *excellent egg laying activity, high production of pheromones, good egg plasma factors*, and the characteristics that are needed to identify the worker bees are among the following: *excellent care of the brood, having the character that determines their longevity, excellent ability to harvest, high response to pheromones, resistance to major diseases, hygiene and good instincts.*

All of these features, when combined with the ecosystem, the climate and good beekeeping techniques, help to determine the response that the "system hive" offers to the genetic selection made by the beekeeper.

Some of the beekeeping problems

For example, before starting to implement the work of selection, if the biggest problem for the beekeeper should be represented for example by the tendency of swarming of the colonies in his possession, some queens could be forced to develop in small areas (hives with 5 -6 combs) in order to verify the following spring the actual tendency to swarm. Once started the selection program described in the previous intervention, once chosen the 2 best colonies, through the application of the formula of the merit index, we can start with the production of queens. By implementing the technique moving young larvae taking care that they are less than 72 hours, we will try not to give t the selected colonies for the breeding of cells, more than 20 queen-cell cups for each cycle, so that each larvae is well fed and at its birth may remain on the bottom of the royal cell some jelly, a sign of good nutrition by nurse bees. Once the cells are close to the actual birth and ready to be inserted in the insemination nuclei, it is necessary to remember that:

- the royal cells are maintained in the position in which they are naturally built by bees,
- do not have to be taken before 11 -12 days from the date of moving the young larvae;
- must not be inserted into small size nuclei;
- it has to be offered to young queen bees the possibility to have a large number of selected drones, adults and sexually mature (40-50 drones/one queen bee),
- check that the queens, weather permitting, are inseminated in the first 15-16 days of life;
- before marking the new fertile queens, make sure of the quality and quantity of their brood.

Only by working in this way we can ensure genetic uniformity within our apiaries and good and constant production and to different countries to have now, as ever, but especially for the times to come, excellent honey bees in their autochthony.

FORM 1

INDIVIDUAL FORM OF THE COLONIES MEANT FOR DISEASE ASSESSMENT Beekeeper Code …………… Apiary No. ………………………………. Beehive No.………………….. Queen bee, year: ………………………. Date of detection: …………………………………..			
Score	*Vitality of the brood**	*Docility*	*Swarming*
5	Very compact	Very calm	No royal cell
4	Compact	Calm with smoke	Few royal cells
3	Mediocre	A little aggressive	A lot of royal cells
2	Low	Aggressive	Swarmed
1	Very poor	Very aggressive	Orphan
Score assigned			
Amount of honey produced during the whole year (kg): …………..........			

Legend: Assessment of presence of varroa through the analysis of the ***vitality of the brood****.

Assessment of varroa assigning a score (from 1 to 5)	Score = 1	Score = 2	Score = 3	Score = 4	Score = 5
	Few bees, lots of dead brood, colony died	Presence of deformed bees and many cells with dead brood	Presence of deformed bees and few cells with dead brood	Brood not very compact and presence of few deformed bees	Compact brood with regular birth of bees during the winter

Assessment form for the selection of beehives (year: ……) **ANNEX 1**

Date ……………………………………..
Place……………………..……………………

Apiary ……………………………………………………. Beehive No…………………..

To assign values to the quantity and vitality of the brood, ideally you need to split combs into six equal parts (as shown in the red outline in the picture), then assign a score from 1 to 5, in fact at least 1/6 should always be occupied by deadstock (pollen and honey) and as shown in FORM 1.

parameters	evaluation
Spring start-up	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Vitality of the brood	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Quality of the brood	Whole frame ☐ Crescent: ☐ 2/3 ☐ 1/2 ☐ 1/3 ☐
Numerical force of the colony	(frames covered with bees: n/10) **(... / 10)**
Period of restriction of brood rearing	(period of brood interruption) **From** ……… **To** ……………….……..
Livestock/deadstock ratio	(ratio adult bees and brood/honey and pollen) 3/3 ☐ 2/3 ☐ 1/2 ☐ 1/3 ☐
Tendency to swarming	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Honey produced	**Kg ………………………………………….**

In order to choose colonies for selection (selection of breeding stock: queens mothers and queen fathers) you must use the form (ANNEX 1) and carry out an individual evaluation within each apiary (beehive station) for at least 2 consecutive years.

At the end of 2 years of observations (at least 4 visits per year), based on the scores collected for each of the parameters that are expected to improve (I), it can be drawn up a merit classification list, using the following formula:

Merit index (I) =(average value queen sisters - average value apiary)
+(individual value - average value apiary)

EXAMPLE OF APPLICATION OF THE FORMULA WITH RESPECT TO THE CLASSIFICATION OF BEEHIVES FOR SELECTION CONSIDERING THE PARAMETER "HONEY PRODUCTION"

1A	2B	3A	4B	5A	6B	7A	8B	9A	10B	11A	12B	13A	14B	15A	16B	17A	18B	19A	20B
8	15	20	17	34	19	5	16	11	17	22	19	7	15	16	17	12	18	41	17

Average queen sister genetic line (strain) A	17,6
Average queen sister genetic line (strain) B	17,0

Merit index (I) =(average value queen sisters - average value apiary)+
(individual value - average value apiary)

Ex: Calculation of the merit index in relation to hive No. 9 with respect to the parameter "honey production":

(17,6 – 17,3) + (11 – 17,3) =(17,6 – 17,3) = 0,3
(11 – 17,3)   = - 6,7

0,3 + (- 6,7) = - 6,4 (The beehive No. 9 of the group of queens of genetic line A, turns out to be negative for the genetic selection and therefore should not be used to improve the parameter honey).

Section III:

Bees and environmental sustainability

1. Importance of bees for the environment, food production and ecosystems

A worker bee makes 10 foraging trips per day and and also assume she flies outside the hive for 20 days of her life. Then in 20 days of foraging she visits some 300.000 flowers to collect o,6 gram of honey. For a pot of honey of 450 gram therefore 750 bees will have worked all their lives. During this period they have together visited some 225.000.000 flowers and all these flowers are dressed up in their best colours and scents: “Come to me, have my nectar and pollen, I am the sweetest ” And this is then the miracle exchange: I need you, you need me. Bees hopping from one flower to the next are also transporting pollen as a kind of mailman. And the mailman gets paid well with honey and nectar. The scientific word is **POLLINATION**, transfer of pollen from one flower to the other (Table 1).

Table 1. The role of honeybees in the pollination of fruit

Fruit	Variety		Fruit set (%)	Yield/tree (kg)
Apricot	Trevatt	Open* Enclosed**	19 11	99 67
Cherry	Moss Early	Open Enclosed	36 2	35 2
Peach	Golden Queen	Open Enclosed	26 22	216 155+
Peach	Crawford	Open Enclosed	28 10	47 18
Plum	Satsuma	Open Enclosed	6 2	38 15
Apples	Yates	Open* Enclosed**	240 8	125 9
Pears	Winter Nelis	Open Enclosed	53 5	88 12

* Open trees; trees to which bees and other insects have access

** Enclosed trees; trees enclosed during flowering in bee-proof cages to prevent bee pollination

\+ Weight of fruit harvested not very different

Exact figures are not available but it is estimated the 1/3 of all our food is pollinated by honey bees. Also other insects like solitary bees, wasps, moths and even to some extend butterflies and other insects perform pollination services. Also it is not certain that honey bees are the most efficient pollinators. In particular mason bees are said to be more effective. Is pollination really needed one might ask? Results of research on pollination trials show the difference between honeybee pollination and natural pollination. The following tables give the results of experiments designed to determine the usefulness of honeybees as pollinators in fruit tree crops (Table 2). Fruit set and fruit harvested from trees open to bee pollination are compared to those from trees enclosed at flowering to prevent bee pollination.

Table 2. Some interesting data about bees and their activities

Q	A
How many flowers must honey bees tap to make one pound of honey?	Two million.
How many flowers does a honey bee have to visit to gather a load of pollen?	1500 flowers.
How far does a hive of bees fly to bring you 1 kg of honey?	Over 120.000 km, or three orbits around the earth
How large an area does a honey bee have to cover to collect a load of pollen?	Approximately 30 square km or some 3000 ha.
How heavy is a load of pollen?	Approximately 10 mg.
How fast does a honey bee fly?	About 24 km per hour
How much honey would it take to fuel a bee's flight around the world?	About one ounce.
How long does a worker honey bee live?	Approximately 42-45 days in peek season.
How much honey does the average worker honey bee	1/12 teaspoon, 0,6 gram

make in her lifetime?	
How much bees wax does 1 tonne of honey contain?	Approximately 9 kg.
How do honey bees communicate with one another?	Dancing.
Can bees smell?	Honey bees have 170 odorant receptors, compared with only 62 in fruit flies and 79 in mosquitoes. They can recognise related bees, and odour recognition for finding food. Their sense of smell is so precise that they can differentiate hundreds of different floral varieties and tell whether a flower carried pollen or nectar from metres away. Each honey bee colony has a unique odour for members' identification.
How many wings and eyes does a bee have?	Honey bees have 2 pairs of wings, 6 legs, 2 compound eyes made up of thousands of tiny lenses and 3 simple eyes on the top of the head.
How many bees does it take to kill a person?	600-800 Honey Bees has enough venom to kill a 100 kg. person.
How old are bees?	Honey bees evolved between 150 - 180 million years ago.
How fast is the wing of a bee?	The honey bee's wings stroke incredibly fast, about 200 beats per second, thus making their famous, distinctive buzz.
How far will a Honey Bee chase you?	Honey Bees can chase you for many km when disturbed.
How many Honey Bees are there in a hive?	In a strong hive there are 70,000 - 100,000 Bees in a hive
When are all the bees in their hive?	At night or bad weather, all the Bees are in their hive.
When do Honey Bees sleep?	Honey Bees do not sleep. They take mini cat naps. They work all day long in the field collecting nectar, pollen, water, propolis, etc. and at night they work in the hives building new combs, repairing old combs, etc.

2. Pollination

Honey bees which produce products such as honey, beeswax, royal jelly, bee venom and bee gum rich in food and pharmacological values more importantly ensure pollination of plants and the superiority of the product quantitatively and qualitatively. Pollination is the first action that ensures fertilization and determines the product amount. It also affects the shape and size of the fruit. As productive male plants produce pollen, the pollination factor is very important for carrying the same on female flowers and ensuring fertilization. The wind considered as the basic pollinator of flowery plants is not sufficient for pollination of many plant types as they cannot ensure homogenous pollination and cannot carry heavy pollen. It is a fact that the value of the honey produced thanks to the bee pollination is more than 50-fold of the honey of previous year. 90% of the world food materials are produced from 82 different plant types. 63 of these plant types (77%) require pollination by bees. Bee pollination is required for especially 39 plant types. 1/3 of food for human beings is comprised of plants which directly or indirectly need bee pollination. Therefore, bee colonies are needed during flowering periods in order to ensure sufficient pollination. It is clear that honey bee colonies contribute to the increase in the productivity of fruit gardens and that if they are used effectively, there will exactly be an increase in the productivity of fruit gardens. If the farmers perform all cultural works but fail to care for pollination, they will be unsuccessful to get a fertile harvest. Bee honeys are considered as first grade pollinators as they have big colonies, can be easily moved and managed. As intensive cultural works carried out on today's agriculture and especially the use of pesticides decreased the number of pollinators significantly, the only pollinator to satisfy this deficiency is the honey bees. It is recommended that at least 3 to 4 bee hives should be located on an area of 1 hectare for effective pollination. The bee activity is low in windy and shadowy places and the flowers cannot be sufficiently pollinated and the fruits will be small. The bee hives should not be very far from the plants wanted to be pollinated in order to benefit from honey bees in pollination at a maximum level. It is stated that the honey bees can travel to 11.3 km away and the maximum distance for their being successful is 5 to 6 km. However, it is also claimed that they work hard at a distance of 600 to 800 m. The first bee hive was rented for pollination purposes in 1909 in the USA. However, there was an increase in this act in the world.

The bees do not only cause the improvement of the product quantitatively and qualitatively by pollinating the cultural plants but also ensure pollination in wild plants and by this way allow such plants to reproduce and extend, that the wild life is improved and that the plants and animals are diversified. The technical information has to be applied as required and the bees have to be used optimally for the pollination of cultivated plants. This allows the development of bee keeping and will help to increase the production of plants. The most important features of the bees including the honey bees are to ensure the pollination of alternative wild plants in the nature, to maintain their continuance, to ensure their spread to all around the world, to help other plants in the same group to survive and finally to allow thousands of animals to survive which use these plants as food and shelter or as a place for their nest, apart from their direct benefit of ensuring pollination in cultivated plants. While they ensure the continuance of biological diversity, they also perform many functions which are of great importance for our life such as prevention of erosion without their knowledge. The existence of the plants whose pollination is ensured by the oligolectic bees depends mainly on their activities if there is not the opportunity of vegetative reproduction. The types of plants mostly visited by the oligolectic bees are included in important families such as Asteraceae, Fabaceae, Malvaceae, Onagraceae and Cactaceae. As it is known, erosion is one of the most important problems of countries like Turkey and tons of soil are carried to the sea every year and the number of human and animal deaths reach high levels. It is very difficult to estimate the deaths of plants and wild life in the nature.

The honey bees have to be considered as an indispensable element of agriculture and be used in pollination in addition to that other agricultural techniques have to be used as required. This will increase the quality and quantity of the agricultural production, strengthen the bees, encourage the promotion of bee keeping and direct the agricultural engineers and other faculty graduates towards this profession.

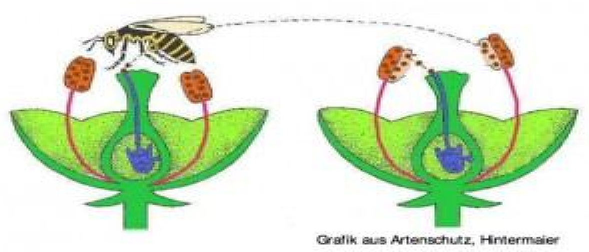

Figure 1. Pollination by bees

Consequently, many scientific researches consider the bees as the most important pollinator bugs. It is a fact that the bees visit around 20 thousand bees among more than 250 thousand plants with flowers over the world. It is known that around 300 plants naturally or artificially grown in Turkey have nectar and significance for bee keeping. The bees visit the flowers to take nectar and pollen. The nectar is used as a source of carbohydrate and pollen as of protein. Some producers engaged in agricultural production are against the bee keepers as they believe that the honey bees have negative effects on the flowers and fruit. This attitude not only annoys the bee keepers but also causes unhappiness to the persons engaged in agricultural production due to product loss. In fact, the honey bees do not harm the flowers and fruit as they do not have the feature to bite and to break into pieces as they have a mouth structure with the ability to lick and suck.

3. The bees' physical and environmental requirements

As will be seen in another field, bees are vulnerable and suffer from pest and diseases. There are furthermore strong indications that the use of pesticides and other chemicals by agriculture and other activities in nature have a negative effect on their ability to reproduce, orientate and other aspects of their natural behaviour. Below is given the needs of the bees and the hive, but foremost they will need a clear environment, flowers and air not poised by chemicals.

What bees need?

Honey bees need a clean environment, shelter, nectar, pollen, propolis, and water.

- **Shelter** -- In nature, the honey bee uses a number of natural cavities to build their brood nest. The term "Bee Tree" was once common. It referred to a tree that had a colony/swarm of bees living in it. The reason we can keep bees is because honey bees will adapt to man made hives for shelter.
- **Nectar** -- Bees can't make honey without nectar (nectar is the liquid sugary substance produced by flowers). Hundred of plants produce nectar but they are not all major sources of honey. Often we refer to honey as "wild flower honey". What that means is that the honey produced by the bees comes from a number of nectar sources. However, bees do produce crops of honey from certain major nectar sources and these are easily identified by taste and colour, examples include: buckwheat, clover, rapeseed, acacia, heather, sage, pine and thistle just to mention a few.

Photo 1. Wild honey bees building in a box

Photo 2. Filled the glass with honey.

Photo 3. Drinking nectar from flowers

Photo 4. Diving into the flower

Pollen -- As worker bees gather nectar from flowers, tiny particles of pollen stick to their bodies and are accumulated in pellets on their hind legs. The hind legs are equipped with pollen baskets (hairs and special structures on the bees leg) to carry the pollen back to the hive. Pollen is sometimes referred to as "beebread". Pollen contains the nutrients that are converted into larval food by special glands in the worker bees which is then used to feed young larvae. it should be noted that honey bee workers also produce what is called "Royal Jelly". Royal Jelly is a special food that is given to larva to be raised as queen bees. It has been estimated that a strong colony of bees may use 100 pounds of pollen each year.

Photo 5. Bee covered in pollen

Photo 6. Bees drinking

- **Propolis** -- As we have already described it, propolis is used by the bees to cement holes and cracks in their hive. It is gathered by honey bees from secretions in trees and shrubs. Bees have been known to encase a dead mouse inside their hive with propolis.

- **Water** -- Water is essential for the survival of the hive. Bees should always be located near a good water source or the beekeeper should provide one for the bees.

Section IV:
Spring and summer management of bees

1. Spring maintenance of bees

It is important to maintain, feed and manage colonies with sufficient knowledge in order to achieve success in bee keeping. The members of this hardworking and mysterious army that flutter their wings million times a day in order to get their share from the sea of flowers provided by the nature have to be healthy. The colonies are required to always be strong in order to benefit from the flora in the best way possible, to get high efficiency and provide pollination at the required level in herbal production. The colonies should be seasonally maintained in a cautious and careful way for an effective and healthy bee keeping. In the regions where bee keeping is carried out, the first controls in the colonies are carried out with the beginning of blossoming. Spring maintenance starts when the cold days of the season are over. The colonies which are wintered indoor are released to open fields. In this term, as the weather gets better flights start and the excreta accumulated in the beehive starts to be removed from there. In these periods, the colonies are controlled from the outside. In the controls, availability of queen, status of honey and colony are noted and appropriate management and feeding is accordingly applied. The main purpose of the controls to be carried out in spring is to control how the bees have spent the winter, available feed amount in the beehive, existence of the queen, egg laying status, number of worker bees, whether there are symptoms of moldy comb or disease or not. Beehive record cards or books are kept in order to consider how the beehives are and which beehive needs what, breed, age and egg laying status of the queen, quantity of offspring and adult bees, quantity of honey and pollen and disease status. In addition, diagnosis of disease and pests are carried out with spring examination as well as the determination of existence and performance of queen. Thereby, the necessary precautions are taken on time.

First control time

If the colonies are indoors, the time of removing the beehives outside from indoor bee yards varies depending on the regions. The first controls of the colonies which are wintered indoors and released outdoors and the ones which are wintered outdoors can be carried out between 11^{00}am and 2^{00}pm provided that the weather is warm enough and the temperature is 16-20 °C in the shade in a sunny, open and calm day. This examination which is to be carried out without opening the beehives may give an idea about the colony. Existence of a good flight activity and bees carrying pollen are the first indications of a healthy colony. However, the best is to open and examine the beehive in a proper time. It is necessary not to make the colony take cold during the colony controls. In case the colony takes cold, it should be noted that the bees should eat a considerable amount of honey to increase the temperature back to 35 ^{0}C which is pupa growth temperature and that it is an appropriate environment for diseases.

How to open and examine the hive?

Beekeepers should always wear protective equipment when they work their hive. They should light their smoker before getting started. They have often been asked how I keep my smoker going. Seems some people have smokers go out just about the time they need them. The key is to take time to get the smoker going before rushing off to the bees. There are many types of smoker fuel. Start small and then add new material slowly to the fire. Don't dump a lot of smoker fuel onto a newly started fire. The goal is to have a good cool flow of smoke when you press the bellows on the smoker. One other thing, inspect the hive during the mid part of the day. Select a day when the bees are flying and seem very busy. Avoid cloudy overcast days or days with threatening weather. Bees can be really nasty during stormy weather.

- First, make sure all is ready. Do you have your hive tool? Is the smoker going? What about neighbours? Children?

- Approach the hive from the side if possible. Do not stand in front of the entrance. If you do, you will notice a crowd of bees in a holding pattern behind you.

- Use your hive tool to remove the top cover. Blow a little smoke toward the entrance.

- Next remove the inner cover. Bee have a tendency to glue this down to the inner side of the hive with propolis, so you may have to pry the inner cover off. Keep your smoker handy.

- Once the inner cover is off the top bars of the frames in the top box (super) are exposed. Bees will start to migrate toward the disturbance and you will notice them coming up between the top bars. You can apply a little smoke to calm them down. A few may become air borne and fly about you. Ignore them.

What are you doing in the hive? Do you know?

- Move slowly -- avoid quick sudden movement.

- Don't spend a lot of time with the hive open.

- Since this is a new hive, you could or should be looking for:

- ✓ Are the bees building new comb on the foundation you put into the hive? New comb is nice and white or slightly yellow.
- ✓ The wax cells have been filled with pollen, packed tightly in by the bees with a little honey added to help preserve the pollen. The pollen is stored adjacent to the eggs and larvae (in the cells on the right) because it will mostly be needed to feed to those larvae as they grow. Some of the cells on the bottom left contain honey or nectar, which is glistening on the surface under the light.
- ✓ **Are all frames drawn out ?** This depends on how long the bees have been in the hive. If the comb is drawn out (the bees have made new comb over the foundation), do you have a new super to add to the colony ? I like to add a new super when 3/4 of the comb is drawn out. The last frames to be drawn out are the ones on the outside of the hive body. The bees will instinctively store honey in these outside frames. Don't take it away from them.
- ✓ **Can you recognize brood ?** It will be located in the center of the frame of comb. It is tan to dark brown in color. It may be hard to see eggs especially in new comb that is demonstrated above, but you should learn how to spot them. They look like little spots of sugar at the bottom of cells. Larva is easier to spot -- they look like pearly white worms coiled within a cell. The capped brook is brownish in color. Older comb turns dark in color. This is because of travel stain and also brood raised in comb turns the comb dark--sometimes almost brown/ black. If you can see eggs you do not need to find the queen to know that you have one. There may be

one exception: when a worker is laying eggs, but this is rare.

- ✓ **Can you recognize capped honey?** Capped honey will be found in an arch across the top of the comb. If it is unsealed, it will be a liquid. When sealed, the cappings are a distinct whitish colour. (Picture above) You will also see cells that have a yellow or brownish substance in them. These cells contain pollen. A normal hive will have most of the frame filled with brood, a small arch of honey at the top of the frame and some pollen stored between the two. It is not unusual to find a frame which is almost all brood in a strong hive.

- Get ready to close the hive if you are satisfied that all is well.

Photo 1. Open honey cells

Photo 2. New cells

Control and cleaning of bottom board

When the bees are gone for a flight, bottom board cleaning of the beehive may be carried out. Pieces and residuals on the bottom board are examined; thereby you may familiarize yourself about the status of the colony. Sometimes the weather conditions are not convenient to completely open the beehive outdoors. In these days when the temperature is not enough, examinations may be carried out only from the bottom board at the beginning of spring in order to prevent the larvae (worm) in the cells of the comb from taking cold and dying. In addition, the bottom boards on which water and moisture accumulate should immediately be changed.

In some beehives, the bottom board is a separate part from the beehive body. During the cleaning of these kinds of beehives, a clean bottom board is kept spare and the brood nest to be cleaned is put on this. The cleaning of beehives whose bottom board is not separate should be done during the warm and sunny hours of the day between 16 and 20 °C. With a hive tool or a spatula, candle pieces and other residuals on the bottom board are cleaned. However, the residuals should not be thrown away and if necessary they should be burnt by being accumulated in a private place. Otherwise, a proper environment for plundering and diseases is prepared.

Control of the frames

In the frame control, moldy, over darkened frames with broken combs are removed from the beehive and clean frames of previous year are placed instead. If there is no processed comb, the frame with comb foundation is put to the last place. If the broken frames are left in the beehive, during the repair carried out here, the bees will make drone combs and thereby they cause the drones to increase. The queen does not lay eggs voluntarily on the darkened and moldy combs and this causes the colony to weaken and production loss. If the present bee amount does not fill the frames in the beehives, the empty frames are removed and the space is narrowed down. The frame removed out of the beehive during the frame control should be kept on the beehive and should not be slipped. Otherwise, the queen may fall down outside the beehive in case the she is in the frame which is being controlled. During these processes, the beehive should not be kept open for a long time not to make the colony take cold.

Control of Queen

There is one queen in each colony under normal circumstances. Her anatomy is slimmer and taller and her color is lighter and brighter than other individuals. The existence of queen in the queen directly affects the continuity of the colony. If the queen is not seen in the controls, daily egg amount is checked. If there are daily eggs in the colony, there is probably a queen. If there are no queen and daily eggs, there is no queen of the colony. In this situation if it is possible, a new queen should be provided for the colony or this colony should be combined with another one.

Control of nutrient availability

Aim of nutrient control is to determine the amount of honey and pollen in the beehive. In case there is lack of nutrient in the control in early spring, feeding with cake and thick syrup made from honey and powdered sugar is more proper. Aim of nutrient control is to determine the amount of honey and pollen in the beehive. In case there is lack of nutrient in the control in early spring, feeding with cake and thick syrup made from honey and powdered sugar is more proper. Thick syrup is made with 1 level of water and 2 or 3 levels of sugar. In the ongoing periods of spring, feeding should be made with more diluted syrup made with 1 level of water and 1 level of sugar. Giving syrup to the colony will accelerate the growth of the colony and it helps to enter the honey season with stronger colonies.

Spring feeding

Maintaining its life like any living thing depends on getting the necessary nutrients. The two basic nutrient requirement of the bee is carbohydrate for energy and protein for cell renewal. Carbohydrate is provided from sucrose and protein from pollen. The bee keeper needs to feed his bees for various reasons. This feeding is mostly carried out with different types of sucrose for meeting the energy need. The reasons of the mistakes made by bee keeper while feeding the bees is that he ignores the facts that the bees are living things and they may get sick when they are not fed with nutrients fit for their digestive system. Spring feeding is a kind of feeding made in case that the nutrient sources in the beehive are deficient in terms of quality and quantity as well as to boost the offspring development. In spring feeding, temperature is an important factor. If the weather is cold, the syrup must be thick (2 or 3 levels of sugar + 1 level of water) and must be filled into the cells. Syrup with high levels of water may cause molding and diseases by increasing the moisture in the beehive. However, in the feedings made after the weather is warmer, the syrup with 1 level of sugar and 1 level of water should be used. This syrup is only given to stimulate the lay egging. Since plundering may be seen during the syrup feeding in spring, necessary measures should be taken for this. Giving syrup during the late hours of evening may decrease the risk of plundering. Another substance required for the development of the colony is pollen in early spring. If there is not enough pollen in the colony, the colony should be fed with a cake made from honey and pollen. It is an important technical issue that the bee keepers should collect pollen when there is abundant and use it in feeding the colony or trade it. It should be kept in mind that panic occurs in the colony and offspring production stops in case of lack of pollen. There should be 15-20 kg of honey for the bees to meet their needs. If there is not enough honey in the beehive, they should be fed artificially.

The reason why there are more deaths in spring is starvation, namely lack of nutrients. In addition, since offspring production will increase in spring, beehive honey is of great importance. With the spring, nectar and pollen collecting starts. It is necessary to enter this nectar flow with the best squad of the beehive. This is only possible with many young bees. Before 4-5 weeks of collecting the nectar, it is necessary to start artificial feeding. The healthiest product to be used in bee feeding is refined granulated sugar made from sugar beet or sugarcane. Although the literature has information saying that sucrose such as glucose or fructose produced from maize or wheat starch can be used in feeding the bees, with the latest researches it is not recommended to use starch based sucrose in feeding the bees. Pieces of starch in the starch based sucrose cause some problems in the digestive system of the bee.

The biggest difference in the feeding habit of the world's bee keepers occurred when the solid feeds started to be used. In countries where bee keeping is developed, solid feeding is only used to help the bee get rid of stress and continue the breeding activity only after the harvest when there is no nectar flow. In case there is lack of nectar flow in autumn, the bees should be fed with solid nutrients such as cake instead of intensive feeding with thick syrup. In short, nutrients such as cake can be used to increase breeding by creating a nectar flow affect and to protect the bees from stress. The correct one is this kind of feeding. In autumn, the bees should be fed with thick syrup made with 2 levels of sugar and 1 level of water instead of solid nutrients, thereby the winter stocks grow healthily and become capped honey instead of going to the cluster. However, sucrose types which are not produced for the bees and which may be harmful to the bee health should not be used.

Sugars which are produced for human consumption are sometimes used for bee feeding. However, they are not proper products for the digestive system of the bees because of many reasons such as being subjected to high temperatures during production and having many foreign materials giving color, aroma, taste and thickening added. Besides them, it is also inconvenient to use dark sugar which is dyed with different kinds of chemicals or whose color is darkened by being subjected to heat, raw sugar, molasses, sorghum, dirty residual sugar or various sugar types which are not used by humans since they are expired in bee feeding. These kinds of sugars may cause digestive disorders such as obstipation and diarrhea in bees since they consist of residues, food additives, starch and dirt in high amounts. Solid sugars increase breeding relatively, cause disorders in digestive system of the bees and unhealthy bees have short lives because of the nectar flow effect they form on the bee, and thereby they are not a benefit for the bee keeper. The bee keeper should not give credit for any application which may risk the bee health, unhealthy bees are the biggest loss of the bee keeper.

Syrup examples which may be used in spring feeding of the bees:

- By using honey: 2 kg of honey + 1 liters of water or

  4 kg of honey + 3 liters of water + 1 kg of sugar.
- By using sugar: 1 kg of sugar + 1 liter of water or
  2 kg of sugar + 1 liter of water.

Preparation of syrupe: Firstly the water is brought to boiling point. Then it is taken off the stove, it is mixed by adding sugar or honey. Syrup is never boiled. If it is boiled, it becomes caramelized and the bees do not eat it because of caramel smell.

Methods of giving syrup to the beehive:

- Bottom board of the beehive is separated with a stick from 10-12 cm back of flying hole and thereby it can be used as a feeder.
- The beehives with a feeder in the bottom board can be used.
- Comb can be used as a feeder.
- The feeder which is in the size of a standard frame can be filled with syrup and placed into the hive like a comb.

- Glass with perforated lid or steel jars can be placed in front of beehive flight hole or inner cover hole. These jars have some plastic types which can be placed like a layer on the beehive and which can be filled with syrup up to 8 liters. Each beehive should be give about 4-5 liters of syrup

Disease and parasite control

Foul brood, nosema and parasitary diseases which may be seen during the year in the bee colony should be observed. When a disease or a disease symptom is seen or doubted, you should consult a professional for the control and fight against the disease and act in line with the professional's opinions and recommendations. Otherwise, an ignorant application may bring harm instead of benefit. If the bees are to be given preventive or therapeutic medicine when entering into spring, it should be added to the syrup. Firstly the syrup is prepared, cooled and then vitamin or medicine is added. Early fight against diseases such as varroa, foul brood, nosema is only possible with disinfection with spring syrup.

2. Summer maintenance

As July approaches it is time to put an extra super of white frames on the colony to hold the honey. Bees need this extra room or they cease working well and may even swarm. Continue to monitor the hives and add another super on top as the five centre frames fill with honey. When all the frames in a super are filled with honey and one-half of the cells are capped with wax, the super and frames may be removed from the hive and the honey extracted. After ordinary spring maintenance of the colonies, maintenance and controls of summer continue. The main works carried out at the beginning of summer are providing frame as the colony develops, support of weak colonies, providing layer to the strong colonies and flora follow-up. It is not unheard of for a package of bees put on new foundation to have surplus honey. A number of factors determine the amount of honey a hive of honey bees can gather. These are:

Favourable weather: Favourable weather is important. People who have kept bees over a period of time can tell you that honey crops fluctuate from year to year. Bees do much better when the weather is warm and dry. Cold wet weather keeps the bees in the hive. They must be able to go out of the hive in order to gather a honey crop. Bees also need to eat and when the weather is cool and wet, the bees just maintain themselves (use what they gather with out storing much surplus). It takes one frame of honey and pollen to produce one frame of bees. How much honey and pollen a hive uses during the year to produce brood depends on the quality of the queen. A very productive queen will lay a lot of eggs. These eggs need feed. On the other hand, if the bees have ample nectar supplies and can fly on a daily basis, the large population of bees produced by the hive will also result in more honey being brought back to the hive.

Honey plants/honey: For the bees to produce surplus honey, they must have a nectar source. Bees are known to fly up to two miles or more to find nectar but if nectar sources are close to the hive, less time is spent flying to get the nectar and a honey bee can make more trips to forage for nectar in a day's time. Commercial beekeepers place hives in honey locations. A honey location can be identified as a place that has acres and acres of a plant that produces nectar in large quantities for the honey bee to gather. On the other hand, many beekeepers are limited to their back yards and the bees are limited to the area that extends two miles out from that yard. As a result, most hobbyist beekeepers have hives that gather 30 to 50 pounds of honey per season. If the area is a good area, the bees might bring in 100 pounds of surplus honey.

Management of hives: Much of the planning that goes into producing a honey crop has to do with timing. Did you get your honey supers on the bees at the right time? Are your bees strong when the honey crop is to be gathered? Are you inspecting your hive for swarming? Do you have a productive queen? All of these things are the duties of a beekeeper that wants to get a honey crop.

Feeding a new hive of bees: Feeding a hive of bees especially one just started on new foundation helps the bees immensely. They need to build new comb, raise brood, and store food for those days they can not get out to gather nectar. However, there will come a point when the feeding should stop. It has been asked, "Why not let the bees convert the sugar syrup into honey? First, if you feed the bees and they do convert the sugar syrup into honey -- you will have adultered honey. The sugars that make up the honey will not be honey sugars. When a nectar flow is on and you need to add additional supers, the feeding should stop. The bees will then store pure honey in the comb they build on the foundation you provide. Pure honey is a wholesome food and has an outstanding reputation.

How and when do we get "Surplus" honey?

A hive of bees stores honey for a reason. They put it away for later use during the winter season. Honey bees do not hibernate. They remain active even on cold days. It is estimated that a hive of honey bees will consume 60 to 90 pounds of honey during the winter. You will notice during warm days during the winter season that bees will leave the hive to take a flight. This is necessary because the bee holds it's waste until it can leave the hive to get rid of it. Honey bees do not generally defecate in their hive. You must leave enough honey for the bees to survive the winter season. A new hive should have at least a double brood chamber with one of the boxes completely full of honey and the lower one should have the outside frames filled with honey.

When is the time to remove the honey?

Honey can be removed from a hive almost anytime provided that the honey is fully capped over. Capped over means that at least 7/8 of the frame has been capped (that is the wax covering the bees put over the cell that holds the honey). If you try to take unripe honey (honey in cells not capped over), you will run into a serious problems with your honey spoiling because it has too much moisture in it. Most beekeepers remove honey just before Labour day or shortly after Labour day. It can be done later, but extracting is difficult when the temperature turns cold and honey is stiff and will not flow well. It is necessary in that case to warm the honey supers to 80 degrees or so before extracting. Even then the honey will not flow as well as if the temperature of the honey at extracting time is 90 degrees. The cardinal rule is: Always leave enough honey for the bees. Take only what they can spare!

Providing frame and layer

As the development activity starts in bees, comb knitting activity also starts. In this period, new combs should be provided for the beehives. After opening two holes on two sides of the frames and placing a wire, comb foundation is placed and new frame with comb foundation is given into the colony. The point which should be paid attention while giving the frame into the beehive is that the new frame is given as the penultimate frame and offspring production area is not separated. When the brood nest is filled, a layer should be provided for the beehive. While giving layers, at least 2 frames are taken to the layer from the frames with honey from the sides of the brood nest and new frames are placed instead. Frames with honey are placed on to the layer brood nest which is provided with a couple of new frames. When the first layer is filled, second layer is placed onto the brood nest and first layer is taken onto the second one. Thereby, the bees process the new combs better and quicker.

Providing support (supplement)

In case the bee quantity in the colony decreases for any reason, supplemental frames are taken from strong colonies and given to the weak ones. Frames with closed offspring cells can be given to the weak colony by giving smell. The reason of giving smell is to prevent the bees on the frames in the colony and bees of the other colony on this frame from killing each other.

Follow-up of the flora

In technical bee keeping, it is necessary to move the bees to another place according to status of the flora in order to get productivity. This is called flora follow-up or mobile bee keeping. It is not possible to gain profit in sufficient levels from colonies without mobile bee keeping. Moving the colonies, in other words following the flora namely the flowers is the most important principle of technical bee keeping. Transfer of the colonies should definitely be carried out when the bees are in the hive, in other words at night. Before the transfer of the colonies, necessary preparations should be made, the frames should be secured, the holes and cracked parts from which bees may escape should be closed and good ventilation should be provided. When the bees are taken to the point, they should duly be lowered and flight holes should be opened using fume. In case the flight hole is opened without using fume, the bees may harm the living things around. The most important point in bee transfers is to provide the sufficient ventilation. If the colonies are transferred to the combs with fresh honey, it should be kept in mind that these kinds of combs may easily break especially in hot days of summer months and may cause colony loss. Especially in summer months if it is not possible to arrive at the place of transfer at one night, it should be accommodated in a proper place in day time and the transfer should be completed at the second night. Otherwise, colony losses may occur.

Combining weak beehives

The reason of this process is to combine the beehives without queen with one ones with a queen and form stronger beehives. Since there will not be enough bee in the weak beehives, they even cannot meet their honey need. In addition, they cannot protect the queen from cold of the winter and cannot protect themselves from the plundering bees coming from around. Beehive combining is carried out mostly in autumn or spring. Combining the beehives especially in autumn helps to form robust beehives against fatal colds of the winter. Another reason for combining the beehives is the queen factor. In other words, there may be sufficient adult bees in the beehive. But if there is no queen, it should be combined with a beehive with a queen. Before combining, both beehives are fumigated and the beehives are immediately opened. Frames with offspring are combined in a single beehive. The bees are shaken in front of this beehive and thereby the process is completed.

Another method is to put one beehive on top of the other one. The beehive with a queen is put at the bottom and beehive without a queen is put onto it and sheet of newspaper which is perforated from some parts is placed between the two beehives. The worker bees try to break into pieces and throw out the newspaper in time and thereby they get used to each other's smell. If both beehives have a queen, the queen bees encounter and fight until one of them dies. In case the beehives are combined without a sheet of newspaper, sometimes both queen bees may die. If they are to be combined without a sheet of newspaper, the combs of the beehive are moved to one side of the beehive and combs of the other beehive with the bees are placed next to the other side. A queen grid is placed between them, and syrup is sprinkled onto the bees.

Section V:

Mobile beekeeping and feeding bees

Mobile beekeeping is a general way of harvesting much honey in a season by using different floras in the country. It is also general in some European countries. Mobile beekeeping means carrying hives from one place to another in order to get more products from a colony and to ensure pollination of plants. If there are a few honey-flowers whose pollination lasts a short period of time in the region where bee keeping is carried out, mobile bee keeping should be done and carry hives to other places rich in nectar and pollen resources. It is possible to benefit from different plants at different times and to get more products thanks to mobile bee keeping. The hives are carried from shores and plains to high plateaus in late spring and early summer and to pine groves and shores. Mobile beekeeping is carried out to increase the productivity gained from the beehive with economical expectations. In this bee keeping method, a movement route from the regions where spring start early to the regions where the flowers have just bloomed. This process is generally called flower chasing. After then, as the winter approaches, the bees are wintered by moving them from regions where the winters are harsh. Mobile keeping is a painstaking work. It is necessary to follow the flora and climate features of our geographical regions and to accommodate according to the proper order. The beehives which are moved a lot should continuously be checked against parasitary invasions.

1. The matters to be taken into consideration in mobile beekeeping

The vegetation and amount of nectar and pollen should be carefully researched before carrying the colonies. The accommodation place should not be exposed winds and located in gullets. Preliminary researches should be conducted on the places where the colonies will be located. South eastern slopes of hills, places where agricultural struggle disinfection is not applied and places away from the main roads should be preferred as accommodation place. The region where mobile bee keeping activities will be carried out should be free from contagious bee illnesses and pests. The distance between the beehives should not be less than 1 km in natural flora and than 500 meters where high amounts of nectar or extract are released in places where citrus fruits, sun flowers, cotton and pines are grown. The intensity of the honey flower in the region, nectar or extract production capacities and the number of beehives should be taken into consideration while calculating the distance between the beehives. Otherwise, the potential cannot be utilized economically due to the low or high numbers of colonies. The hives should not be shaken during loading, transfer and unloading transactions in bee transfers, one of the main elements of mobile bee keeping. The hives should not be carried when they are full and sufficient air-conditioning should be provided. The transfers should be made at night and bees should rest while opening the beehives in the mornings at stop points on very long roads.

The issues mobile or fixed bee keepers should pay attention while moving the beehives can be summarized as follows:

- The cracked parts or holes on the beehives should definitely be repaired.
- It should be noted that the beehives should be fumigated before loading them onto the vehicles.

- During their loading, the vehicle should be in the idling mode against high noise.
- While placing the beehives onto the transportation vehicle, there should be wind holes.
- No breaks should be taken if possible, and if a break is taken, the vehicle should be idling and water should be sprinkled onto the beehives.
- The flight holes of the beehives should be kept open to get air.
- Beehive loading process should be carried at night or at dawn.

2. Effects of chemicals used in agriculture and beekeeping on mobile bees

Various illnesses, pests and weeds that harm cultivated plants are struggled against agriculturally and many chemicals are generally used. These chemicals both harm the honey bees which produce honey and which have vital importance in the pollination of plants and result in their deaths. The dangerous affects of the pesticides used in agriculture to the honey bees change according to many factors such as the type of the pesticides used, their place and time of implementation, dose, action time, disinfection method and meteorological conditions during disinfection days. Water resources and pollen powders polluted by some agricultural pesticides applied in a faulty way not complying with the technique cause the deaths of many adult bees and offsprings. Agricultural pesticides applied in powder form are more dangerous for the bees when compared with the liquid pesticides. That is because the pesticides in powder format are more easily distributed and can be carried to the hives with the pollens.

Protection of mobile bees from pesticides

Bees produce bee products and also help the creation of fruits and seeds by pollinating the plants. Therefore, both the beekeepers and plant growers have some duties to protect the honey bees. The cooperation between the bees and flowers existing for millions of years and based on mutual benefits should also be ensured between the plant growers and the bee keepers. Some precautions to be taken by the bee keepers, plant growers and managers to protect bees from the dangerous affects of the pesticides are as follows:

Precautions for beekeepers

- A place which does not cause any risks for the colonies or has low risks should be chosen for bee hives.
- Beehives which can be easily carried, are air-conditioned and suitable for mobile bee keeping should be used.
- Bees can be closed for 1 or 2 days after disinfections with pesticides with short term affects provided that sponges soaked in water are left in the hives, sufficient air-conditioning is ensured and wet sacks or clothes are placed on the hives.
- Colonies should be transported to a place which is at least 7 to 8 km from the disinfection sites if pesticides with long term affects which are very dangerous for the bees are used.
- The possibility of bees to drink water from other sources that might be dangerous should be minimized by placing water bowls to the beehives.

Precautions for plant growers

- If there is not any requirement, the disinfections should be made during the pollination periods of the plants.
- Pesticides which are less dangerous for bees should be preferred.
- Liquid pesticides rather than powder pesticides should be preferred.
- Disinfections should be made during the evening hours when the bees are in their hives.
- The pesticides and pesticide wastes should not contact the water resources.
- The plant growers should notify the bee keepers about the times of disinfections and the pesticides to be used.

Photo 1. Carrying of hives in mobile beekeeping

Precautions for managers

- The pesticides which are less dangerous for bees should be produced and used and the plant growers should be encouraged in this respect.
- Bee keepers and plant growers should be trained about the affects of pesticides on bees.

- The contributions by bees to the product amount and quality in fruit and seed production should be explained to the plant growers.
- Laws, bylaws and regulations regarding the matter should be prepared and the mutual benefit relation and cooperation between plants and bees that last for millions of years should be ensured between bees and plant growers.

3. Feeding mobile bees

Natural nutrients of honey bees are nectar, honey and pollen. The nectar is turned into honey after undergoing some physical-chemical changes in the bodies of the bees and cells in the hives after being collected by the bees and stored in cells. Nectar and honey is used by bees in order to meet the energy need. Bees can only survive by eating honey. However, pollen is required in order to raise offspring and ensure that the young bees in the cells can complete their developments. Pollen is a natural nutrient that provides protein, vitamin, oil and mineral needs of bees. The offspring production is very limited or no offspring is produced if there is no pollen in the hive notwithstanding the amount of honey in the hive. The development of colony is slowed down or stops entirely. The bees will die because of starvation if there is no honey in the hive, no nectar is collected from outside or no additional food is given to the colonies notwithstanding the amount of honey in the cells. The bees do not have to be regularly and continually fed like the other farm animals. However, they have to be fed in emergencies or when additional nutrients are required. The colonies should be generally feed in the following cases: When the bees cannot collect enough honey for winter (Autumn Initiative Feeding). In order to increase bee staff by encouraging the queen to lay eggs before main nectar flow. When there is danger of starvation, when the time of spring comes late or bad weather conditions prevent the collection of nectars during the nectar flow.

Regarding the colony management

- When a swarm is taken,
- When colonies are divided,
- When weak colonies are unites,
- When colonies are controlled,
- When the queen is placed,
- When the queen is renewed,
- When transfer is made.

If the plants that will ensure pollination do not produce enough nectar or pollen. In order to decrease the negative effects of agricultural pesticides on the colony. When pesticides are required to be applied to the colony against the illnesses and dangers. Two types of feeds are used for the additional feeding of colonies:

- Solid feeds (cakes including different mixtures);
- Liquid feeds (Syrups prepared from water + sugar at different amounts)

Solid feeds

The materials used instead of pollens provide many important nutrients needed by the bees but do not include special chemical materials encouraging the bees to eat pollens and releasing larvae feed. Oil free milk powders, oil free soya beans, bear yeast and egg yolk are added to the bee cakes. It should be kept in mind that these materials trigger bee illnesses such as Diarrhea and Nosema. Therefore, it is enough to add pollens rich in minerals, vitamins and amino acids to the honey and powdered sugar mixture while making cakes. Attention should be paid to be informed about the source of the honey and pollen to be used in cake and whether it bears any illness.

Cake preparation

Water is poured into a boiler. The clean extracted honey can to be used for making cakes is put in the boiler filled with water and the honey is melted. The melted honey is added to honey and powdered sugar mixture and this mixture is kneaded with dough kneading machine or with hands. The cake as thick as bread pastry is put into transparent nylon bags and placed into the colonies as much as required. The nylon bag should be torn from the point it touches to the hive for the bees to consume the cake easily.

Liquid feeds

As the hive receives sugar and starts to consume it, the first sign will be seen which causes the queen to want to lay eggs and the colony to initiate and continue offspring raising activities. This sign happens naturally when the bees find nectar and artificially when the colony is fed with sugar syrup.

Syrup preparation

Syrup is prepared with clean water. First, the water is boiled. The boiled water is left to cool for some time. Sugar or sugar is added to the warm water which will not burn your finger. Syrup is mixed until the sugar is melted.

General principles regarding feeding of bees

The colonies should be fed when required. This is a challenging and expensive task. Inexperienced beekeepers may cause the initiation of plundering. Feeding should be made in the evenings in order prevent plundering while feeding. As the bees fed in the mornings finish the syrup in a very short time, they attack the surrounding week colonies and nucleus hives. Flying hole should be narrowed and other holes and cracks should be closed in order to prevent plundering bees from entering the fed hive. The syrup bowls should be located in a place where the bees coming from the outside cannot reach. The colony to be fed is generally the weak colony. Precautions should be taken to prevent offspring from feeling cold while feeding the bees. The syrup bowls should be near the bee bob. Bees should be able to reach the syrup without damaging the bee bob in cold weathers. The bee keepers should try to have a strong colony by uniting them rather than having weak colonies.

Section VI:
Swarming and plundering in honey bees

1. Swarming and its prevention

When a part of colony individuals leave the beehive with the queen and constitute a family, this is called swarm. Although swarming is a behavior of maintaining the generation, the tendency to swarm differs according to the genetic structure and environment conditions. In technical bee keeping, swarming of a colony is not a desired process and measures are taken against swarming. Since the power of swarming colonies will decrease, it is not possible to produce enough honey. Therefore, the conditions supporting swarming should be well known and measures should be taken against it. The conditions which support swarming can be listed as follows: increase of bee colony so much that it does not fit into the beehive, no space to grow offspring and store honey, insufficient ventilation in the colony, increase of temperature, aging of the queen, effect of genetic structure. Eliminating the above conditions which support swarming and preventing natural swarm are important principles of technical and economical bee keeping.


Photo 1. Swarm

There is one queen in a beehive. Queen of the colony leaves the colony in times depending on the regions in a period of 20-25 days and generally at midday and tries to make a new home, in other words a new bee family; this is called swarming. Swarming time is the beginning of spring. The swarms before and after these dates are generally weak and they cannot be strong enough in honey season and they are not economical. Before this season, the worker bees in the beehive which will swarm form cells and start to produce new queen bees and they prevent the older queen from destroying these queen cells and killing new queen bees. New queen bees which will come out of the queen cells start to make sounds like “vang vang” or “quack quack”, in other words they start to warble 2-3 days before they come out. Hearing these sounds, older queen makes necessary preparations to leave the beehive, she communicates with the new queen bees which will come out with sounds similar to pipe or whistle and leaves the beehive as soon as possible to form a new bee family. Therefore, in the first swam (prime swarm) there is generally one queen and this queen is the old queen of the beehive. Prime swarms are the most acceptable swarms. Then, the young-virgin-queens make a sound of “ti-ti-ti”, about 5 days after the first swarm they make subsequent breeding flights; since the worker bees join that flight to lead the queen, they look like a swarm. Because of the abundance of young worker bees, sometimes there are separations between the young worker bees. Some of the queens can be brought back to the beehive after they breed by the worker bees, some of time stay outside and form a swarm. These kinds of secondary swarms are generally weak and a decision about their outcome should be made by controlling their beehive. Accordingly;

- If the beehive they leave and the resulting swarm are strong, they are taken into a new beehive.
- If the beehive they leave and the resulting swarm are weak, they are placed back to their old beehive.
- If the beehive they leave is strong, but the resulting swarm is weak, they are placed back to their old

beehive or they are added to another weak beehive or swarm.

Indications of swarm

- Number of drones increases in the beehive,
- Queen cells are formed,
- Queen bee starts to lay many eggs,
- Sounds from old and new queens are heard,
- The bees gather in front of flight board with the specific smell of the queen,
- There is a hectic and restless combination in front of the beehive right before the swarm,
- Lastly, there is a strong combination in the beehive and young worker bees in large numbers, old worker bees in small numbers and some drones intensively dash out of the opening of the beehive like they are pouring.

The bees coming out of the beehive recognize each other even in the location of the beehives and they fly together. Firstly flying with their faces towards the beehive, the bee flock make their flights which is called swarm dance a couple of meters above. This lasts a couple of minutes. Since they fill their bellies with honey before they leave the beehive, the worker bees cannot go very far. In addition, since the previous queen of the prime swarm is old, her wings are worn-out and she is heavy because of the eggs in her belly, the queen cannot go to far from the beehive and settles on the nearest place, branch, etc. Since the worker bees leaving with the queen are full, they do not go back to their old beehive and they embrace their new one. It was detected that they go back to their old beehive in case they leave when they are hungry. The beehive which swarms calms down, beehive works are arranged and the it keeps on working directing to outer resources.

Reasons of swarming

When a hive swarms the queen leaves with the bees but before leaving, she lays eggs in special cells called queen cells. These cells (20 or more of them) will be located at the edge or bottom of the frames. Other reasons are:

The bees go through three important stages in their spring developments.

- Renewal of old bees spending the winter with young bees,
- Increasingly increasing and rejuvenating the bee existence,
- Continuing to strengthen the beehives by increasing in number as many as possible until the honey season.

In the first and second stages, a good queen lays about 2000 eggs in 24 hours in a period of 40-45 days without stopping; however with the honey season the queen decreases her eggs at the least after the bees start to bring nectar. Since the quantity of newborn young bees continues to increase at the beginning of honey season, they gather inside the beehive and in the back wall across the flight hole, because they are not field bees yet.

These out-of-work young bees start preparations there as the swarm of the future. On the other side, it should be kept in mind that swarming instinct never develops in the same pace and way in every colony. The biggest factor is when and how much the queen decreases the eggs she lays. If she decreases laying eggs 15-20 days before the honey season, offspring feeding of the young bees quickly decreases in 7-9 days and they immediately form queen-cell cups. It means that the colony tends to swarm. The bees instinctively stops wax knitting and raising works. Queen cuts of laying eggs. Unless urgent measures are taken, the colony will start to swarm in the first 8-10 days, in other words when the first queen-cell cups are closed under the proper weather conditions. It may keep the queen laying eggs in a normal way until the beginning of honey season. Thereby, the young bees do not tend to swarm since they are busy with offspring feeding and care. In addition, ripening the honey is the work of young bees since the honey season has started and there is nectar flow. In such beehives, eggs laid by the queen gradually decrease.

Swarming may occur when practically no empty comb from the readily raised stores or frames which are not raised and raising works and egg laying area for the queen and bees are not provided. Some bee keepers provide readily raised cells and egg laying area only for the queen bee without being aware of swarming reasons and they encounter unexpected results. After the empty cells are cleaned by the bees in a short time, queen bee lay eggs and young bee quantity of the colony rapidly increases and thereby young bees become out-of-work and gather on the back wall since the honey season has not started yet. Because of these reasons, the colony should be provided with non-raised new cells and wax raising works to prevent swarming. After forming the queen-cell cups and seeing the eggs in the cells, wax raising works completely stops. At the same time, the bees reduce feeding the queen bee with sufficient royal jelly. Then, the queen starts to feed herself with honey and when she is not fed with royal jelly, she stops laying eggs and become lightened to fly. Thereby it is understood that the reasons of swarming are rapid increase of young and out-of-work bees and queen’s sudden stop of egg laying.

There are two main reasons for swarming:

- There is more then 1 queen in the hive or
- The hive becomes too crowded.

We can mainly list the following as the reasons of swarming;

- Reproducing of the bee family because of the reproduction instinct and sticking in the beehive,
- Young bees' outnumbering the old ones, genotypic traits of the bee,
- Injuring of the queen for any reason, dying, aging and/or laying too many addled eggs,
- Small or tight beehives, making the flight holes small,
- Not adding honey chamber in time or when necessary or not extracting the honey, no place for storing the honey,
- Placing queen grid, keeping the beehive under sun.

Methods to prevent swarming

The main reason of the bee keeping is to get the highest productivity per beehive. To that end, it is necessary to increase the bee quantity of the beehives and enter the honey season with strong beehives. When the bee family is separated because of swarm, the beehive may lose power and thereby the products to be obtained from the beehive may decrease.

In addition, waiting in the bee yard not to allow the swarms run, following them, placing them in their positions, maintenance and control of them are time consuming works and cause waste of time. In modern bee keeping, natural swarm should be taken under control and if necessary artificial swarming should be chosen.

What can you do if you see queen cells?

- First, you can try to cut all of them out and this must be done every six or seven days. Once bees start building queen cells, it is hard to stop them from building more.

- You can give them more room by putting a new super on the hive. This doesn't always work.
- You can take several frames with queen cells on them and start a new hive. The new queens will emerge, fight, and the survivor will mate and begin to produce more brood. Don't use this method after mid July. Add new brood frames to the old hive and cut all remaining queen cells.
- You can clip the wings of the queen so she can not fly. When she tries to leave the hive with the swarm, she will be unable to fly and can usually be found on the ground in front of the hive. The swarm without a queen will return to the hive and wait until one of the virgin queens emerges and take off again with her. The bees will swarm before this new virgin queen emerges (hatches- is an incorrect term). If you again go through the hive and find queen cells, you can destroy them and put the old queen back into the hive.
- The best thing you can do is just make sure your bees do not reach the critical point of being too crowded.

The following methods can generally be applied to prevent the natural development of swarms:

- Deformation of queen cells,
- Broadening the inner volume of brood nest or beehive,
- Providing beehive ventilation by expanding the flight hole, keeping the beehives under shade,
- Changing the strong beehive which may swarm with the weak beehive, separating the strong beehives, in other words artificial swarming,
- Giving syrup to the beehives which are confined for a long time because of improper weather conditions,

- Changing the old queen bees with younger ones, reducing the cells with offspring, placing non-raised foundation cells instead,
- Reducing the number of cells with honey or extracting honey in order to increase honey storing volume, placing drone trap in the entry of the beehive,
- Working with bee races which do not tend to swarm or taking swarm criteria into consideration in improving works.

However, the important issue to be paid attention is to remove the queen cells in the beehive whose swarming will be prevented. The new bees from the neglected queen cells may cause the beehive to swarm. The beehives from which artificial swarms will be taken, in other words which will be separated are not only the bees which tend to swarm. By separating strong beehives, it is possible to prevent swarming and obtain 2 or more strong beehives. To that end, queen of the strong beehive is found and left in the primary beehive; than the combs with offspring, combs with honey and present bees of the beehive are equally separated and two new beehives are formed.

The issues to be considered;

- Giving the young queen to the new beehive,
- Or giving combs with queen cells. In case there are no combs with queen cells, combs with new laid eggs are given and it is ensured that worker bees produce queen.

Other methods to prevent swarming:

- Making the young bees work by giving the bee colony non-raised combs.
- Sequence of frames on additional frames (honey chambers).

- Working system with queen grid and second queen (double queen).
- Changing the present queen with a queen which was born in the same season and which lays eggs 20-25 days before the honey season.
- Making artificial swarms with at least six frames.
- System of changing the places of beehives.

Photo 2. Swarms set in trees

Producing artificial swarms

Natural swarming of the colonies is an undesired event. The swarm which is formed in the period of nectar flow reduces the power of the colony and thereby decreases the honey productivity. In case swarming continues, breeding activity is hindered in the nurturing colony when the young worker bees who work as a breeder in the colony go with the swarm and thereby chalk brood may be seen. Measures should be taken against natural swarm not to experience such negative issues in bee keeping and if it is wanted to increase the number of colonies, artificial swarms should be formed.

Colonies with sufficient power are equally separated and a new colony is obtained. To this end, empty beehive is brought next to the nurturing beehive. The cells with bee-honey and offspring are equally separated to the both beehives. The issue to be paid attention is to ensure that the field bees equally enter both beehives. For this purpose, nurturing beehive is moved half a meter right and left and new beehive is placed in a way that the old flight line will be in the middle.

After this process, field bees may however prefer the nurturing beehive, in this case nurturing beehive is moved a little bit more outward and most of the flight line is given to the side of the partition. Another artificial swarming method is to make 2-3 partitions with 3-4 frames from a beehive especially in order to increase the number of colonies. In this case, one frame with bee-offspring and one bee with bee-honey are placed into the new beehive. The beehives whose flight holes are closes are moved at least 5 km away to prevent the field bees from returning their old beehive location. Another artificial swarm method is to take 1-2 frames from each frame based on the strength of the beehive and form new colonies by gathering method.

2. Plundering in honey bees and its prevention

Plundering which is seen in regions where flowers and nectar capacity is low is the theft of the present honey of beehives by the bees of another beehive. If the beehives are not strong, they cannot protect themselves from these attacks. It is difficult to know plundering bees. These bees are the types of bees which are generally timid, which try to enter the beehive without touching other bees and which sometimes tend to escape. It is necessary to distinguish the game flights in spring and abnormal flights of the plundering bees. These game flights are performed by young bees in good weathers. Sometimes plundering happens very calmly and there may be no bee fight.

Ways to protect from plundering:

- Beehive control should be carried out in a quick way. If there are suspicious bees, no control should be made.
- No honey should be contaminated around during

the honey harvest. Old combs and waxes should not be thrown away.

- The environment should not be polluted while giving syrup.
- The emptied frames should be placed in beehives in the evenings.
- There should be no holes or broken parts in the beehives, the beehives should not be left open for a long time.
- The flight hole of the plundered beehives should be narrowed, entry of foreign bees should be prevented and the bees should be helped in their beehive protection.
- Weak beehives should be combined, the plundering bees should be twisted by changing the places of the beehives.

Section VII:
Queen bee production

1. Queen bee production methods

Since the life of the bees is short, the resources in nature should be utilized in time and in the best way possible. In the spring months where pollen resources are abundant, the colony should complete its development and collect enough honey in nectar flow period. These conditions which are essential for a productive and profitable bee keeping depend on the genetic and physical characteristics of the queen the colony has. In the colony where there are ten thousands of worker bees and sufficient drones, the single queen in the colony directs all development and productivity of the colony. Therefore, queen breeding and using is of great importance in technical bee keeping. No matter it is grown or bought, having a young and quality queen in the colony and as a result working with strong bees is an obligation work economical bee keeping.

Queen bee production requires the production works to be carried out in order and in time. The production of a queen which begins to lay eggs as of preparation of initiator colonies requires a one-month time. The most important factor affecting the queen production capacity is the number of breeding boxes. In the production period between May and September, 4-5 queen bees can be produced for each breeding box. For instance, a commercial queen production facility with 100 breeding boxes can produce and sell 400-500 queen bees in production period of 1 year. To reach this number, it is necessary to carry out the following works without delay. Queen production is not a hard work, however it requires plan and schedule.

Selecting and preparing breeder

Queen bees to be used in breeding should significantly carry all the genetic features of their race and pass all necessary selection stages. Facilities producing commercial queen bees should carry out their production by using queens which carry value as breeder and whose generations have been tested and which preferably have breeder certificate. Breeder queen bees with certificate should be artificially inseminated or bred in isolated breeding areas. If breeder colonies with bee keeping conditions are not supplied, simply the colonies whose spring growth rate is high, which produces the most honey in previous years, which do not swarm, which have never caught disease and which are calm and bland can be used as breeder. Swollen comb in the appropriate color is given 4-5 days before the transfer to the grafting colonies and it is ensured that there are larvae at the desired age on the breeding day.

Preparation of initiator colonies

The colonies which reached to at least 15 frames with bees and which have developed well are selected. The queen of them is taken 4-5 days before the transfer and the colony is left with no queen. In the morning of larvae transfer, surplus frames are removed and the bee intensity in the colony is increased, natural queen cells produced in the colony are destroyed and frame organization is carried out. These colonies are fed with syrup as long as they are used in the production, and they are supplemented with young worker bees or confined offspring which are about to hatch. As initiative colony, a swarm box with 2-3 combs where abundant young worker bees are gathered and which have honey may be used.

Preparation of foundation Queen cells

In modern queen bee breeding, the basic queen cells where larvae will be placed are artificially prepared from pure wax. The bright colored odorless wax is melted in double-walled melting pot. Cell mould, which is soaked in water and which is waterlogged, is firstly soaked in water then in melted wax and then again in water; these queen cells are mounted on to a stick with melted wax. These queen cells should in depth of 10-11mm and in diameter of 9-10mm. There are 15-20 queen cells on a stick, three sticks are mounted on a frame and it is ensured that there are 45-60 queen cells on a frame which is specially designed for this work. In queen production, basic queen cells made from pure wax as well as plastic ones specially designed for this work are used.

Photo 1. Queen cells and their pinched appearances

Larvae transfer

Frames with larvae at 6-12 hours old are selected from breeder beehive. The bees are cleaned by emptying them into the beehive with a brush. It should be avoided from strongly shaking the frame since the daily honey will flow onto the larvae. The selected frame is brought to the transfer room by protecting it from wind and direct sunlight. Transfer room should have the similar conditions with the beehive with 30-33 ^{o}C temperature and 60-70% moisture.

Photo 3. Development stages from larvae to bee

Photo 4. Materials used in larva transfer

In the first usage periods of initiator colonies, keeping these artificial queen cells in these colonies for one day and applying diluted fresh royal jelly into the queen cells before the grafting affect taking rates positively.

Placing the grafted Queen cells into the initiator colonies

When the 45-60 larvae transfer to be given into an initiator colony is completed, grafted queen cells are placed into the initiator colonies. In an initiator colony whose queen is removed 4-5 days before the larvae transfer and whose frame arrangement is done a couple of hours ago, the frame in which was larva was transferred is placed between two frames one of which has open offspring and one which has pollen. Other combs with open offspring in the initiator colony should be removed to look after the transferred larvae in a better way. Cells with larvae in this colony are necessary for the young worker bees to produce royal jelly and cells with open offspring are necessary for the young worker bees to gather in the place where the larva transferred frame. Other frames in the initiator colony should have confined offspring, honey and pollen. In continuous productions, this arrangement should be provided before each larvae transfer. The abundance of young worker bees in the initiator colony and frame arrangement directly affects both larvae taking rate and quality of queen to be produced. In addition, in continuous productions new frames should be placed and old ones which are out of purpose should be removed for providing the first arrangement in the colony in every 5-6 days in order to maintain the young worker bee population in the colony.

Preparation and use of finishing colonies

Grafted queen cells can be held in the initiator colonies until the day they are distributed to breeding colonies. However, in enterprises which make production on a large scale, it will not be economical and it may negatively affect the quality of the queen bred in long term uses. Thereby, 1-2 days after being given to initiator colonies, queen cells whose acceptance is ensured in initiator colonies for queen production are transferred to the upper layer of strong colonies with 16-18 frames with bees whose queen is confined to grid and the brood nest. In this layer, there should be plenty of young worker bees and frames with pollen and confined offspring. Frame change should be carried out every week to ensure the arrangement between lower and upper layer. The transfer frame which is transferred to the finishing colony is changed with a new one in initiator colony and thereby production durability is ensured. Feeding and maintenance of the larvae which are transferred into the finishing colonies are provided in these colonies after this period.

Preparation and use of breeding boxes

In the 10^{th} day after the transfer, confined queen cells are removed from the sticks they are on and distributed to the breeding colonies which are prepared 1 day earlier. Different beehive types are used in the constitution of breeding colonies. These are the versions of standard colonies which are divided into 3 or 4 parts or small breeding boxes made from wood or isolated materials. The entry holes of these boxes should face to different sides and they should be placed on a large area to make sure that the queen bees which come back from orientation or breeding flight return to their own boxes. Front sides of the breeding boxes are dyed with different colors in different shapes to provide a mark for the queen. The durableness of these breeding colonies which are formed in the beginning of production season is provided with the offspring produced by the queen and thereby they can be used through the season. Queen which starts laying eggs is kept laying eggs in the breeding colony for 2-3 weeks until the first worker bee closes its eyes.

At the end of this period, the queen bees are sold and new queen cells are provided in place of these. It should be paid attention in removing the queen cells from their sticks and distributing them and the cells should be distributed according to the position on the stick and should not be turned upside down. After placing the queen cells into the breeding colonies, queen bees hatch after 2-3 days according to the age of the transferred larvae. In the controls carried out 4-5 days after placing the queen cells into the breeding colonies, cells where no queen has hatched or cells destroyed by the worker bees can be seen. In this case, new cells should be given.

Breeding of Queen bees

The queen bees which hatch in their breeding boxes make an orientation flight when they are 2-3 days old and in the next 2-3 days they make a breeding flight. The breeding takes place in a special field called "Drone Gathering Area" while flying in 10-30 meters of height. The queen arriving at the Drone Gathering Area is discovered by the drones with sex pheromone she releases and by eyesight. The queen which breeds with 6-20 drones returns to her colony (breeding box) and starts to lay eggs 3-5 days later. The drones which have bred with the queen die after the breeding. The queen go on another breeding flight for 1-2 times on the same day or following days in case there are not enough number of drones in drone gathering area and she cannot breed with enough number of drones under the negative weather conditions. The queen bees which have not breed in 20 days since their hatching lose their breeding urge and start to lay addled eggs; no breeding occurs after this. Taking the breeding under control is done with isolated regions with a radius of 8-10 km or artificial insemination.

Artificial insemination of Queen bees

Artificial insemination of the queen bees is not a hard work, but it requires skill and experience. In technical bee keeping, artificial insemination can be carried out. In this application, the sperms collected from drones from colonies with a special breeder importance are injected to the queen bee which is grown for this special purpose with an artificial insemination device under a microscope in a laboratory environment. Artificial insemination of the queen bees is not a hard work, but it requires skill and experience. This application is carried out to control the breeding in order to obtain pure race or hybrid in researches and improvement studies rather than to produce queen bees to be used as production material.

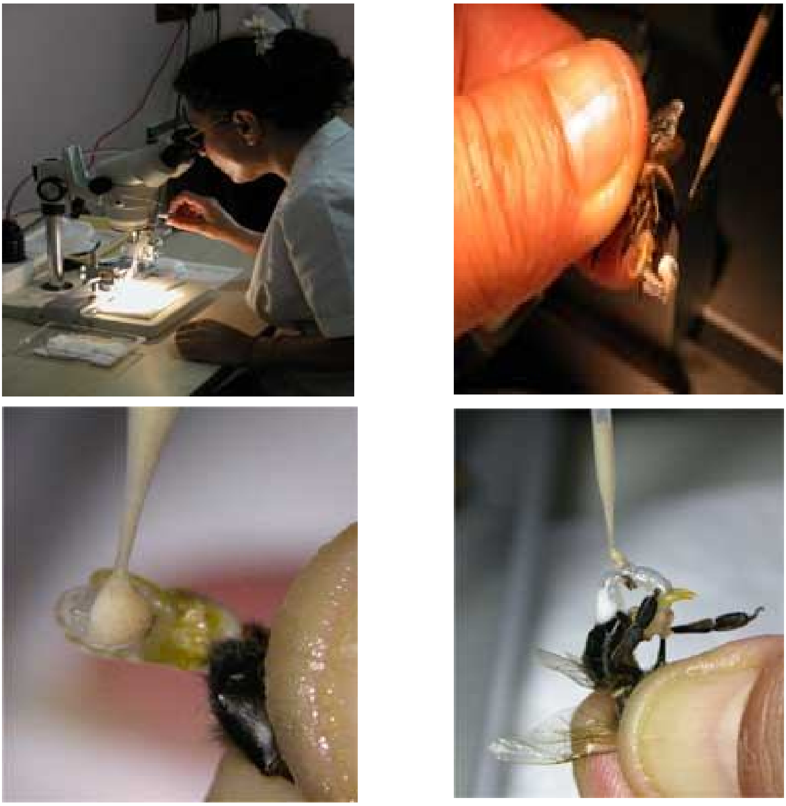

Photo 5. Artificial insemination

Placing the Queen bees in production colonies

Removing and selling or utilizing in other ways the queens which start to lay eggs in breeding boxes are obligatory in continuous productions. The most important process in placing the queen bees which starts to lay eggs in other colonies is to make the colony ready. For this, there should be no fertilized or addled queen or queen cell in the colony into which the queen will be placed. One day after disposing of the old queen in the colony where the new queen will be given, the cage with the queen bee is placed between the two frames with offspring in a way that ventilation and feeding holes will face to front and reverse sides. The exit hole on the side where the cake chamber is located is opened the next day and it is ensured that the bees eat the cake and remove the queen. After that, the beehive should not be opened and distracted; however 2-3 days after the queen and eggs should be controlled. In technical bee keeping, using the present queen laying eggs provide important benefits in queen losses or providing queen for artificial swarms. Gaining time of 25-30 days in queens' starting to lay eggs, eliminating the risk of not being able to breed for the queen bee produced by the colony and gaining material with a certain origin are among these benefits. However, despite its important benefits, habit of using present queen bee is not common enough among our bee keepers.

Section VIII:
Autumn and winter management of bees

1. Autumn maintenance and preparation of bee colonies for winter

Once the honey supers have been removed, the bees in the colony can be killed if you plan to buy package bees in the spring. If you wish to winter your bees then the colony should be examined to ensure the queen is still viable and that no disease has developed. Medicate the colony at this time. The colony must be fed sugar and water to ensure that it will have enough food to survive the winter. This feeding is best done before the end of September. The total weight of two supers, lid, bottom, honey, pollen and bees should be at least 60 kg. Towards the end of October the bee colony can be moved indoors for winter or wrapped to protect the bees from the elements. The autumn care and feeding of bees is the most important condition for the survival of the colonies of next year. It is always possible to decrease deaths of bees in winter and this is mainly related with the autumn care. Autumn care and preparation works for winter are made in colonies after honey harvest. Bees will adapt to the ecological conditions in parallel with the honey and pollen from the nature within their natural circulation.

The beekeepers who are not much well informed actually disturb the natural cycles of bees by taking honey and other bee products. Bee keepers in fact should perform the necessary actions that the bee keepers have to take in consideration of the many benefits provided by the bees and contribute to their life cycles. The condition of each colony, the existence and age of queen, the honey amount of colony and illnesses and pests should be noted on colony cards and evaluated in order to experience a winter time with the least loss. The winter care is initiated in the colonies after the honey harvest. The autumn care of colonies is very important for the bees to survive the winter without any loss or with the least loss. As beekeepers begin preparing and evaluating their colonies for winter, it is important to review the factors and conditions that are important to colony survival.

Successful wintering- depends primarily upon:

- Colony strength,
- Adequate food stores,
- Hive ventilation and
- Colony health.

Colonies need sufficient room for stores and cluster formation. Normally, two to three hive bodies are required. Stores should consist of 23 to 27 kg of honey and several frames containing pollen which is a necessity for early spring buildup. The distribution of the food in the hive is also important, since the cluster moves upward during the winter. Even if a colony is starving, it will not move down. Forty to forty-five pounds of food should be in the uppermost hive. body, with the centre two or three frames being only one half to two-thirds full. This arrangement provides the bees with adequate space for cluster formation. If the uppermost hive body is honey bound, then the frames in the centre should be exchanged with others from below that are only partially filled. All supers that are empty or only partly filled should be removed at the end of the fall honey flow. If queen excluders were not used, the lower hive bodies may be empty and they should also be removed. Colonies should not be wintered on foundation and all queen excluders should be removed.

In autumn:

- The general condition of the queen is examined and quality queen is provided to bee hives without bees.
- The honey stock is examined and its sufficiency should be determined. Combs filled with honey and

pollen are left in the colonies as winter food. However, the combs should not be fully filled with honey and the cells in the bottom should be empty. That is because the bees establish winter cluster on empty cells under the part of the combs filled with honey rather than the cells full with honey. The honey in molded combs, bad honey, low quality honey and honeydew honey should not be used as winter food. Whether 8 to 10 combs are filled with around 12 to 15 kg of honey as winter food for a colony filled with bees should be taken into consideration during the controls. 3 to 4 combs with honey left for the initiation and continuance by the bees of the raising of offspring should include sufficient pollen until the creation of fresh pollen especially in spring.

- The bee hives should later be examined technically and the breaks, cracks and water permeability should be examined. Weak bee hives are united and strong colonies are formed. The colonies with weak bee population and the colonies without queens, whose queen is old and ineffective, should be united. The level of adult bees in the colony should also be carefully examined. If the autumn feeding is performed, strong and young bees will be raised for the future generations and they will have a healthy winter. A strong staff will be prepared for the spring and the number of winter deaths will be decreased. If the bee hive is weak, it cannot establish a winter cluster and will die because of cold. In such cases, a division should be formed in the bee hive and the area should be narrowed down.
- The colonies should be examined for illnesses and parasite before winter. The fight against varroa in autumn should be initiated after the last honey harvest and when the breeding activity is low.

- Illnesses and parasites should be fought against after the end of honey harvest in autumn. Drugs should be added to the autumn syrup for preventing nosema and poor offspring. All offspring should open their eyes for Varroa fight.
- Offspring should be produced in autumn for successful wintering and there should be young worker bees and queen when entering winter. That is because young queens have less death risk compared to old ones and as they are better at winter breeding, the colonies with young colonies will have a more guaranteed winter.
- The colonies are fed with syrup after honey harvest even if enough honey and pollen are left in the colonies. The sugar-water rate of the sugar syrup prepared for autumn feeding should be 2:1 (2 pieces of sugar and 1 piece of water). The sugar syrup feeding of colonies will increase the rate of egg laying of the queen and ensure that young worker bees that are not worn out are raised. The colonies which enter winter with young bee workers will be stronger in spring without sacrificing many bees. The colonies wintered with young bees will develop fast by showing an affective offspring raising rate in spring. The colonies may be fed with cake instead of syrup at the beginning and end of winter. The cake is prepared by adding one piece of honey and three pieces of powdered sugar. Cakes should be as solid as to prevent it from melting and pouring on the bees due to the internal temperature of the bee hive and as soft as to be able to be eaten by the bees. The protein and vitamin need of bees may be satisfied by adding ingredients such as milk powder, barm and soya beans powder with no oil rich in proteins in regions and periods where and when there is a pollen deficiency during cake preparation. However, this feeding may cause some illnesses such as nosema and diarrhea. This should not be used when and where the pollen is sufficient.

Photo 1. Winter cluster

Photo 2. Bees outside winter cluster

Renewal of Queen

The queens which are deprived throughout the year are substituted after the honey harvest. As mobile bee keepers take their bees to different regions during the year, the ability of bees to lay eggs and the number of sperms in seminal pump; thus, mobile bee keepers have to renew the queen. Fixed bee keepers have to perform this process once in two years.

The scientific researches and applications show that the bee keepers who substitute the queen every year perform a more effective bee keeping activity. Old and ineffective queens should be substituted with young bees whose race is not known. The application should be performed in accordance with the technique by taking into consideration the condition of the hive. According to many researches, the new queen should be given some time to produce a new generation of worker bees during queen renewal. Thus, the colonies enter the winter safely and the number of queen losses in spring or the swarming tendency in honey season will be low. This process is very important in bee keeping. Not all works are finished with the honey harvest. Queen directs all genetic characteristics of a bee colony. The queen includes the entire genetic stock.

Photo 3. Colonies ready for winter

Colony care in Autumn

When a colony has a queen, 15 to 20 thousand young worker bees and sufficient honey in the bee hive, it will have a problem free winter generally in terms of feeding; if the worker bees are not young, the ones which come to the end of their lives die and many adult bees die in the colony.

If there are not enough numbers of workers to form the winter cluster, the colonies will not resist the winter conditions, they will not undergone sufficient improvement even if they reach spring and die under the bad weather conditions. The persons who perform bee keeping activities in regions where winter conditions last long should harvest the honey at the end of the season before the bees start plundering.

The bees should leave themselves some time to get prepared for the winter. The bee hive frames should not be controlled when the bees do not fly; that is because the bees make bee gum connections and possible controls will cause the disturbing of these connections and the bees cannot improve. These controls should be done in the active period. The colonies which lack sufficient conditions should be united; a strengthened colony rather than two colonies which may die due to weakness in winter should be prepared for the winter and the queen of the weak colonies should be taken and united with the other bee hive. A good preparation should be done for the autumn and the colony should be prepared for wintering with bees filling 7 frames.

The empty and unnecessary frames in the bee hive should be taken, the colonies should be suppressed with the division board and the bee hive should be covered with thick cloths. If the colonies are powerful, a separated swarm will be had after the honey harvest. A breeded young queen should be used in this separated swarm.

Autumn harvest

The boxes from the top of the hive, containing the frames with only honey in them, are cleared of bees and removed from the hive. It is usual to bring the boxes of frames into a warm room, as the honey is more easily removed if it is not too cold. The process of extraction - that is, separating the liquid honey from the combs - requires a lot of labour on the part of the beekeeper, as the photographs below illustrate.

Photo 4. Harvesting honey

First (above) the cappings must be cut carefully from the wax cells of the comb containing the honey. This is done with a sharp knife and a skilled pair of hands. The frames of honey with cappings removed are then placed in a machine like a spin dryer. The combs are seen in the photograph above, placed vertically in a wire mesh basket inside the drum of the machine.

Photo 5. Small electric and hand driven

Photo 6. Filtering honey extractors

The basket then spins around rapidly on its vertical axis, either turned by hand or by an electric motor. As the combs spin round rapidly, the honey flies out of the open wax cells, strikes the wall of the drum and trickles slowly down to the reservoir at the bottom. The liquid honey still contains small fragments of wax, which must be filtered out. The honey is therefore allowed to pass from the bottom of the extractor drum via a fine cloth into a second storage container. It can then be allowed to run into jars, ready for selling.

Satisfying honey requirements of colonies

The bee hives should have sufficient amounts of honey in order to spend a comfortable winter. The amount of the honey required to be in a bee hive should be one frame notwithstanding the location. There should be at least 2 kg of honey in a frame covered with bees. This should be capped outside the area in the middle bottom section of the frame where the bee will form its cluster. The cluster temperature will be regulated by the bees on the cluster in winter. However, the temperature of the bee hive outside the cluster cannot be regulated by the bees. The moisture in the colonies wintered with open honey will be emitted by the honey in the open cells. As the water rate in the honey, fermentation will start. This will be negative for the feeding of bees. Having 1 or 2 frames filled with honey is very important for the early development of the bees. These frames filled with pollens and honey will ensure the continuance of the colony development in the early spring when the bees do not fly, however the offspring development continues. It is known that the bees reach the honey in the bee hive by moving on the cluster and fed by it during the winter. The bees eating honey keep the temperature outside the cluster around 17 ^{0}C. This temperature is enough for the wintering of bees in the period without offspring. The worker bees keep the cluster by eating the honey. The source of the honey to be eaten by the bees during the winter should come from flowers. Honeys derived from sunflowers and cotton granulated in the cells should be preferred for wintering.

Autumn feeding

It should be ensured that sufficient amounts of honey are left for the feeding of bees during honey harvest. Collecting all the honey and leaving syrup to the bees are not a right application. The amount of sugar to be added to the syrups in winter should be around 1 to 2 lt in total per bee hive and this application should be done 5 to 6 times in two days. The bees should be fed with syrup when they bring pollen and fly. The syrup to be given to the bees in autumn should include 2 units of sugar and 1unit of water.

It should be stopped to give syrup in the late autumn and started to give bee cake. Nearly half of the nectar the bees extract from the flowers is comprised of water. Bees put water in the honey they have under stock while eating it, invert the nectar while storing the nectar they collect from the nature and decrease the water rate under 17% and store them as honey in combs and cap them. Worker bees use their invertase enzyme to change sugar to honey in case of excessive feeding. This enzyme is obtained from the oil and protein stocks of worker bees under the chitin. If no pollen is obtained from the nature, the enzyme will not continue to be made and the worker bees will become older and torn in a shorter time. The bees which get tired of turning sugar into honey will not be healthy during the winter and die in case of such an application. If not sufficient pollen is received from the nature, cake mixtures should be prepared with pollen, milk powder and bee vitamin. Continuance will be ensured in feeding with this method as new worker bees will be born in spring. There will always be deaths in the colonies of bee keepers which do not know or care about the feeding physiology of bees. The best source of feeding for bees is honey they make and the pollen they collect from the nature. However, no honey should be taken from the brood nests.

Preparation of autumn syrup: 1 lt of water + 4 kg of honey or ½ lt of water + 1 kg of sugar.

If stores are not sufficient, concentrated sugar syrup should be fed during September and October until there is the equivalent of nine full frames of honey not counting the cells containing pollen. The syrup is prepared by mixing white granulated sugar with hot water at a ratio of 2:1 by volume. Heat only until all of the sugar is thoroughly dissolved. Do not boil the syrup. Allow it to cool before giving it to the bees. Each gallon of syrup fed increases reserves by about seven pounds. The quality of the winter food is of considerable importance. Fruit juices and honeydew are not desirable winter foods since they contain large quantities of waste materials and may cause dysentery because the bees are unable to ripen the nectar due to cold weather. Aster honey also crystallizes very rapidly which prevents the bees from moving it into the clustering space. The feeding of syrup will help to improve or correct this situation. Feeding is normally done by inverting a jar or ten pound friction-top pail, with six-eight small holes in the lid, over the hole in the inner cover and protected by a super. Other ways include using a boardman or a division board feeder. However, the bees have to break their cluster in cold weather to take advantage of them. Depending on how much honey the bees have managed to store, the beekeeper will have to feed as much as ten or fifteen pounds of sugar, or more, to each colony. The sugar is dissolved in hot water, and the resulting syrup, once cooled, is run off to be fed to the bees.

The syrup is fed to the bees from a special container, which is placed over a hole in the inner roof or crownboard, which covers the frames of comb and bees. The bees can crawl up into this container from below, and come directly into contact with the syrup without falling into it and drowning. They suck up the food into their stomach, then go below to the wax combs and regurgitate the syrup into the wax cells, just as they do with nectar. Once they have evaporated the excess water from the syrup, it is sealed up by the bees, again just like honey. In this way it will keep through the winter without fermenting.

Photo 7. Feeding bees

Above, the disassembled feeder on top of the cover board, in which the central feed hole is visible. Below, the feeder has been assembled, filled with syrup and placed over the feed hole. All that remains is to replace the roof on the hive.

Disease control and fight against Varroa in bee hives in Autumn

If there is a suspicion of illness in a colony, samples should be taken and a diagnostics should be made and fight should be initiated with pesticides. It should not be forgotten that the pesticides used randomly will accumulate on the bee wax and the food and this in turn will cause problems in marketing honey and loss of market. If the pesticides used in treatment are administered according to the prescription, the results will be much better. The fight against Varroa is very important. The population of bees increases during summer months. And the varroa parasite will increase, too, in parallel with this. The condition will start the decrease with the death of old worker bees in the bee hive after the honey harvest. As the death rate of varroa parasite is lesser, varroas will focus on the remaining 20,000 bees when the number of worker bees in the bee hives decreases from 60,000 to 20,000. A fight against illness should be initiated in this period. If there is no fight, the younger worker bees to undergo the winter conditions will be attacked by the varroa parasite; the colony will face the winter conditions with weak worker bees and the wintering will not be good. The following are generally required in order to prevent this:

Sufficient information should be obtained about the biology of the bee and varroa. As known, Varroa reproduces by eating the bee larvae in cells. Some adult varroas feed from the bee blood. Some varroa parasites focus on the offspring and some on the bees in a bee hive with offspring.

The fight method should be selected well and no fight should be initiated when the offspring and honey are in the colony. Licensed pesticides should be used when the number of offspring is low. Effective results will be achieved by making good decisions to select suitable pesticides, perform good disinfection and using pesticides with an achievement rate over 90 percent regarding the fight against varroa. The rate of varroa in the colony should be lower than 1%. The pesticides to be used for the fight against varroa should not cause the death of bees, accumulate on the honey and bee wax, harm the queen, and should kill the varroa parasite.

2. Winter maintenance and wintering in beekeeping

The activities in the bee hives end with the winter season. The bees will go under the winter sleeping condition. The bee hives where the bees will be located should be covered from the top whose northern side is closed and southern side is open. Open bee hives should be located in places which are not subject to winds, water and humidity. The bee hives should be placed on a small table and be disconnected from the ground and be protected from humidity and water. Moreover, the place of winter cluster should be away from the noise that may cause the disturbance of the winter clusters of the bees. It should not be forgotten that the reason behind the deaths in winter is not the cold weather, but the insufficiency of heat generation and energy source in the colony, in other words, starvation. As stated before, the golden key of successful wintering is to have young bees and sufficient food stock while entering winter.

Bees will form a winter cluster by becoming together when the internal temperature of the bee hive is low than 14 °C. The temperature in the center of cluster can be 33 °C' and its outside area can be 6 to 8 °C. Bees generate the required temperature by eating honey and expand the cluster as the temperature rises. The bees which fall from the winter cluster with a single shake cannot go up to the winter cluster and die. The bee hives should not be disturbed during the winter and in cold period in order not to disturb the winter cluster. Leaving honey is very important during autumn examination. The bee hives with 20 to 25 kg of honey and 12.000 to 20.000 may have a safe winter. The most important work to be done by the bee keeper, fight against cold, can be ensured by narrowing the internal areas of the bee hive. The internal temperature of bee hive is affected by the outside environment temperature, the temperature of the environment of the cluster, the structure of the bee hive and the air conditioning in the bee hive.

When the weather is very cold, the bees come closer and form the community called “winter cluster”. The temperature will be 14 °C for winter cluster. The bees in the winter cluster generate heat and the ones around it will perform temperature insulation duty. If the temperature is below 7 °C, the winter cluster will be tighter. As the weather becomes very cold and the bees cannot fly, the precautions required for the winter conditions should be taken in the bee hives. If there are many bee gum resources in the surrounding area, the bees will narrow their entrance holes by themselves. However, if they do not narrow it down, then the entrance hole should be narrowed. The direction of the entrance hole of the bee hive should be the opposite of the cold and high winds. The bees cannot ensure the required temperature in the bee hive if these matters are not taken into consideration.

Sometimes the bee hives should be covered and protected against cold during outside wintering. Attention should be given to the fact that the flying holes are not closed. The bee hives should be located at a place receiving much sunlight, protected from humidity and not subject to strong winds. The best action that should be taken is to place the bee hives on tables with a height of 40 to 50 cm. If the bee hives are located directly on the ground, their contacts with the ground should be eliminated before winter. Moreover, they should be inclined towards the ground to ensure the water and humidity exit from the flying hole. Snows on the bee hives will not cause any problem. In the contrary, the bee hives will better protected against cold. The entrance holes of the bee hives should be controlled and opened especially during the days of heavy snow. The sunlight should be prevented from entering in the bee hive by placing a small piece of wood to the bee entrance during the days when it is snowing but also sunny by paying attention not to prevent air conditioning. That is because the bees which see the sun will try to go outside the bee hive during these weather conditions. But as it is snowing, they cannot fly and die. If the bees cannot be prevented from going outside, ashes, hay or grass should be placed in front of the bee hive in order to prevent the bees from landing the snowy area. Closed heating system may be implemented in places with hard winter conditions. The places to be used for these purposes have to be bright and air conditioned. The temperature should not change.

The flying holes should be closed with wire cages before the bee hives are taken to these places. They should not be taken inside in regions where it does not snow in winters. However, the autumn care and feeding should be good.

The importance of bee hive condition and bee race in wintering

The bee hive should have a slight elevation of 10 percent. The size of flying holes should be 1 cm for each frame according to the number of frames with bees. The combs without any bees should be taken from the bee hive and the gaps should be filled. The flying holes should be narrowed when the bees are active. The elements that cause humidity in the bee hive should be eliminated. The bees cannot be get sufficient air conditioning during winter time and the carbon dioxide gas should easily be discharged. There should be an air-conditioning hole in the bee hive. There are bees which adopt to the natural conditions of every region. This should be taken into consideration in the wintering region. Otherwise, negative conditions will have to be faced. Transferring the colonies to the original climate zone will be suitable for the winter season.

Winter care and wintering conditions

Vital to successful wintering is a large population of young bees that can live five-six months. Strong colonies with young queens are a must. Therefore, colonies need to be re-queened periodically, preferably every other year. Young queens lay later into the fall and produce more eggs in early spring. Fall re-queening should be done in September during the boneset, Spanish needle and golden rod flow; so the colony has time to build up. Only strong colonies should be overwintered. Weak colonies should be united with strong colonies in September so that they have time to arrange their brood nest and stores. Diseased colonies and weak ones that have suffered from pesticide poisoning should be destroyed since food stores may be contaminated. Weak colonies that successfully make it through the winter, build up slowly in the spring. Most colonies are wintered on summer stands, with reduced entrances, and no wrapping or packing. The cleat should be nailed into place with the opening turned up rather than down, to reduce the chances of mice entering and entrances becoming clogged with dead bees. Hardware cloth placed over the entrance will also prevent mice from entering the hive and destroying the combs.

Colonies should be located so that there is good air drainage. A wind break, either natural or man-made, that will break the full force of wind is important, especially in late winter and early spring when brood rearing has started. Woodlots, evergreen hedges, buildings, and board fences offer such protection. The hive should face away from prevailing winds and storms. A southern exposure is most favourable, since it will allow the bees to go on defecating flights more often during the winter.

Photo 8. Bee hives during winter

Winter management

If the bees are outside there is little that can be done to assist them. They will survive even if they are completely covered by snow for a while. If the bees are indoors ensure that the temperature stays low and constant (about 5°C) and ventilation is maintained. It is normal for bees to leave the hive during the winter and die.

Get bees ready for winter, begin to think of autumn management as the beginning of a new bee year. Things you can do in the autumn will reduce problems you may face in the spring. There are several tasks that need to be taken care of in the autumn after the honey is removed:

- First, an inspection of the hive is in order. The hive should have ample supplies of honey stores, a good population of bees, and the queen should have a good brood pattern rather than a spotty one. Disease is a concern, but if you started with package bees and new equipment, it should not raise its ugly head (American foulbrood). However, you should know what to look for.
- Second, autumn management to save your hive involves doing several things.
  a) Level your hive making sure the hive slopes slightly in the front so water does not run back into the hive from the landing area of the bottom board.
  b) It is time to use miticide strips to control Varroa. Check the catalogues for products and follow directions on labels. More hives die from mites than any other reason.
  c) Place an entrance reducer at the front entrance. This keeps mice out and winter wind damage at a minimum.
  d) Provide the bees with a wind break.

e) Make sure the hive has good ventilation. Air has to move about within the hive so that condensation does not collect and fall on the bees.

- Feed the hive with sugar syrup mixed 1:1 if they do not have enough surplus honey to carry them through the winter. This should be done before it gets cold.
- Third, autumn is a good time to replace a failing queen. Don't wait until spring.

Finally, if you have done all you can, don't disturb the bees during really cold weather. Bees will fly during the winter on warm days and on a day such as this, you might open the hive and check bee activity and get an idea of the number of bees in the hive but don't go looking for the queen. The bees need to conserve as much heat as they can. You can only do damage to the hive. The cold weather conditions mean that it is time to adopt the bees to the winter life conditions. Simple precautions taken in autumn will ensure the bee colony to have a safe winter time. A strong bee family in autumn will also be strong in spring. The egg laying process of the queen will slow down when the honey resources in the land decrease. The bee colony is converted into a brood nest from a honey chamber as its population decreases after honey harvest.

The works to be carried out in autumn in an order are as follows:

- **Control of food stock:** A bee hive with around 15 to 20 kg of honey will survive the winter. Therefore, honey frames from other bee hives should be placed in bee hives with less honey stock for winter. If there is honey but the honeycombs are yet to be capped, honey syrup will be given to the bees and these combs are ensured to be capped. That is because the honey in uncapped honeycombs will go bad in time.

- **Control of bee existence:** The bee hives with few bees should be united as strong bee hives can more easily overcome the winter conditions. Syrups should be given as an initiative to the bee hives which are not very strong but have many bees.

The queen will start again to lay eggs thanks to the syrup given and the number of bees in the bee hive will increase. Moreover, as the bee hive population becomes younger, there will be many more bees for the spring season. The bee hives with 7 to 8 honey frames will have an easy winter. The bee hives with 5 to 6 honey frames should be given syrups as an initiative.

- **Control of queen:** The condition of the queen should be controlled and bees which are ill, old or disabled in some way should be substituted. If it is not possible to substitute the queen in this season, such bee hives should be united with bee hives with healthy queens but little population. The colonies whose queen dies in winter cannot unite and get separated.

- **Physical control of bee hives:** The bee hive structure should be controlled and the problems that may be caused by heavy rains in autumn or winter conditions should be resolved. If the heavy rains leak into the bee hive, they may cause humidity and molds and result in the death of bees. The problematic bee hives and bee hive covers should be strengthened. Moreover, precautions should be taken to ensure that the bee hives have a safer winter.

- **Top cover control:** The top over of the bee hive should emit the excessive humidity in the bee hive. Therefore, a cloth should be laid on the comb frames. Paper pieces and clean trusses can be laid on this cloth. It is not true to place nylon and plastic materials; that is because such materials may cause humidity in the bee hive.

- **Bee hive division board:** If there are frames which cannot be occupied by the bees in the bee hive, these should be taken outside. A division board should be placed between the frame and gap in order to narrow the internal volume of the bee hives. A pillow filled with grass, cloth and paper can be placed on the free side of the division board to ensure a good insulation and can help the bees to be warmer.

- **Excessive amounts of honey:** The excessive amounts of honey in brood nest should be removed. The average honey need of a bee hive is around 15 kg. It means the bee hives with around 5 to 6 frames of honey can have a good winter. The bees in bee hives whose all frames are full with honey will have problems regarding heating.

- **Precautions against plundering:** The autumn months are full of plundering risks. The bees which do not have enough food may attack the other bee hives. Or the bee hives may be attacked by the robber bees which spend the winter in the bee hives but cannot collect enough food. The required precautions should be taken.

- **Precautions against pests:** As the number of bees in the bee hives decreases, the resistance of the bee hive to the illnesses or to other pests. Attention should also be paid to this matter in autumn months and the required precautions should be taken against the attacks by pests such as bee lauses, moths and digger bees.

Section IX: Bee diseases, treatments and precautions for organic honey production

1. Exotic pests and disease, surveillance program for exotics, exotic incursion responses

Honey bees and bee colonies may be affected by a range of pests. From the fully-developed bee to brooding, the structure of the beehive, inside and outside of the hive, there are lots of harmful pests that can endanger a bee colony. Greater part of these pests can cause diseases of bees that may weaken, or in some serious cases, may destroy the bee colony. Beside the “traditional” pests, some exotic ones have been appeared. The control of these pests is a national and European Union task. There are several Community legislations in this theme.

The Committee governs the trade of bees according to the Directive 92/65 EEC that was implemented by the 2000/462 EC Comission Decision. Special attention is paid to the control of a new pest, the small hive beetle (Aethinia tumida). This pest has already been appeared in the USA, and the European Union wants to avoid or prevent the introduction of the beetle into the Community. That is why strict regulations were enacted by the EU (1398/2003 EC Comission Decision). The small hive beetle, similarly to the large hive beetle (Hyplostoma fuligineus), is a native of South Africa. Accompanied with queen bee consignments, the small hive beetle was managed to get to North and South America, Australia, New Zealand and Egypt. This pest was also discovered in Europe: England and Ireland (1998), Spain and Portugal (2000), and Italy (2002). The small hive beetle develops through complete metamorphosis (egg, larva, pupa, and imago). The imago may lay its eggs anywhere in the hive, and the eggs hatch into larvae within

2-4 days. 2 or 3 beetle can provide as many eggs that may do serious damage to the bee family. The destroyer form of this pest is its larva, that is similar to the larva of the wax moth. Larvae's developmental period is 10-14 days. After having developed (7 mm long and 1.5 mm wide), larvae leave the hive, get into the soil and enter the pupa state. The pupa state varies between 15-60 days, it usually lasts for 3-4 weeks. After this state the imago comes out of the soil and gets back to the hive.

The small hive beetle is not a serious threat in South Africa, but in any other third countries (e.g. in the USA, etc.) where Varroa and other diseases may affect bee families, the small hive beetle is a great risk. The larva of the small hive beetle is omnivorous. The infection progress is rapid in the honeycomb. In the USA, people try to control beetles and pupae with chemicals. The application of chemical substances can only be started after removing the honey chamber. The most vulnerable development state of the pest is the pupa state. Larvae are unable to enter the pupa state, if the soil is too dry, too wet or in case of sandy soil. The metamorphosis can also be damaged by soil fungi. Another exotic pest of bees is the *Tropilaelaps mite.* If introduced into the Community, the *Tropilaelaps mite* could have devastating consequences on the health status of honey bees and on the apiculture industry. Both diseases must be notified in the EU countries.

<u>The occurrence of exotic bee diseases can be avoided by some preventive maintenance. Such as:</u>

- thorough cleaning around the beehive. Honeycombs should be stored only for a short time before the extraction of honey.
- application of contaminated instruments and honey chambers to other bee families should be avoided.
- only healthy bee families are appropriate for unification purposes.

The fulfilment of these animal health requirements is checked upon entry into the EU in veterinary border inspection posts, where documentary, identity and physical checks are carried out by official veterinarians. These measures guarantee the safety of bee imports while ensuring genetic resources for beekeepers and respecting the needs of pollinators especially in green houses. The importation of honey bees and other related species to honey bees into the EU shall be controlled and in case of suspicion of the presence of the small hive beetle, and a laboratory test confirms this, then the whole bee colony of the concerning apiary must be destroyed. At the same time of the diagnosis of the disease, an epidemic investigation must be carried out concerning the origin and the possible transmission of the disease and local quarantine must be ordered. The quarantine must be lifted if expressly no small hive beetle is present any more.

Development period of honey bees may form suitable setting for many diseases factors and pests. So a number of pathogens and pests may cause a disease in the honey bees. Diseases of honey bees are one of the most important factors that prevent the development of bee keeping and limit the production activity in our country. As the development period of the bee forms a suitable setting for many disease factor and pests, it is observed many diseases and pests in the bees. Moreover, fast transportation in the world, trade of bee, bee products and bee keeping materials between continents and countries cause spread of bee diseases over all countries in a short time. Similarly mobile bee keeping is also important factor for the fast spread of diseases and pests within the country. Bee diseases are generally observed in spring months. The leading reason of it is unexpected cold and rainy weathers and offspring raising activity to gain speed in the spring months. Therefore it should be paid great attention in order for the colonies not to catch cold in the colony control to protect the bees against especially offspring diseases in this critical period. Bee diseases can be classified based on the factory causing the disease as bacterial (American and European Foul Brood, Septicemia), fungal (Chalk and Stone brood), viral (Chronic and Acut Bee Paralysis), parasites (*Varroa jacobsoni* and *Acarapis voodi) and* Protozoan (*Nosema* and *Amoeba*) and according to the host in which diseases occurs, Adult Bee and Offspring Diseases. Many pathogens can cause disease in either development period of the bees or their adult period. However all of these pathogens are not dangerous at the same degree.

2. Management strategies for disease prevention emphasising the use of management and intervention techniques listed in the organic standards

The need and method of the management of bee colonies are determined by the biology of the bee colonies and the production trend. Examinations are never unilateral. Beside the principal aim, there are several things that beekeepers should pay attention to, such as the mood of the bee colony, its localization, brooding, and tidiness. Always make notes about the observations!

The date of the handling should be adjusted to the weather and the temperature. It means that do not open the hive when the temperature is below +14 ^{0}C. It is recommended to start the examination in the morning. If the weather is hot, before storm or rainfall, in the noonday hours and out of foraging season, bees are much more aggressive than on another occasion.Make sure that the smoker is working.Beekeepers have to be protected against bee stings, because of the harmful effect of the bee venom. Provocation of bees should be avoided! An aggressive bee colony or an attacking swarm makes more difficult the handling. The handling should be done by wearing clean and odourless clothes. Sweaty or odorous clothes and body and scented or alcoholic breath may irritate bees. The hive should be opened as silently and carefully as possible. If some smoke surrounds the frames, bees calm down because they start to consume honey and their abdomen distend. Now the open mesh floor can be opened. If a bee sting is received, the stung area should be washed down immediately, because the scent of the venom and the secretion of the bees' mandibular gland may attract other bees to attack. If one frame has been removed, it makes easy to access the rest of the frames. During the examination frames should be held vertically. During handling, the beekeeper has to follow a logical order. After having finished the work, around the hives and the apiary should be cleaned up and the instruments should be arranged. It is highly recommended to avoid handling when the weather is wet, cold or windy, from dusk till morning, during robbing and the main forage. During the examination the beekeeper can observe the presence of the queen, her oviposition, the size of the brood nest, the food supply, the drone brood, the symptoms of the diseases, the presence of the pests (ant, moth, earwig), the inside cleanliness (mould, dead bees, rubbish, mummies), the population, the capped honeycombs, the size of the exits, the shading of the hive etc. The frame or the honeycomb that is being examined should be held above the hive or nest (if the queen falls down, she will land in the hive/nest). The brood honeycomb should be removed only for a very short time, because the nest may get cool and the capped brood may get cold.

During handling, bees may become aggressive in the following cases: if the hive is opened in an inefficient way, if the collector bees are inside the hive, if the weather is raw, cold, wet or hot. The situation is the same if there is no foraging during the season, or if the bees collect from certain plants (gooseberry, rape), or if the bees got poisoned. Bees can also become aggressive if the handling is too slow or hasty, if the hive is queenless, if the bee population is too old or has a false queen, if the smoker is not used in time, if some bees are killed accidentally during handling, if some stranger, scout bee tries to approach and explore the honeycomb, if the beehive is exposed to the fiery sun, or one hour before feeding. Bees are peaceful in the following cases: if they suffer from nosemosis, in case of chalkbrood, if the weather is clear, calm and sunny, during foraging, if the bee family has eaten enough, if the hive is unpopulated, in the morning or in the late morning hours, if the old bees have been returned to the hive.

<u>In order to prevent the occurrence of the diseases, the beekeeper should pay attention to the following things:</u>

- the apicultural year begins after the last extraction of honey of the season, when the beekeeper starts to prepare his bee colony for the winter and the spring development,
- it is recommended to cull queens older than three years. Honeycombs, that are older than three years must be sorted out that makes the self-purification possible to the bee colony.
- worn out and cracked hives may endanger the health of the bee colony in winter. The inhabitants of this kind of old hives should be migrated into a new and modern hive. A hive with excessive inside moisture is not suitable for beekeeping,
- it is good if the queen naturally decreases her oviposition in August, thus the colony fills up the empty honeycombs as a preparation for the winter. Thus, only one task remains: the honeycombs with pollen have to be filled up until September.
- the honeycombs should be put back into the hive from where it has been removed before the extraction of the honey, otherwise, 3-4 bee families may get infected.
- honey extractors are the main possible fomites (e. g. foulbrood), that is why they and their parts must be sterilized from time to time,

- beekeepers usually perform artificial swarm manipulations to increase colony numbers. Artificial swarms rarely get foundation starters, they rather get brood frames or empty frames, that can easily transmit infections,
- the stranger queen can also transmit pathogens, parasites
- mobile apiaries are used to increase the beekeepers' profit, but they can accelerate the spread of the infections too.

Nowadays, organic foods start to gain ground, so more and more organic products are produced. The situation is the same concerning honey production. There are more and more organic apiaries are established and organic bee products are produced. At organic apiaries, a special attention is needed to the spring season that can help, but can also prevent the development of bee colonies. During the examination of the hives and the stock in spring, it is very important to check the surplus winter food supply, if there was no spring foraging. The bee colony must be fed if necessary, because the degree of rejuvenation, the population, the strength and the health condition of the colony depend on it. If the weather is favourable, the blooming of the fruit trees has a very good effect on bees: it can help the development of the bee families and the gradual generation change. Young bees like building foundation starters too. They do not just build, but extend the nest, so make it depends on weather and foraging.

The EU organic standards (Council Regulation (EC) No 834/2007 and Comission Regulation (EC) No 889/2008) declare that a detailed description must be done about the agricultural holding. This Organic System Description is the basis of the certification and it is for the inspection of control bodies.

According to the regulation, the following things must be paid attention to:

- Selection of the hives, and the aspects of their location
- Moving the apiary,
- The origin of bees,
- Feed, veterinary treatments, disease prevention,
- Harvesting and processing bee products,
- Parallel husbandry,
- Storage,
- Packaging and labelling of bee products,
- Disinfection, cleaning and pest control.

Precautions that were made in order to avoid the contamination with prohibited materials or substances in the different level of the production chain:

- during collection (what precautions have been made to avoid the possible contamination - distance, map, owner's declaration, registry etc.),
- traditional beekeeping and its products (similarly to the previously mentioned),
- during handling, storing and transportation of animal products (technological process and check points that can prevent contamination),
- other critical points – GMO, ionizing radiation (what precautions are needed to prevent them – registry, bee pasture, incoming material control etc.).

What is organic honey?

Organic honey is collected from a clear and chemical free pasture, and does not contain any chemical, medicinal or antibiotic residues. If bees can collect pollen and nectar continuously from spring to fall, thus the appropriate feeding may prevent them from several bee disease. If medicines are not required, medicinal residues cannot get into the honey. Natural substances (lactic acid, oxalic acid, formic acid) should be used against Varroa mites. These substances can be found in nectar or sorrel in small quantities.

Honey *bee*s commonly *fly* up to 5-6 km to *collect nectar* and pollen; drones may perform up to a 10 km flight to mate a queen bee. However, the intensive collection takes place within a 3 km range. That is why it is so important to avoid any polluting factor (e. g. crowded highways or industrial units emitting smoke or chemical residues within 3 km range etc.). The organic apiary should be placed to an area where field crops are not treated with any chemicals within 3 kilometers range. The organic honey is a pure food product containing full value vitamins, enzymes, amino acids, aroma and smell materials. One of the main missions of an organic apiary is to preserve the materials in the honey for a long time. Enzymes of the honey are thermo sensitive. High temperature (above 20 ^{0}C) is harmful for honey. The optimum temperature for storing honey is 12-14 ^{0}C. Aging of honey is much slower at this temperature. That is why the expiration date is only 2 years in case of organic honey.

3. To promote awareness and surveillance for exotic pests and diseases thereatening the beekeeping industry

The Animal Health Strategy for the European Union (2007-2013 – "Prevention is better than cure"), was adopted in 2007 and was followed up in 2008 by an Action Plan with specific actions grouped under four pillars:

- Prioritisation of EU intervention;
- A modern EU animal health framework;
- Improving prevention and crisis preparedness; and
- Science, innovation and research.

Partnership and communication with stakeholders are two key principles of the Strategy. Possibilities for non-legislative initiatives to promote a higher level of responsibility for, and awareness of, diseases amongst producers are also being explored. In the past decade several health problems have affected the beekeeping sector in different countries worldwide. In particular, in recent years, there have been several reports of increased mortality in bees both in the EU and elsewhere. This has caused serious concern all over the world, but scientific studies have not been able to determine the exact cause or the extent of these increased mortalities.

Nevertheless, the health of bees is linked with many factors of a different nature (bacterial, viral, parasitic, etc); availability of appropriate treatments; invasive species; and environmental changes. Other factors to be considered include the use of pesticides in agriculture. At least in order to clarify if and to which extent they may play a role in bee health.

4. Bee diseases and GMOs

As regards genetically modified organisms (GMOs), although so far no evidence has been found for a link between them and bees' health, the Commission will continue to closely follow any developments in this area. The legislation in force provides for animal health certification and requirements for the movements of bees between Member States. These requirements are intended to prevent and control a number of bee diseases, namely American and European foulbrood, small hive beetle and Tropilaelaps mite, which can spread via the movement of bees. The small hive beetle (Aethina tumida) and the Tropilaelaps mite are exotic to the EU. Their notification is thus obligatory, so that Member States may take immediate action in the case of an outbreak. However, the above requirements do not cover an important bee parasite (Varroa) that is present and well established in the EU, because restricting bee movements would not limit the spread of this disease agent, and would be a considerable burden on beekeepers.

Other diseases considered endemic in the EU are treated in a similar way. Financial support is given to Member States in order, inter alia, to fight Varroa. There are animal health requirements for imports from third countries of live bees and bumble bees to avoid introduction into the EU of exotic bee diseases. These have been applied since 2000. The small hive beetle caused major losses to the beekeeping sector of the countries in which they had been introduced, and therefore the EU import rules provide that only queen bees and colonies of bumble bees from biosecure premises can be imported from third countries.

These requirements have been put in place in order to reduce the risk of introducing new diseases into the EU. The fulfilment of these animal health requirements is checked upon entry into the EU in veterinary border inspection posts, where documentary, identity and physical checks are carried out by official veterinarians. These measures guarantee the safety of bee imports while ensuring genetic resources for beekeepers and respecting the needs of pollinators especially in green houses. The problems of the bee-keeping sector and the decline in the bee population all over the world are complex and diverse and have raised various concerns, among them the lack of adequate medicines to treat bee diseases. The surveillance systems in the EU Member States are, in general, weak. There is a lack of representative data at country level and comparable data regarding colony losses at EU level. There is also a general lack of standardisation and harmonisation at EU level as regards the data collected. No effective harmonised control system for bees has been set up to estimate the extent of bee mortalities or to prevent them as much as possible. Fully harmonised requirements are in place in the EU as regards veterinary controls for imported live animals and products of animal origin including honey and other apiculture products.

These controls are carried out by the competent authorities of the Member States at the EU border inspection posts in order to ensure that the products imported from non-EU countries respect the EU health import conditions, and offer guarantees equivalent to those that apply to EU products.

As regards GMOs, increased bee mortality has been reported all-over the world, however, no difference has been reported between the areas where GMOs are extensively cultivated (like the Americas) compared to those areas in which GMOs are much less common (like in Europe), or even in those EU Member States in which GMO cultivation has been prohibited. This situation does not support the hypothesis that increased bee mortality is related to an increase in the cultivation of GMOs. EU legislation is very prudent in this regard. Before a genetically modified plant or GMO can be released into the environment and/or cultivated, it needs to be authorised under Directive 2001/18/EC or Regulation (EC) No. 1829/2003 following a thorough scientific risk assessment of the EFSA, which includes inter alia, the potential adverse effects of GMOs on bees. Bee health is also affected by biodiversity loss. One of the main direct causes of biodiversity loss is land-use change and mismanaged intensification on the one hand, and land abandonment on the other hand, as well as the loss of traditional farming and forestry practices, which have often generated species rich habitats. Habitat loss and fragmentation, pollution and pathogens are some of the potential factors behind this trend. Other drivers may be the disruption of pollination timing due to climate change; the spread of invasive insect species out-competing native pollinators; and invasive plants drawing native pollinators away from native plants. The Commission is promoting research on conservation, restoration and sustainable use of pollinator diversity in agriculture. Bees which have access to a mixture of pollen from different plants are healthier than those fed only one type of pollen. Results of a recent study suggest that an environment with sufficient biodiversity to maintain the ecosystem service that is pollination is critical for bee health.

5. Using IFOAM, or local standard as a guideline identify and describe and suggest appropriate treatment of identified bee diseases

Agricultural products should only be labelled as organic if the producer takes part in the control system of organic farming, keeps the regulations and has the appropriate certifications. The International Foundation for Organic Agriculture (IFOAM) and its member organizations define and control the requirements for ecological farming products. Council Regulation (EC) No 834/2007 and its implementation regulation, Commission Regulation (EC) No 889/2008 entered into force from 1 January 2009. Commission Regulation (EC) No 1235/2008 controls the imports of organic products from third countries. Most people realized that minerals and vitamins are missing from our everyday nutrition. Organic honey is a kind of natural foodstuff fully containing vitamins, enzymes, amino acids, and flavoring substances. Organic honey does not contain any unhealthy antibiotic, chemical or drug residues. One of the main tasks of organic apiarists is to preserve the living substances in honey, such as vitamins, enzymes and amino acids.

Nowadays, it is a great challenge for beekeepers to produce natural and pure products. Bees could live on for millions of years without human intervention, but now they do not have this ability. This was caused by the worldwide spread of Varroa destructor. In order to survive, bees require constant human care. In traditional bee keeping, pesticides are usually used in the hives against mites and other pests, therefore, bee products may contain some residues. Pesticides are often harmful for bees too, and can cause a weak immune system. In many cases, neither the timing of the treatment guarantees residue free honey, because the fat-soluble, synthetic substances may accumulate in the wax and get in the honey during the extracting. The environmental pollution, the agricultural chemicals and the traffic impact heavily the purity of bee products.

Purchasing bees, conversion

The requirement of producing organic bee products is that rules have been complied with for at least one year, and during the conversion period the wax shall be replaced with wax coming from an organic beekeeping. The wax replacement is needed because chemicals, which have been used before the conversion, may accumulate in the wax (e. g. residues of the different pesticides) that may contaminate bee products. The bee keeper should choose the gentle Carniolan bee that is the most suitable for local conditions, and has an excellent productivity. Bees must come from an organic apiculture and the colonies must be kept according to the ecological rules. Colonies come from non-ecological farming can also be introduced into an ecological apiculture under certain conditions: yearly, 10% of queens and colonies (package bees) can be replaced with those come from conventional farms, provided that the colonies have ecological combs, wax comb-foundations and foundation starters (there is no conversion period needed in this case). The replacement of the queen may be done as circumstances require. In case of a huge colony loss due to health reasons or a disaster and the bee keeper cannot obtain some ecological colonies, the apiary can be renewed with traditional colonies, provided that the bee keeper has the appropriate temporary permission for it and performs a conversion period.

Placing and keeping conditions

Apiaries should not be placed near contaminating sources within the flight range of bees, thus the contamination of bee products and the decline of bees' health can be avoided. An area with ecological culture, natural vegetation, forest, or stock of plants treated by methods causing low environmental damage should be found that can provide the appropriate pollen and nectar source. So, there should be a safe nectar and pollen source within the circle with radius of 3 km of the apiary. However, there are not just grown blooming plants but wild plants and different weeds providing pollen and nectar for bees. There is no need to keep the above mentioned requirements in case of wintering and non-flowering stock of plants. In case of ecological apiculture, the hives must be made of natural materials, and it is important that neither these nor other materials can be used for the hive that should pollute the environment or contaminate bee products. Only organic wax can be used for wax-combs. If organic wax cannot be found on the market, traditional wax can also be used if it is free from any substances forbidden in organic apicultures, or if it comes from an apiary where uncapping method is used. Beside the permitted substances, only natural ones can be used for treating colonies. Synthetic bee repellents are not allowed to use. Extraction methods of bee products resulting in bees' death are forbidden to use. Combs consisting open brood must not be extracted. Clipping queen bees' wings is forbidden in organic beekeeping.

Feeding

There must be left enough stored pollen and nectar in the hives for wintering. Feeding is allowed only in the following cases: if the weather conditions endanger the survival of the animals, and 15 days before the beginning of between the period of the last honey extraction and the next nectar producing season. Organic honey, organic syrup or organic sugar can be used for feeding purposes. In case of unusual weather or disaster, if needed, feeding is temporarily permissible (with organic food only). This permission must be documented.

Bee health

Prevention has a significant importance in organic bee keeping too. Physical treatments are allowed for disinfection purposes, such as steam and direct gas flame. Chemicals can only be used in traps in order to protect frames, hives and combs against rodents. Furthermore, substances can be used which are permitted in organic plant protection. If bees get sick they should be treated immediately, and sick colonies should be quarantined. In case of Varroa mite infection, formic acid, lactic acid, acetic acid, oxalic acid, menthol, thymol, eucalyptol and camphor can be used. Treated colonies should be converted again with a one year conversion period. Brood management (young colony, swarm condition, artificial swarm, etc.) is a kind of **biological control** against mites. The main point of this method is that the mite reproduction cycle progress is broken off by inserting a brood free period into the brooding season. Since there is no brood in the hive, the mite population will decline. After it, one of the permitted substances should be used as a second strike on mites. Some laboratory tests are in progress to use bacteria against mites but its large-scale applicability is not available yet.

Using drone frames is a kind of mechanical control against mites. The heart of its matter is the usage of a building frame. Springtime building activity of bees is a good opportunity to the extension of the nest and therefore the installation of the building frame too. The capped drone brood should be removed from the hive and should be uncapped before hatching. Formic acidic, oxalic acidic or other treatment should be used when the last capped building frame has been removed. **Oxalic acidic** treatment should only be used if the colony has no brood. This treatment should be done if the temperature is about 8-10°C. Depending on the number of the bees, the sides of the combs are needed to spray with 4-5 ml solution of 3% made by a pharmacy. Oxalic acidic treatment is suggested to use twice, 10-14 days after foraging. The first one should be done right after the extraction of July-August, and the second one in September. Long lasting evaporation is not harmful. In case of strong infection, genial climate or no wintering, at least two treatments are needed to be done lasting for 3-4 weeks.

Heat-treatment is a kind of physical control. If the temperature is raised up to 40-45°C in a colony with no brood, mites will perish. However, this method should be done with care.

It is important to keep a record of the permanent site of the apiculture and the identification of the hives and their places. The supervisory organization must be informed and agreed about the migration of the apiary and its date. Extraction dates, results, important actions and the materials used in the apiary must be recorded. After having checked the documentation, and there are some missing files, they should be made up on schedule and should be presented to the inspector. The mission of the organic bee-keeping is to produce chemical-free and healthy honey; however, it should be done with care and needs special attitude.

6. Seasonal cycle of honey bee colonies and diseases

A honey bee colony needs healthy bees to produce full value honey and other bee products in a year. A colony consisted of healthy bees ensures the common behavioural standards in every season. The success of wintering depends on how the colony was prepared to this crucial period. Successful wintering will help and establish spring development of bees. After the last bee pastures have been shed their blossoms (e. g. sunflower), extraction should be started as soon as possible. The previously finished feeding should be resumed in order to replace superannuated bees.

A winter nest should not contain any young combs because they are bad heat conductors and will not keep the warmth in. No old combs should be used in a winter nest because they can easily become the hotbed of diseases. Nest management should be carried out after the last honey collecting period ends in order that bees can process, ripen and seal the winter food coming from feeding. The main goal is that bee colonies do consume winter food until the middle of September. After having prepared for wintering, bee colonies should be examined, uncapped combs should be removed and the stored food should be refilled, if needed. If everything is done, the winter covering of the hives should be started. A good covering material ensures adequate heat insulation. A bee colony that lives in a hive with leaks, or exposed to winter winds will suffer a lot. In the interest of the winter rest of bees, rodents, birds and other animals should be kept away from the hives; even snow should not be cleaned from them. Bee colonies must be harked from time to time in order to make sure everything is all right with them. Noises coming from a hive may refer many things. Consistent humming refers to that the colony feels well; wintering is going on without any problem. In the winter period, if the daily temperature reaches the 8-12 ^{0}C in the noonday hours, bees will leave the winter cluster and fly out of the hive. Bees defecate outside in order to shed the undigested food accumulated in their colon. The higher the temperature, the more intensive the cleansing is. Bees would chill and die if they flew on the snow. That is why a black coloured plastic covering helps them to fly up into the air again and get to the hive. If some liquefied honey is found in the hive during the examination it should be replaced with some healthy honey.

Towards the end of winter, life begins in the colony: the queen starts laying eggs and the nest’s temperature rises up. It is the time to start feeding bees with some sugar patty or with some industrial food that can contain some medicine too. The reason for this is that the beekeeper prepares bees to the early foraging, in which up to 40-80 thousand workers may take part. During the examination in spring, the beekeeper will make sure whether the colony has a queen, whether the food is enough or whether the nest is too large. If the beekeeper experiences that the queen started laying eggs, the bee colony will develop well. If drone brood can be found instead of worker brood in the hive or the bees' humming indicates that there is no queen in the hive, the beekeeper should make interventions. That is why 10-15% spare queen should be kept. Drone eggs laying queens must be killed. It is much more effective to provide a queen for a colony in early spring than another time.

In early spring, when there is no adequate foraging and feeding, bees' searching then robbing behavior may develop. Bees look for honey during searching. In case of a weak colony, alien bees will fight down the guards, get in the hive and absorb honey. The robbing starts after a honey source has been discovered by searching bees. During robbing, alien bees invade the robbed colony's combs and carry away their honey. In order to prevent robbing, entrances of the hives should be made narrower and cracks should be fixed etc. Providing (lukewarm) drinking water for bees at the first fly out in spring is another criterion for their development. Lukewarm water gives 20-25% better efficiency in bees' development than cold water. In spring, general examination should be carried out when daily temperature reaches 14-15 ^{0}C in the shade. The aim of the examination is that the beekeeper observes the development of the colony and checks whether the former defects and faults have been ceased or not. The queen should not be searched for if the frames contain extensive, uniformly capped and different aged brood. Faults and defects must be ceased (e. g. queen replacement, food supply etc. in case of a brood disorder). Stimulating feeding of bees is a widespread method to increase the amount of brood. There are several stimulating feeding methods, such as feeding thick then thin golden syrup, granulated sugar or pollen etc.

Chronological tasks from the beginning of spring to the main forage

At temperature 10-12 ^{0}C	A quick examination. Feeding some medicated or pollen patty, decreasing the size of the nest, strengthening the covering, providing a queen for the colony or unifying them, setting up a watering hole, pollen supply.
At temperature 14-16 ^{0}C	General examination, food supply, replacement of low quality queens (queen exchange, unification), migration in order to collect pollen and nectar, hive cleaning.
At temperature 18-22 ^{0}C	nest extension, food control, health inspection.
Late spring	Nest extension with some wax-comb, general inspection, weakening overdeveloped colonies, and strengthening medium ones.
Summer	Equalizing bee colonies, in order to prevent swarming a beekeeper can remove cells, open the honey chamber, and migrate the apiary.

If the weather is hot the bee cluster extends and covers more combs than in case of cold weather when it shrinks. The ideal temperature for brooding is 34-35 ^{0}C. A nest can be prevented by covering it, making the entrance narrower and closing up the top of the bee spaces. Healthy colonies with adequate population should be kept in production.

The production trends

Artificial swarming, mellification, queen rearing, wax production, royal jelly and pollen production etc. Mostly the good bee pastures, good weather conditions, the well developed bee colony and the adequate number of combs promote the production. After the honey and other bee products production of spring and summer months, bees' seasonal life cycle continues with the preparation for wintering that ensures the physical and seasonal cycle for honey bee colonies.

7. Bee Diseases

7.1. American Foul Brood

Etiology and pathogenesis

The disease agent is Paenibacillus larvae, a Gram-positive motile bacteria. The vegetative forms may give rise to spores, exceptional resistance to physical, chemical and environmental agents, making P. larvae especially dangerous. The infection is transmitted only through food contaminated with spores. The larvae between 1 and 48 hours are the most receptive. However, with the increasing of concentration of spores, the risk of infection increases as well for older larvae. The spores germinate not before the third day after hatching, and only in the last stage of the larval life of the bee, after the capping of the cell there is rapid multiplication of bacteria. It pours from mesocolon into the haemolymph and from it to the various organs in septicemic form. American foul brood is a very dangerous epidemic illness that is observed in honey bee larvae and causes the dead and rotting of larvae. Larvae of each three bee individual are affected by the disease. The reason of the disease is a sporulated bacterium called *Bacillus Larvae*. Bacteria spores are in the shape of slight spindle and have the length of 1.2 N and width of 0.5 N. While *Bacillus* Larvae spores do not cause threat for adults, it is pathogen for Larvae and Pupas. Spores, cause of the American foul brood, can live for 30 minutes at least in the honey heated up to 100 Co, 20 minutes in 116 C o, 33 years in Bee Hive, 60 years on the earth and 45 years in the basic comb.

Transmission and spreading features

Disease spores are transmitted to the larvae in the comb cells through the contaminated food during the feeding of this larva. Nevertheless larvae are immunized due to the bee milk they take in their first 3-day period. It is not effective on the elder bees which are fed with honey and pollen. Disease carrier bees, which transmit the disease to the larvae in the cells during the feeding, are not affected itself. Larva catching the disease weakens and dies in the pupa period. So bacteria transform to spores. The number of spores generated is much more than the number transmitted to the larva. Infected pupa can carry 2.5 billion pupas. Dead larvae are tried to be cleaned by the worker offsprings. In the meantime, spores are spread everywhere in the bee hive.

Transmission and spreading between the colonies are caused by different means including contaminated material used by the bee keeper, contaminated honey, using them for the health of colonies, taking swarms, befuddlement, plundering, bee and frame transportation. Spores entering the digesting system of the larvae through the food given reach intestine after one day and develop there, they reproduce by passing to the blood tissue and spread to all body by destructing intestine sugar. Off spring dies 9-10 days after hatching during the prepupa or pupa period.

Symptoms and Diagnosis

After their death, the larvae or pupae show a colour change. From pearly white it darkens. The texture becomes watery and then sticky. The latter alteration makes the extraction of the dead larvae filamentous. Another characteristic of this stage is the smell: pungent, of putrefaction. Finally, there is the complete drying of the larva, which remains attached to the bottom of the cell wall. In this phase it contains billions of spores. It is very difficult to recognize the newly transmitted disease in the strong colonies. It is observed decrease continually as the disease proceeds. Worker bees, which were previously working eagerly and lively, start to display laziness and disease. In strong colonies, open or sick offspring are removed out of the bee hive by the worker bees.

- In healthy colonies, offspring distribution is regular and thick in breeding sites, while it is irregular and dispersed in sick colonies. It is in abandoned state with the removal of dead larvae. Open, close and empty cells are mixed up with each other.
- In case of closed offspring cells, eyelids are fallen down and eyelids of some offspring with closed cell are punched or its color has faded and the offspring in it has died.
- Offspring dead are mostly observed during prepupa or pupa period in case of closed offspring cell.
- Dead offspring stick to the side surface of the cell longitudinally and start to decay. The color of the dead offspring is primarily medium white, then it turns to light brown and finally bold brown.
- Dead offspring has watery consistency and are a bit sticky. As decaying proceeds, color darkens, stickiness increases, if it were to pull along the offspring residue by inserting matchstick to the punched cells, it is seen that residue stretches for 5-

10 cm. In this period, dead offspring residue is its extension stuck to the bottom surface of the cell. Bees cannot this type of dead offspring from the cells.

– If the offspring dies in pupa period, tongue of the bee becomes stiff and rises and stretches towards to the eyelid as to divide the cell two parts. In the advanced period of the disease it smells as aged glue.

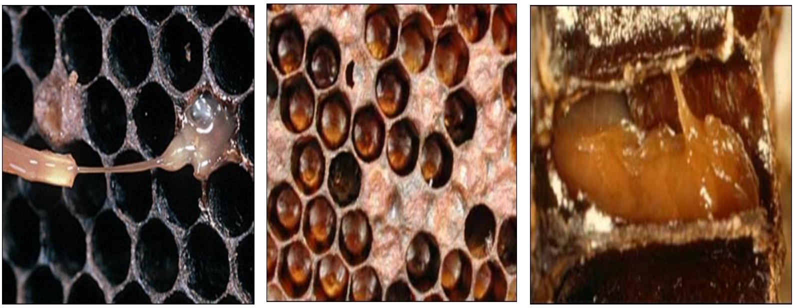

Photo 1. Comb cells in the American Foul Brood

Propagation

It takes place within the same beehive during cleaning operation, there is a typical presence of perforated cell caps, which contributes to the dissemination of spores in the food. Among beehives is due to sacking, drifting, and above all, for the incompetence of the beekeeper.

Prophylaxis and therapy

To reduce the chance of infection, it is necessary that the beekeeper is aware of the biology of this bacteria and consequently of the mechanisms that prevent the contamination and the spread to the whole apiary. Periodic inspections, the use of safe materials, the removal of abandoned beehives can significantly contribute to lower the risk of infection. Once ascertained the presence of the disease, it is rationally agreed upon the destruction of the family and of the infected material. The hives can be disinfected with 10% sodium hydroxide in boiling water for at least 3 minutes.

The use of gamma and beta rays is also safe and they even allow the recovery of combs. Treatment with drugs (antibiotics), banned in Europe, allows non-germination of spores but does not eradicate the problem. It hides it. In addition to this, their side effects are widely known in relation to the contamination of honey and to the resistance-inducing factor. The selection of strains of bees resistant to the insidious disease is very interesting, the latter being not insidious for those families that are able to find and o get rid promptly (in less than 24 hours) of the sick brood.

- The honey taken from the sick bee hives should not be given to other colonies.
- It should not be given bee, comb and offspring from the sick colonies to the healthy colonies, it should be paid great attention during mating and wrong practices that encourage the plundering the bee keeping should not be applied.
- It should not be taken swarms from the sick colonies and they should not be used.
- Uncontaminated, disinfected basic comb should be used.
- Materials used in the sick colonies should be exposed to flame and those unresisting to the flame should be washed with water containing 10% soda, and hands should be washed with soap.
- It should be worked with strong colonies and fought against other colonies and parasites.
- If the disease has advanced too much and reached to the stage that cannot be treated with medication, combs and bees in the colony should be fired and the bee hive should be scorched.

Fighting against American Foul Brood

Destruction of colonies: American foul brood is a dangerous illness. Because the reason of the disease adapts to the different conditions for a long time and spreads fast. Thus destruction of the bees and all combs of sick colonies by burning them and burying the residues are the most accurate method. Material of bee hive and its body are used after disinfection. For this purpose, flying hole of the bees is closed in the evening hours and taken a place distant from bee hive. Dying of the bees is ensured by pouring benzene in it and dead bees, offspring, combs and other residue taken from the bee hive are destructed by means of burning.

Disinfection of contaminated materials: If the disease is diagnosed in the beginning stage, it is possible to treat the sick colony. In this situation, bees should be transferred to a clean bee hive and the contaminated combs should be destroyed by means of burning, and other contaminated materials should be disinfected. For the application, it is provided an empty bee hive in the place of sick colony and raised empty combs are placed in it and bees are shaken on these combs. It is poured benzene of the combs of the sick colony and they are destroyed by firing in a place distant from the bee hive. During the operations, Potassium Hypochlorite (Bleacher) is used and combs are disinfected by applying Formaldehyde and used.

Applications:

- **Potassium hypochloride application:** It is used for the disinfection of such materials as queen excluder, smoker, hive tool, gloves and mask.
- **Formalin application:** It is a disinfection operation conducted with the preparation of formalin solution. However it requires much time and effort and it is not practical. Formalin should not be applied on combs with honey and the combs and honey to

which formalin is applied should not be given to the bees. Honey absorbs the formalin and becomes toxic for bees.

- **Treatment of Contaminated Bees with Medication:** It is immediately begun medical treatment of the bees shaken on the empty combs bloated up, which is placed in a clean bee hive. The most effective medication used for American Foul Brood is Sodium Sulfathiazole from Sulphonamides and an antibiotic Terramycin.
- **Antibiotic applications*:*** Terramycin was firstly used in the US in 1951 and successful results were obtained. It can be used in spring and fall, and it is given with syrup. For application, it is added a full teaspoon of Terramycin to each 4 liter of the sugar syrup prepared in 1/1 ratio.

7.2. European Foul Brood

It is one of the most common diseases in the world. According to the latest classification made, the reason of the disease is a bacteria called *Melisococcus pluton*. It is observed some other bacteria types (secondary) in the disease; however they do not directly cause illness, but they are effective on the smell and consistency of the dead larva.

Etiology and pathogenesis

It 's a disease of bacterial origin whose etiologic agents are still under study on their pathogenesis. The main agent is believed to be the Melissococcus pluton, which is often associated with other bacteria, but probably with the role of opportunists. Gram positive, non-spore-forming bacteria, it has good a resistance to adversity being able to remain viable for three years on the combs. It is transmitted through contaminated food and attack the middle intestine of the larvae not yet capped. Only after its death it occurs a septicemic spread and the arrival of other species of bacteria.

Photo 2. Typical symptom of European Foul Brood

Symptoms and diagnosis

The death occurs before the pupal stage and is distinctive character of the American foulbrood. From the observation of the brood is detectable the unusual positioning and the attempt to extract that are not normally stringy. With the putrefaction of the tissues there is a less pungent smell than American foulbrood and the scales are not adhering to the cells. The unique smell of the disease as rotten meat or fish can be recognized when the bee hive is opened. In open, uncapped brood period, larvae are in the color of dark brown and black and color change in larva is an important indication. In severe situations, it can be also observed in closed offspring cells. When the dead larva is pulled out with matchstick, it is not seen threadlike elongation observed in American foul brood and it can be removed out of comb cell easily. European foulbrood is the disease of the open, uncapped brood, whereas American foulbrood is the disease of the closed, capped brood.

Predisposition and propagation

The weak families, poorly maintained, with few livestocks are the ones affected the most. It is hold, together with ascosferosis and Nosema disease an opportunistic disease: it occurs only in presence of weakened colonies. Its appearance is normal in the late spring and is more prevalent in northern Europe than in the south. Regarding its spread are valid the consideration for the American foulbrood.

Prophylaxis and therapy

Good husbandry techniques and timely controls allow the reduction of transmission and ability to implement early corrective actions. It is not necessary to destroy the affected families, provided in the most compromised cases. The same considerations related to antibiotics for the control of Paenibacillus larvae apply and it is recommended to take action, where the cases are recoverable, with the block of brood and the subsequent replacement of the queen. Worker bees are allowed to remove the dead brood and usually this is enough to overcome the infection. Sometimes it disappears without external operation.

Fighting

Contrary to the application in American foul brood, there is no need for the destruction of bees and offspring combs in this disease except for severe situations. The queen of the colony is caged in the bee hive for a while and it is prevented to throw egg. It can be treated with Oxytetracycline, erythromycin or other antibiotic regimes. However, for antibiotic use, it should be definitely referred to the opinions and advices of an expert. Because antibiotics are substances that should be used with definite intervals at certain doses for a definite period of time. Otherwise bee colony, family budget and quality of honey are damaged. The honey derived from the comb given antibiotic should not be consumed for a while. For example; this period is at least 8 weeks for oxytetracycline group, while it can rise up to 1 year for other antibiotic groups. Equipments used in the bee hive and empty bee hives of the sick colonies should be disinfected in 50 l water – 1 kg soda solution or 1/1 ammonium chloride solution.

Protection of the bees from European Foul Brood disease

For the protection against both American and European Foul Brood,

- Bee hive should be always clean and organized.
- While buying bee and queen, they should be bought from the credible organizations issuing health certificates.
- When it is bought second hand tools – equipment, they should be disinfected and sterilized.
- Since the bacteria spores which enable the transmission and spreading of American foul brood can live in honey for long years, bees should not be fed with honey derived from the bee hives with unknown origin or gone through an illness.
- Swarms with unknown origin should not be put in bee hive.
- It should not be allowed for plundering in bee keeping. Settlement layout of the bee hives should be organized in a way that prevents bees from entering wrong hives. For this purpose, the flying holes of the hives should be positioned in different directions and the distance between the bee hives should not be less than 1-2 m. If it is possible, this distance should be increased.
- It should be acted with care while exchanging comb between colonies.
- As far as possible, it should be avoided using old combs.

- Colonies should be kept in regions rich in nectar and pollen and bees are not taken away in the areas carrying disease risk.
- Colonies should be controlled continually and it should not be forgotten that the most effective way preventing the transmission of the disease is early diagnosis.

7.3. Varroa Mites

The Varroa mites live in the hive, attach themselves to the bees' abdomens, and suck the bees' vital fluids. The bees become sick, and the hive slowly dies. As the mites are extremely small it is rather difficult to recognise, but with good sight or a magnifying glass they can be recognised, usually on the abdomen of the bee. The symptoms are always the same: the bees become weak, they die and the colony gets smaller. Eventually the colony dies. In the UK the 1990s, the honeybee population was badly affected by Varroa destructor. As well as almost eradicating Britain's wild swarms, many bee-keepers were put out of business and membership of the BBKA halved from 16,000 in 1990 to 8,000 a decade later. Chemicals were eventually developed to treat the condition, leading to a revival in the number of hives.

Etiology

The Varroa Destructor is the etiologic agent of parasites now present all over the world. Apis Cerana parasite has passed to Apis mellifera when it was introduced in the East Asia. Later on, with the worldwide diffusion of A. Mellifera, the Varroa, whose life cycle takes place in sync with that of the bee, has become the most studied and fought parasite in the world.It presents a marked sexual dimorphism, the female being larger than the male, oval-shaped and reddish brown. The male is more rounded and yellowish-white. Morphologically, the female is equipped to be able to cling to the body of the bees being provided with suction cups on the legs and sturdy bristles on the ventral shields. The male is unable to take food and dies soon after mating.


Photo 3. Varroa mites on the back


Photo 4. Varroa Mite on larvae

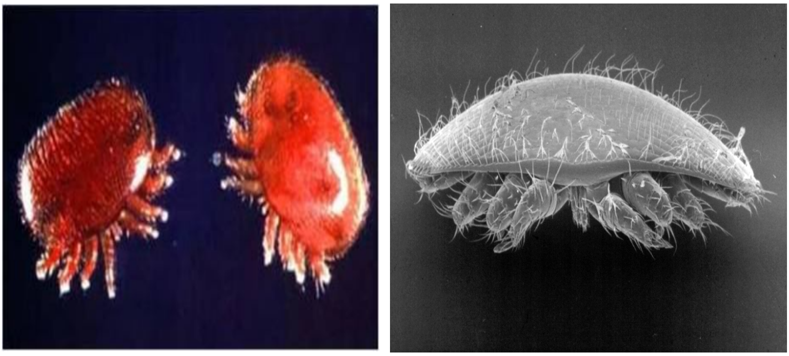
Photo 5. The Varroa Mites through electron microscope

Tolerant strains of honey bees

Since Varroa mites became a major problem, various strains of honey bee have been tested and crossbred in the hope of finding bees that are tolerant to mites — whether through selective breeding for grooming behaviours or for cell-building tendencies. Currently there are at least four options in the United States for beekeepers to consider. They are the hygienic bees, Russian bees, SMR (Suppressed Mite Reproduction) Smart bees, or local varroa-tolerant bees. Below, a varroa mite (Varroa destructor, left) and a "lesser mite" (as it is called in China), Tropilaelaps clarae, side by side. Tropilaelaps jumped host from Apis dorsata (a wild bee variety) to Apis mellifera in Asia. Hopefully it will never make its way to Europe because in southern China it is sometimes more harmful than varroa.

Photo 6. Not only honey bees suffer from Varroa: this is a green mason bee loaded with them

Varroa types

Almost 125 types of varroas have been determined in honey bee colonies. 8.5% of them live in honey bees, while 16.5 thereof live in both bees and plant, and 77.7% of them are known as hopper and warehouse pests. Varroas are a kind of external parasitic mite living on the larvae, pupa and adults of bees by sucking their blood. The fact that it lives on both closed offspring cells and adult bees affect the colony life negatively. So although it is an important type in the agenda of bee keeping even today, it can live in *Varrao Jacobsoni Apicerena* and *Apismellifera colonies.* Honey bee types, host of the acarine mite are those that live in the bee hives. The real host of the varroas is Apiscerena known as Indian bee. Indian bee living with varroas for long years protects itself against the parasites through adaptations raised and defense mechanisms. It prevents damage to the reproduction of the colony. Bee race learnt the defense.

Apiscerana: Apiscerana is quite susceptible against varroa. Apiscerana colony performs cleaning dancing in the bee hive and notifies the varroa existence in the hive to the other bees. Other bees clean the dancing bee from the parasite. Also varroa cannot complete its development in the cells of Apiscerana worker bees and only reproduce in male bee cells. Apismelifera was firstly recognized in 1958 in South China. This varroa has spread over a very wide area as of 1960s and become a problem that threatens the world bee keeping. According to the studies in our country, this pest has passed Thrace over Bulgaria as of 1976 by natural means and it should be taken into account that the bees from Aegean Region which go this site catch and carry this pest.

Structural characteristics of varroa

Adult female varroa is in Brown or dark Brown color and its body is covered with latitudinal chitin layer. The body is compressed by back-tummy side and back side is slightly cambered. It is in latitudinal ellipse shape. When looked from the top, tough back shell covers the body substantially. Adult females are at the length of 1.1 and 1.2 mm and 14.5-1.6 mm. The body is covered with parallel hair at the length of 15-20 micron and it has very strong 4 pairs of legs with 6 parts. First pair of legs functions as antenna. A series of chordotonal organ is available on front legs. Body shape is in the structure that can hang on to the honey bee easily. It has well-developed trachea system. Respiratory tract enabling the respiration is well-developed in order for the varroa to tile in different gas densities. However it can live easily in CO_2 available in closed cells as well as in a plenty of oxygen existing in the cells of flying bees. It has penetrating and sucking mouth structure. Larvae and pupa can easily hang on by means of ridges in the shape of several small safety pins extending forward on the mouth parts. It has no anus valve. Anus is closed with two hair and digesting remaining is left to the narrow side through pupa. Adult ones are smaller than females and their sizes are 0, 8-0,97 and 0.93 and in white, grey and yellowish color, respectively. Joints are made of softer chitin.

Photo 7. Views from different development phases of varroa

Reproduction and development

In honey bee colonies, reproduction of Varroa. J is limited to the activity of colony. Reproduction begins in spring with offspring raising and lasts until the breeding activity ends in fall. There females which are not inseminated in winter. Varroas select especially cells of male bees for reproduction. There are opinions that this situation is caused by the period of bee larvae's staying in closed cell to be longer, and eyes of male bees to be located mainly in the bottom and sides of bee hive. Inseminated female parasites, spending winter on the adult bees, enter the place of 5-6 – day developing larvae in spring before the cells are sealed. Female varroa passes to the larva and starts to be fed with blood of larvae. Female larvae fed with blood of adult bees have not egg laying ability. In order for the parasite to lay egg, hemolymph of larvae (blood liquid) is definitely necessary. The ovaries of the female varroa receiving Juvenile hormone during feeding, which is present in hemolymph, are developed and get ready for laying egg. Note: Juvenile hormone is low in *Apiscerana bees, high in Apismellifer bees.* Varroa, the ovaries of which develops by taking adequate juvenile hormone, lays egg 60 hours after the cells are sealed. According to the last studies, it is observed that female varroas become adult in 6.2 days, male ones in 6.9 days, if the first egg is not inseminated (n=7 chromosome), and then the next one is inseminated (2n=14 chromosome), the eggs come out. In this situation, the first egg develops as male and the other as varroa. In worker bee cells and male bee cells, 3 and 5 female varroas generally become adult, respectively. As the development period of male bees in closed cells is longer, more varroas can get adult in these cells. Exiting days of Varroas present in male bee cells that stay sealed for the longest period of time in comb cells. The reason of it is the days that cells are closed. In return for this, before offspring varroas in the queen-cell moulds become adult, queen completed breeding period, so varroa has no chance to reproduce in queen-cell moulds. Eggs generally left at the bottom of comb cell and on the larva directly complete their breeding term and breeding phase. Ripen varroas mate in the closed cells with varroas completing their breeding phase. As male varroas die in closed cell after mating, male varroa is not present on the bees. Mated young females and old female varroas feed by hanging on young bees in the cell and go out. Varroas, which cannot its development in the breeding period of young bees, die in the cell. Female varroas going out in inseminated state start to laying egg for 5 days and 4-13 days under laboratory conditions. These varroas continue reproduction by passing again to the offspring cells. Ingrown varroas continue living for 3 months in summer and for 5-6 months in winter.

Life cycle of varroa

The female Varroa hibernates on the body of worker bees within the hive. In the presence of brood it resumes its reproductive activity. Fifteen hours before capping, the females go into the cells of worker bees and 45 hours in those of the drones. She dives into the food destined to the larvae, and goes out when the cell is capped, beginning to take larvae's food. After about 70 hours, the first egg-laying begins.

At intervals of 30 hours are laid up to 6 eggs. The first is always feminine, the second male and the other female only. Within 48 hours from egg laying, protonymph comes out of haemolymph and begins to feed the pupae.

The development takes about 130 hours for females and 150 males. In general 1,45 females reach adulthood in a working bee cell and 2.2 from a drone cell.

Mating occurs between the male and his sisters inside the cell, the first flickering of the bee. The fertile Varroas go onto the adult bee and enter a phonetic stage. At this stage the mites feed themselves on the haemolymph of the bee, waiting to enter again into the brood to reproduce. Each female can take several reproductive cycles.

Period I: Going of the adults out of the comb cells: Inseminated or unfertilized female varroa, which is ripen to form infection, leaves the comb cell or after leaving the comb cells, it goes out itself. It passes to male or female bee by wandering around. Penetrating its mouth parts to the site with soft tissue between segments, it sucks the blood of bee for a couple of days. In the studies conducted related with the period of this phase, it is indicated that varroa walks around on bees for 4-6 days before entering in comb cell.

Period II: Passing to larva food and stopping. Varroa leaves the bee having stayed for a while on the adult bee and struggles to enter in the larva cell. When the larvae in worker bee cells get 5 days older, and those in male cells get 5-7 days older, it is the most suitable time. It is known that 21 varroas are counted in one male bee cell. Carbon dioxide and some other chemical substances contained in the cell where the bee larva is present have appealing effect in order for the varroas to enter in the cells. After varroa leaves the cells, the food of larva stays in lethargic state possibly due to oxygen deficiency and carbon dioxide surplus.

Period III: Varroa’s to be active again and placing of first two eggs: After the bee cell is sealed, the larva that is present in the cell eat the food there and proceeds to pupa phase. The varroa here eats this food limitedly with larva. However the importance of this feeding for the varroa is not known. If the food of larva does not run out completely, varroa continues its lethargic state and dies finally. When the food in the cell runs out normally, the amount of oxygen in the cell increases and varroa becomes active again. Varroa passing to the larva or pre-pupa penetrates its mouth parts into the skin of host and starts to suck hemolymph. Varroa fed adequately reaches sexual maturity and lays the first inseminated egg that will form the female varroa 60-64 hours after the cell is sealed. Afterwards it lays the unfertilized egg 94-96 hours after the sealing without feeding again and male Varroa hatches from this egg. Although eggs are placed one by one on the tissue covering the pupa, it also rarely known to be placed on larva or pre-pupa. If the varroa is not fed enough possibly in 3rd and 4th phases, egg is not laid and the number of egg does not exceed 1-2.

Period IV: Placing the last egg and development of the embryo: At least 5 when female Varroa is in the bee cell (4 female 1 male). It has a capacity for 7 eggs in the male eye. After placing the eye which may form the male, Varroa is fed and makes 3 eggs (which will form the 2nd female...). It occurs 120-124 hours after sealing the eye. Feeding and laying eggs again occurs twice more which happens respectively 148-154 and 190-192 hours after sealing the eye. When the eyes of the worker bees and drones are black, Varroa is fed for the last time and egg laying stops. At this time, worker pupa is 19 days old or the worker bee has reached to a time of 216-220 hours and drone to a time of 240 hours after being a pupa. The number of eggs produced by Varroa differs and this depends on the time from sealing of the eye to the hatching of adult bee. This time is different in various races of honey bees. In *Apismellifera Corsica* which is an European race, this period is 12,1 days. The varroa which is fed on this normally lays 5 eggs. However, only 1 female and 1 male among these find time to develop. Thereby two offspring develop. Since this term is a bit longer in *Apismelifera Cepropin* race, 2 females and 1 male comes out of 5 eggs. This term in *Apismelifera Capensis* which is an

African race is 11,1 days. Only 1.50 of septic cells form one female each. Since this period is 14 days in males, 5 female varroas are formed in these.

Symptomatology

The Varroa mite causes damages in a direct and in an indirect way. The first is the removal of haemolymph and then in a general weakening of the host. It has been shown a weight loss (5-10%) in the young age affected bees in comparison to their healthy sisters, resulting in shortening of life span. The immune system is depressed by inoculation of specific proteins. The latter condition determines the indirect damage, the most devastating, with the proliferation of viruses (at least 16 types) in some way activated by the Varroa and various pathological agents. It has been shown that the APV (acute paralysis virus) is normally present on some tissue of the bee. It does not cause damage in uninfested bees even when it is present in millions of individuals. In the presence of Varroa 100 viruses are enough to kill a bee in 3-6 days.

Propagation

It occurs through the traditional channels: looting, drones, beekeeper.

Prophylaxis

Prophylaxis can only prevent reinfestation. The coordination related to periods of treatment may give good results. We have to recall to the man responsibility.

Protection and control methods

Chemical fighting method: The most important biological feature of *V. jacobsoni* is that they are located in the closed offspring cells of developing forms and young females. That's why, the chemicals used in fighting against parasites do not manifest its fatal effect for the varroa protected in offspring cells and this makes fighting more difficult. The disinfections should be carried out in the period without offspring in order to increase the efficiency of the medicines used and success rate in the fight. In winter, breeding activity stops in Eastern Anatolian Region and in other regions with similar climate conditions and an important opportunity is taken in which fight against parasites can be very effective. However, in other regions in which climate allows for breeding activity even in winter, disinfections never give definite results and with the increasing breeding activity from the beginning of spring, parasite population starts to increase again. In this case, the most appropriate period in the fight against *V. jacobsoni* is early spring and late autumn when the breeding activity and confined offspring quantity is the least and when there is no honey to harvest. In order to prevent wintering losses and staff reducing in the spring, an efficient fight to be carried out after the honey harvest in autumn term becomes more important. In order not to experience medicine residue problem in honey because of the disinfections, it is an obligation to carry out the disinfections in the term outside the nectar flow and honey harvest. In the countries contaminated with *V. jacobsoni,* various chemicals have been used until today. Some of these chemicals whose efficiency varies between 70 and 95% are contact effective, some of them are systemic effective and some of them are fumigant and consist of insecticides and acaricides.

Some of the chemicals used in different countries are **Sulphur, Naphthalene, Formic Acid, Phenothiazine, Varroasin, Apivarol, Varrostan, Folbex-VA, Vamitray-VA, Rulamit-VA, Malathion, Varation-TKV, Sineacar, Tymol, Forzam, Apistan, K-79, Perizin and Fulivalinate.** Most of them are used in the fight against bee varroa in various ways in our country. However, most of the chemicals used in the fight against Varroa in Turkey do not have a license. It should be noted that most of the chemicals used have a carcinogenic effect. Using random and unauthorized medicine causes residue problem in honey. On the other side, wrong medicine selection and use allows for the resistance of the varroa in time and increasing the dose result in bee deaths. Kenaz with Amitraz active agent and Israeli stick with Fulivalinate active agent and Forzam with Formic Acid active agent which have a share of 30% in the market among the chemicals used in the fight against *V. jacobsoni* are unauthorized in Turkey. Some other chemicals with Malathion active agent whose use share is about 25% are kept on the agenda in our country even though they are no longer used in almost all of the world because they are carcinogenic and they leave residue in the world.

Development of resistant forms of the parasite to the chemical used keeps new chemical searched on the agenda. That's why, whatever chemical is preferred, its manual should be followed and chemicals with different active agents should be used. It is necessary to carry out the disinfections before the nectar flow in early spring and after the honey harvest in late autumn. Thereby, both the efficiency of the medicines are increased against the parasite and the residue problem is minimized. The list of the chemicals used in the fight against *V. jacobsoni* is not fixed and always changes.

Treatment

In Europe, their treatment for about 30 years is only possible through the following active ingredients: cumaphos, amitraz, flumethrin, tau-fluvalinate, formic and oxalic acids, aromatic essential oils and aromatic synthesis agents (thymol, menthol, camphor). If you add that for the first four P.A. phenomena have been reported resistance phenomena and for the remaining the effectiveness is very variable it's possible to understand how miserable is the fight against Varroa. To make more effective the use of organic acids for some time beekeepers have been artificially blocking the brood. In its absence the Varroa mite is prevented from hiding from the effects of the active ingredient. The procedure involves the manipulation of all families in more than one apiary. When this happens, if you do not know well enough pathogens of bees, you are likely to fight a disease and to spread many others. We conclude with a special mention to some of the initiatives undertaken, with good results, by farsighted beekeepers for the natural selection of tolerant / resistant bee strains to Varroa. Once again we want to emphasize that if the productivity is the only thing pursued, the solution to the problem becomes more complex.

Using medicines:

- Chemicals such as folbex and apistan are used in many countries. The most proper period for the disinfection is early spring and late autumn before the nectar flow and after the honey harvest when the breeding activity is in the lowest level in the colony.
- Formic acid was densely used in 1980s in our country, but its use gradually decreased because of not being able to control fumigation. Its fumigation was controlled by impregnating with the plates and it was started to be used in the Europe.
- There is formic acid in honey naturally. Its quantity in honeydew hone is 620 mg/kg. Since it is used as preservative agent in some food stuffs such as fruit and fruit juices, its residue amount is reduced to the natural limits by fumigating shortly after administration and it is efficient in the bee varroa in the confined offspring cells; it is heavily used.

Physical control methods:

- The offspring raising activities of the colonies in cold and warm weather conditions cease for some time. The breeding period taking a longer time in high parts of the Eastern Anatolia Region and Central Anatolia and Black Sea Regions is very limited in the Aegean Region and by the shores and the breeding production continues at minimum levels in winter.
- It becomes very difficult to fight against V. jacobsoni in colonies where the breeding activity lasts during the year and this difficulty further increases as the bee keepers narrow down the flying holes of the bee hives as the winter approaches. It is possible to put an effective fight against the parasites with pesticides used in late autumn and winter months when the number of offspring is very low in Eastern Anatolia Region.
- The breeding activity is stopped by expanding the bee hive entrance holes during winter with the applications in Germany and the population of mites can easily be decreased due to the ones which die and fall on the bottom board during cold days. It is known that the parasites can be taken under control with a limited pesticide application. It is understood that the same application can be useful in regions when the winter conditions is warm and hot, especially the Aegean and the Mediterranean Regions.

Biological control method:

- Adult *female V. Jacobsoni*s prefer the male bee cells in the bee hive to lay eggs. It is recommended that the female mites are ensured to lay eggs on the female bee cells to be formed on the frame with a basic comb with a width of 5 to 6 cm placed on the top stick in the breeding site of the colony suffering from the disease and it is stated that the number of the parasites in the colony can be decreased very much by taking the comb from the colony after the offspring cells are closed. However, this method may often not provide the desired benefits and can be rather dangerous as this requires the queen and the worker bees do spend more time and energy and encourage the generation of parasites.

Genetic control method:

- The growth process of the offspring of bees from the race *A. m. capensis* is shorter in closed cells. Thus, the bees complete their breeding period before the parasites grew and *V. jacobsoni* cannot reach the population numbers to cause epidemic. The bees from the race of *A. cerana* dance and let the others know that they carry parasites and other bees receiving the message clean such bees.
- This method is known to kill 99% of all parasites. Moreover, the ovary of *V. Jacobsoni* cannot develop as it cannot get enough hormone from the worker bees with less juvenile hormone in the hemolymphs, and it can only reproduce in the offspring cells with the larvae of the drones. It is hoped that the genes determining these features will be isolated with the help of the latest biotechnological developments and added to *A. mellifera* in recent years and that *V. jacobsoni* will be removed from the agenda of bee keeping.
- Recent researches on Italian, Carniolan and Caucasian bees conducted in Israel and some European countries resulted in some groups able to resist V. jacobsoni thanks to breeding and selection. The practice of the positive improvements is expected to cause significant benefits.

In short, female Varroas prefer drone cells to lay eggs during spring. Combs with drone cells are put in the colonies in this period and female Varroas are ensured to come together in these drone cells. After these cells are closed, they are taken outside and destroyed. This ensures that the female Varroas, the eggs laid by them and drone pupas are destroyed. If half frames with combs are given to the colony, the bees complete the comb by forming new combs with drone cells to the bottom of these frames. As Varroas prefer to reproduce in drone cells, they enter these cells before they are closed. After these cells are closed, the comb with drone cell is cut and destroyed. It is possible to decrease the number of Varroa in the colony. However, the Varroas reproduced in the worker bee cells continue to be effective. Another fight method is to destroy the Varroa eggs laid in the worker bee cells during nectar flow period. According to this method, the queen of the colony is kept in a frame by using queen excluder and it is ensured that all Varroa eggs are collected in one comb. If this comb is taken outside during the closed offspring period, all varroa eggs in the bee hive will be destroyed. The disadvantage of this method is that it cannot be applied in every period and prevents the colony development in part.

7.4. Colony Collapse Disorder (CCD)

History

The Colony Collapse Disorder is a recent phenomenon and is the subject of numerous studies and sensational claims about its resolution. It takes place with a sudden depopulation of the bee families (Apis mellifera). Inside the hive remains little brood and honey stores that they are almost ever the object of plunder. The phenomenon was found for the first time in the bee colonies in North America. Even in Europe similar situations have been reported. There are many possible causes under investigation. Climate change, biodiversity and food quality flattening, pathogens such as Nosema IPAV, healthcare products, especially neonicotinoids, electromagnetic radiation, GMOs. Recently, it is believed to be responsible for this phenomenon the addition of more causes eg. Virus + fungus; Nosema + imidacloprid; etc.

US commercial beekeepers, many of whom have been in the business for a long time and have always had normal, healthy colonies, began losing their bees in the spring of 2007 for unknown reasons. They could find no signs of poisoning or acute mortality, and no dead bees would be found in or around the hives. From 1972 to 2006, there was a dramatic reduction in the number of feral honey bees in the U.S. (now almost absent) and a significant though somewhat gradual decline in the number of colonies maintained by beekeepers. This decline includes the increasing losses from all factors, such as urbanization, pesticide use, tracheal and Varroa mites, and commercial beekeepers' retiring and going out of business. However, in late 2006 and early 2007 the rate of erosion was alleged to have reached new proportions, and the term "colony collapse disorder" began to be used to describe this sudden rash of disappearances (sometimes referred to as Spontaneous Hive Collapse or the Mary Celeste Syndrome in the United Kingdom).

Losses had remained stable since the 1990s at 17%-20% (USA) per year on a variety of factors, such as mites, diseases, and management stress. The first report of CCD was in mid-November 2006 by a Pennsylvania beekeeper overwintering in Florida. By February 2007, large commercial migratory beekeepers in several states had reported heavy losses associated with CCD. Their reports of losses varied widely, ranging from 30% to 90% of their bee colonies; in some cases beekeepers reported loss of nearly all of their colonies with surviving colonies so weakened that they might no longer be viable to pollinate or produce honey. Losses were reported in migratory operations wintering in California, Florida, Oklahoma and Texas. In late February, some larger non-migratory beekeepers in the mid- Atlantic and Pacific

Northwest regions also reported significant losses of more than 50%. Colony losses also were reported in five Canadian provinces, several European countries, and countries in South and Central America and Asia. In 2010 the USDA reported that data on overall honey bee losses for 2010 indicated an estimated 34 percent loss, which is statistically similar to losses reported in 2007, 2008, and 2009. Limited cases resembling CCD have been documented as early as 1869 and this set of symptoms has in the past several decades been given many different names (*disappearing disease*, *spring dwindle*, *May disease*, *autumn collapse*, and *fall dwindle disease*). Most recently, a similar phenomenon in the winter of 2004/2005 occurred, and was attributed to Varroa mites (the "Vampire Mite" scare), though this was never ultimately confirmed. Nobody has been able to determine the cause of any past appearances of this set of symptoms. Upon recognition that the syndrome does not seem to be seasonally restricted, and that it may not be a "disease" in the standard sense that there may not be a specific causative agent the syndrome was renamed.

Signs and symptoms

A colony which has collapsed from CCD is generally characterized by all of these conditions occurring simultaneously:

- Presence of capped brood in abandoned colonies. Bees normally will not abandon a hive until the capped brood have all hatched.
- Presence of food stores, both honey and bee pollen:
  - which are not immediately robbed by other bees
  - which when attacked by hive pests such as wax moth and small hive beetle, the attack is noticeably delayed.
- Presence of the queen bee. If the queen is not present, the hive died because it was queenless, which is not considered to be CCD.

Precursor symptoms that may arise before the final colony collapse are:

- Insufficient workforce to maintain the brood that is present
- Workforce seems to be made up of young adult bees
- The colony members are reluctant to consume provided feed, such as sugar syrup and protein supplement.

Scope and distribution in Europe: According to the European Food Safety Authority (EFSA), in 2007 the United Kingdom had 274,000 hives, Italy had 1,091,630, and France 1,283,810. In 2008 the British Bee Keepers Association reported that the bee population in the United Kingdom dropped by around 30% between 2007 and 2008, and an EFSA study revealed that in Italy the mortality rate was 40-50%. However EFSA officials point out that the figures are not very reliable because before the bees started dying there was no harmonisation in the way different countries collected statistics on their bee populations. At that time (2008) the reports blamed the high death rate on the varroa mite, two seasons of unusually wet European summers, and some pesticides. In 2010, David Aston of the British Beekeepers' Association stated, "We still do not believe CCD (which is now better defined) is a cause of colony losses in the UK, however we are continuing to experience colony losses, many if not most of which can be explained". He feels that recent studies suggest "further evidence to the evolving picture that there are complex interactions taking place between a number of factors, pathogens, environmental, beekeeping practices and other stressors, which are causing honey bee losses described as CCD in the US**".** In 2009, Tim Lovett, president of the British Beekeepers' Association, said: "Anecdotally, it is hugely variable. There are reports of some beekeepers losing almost a third of their hives and others losing none. John

Chapple, chairman of the London Beekeepers' Association, put losses among his 150 members at between a fifth and a quarter. "There are still a lot of mysterious disappearances; we are no nearer to knowing what is causing them." The government's National Bee Unit continued to deny the existence of CCD in Britain; it attributes the heavy losses to the varroa mite and rainy summers that stop bees foraging for food. Beekeepers in Scotland also reported losses for the past three years. Andrew Scarlett, a Perthshire-based bee farmer and honey packer, lost 80% of his 1,200 hives during the 2009 winter. He attributed the losses to a virulent bacterial infection that quickly spread because of a lack of bee inspectors, coupled with sustained poor weather that prevented honeybees from building up sufficient pollen and nectar stores. In Germany, where some of the first reports of CCD in Europe appeared, and where, according to the German national association of beekeepers, 40% of the honey bee colonies died, there was no scientific confirmation; as of early May 2007, the German media were reporting that no confirmed CCD cases seemed to have occurred in Germany.

Possible causes

The mechanisms of CCD are still unknown, but many causes have been proposed as contributing agents; malnutrition, pathogens, immunodeficiencies, mites, fungus, pesticides, beekeeping practices (such as the use of antibiotics, or long-distance transportation of beehives) and electromagnetic radiation. Whether any single factor or a combination of factors (acting independently in different areas affected by CCD, or acting in tandem) is responsible is still unknown, however most recent information suggests a combination of factors is most likely. It is likewise still uncertain whether CCD is a genuinely new phenomenon as opposed to a known phenomenon that previously only had a minor impact.

A survey of beekeepers early in 2007 indicated that most hobbyist beekeepers believed that starvation was the leading cause of death in their colonies while commercial beekeepers overwhelmingly believed that invertebrate pests (*Varroa* mites, honey bee tracheal mites, and/or small hive beetles) were the leading cause of colony mortality. A scholarly review in June 2007 similarly addressed numerous theories and possible contributing factor, but left the issue unresolved. In 2009 the CCD Working Group in USA published a comprehensive descriptive study that concluded: "Of the 61 variables quantified (including adult bee physiology, pathogen loads, and pesticide levels), no single factor was found with enough consistency to suggest one causal agent. Bees in CCD colonies had higher pathogen loads and were co-infected with more pathogens than control populations, suggesting either greater pathogen exposure or reduced defences in CCD bees." It was reported that although many associations, including pesticides, parasites, and pathogens have been identified throughout the course of research, "it is becoming increasingly clear that no single factor alone is responsible for [CCD]". Their findings indicated an absence of damaging levels of the parasite *Nosema* or parasitic *Varroa* mites at the time of collapse. They did find an association of sub-lethal effects of some pesticides with CCD, including two common miticides in particular, coumaphos and fluvalinate, which are pesticides registered for use by beekeepers to control varroa mites. It was reported that studies also identified sub-lethal effects of neonicotinoids and fungicides, pesticides that may impair the bee's immune system. It is hypothesized that these pesticides impair the bee’s immune system, which leaves the bee more susceptible to bee viruses. A large survey of healthy and CCD-affected colonies also revealed elevated levels of pesticides in wax and pollen, but the amounts of pesticides were similar in both failing and healthy hives. They also confirmed suspected links between CCD and poor colony health, inadequate diet, and long-distance transportation. Studies continue to show very high levels of pathogens in CCD-affected samples and lower pathogen levels in non-affected samples, consistent with the empirical observation that healthy honey bee colonies normally fend off pathogens. These observations have led to the hypothesis that bee declines are resulting from immune suppression.

Malnutrition: It was noted that a period of "extraordinary stress" affecting the colonies in question prior to their die-off, most commonly involving poor nutrition and/or drought. This is the only factor that *all* of the cases of CCD had in common in this report; accordingly, there is at least some significant possibility that the phenomenon is correlated to nutritional stress and may not manifest in healthy, well-nourished colonies. This is similar to the findings of a later independent survey in which small-scale beekeeping operations (up to 500 colonies) in several states reported their belief that malnutrition and/or weak colonies was the factor responsible for their bees dying in over 50% of the cases, whether the losses were believed to be due to CCD or not. Some researchers have attributed the syndrome to the practice of feeding high-fructose corn syrup (HFCS) to supplement winter stores. The variability of HFCS may be relevant to the apparent inconsistencies of results. European commentators have suggested a possible connection with HFCS produced from genetically modified corn.[If this were the sole factor involved, however, this should also lead to the exclusive appearance of CCD in wintering colonies being fed HFCS, but many reports of CCD occur in other contexts with beekeepers who do not use HFCS. Other researchers state that colony collapse disorder is mainly a problem of feeding the bees a monoculture diet when they should receive food from a variety of sources/plants. In winter the bees are given a single food source such as corn syrup (high-fructose or other), sugar and pollen substitute. In summer they may only pollinate a single crop (e.g., almonds, cherries, or apples). A study published in 2010 found that bees that were fed pollen from a variety of different plant species showed signs of having a healthier immune system than those eating pollen from a single species. Bees fed pollen from five species had higher levels of glucose oxidase than bees fed pollen from one species, even if the pollen had a higher protein content. The authors hypothesised that CCD may be linked to a loss of plant diversity.

7.5. The Small Hive Beetle

The small hive beetle, *Aethina tumida* (Order Coleoptera; Family Nitidulidae), was first discovered in Florida in June of 1998 and has now been found in 6 other states, Georgia, South Carolina, North Carolina, Pennsylvania, Ohio and Minnesota. Recent findings also indicate transport of the beetles in packages of bought in bees. The small hive beetle can be a destructive pest of honey bee colonies, causing damage to comb, stored honey and pollen. If a beetle infestation is sufficiently heavy, they may cause bees to abandon their hive. The beetles can also be a pest of stored combs, and honey (in the comb) awaiting extraction. Beetle larvae may tunnel through combs of honey, feeding and defecating, causing discoloration and fermentation of the honey.

Life history of the Beetle

Aethina tumida was previously known only from the southern regions of Africa where it has been considered a minor pest of bees. The life cycle information is known primarily from studies in South Africa. No detailed studies have yet been conducted in the different regions of the U.S. where the beetle has been found. The small hive beetle is a member of the family Nitidulidae, most of which are scavengers or sap beetles. The adult beetle is dark brown to black and about 0,5 centimeter in length. The adults may live up to 6 months and can be observed almost anywhere in a hive, although they are most often found on the rear portion of the bottom board of a hive. Females beetles lay irregular masses of eggs in cracks or crevices in a hive. The eggs hatch in 2 - 3 days into whilte-colored larvae that will grow to 10 -11 mm in length. Larvae feed on pollen and honey, damaging combs, and require about 10 - 16 days to mature. Larvae that are ready to pupate leave the hive and burrow into soil near the hive. The pupation period may last approximately 3 - 4 weeks. Newly emerged adults seek out hives and females generally mate and begin egg laying about a week after emergence. Hive beetles may have 4 - 5 generations a year during the warmer seasons.

Photo 8. Adult Small Hive Beetle, Aethina tumida

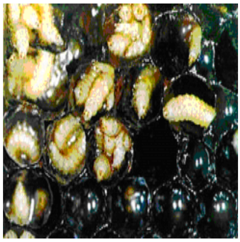

Photo 9. Larva of the small hive beetle

Damage to colonies and stored honey

The primary damage to colonies and stored honey caused by the small hive beetle is through the feeding activity of the larvae. Hives and stored equipment with heavy infestations of beetles have been described as a mess. A summary taken from various reports of damage caused by these beetles is listed below:

- Larvae tunnel through comb with stored honey or pollen, damaging or destroying cappings and comb
- Larvae defecate in honey and the honey becomes discolored from the feces

- Activity of the larvae causes fermentation and a frothiness in the honey; the honey develops a characteristic odor of decaying oranges
- Damage and fermentation cause honey to run out of combs, creating a mess in hives or extracting rooms
- Heavy infestations cause bees to abscond; some beekeepers have reported the rapid collapse of even strong colonies

Control of hive Beetles

The small hive beetle is considered a secondary pest in South Africa, and, as such, has not been the subject of major control efforts. The beetle is most often found in weak or failing hives and rarely affects strong hives. However, differences in the housecleaning traits of the bees found in South Africa and the U.S. may mean very different responses to the beetles. Some early reports from Florida and South Carolina suggest the beetles may be more damaging here than in Africa. Strong hives are still probably the best protection, and weak hives should be combined or requeened, but care should be taken against using infested equipment on non-infested hives. Protection of stored equipment is recommended and supers with honey should not be left standing for any length of time. PDB (paradichlorobenzene) has been used for protecting empty stored combs. Coumaphos bee strips (Bayer Corporation) have been approved for use in hives for the control of small hive beetles in some states under an emergency registration.

7.6. Chalk Brood

This is an offspring disease caused by a fungus named Ascosphaera apis. The larvae suffering from the disease are embalms and black, grey or white. The larvae which become white can be crushed with two fingers but harden like rice in later stage. These larvae are dropped by the bees to the front of the bee hive and flying board. As the spores causing the disease can be effective for 15 years under the ground and in different environments and can be drifted with the wind, the fight against this disease may yield successful results by using cultural precautions. The fungus giving rise to the disease develops in the environment with CO_2 and moisture due to insufficient air conditioning in the bee hive. Therefore, the air conditioning should be ensured while the bee hives are placed on tables and they should be protected from moisture. Another precaution against chalk brood is to substitute the queen of the colony suffering from the disease with new queens of the healthy colonies. Weak colonies tend to develop the disease more. Thus, the best cultural method is to work with strong colonies. Another effective method is feeding the colonies and providing the bees with natural nectar resources. Hunger, cold and discomfort which cause stress in the colony, decrease in the number of workers in the colony and destroying flora which is useful for the digestive system of larvae with unnecessary and wrong use of antibiotics cause the chalk brood or increase its severity. Avoiding these applications and working with strong colonies and young queens are the best protection precautions to be taken against the disease. Sufficient and positive results are achieved from the trials for fight with pesticides performed in the colony for the treatment of the chalk brood.

Etiology and pathogenesis

The agent responsible for the disease is the bisexual fungus Ascosphera Apis. In this case as well the ingestion of spores determines the infection of larvae. They are more exposed when aged between three and four days.

Symptoms and diagnosis

The symptomatology is particularly complicated since there are few outward manifestations other than a deliquescence of tissue. It's only the advanced stage of death that makes this disease recognizable and unmistakable. In fact, with the invasion of the mycelium of the whole body of the larva it is mummified. The extraction of calcifications is easy and they are usually accumulated on the alighting-board.

Predisposition and propagation

The predisposing factors, subject to verification, are the strength of the family and the environmental parameters for the development of fungi (the humidity inside the hive and the microclimate in general).

Prophylaxis and therapy

In the case of the occurrence of the disease, it is recommended to improve hive ventilation also acting on the movable floor, avoiding the feeding of large quantities of syrup to weak families to avoid the increase of moisture and in particular avoiding attempts to "save" withered families at all costs. The strains with a marked hygienic behaviour contrast effectively the spread of the fungus.

7.7. Diarhea

It is seen when the bees become active in spring. The bees suffering from diarrhea release dark yellow, sticky, watery feces smelling bad. The main reasons of the disease are being closed for a long period of time, feeding the bees with bad honey and eating pollen by the bees as there is not sufficient honey in cold weathers or winters. The disease is not contagious and pathogenic. It is automatically treated as the season goes by. The factors causing the disease should be eliminated in order to be protected from it. The bees suffering from diarrhea defecate in the bee hive if they cannot go out and stay inside for very long time if it is raining and cold. This stage is the most dangerous stage of diarrhea for bees. The colony will be damp, musty and stinky and mass amounts of bee will start to die.

Photo 10. Bee diarrhea

Photo 11. A bee hive with nosema

7.8. Nosema

It is very dangerous adult bee disease caused by a microsporidian called nosema apis. Behavioral changes and fast ageing are experienced in colonies suffering from the disease. The stomach of the sick bees should be examined in terms of macroscopic or microscopic features in order to certainly diagnose the disease. The color of stomach is normally straw-colored when the bee is healthy. It is hard, dirty and white when the bee is sick. The disease can be seen at any time during the year; the highest number of the disease is experienced in spring and the second highest number is seen in autumn. There are orange and white bee feces on the frames, combs, hive cover and flying board in colonies suffering from nosema. The disease is spread with feeding. Sick bees lose their maintenance power, cannot fly and crawl around the bee hive. Fumagillin is used for the prevention and treatment of nosema. The drug is administered with syrup in spring and autumn. Fumagillin administered with syrup especially in autumn is a good precaution. Feeding with cake mixtures instead of pollen and with honeydew in winters other than pollen of the colonies can cause the disease. The disease is caused mainly by problems in feeding. It should not be forgotten that the bees do not need any material other than honey and pollen regarding this disease.

Etiology and pathogenesis

The Nosema is a disease spread throughout the world caused by microsporidia (unicellular fungus): the Nosema Apis. The ingestion of spores determines their germination in the intestine and the invasion of epithelial cells of mesocolon. New spores forms and following to the disintegration of the epithelial cells they are poured into the intestinal lumen and then to the ampulla of the rectum and expelled in the faeces. Often the bees cannot reach the outside of the nest and smear with their faeces everything that is inside it. In this way, the disease is transmitted to the whole family.

Symptoms and diagnosis

The bee is weakened as a direct consequence of the alteration of its digestion and the absorption of nutrients. Reduced flight capability, diarrhea, regression of the hypopharyngeal glands, reduction in life expectancy, depopulation. The diagnosis is certified with the microscopic analysis of the intestine of adult bees.

Predisposition and propagation

The disease occurs in acute form in the spring as the temperatures of the season (between 30 °C to 35 °C) promote the development of the fungus. It tends to stop, seemingly in a spontaneous way, with the arrival of high summer temperatures (37 °C).

In the faeces, the spores remain viable for about two years and in the honey from 3 to 6 months. We go back to the responsibility of the farmer, sometimes stubborn in recycling honeycombs and using poor quality materials, not attentive to positioning of the apiary, regardless of the rules on liquid nutrition, manipulating and trimming families in an attempt to minimize swarming and standardize the production and with them to determine the spread of infectious agents, parasites, and finally Nosema.

Prophylaxis and therapy

Prophylaxis is based, as for other diseases, on the rational management of the apiary. Populous families, a large livestock of good quality, young and prolific queens, renewal of the combs, placement of beehives in dry and sunny places contribute to the defense of our bees.

Additional knowledge on Nosema Ceranae

This fungus is typical of the East Asia and has a global spread. Numerous studies correlate it with the CCD (colony collapse disorder), not only having the ability to prevent the intake of nutrients by striking, as N. Apis the intestine of field bees, the latter far more infected than home bees, but also leading to a loss of sense of direction and the resulting non-return to the hive. This is the first reason for depopulation. The bees seem to be followed in their disappearance, as a second cause, by the young infected bees as well, that however, would come out to compensate for the lack of first. Unlike N. Apis, they do not show diarrhea, it becomes evident to the beekeeper only when opening the hive, he finds the deserted families. The phenomenon that makes the difference from the impacts of the infection of two species of Nosema is the immune response. It is demonstrated that the immune system of bees, as a result of infection by N. apis, occurs quickly while ceranae infection suppresses the immune response by reducing the transcription of certain genes. In addition to this, the suppression of the immune system as well as the proliferation of N. ceranae, also opens the door to the attack from other pathogens such as chalk brood and the replication of viruses present in a latent state. Along with Varroa, which has proved its immune suppression since 2005, the severity of the consequences is greatly enhanced. The research on the pathogenicity of Nosema have recently linked it to neonicotinoids. From their synergistic effect, even when the presence of the latter is at a sub-lethal level, it would trigger the CCD.

7.9. Mange

The 80 to 120 micron mite which can be seen with the microscope and do not have any mite enter through the spiracles on the chests of the bees and stay on their tubes. The mite multiplies here and causes damage here. It leaves 30 to 40 days. The female mite lays 6 to 10 eggs in the trachea. They grow in 12 to 15 days. It has penetrating and sucking mouth structure. The trachea of the bees is filled with dried blood, feces of the mite, remains and other wastes. The wings of the bees with mites are loose and shaky. They start to crawl and lose their flying reflex. Their stomach is swollen. When the trachea is examined with the microscope, its cream colored, straight structure without any dots seems to turn to black.

Photo 11. Mites causing mange

7.10. Bee Moth

There are two types as big bee moth (*Galleria mellonella*) and small bee moth (*Achroia grisella*). Big bee moth is more dangerous. Bee moth is seen more frequently in especially the bee hives on the coast and causes serious harms. The larvae of the moth is fed with bee wax and pollen in the combs and harms the combs of the weak colonies and during the preservation of the combs whose honey is filtered. It will not harm the colony when it is strong and there are bees on all combs.

All combs' in the colony being covered with bees will ensure that the number of the moth will not increase. Moth problem and harm is usually experienced during the preservation of combs whose honey is filtered. Physical, chemical and biological methods can be used for the protection of combs whose honey is filtered. If the combs are preserved under 10ºC, for instance, in cold warehouses, the moth eggs in the combs will not open and the larvae will not develop. Keeping combs at 12ºC for 3 hours or at 15ºC for 2 hours will kill the moth during the entire development periods including the eggs in the combs. For chemical fight, if 50 g of sulfur powder per 1m3 is burnt in the protected rooms where the combs are stored, the moth larvae, pupas and adult moths will die. As the moth eggs do not die with this application, it has to be repeated depending on the temperature of the application.

Mothballs should not be used by the bee keepers for chemical fight. Mothballs are carcinogenic and made of petroleum and leave residues on honey and bee wax. For biological fight, *Bacillus thuringiensis* is added to main combs in foreign countries. However, this is not implemented in our country yet.

Photo 12. Bee Moth

Photo 13. Bee Louse

7.11. Bee Louse

It is a kind of louse which is a little short than flea, round, chestnut colored and with six feet with hooks ensuring it to move like a crab. They stick on the back and chest of the bees and are fed with the honey they can get from their mouths. This parasite especially pesters weak bee families and queens. Bee louse likes royal jelly. It imitates the food exchange of bees and steals the royal jelly released from young worker bees. Sometimes there are 5 to 10 bee louses on a queen and disturbs her in a way to stop doing her work. Female bee louse leaves their eggs into honey caps. The louse at the larvae stage harms the combs by opening channels in them. The best protection method is to keep the bee hive strong at all times. The pesticides used for the fight against varroa can also be used for the fight against the bee louse at the appropriate doses.

7.12. Wasps

The wasp types named *Vespa orientalis* and *Vespa crabro* are very common in our country. They capture honey bees and take them to their nests while they collect food from the land or over the bee hive flying board during offspring raising periods. They cause great harm to the bees in some years. Although there is not an effective method of fight against the wasps, some useful applications are harming the nests, decreasing their numbers by placing traps with meat, fish and liver, narrowing down the bee hive entrance hole and killing the offspring in the nests with toxic feed to be prepared by pesticides and minced meat. The best way is to move the colonies from the region when the number of wasps increase greatly.

7.13. Sacbrood virus

Etiology and pathogenesis

The agent responsible for the disease is the virus called SBV (sacbrood viruses). The genome consists of RNA. Even in this case is the nutrition to transmit the virus and preferentially affects the larvae of about two days. The incubation period is 6 days

Symptoms and diagnosis

The death arrives when the brood is capped. The latter, similar to American foulbrood, is perforated and irregular, but the affected combs do not have any peculiar smell. The colour of the larvae is yellowish but it is characteristic is that the integument is still consistent and elastic while the internal organs are fluid. By extracting the larva, it looks like a bag. In this phase, infectivity is maximal. Over time it dries and becomes an easily removable scale.

Predisposition and propagation

There are no known predisposing factors, and the spread takes place during the cleaning of cells.

Prophylaxis and therapy: No treatment exists and in case of occurrence of the disease, it is advisable to destroy the family affected only in case of severe infection, with at least one suspension in the reuse of combs from infected families of at least six weeks.

Section X:
Beekeeping equipments and work safety

1. Beekeeping equipments

The minimum personal equipment that is needed includes a veil, hive tool and bee smoker. The bee veil keeps bees away from your head. It is disconcerting to have bees crawling on your face or in your hair. As well, stings on the head are especially painful. A special hat may be purchased to hold the veil but you may already own a suitable wide brimmed hat. A baseball cap will not do.

Bee hives

A standard beehive has a bottom board and a hive cover with five supers in between. Each super contains nine or 10 frames of comb in which the bees rear their young and store honey and pollen. Normally the bottom two supers are brood supers used for rearing the young and storing honey and pollen for short-term and winter use. The top three supers are used to hold the honey crop. Special "shallow" supers can reduce the weights that must be lifted. A beehive may be built from new components, but installing bees into such a hive stresses them and usually reduces the honey crop. It is better to purchase a hive that has already had bees in it for a year or more. If you are inexperienced or unsure, ask a beekeeper for advice and help to inspect a potential purchase. Buy standard sized equipment that has been properly constructed and well maintained.

- The supers and frames should be square and tight. The interior dimensions of the supers should be 18 5/6" by 14 15/16" by either 9 5/8" or 6 1/2" deep.
- The dark brood combs should be checked to ensure that:

- the vast majority of the cells are worker sized to give good populations of worker bees.
- the cells are free of brood diseases so that all the eggs laid will have a good chance to develop into adult workers.
- there are no moths attacking the frames, eating the wax and pollen and sticking all the frames together with webbing.

The white honey frames should be checked to ensure that they are in good condition so that, in future, they can be used as brood frames. Make enquiries to be sure that you are paying a fair price for the equipment you are buying. Bee hives may be purchased with bees in them or the bees may be purchased separately. The best time to buy bees is in the spring when you can ensure that you receive a viable hive headed by a good laying queen. Packages of bees with two or more pounds of bees and a queen can be obtained. Nuclei colonies (nucs) with three or four frames of bees, brood and honey can also be purchased. January is not too early to make arrangements for the bees you want in April or May. Before purchasing bees determine what their status is relative to bee mites. If you are offered bees known to have mites consider carefully the welfare of neighbouring beekeepers and your own ability to deal with this condition.

Photo 1. Beehives with swarms of bees in the shade of a tree

Today the most used types of bee hive is the wooden Langstroth bee hive for Professional bee keeping all over the world. Although there are various local bee hive types, wooden Langstroth bee hives are mostly preferred bee hives of the professional and mobile bee keeping thanks to its appropriate air conditioning, durability, the ability to exchange the brood frames and honey frames (combs), transfer of combs from one another, the ability to burn with blowtorch, being easy to carry and the ability to emit moisture. A standard Langstroth bee hive is comprised of 5 parts including a bottom board, brood chamber, honey chamber, inner cover and outer cover. As the wood to be used for making the bee hive is used from the coniferous trees (mainly the pine trees) and is dried, this increases the quality of the bee hive. It should be noted that excessive moisture that cannot be released is a danger for the colony for its giving rise to diseases and pests due to structure of the bee hive or insufficient air conditioning.

Primitive bee hives: Some beekeepers still use primitive bee hives made from earth, logs, split wood, basket, straw or wooden crates. The baskets are plastered from inside and outside with mud or animal fertilizers (especially cattle feces) and the crates from only inside. This ensures that the holes and cracks are closed and provides protection against external factors. Primitive bee hives generally have one cover in the front and back and a flying hole in the front. It is not possible to interfere to these bee hives and perform effective bee keeping. The bee keeper places the swarm inside and gets honey in autumn.

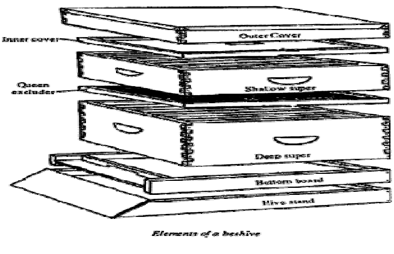

Photo 4. Traditional beehives made of straw, named ‘skeps’.

Modern bee hives: Although they can be in different sizes, they mainly have parts such as bottom board, brood chamber, honey chamber, inner cover, outer cover and frames. There are two types of modern bee hives as Langstroth and Dadant-Blatt. Their systems are nearly similar and have different sizes.

Langstroth bee hives:

- The brood and honey chambers have 10 frames.
- The size of the brood and honey chambers is the same.
- The thickness of the wall is 25 mm.
- It is used in regions with a flora of long plants and better winter conditions.

Dadant-Blatt bee hive:

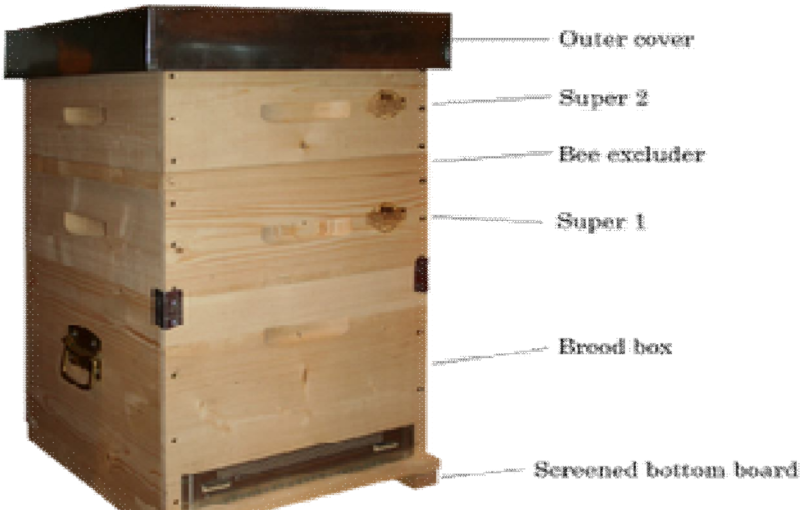

Photo 3. View of Dadant-Blatt bee hive:

The features of these bee hives are as follows:

- The brood and honey chambers have 12 frames.
- The honey chamber is shorter than the brood chamber. Thus, the frame sizes are different. As the brood frames are larger, more bees and work can be produced.
- The thickness of the wall is 30 mm.
- It is used in regions with a short nectar period and severe winter conditions. The largeness of these bee hives is very important for wintering. The bee hive which is to be closed for a long period of time will be better air conditioned.

Features and advantages of modern bee hives:

- As the bee hive parts are mobile, it is easy to open and control.
- We can get information on the strength of the bee hive by examining the existence of queen, bee amount, number of combs with offspring and pollen and honey status of the bee hive.
- It is possible to change the old combs and provide combs with honey or offspring from the strong bee hives.
- We can give a queen to the bee hives which do not have a queen or whose queen is incapable, old or ill from other bee hives.
- It is possible to change the productivity of the bee hives. We can produce queens, bees, royal jelly or honey.
- We can create a strong bee hive by uniting the weak bee hives or split and increase the number of strong bee hives.
- We can easily feed the bee family without the risk of plundering or spreading disease.

- We can prevent the bees from consuming much honey in order to produce bee wax by adding main combs and their lifetimes from shortening by spending excessive strength. We can produce more honey by placing the extracted combs back to the bee hive.
- It is possible to market the combs with honey as comb honey.

Points to be paid attention for modern bee hive production:

- The timber to be used should be from white or yellow pine wood.
- The timber should be dry, kiln-dried, clean and unresinous.
- The outer surface of the bee hive should be dyed to white.
- There should be one internal cover if possible; the internal cover should have an air conditioning hole on an appropriate point of the inner cover.
- Attention should be paid to standard sizes. There should be a gap of 8 mm between the side frame laths and bee hive walls and frames and inner cover. The bottom board of the bee hive should be inclined from the front to the back. There should be a gap of 25 mm in the front and 15 mm in the back between the lower lath and bottom.
- The cover should be straight for easiness of transfer. It should be covered with zinc or iron sheet which is corrosion fee and water resistant. There should be an air conditioning hole in the front and back.
- There should be handles on the sides of the body for carrying the bee hive.

- A loop should be placed to the two sides of the body logs to ensure the frame to be moved easily.
- There should be big and small flying holes on the flying lath and it should be movable to allow changing when desired.

Smoker

It is tool which generates smoke used for facilitating working when the bee keeper has to open and check the bee hive for any reason whatsoever, for calming down the bees and applying the pesticides to be administered as fumigation. Dry cattle feces, cotton cloths, wooden shavings or parts of curing blankets are burned. Materials which release bad and strong fragrance or sulphurous gas such as woolen cloths and sheep shavings should not be used. The bee smoker allows the beekeeper to keep the bees from becoming agitated. A gentle puff of smoke usually calms the bees and permits the beekeeper to continue working in peace. The hive tool is specially designed to assist the beekeeper in manipulating the frames in the supers. Bees are less likely to become disturbed if the proper tools are used.

Photo 4. Smokers

Mask and gloves

A bee suit and bee gloves are desirable accessories that can be added later. The bee suit is designed with no opening to the interior. When outfitted with a bee suit, a pair of suitable high top boots, bee gloves, veil and a good hat, a beekeeper is well protected from bee stings during normal beekeeping operations. Occasionally, when provoked, bees may penetrate the join between the suit and the veil or sting right through the cloth of the bee suit. Working the bees with your bare hands improves your feel for what you are doing and leads to less jarring of the hive and calmer bees. Sometimes, however, the work must be done quickly at which time gloves are good to have.

Photo 5. Veil

Photo 6. Beekeeper mask and gloves

It is a tool which can be worn as a hat and covers the head to protect the face with a dark colored a veil or net on the face part which will not whelm the bee keeper and block his view. It can be with or without a shirt. The gloves generally used by the persons who are recently engaged in bee keeping for protection against bee stings should ensure comfortable working, cover the wrists and be thick enough to prevent the bee sting. The experienced bee keepers generally do not want to use gloves as they decrease sensitivity.

Hive tools

It is tool made of iron with two sharp sides, called also as pointer or hive opener, used for opening the inner covers, taking out the frames, scraping bee wax, bee gum or residues, cleaning the bee hive and separating the brood chamber, honey chamber and bottom board.


Photo 7. Bee keeper hive tool


Photo 8. Types of bee keeper brushes

Brush and pile

The bee keeper brushes are used for moving the bees on the comb away without harming them. Soft, long and durable ones with lots of piles should be preferred. Hen, goose and turkey quills or soft plant branches can also be used. Brushes covered with soft and white hairs or long and wide wing feathers of animals such as turkeys, goose etc. can be used to move the bees away from the place one works on in the bee hive without causing any harm.

Frame mold board and frame wire

It is simple board as thick as the upper lath of the frame, cut to the size of the frame. The main comb is placed on the frame on this board. It should be made of hornbeam and wetted before use. The frame wire ensures that the combs are attached to the frame and prevents the combs from breaking during bee extracting.

Photo 9. Frame wire

Beekeeper spur and honey pricker

It is a small cogwheel with a hole in the middle which ensures that the frame wire is sank into the main comb while attaching the main comb to the frame. It is used after heating. If it is overheated, it may melt the main comb. There are electrical types. Honey pricker is used for opening holes in the side laths of the frame for placing the frame wire.

Photo 10. Bee keeper spur and honey pricker

Wax melting pitcher

It is a double-walled tool made of copper or aluminum which ensure the melted beeswax is poured on the thread of upper lath to which the main comb is entered while mounting the main comb to the frame. Comb pieces and beeswax residues are added inside.

Feeder

When there is not sufficient amount of honey in the bee hive, these containers ensure that the bees are given dry or wet feed. It prevents plundering, economic and does not have any risk of contamination. Glass pots whose cover is drilled with a brad or plastic or zinc containers attached to the frame can be used for giving syrup.

Queen cage

It is tool made of wooden laths or net used for giving a queen to the bee hives without any queen or change the old queens with young ones and with a hole on the side of the lath for placing or taking out the queen.

Photo 11. Queen cage

Queen excluder

It is an excluder made of metal or kiln-dried wood with holes of 4.4 mm placed between the levels of honey chamber and brood nest in order to prevent the queen from entering the honey chamber and laying eggs. Only workers can go through this excluder but the queen or drones cannot pass through.

Drone trap

It is a simple tool which is placed in front of the bee hive flying hole and prevents the entrance of the drones or wasps to the bee hive or exit of drones in the event of breeding works.

Pollen Trap

It is tool placed on the bee hive flying hole for collecting the pollens brought to the bee hive by the bees. The pollens on the back feet of the workers which pass through this tool fall down and collected in the department at the bottom of the tool.

Photo 12. Pollen trap

Bee escape

It is a tool which prevent the bees on the upper floor to go down to the lower floor or vice versa in case of two-floor bee hives.

Uncapping knife and fork

It is used for extracting the capped combs in the honey season and removing the caps for feeding the bees with combs filled with honey is spring.

Extracting equipment

It is a large tool used for extracting honey on the combs in the honey season. It is made of sheer iron or zinc in the shape of a cylinder and has a stringed reservoir with a capacity of 2, 3, 4, 24 or 48, a mechanism and a tap for the flow of the collected honey. It can be manual or powered. Harvesting the honey crop involves several steps, all of which require some equipment. The first step is to separate the combs of honey from the bees (pulling the honey). This can be as simple as using a bee brush to sweep the bees from each frame. With just a few hives a bee brush is adequate and inexpensive, but a fair bit of work. Bee escape boards can be used to direct the bees into a one way trip out of the honey supers. This method uses one escape board for each hive in the apiary, which means plenty of lifting and two trips to the bee-yard.

Using chemicals (Bee Go, Bee Robber) requires a number of special covers (acid boards). The chemical is placed on the underside of the cover and the smell drives the bees out of the honey super. Using a bee blower may require a stand to place the super on. The bees are blown right off the frames, out of the super and onto the ground in front of the hive. Once the honey is pulled, you can extract it yourself or perhaps an established beekeeper will extract it for you. Honey extractors range in size from two-frame, hand-powered devices to motor-driven machines that can handle 100 or more frames. New extractors are expensive, but a second hand unit can occasionally be found at a good price. If there is a possibility of you getting more bees in the future, it is better to buy a larger extractor now than to deal with an inadequate machine in the future. In addition, a device will be needed to remove the wax cappings from the honey comb. An electrically heated knife is commonly used.

Once the honey is extracted it should be strained (cheesecloth or nylon work well) and then stored in a warm place in a tall tank or container to allow the fine impurities to rise to the top. At this point it helps to have a proper tank with an outlet at the bottom so that the clean, warm honey can be drawn from the bottom directly into the honey containers.

 

Photo 13. Honey extractor**s**

Any clean containers can be used for packaging small quantities of honey, but proper honey containers make the crop more attractive and easier to sell.

Wintering equipment

With just a few hives it is easier to winter bees outdoors. Insulation must be placed around and over the hives. The hives are then wrapped in plastic or tarpaper to hold the insulation in place. The insulated hive is covered with a lid or piece of plywood and the whole thing is tied with twine to prevent wind damage.

2. Work Safety in beekeeping

2.1. Bee sting

The bees which are 1.5 cm in average collect the juice of the plants and produce honey, a valuable nutrient. Moreover, they carry pollens between the flowers and ensure the pollination and fruit raising. However, these living things with high levels of benefit may have very risky affects on humans which may even cause deaths. This is referred to as an allergic reaction (anaphylaxis) caused by bee venom after the bee sting immediately.

Photo 14. Examples of bee stings

Bee sting allergy is one of the allergic diseases frequently seen and attracting attention with its deathly affects. The archeological excavations reveal that the bee keeping was carried out in Egypt 4,000 years ago. The first written records regarding bee allergy is about the Egyptian Pharaoh Menses who was stung by a bee and died in 2461 B.C. There are different figures regarding the frequency of bee allergy as revealed by the studies in the world (0,5 - 5 %). It is announced that annually 40 bee stings in the United States of America resulted in death and 20 in Europe and 10 in Asia. Despite this, it is a known fact that many incidences could not be diagnosed. Although it seems that the bee sting allergy threatens the persons engaged in bee keeping activities, the other members of the society are also impacted in this respect. Serious reactions to bee sting allergy can be experienced by individuals at any age, however, the reactions which can result in death are seen in individuals under 20. Men are stated to experience serious reactions to bee sting allergy two times more than the rest. There are many types of bees in the world. The bees which more frequently cause allergies are honey bees, yellow jackets and wasps and hornets. The bee venom is released from the special glands in their stomach and the venom in the end of their sting is collected in the venom sac. The venom sac of the bees which are only a few days old is generally empty. As the bee grows older, its venom also increases. A 20-day old bee has venom which will be enough for its entire life. When an adult bee stings an individual with its sting, it dies as some of its internal organs are parted together with its sting. However, some wasp types do not leave their stings and can use it several times.

When a honey bee stings a person, 50 micrograms of venom enter into the body. This amount is 5 micrograms in case of wasp stings. The bee sting is not very important as a threat to the life. However, if more than one bee stings a person, it might cause an asthma attack in vulnerable persons. A short but severe ache and scratching happen in the place where the bee stings. There will be swelling and rush in the point of sting. Dizziness, sickness, palpitation and numbness may be experienced. It may sometimes cause temperature. When a honey bee stings, its sting is left in the skin and it dies immediately. The sting of the wasp does not come loose as it is straight. These bees may sting several times. Bee stings may cause serious events. Stinging by many bees may cause the death of an adult. Stinging by a small number of bees may cause bad results for persons with heart and kidney diseases.

The bee's stinging inside the mouth may cause very dangerous situations like the entrance of the bee to one of the blood vessels. Bee stinging causes more serious reactions in adults than children. Several bees' stinging a child may cause more dangerous results, compared to the adults.The allergic reactions caused by bee sting is not experienced as frequently as it is thought. The occurrence rate varies from 0.4% to 5% in various societies. The allergic reaction is possible at every age, but it is frequently experienced before 20 and the figures are doubled in case of men. However, the allergic reaction caused by bee sting is more severe if occurring at later ages. While especially stinging from the head and neck causes allergic reaction, the same reaction can be seen if any part of the body is stung. It is reported that bee stings cause 50 deaths in average in the

USA annually. 26 deaths are reported in Denmark in the last 20 years. 15 out of these 26 deaths are caused by wasps and 9 by honey bees, and the bee type cannot be identified in the remaining 2 deaths. 4 of the deaths are caused by stinging from the neck and larynx edema (swelling inside the throat). 5 were caused by cardiac arrest. It is reported that bee stings cause 2 deaths in average in the Sweden annually. Those who found to be dead and considered to die from myocardial infarction (heart attack) are thought to die from bee stings. The symptoms start to develop in people with the allergy in one or two minutes and the earlier it develops, the more severe it is.

The symptoms differ from one person to another. Allergic reactions are experienced as urticaria (nettle rash), redness and angioedema (common swelling). The reactions which threaten the life happen when the respiratory tract (shortness of bread) and cardiovascular system (arrhythmia, shock) are included. It may also be life threatening when the heart and lungs are not involved but there is internal tissue swelling called angioedema in the neck and throat. The cause of death is cardiovascular shock and hypotension. Some persons may suffer intestinal spasm, diarrhea and uterus spasms similar to labor pain. The deaths caused by bee sting are usually seen in adults. The reason is that the adults have some underlying diseases, that they cannot overcome a serious allergic shock and that their body is less endurable when compared to the young people and children. If one adult suffers from a serious allergic reaction caused by bee sting, it has a high risk that may cause a life threatening allergic reaction. In some rare cases, cerebral bleeding and edema and some blood clotting disorders can be experienced.

Actions to be taken in case of bee stings (treatment):

- When a bee stings, first its sting will be taken out with the pliers. Cotton soaked with ammoniac and three units of water should be applied to the region to where the sting of the bee enters. It is washed with 1% of potassium permanganate. This process is performed for three times.

- If the place from where the bee is stung is moved, ice is applied and mud is applied, infection may be caused.
- Antihistaminic or steroid cream should be used against swelling. Any antihistaminic tablet to be taken orally should be beneficial. However, the required medical treatments should be performed without any delay for serious reactions.
- It is not right to rub or soak the wound after the bee sting. If the person who is stung by the bee is sweaty, the venom will increase its affect.
- If more than one bee stings occur, then the people will be in danger. This is because the body exposed to large amounts of poison cannot fight against this poison, will lose the fight and can die.
- If a bee stings from inside the mouth and mouth cavity, this will cause swelling in larynx. As this may cause shortness of breath, there will be difficulties in breathing and this may cause the death of the person. There may be swelling and infection after the bee sting. This swelling may be itched.
- The swelling will be more and immediate if the individual is allergic. There may be other symptoms like shortness of breath. In such cases, the medicines with cortisone and antihistaminic medicines should be used for treatment.
- The persons with bee allergy have to carry Adrenaline (epinephrine) for first aid. This medicine is sold as an oral spray or automatic syringe. Automatic syringes can be administered over the clothes in emergencies. It is like a pen and its needle comes out automatically when pressed

against the body and one dose is administered to the body.

- There are sprays like the ones for bronchial asthma patients which can be carried in pockets or bags for people who do not want to inject themselves. 15 to 20 sprays are considered as an injection of one dose. These people should also carry antiallergic tables (antihistaminic) and they should also be used. Cold treatment, pain killers and medicines including cortisone should also be used. The persons who know that they have bee allergy should also take tablets with cortisone in addition to antiallergic tablets and adrenaline (50 mg of Prednizolone). The asthma patients can suffer from an asthma attack and thus they have to carry an asthma medicine. The victims have to go to a health center after this recommended first aid.

The actions to be taken to prevent bee stings:

- To use safe and protective masks without any holes, to wear suitable gloves and dresses that will prevent bee stings,
- To be calm and act slowly while working with bees,
- To perform smoking by using smokers,
- To arrange the bee hive opening timings in the best possible way and to perform maintenance in the early hours
- Not to use perfumes, deodorants, cologne and scented materials,
- Not to use soaps and shampoos with nice fragrances,
- Not to wear shiny dresses with flowers,
- Not to pick up and wear any flowers,
- Not to kill wasps around their bee hive (the odor released by this bee will attract other bees),

- Not to walk barefoot, to wear long-sleeved and long clothes when outside and to prefer brown clothes, if possible. Bees do not like brown.
- Sweat attracts all kinds of bugs. One should try not to be sweaty around risky regions.
- Wasps are aggressive, but honey bees are calms; however, as both will be aggressive in hot weathers, care should be taken.
- If a honey bee stings, its sting should be taken out with a magnifying glass and tweezers or help should be get from another person.
- Antiallergic drugs should always be available.
- The persons who experienced serious bee allergy before should always carry EpiPen®. EpiPen® can be administered by the person on his own. He should have knowledge about the drug. It includes epinephrine. Epinephrine is an important drug used for the treatment of anaphylactic shock.
- A bandage should be put on the place of sting and this bandage should be loosed for 3 minutes per 10 minutes in case of bee stings.
- Cold should be applied to the place of sting and antiallergic creams should be used.
- In case of risk of allergy, the victims should be referred to a doctor as soon as possible.

How to act when anaphylactic shock or serious stings occur?

Anaphylactic Shock: This is an extreme allergic reaction, which can be fatal and must be taken seriously. First aid can help, but anyone having an anaphylactic reaction needs Urgent medical attention.

Anaphylactic reactions are characterised by the sudden (minutes or less) onset and rapid progression of the following features:

- Difficulty in breathing due to airway swelling or spasm and they may make snoring or wheezing noises when they breathe.
- Faintness.
- Anxiety (they may get a 'feeling of impending doom').
- Pale and clammy appearance.
- Occasionally, abdominal pain, sickness (vomiting) and incontinence.
- An itchy rash (hives/urticaria) or swelling in the mouth, although this may be absent.

Action if the person is concious:

- Sit the person in an upright position that helps with breathing If they feel faint it may be helpful for them to lie down, raising their legs if necessary.
- Loosen clothing around neck and waist
- If the person is conscious and has medication (such as an auto-injector or Epi-pen) help them to use it, if they unable to do it themselves and you have been trained,
  a) Make sure that the device is still in date before administration.
  b) Ascertain the ‘right way up’ for the device – you don’t want to inject your thumb.
  c) The safety cap should first be removed. It should be held around the shaft (not over the end) and pushed down firmly into the upper outer thigh, roughly where the seam of a pair of jeans would lie.
  d) A release button may need to be pressed to should be held down for 10 seconds.

CALL Emergency and follow advice given by the call handler

- People who suffer severe allergic reactions may develop a delayed reaction several hours later: if an adrenaline auto-injector is used, they must be assessed in the nearest Accident & Emergency Department and must obtain a replacement adrenaline auto-injector.

Action if the patient is unconcious:

- If the patient is already unconscious, an EpiPen should only be used if there is prior permission from the patient. This consent may be written or have been given verbally in front of reliable witnesses.
- Tight clothing, especially around the neck should be loosened and the patient should be made as comfortable as possible.
- Lie them down flat on their back and raise their legs whilst you await further assistance. Do not place them in the recovery position.
- CALL Emergency, stating that this is a possible bee sting reaction and follow any advice given by the call handler.
- If there is another person, send them to flag down the ambulance.
- Do not try to give the person stung any food or drink.
- If the person’s heart stops or the breathing stops, resuscitation should be provided by a trained person.

Treatment for stings

If a beekeeper has a fairly severe reaction to stings with some degree of pain and swelling, he may choose to take medication before going to the apiary

Aspirin and anti-histamines are the tablets to consider, but nothing should be taken without consulting your own doctor first. Only your GP can advise about the possible interaction with any other medication which is already being taken.

If a beekeeper is likely to have severe reactions to stings his doctor might have prescribed an Epi-pen adrenaline injection to carry, for an emergency. Only the beekeeper or a trained colleague who has been given prior permission by the beekeeper may use this injection.

Bee sting shock

If a person is stung and shows some distress it is important to follow a few basic guidelines. Bee sting anaphylactic shock is rare and you may never see it, but if you know what to do you can react quickly and calmly to help.

2.2. Extinguishing smokers

One of the matters the bee keepers should pay attention is the extinguishing the smokers when they are done. This is an important issue and many bee keepers experienced big fires as they did not extinguish their smokers. Fires are more frequently seen during the transfers of the colonies. Generally the colonies are loaded carelessly and fast without checking the smokers and the transporters (trucks, lorries) may experience fires on the road.

Section XI:

Bee products, harvesting and bee therapy

As it is known, the products obtained from the beekeeping operations generally are honey, pollen, bee gum, royal jelly and bee venom. However, although the honey is the basic product of beekeeping, the profitability of beekeeping has been increasing thanks to also royal jelly, pollen or both of them. Furthermore, the findings obtained from the scientific researches made show that the ever increasing demand for royal jelly and pollen by consumers in recent years with the help of communication and influence potency of the printed and visual media has created an appropriate environment for a more profitable beekeeping. In short, the product range and the quality production of such products have importance both for producer and consumer. The most produced and merchandised basic bee product worldwide is honey. Besides this, beeswax, pollen royal jelly and bee gum also have an important place in world trade as bee products. The production and consumption of bee venom, another bee product, is highly limited comparing to other bee products.

1. Honey

Honey is the most important bee product for economic aspects. Honey has been used as medicine in addition to being used as food through the history of humanity. The conscious production of honey goes back to 4000 B.C. and the consumption of it dates back to much older times. Honey has been used not only as food, but also as medicine throughout the history by people. Honey is a sweet food made by honey bees using nectar and sucrose from flowers and then transformed and stored in honeycombs. It does not contain water more than 25%, ash more than 0.25% and sucrose more than 0.8%. Honey is harvested in Anatolia during May, June and July. As there will be so much nectar collection during these three months, the bee keeper must be very careful and prepared. That is, if there is not enough place or enough honeycomb in a hive, the large portion of nectar brought by bees gets wasted, or the bees want to swarm. When there are plenty of honey pots, the bees can work faster. Honey is made by bees in one of the world's most efficient facilities, the beehive. The 60,000 or so bees in a beehive may collectively travel as much as 55,000 miles and visit more than two million flowers to gather enough nectar to make just a pound of honey!

Honey bees collect pollen and nectar in the spring when most flowers and plants are in bloom. They use their long, tube-like tongues like straws (called proboscis) to suck the nectar out of the flowers and they store it in their stomachs and carry it to the beehive. While inside the bee's stomach for about half an hour, the nectar mixes with the proteins and enzymes produced by the bees, converting the nectar into honey. The bees then drop the honey into the beeswax comb, which are hexagonal cells made of wax produced by the bees, and repeat the process until the combs are full. To prepare for long-term storage, the bees fan their wings to evaporate and thicken the honey (note: nectar is 80% water and honey is about 14-18% water). When this is done, the bees cap the honeycomb with wax and move on to the next empty comb, starting all over again. So, in a nutshell, the honey we eat is flower nectar that honey bees have collected, regurgitated and dehydrated to enhance its nutritional properties. The colour and flavour of honey differ depending on the bees' nectar source (the blossoms). In fact, there are more than 300 unique kinds of honey in the United States, originating from such diverse floral sources as Clover, Eucalyptus and Orange Blossoms. In general, lighter coloured honeys are mild in flavour, while darker honeys are usually more robust in flavour.

Valuable honey properties

Be pleasantly surprised by these amazing honey properties antimicrobial, antioxidant, and hygroscopic which all make honey a popular food as well as a medicine.

Honey is hygroscopic: Honey has a hygroscopic nature, which means when exposed to air, it naturally absorbs moisture in from the air. In treating open wounds, honey is useful as it could help prevent scarring by keeping the skin moist, encourage the growth of new tissues, and allow easy removal of any dressing by preventing dressing from becoming stuck to the skin. Honey's hygroscopic properties also make it an ideal ingredient in a lot of cosmetics as it helps keep skin hydrated and fresh and prevents drying. Thus, some people call honey a natural "humectant" as it attracts and retains moisture. When used in skin and hair treatments, honey trap and seal in the moisture leaving skin soft and supple, and hair glossy and healthy.

Honey is antibacterial: Researchers began to document the healing properties of honey in the early part of the 20th century. This ceased with the development of antibiotics but recently the development of resistance to antibiotics has led to a resurgence of interest into the healing properties of honey. The effective antimicrobial agent in honey prohibits the growth of certain bacteria. It contains an enzyme that produces hydrogen peroxide which is believed to be the main reason for the antimicrobial activity of honey. As such, honey is a useful treatment for wounds and scalds. Cuts, abrasions and scalds can be covered in honey to prevent bacteria from entering the wound and promote healing. Honey can help treat minor acne by attacking the bacteria that cause the outbreaks while moisturizing the skin to aid rejuvenation. Types of honey differ greatly in their antimicrobial potency, varying as much as a hundred fold. Honey derived from the Manuka bush, found in abundance in New Zealand, claims the highest potency of such antimicrobial properties.

Honey is a source of antioxidants: Honey contains natural antioxidant properties that can destroy biologically destructive chemical agents which have been linked to many diseases such as cancer. Studies also found that dark-color honeys such as Buckwheat seem to possess more antioxidants than light-color varieties. Not only could honey's antioxidants help to eliminate free radicals in the body, they are also part of the nutrient supply for growth of new tissue. These precious honey properties help protect the skin under the sun and help the skin to rejuvenate and stay young-looking. As such, there have been an increasing number of manufacturers of honey skincare products such as sunscreens and facial cleansing products for treating damaged or dry skin.

Honey and sugar

Both sweeteners contain glucose and fructose. However, for sugar, in the process of manufacturing, the organic acids, protein, nitrogen elements, enzymes and vitamins in the sugar cane or beet are destroyed, whereas honey, a natural sweetener, subjects only to minimal heating. Also, honey has certain beneficial antioxidant and antimicrobial properties which are not present in table sugar. Here are three honey nutrition facts that will make you feel good about eating honey:

1: One tablespoon of table sugar or sucrose contains 46 calories, while one tablespoon of natural sweetener honey has 64 calories. Though honey may have more calories, we actually need to use less of it since it is sweeter than table sugar. As a result, you may in fact consume even less amount of calories that you would with sugar. And in the long run even though honey is more expensive, it may be more economical than table sugar. How much sugar is in foods?: 1 can of coke = 10 teaspoons, and a 50g chocolate bar = 7 teaspoons.

2: Table sugar is sucrose, which is made up of two molecules bonded together. When we eat table sugar, our stomach has to use its own enzymes to separate the molecules apart before we can use the sugar's energy. Honey is quite different. The bees have added a special enzyme to the nectar that divides the sucrose into glucose and fructose – two simple sugars for our bodies can absorb directly. Hence, honey vs sugar, honey has a healthier Glycemic Index (GI) which measures the negative impact of a given food on the blood-glucose level. The lower the GI rating, the slower the absorption and infusion of sugars into the bloodstream and hence a more gradual and healthier digestion process.

3: Unlike honey, table sugar lacks minerals and vitamins (hence it's been often called empty calories), they draw upon the body's nutrients to be metabolized into the system. When these nutrients are all used up, metabolizing of undesirable cholesterol and fatty acid is impeded, contributing to higher cholesterol and promoting obesity due to higher fatty acid on the organs and tissues. That is why it is not uncommon for fat people to suffer from malnutrition and many other health related problems. So the message is, honey versus sugar, if you are watching your weight, honey will be a smarter choice than sugar.

Honey colour and flavour

Honey is normally bought and sold in one of two ways: by variety or by colour. Most consumers, whether buying honey in a supermarket, at a farmer's market, or directly from a beekeeper, will typically buy a blend of pure honeys, the so-called Supermarket Store Brands or a particular honey varietal, such as the most common of all the varietals, Clover Honey. The colour and flavour of many honeys are linked; that is, the darker the honey, the more apt it is to taste stronger and more robust. The lighter coloured honeys are usually more delicate and sweeter in flavour. Sometimes people shop for a honey varietal simply because they like the flavour or it reminds them of the kind of honey they had when growing up or they like to impress their friends with a unique treasure! Overall, these customers like the delicious flavours of honey; the colour is irrelevant to them.

However industrial users, such as bakers, food processors, and beverage makers, will often buy honey by colour. Industrial users are typically driven by ingredient cost. The industrial users will often contact a major honey packer (bottler) and buy in large totes or 55 gallon drums. While they want pure honey in the formulas, of course, they want the honey as an ingredient more for labelling purposes than for variety. In addition, the functional aspects of the honey, for example, as an ingredient used in baking, doesn't much change if the honey is light or dark. Honey is hygroscopic and attracts moisture to the bread or dessert – a very valuable trait in baking. Generally speaking a very light coloured honey is much more expensive than a dark honey. The baking company may specify a darker colour grade such as amber honey, rather than a lighter coloured honey such as a water-white honey. A question that is often asked is how industrial grade honey is "made?" Most people understand how bees will visit a particular field of flowers to get a certain variety, e.g. Sage honey, but they can't quite understand how an Extra Light Amber colour of honey is found. Actually, the answer is rather simple. Many commercial beekeepers, rather than keeping track of to what flowers their bees might go, are simply content to collect whatever honey the bees bring in at the end of a season. It's a little more scientific than that, of course, but at the end of the season or month, or whatever the time period, the honey is collected and graded by colour. One last quick point: one should be amazed at the fact that there are more than 300 varieties of honey found. However, only a small percentage of those honeys are popular. It sometimes takes more of an effort to market a particular variety, e.g. Huajillo or Sunflower, than to simply collect those honeys and grade them into amber and extra light amber honey for industrial usage.

Physical properties of honey

Honey contains different types of sugar such as mainly glucose and fructose. The color of honey can vary according to the plant source used from white to dark brown. Honey may be liquid, viscous, or partially or completely crystallized. The taste and flavor of honey vary depending on the source of honey and the plant species. Generally, the honey contains 80% sugar and 17% water. The remaining part of 3% comprises of mineral matters, amino acids, pigments, vitamins and enzymes. Those make honey more valuable than other sugary foods are the enzymes contained in it. As the enzymes will get damaged at high temperatures, honey must not be heated at high temperatures. Honey should not contain drug residuals used for problems resulting from wrong timing of varroa fight and for other diseases and parasites. For this reason, drug should not be given to colonies during early spring and after the last harvest, except late fall periods. Otherwise, honey will be dangerous for human health rather than being an invaluable food. Whether it is extracted or comb, all kinds of honey not containing drug residual and containing a certain amount of enzyme are quality and valuable.

Honey may last for long years without got spoilt as long as it does not turn sour depending on the high water ratio. In order to avoid being spoilt (turning sour), the water ration in honey must not be over 20% and for ensuring this the ripened honeycombs, in other words, the all or at least 2/3 of all cells of the capped honeycombs should be harvested. Harvested and extracted honey must be poured into glass jars or proper containers after having been rested. Particularly the honeys containing water more than 17%

should be heated at 60°C for half an hour before being packaged in order to prevent turning sour. Note that when the heating process is not performed properly, honey loses its enzyme value and the value of HMF (hydroxymethylfurfural) that is a quality criterion for honey increases.

Crystallization of honey: Crystallization of honey over time depending on the plant it is collected from is a natural situation. Crystallization of honey is the transformation Crystallization of honey is considered as that sugar syrup is added into honey but it's not true in fact. Because the situation is exactly opposite of this and the sugar syrup-added honey may stay without becoming crystallized for a long time. Real honeys may become crystallized even in one month according to winter conditions or at the temperatures around 14°C. Such crystallized structure can be solved by keeping honey in a water bath at a temperature under 45°C avoiding its contact with the water. As flower honeys contain more pollens in their composition, they may become crystallized more than honeydew honeys. Adding anything in or removing any matter from honey is prohibited as it causes honey to lose its distinctive feature. The most important method for distinguishing real and fake honeys is laboratory analysis. Because fake honey cannot be recognized by testing its properties such as flavor, smell, and consistency.

The delicious forms of honey

Most of us know honey as a sweet, golden liquid. However, honey can be found in a variety of forms.

- **Comb Honey** – Comb honey is honey in its original form; that is, honey inside of the honeycomb. The beeswax comb is edible!
- **Cut Comb** – Cut comb honey is liquid honey that has added chunks of the honey comb in the jar. This is also known as a liquid-cut comb combination.

- **Liquid Honey** – Free of visible crystals, liquid honey is extracted from the honey comb by centrifugal force, gravity or straining. Because liquid honey mixes easily into a variety of foods, it’s especially convenient for cooking and baking. Most of the honey produced in the United States is sold in the liquid form.
- **Naturally Crystallized Honey** – Naturally crystallized honey is honey in which part of the glucose content has spontaneously crystallized. It is safe to eat.
- **Whipped (or Creamed) Honey** – While all honey will crystallize in time, whipped honey (also known as creamed honey) is brought to market in a crystallized state. The crystallization is controlled so that, at room temperature, the honey can be spread like butter or jelly. In many countries around the world, whipped honey is preferred to the liquid form especially at breakfast time.

Specially certified honey

- **Organic Honey** – Organic honey is honey that is produced, processed and packaged in accordance with organic regulations on organic products and certified by a certified agency or organization. (see annex 1 for EU regulation)
- **Kosher Honey** – Kosher honey is honey that is produced, processed and packaged in accordance with Jewish dietary regulations and certified by a Kosher organization.
- **Halal Honey –** there is some certified Halal honey offered in the internet, but according to some other sites all pure honey can be considerd Halal.

 

Photo 1. Comb honey and extracted liquid honey

Harvesting honey

They can fill up a honey pot within three or four days. Honey pots must be inserted in a regular order and in sufficient amount, and a new honey pot must be placed before taking out the full honey pots. If the honey pot is removed as soon as it is full, the honey would be removed without ripened. The bees cap over the ripe honey with a thin wax. Honey should not be taken out before such sealing process is completed. While the water proportion contained in the composition of honey has an effect on ripening, the level of being capped is also one of the main criteria on the ripeness of honey. Furthermore, the water amount of honeys received from different flora varies after being capped. A fully capped honeycomb contains 14-18% water in average. As a honeycomb 2/3 of whose total surface is capped contains 16-18% water in average, it is considered as ripe enough to be harvested. However, the capping is not at the same level for all honeycombs. In this situation the bee keeper can harvest honey when 2/3 of all honeycombs have been capped. Honey must be harvested during honey season and before drought begins and nectar collection ends. Otherwise, plundering increases highly due to drought, and the struggle among bee increases. If the nectar collection is too much, the combs that are capped as 3/4 may be considered as ripe. Harvesting must also be performed when capping is at the level of 1/3, if it becomes too necessary.

It is important to pay attention not to contaminate honey around, not to leave honeyed combs or chunk residuals around, and to keep sufficient amounts of honey for winter in the hive during the harvest. In order to reduce plundering, honey should be harvested earlier in the day. When ripe honeys are received during harvest and put on one layer hive that comprises of semi-filled combs, both plundering is prevented and a place for storing honeys coming from continuous nectar flow is provided.

Methods for honey harvest: During honey harvesting process, bees must be kept away from honeycombs. The methods used for this purpose are as follows:

- Shaking and brushing**:** The frames are taken and moved to harvesting room after being shaken and brushed.
- Bee escape method**:** Bee escapes are placed in the middle of the inner cover of hive and over the honeycombs to be harvested. Then roof of hive is slightly opened and its inside is fumigated.
- Extracting and resting honey**:** Honey combs and pots to be extracted are moved to the extraction room. All frames are removed and the caps over combs are scraped with uncapping fork or uncapping knife. The honeycombs whose caps are removed are put into honey extractor. These machines have a mechanism based on the centrifuge basis. There are different types of this extraction machine such as the electrically operated and manually operated ones. At the end of the process, some honey residual still remains on the extracted combs. Those combs must be cleaned and repaired by giving them to the strong hives and on the following day they must be distributed to other hives. The honey received from extractor is not clean. There are chunks, larvae, dead bees and pollen grains within it. Wire screen with number zero is used in order to remove foreign

materials in the honey. After being filtered, the honey is poured into resting pots.

2. Beewax

Beeswax is a material secreted from wax glands on the last 4 pair abdominal segments of young worker bees of 13-18 days and used in the formation of comb by bees. Secreted from wax glands in liquid form, the beeswax transforms into a white plea by becoming solid as soon as contacting with air during its going out among the abdominal segments. Bee forms the comb by mastication of the plea which is taken into mouth by bee with the help of its legs. Beeswax is used in different areas such as cosmetics and drug industries, polishing, varnishing, ensuring water impermeability, molding and dentistry besides its main function in comb foundation formation. A bee needs to eat approximately 10 g. honey in order to be able to produce 1 g. beeswax. Therefore, for the development of the colony, in other words, for ensuring bees can form combs or enlarge the comb foundations, it is required to have plenty of appropriate young and old worker bees and sufficient amount of honey in the colony, or nectar flow must be ensured or the colonies must be fed with sugar syrup. Unhealthy and poor colonies turn into black over time as they cannot produce beeswax and develop. On the contrary, the healthy and strong colonies can secrete wax and form combs continuously. New-formed white combs in the colony and white connections among frames are the characteristic indications of a healthy and developing colony.

Photo 2. Beewax

Production of beewax

Beeswax is a more important bee product in especially Africa, Central and Southern America than honey. Beeswax is traditionally produced by melting comb chunks in hot water and transferring that mixture into another container after being filtered and then receiving the solid mass here formed by the beeswax cumulated on the water after being cooled. Wax melting pots with solar energy can also be used for this process. Converting darkened old combs into beeswax by melting is a significant process required to be taken into consideration for controlling diseases.

Usage areas of beewax

Beeswax is used in lots of different areas but it is mainly used in basic comb foundation formation and cosmetics industry. Besides these, as it is required for candles lighted in Catholic churches to contain 32% beeswax at least, it is also used substantially in candle production industry. Apart from these, the beeswax is used in drug industry, in production of polisher, paint and varnish, in the areas such as moulding and dentistry, and for ensuring water impermeability. Our country which was self-sufficient in terms of beeswax need previously has started to import beeswax during recent years. It should be remembered that due to the comb foundations made of the beeswax whose source is not certain, the bee diseases such as American foul brood and chalk brood may spread largely both within country and internationally. For this reason, the beeswax to be used in comb foundation formation should be sterilized at 110°C for 12 hours as a mandatory provision of the “Beekeeping Regulations”. Beeswax should be 100% pure for its all usage areas and it should not contain foreign matters such as paraffin, ceresin, resin and tallow.

Photo 3. Melting and resting tanks for beeswax

Photo 4. Sterilization tank

3. Pollen

Bee pollen is one of the world's most complete natural foods. It is the pollen produced by flowers that honeybees collect as their source of protein, vitamins and minerals. Pollen is the material on the anther of flowers and it is used for feeding both young worker bees secreting royal jelly and the broods thanks to the high protein content in its composition. It contains protein at the varying amounts of 7.02 - 33.5% in its composition. The structure of pollen comprises of 20-25% water, 1.8-3.7% ash, 13-17% carbohydrate, 3-5% cellulose and 1,2-3,7% fat. In addition to these, it contains vitamins B_2, B_3, B_6, C and E. Pollen is a vital material for bees to grow and carry out their functions. In case that there is not any pollen in the colony, brood development stops and a great panic occurs in the colony. As it is known, the bees meet their energy needs from honey while they take all other materials they need (such as amino acids, vitamins, mineral matters, etc.) from pollens. In short, pollen contains all materials that are needed by bees as well as it is an important food source for humans. Some professional beekeepers produce pollen beside honey and even they primarily produce pollen so as to gain more profit. Pollen is an important product to produce for a more profitable beekeeping.

Ambient temperature is important for pollen collection and bees do not collect nutrients at a temperature under 10°C. Temperature for pollen collection must be over 21°C. Pollen is produced by using pollen traps that can be mounted in front of the hive entrance hole or hive bottom. The pollen gathered in the drawers of pollen traps should be collected every day or in every two days, and then it should be ventilated technically in drying stores the temperature of which is not exceeding 40°C, or simply by laying it over a warm place not getting direct sunlight in a way that its thickness will not exceed 1 cm and stirring from time to time. By drying, it is ensured that the high humidity of pollen decreases 7% and it is stored safely. Dried pollen is sifted through fine screens and cleaned with a simple blowing system. Dried and cleaned pollen is stored in air-tight glass jars or in polyethylene bags. While normal room temperature is enough for keeping pollen for short periods such as 1-4 weeks, the ideal storing temperature of it for long term is 4-5°C. Simply a refrigerator used in daily life provides this ambient. After the drying and cleaning processes, subjecting pollen to carbon dioxide application helps storing pollen more safely. Most beekeepers think that pollen collection has a negative effect on colony development and honey production. On the contrary, the studies have shown that the bees in pollen collected colonies work more to close such deficit and as a result there is not any significant negativity for colony development and honey production despite the pollen collection. However, it is essential to keep colonies at the places where plants that produce abundant pollen exist, to keep colonies strong, to have broods in them and to feed them with sugar syrup, when necessary. The colonies weak and not containing broods cannot collect sufficient pollen even if they are at suitable places. Pollen is accepted as a drug thanks to the nutrients in its structure. Pollen is the sole and most rich food in the nature that has all amino acids, vitamins, minerals and other materials required for human health and human nutrition in a well-balanced way. With this aspect of it, pollen is used for increasing and protecting body resistance, regulating developmental disorders, and especially for eliminating prostate and liver problems by sportsmen, adults and children. In addition, it is also used as skin cream or in the production of such creams. It is recommended to consume pollen at the morning on an empty stomach before breakfast. Daily dosage varies according to the person and the case but it can be generally 15-20 g for adults, 5-10 g for children of 3-5 years old, and 10-15 g for children of 6-12. Even it is seen rarely, it should be taken into consideration that pollen may cause allergy on some people and in such a case pollen intake should be stopped. Pollen should be kept in tightly closed and light-proof containers in refrigerator conditions.

4. Royal Jelly

Used in the nutrition of queen and larvae, the royal jelly is a bee product that is secreted from the hypopharyngeal glands in the heads of young worker bees of 6-12 days old, with a considerably high nutritional value, colored, jellylike and slightly bitterish. Today royal jelly is used for human health in order to enhance and protect immunity system as well as to reduce cholesterol and blood pressure, improve sexual functions, and to eliminate skin and hair problems due to its cell regenerative and repair effect throughout the world.

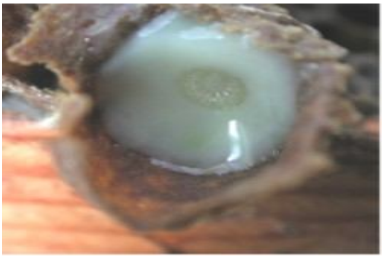

Photo 5. Royal jelly

Within this scope, tons of royal jelly is produced all over the world and especially in China and it is merchandised. As it is in the pollen production, royal jelly production also increases the profit gained from the beekeeping. Technical production of royal jelly is carried out by “larva transfer method” called as “Doolittle method” similar to the queen rearing. With this method, 2 or 3 sticks that can turn around are mounted to an empty frame and so a transfer (graft) frame is prepared. Before or after this process, basic queen cells in 8-9 mm length made of melted beeswax with the help of 8-9 mm diameter wooden mould or the factory-made plastic ones are provided. Such basic queen cells made of beeswax or plastic are adhered to the sticks on the frame with the help of melted beeswax. A comb with open brood containing plenty of larvae (1 day old larva) is taken out from colonies in apiary and the daily larvae are transferred into the basic queen cells through the transferring tool. Following the transferring process, the graft frame is given to the production colony that has been arranged 1-2 days before the transferring process. After 2.5-3 days of giving graft frame to the production colony, the larva in the queen cells is thrown out and the royal jelly in the cells is conveyed with the help of a little, wooden spoon into the colored glass jars. The production of royal jelly is maintained by transferring larvae again into the cells from which royal jelly is collected and giving them to the production colony. The royal jelly put into the glass jars should be immediately brought a cold environment such as refrigerator and should be kept there.

Royal jelly production colonies, in other words, queen-rearing colonies may be arranged as queenright or queenless, while they can also be prepared as “swarm box” containing plenty of young worker bees. When the production will be carried out in queenless colonies, the queen of the colony should be taken out 1-2 days before larva transferring, and the colony should contain plenty of young worker bees, pollen, honey and closed broods. The colony should be fed with sugar syrup throughout the season and young worker bees or closed brood comb should be supplemented to this colony once in a week. Depending on the strength of the production colony, 1-3 or more transferring frames that contain 100-300 cells may be given to that colony. 1 g royal jelly in average can be received from 5 cells.

The composition of the royal jelly is quite different from honey or pollen. Royal jelly is a kind of medicine that has a physical, psychological and hormonal effect. In general, the studies conducted have shown that it whets people’s appetite, regulates menstruation period of women, helps the development of children, refreshes hair and eliminates tiredness. Royal jelly is a vital material. Daily dosage of royal jelly consumed together with honey is recommended as 1 mg/kg as live weight. Royal jelly has positive effects for heart, vessels and nerves and it is used in the developed countries in the form of bulbs or capsules. Royal jelly is generally put into market after being mixed with honey and pollen. However, this situation causes that the amount of royal jelly contained in the mixture is concealed and so it is not convincing for consumers.

Nutritious value of the pollen which constitutes the basis of the royal jelly is considerably high; it contains 35% protein. Also there are vitamins B, C, A, H and E, almost all amino acids, and minerals contained in it. Pollen has significant effects on human nutrition and human health. Furthermore, it affects digestive and nervous systems positively, it is sedative, it eliminates anemia, accelerates growth, removes tiredness and exhaustion, regulates metabolism, and it is highly effective for prostate enlargement observed at older men. For this purpose it may be consumed 20 g daily, and 32 g daily for gaining shock effect. It is more effective when consumed together with honey. It should be taken on an empty stomach morning and night and should be kept taking for 2 months in normal dosages, and the same cure should be repeated after a while. 16 gram and 20 gram are the daily remedial dosages for children and adults, respectively. Normally honey contains pollen even if it is just a bit. Royal jelly that is required to be kept in cold environment is recommended to be consumed sublingually. Daily dose for an adult may be 500 mg as well as it may be calculated as 3 mg per each kg of body weight. Wooden or plastic spoon should be used when collecting royal jelly in order to prevent the spoilage of it. Royal jelly should not be used continuously as health supplement cure, but it should be used twice in a year as cure. Royal jelly could be stored fresh without being processed by freezing it. Also it can be kept in the freezer by mixed with other products. It can also be stored as lyophilized. Shelf life of royal jelly is short and it should not be kept in refrigerator at the temperatures of 0-4°C longer than 7 days in pure state. It can be stored for 1.5 years with freezing method. Lyophilized royal jelly may be stored for a longer time at room temperature.

5. Bee Gum (Propolis)

Propolis is a natural resin collected by the honeybee from trees and plants. Propolis is nature's way of assisting with immune defence. Bee gum is an adhesive and gummy material that worker bees collect from plants. Bee gum is used for closing cracks at the hives by worker bees, for narrowing the flying entrances, for mummification of living creatures that are killed after entering into the hive but could not be thrown out in order to prevent putrefaction of them or for polishing comb cells and interior wall of hive and for preventing brood spaces from diseases. It is composed of resin, pollen, beeswax, etheric oils, and various organic and inorganic compounds. The simplest raw bee gum production is carried out by scrapping the bee gum collected from the entrance hole of the hive and its around. For technical production of bee gum, on the other hand, the plates and some special mechanisms are placed to the top, center and bottom of the hive. Collected raw bee gum is purified with some chemical methods and its extract is acquired. Bee gum is an important material for its antiviral effect besides its antiseptic, antibiotic, antibacterial and antifungal characteristics. Therefore it is used for human health especially for regulating the operation of endocrine glands, as local anesthetic substance in dentistry, for the treatment of viral infections such as influenza, herpes, etc. and for skin problems, as an antirheumatismal substance, in food and cosmetics industries and in the production of drug.

While bee gum can be consumed naturally by chewing in the mouth, it can also be used by melting in alcohol of 70% and diluting at the rate of 30%. And purified bee gum may be used as cream after being mixed with vaseline and beeswax. However, while using bee gum it’s essential to be more cautious than using the other bee products and allergic reactions should be paid attention. As it is known, bee gum is an adhesive and resin-like material that is collected by bees from plant burgeons and buds, that closes the cracks and fractures in the hive entrance, and has antibacterial, antiviral, antifungal, antioxidant and antiparasitic properties. Bees move the resin-like material they collected from those plants to the hive with their back legs. They mix it with beeswax and some digestion secretions and use it inside of the hive. Bees collect bee gum from poplar, oak, beech, and eucalyptus trees and bushes. The bee gum carried by bee with its back legs can only be discharged with the help of other bees. Bees accumulate bee gum at bottom board, frame edges and behind of the entrance hole in the hive.

Physical properties of bee gum

- Color: The color varies from yellow to dark brown depending on the plant species.
- Bee gum is liquid at 60-70°C, soft and viscous at 25-45°C, and solid and fragile under 15°C.
- Bee gum is solved in ethanol, glycol and water at certain proportions.
- Antibacterial compositions are generally solved in alcohol and water.
- Bee gum is marketed in many different forms and formulations such as pure, solid, tablet, spray, pomade, soap with bee gum, sugar with bee gum, etc.

Structure and composition of bee gum

150-200 compounds or chemicals have been detected from the samples of bee gum depending on the plantal source.

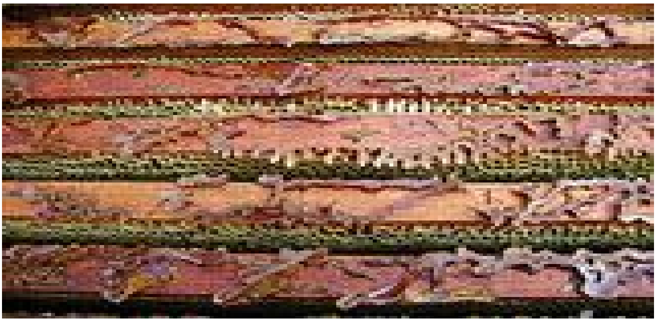

Photo 6. Construction material for bees “Bee gum”

Some of these are:

- Flavones and flavonoids
- Terpenes and terpenoids
- Aromatic acid and esters
- Aliphatic acid and esters
- Amino acids
- Alcohols
- Aldehydes, chalcones, ketones, hydrocarbons

Bee gum collection methods

Collection from entrance hole of hive: It is carried out at the same time with pollen production. For this purpose pollen traps are used. The bee gum brought by bee from outside falls into reservoir while passing through such traps.

Collection from cover cloth: For this method special wired covers are used. Bees fill the holes on that wired cover with bee gum in order to close them. Then that cover cloth is immersed in water and it is ensured that bee gum passed to water. Then it is collected from there.

Benefits and usage areas of bee gum

- Anti-asthmatic effect and mouth sprays
- Antirheumatismal effect
- For lung diseases,
- For treatment of melanoma and carcinoma tumor cells,
- Tissue regenerative,
- Restorative for capillaries,
- Antidiabetic,
- Phytoinhibitor,

Bee gum has no adverse effect but it may cause a slight allergic reaction for some people. Bee gum is accepted as the “most excellent natural medicine” discovered in this century by the Far East countries such as Japan and China.

Use of bee gum in medicine

Antibiotic property:

- **Gram positive bacteria**: *Bacillus brevis, B.polymyxa, B.pumilus, B. sphaericus, B. subtilis, Cellulomonas fimi, Nocardia globerula, Leuconostoc mesenteroides, Leuconostoc mesenteroides, Staphylococcus aureus and Streptococcus faecalis.*
- **Gram negative bacteria:** *Aerobacter aerogenes, Alcaligenes sp., Bordetella bronchiseptica, Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa and Serratia marcescens*
- *Staphylococcus aureus* and *Sptreptococcus mutans* (flavonoids galangine and pinocembrine)

Antioxidant activity: Arthritis, Rheumatism, Artrosis

Anti-fungal activity: Cinnamic acid and flavonoid crisina)

Anesthetic effect: Used in dentistry due to its anesthetic effect 3-5 times stronger than cocaine

Anti-protozoan effect: *Trichomomas vaginalis, Giardia lamblia,*

Anti-viral activity: Herpes simplex type 1 and 2, adeno virus, corona virus and rota virus

Anti-cancerous: Cinnamic acids and terpenoids contained in bee gum have cytotoxic activity and the bee gum is used successfully for intestine, kidney, breast, nose and pharynx cancers.

In Dermatology and cosmetics: Antibacterial, antifungal and tissue regenerative

6. Bee venom

Among honey bees, only female members (queen and workers) have stinging ability and male members do not have any stinger, which is the defense organ. Venom secretion is generally for defensive purposes as it is for individual or social insects. While bees secrete venom in order to protect their host hive or to attack against any plundering, the queens use it for the competition when there are two or more queens in a colony in order to kill the other one with the venom of the stronger one. Stinger of bees places at the end of abdomen. The stinger has been transformed into a complex structure which has become the defense organ with the structural change of ovipositor for other female insects. The stinger composes of two sections and three parts. These sections are formed by tapering of one top part (Stylet) and two lower parts (Lanset) and their thickening towards the body and connected to a venom reservoir. The venom is secreted from alkaline and acid secretion glands which are in connection with those sting parts and it is stored in the venom sac. Venom production increases during the first two weeks of mature worker bees' lifetimes and it is maximized when honey bees start to fulfill their duties for defending the hive and foraging.

When bee stings, it does not discharge the entire venom of 0.15-0.3 mg in its venom sac normally. When it stings a living being, the bee loses its venom sac, muscles and nerve center together with its stinger and then dies. When a person is stung by bees 600 times simultaneously and when those stingers are not removed immediately and when it is assumed that each bee discharged its total venom of (0.3 mg), such stings may be lethal for a person, and it will definitely be lethal for a child of 10 kg weight.

Structure of bee venom

Bee venom is a product that is produced by venom gland of worker bees during the period from the taking out of the bee until it becomes of 20 days old, and it is stored in the venom reservoir. Bee venom is used for defense purposes by bees against the enemy, while it is used in medicine to enhance immune system against bee venom and in the treatment of rheumatismal diseases. Special mechanisms are required for its production. However, its production and trade volume in the world is limited due to its restricted usage areas. Bee venom is produced in the venom glands of worker bees and stored in the venom reservoir. Bees newly come out of the comb cells have very little venom producing skill and when they are of 12 days old they reach maximum level of venom producing ability and lose it when they are of 20 days old. Bee venom has a quite complex structure chemically. It contains significant active materials pharmacologically. The most important one among these is the melitine having a polypeptide structure and constituting about 50% of the chemical structure. Bee venom is a light-colored, odorless, water-like liquid material and it has a sharp and bitter taste. It has an aromatic feature due to the alarm pheromones contained in it. Bee venom which is of clear and acidic structure loses 30-40% of its weight by drying at the room temperature and turns into light yellow. It also contains compounds that can easily be disappeared by evaporation during venom collection. When the walls of venom sac contact with eyes, it causes irritation and inflammations. Though venoms acquired from Apis type of bees are of similar structure, there are small differences in the structures of each type of venom, as it is for the venoms acquired from various races. It is known that *Apis cerana* (Indian honey bee) venom is stronger two times than the venom of Apis *mellifera* (honey bee). Bee venom is of a highly complex structure that contains biochemical and pharmacological active materials. Bee venom contains some proteins and enzymes causing to allergic reactions.

According to the common view, bee venom contains formic and malic acids. Also hydrochloric, iso-phosporic, histamine, choline, tryptophane, sulfur, and other materials are among them. For example, phosphate, magnesium, copper, calcium, a number of proteins and volatile oils can be listed.

Materials contained in the structure of bee venom are:

1. **Enzymes:** Phospholipase A_2, Hyaluronidase, Acid Phosphomonoesterase, a glucosidase, hysophospholipase
2. **Proteins and Peptides:** Melitine, Pamine, Mast Cell Degranulating Peptide (MCD), Secapin, Procamine, Adolapin, Protease inhibitor, Tertiapinc, micro molecular peptides (<5 amino acids)
3. **Amines and Others:** Histamine, Dopamine, Noradrenaline, Amino acids, Sugars, aromatic materials, Phospholipids

80% of venom consists of water, and glucose, fructose and phospholipid structures, and at least 18 pharmacological active components consisting of various enzymes, peptides, and amines have been already identified. Histamine is a chemical that may cause headache, inflation, itching, vomiting and visual disorder for people sensitive to venom, and it has an effect that may result with death by enlarging blood vessels. Bee venom has a pharmacologically active effect because of its components.

Collection of bee venom

The easiest way of collecting venom is to remove venom gland by surgical operation or squeeze the bee until it releases venom. Electroshock method which is put into practice in 1960 and known as a standard method has been used until today by developing continuously. In order to avoid evaporation of very volatile compounds, venom collection under water is another way of venom collection. Venom collected from surgically removed venom sacs has different protein contents than that collected with the electroshock method. Electroshock may be dangerous when applied to colony as it causes bees alarm immediately to other bees and colonies in the beeyard and attack to the people around. Specialists indicate that the most efficient collection period of electroshock method is 15-minute application at intervals of three days and the same process can be repeated after 2-3 weeks. The Argentinean beekeepers have developed a new electroshock method that disperses bees less and increases the efficiency of collection considerably. It is stated that in order to be able to collect 1 g venom from bees, venom is collected from 20 colonies for 2 hours.

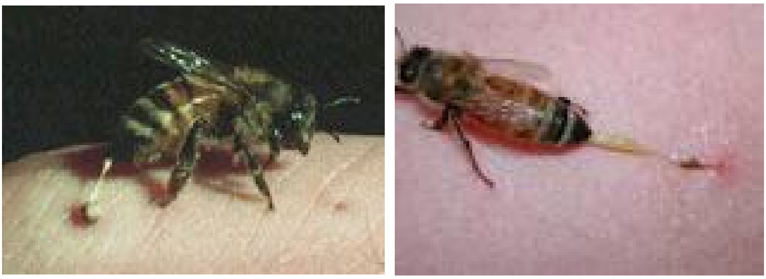

Photo 7. A bee ready to sting

Storing and marketing bee venom

All venom preparations in particular the dried bee venom should be kept in refrigerators or dark colored bottles as frozen. Bee venom is resistant to the highest and lowest temperature degrees. There will be no reduction in the amount of bee venom by boiling or freezing it.

Bee venom is put into market in the forms of pure bee venom, injectable pure liquid venom, dry crystalline, tablet and cream. In general, most bee venom is sold in the form of dry crystalline. The venom prepared in this form becomes more stable and pure, so its probability of spoiling diminishes.

Benefits of bee venom

Bee Venom functions for topical application include: anti-inflammatory, anti-bacterial – helps eliminate blemish cause, helps cell regeneration – renewal of damaged skin cells & scar healing effect, and collagen formation and anti-wrinkle.

Production of bee venom and its use in medicine has been increasing day by day because of its pharmacological effects, stimulation of immune system and being good for many disorders. Bee venom is widely used in pure form as injectable solution, cream, tablet and pomade in pharmaceutical industry. Pharmacologically the bee venom has effects on increasing blood circulation, eliminating bacteria, protective against radiation, decreasing blood pressure and activating immune system. Bee venom has been being used in the studies conducted in recent years successfully for the treatment of many diseases such as multiple sclerosis (MS), aids, cancer and others that are not curable. Because of such properties and common usage of bee venom.

Apitheraphy has been accepted as an alternative medicine in many European countries and particularly in USA and Apitheraphy hospitals are started to be founded. Some other diseases and disorders that bee venom is effective for are; arthritis, epilepsy, myositis, iritis, bursitis, migraine, rhinosinusitis, some types of cancer, embolisms, cholesterol, intercostal myalgia, Asthma, and keratoconjunctivitis. Recent scientific researches have come to the conclusion that bee venom is one of the most potent antibiotics. Researchers have found out that 20 ppm bee venom solution has a germicidal effect. A microscopic living being called Paramecium dies immediately in a 100 ppm bee venom solution and in a 20 ppm solution it dies after a waiting time of 30 seconds. Also Egyptians knew that the rheumatism could be treated by particularly bee venom. The treatment was applied by making bee sting the point aching.

Today venom can be collected with a special method and dried and then stored indefinitely. The studies on venom show that bee venom increases the secretion of cortisone. Today rheumatism, arthritis, arterial diseases, skin and vessel diseases, joint inflammations, hematoma, neurology (aches felt due to neuritis), sciatic, allergy, and hay fever are treated with bee venom. It is known that bee venom is efficient especially for rheumatism and various treatment forms have been developed on this matter. Rheumatic pains are rarely seen on beekeepers. Bee venom is used as a therapeutic substance for muscle aches, low back pains, neuralgias, and neuritis. Bee venom production is a quite complicated and technical subject. Basically, a tight membrane is stretched over a container that will make bee sting and facilitate the removal of its stinger, and then venom is collected.

Section XII:

Pesticide residue risks of bee products to human and the environment

We will be needed more food to feed world population predicted to be 9 billion by 2050. However, the foods have to be healthy and not harmful to the environment. The development of public and private food safety standards has been driven by the numerous scandals like dioxin that occured during the last years. In recent years public concern about the safety of foods of animal origin has heightened due to residue problems originated from contaminants, dioxins and pesticide resistance. Residues are substances that can ocur in foods after using veterinary drugs and pesticides in beekeeping and in agriculture. Pesticide residues in foods are unwanted phytosanitary products or derivates. Pesticides are designed to control pests and disease-causing organisms. They are chemicals that control insects, weeds, fungi and other pests that destroy almost half of the world's food crops. However, pesticides are poisonous. Therefore they must be applied correctly to protect bees in pollination. Many pesticides contain persistent organic pollutants (POPs), which persist in the environment and accumulate in the fatty tissue of animals, including humans. The accumulation of these chemicals in the body can pose a serious health risk to living organisms, and have been implicated in causing cancer, disease, hormonal imbalances and reproduction problems, including birth defects. Due to the lipophilic nature of most pesticides, they enter into the food chain by accumulating in fats, such as vegetable oils and animal fats. They can be also present in non fatty products, such as water, fruits and vegetables. Organochlorine pesticides (OCPs) can be present in honey by the means of treatment of some plants. Pesticides might be introduced into honey from nectar or pollen collected by honey bees from contaminated blossoms. They and their metabolites can accumulate in wax of the comb. However, for every one dolar that is sepent on pesticides for crops yields approximately four dollars in crop saved. Pesticides also reduce biodiversity, destroy habitat and cause pesticide resistance. Pollination is an essential part of the ecology and bees are the most important pollinators. They are beneficial to human by producing honey, wax and pollen, besided pollination. They are biological indicators, picking up chemicals and other pollutions from their environment both external and internal to their hives.

Bee products have the image of being natural, healthy and clean. Asia is the greatest honey producer. Other major honey production is in Europe, United States, Argentina and Turkey. Total honey production in the world is 1.3 million tones and 93.000 tonnes in Turkey. Today honey and other bee products such as pollen, wax and propolis, are produced in an environment polluted by different sources of contaminants. The contamination sources can be environmental (heavy metals, pesticides, bacteria, GMO and radioactivity) and apicultural (acaricides, bee repellents, pesticides and antibiotics). These contaminants are also present in air, water, soil and plants are transported to bee hives by bees. Residue in food, especially in honey, is a very sensitive subject and it is very difficult to give correct information considering that the consumer’s perception of hazard differs a lot from the real risk. There is a need to improve preventitive methods to reduce or avoid accumulation of contaminants in the apiary infrastructure in aim to produce clean honey and apiary products. As the use of pesticides has increased governments have introduced measures to resistant and regulate their use to protect the users of pesticides, consumers, domestic animals and the environment at large. Good Agricultural Practice (GAP) and Integrated Pesticide Management (IPM) can reduce risk to human, bees and the environment. Residue can arise from overuse of pesticides, or use too close to harvest, illegal use of a pesticide, and incorrect use of pesticide.

The aim of this paper is to give information about pesticides, their action and effects on bees and bee products, human and the environment. It also aims to give preventition methods and legislations of pesticide residues in bee products.

1. Pesticides and their chemical structure

Pesticides are used in agriculture and farming practices to eradicate insects, rodents, weeds and other forms of pests. They are in powders, liguid, spray, gel, granule, pellet or lotion forms and can be applied by using various methods. They can be classified based upon their chemical, biological mechanism function and what organisms they target or application method. They can be also divided to two classes, broad-spectrum and narrow-spectrum pesticides. Broad spectrum pesticides kill many kinds of pests, while narrow-spectrum pesticides do just the opposite. Narrow-spectrum pesticides are developed to kill specific organism types. However, systemic pesticides work differently. They penetrate to the inside of a plant travelling along its absorbtion path. These poisons work by poisoning the pollen and nectar of flowers and this can kill needed pollinators like bees and butterflies. Pesticides include insecticides, fungicides, herbicides, acaricides, bactericides and nematodices. The residues of pesticides detected in bee products are mostly insecticides, acaricides, fungicides and herbicides. The total amount of pesticides applied worldwide is currently put at 2.5 million tonnes. Of this 50-60% is herbicides, 20-30% insecticides and 10-20% fungicides.

Pesticides used on various crops are divided to groups based on their chemical structure:

- Organochlorines pesticides (OCPs): They are hazardous because of their bioaccumulative action into the food chain, to remain stable for years and to move the environment. DDT is the first synthetic pesticide in this group produced in 1939. This was followed lindane and its isomers, hexachlorocyclohexane, aldrin, dieldrin, endrin, heptachlor and endosulfan.
- Organophosphorus pesticides (OPPs): This specific class of pesticides is of relatively high toxic for humans. This include dialiphos, trichlorophon, dichlorvos, parathion, malathion, ronnel, methoate and several others. They were introduced in 1930. These chemicals break down quickly when exposed to weather and very hazardous for mammals than the OCPs.
- Carbamates: These insecticides contain one or more amino groups. They don’t leave residue on foods. Aldicarb is more toxic than carbaryl. Their mode of action is similar to OCPs but their insecticidal activity is more selective.
- Pyrethroids: A new class of insecticides was introduced in 1970. These chemicals are similar to pyrethrum, a natural insecticide, but do not break down quickly as the natural products. They are not toxic to mammals. These substances were proved toxic to bees but the concentrations of residues detected in honey were very low.

The *Varroa* mite, *Varroa* destructer, is one of the most serious pests of honey bees in worldwide. Beekeepers are frequently compelled to use Varroacides to avaoid colony death and residue. The Varroacides canbe divided into three categories:

- Synthetic organic pesticides: They include pyrethroid, fluvalinate, amitraz and fenpyroximate.
- Natural product pesticides: They are thymol, menthol and other essential oils of herbs.
- Organic acid pesticides: Formic acid and oxalic acid are in this group use by beekeepers in recent years as alternative to hazardous chemicals.

Residues of pesticides in bee products can arise from the use on crop of legaly allowed pesticides according to GAP, overuse of pesticide, or use too close to harvest, of a legaly permitted pesticide, illegal use of pesticides that are not approved, and incorrect use of pesticides after harvest, to reduce pest infestation in storage.

2. Pesticide residues in honey and other bee products

Effects of pesticides on honey bees

Honey bees make an important contribution to sustainable agriculture and the environment as the main pollinators. Pesticides are responsible for disappearing of honey bees in recent years. Pesticides are stored in honey bee's body while they are harvesting nectar and pollen from flowers. Beekeepers have to control *Varroa* and the number of mites to prevent colony losses. Most of the time, accaricide treatments for *Varroa* lead to residues in hives. While insecticides selectively target insects, they do not discriminate against which insects, they kill, so pollinators who come into contact with the insecticide will also be killed. The same for fungicides.

The recent sequencing of the honey bee genome provides a possible explanation for the sensitivity of bees to pesticides. The honey bee genome is markedly deficient, including cytochrome P450 monooxygenases (P450s), glutathione-s-transferaes, and carboxylesterases. Pesticide residues as ppb and occasionally ppm can be detected in hive matrices when honey bees forage in any conventional agricultural or urban settings. Delayed development was observed in bees reared in teraatment combs containing high levels of pesticides particularly in the early stages of worker bee development.

Pesticide residues in bee products

Systemic pesticides are usually incorporated into the soil or onto seeds and more up into the stem, leaves, nectar, and pollen of plants. Dust and wettable powder pesticides tend to be more hazardous to bees than solutions or emulsiffible concentrates for contact pesticides. A systemic pesticide may incorporate into fruits, pollen and nectar of the treated plants. However, bee products from natural vegetation contains lesser residues than agricultural fields.

Acaricides used for varroa control within hives in Europe mainly cymiazol, fluvalinate, amitraz, flumethrin and coumsphos. Most of the acaricides such as coumaphos, amitraz and fluvalinate leave residues in hives. In honey, residue levels are low, but accumulation of several pesticides in beewax could lead to synergistic toxic effects on bees, also, the persistence of acaricides in beehive wax favor the appearence of acaricide resistent mites. The medicines used in varroa treatment leave residue in honey, wax and propolis. Fluvalinate and flumethrin, fat soluble compounds, hazard with wax. They become the active ingredient and we do not get rid of it until the wax is burned. If these compounds are used several years in succession than the residues build up and some moment they become so large that there are traces to be found in the honey. Already after one year, there are such large traces in the wax. After one or two years the compounds can be found in honey. The compouns alternate to these chemicals (formic acid and lactic acid) are to be found naturally in honey. With the recomended dosages they do not produce a larger content in honey. The relatively low concentration of pesticides in honey seem to be due to a filtering effect of bees. Pesticides can bound strongly with propolis but there is no market for propolis with traces of pesticide residue.

The main contamination risks for the different bee products are listed as:

- Honey: Antibiotics
- Wax: Persistent lipophylic acaricides
- Propolis: Persisitent lipophylic acaricides, lead
- Pollen: Pesticides
- Royal jelly: Antibiotics

Effects of pesticides on human health and the environment

In the EU no plant protection substances can be used unless if they have been scientificly established that they have no harmful effects on consumers, farmers and by standards. They do not provoke unacceptible effects on the environment. However, the WHO estimates that each year, 3 million farmers in agriculture in the developing countries experience severe poisoning from pesticides, about 18,000 of them die. Pesticides are economically beneficient for farmers but these economic benefits are not without their risk to human and environmental health. Pesticide residues may cause harmful health effects including skin irritations, delayed or altered development, lung and breathing problems, brain-nervous system disorders, liver-kidney damage, reproductive damage, endocrine and immune damage, and cancer. Childrens and infants are more sensitive to pesticides than adults. The dangers of pesticides can start as early as fetal stage of life and cause growth problem, fewer nevre cells and lower birth weight.

The health effects of pesticides depend on the type of pesticide. Organophosphates and carbamates affect the nervous system. Others may irritate the skin or eyes. Some pesticides are carciogens. Others may affect the hormone or endocrine system in the body. Organochlorine hydrocarbons (e.g. DDT) operate by disrupting the sodium/potasium balance of the nevre fibre, forcing the nevre to transmit continously. Organophosphates and carbamates operate through inhibiting the enzyme acetylcholinesterase, allowing actylcholine to transfer nevre impulses indefinitely and causing a variety of symptoms such as weakness or paralysis. Organochlorine pesticides transfer from blossom to honey and finally to the consumer. They have been restricted or banned in agriculture because of their persistence and bioaccumulation in the environment. However, these type pesticides are stil found in soil from which they continue to cycle through the environment. Due to its lipophilic nature, OCPs, enter into the food chain by accumulating in fats, but also be present in non-fatty products. Compounds that are soluble in water are removed from the blood stream by the kidneys and excreted in the urine. Fat-soluble chemicals break down by the liver and these broken down products are excreted in urine or bile. Because DDT and its relatives are fat-soluble, they are not excreted in the urine. Modern pesticides are much less persistent than DDT and are not prone to bro-accumulation. The organochlorine pesticides are banned in developed countries. However, they are stil widely used in developing countries because they are relatively cheap.

More than 95% of insecticides and herbicides can reach non-target species, air, water and soil. They can be carried to other areas by wind. Pesticides also reduces biodiversity, damages habitat and decrease pollinators. Gradual route of pesticides with an increasing order in food chain is from plants, water or soil to bee products then to human.

Methods to decrease pesticide residues in bee products

The beekeepers are the first subjects in the production chain, the most important point of the chain to avoid honey contamination. They are mainly entered in the quality of bee product, but they needed more effective control tools. Pesticide residue problem is on second of consumer perception list of possible risk. Food additives are on top of this list. A correct management of the risk analysis is made up of different steps such as risk assessment, risk management and risk communication. Alll pesticides must be adequately tested, evaluated and authorised for potentionally adverse effects on foods, human health and the environment before they are licensed. Some pesticides are restricted. The restricted and not authorised pesticides carry a greater level of risk.

In the EU 0.01 mg/kg pesticide in honey is limit. To avoid pesticide residues should be used outside the bloom period or at least, not during the foraging time of bees. Beekeepers can also avoid residue by placing their hives more than 3 km from agricultural plants treated with pesticides. Farmers must be careful with pesticide application. They should do this application by using Integrated Pesticide Management (IPM). it is the best available pest control system. Farmers and beekeepers should also apply Push Pull strategy which uses a mixture of behaviour-modifying stimuli to manipulate the distribution and abundance of insects. Other methods to decrease pesticide residue are:

- The overuse, misuse and overuse of peticides must be conrolled by the governments and specialists.

- Farmers should use cultivation practices including polyculture and crop rotation to manage the pests damage.
- Farmers must prefer biological pest control methods including natural predatorsor parasites of the pests.
- Beekeepers and farmers must be in a good accordanceduring pesticede application period.
- It is beter to use new products have been produced in recent years as alternative to hazardous pesticides. New pesticides include biological and botanical derivates and alternatives that are though to reduce health and environmental risks.

3. Legislations for pesticide residues in bee products

In Europe, recent EU legislation has been approved banning the use of carciogenic, mutagenic or toxic to reproduction, those that are endocrine-disrupting, very persistent and very bioaccumulative. The EU approves the use of pesticides and sets tolerence levels. The maximum amount of pesticide residues permitted in or on a food are often 10 to 1,000 times less than the amount needed to pose a health risk. However, pesticide regulations must ultimately protect infants and children, who may be more sensitive to pesticides than adults. The amount of pesticides on fruits, vegetables and crops can be decreased by washing, peeling, blanching and cooking but people consume honey directly. Although most countries aim to observe Codex MRLs so they can export products, this does not necessarily mean that they have in place on effective system of national MRLs for domestically produced and consumed foods.

The substances for any type of animal or food that must be monitored were divided into two main groups in EU legislations. The categories are shown in the table have to be monitored in bee products:

- GROUP A- Substances having anabolic effect and outhorized substances:
  - (6) Compounds included in Annex IV to Council Regulation (EEC) No 2337/90
- GROUP B. Veterinary drugs and contaminants
  - (1) Antibacterial substances icluding sulphanomides, quinolenes
  - (2) Other veterinary drugs
  - (c) Carbamates and pyrethroides

(3) Other substances and environmental contaminants

- (a) Organochlorine compounds including PCBs
- (b) Organophosphorus compounds
- (c) Chemical elements

However, in Europe, accaricide residues in beewax are not regulated .The EU proposed two legal proposals in 2006. First of them is for Regulation on placing on the market of plant protection products. It includes substittution of more toxic pesticide by safer alternatives. The second proposal is for a Directive on the sustainable use of pesticides. It includes the application of pesticides and education of users, and IPM schemes. In 2008, the EU issued new and revised MRLs fort he roughly 1,100 pesticides ever used in the world. The revision was intended to simplfy the previous system, under which certain pesticide residues were regulated by the Commission, other were regulated by the Member States, and others were not regulated at all. The new Regulation covers pesticides currently or formerly used in agriculture in or outside the EU. The safety assessment for consumers is undertaken by the European Food Safety Authority (EFSA), based on the toxicity of the pesticide, the maximum levels expected on food and the different diets of European Consumers. For crops grown outside the EU, MRLs are set on request of the exporting country. Developing country exports must meet importer's MRLs or perhaps in future the international recommmendations under WTO rules.

In conclusion, the main contamination for bee products come from apicultural practices and agriculture. To avoid harmful effect of pesticides on environment, farmers, beekeepers, bees and bee products, and human educational programs and projects should be developed by the public health organisations. Especially, developing countries need to assistance in establishing pesticide residue standards. Consumers in these countries must be also educated about health concerns associated with pesticides. It is also necessary for developed countries that importing bee products from third countries.

Section XIII:

Marketing and cost management for sustainable beekeeping

Introduction of marketing concepts in the beekeeping is not easy. It is mainly due to the specificity of this kind of activity. The transfer of experience from the industry is not possible. Here we are dealing with a large number of beekeepers, each of who has a relatively small contribution to overall production and a small impact on price formation. Hives production is also accompanied by uncertainty of weather conditions. The primary reason for the slow pace of transformation in the native beekeeping is, in our opinion, the underestimation of the importance of marketing and lack of marketing orientation in the apiary farms.

The marketing conception is a philosophy, not a system or an organizational structure. It is based on the belief that the return of sales and a satisfactory return on investment expenditure, can only be achieved by identifying, anticipating, stimulating and satisfying consumer needs. In the past, the beekeepers' role was limited to manufacturing. They remained in a comfortable situation for unmet demand. Beekeepers focused on the production, improving the efficiency and lowering costs. Beekeepers produced and offered to sell these products (eg, those varieties of honey), which could be produced efficiently. The consumers needs and desires had a minor importance. In order to make a profit, beekeepers must recognize the needs of consumers and produce such products which satisfy those needs better and more efficiently than competing products. Beekeepers can benefit from the significant achievements of agricultural marketing. Like many beekeepers, farmers believe that marketing begins only when the products leave the farm. This, however, strongly limits the effectiveness of marketing. Marketing is the performance of all economic activities, associated with the movement of food products and services, from the point of initial agricultural production until the hands of consumers.

1. Stimulating demand for beekeeping

Manufacturers, in order to understand market needs better and improve the ability to meet these needs, can increase the demand for their production. To make this possible, it is necessary that producers, either individually or in collaboration with others, were able to identify new markets or new products, or to increase the demand on existing markets through the use of advertising or improve sales. The most frequently used approach is to raise revenues at the existing level of demand. In many countries voluntary or compulsory marketing organizations have been founded. They have a dual purpose: increasing the role of producers in the market and a reduction of more than normative profit companies that buy raw materials and increase its value by combining the processing, distribution and packaging. The alternative solution is to decrease, with action of the producers group marketing costs by reducing the risk of marketing, optimizing the scale of distribution, technology, location, operation systems and to adjust marketing channels and marketing services. Huge potential to boost demand for bees products lie in direct sales. Customers often first learn about the medicinal properties of honey and other bee products. They arouse their interest in these products and effictively stimulate the demand.

2. Lowering production costs

The activity aiming to reduce production costs, has become the largest field of activity among many beekeepers in recent years. There have been many improvements in production technology, chiefly the introduction of intensive economy trout (8-12 using the proceeds of the season), that allowed productivity growth. It is certainly a direction in which

Polish beekeeping should go. The reduction of unit costs and productivity growth is not only possible but also necessary if we want to be competitive on world markets.

3. New challenges to the market situation

The special features, determining the organization of work, production and economics of the whole sphere of agri-business, including beekeeping, are: seasonality, dependence on weather conditions (the factory under the open sky), the presence of living organisms, separation during the production process and work process (working man, working nature), manufacturing in space, the renewability of resources, the inevitability of supply. These features indicate a high risk, and so is the apiary production. Nowadays the complexity of decision making, production, trade, external relations on the beekeepers' farm is no less than any other company in the agribusiness. If a beekeeper rarely uses the word enterprise it is mostly because the farm is usually a family company.

However, in an economic aspect, beekeeper farm is an enterprise, in other words it is an organized group of production factors, that is open to the surroundings and is under its influence. It is a functioning unit formed to achieve the economic benefits and their own goals. The actual changes in agriculture, require that beekeepers are able to distinguish the difference between sales and marketing. The option of an absolute production growth (at any price) in a market economy in developed countries is not sustainable. In this situation the beekeeper will have to look for other opportunities to sell their products or their storage, hoping that the next year prices will be favorable. In large, specialized farms, wide amounts of products for sale are produced. Since the difference between income and expenses from the sale of the production is usually small, the price fall even of a few percent can mean the development or the bankruptcy of beekeeping farm. Beekeeper has no significant impact on prices. He is a seller. There are many other sellers like him, and they are all in the same position to the buyer. To stay in the market under current conditions a beekeeper must introduce a marketing approach. The analysis of future market needs should be a starting point. This considerations must take place before the production cycle starts. Aiming to dispose the goods, such actions may be undertaken:

- Signing a contract with the processing industry (eg, label mead);
- Signing a contract with the intermediary purchasers products;
- Preparation of direct sales;
- Accession or the establishment of the marketing organization aimed at protecting the interests of beekeepers.

4. Marketing management

Marketing management is a complex process that includes: strategic and operational planning and implementation phase. Strategic planning (strategic marketing) should include long-term objectives (strategic) and the framework guidelines, defining the way of arriving at them, or identifing marketing strategies. This stage is often called strategic management. Its basic elements is to determine: the mission (as it defines the business and sets out the basis of its philosophy), a strategic vision (a picture of the future and the market position), the aims and objectives for future operations and strategies (guidelines, rules and instruments of the market). In this phase there is a choice of action or market segments. The basic tools of strategic planning are: SWOT analysis (strengths, weaknesses, opportunities and threats), portfolio analysis and analysis of the relationship: the product - the market. Operational Planning (marketing mix) includes the specific expression of the arrangements accepted. The accomplishment of this operative is a marketing plan. It specifies the short-term goals. The plan also indicates product policy, distribution, promotion and pricing. The diagram of marketing management is in practice far from the idealized model. The differences indicate particularly in the sequence and, prior to the implementation phase. The complexity of the marketing management process results from the specific kind of marketing decisions. They are usually taken on the basis of incomplete information on market processes, which mutually interact.

5. Marketing strategy

The starting point in determining the marketing strategy is to seek opportunities at the market. An opportunity for beekeepers is to find or identify the group of buyers, whose needs can be best satisfied by a beekeeper. Opportunities must be confronted with the mission of the beekeeping farm, with his objectives and the resources, with a particular emphasis on its strengths. Only on this basis the formulation of marketing strategies, defining the activities in the area of products, pricing, distribution channels and promotion can be done. The concept of marketing strategy includes therefore:

- Internal factors: strengths and weaknesses of the farm;
- Environmental condition:opportunities and threats;
- Strategic objectives;
- Specific decisions related to the intentions in the sphere of products, pricing, distribution and promotion process;
- Ways of practical implementation of the earlier establisments;
- Systematic monitoring and analysis of the effects of strategic actions in the sphere of marketing.

The elements of marketing strategy are:

1. **Product** – “**the right product**” must be closely related to the customers needs and desires.

2. **Price** - must be at an appropriate level, taking into account both the income opportunities of customers and their aspirations about the quality, prestige, etc.

3. **Place** - the product must be delivered precisely to the consumers (target market) in order to be accessible and achievable.

4. **Production** - communication messages must be sent to consumers (buyers) to learn about the values of the product, price, place and conditions for its acquisition, and why you should buy exactly this product, and not the other one.

Consumers should be-if it is possible – similar in their response to the marketing elements. They should be grouped due to such criteria as(age, family, education level, interests, lifestyl, life values). Marketing strategies define markets that should be supported, as defined in terms of types of needs, consumer groups and product groups, which are to be produced on the basis of environmental features, resources and objectives.

5.1. Strategies of selective demand

Strategies of this type are used to promote the competitive position of the product. The main element of this strategy is the participation in the market. Strategies for selective demand, can be realized by keeping existing customers or gaining new ones. The ability for adaptation to individual customer preferences and building and strengthening confidence in the quality of honey products is very important. A special attention should also be paid to the matter that honey should still be on sale. They must have a constant quality, the same properties, texture, color and taste and, what is important, a stable price. The exterior appearance should attract the consumer's attention. Glass jars are the best way of packing honey. Colorful labels should also be print.

Customers pay a special attention to such optical features of honey as: color, texture, method of crystallization. A beekeeper should skilfully use his knowledge. Honey, containing much glucose belongs to the rapidly crystallizing kind of honey. If honey is purchased in advance and will be eaten, it forms large crystals and in such condition is not liked by consumers. This kind of honey should be sold in the form of a cream. Sales of honey can be recommended in the following form:

1. Honey rape - in the form of cream.
2. Nectar honeys without the participation of rape - cream, or in a state of “patoka”, even though there is a threat of having to re-crystallization and dissolution.
3. Honeydew - the most able are “patoka” or sometimes just creamy.

Strategies for gaining customers - the base of this strategy is the localisation of the product on the market. The product's posistion shows how the product is perceived by consumers in the market, compared with the competitive products, taking into consideration the specific characteristics that are desired by buyers from every segment of the market.

There are two main strategic options for gaining the customers:

A - of the product, "head to head"

B - differentation position of the product.

A strategy lies in the fact that the beekeeper offers the same benefits as the competition, but tries to outdo the competition with higher product quality. Another way to use this strategy takes into account the competition for advertising expenditures, offering greater availability of goods, faster delivery etc. In addition, beekeepers can compete with the pricing strategy. Offered products of comparable quality are cheaper. In the case of strategy B, a beekeeper tries to differentiate itself from others, offering characteristics (properties) of products and benefit from it, in order to meet the needs of different types of customers.

5.2. Customer loyalty strategies

Managers of many companies have noticed that it is more profitable to retain old customers than seeking new ones. Experts have estimated that the acquisition of new customers is five times more expensive than the old customer service. This type of strategy deserves special attention.

There are three main options to caused that customers will be faithful to a product or a supplier:

- maintaining a high level of customer satisfaction
- facing the competition offers (read the proposals of competition)
- creating strong economic and interpersonal relations with consumers.

Many popular brand names that have dominant market participation, have focused its strategies and programs at maintaining the faith of consumers. Beekeepers can do the same thing. Satisfaction from the product can also be enhanced by giving additional information to enable proper and efficient use of the product. Loyalty to the beekeeper, which was established on the basis of bee products, is the best guarantee for the apiary farm. The aim of the mutual relationship strategy, is to create a strong relationships with consumers. It was created in order to increase chances of repeating the success by developing a formal interpersonal relationships with buyers. In practice it is usually a situation that it is not proper to buy a competitor's products, even if they are much cheaper. A beekeeper must always be prepared to present the customer with information about products, such as varieties of honey, the processes related to its crystallization. Beekeeper should be able to advise a client in what form and how to buy honey, to which diseases it can be used. He must therefore have specialist knowledge so that, during conversations with customers can, in a convincing way, answer questions and dispel the doubts. In should not be forgotten that competitors are able to provide products and services that will satisfy customers mofe efficiently. They may offer more opportunities of product features and lower prices, more effective advertising. The best strategy for defense against attacks of competition on product quality, price or advertising, is to look at the competition (and then outrun it.)

5.3. Product mix strategies

Most companies offer a whole line of products. Products that meet similar needs, are called substitutes (functional substitutes). Products that are used simultaneously, or are sold together and meet related needs, are called complementary products.

Strategies for substitute goods

There are two main strategies for substitute goods:

- strategy for developing the product line (range)
- marking strategy (brand).

Strategy for developing the product line is to introduce new products while keeping the former name (brand). We should offer to sell a full range of varietal honeys. An example of this strategy may be to introduce products with new features such as creamy honey. The main advantage of this approach is that the position of the existing brand, is not disputed, so it is easier to get acceptance of new product. The disadvantage is that the new product will probably be more appealing to users of the brand, and as a result the sale of the old product may be limited. Developing a product line involves the presentation of the richest offer possible to customers of the apiary. Besides honey there should be offered bee bread pollen, royal jelly, propolis, beeswax candles or figurines. There can also be offered such products as: meads and barley. To be able to sell products in the whole year a beekeeper should consider buying honey from other beekeepers. It should, however, in this case, pay close attention to the quality of honey. It can be generally stated that the larger the range, the better and the more you sell. Rich stand or store decor attracts a wider group of consumers, who usually buy something.

It turns out that active beekeepers generally do not have trouble in selling their products, even in large quantities. Often the packaging, colored labels etc. is not important because the most important argument for the buyer is that he knows the beekeeeper personally and is convinced of the excellent quality of his products. The connection of the brands - in some countries, bee products are sold under the same name (brand name). This strategy is useful both for maintaining the position of existing products and new products. Strategies for the complementary goods are directed to retain customers. These strategies can be adopted to maintain the position of one (existing) product in order to acquire new customers for other goods and services.

Complementary strategies:

- leaders strategy
- bond strategy

In the leaders strategy a product is aggressively promoted and prices are set for a certain product, while expecting that customers will buy complementary products or services at the same time. Bond strategy involves the development of a specific combination of products that are sold simultaneously. Typically, this refers to a price which is lower than in a situation where these products are sold separately. This strategy gives good results when buyers prefer products with lower price and need a product. Both binding strategy, and leaders strategy are effective when clients can save time buying sets of goods from one source.

5.4. Competitive Strategies

5.4.1. Strategies due to the type of dominance

These strategies shall be adopted if we consciously aim to fight with the competition. They are differentiated by a type of competitive dominance in conjunction with the field of the activities in which you want to achieve an advantage:

- A strategy of leadership in terms of costs;
- A strategy of leadership in terms of diversification;
- The strategy of focusing on selected market segments.

At the same time it must be remembered that the idea of competitive advantage is the root of any competitive strategy.

5.4.2. Strategies due to market participation

There are four main strategies: market leader (40%), challenging the company (30%), forgery strategies (20%), or strategies that look for market gaps (10%).

Leadership strategies are characterized by high market shares, pricing or cost-leadership. It requires a lot of effort to maintain the leader posistion.

Strategies for challenging, require a clear definition of strategic objectives, such as increasing market share, identifing an opponent whose weaknesses are attacked frontally (in terms of quality, price, etc.) or avoiding competition. Forgery strategies, rely on the adaptation of offers for those products or companies that imitate, if there is no competitive between companies. This strategy can be well tolerated by the leader. Strategies for searching market gaps (niches), are characterized by action on a small section of the market, they help to avoid confrontation with stronger competitors. This strategy requires a high degree of specialization, which refers to specific markets, purchasing groups, products.

6. Marketing mix

In every business in every country that allows free competition, it is necessary to pay attention to marketing strategy. It is because that the success or failure on the market depends on the results in comparison with competitors. For this reason, the ingredients of mix marketing - product, price, promotion and place - are crucial.

6.1. Product Strategy

The product has many features, these are:

- physical characteristics,
- brand names,
- product and company image,
- social and cultural associations with the product.

All of these features influence the perception of the product by customers. This is important and will affect their decision regarding the purchase of the product. The product can be analyzed in three levels of existence (functioning). The first level of the product is called "root", the second level is a real product, and the third level – is the "improved” product.

6.2. Pricing Policy

Pricing policy is another important element of the marketing mix. Price that is required for the offered product must meet the following requirements:

- cover all costs associated with delivering a product to a consumer (from production to consumption)
- provide a profit,
- approximately reflect consumer’s perception to the value of the product,
- have a relationship with other elements of the marketing mix so that pricing is not the only way to compete with other products.

6.2.1. Establishing the price

One of the most difficult decisions faced by each beekeeper is to determine the price for the products offered for sale. In making this decision such factors should be taken into consideration:

- the extent to which the product is known in the market,
- position of the product on the market,
- the potential and practical competition for the product,
- production costs,
- distribution channels.

Among these factors, one of the most important activities are usually competitors actions. Many factors affect the way we set prices for products. In normal conditions, when there is an intense competition for the product, a price must be very similar if not identical, to the price of competitor's product. Beekeepers work exactly in such situation. The market sets the price for their products and they all get a very similar price for manufactured goods. In order to distinguish our product from the competitor's product, you can enter the business name (brand). If the branded products will have a positive mark of clients, as a result the price can be raised. The entrepreneur who has set the best branded product can operate on the "price leader. " He sets the price conditions, to which the competition set its prices.

6.2.2. Pricing strategy

When establishing the price several different factors play an important role. One of the most basic, is to set prices based on production costs. It consists in adding the margins to the cost of the product. You can also set a price, taking into account the price in the competitive company. The third approach is pricing based on demand. It consists in estimating the demand for the product at different prices and setting a price to achieve the target level of sales.

6.3. Promotion strategy

The aim of the promotion is to influence attitudes and behaviours of potential customers. The promotion, strengthen existing attitudes and change existing attitudes and behavior. Promotion should reinforce favorable attitudes and views of customers about our products and change their negative attitude.

There are many ways of promotion. The most important of these include:

- individual sale;
- advertising;
- gaining notoriety;
- forming a favorable image of the company (public relations).

6.4. Distribution strategy

The last aspect of the marketing mix, which should be considered is the category of space. This element is very important for the development of marketing strategy, because the product should reach the target market at the right time and in good condition. Decisions regarding the distribution, generally are long-term and have a significant influence on the management of all other elements of marketing mix. In developing the distribution strategy the most important issue is to identify the distribution channels and selecting the most suitable markets for the product. Very important matter is also transport what means delivering products to the markets. One of the important decisions that we must take is to determine whether to use the service of the intermediaries, or do it yourself. There are many advantages and disadvantages of both of these options. Therefore, in deciding on the best method of distributing the product, you must thoroughly analyze the individual characteristics of the particular product. A very important element in apiary products is the choice of place. Locating it near recreation centers or major roads passing through the tourist areas, usually provides a large number of customers. It is vital to have an apiary near the place of the purchase . Such an arrangement also allows better use of the other elements of marketing mix.

7. Beekeeping marketing initiatives

For many years, there have been various ways of raising the customers and strengthening ties with them. Some of them are presented below:

Open door day

It is quite an expensive undertaking however, it allows to gain new customers and strengthen customer intimacy among the constants. At the open door day in the apiary there are invited all interested people, handing out invitations in person, sending mail, or by posting appropriate notice in the newspaper, etc. This is a very attractive form of familiarizing customers with the beekeeping farm, work organization, biology of colonies of honey varieties, etc. In is worth organizing so-called thematic "stations" during which visitors can obtain reliable information on a particular topic, you may also prepare tasting of honey produced in the apiary served with fresh white bread, coffee, tea, mineral water or milk. You can offer the following "stations":

1. Observational hive overviewing the biology of bee colonies.
2. Bee colony (mildest) which are filled with slices of honey. Here you can discuss beekeeping, the maturation stages of the honey collection, bee bread formation, etc.
3. *Historical* corner with a few old bee hives. There, you can refer to the tradition of beekeeping and discuss the history of the development of hives and beekeeping equipment.
4. Presentation of the workshop and subsequent stages of the procedure up to brew into the jar. This topic is particularly useful in the present hygiene, which accompanies the production of honey. In this presentation beekeeper can get a permanent public respect.
5. View of the film about beekeeping. If the presentation of a video is not possible, you can organize an exhibition of attractive, colorful photographs.
6. Preparing a short, but well-prepared talks on a specific topic (such as medicinal properties of honey bee products in prevention, the importance of bees in agriculture, etc.).
7. Demonstration of an artificial insemination of bees queen. This special theme through their exoticism, is often viewed.

Lectures are very interesting idea that can be carried out in school or kindergarden. It is also worth to invite a class or a group of kindergarden classes for the classes made in the apiary. There is no better form of encouragement and interest of young people with bees and their products as a direct presentation in the apiary. Organizing acitivities for young children is not easy but such an effort is very worthwhile. Children encourage their parents to buy honey and other products produced in the apiary they have visited. There is also a custom of giving presents for Christmas and New Year. Companies that seriously treat their clients, are giving gifts of different values. This custom may have a double positive meaning. Firstly, it is an easy way of gaining customer's respect. It may be a small statue or candle wax, which we give when a customer buys honey from November to February. here are also many other ideas. Much depends on individual skills and ingenuity of the beekeeper, as well as financial capabilities.

Business Plan

The idea and importance of business plan

A business plan is a special type of plan. It is a form of concrete goals and ways to market their implementation, both for the company itself, as well as to raise funds for starting a business, enter the company, issuing shares, attempts to bank credit, etc. A business plan is a good model to develop any plans, because the objectives, measures, resources, strategy and results of the project must be presented to demonstrate the skills and entrepreneurial skills and build up trust, necessary for obtaining a loan or increase a capital. A business plan is one of the modern techniques of management, making a preliminary condition for success in the market. A success will not be achieved without the knowledge of the market and the ability to predict and plan. A business plan should be drawn up for each major project. It is an internal plan, setting out the intended actions, measures and methods and its implementation strategy, estimated costs and expected profits.

A business plan is necessary to:

1. Determine if a project is worth making and if it is worthwile to devote time, labor and capital.
2. Verify the possibility of taking up the project.
3. Estimate the necessary resources and means and ways to generate them.
4. Examine the benefits and possible risks to the project.
5. Develop strategies for its implementation.
6. Point out the tasks for the participants of the project.

The degree of formalization of the business plan depends on the nature of the project and the purpose for which it will serve. In any case, both the object and its form, must satisfy the requirements of objectivity throughout the development, pricing, the expected risk and the probable company's profit.

The structure of a business plan

Here are a few practical observations and an example of the structure of a business plan together with a number of questions, which should facilitate the process of planning and to taking appropriate decisions on strategy and effective management.

Preparing a business plan requires:

- defining the tasks and the recipient,
- drawing the preliminary plan,
- preparation of the next part of the plan including: the aim of the plan, the profile of the farm and its characteristics, market analysis, marketing strategy, staff qualifications and financial situation.

The basic layout of the content might look like this:

- front page of a business plan should include: company name, address, logo, name of the owner's, address and telephone number, date of preparation of the plan, company name (s), person who make the plan,
- summary of the plan from which the recipient usually begins to present a plan, a preliminary feasibility assessment of plans and benefits of participation. It also contains the key elements to develop a business plan,
- characteristics of a product (products)
- characteristics of the customer and market analysis - market size, trends and development - the potential growth of the market (it is recommended that the business plan includes analysis of the last three years and predictions for the next 5 years), the company's position in the market,
- sales and distribution – kind of sales (direct sales, agents, other solutions), keys customers and percentage of the purchase of products,
- promotion – methods and instruments of the promotion and advertisment, annual spending on promotion, seasonality of sales and production,
- price - pricing policy for all product groups, price sensitivity to changes in the cost, cost of sales as a percentage of earned income and their variability depending on sales volume,
- competition (how the company will compete with others) - the most important competitors and their: name, address, size of their sales, market share, strengths and weaknesses of the competition, type of competition: image, location, product, services, pricing, advertising, sales methods,

- project location – where production is located, the economic base in this area, distance from the market,
- management skills - age and education of the owner (s), the financial status of the owner (s), professional experience, management structure and division of competences, the use of counseling and consultation,
- staff- qualifications, skills, salaries,
- investments and loans - a plan for the necessary investment, the time of their implementation and their cost, the projection of loan needed to complete the planned investments,
- timetable for project development - a list of objectives divided into foreground, short-term and long term strategies, target market, product features, price, promotion, distribution, and the necessary resources and relevant factors affecting the success,
- financial plan is the most difficult but also the most important stage of the planning process. It is usually drawn up for the next 5 years. The first step should be a monthly or quarterly analize.

Balance sheet assets

This is a summary of financial assets and liabilities drawn up on a given day.

Production costs calculation

The precise knowledge of the level and cost structure is one of the condtions for success. What is nee is a detailed calculation of all variable and fixed costs, as well as the determination of the frontier point of production volume at which there is an equality of the total cost of revenues (the threshold of profitability).

Table 1. Balance sheet assets

Specification	Assets	Liabilities
	in EUR	
Assets A. Fixed assets 1. Land 2. Buildings 3. Machines and equipment 4. Means of transport B. Current assets 1. Stores 2. Charges 3, Cash (in hand, in bank) C. Other		
Assets together:		
Liabilities A. Equity B. Loans and credits C. Current liabilities D. profit left E. Private capital		
Liabilities together:		

Income statement

Shows the profits and losses in a certain period. The above information allows potential investors and lenders to determine the risks and determine the acceptable conditions on which there will be an agreement (contract). Calculation of income and expenses is as follows: expected revenue from the sale of goods and services- the expected cost of revenue (variable costs + fixed costs)= expected profit from operations

-f - extraordinary gains, extraordinary losses = gross profit - income tax = net profit.

Cash Flows Calculation: Cash inflows and outflows

Table 2. Financial flows scheme

Month, year	I	II	III	IV	V
Opening balance (cash)EUR					
Cash sales					
Proceeds of the current receivables					
Growth in equity					
Sale of personal assets					
Investment Credits					
Working capital loans					
Other income					
Total receipts					
Total cost of revenues (excluding amortization)					
Repayment of loans					
Repayment of interest					
Investments					
Taxes					
Dividends					
Discretionary fund					
Total cash expenditures					
Cash balance at the end of the month of the year					
The cumulative cash balance at the end of the month of the year					

The summary of projected cash flow gives a dynamic picture of the incoming streams and outflow of cash from the farm. The list shall also provide information on cash needs, the need to take a loan to cover current expenses, the repayment capacity of the surplus cash available in subsequent periods. It also helps to plan the best use of liquid cash and prepare for investment decisions. It should be noted that by making statements of cash receipts and expenditure in each month only the receipts and payments made in cash are taken into consideration. To prepare an overview of the planned cash flows in individual months, quarters and years, it is

essential to plan the volume of sales in subsequent periods, including the sale of cash and deferred payment. The same should be done with expenses.

Cash balance at the end of the month, shows our cash resources, which we have in the next month or estimated deficiency to be remedied (external financing such as loans) to meet all the needs of cash during the month. Balance at end of each month is the sum, the volume of cash accounting opens next month. Transferring the balance from month to month, we get the total balance of cash resources in the long run so called cumulative flows.

Evaluation of the investment efficiency

Investing is buying certain goods such as machinery and equipment, buildings, land or a whole company. This process has its economic base. We buy, we commit capital in the hope that in the future, we will not only recover invested (interest) money, but also get surplus (profit). Future benefits will outweigh the initial capital outlay.

The analysis of the efficiency of investment should answer the question: "Are the benefits gained in the future higher than the cost of investment? "The most common methods of evaluation are:

- WAN - Net Present Value
- Indicator B / C -Benefits to Costs Ratio
- WSZ - IRR Internal Rate of Return

1. Net Present Value

+ RVA

PPO - the initial outlay

PPN - expected net benefits

q - the discount rate (cost of capital)

n - the expected payback

RVA - residual (final)

If the WAN is positive, meaning that the discounted (expressed in today's U.S. dollars) future benefits are higher than the initial investment outlay, the investment makes sense and should be implemented. If the WAN is negative the project should be rejected. If two projects are mutually excluded, the one that has a higher WAN should be chosen.

2. Indicator B/C

It is based on the same assumptions as the Net Present Value method. It defines the relationship between the benefits and the initial effort. If the discounted benefits are greater than the initial cash outlay, the rate of B / C> 1, then the investment makes sense, at a ratio B / C <1 investment should not be implemented.

3. Internal Rate of *Return*Internal rate of return is the discount rate at which the Net Present VAlue is zero and B / C is equal to one. With such a discount rate (cost of capital) outlay will be paid to the assumed period of time. Comparison of interest rate with the Internal rate of Return indicates whether the investment makes sense. If the Internal Rate of Return is greater than the cost of capital (interest rate, which we have to pay), an investment makes sense.

8. Cost management in beekeeping

Beekeeping is an agricultural activity or business that is generally done individually. Beekeeper is a small or big enterprise or business each of who produces bee products. Purpose of a business is to earn financial returns by serving a targeted all buyers in a market. At the present day, businesses generally compete both in domestic and foreign markets. Primary condition of competition is effectively and efficiently to accomplish components such as superior quality, low cost and speed that acquire competitive force to businesses. The way of accomplishing these components is possible by managing activities which are necessary to produce products and services in a more effective and efficient way. Managing activities depends on that they can be measured.

Cost management makes the measurement of activities possible and supplies to managers the information needs to be relevant results of activities. Measuring the cost and performance of activities and resources, businesses can improve the value received by the customer and the profit achieved by providing this value. When a business carries on its activities in a more cost-efective way than its competitors do, it will also have a competitive advantage. Cost management identifies the true link between costs and revenues, and can reveal hidden costs as well as profits in providing products and servicing customers. Thus, cost management becomes an important decision-making tool for businesses.

8.1. Cost management

In releted issues of cost management, instead of directly definition of cost management, it has been given goals and objectives of cost management by expaining factors that make it necessary. Cost management provides possible of measuring a business' performance in topics such as quality, flexibility, service, timing and cost by combining financial and non-financial indicators.. Within this context, as a system, cost management aims to provide information to help businesses use resources profitably and effectively to produce products and services that are competitive in terms of cost, quality, functionality and timing in the market, by identifing the cost of resources consumed in performing significant activities of the business, determining the efficiency and effectiveness of the activities performed, and identifing and evaluating new activities that can improve the future performance of the firm.

Cost management begins with an awareness of what events cause costs. This awereness is the prerequisite for a full understanding of costs. Cost management uses cost information to evaluate how effectively a business consumes resources to create products or services that have value to customers. Therefore, the philosophy of cost management offers an appropriate framework to identify causes (activities) and effects (costs). Approaches based on cost management are as follows according to the needs of businesses.

8.2. Cost containment

The cost containtfocusedment is an approach focused the covering or avoiding the increases in the fixed and per unit variable cost in the future. The philosophy of this approach bases on performing in basis of same productivity and efficiency, in future, activities performed by businesses. In terms of the businesses, it must be known well the nature and formation of costs in order to acquire expected utility. Fixed costs are the cost that doesn't change in total even though changes in activity capacity realized. These costs are also a part of the total of products so that any reduction in the activity increases in the total cost of per unit. Fort he reason, business administration should take into consideration the structure of such costs in case of making a decision. Reasons causes increases in fixed costs that are: activities performed inefficient and sources that are not used effective and productive, operating in the low level of production capacity for reasons such as small market share, not being capable of taking advantage of scale economies or not producing product or services that creates added value and meets customers' needs and has quality. Business' managers can avoid these costs by making decision in direction of the correct information that they can acquire from cost management system. On the other hand, variable costs are the costs that do not change for per unit but change in total though activity volume can change. These costs are the costs of activities that are performed related with the products produced. Therefore, performing of these activities at the same effective level and usage of reseources to perform the activities in the same level of effective and productivity, it will ensure to cover the cost at the same level.

8.3. Cost avoidance

Cost avoidance is an approach for eliminating of the activities that can not explain its benefit on the bases of cost-benefit analysis are removed. The philosophy of this approach depends on eliminating of the activities that doesn't creat added value and performing in cost-effective way of the activities that creates added value.

Therefore, managers of business should classify the activities as value added and not value added by determining activities firstly and it is required that they should seek and apply the way of those with a participatory approach of how them to be eliminate or to be reduce as possible as activities that not have value added, and how them to perform in the cost-effective way of activities that have value added later.

8.4. Cost reduction

Cost reduction is an approach that focuses cost reduction on variable and fixed costs relating to activities that is essential in term of a business in current period. The philosophy of this approach depends on reduction in costs relating to activities that is essential in term of a business in current period. It is possible with that managers would provide to be use in effective and productive way the resources consumed to perform activities and perform activities.

8.5. Costs and cost management in beekeeping

Beekeeping is a business that it has different features. Cost management are directly related with the business of industry. The experience from the industry is not possible for the beekeeping. Notwithstanding, cost management can principally implement for every business, including beekeeping. Beekeepers can benefit from cost management practices and require to know them.

Costs and cost classifications

Cost are a measure of the resources consumed to provide a product or service. A beekeeper have to also compute costs on a total or on a per unit basis such as every organization.

Total costs represent the aggregate resources consumed by the a product, a work area or an acyivity. Total costs are generally summarized by major cost categories (e.g., labor, material, and facility costs) or by functional areas (e.g., manufacturing, sales, management).

A unit cost is the cost of one unit of measure of a product or service. The unit cost is simply the average cost, which is the total costs divided by the total volume in units. Unit of measure is important and should identify the output of organization in a meaningful manner- for example, units of products, units of beehive, units of honey or polen. The unit costs are useful to measure productivity or detect significant cost trends.

Costs must be classified according to the purpose for which they will be used –for decision-making purposes.

Different costs have different purposes. Costs that are classified and recorded for one purpose may not be appropriate for another. Here, it will be focused on cost classifications of which are useful and valid for beekeepers.

Fixed and variable costs: In this classifying cost, it is established a relationship between the cost of an item (the cost object) and how it reacts to changes in volume or usage levels. The cost object is the item being measured; activity levels are measures of volume or usage that vary according to the cost object. Costs are classified as fixed or variable with respect to the cost object and how it behaves with changes in volume or usage. So cost classification is important for decision-making purposes.

Fixed costs do not change in total with changes in volume or activity levels- for example, depreciation on building, machinery and equipment, property taxes, rent, administrative expenses. Fixed costs are considered fixed only in the short run, a brief period of time in which the quantities of the available resources cannot be varied. In the long run, all costs are variable. However, fixed costs are varied on per unit basis.

Variable costs change proportionately with increases or decreases in activity levels. Variable costs vary directly in total with changes in sales or production volume or some other measure of activity; however, they remain constant on per unit basis. Some costs are **semivariable**; they have a fixed and a variable component. Maintenance and repairs cost is an example of semivarible cost.

Costs are also classified according to the functional area in which they are incurred (e.g., administrative, marketing and selling, research and development,and manufacturing).

Manufacturing (production) costs are the costs required to produced a product. Manufacturing costs are composed of three major elements: Direct labor, direct material, and overhead.

Direct material cost includes the costs of all raw materials that are used to manufacture the finished product. Direct labor costs are composed of all labor costs related to the time spent manufacturing a product.

Overhead costs consist of all other manufacturing costs that are not included as direct labor or direct material. For example: indirect labor and materials, depreciation, utilities (electricity, water, gas, fuel, and telephone), rent, and maintenance. Overhead costs are usually incurred in a production department or unit and are related to more than one product or product family. Therefore, overhead costs must be assigned in some meaningful and systematic way to individual products. This process is called overhead allocation.

8.6. Calculating the cost of product for beekeepers

Costing is not simple and many times, not straightforward. It can be produced a lot of product in beekeeping activities such as honey, beewax, *polen,* royal jelly, propolis (bee gum), bee venom. We can recommend to beekeepers the general costing guidelines that can be applied in any company or industries. This approach will result in the availability of more accurate cost information for management decision-making purposes.

Step 1. **Define the Item to Be Costed**: Item or object to be costed can be almost anything in an organization; a product (honey), a business process. A clear definition of the cost object defines the scope of the costing exercise. The scope and the availability of information will determine the organizational resources required to develop the desired costs.

Step 2. Understand the Purpose of the Costing exercise: An organization uses different costs for diffirent purposes- for example, determine product profitability and cost, making decision, capacity utilization.

Step 3. Determine the Cost Basis: Costs can be estimated on an actual or projected basis. Actual costs show what has happened in the past based on historical data; therefore, they may provide a more accurate representation of the business. Projected costs are estimated future costs that are based on historical data, industry forecasts. Projected costs are used in the preparation of budgets, capital investment analysis, and other key management decisions.

Step 4. Identify the Major Cost Components: As explained above, there are three cost components in any cost analysis: Direct labor, direct materials, and overhead.

Step 5. Calculate the Cost: Based on the information gathered in step 2-4, it can be calculated the product costs. Individual costs are calculated for each key cost components and then added together to obtain the total cost of a product.

Cost-volume-profit analysis for beekeepers

By studying the relations of costs, sales, and net income, beekeepers better able to cope with many planning decisions. Cost-Volume-Profit (CVP) analysis is a tool using for planning decisions. It looks at the effects on profits of changes in such factors as variable costs, fixed costs, selling prices, volume, and mix of products sold. Break-even analysis, a branch of CVP analysis, determines the break-even sales. Break-even point is point where revenues exactly match costs. This analysis can be useful for beekeepers. So, beekeepers will be able to calculate the sales necessary to break-even or to achive a target income.

The break-even point represents the level of sales revenue that equals the total of the variable and fixed costs for a given volume of output at a particular capacity use rate. The break-even point can be calculated in units and amount.

The break-even point in units = Fixed Costs / (Unit selling price- Unit variable cost)

in amount = Fixed Costs / ((Unit selling price- Unit variable cost)/ Unit selling price) or

in amount = Fixed Costs / ((Total Tales- Total variable costs)/ Total Sales)

If a beekeeper will calculate to achive a target income, target income amount is added the fixed costs.

Example: price of a kilogram of honey is ¨25 (Turkish lira) and unit variable cost is ¨10, and total fixed costs are ¨5000.

The break-even point in units:

¨5000 / (¨25-¨10)= 333,33 kilograms of honey, or

The break-even point in amount:

¨5000 / ((¨25-¨10)/25)= ¨8333

Section XIV:
Best practices in beekeeping

1. Beekeeper: who is he and what is his role?

Beekeeping can be a hobby, a sideline operation or a full-time vocation. Keeping bees is a hobby practiced by millions of people around the world. Beekeeping is a relatively inexpensive hobby that provides a sweet bonus each year. There are two considerations somebody has to make before committing himself to beekeeping: the sting and the back. If you keep bees you will surely be stung by them and probably some of your family will get stung over time as well. For most people a bee sting hurts, and a brief period of discomfort follows.

For others (about 0.4 per cent of the population) there is a danger of death from *anaphylactic shock* brought on by the bee sting. Frequently there are indications that a person is becoming highly allergic to bee stings, but occasionally the problem occurs unannounced. (Swelling at the site of the sting is normal; hives over the body, itching in areas of the body remote from the sting and shortness of breath are abnormal and cause for concern.) (Also it is known that persons with rheumatism in their joints find a lot of comfort and improvement in regular bee stings.). You do not have to be physically strong to keep bees, but it is helpful to have someone to help with the heavy lifting. If the stings can be endured and the lifting accommodated then by all means go ahead and become a beekeeper.

Gaining knowledge

Reading is a good way to learn about beekeeping. However, no written material can prepare you for the assault on your senses when you first open a hive and all those insects are so close to you. If possible, contact an experienced beekeeper and trade your free labour for a chance to accompany him or her as the hives are worked. Learn how to open a hive and remove frames. Become familiar with the differences between queens, workers and drones. Observe closely what normal brood looks like, the difference between brood and honey cappings and how honey shines in the cell compared to pollen. So, beekeeping has been part of mankind's activities for thousands of years. The following is made to make young students of organic and biodynamic agriculture curious and then understand why this has fascinated people all over the world for this long time.

Personal characteristics

Beekeepers need the following characteristics:

- an interest in working with honey bees
- good coordination and manual dexterity
- some time, lots of patience and quiet
- a very good observer
- the ability to withstand bee stings and no allergies to honey bee stings
- good physical condition
- a responsible attitude when handling bees and equipment
- the ability to work alone as well as with others
- flexibility and adaptability.

Beekeepers need to have:

- thorough knowledge of the yearly cycle and habits of bees, bee biology and behavior
- good bee-handling skills so they know when and how to approach bees
- knowledge of plant types and life cycles, and how and when plants produce nectar

- skill for the identification and control of diseases, parasites and predators that affect bees
- knowledge of how to extract and assess the quality of bee products such as honey, pollen, royal jelly and propolis (an antibiotic gum or resin)
- carpentry skills for building and repairing hive boxes
- the proper use of pesticides, antibiotics and chemicals
- issues and trends related to the industry as a whole
- legislation (bees, beekeeping, honey, transport, health & safety) as well as food safety and employment regulations
- marketing methods
- financial and production record keeping.

Ad. A

If you run like a banshee every time you see an insect, beekeeping will be an uphill challenge for you. But if you love animals, nature, and the outdoors, and if you're curious about how creatures communicate and contribute to our environment, you'll be captivated by honey bees. If you like the idea of "farming" on a small scale, or you're intrigued by the prospect of harvesting your own all-natural honey, you'll enjoy becoming a beekeeper.

Ad. B

Beekeeping isn't labour intensive. Sure you'll spend part of a weekend putting your new equipment together. But the actual time that you absolutely *must* spend with your bees is surprisingly modest. Other than your first year you need to make only five to eight visits to your beehives every year. Add to that the time that you spend harvesting honey, repairing equipment, and putting things away for the season, and you'll probably devote 35 to 40 hours a year to your hobby (more if you make a business out of it).

Ad. C

As you will have understood from taking this introduction course, it is important to know what is going on in your hives. So, taking your time for observing the bees and the hives in a relaxed manner, without disturbing their daily routine, is very important.

Ad. D

All bee stings can hurt a little, but not for long. It’s natural to experience some swelling, itching, and redness. These are *normal* (not allergic) reactions. Some folks are mildly allergic to bee stings, and the swelling and discomfort may be more severe. The most severe and life-threatening reactions to bee stings occur in less than 1 percent of the population. If you’re uncertain, check with an allergist, who can determine whether you’re among the relatively few who should steer clear of beekeeping.

Ad. E

Most of the work with the bees will be done by the beekeeper alone; there will rarely be a need for somebody else to give assistance. Only when you have a lot of hives you will need help with harvesting honey, catching swarms, moving hives and that kind of tasks.

Ad. F

Although all the textbooks, even this one, has it all lined out as a routine, a series of events which takes annual turns, the year of a beekeeper is never the same. Always there will be new things, good or bad, unexpected events that will keep you surprised. You must be able to accept and adapt to this, maybe even appreciate the value of being connected with the unpredictable side of nature.

2. The case studies of the project's partners countries

2.1. The model of bio beekeeping farm in Hódmezővásárhely, Hungary

Hódmezővásárhely was already inhabited in the prehistoric age. A near 6000 years old archaeological site was opened up on the confines of the town. The inhabitants lived on fishing, trade, farming and animal husbandry. By the 15th century, the town became a typical market town with large areas. Hódmezővásárhely used to belong to the *Calvinist religious community from the Middle Ages, but the Roman Catholic Church started dominating the town from the second half of the 20th century.* Beside farming and animal husbandry, most of the farmers used to keep bees in the world of farms started evolving from the 18th century. Beekeeping best reflects one of the main points of the landscape management: "the more we do for nature, the better we can exploit it". Bees pollinate plants, produce honey and other products that healthy for human such as pollen, propolis, beeswax and royal jelly. The pollination of plants by bees produces from 30 to 50 times more profit to agriculture than honey production.

The most widespread bee in Hungary is the honey bee (*Apis mellifera*). From spring to autumn, bees collect pollen and nectar that they will convert into honey. Bees do not hibernate; they use the stored honey to survive in winter. The beekeepers' job is to set up hives to where they introduce bee families, protect bees' health, provide the appropriate conditions for them and remove the surplus honey. If a good quality bee pasture is available, bees can produce from 30 to 60% surplus honey. Bee pastures are areas full of plants where bees can collect nectar and pollen. In Hungary, the best bee pastures are acacia and linden trees. There are also some other important bee pastures such as rape, sunflower, phacelia, clovers, Common Milkweed and melilot. Our country is mainly acacia honey and mixed flower honey producer. Beekeeping may provide a good profit for small farms. Besides, its ecological benefits are also significant.

Beekeeping has two kind of economic benefits: direct and indirect. The direct benefits are the honey and other bee products, while the indirect benefits are the enrichment of the ecological system and the improvement of its function. 8-20% growth can be predicted in apple, apricot and pear orchards. Sunflowers are beetle pollinated plants. If they are pollinated by bees, 35-50% crop growth can be predicted. In case of rape, the growth can be up to 15-20%. The two basic principles of bio beekeeping are the careful treatment of bees and the bee products production free from chemicals.

Bio beekeeping is a more expensive branch than traditional beekeeping and needs much more care.

Honey productivity	
acacia	800-850 kg/ha
phacelia	250-300 kg/ha
linden	560-1200 kg/ha
sunflower	80-100 kg/ha
rape	50-60 kg/ha

Hungary exports the 85-90% of the honey production. The greatest buyers' market for Hungarian honey is the EU, especially Germany, France and Italy. In Hungary, the most important honey is the acacia honey from which we have large quantities. Honey consumption is 0.5 kg per capita per year in Hungary. The aim is to increase this ratio up to 1 kg.

Héjja-ecofarm biofarm

Hódmezővásárhely, Hungary

Héjja farm is a family enterprise and located in Hódmezővásárhely, Hungary. Two neighbouring farms and the belonging lands were joined together resulting in 20 ha area that is used for ecological farming purposes. Kitchen garden vegetables, different kind of fruits and field growing plants are grown there. The farm can be visited by practical farmers, students of educational institutions (lessons, class outings) and individuals who are interested.

In the last few years the farm became very popular. It has an increasing number of wide ranges of different kind of visitors (even agrarian experts, students etc.). Some people visit the farm to buy products, others want to spend some time relaxing in nature. The farm’s honey production and marketing is increasingly getting better, a stable buyers’ market is provided for the bioproducts. Their bio-acacia, bio-linden, bio-Common Milkweed honey, honey-comb, bio-beeswax, bio-pollen and propolis are very popular products. At the farm, rape and sunflower are also used as bee pastures. Two new products were introduced to the market by them: seeds and mushrooms stored in honey. Their aim is to promote the regional and domestic honey tourism and honey consumption.

2.2. The model of beekeeping farm "Barć " in Kamianna, Poland

The beekeeping farm presented below is a great example of using all possible and affordable marketing methods to promote and sell their products and to promote apiary education.

Kamianna is a small village located in the middle of the fir woods and small mountains of the Low Beskid Mountains at an altitude of about 600 m above sea level. This area primarily had been inhabited by an ethnic group called Lemkos. They had its own culture, traditions, customs, costumes and language. They occupied mainly in pastoralist and forest use. Lemkos

were Greek-Catholic, that is why throughout this site there can be seen beautiful works of wooden architecture - churches.

In Kamianna there is an apiary "**Barć** ", which produces honey and other bee products, which are manufactured into medicines, paramedicines, cosmetics, nutrient mixtures and other products. The "Barć" apiary offers good honey only from their own hives that is why it gains credibility and a good reputation. The shop located near the apiary is not only a place where you can buy honey, pollen, mead, wax candles, cosmetics, paramedicines, literature and souvenirs, it is also a place where talks and lectures are conducted. You can get answers to any questions related to bees and honey. In addition you can get a full information on the treatment of bee products – apitherapy. People who once bought the products in the apiary often become faithful customers. All these factors cause that Barć become recognized throughout the country as a producer of high quality bee products.

Three types of acitivies run by the BARĆ apiary:

1. Bees queens breeding
2. Acquisition of bee products and their applications in apitherapy
3. Practical training of beekeepers and young people from secondary schools and universities

In the apiaries of the BARĆ farm there can be found almost all bee products apart from venom. These products include:

- Honey
- species of honey
- ropolis
- royal jelly
- pollen

Pharmacy department produces (mainly based on propolis), ointments, creams, solutions EEP and others, which are used in the treatment of apitherapy.

Teaching is carried out in BARĆ apiary. They teach people from all over Europe. The apiary also holds a professional practice for students of secondary schools and universities.

Coach and tour groups not only have the opportunity to listen about the life of bees, but also they have a chance to complete information about bees products and their preparations.

- tradition says that the gold on this earth will be born on the stone. This gold is of course honeydew, which here arises mainly from the fir trees.
- carries queen bees breeding, it occupies in finding the bee products processing and manufacturing, training and information about beekeeping and selling them. It also distributes basic beekeeping equipment and specialized literature.

- it deals with introductory analysis of honey and other bee products
- it won many prizes in Poland and abroad
- products from the Apiary have the signature of Dr. Henryk Ostacha
- it rents rooms with the possibility of eating tasty meals

The apiary has been adapted for tourists. A very interesting place there are so called demonstration and glass hives allowing to look into the nest. In the old studios a museum has been founded where everyone can see the work of the beekeeper, directly observe the operation of the equipment and apiary, and even make a candle. You can also see the artificial insemination of the mother colony, marking it and other unusual activity on a daily basis. Artificial insemination of queen bees, is a treatment that makes that we have controlled the selection of parents and protect ourselves against the influence of bees from other climatic zones. Long-term selection in t helped to breed a bee KAMIANKA that meets our expectations.

There ia a company store in a farm. There is also a honey cafe, which offers meads, but also delicious simple food - soups, dumplings, knuckle of pork, kebabs and other. You can also sweeten tea or coffee by honey.

In the new pavilon there are modern workshops, laboratories and social facilities that meet the latest sanitary-hygienic requirements. There is no standardization and mixing, so the farm can offer: nuns honey, white clover honey, raspberry honey, honey bean, honey from tansy, and of course: rape, lime, honeydew, buckwheat and heather honey.The apiary offer is addressed to individuals, families, tourist groups and school groups. During May and June, biology lessons are hold outdoors. In winter you can go skiing in this region.

2.3. Case study in beekeeping, Belgium

Beekeeping is practiced in Belgium primarily by hobbyists. There are no strictly professional beekeepers. There are, however, some semi-professionals, focussing on pollination instead of honey production. The mean age of the Belgian beekeepers is above 60 years old. After a long period of declining numbers of beekeepers, now younger people are becoming more and more interested in it, due to successful advertisement by beekeepers associations and references in media at all levels.

The high mean age of the Belgian beekeepers society doesn't mean that they are all still using the same methods and practices they learned more than 30 years ago. Local beekeepers associations organise lessons and schooling opportunities at a regular basis. The instructors teaching those courses keep a close watch on the research output of all mayor beekeeping institutes, and translate it to the beekeepers. Additionally an increasing part of the beekeepers are starting to use the internet to find solutions for the challenges they encounter while managing their hives. A group of dedicated volunteer-experts, accurately answering all sorts of questions, arose spontaneously on the internet forums of the beekeepers associations. Topics handled mainly fall into the categories of disease management, additional bee nutrition and new techniques to control brood quantity and quality, which in turn influences swarming behaviour. In this way modern technology and scientific knowledge effectively find their way into the Belgian beekeeping society. In the last decade beekeeping in Belgium almost completely shifted its attention towards *Varroa* control. Because of the lack of authorised bee medicines, and the aversion towards harmful residues, Belgian beekeepers organise several *Varroa* treatments throughout the year. The first treatment consists of weekly removing drone brood during spring, while *Varroa* mites preferentially occupy these larger cells that are closed longer. A second treatment is given with oxalic acid in a closed brood-free period either in a new swarm or a hive harbouring a young queen. If a closed brood-free period cannot be achieved, the beekeeper will opt for an application of formic acid vapour, which is active even in closed brood. This last treatment, however, lasts 3 weeks. The honey collected during that period cannot be collected. As both oxalic and formic acid are naturally present in honey in low concentrations, small residues of those products do not pose threats to the bees or honey consumers. In August, when the winter bee generation is created, and the bees should be supplied with sugar solution for the coming winter, a part of the beekeepers relies on an 3 weeks application with thymol. The other part treats the winter bees again with oxalic acid during the winter brood stop. These combined ways of controlling *Varroa* give satisfactory results, but they require extensive planning, because both the harvesting of honey and the presence of closed brood should be taken into account. Therefore a beekeepers year's planning in Belgium is mostly dominated by *Varroa* management. In the past decade practice has clearly shown that those who neglect this, end up without bees.

One of the supposed reasons for the detrimental effect of a *Varroa* infestation is the lack of sufficiently diverse pollen sources. Too little diversity in the diet of the brood gives rise to less vital bees, which are less able to properly feed the next generation and are more susceptible to virus and disease infections. Belgium and especially the Flanders region is very densely populated, and the open areas are mainly used for agriculture, which exclusively consists of monocultures. This greatly limits the pollen sources in some regions. For that reason Belgian beekeepers are beginning to show an increasing interest in additional bee nutrition, and specifically protein supplements. Another popular way to increase bee vitality is to limit the size of the brood nest in spring and early summer. In that way the amount of nursing bees more or less equals the amount of brood to be fed. Whereas otherwise the larvae would greatly outnumber the nursing bees. The core idea behind limiting the brood, is that the quality of care that is given to the brood can be increased, which would ultimately result in a more vital next generation of bees. An additional advantage to this cultural method is the limited amount of frames that need to be checked for queen cells every nine days. This greatly speeds up the necessary management of swarming behaviour.

Quality of bees not only involve their vitality, but also their genetic background. Belgian beekeepers associations have a long tradition of using pure-bred Carnica and

Buckfast queen bees. Dedicated volunteer-experts are given artificially inseminated pure-bred queens, which they use to grow new queen bees to distribute among the members of the local organisations free of charge. The use of pure-bred lines is strongly encouraged, and all beekeepers associations take part in selection programmes. This leads to very uniform honeybee populations, with all the advantages and disadvantages related to it. To optimise honey flow most beekeepers move their hives to areas with flowering crops. Trips of more than 100 km are not uncommon, because soil types are believed to greatly influence nectar flow. Fruit trees (apple, pear, cherry), currants, strawberries and canola are the mayor crops beekeepers travel to. Travelling to different crops combined with honey flow from flowering trees like willow, maple, horse chestnut, acacia, sweet chestnut and linden generally yields about 60 kilograms of honey per hive. Beekeepers with more than twenty hives are a rarity in Belgium. In 2011 the indicative price for a halve kilo jar of honey was €5. All beekeepers have to be registered at the Federal Agency for Safety of the Food Chain, which organises random checks. In those checks honey samples are analysed among others for the presence of residues of pesticides or unauthorised medicines.

The overall image of Belgian beekeeping is one of a relatively intensive culture, with few hives per beekeeper and high yields per hive, managed by very dedicated hobbyist.

2.4. A case study beekeeping in Anzer and Ardahan, Turkey

A variety of endemic-type flowers exist in Anzer plateau (Ballıköy plateau). This upland is located in the southeast of İkizdere district of Rize, one of the major cities in the Black sea region of Turkey. The "***Anzer honey***", famous with its curative powers, is produced here.

Photo 1. Anzer plateu

Anzer honey is a special honey produced in Türkiye and became known in the world.There are 450-500 kinds of coutryside flowers(in these flowers 80-90 kinds only grow up in Anzer).This honey got up in Anzer high plateau,is famous because of its cures to assorted and different illnesses.Anzer takes a step to the greenness with the bloom of snow flowers in partly snowy at the first week of june and its magnificent beauty begins with june,becomes summit in July and finishes in august.In the last week of june the bees open eyes for the flowers and complete making honeys. Anzer honey only gets from Çiçekli village and Ballıköy.

Anzer Plateau: Rize is 90 km away and 3000 m above the highest plateau in the Anzer. Anzer Plateau is high in natural climatic conditions have led to differ according to other plateaus. As you will see pictures than natural flowers, no plants grow on the tree and fruit species. Also came to our village in particular, Without precedent in the world of flora flowers cover the dirt with his investigations of the Anglo-German botanists in the 450-500 varieties of flowers, many of them 80-90 in the endemic flowers, honey collected by bees from flowers that grow only Anzer honey cure for our troubles. Anzer the long winters, cold and snowy passes. the short rainy summers and cold. Cold climate due to the structure of the honey production depends on the suitability of the weather conditions. For example, according to the type of flora flowers open each spring with the rain, the weather warm and sunny summers gone Anzer honey increases the rate of yield. However, a late spring or type of honey production from the time temperatures rise, hitting the ice flowers, as it reduces the rate of production. This negative reasons such as increasing the production of honey in our village and to produce quality honey bee-denominated preferred Anzere by pure Caucasian, Caucasian or hybrid bees.

Photo 2. Anzer honey production

Products of ANZER

- Bees,
- Queens breeding,
- Acquisition of bee products and
- Their applications in apitherapy,
- **Honey**- (only very expensive anzer honey),
- Propolis,
- Royal Jell
- Anzer pollen,
- Hive production and selling, teaching courses to how to be beekeepers.
- Practical training of beekeepers and young people from around of Anzer, Rize,

Anzer beekeepers are supplier of 100% natural honey with highest quality at reasonable price fort them. But. anzer honey is the most expensive honey in the world. The beekeeping activities has been adapted for tourists as well. They have a museum has been founded where everyone can see the work of the beekeeper, directly observe the operation of the equipment and apiary, and even make a candle. They also have a honey festival like most of the Turkish beekeepers have.

How to get there?

Transportation: 39 km from the town of Rize İkizdere. The sign is 25 km Anzer Plateau Ballıköy new name. Approximately 1 hour way to go. Post office, grocery store, butcher, bakery, grocery, coffee and restaurants are serving. A special chamber to eliminate the need for accommodation in the plateau and the village of Anzer motels. Meals and fresh meat daily meal service for the barbecue can be found anywhere.

Want to Know the Meaning of Life? Ask a Village Beekeeper ?

Photo 3. Rural village communities of Ardahan (from; Cat Jaffee).

From Cat Jaffee, I couldn’t believe it. I had found quite possibly the very last living <u>melified man</u> and he was 115 years-old. This man was on his deathbed, claiming to have kept himself alive over the past few years by eating only his own honey. He was the oldest beekeeper in Turkey, and I would dare say, quite possibly the oldest living beekeeper in the world. He had kept bees during the time of Ataturk, during world wars, during Turkey's rise and fall as a global power, and during hundreds of Karsian honey seasons.

Photo 4. Life on the Edge: Bee Hive in Ardahan

Photo 5. Waggle on! Horon and Hives at the Honey Festival Oyoyoy…

2.5. Passion and tradition in beekeeping from Umbria (Italy)

Danilo Rosati was an employee of Luciano Orazi, experienced professional beekeeper from Marsciano, in the Middle Tiber Valley. Luciano was a broad-minded person and he was in continuous contact and experience sharing with colleagues who were in the forefront of the Italian apiculture, such as Mr. Piana and Mr. Porrini. They were the modern followers of the apiculture pioneers in Italy, such as Mr. Luigi Sartori, around 1860, author of the book “The art of honeybee breeding”, also attracting the famous hero of Italian national unity Giuseppe Garibaldi in his small Caprera island where he spent as a farmer the last years of his life. Those roots were the strong basis of Luciano’s vision for beekeeping in harmony with the nature and territory, in defence of the autochthonous Apis mellifera ligustica Spinola, perfectly adapted in the centuries to all the regions in Italy and even exported to the USA since 1860 for its characteristics of productivity and gentle propensity for breeding. In this context Danilo learnt by Mr. Orazi, since the beginning of the years ‘70s, all the good practices and secrets of apiculture till he started a own beekeeping activity. Within few years he decided to join Mr. Orazi again as a business partner. The two companies were merged in a big one, one of the largest in Umbria, based on the perfect collaboration of two persons respectful to each other, by connecting tradition and know-how of the master with the passion and innovation of the youngster. When unfortunately Luciano died on 19th March 2007, Danilo continued to manage the beekeeping company “Apicoltura Orazi” maintaining the name of the founder. He continues also to study in depth the honeybee life and behaviors, the selection of the queen bees to improve hive performances, the quality of honey and value added from wax, pollen and royal jelly. He becomes honey taster after having followed a training course. Danilo apply his creativity also to the tools for a high quality apiculture; he creates own design for a rational apiary and a joiner’s workshop to realize by himself own apiaries. In the last years, after having improved his beekeeping activities he has been coping with honeybee diseases or troubles, mainly due to imprudent or wrong introduction of weak swarms from non professional beekeepers, as well as with emerging threats like new varieties of seeds (i.e. sunflower) without nectar or a large use of pesticides (i.e. neonicotinoids) causing disorientation to the foraging bees (i.e. Colony Collapse Disorder, CCD), GMO (Genetically Modified Objects) and climate change can be also threats for apiculture in the next future if adopted in open field.

Photo 6- Danilo Rosati shows his home made hives to the participants of the BEES project visit

Danilo thinks therefore that all farmers and their associations, as well as environmental organizations and public institutions, should be involved in a common discussion to avoid irreparable damages to the natural environment so important for human life. Beekeeping, says Danilo, has a strategic place both for agriculture and the planet safety and farmers are to be aware about importance to limit the use of chemicals endangering bees and other insects responsible for 84% of pollination in nature. Also important is to have a vision, he continues, in human interventions including an ecosystem favourable to beekeeping: in example the reforestation of the Middle Tiber banks with poplars is not useful for beekeeping whilst it would have been possible to plant acacias. Danilo tells about collaboration between beekeepers and farmers on pollination of plants not useful for nectar, such as kiwi; in the same way farmers could also include in their fields alfalfa, lavender, rosemary, sage and thymus, appreciated for their nectars by honeybees. Nomadism in beekeeping is necessary today as this is the only way to produce honey sufficiently and in Italy the production is greatly lower than consumption. Low prices from abroad are also a danger for beekeeping in Italy, at risk of constant reduction for the difficulties to get a return. Also more and more difficult is to maintain healthy hives without use of antibiotics with timely measures able to avoid the infection of traditional enemy diseases, such as Varroa-mite and American foulbrood or the new dangers called Colony Collapse Disorders. In Italy CCD have caused the loss of up to 40% of honeybee colonies in some areas. It is very important to maintain healthy own honeybee colonies, with high care on prevention and following up with competence all the life cycle of bees, also including a specific attention to have young queen bees and well balanced hives in general. Science, good practices and environmental protection are the only possible responses to the endangered beekeeping in many countries against old and new enemies. For this reason all initiatives sharing and enhancing knowledge and competencies in farming and beekeeping are to be supported by the associations and institutions in Europe. Honeybees give us a life lesson: the only way to guarantee the future of the new human generations is to be jointly liable and cooperate in protecting our “hive”, the only planet we have.

This is “Apicoltura Orazi” in figures:

1970 year of beginning ; 2500 hives ; kind of apiculture 90% nomad, 10% permanent ; honeybee sub-species Apis mellifera ligustica ; kind of honey, acacia, chestnut, eucalyptus, sulla (clover), “millefiori” ; honey production 75 tons/year.

Quality and innovation in honey products from Tuscany (Italy)

Apicoltura Casentinese is a company specialized in products and by-products from apiculture established in 1982 from the initiative of three partners experienced in the sector. Since the beginning “Apicoltura Casentinese”, located in Bibbiena, Province of Arezzo, had a vision based on a large offer of products and a good price-quality ratio.

Photo 7. Apicoltura Casentinese

The company enlarged its factory and stock sheds and renewed its machineries, also including robotic tools to empty casks from honey, air-conditioned rooms for honey conservation and two multiple packaging lines. The personnel is trained with refresher courses for adapting their skills to the ongoing innovation of the company and fulfil the HACCP and ISO 9002 standards for quality system. The company has been developing both own trade marks and packaging for third parties, supermarkets. The most important customers are, in Italy, Esselunga, CarreFour, Conad, Coop, Crai and abroad Wal-Mart (U.S.A.),Target (U.S.A.), Tj-Max (U.S.A.), Cora (Belgio), Tesco (GB), Sainsbury (GB), Costo (GB), Globus (D), Manor (CH), Kaufoff (D), Tegut (D),Tengelmann (D). The company produces also organic honey certificated by AIAB from 2,500 hives that are moved from Calabria Valleys in the Southern part of Italy to a large natural area of the Central Italy, particularly in the Casentino Forest National Park, in the Biogenetic Natural Reserve of Camaldoli and in the Maremma Natural Park. The firm participates regularly to international exhibitions such as Cibus in Parma, Anuga in Cologne, Sial in Paris, Fancy Food in New York, Foodex in Tokyo, Prodexpo in Moscow. This is “Apicoltura Casentinese” in figures: 1982 year of beginning ; 2500 hives (organic honey) ; kind of apiculture 90% nomad, 10% permanent ; honeybee sub-species Apis mellifera ligustica ; kind of honey, acacia, orange, chestnut, eucalyptus, sunflower, wildflowers, linden, honeydew ; kind of honey (organic), acacia, orange, chestnut, eucalyptus, wildflowers, honeydew ; honey production 1,300 tons/year (more than 50% from Italy) ; turnover 16 millions €/year.

Section XV:

Guide for good beekeeping and biosecurity

WHY THIS GUIDE?

The European Commission has a strict regulatory framework in which all defined traded foodstuffs must comply. In the European Union honey is considered a product of animal origin. However honey exists mainly from vegetable ingredients, namely from flower nectar and/or honey dew, collected by the bees, who then transform this nectar or dew via enzymatic processes and dewatering to the finished product «honey». As a producer of a foodstuff, the beekeepers, are able to guarantee to the customers that a product meets the statutory definition of honey and that there is no risk relating to food safety. The beekeeper is directly responsible for the products he sells. Everything must be achieved to guarantee the food safety of honey from the hive to the honey pot. If, despite everything, still a problem is popping up, one must be able to figure out the cause. Therefore, the beekeeper should keep certain information on the critical points on the level of production, harvesting and packaging of its honey. As producer, situated at the beginning of the production chain, the beekeeper is considered as a primary producer. He is therefore subject to the obligation to keep track of (a) register (s) and the application of good hygiene practices. On the other hand, producers whose activities do not limit themselves to the breeding of bees and producing his own honey, make not only part of the primary sector but also of the secondary sector. For example, this is the case for beekeepers that process or sell honey from other beekeepers. These beekeepers are therefore required to apply a hazard analysis for the various critical control points (= < <HACCP> >). This guide has as mission to help the beekeeper in the production of honey in the best conditions and under compliance with the provisions mentioned in the legislation on self control, reporting and traceability in the food chain. However, this is non-binding for the beekeeper. If the beekeeper does not agree with the Guide, he will still have to prove the inspectors that he respects the rules of hygiene.

TO WHOM IS THIS GUIDE ?

This guide is intended for each bee honey and/or comb honey and/or pollen and/or queens producers, regardless of its level of production. Such activity is considered as relevant for primary production. This guide on the other hand focuses not to the beekeeper who exclusively produces honey for own consumption. This guide focuses not on the production of propolis, not belonging to the food sector and thus will not be consumed. The guide focuses not to the production of wax intended for use as ingredient in the food chain. This guide focuses to the beekeepers who, in addition to producing his own honey, also perform certain transformation operations. The transformation activities which fall within the scope of the Guide are mixing the own produced honey with honey coming from other producers and the conditioning of honey, pollen and queens for other producers. This guide is not intended for transformation companies. The guide is not intended for operators that perform other transformation activities than those mentioned above.

CONTENTS OF THE GUIDE

It is not the objective of the Guide to display the beekeeping techniques into detail, but to clarify elements that can have an impact on the basic criteria for hygiene or may lead to contamination of honey. This is a series of opinions and recommendations. The facts that need to be registered, will also be defined. Given the composition and antimicrobial properties of honey, microbiological hazards are practically non-existent. However, it should be pointed out that the potential dangers of infantile botulism in eating honey by children younger than 1 year do exist. This risk cannot be completely eliminated. One should also note the importance of the hygiene of the staff and the infrastructure and the method of cleaning the harvesting material, on the elimination of pathogenic germs. A high water content in honey can cause fermentation. The water content in the honey will influence the shelf life and storage conditions of honey. The possible presence of chemical contaminants in honey poses the greatest danger, even if the measured quantity is below the limit for humans. There should be paid attention to the development of diseases to try to avoid the use of treatment products. On the bee diseases there are a series of sanitary measures legally !!permissible that will been proposed. The physical dangers are very small and are only linked to the interaction with the harvesting and packaging of honey. None of these risk categories represent a great danger for the health (= critical point), but it can lead to rejection of honey. A detailed analysis of hazards and risks is included at the end of this guide.

HOW TO USE THE GUIDE?

This guide is a primarily working tool that analyzes step by step the production chain of honey. From hygienic point of view the control points, indicated by the logo danger should be followed systematically. They require a registration, indicated with a pencil. In addition to these main points are a series of advice and precautions proposed to reduce the risk of loss of honey to reduce, indicated by the symbol hand and by a level of danger.

Via ☝ we draw the attention to dangers that should be controlled by the beekeeper, this is done in combination of the level of risk, indicated by ❶ ❷ ❸

By using 👓 we refer to dangers that are controllable by the beekeeper,
Dangers that are undetectable by the beekeeper are indicated by ☒
If the danger is found, corrective actions must be performed, indicated by 🛠 After this analysis of the production process of honey, in a production registry all information are listed annually: ✎ .

Precautions of hazard control points:	☝
Level of controllable risk	❶❷❸
	(1=low risk, 3 =high risk)
Control points	🗣
Controllable by the beekeeper	👓
Not perceptible by the beekeeper	☒
Corrective actions	🛠
To be registered in the registry	✎

Choice of the materiel

Bee hives in wood:

• use only non-toxic products to protect the wood.

- It is prohibited to use products containing lead, insecticides, fungicides or carboxyl (information available at the distributors)
- One can also immerse hive components in microcrystalline wax (10 minutes at 150 ° C).
- It is not necessary to protect the inside of the hives.
- Work always with strong bee colonies, these make themself an overlay from the inside with propolis (natural protection).

In case of presence of toxic products in hives:

replace the protective layer by a product suitable for foodstuffs.

Bee hives in straw:

Hives in straw are not recommended as they cannot be disinfected.

Production hives in plastics:

• all parts in contact with the bees shall be made of material of food quality: ask a food certificate to the supplier if the corresponding logo is missing.

If the plastic is not appropriate for foodstuffs,

it should not be used in a bee hive.

Wiring of the frames

- the use of wires in stainless steel is recommended and is required if the wiring is reused after the melting of the wax.
- Galvanized wires should be good melted in the wax. Galvanized iron wires are replaced after the re-melting of the combs.

Wax waffles

- when purchasing new wax ask a certificate to the supplier. This certificate serves to demonstrate that the wax has no residue of acaricides and antibiotics, which the honey or the queens may contaminate above the allowed limit.
- A synthetic wax, suitable for bees and foodstuffs, may be an alternative.

- one can set up wax recycling with:

  - frames that are untreated or treated with acids or with other products without health hazards.
  - cell top wax.
- It is not recommended to use frames that have been treated to use as honeyframes in the upper frames.
- It is strongly recommended to remove the wax comb from the circuit which has been in contact with handling products for several weeks.

Note in the registry "PURCHASES/SALES"

- supply: origin, date and amount
- sale: type, date and amount
- data from the supplier
- data from the buyer

Frames for comb-honey

☝• The frames used for comb honey are made from untreated wood or plastic with food quality.

☝• the beekeeper uses a wax strip or a wax waffle made from cell top wax, was out of biological cultivation or wax out with a certificate that demonstrates that the wax is residue free.

Pollen trap:

☝• All parts that come into contact with pollen (pollen grid, grid, pollen recipient) are of food quality.

- The pollen trap has should assembled in way to prevent dirt, coming out of the hive to reache into the pollen recipient.
- The model of pollen trap should be firm, bees-proove and durable and also allow an easy cleaning procedure. If possible dead spots have in the construction should be avoided.•

A drone exhaust must be installed.

☝• If the trap is put in front, the recipient should be protected against condensation.

☝• In the case a pollen trap is put underneath, it is recommended that the pollen recipient is well ventilated.

☝• The size of the pollen grid should be adapted to the strength of the colony. The grid wouldn't hurt the bees or their wings.

Cups for the production of royal jelly

☝•All elements relating to the frames, wiring and wax combs also apply on the production of royal jelly.

☝•One may only make caps from cell top wax.

- Reusable plastic cups should be made of plastic of food quality.

☝• The cups should be assembled on the frame with food-quality glue, with bee wax or mechanically (screws,…)

Maintenance of the material

Production hives:

☝•One needs to disinfect only by using products that are allowed in the food sector

- Always rinse with potable water.

☝• for good disinfection, it is desirable that all parts in wood or metal will be burned with the flame.

- The disinfection with an approved product based on bleach offers a good alternative for material made from plastic or polyester. When using sodiumhypochloride of 12 ° it is recommended to dilute 1 litre of concentrated hypochlorite to 10 liters of water. For hypochlorite solution of 48 ° the dilution is 250 ml hypochlorite in 10 liters of water.

☝• the most reliable solution, which permits to neutralize all existing pathogenic traces, consists of immersing all wooden components after (cleaning and drying) into a microcrystalline wax (10 minutes at 150 ° C). Always rinse afterwards with potable water.

Frames:

☝• The sorting of the frames is needed before to store them. Frames with beginning of mold or frames that have become black are removed (20% of the frames shall be replaced annually).

- The wax of the frames is removed or re-melted.
- The empty frames can be cleaned in boiling water.

☝• In the case of bacterial bee diseases, all frames will be burned.

Small material:

☝•To prevent the spreading of infectious diseases, it is recommended that if the beekeeper takes material to another bee population (or in between two visits) to disinfect the beekeepers material (e.g. by a flame).

- It is recommended to use specific equipment for each bee stand.
- It is ideal to disinfect frame lifter regularly with the flame or in a disinfectant bath (bleach, etc.).

Cleaning of queen cups:

☝•Before storage of cups for the production of royal jelly, these should first be cleaned with potable water under pressure, and this as soon as possible after the use of the cups.

Storage

Storage room for material:

☝• Avoid chemical products and sources of smoke in the storage room.

- Take care for a general hygiene in the room.
- No rodents, birds, bats. This point is essential in the case of storing pollen traps; droppings of mice can be extremely toxic.

Storage of frames:

☝•To avoid the problem of the fermentation of honey frames, it is recommended to let the bees lick out the honey (1 to 2 days) after the last harvest, by putting them in the honey uppers on the hive before storing them.

- Spare and licked frames (without food) are not stored in open air. These frames can be kept, for example, in a locked frame hive or an old refrigerator.

Precaution against wax moth:

- In order to preserve the honey frames, a good ventilation is recommended. One can, for example, install at the top and bottom of a stack of honey frames a queens grid, this will cause a chimney effect.
- Vapours of glacial acetic acid will keep the waxmoth away.
- If necessary, a biological method with Bacillus thuringiensis or possibly sulfur stripes can be introduced in a a hermetically sealed stack of frames.
- The technique of freezing can also be applied (min. 24 hours at-18 ° c).
- Products such as naphthalene, paradichloorbenzeen, carbon tetrachloride or analog products are banned!

Note in the register “TREATMENTS AND PRODUCTS”:

- name,
- dose,
- method and
- supplier…

I

f it is suspicious that prohibited products are used,

Frames are removed out of the wax cycle

Precaution against nosemose:

☝•To reduce the risk of the development of nosemose is recommended to disinfect the frames with glacial acetic acid, put on top of the frames in a small bowl. This will give the best results at a temperature between 20 and 25 ° c in a well ventilated room (not the honey harvesting room). Ventilate the frames and the honey frames before putting them back in the hives.

✎**Note in the register "TREATMENTS AND PRODUCTS":**

- name,
- dose,
- method and
- supplier…

Working on the bees,

General rules:

☝•Take care for hygiene, order and tidiness.

Opening of the hive:

☝•The supers and the frames are not put on the ground in order to avoid contamination by ground bacteria's.

Fumigation, spraying, joining:

☝•Avoid excessive fumigation

- to fumigate, dry natural plant materials can be used, such as pieces of dry beech.

☝• during the flowering period, the use of resinous or oily substances, as well as hardboard with glue substances are prohibited. As during its combustion toxic substances can be formed.

- only tap water or water that meets the standards for drinking can be used in the sprayer.

- the products used to unite two hives should be of of foodproof quality.

Note in the registry "ALL SORTS OF FEEDING":

- the materials used in the smoker-any used fragrances.

Renewal of combs:

- Check regularly the breeding- and the honey frames and remove all frames that are too old.

- Eliminate annual 20% of the breeding frames (the frames with the darkest wax). Regular renewal of the combs makes the bee colonies stronger and lowers the infection pressure.
- Ideal is the use of virgin wax * or translucent wax for the honey frames in the suppers.

- In any case, dark brown or black frames are not to be used as honey frames.

Introduction of bees and other biological material

Robbery and entering the wrong hive:

- Avoid linear modes of beehives (hives on a row).
- Avoid hives in one and the same color.
- Avoid all activities giving rise to outlaws:

- leave no material outside the hives to be licked out by bees
- never leave frames lying around,
- avoid weak colonies.

In case of robbery, remove the source of the robbery and make the entrance of the hive smaller.

Capture and introduction of swarms:

- Treat against varroasis with approved products.
- Bring the swarm on waxcombs to be build.
- Avoid feeding them honey of unknown origin.

Note in the registry "PURCHASES/SALES":

- the introduction of the swarms
- the date
- the future hive number

Note in the register "TREATMENTS AND PRODUCTS":

-the treatment given

Introduction of other than biological materials

- Even in the presence of a health certificate, it is recommended that to inspect the bee material at the moment of the purchase (e.g. clinical symptoms of bee diseases).
- In the case of purchase of biological material in a European country it is appropriate to have a health attestation of the queen and the bee colony. If this Is not the case, it is designated to keep bees in quarantine to check the absence of bee diseases.

• In the case of purchase of biological material (bees or drones), coming from a country outside the European Union one must meet three conditions:

1. from countries outside Europe only queens can be imported with a maximum of 20 accompanying workers.
2. Queens should come from a region controlled according a sanitarian plan and also free of American foulbrood, acariosis, Aethina tumida and Tropilaelaps.
3. an international health certificate is required (EC 2000/462).

Note in the registry "PURCHASES/SALES":

In case of a queen:

- the producer and the country of origin
- the date
- the number of future hive

In the case of a hive or a six-frame:

- the supplier and the country of origin
- the date
- the future hive number

Keep the health certificate together with the production registry.

Bee diseases

Identification

• Each beekeeper must register with the national authority

• This obligation applies to all beekeepers and is independent of the number of bee colonies, producing honey and any payment of a levy.

- Each hive, which is not located on the area where the responsible beekeeper has his resident, should be identified on a permanent way.

  To reach that, there should be mentioned:

  - the name and address of the owner at the entrance of the closed area.
  - in other cases all hives must of the bee stand should have these data.

- Best is that each hive is numbered in order to guarantee traceability.

Note in the register "BASIC INFORMATION":

-the name of the stand

-the address

-the number of colonies, wintered with more than 15 000 bees (+/-6 frames).

Precaution matters:

- Work with strong bee colonies and in the presence of sufficient good pollen sources.
- Never leave frames with honey and/or pollen lying around in the bee stand.

Note in the registry: "TREATMENTS/PRODUCTS":

- Each new outbreak of a disease must be registered in the registry -In case of a disease outbreak that should be declared, the official forms, should completed and sent to the competent authority by letter, fax or mail.

Compulsory declaration:

☝ •American foulbrood, European foulbrood, the small hive beetle, Aethina tumida, varroasis and the Tropilaelaps mite are so-called ≪ declaration compulsary ≫ diseases. About varroasis, the hole country is considered as infected zone and as a consequence a declaration therefore is no longer necessary.

☝ •If the bee keeper suspects the presence of a ≪ declaration compulsary ≫ disease, or abnormal mortality without finding the cause, he must immediately make a declaration to the local control unit of which the bee stand depends. At the request of an inspector-veterinarian, an assistant for beekeeping will take samples and send it to the laboratory.

☝ • When a ≪declaration compulsary≫ disease is detected, a protection zone with a radius of a minimum of 3 km around the outbreak will be installed. In this protection zone it is prohibited to sell, trade, transport, rent, offer or to derive colonies, queens, combs, hives or material of the beekeeper. Beekeepers also should apply prescribed control measures. Specific measures in function of the identified disease will be applied under the supervision of the authorities.

☝ • In case the varroasis, a declaration is not required in the light of the disease as it is ubiquitous throughout Europe.

☝ • If abnormal bee mortality occurs the beekeeper should, on his own initiative, send a sample to the authorities laboratory. In this case he should also pay for the costs for analysis.

Treatments:

- It is recommended to follow the control strategy, as stated in the regulatory texts.
- Certain veterinary medicinal products require a veterinary prescription. If necessary, contact your authorized veterinarian.
- Use only authorised veterinary medicinal products, as formulated and on the market for application at bees, according to the instructions or veterinary prescription. ❸
- Respect the prescribed waiting periods. ❸
- Treatment during flowering periods and/or in the presence of honey supers.

- Never treat preventively. ❸

- At present there is no veterinary medicinal product registered for the treatment of nosemose (or fumagilline).
- At present there is no antibiotic or sulfonamide authorised as veterinary medicinal product for honey bees. ❸

Note in the register "TREATMENTS/PRODUCTS":

- the bees stand
- the treated colony (s)
- the name of the veterinary medicinal product
- the used dose
- the method used
- the start and the end date of the treatment
- comments and observations in the case of a prescription/administrative document, mention the relevant references and keep the documents for 5 years.

If residues are found:

Destruction of the honey when contamination is found above the standard, as well as suspected of an inappropriate treatment.

What to do with old products?

- The old packaging material and treatment products are to be delivered in the chemical recuperation container park at the special waste department (expired medicines).

Bee stand

Environment

General principles

- choose a stand
  - with a rich and diverse flora (pollen sources are especially important in the spring and at the end of autumn),
  - which is dry,
  - sheltered from the wind,
  - with enough light,
  - preferably far away from agricultural crops, which regularly should be treated.
- Adjust the number of colonies to the surroundings: it is ideal to put not more than 15 bee colonies together.
- If no natural water sources in the short distance of the hives, install a bee drinking place with potable water.
- Hives should be at least 20 metres from a public road or houses. This distance may be reduced to 10 meters if a shelter of 2 meters height is present.

☝ Travelling with bees

- Select a location in a zone without risks.
- Communicate with the owner or locals to the executed crop treatments.
- Each colony belonging to the traveling bees, not meeting the identification requirements is considered to be suspected of contamination.

Note in the register "BASIC INFORMATION":

-the places where the bees have been standing

-the identification of the moved hives

-the dates of traveling with the bees

Pesticides an GMO's

☝• In areas with large areas or orchards, it is strongly recommended to communicate with the owners or tenants about the applied or planned treatment or the use of genetically modified crops.

☝• place the hives (in agreement with the owner) outside the range of spraying and fertilization, taking account the drift.

☝• In case of treatment of flowering plants:

- best is to move the bee colonies prior to flowering
- if this is not possible, temporarily close the hives as long as the product is active.

☝• In the case of the harvesting of pollen one should avoid putting hives in zones that are considered as "pollution or risk areas", or regularly treated with hydrocarbons, heavy metals, etc.

- In case of a GMO culture in the vicinity (radius of 5 km) the risk is that the harvested pollen could be considered as being GMO.

• to avoid the presence of heavy metals, one must avoid placing bee colonies on an industrial environment polluted with heavy metals (in the vicinity of strong polluted enterprises).

Note in the register "BASIC INFORMATION":

- the treatment of the flowering plants and with which product,
- if known, the date

Contaminated environment

if it is not possible to remove the source of pollution, hives must be moved

Feeding the bees

Feeding on a sugar basis

Basic principle

- feed the production hives not during flowering periods and/or in the presence of honey supers (feeding is allowed in case of exclusive production of royal jelly).
- When placing the honey supers it is recommended to remove the frames with abundant quantities of food.

Prepared by the beekeeper

- use only sugar with food quality.
- Sugar syrup is always prepared with drinkable tap water that meets the standards for drinking water. ❸
- store the sugar in a place free from chemical and/or biological pollution sources (absence of mice and insects, dry local, hermetically sealed bags etc.). ❷

Industrial prepared product

- Choose sugar that bees can digest.
- Check the syrup for the absence of fermentation.

Note in the register "FEEDING/VARIOUS":

- the name or the supplier
- the name or the nature of the product
- the quantity
- the date
- the comments and observations

In Case of suspicious presence of syrup in honey

-honey is harvested separately and as winter food given back to the bees

When using a banned product

-If one suspects that the honey contains illegal products, the honey should brought to the container park for destruction.

Feeding to stimulate:

Honey

- use only honey from own stand for stimulation feeding, to avoid spreading pathogens or residues. ❶
- use no spare frames of uncontrolled origin.❷

Pollen

- avoid the use of suspicious or poorly kept pollen.

- just feed pollen of a known origin (from an own beestand).

☝ **Feeding dough**

- use only honey or pollen from own company, without toxic substances or veterinary medicines (ask a certificate to the vendor). ❷

☝ **Food supplements**

- only use food supplements products suitable for foodstuffs and without addition of antibiotics or sulphonamides (certificate of supplier), or products that are allowed to be used as a dietary supplement.❷

Note in the register "FEEDING/VARIOUS":

- the name of the supplier
- the name of the product (type)
- the lot-number (if industrial product)
- the quantity
- the date
- comments and observations

Use of a prohibited product (antibiotic …)

Honey that contains illegal products must be destroyed

Harvesting the honey

Placing honey supers

- when purchasing colonies with filled food frames, it is recommended to remove these frames and destroy them before placing the honey supers.

Removing the honey bees from supers

- avoid the fumigation of honey supers.
- Select a bee exhaust or a bee blower (blower: without use of gas)
- the use of repellent chemicals is highly discouraged, certain products are even prohibited (nitrobenzene = mirban).

Note in registry “HONEY HARVEST”:-harvest method and the name of the product when you use a repellent

Detectable strange smell/taste

Honey with a strange smell/taste (for example of smoke) can no longer be used as table honey. It can later (possibly) be fed to the bees, or it can be used for the industry (bakery honey).

Presence of brood in honey supers

- preferably use a queens grid.
- Never centrifuge frames with brood to avoid contamination of honey.

Presence of brood in the honey frames

Put these frames back in the hive or let the bees be born before harvesting.

Removal of honey frames

- it is recommended to measure the moisture content of the honey before the removal of the honey frames. If you do not have a refractometer, the honey should not splash out of the combs when bumping the combs (bump test). Ideal is an average moisture content below 18%, in any case the moisture content must not exceed 20%. ❸
- remove the honey frames preferably when the weather is dry.
- Get just enough-sealed honey frames out of the hive. ❸
- do not use a water atomizer. ❸
- in the presence of not controlled honey frames, it is recommended to centrifuge them separately.

Harvesting honey that is too wet (>18%)
dehydration of honey supers is compulsory if moisture content >20% and recommended if moisture content is >18%

Transport of honey supers

- use a wheelbarrow with a clean surface for transportation.❷
- close off the supers during transport, to avoid robbery and possible contamination with dust particles. ❷

Harvesting honey honeycomb (in sections)

- this harvesting should be done in very strong colonies and in a period of rich flowering.
- One must ensure that the sections are completely sealed.

Harvest of pollen

☝•The harvesting of pollen may only happen in healthy colonies, free from lime brood.

- Ideal is to harvest the pollen in well-developed colonies.

☝• pollen collector should be replaced as frequent as possible and this at least once every two days in relation of the humidity of the air. If necessary, the pollen collector should be cleaned.

- Check the presence of fungi in the pollen collector; when fungi are detected, the collector should be replaced by a clean one.
- The pollen traps may only come into contact with tidy surfaces (do not place them on the ground).
- All suspicious pollen (clumped, moldy) are systematically removed.
- The main waste (bees) is removed before transport.

☝• in any case, one must avoid that faeces of rodents get in pollen traps. This can be very contagious.

- The hive should be orientated in such a way that no fertiliser granules, which may be spread on the fields, can get in the pollen trap. To this end, one should respect a sufficient distance (10 m).

☝• the recipient for the transport of pollen needs to be of food quality.

Harvesting of royal jelly

☝•**Getting started**

- The start and placing the larva should happen in hygienic conditions.

- All the material for the start and placing the larva should be suitable for contact with foodstuffs and must be cleaned and disinfected.
- If the cups are wetted with royal jelly, this must come from own production or from known origin (note the country of origin if from abroad) and free of residues.
- Suspicious royal jelly may not be used.
- The water to dilute, if used, should be drinkable.
- The stock solution to moisten the cells must be in the refrigerator and should at least be refreshed once a week. Just the neede quantity is taken from the refrigerator and surpluses of used solutions must be removed.

☝• **Placing the larvae**

- the Frames with larvae must come from healthy colonies which in that period are not treated.
- The textile tissue used to protect the larvae from the sun and the heat must be clean and moistened with potable water.

☝•**Harvesting**

- the removal from bees of the cultivation slats should be done with a minimum of smoke.
- The cups from which the royal jelly will be harvested must be protected against all possible sources of decay (sun) and infection.

☝**Transport**

- recipients used for transportation should be of food quality, clean and closed.

Harvesting room

Keeping away the bees

- avoid the presence of honey bees in the supers before entering the harvesting room
- Ideal is to leave the honey supers with remaining bees in a dark room with a light source outside to lure away the bees.
- Total absence of bees during the further processing of honey (after sieving) should be accomplished.

Humidity in the harvesting room

- It is advisable that the relative humidity is lower than 55% in the room where the supers are for more than 48 hours❷
- It is recommended to measure relative air humidity during the process of centrifuge.

> Air humidity above the 55 percent
>
> It is recommended to put an air dehydrator into the harvesting room a few days before the introduction of the honey supers.

Sources of contaminantion

- The harvesting room should be hermetically sealed off for insects and small animals (mice, …)
- absence of pets during the process of centrifuge.
- Prohibited to smoke. ❶
- Absence of sources of dust, smoke, gas exhaust.❶
- No storage of chemicals and cleaning products ... (but in a closed cupboard).❶

Risk of contamination of honey

Make the necessary adaptations to meet the stated requirements.

Maintenance of the harvesting room

- Presence of cold and hot water in or in the immediate vicinity of the extraction room which allows to clean the room and the used material.❷
- the water or tap water must meet the standards for drinking water (annual certificate). ❸
- the disinfectants used must be approved by the authorities of public health.❷

- the room must, at least before and after each extraction period, be cleaned and disinfected with hot water. ❷

- the surfaces in contact with honey (extraction material) should be cleaned and disinfected before and after each extraction activity. ❷

Note in the register "HONEY HARVEST":

-date of cleaning of the premises.

Staff

- Good personal hygiene. ❶
- Clean and addepted clothing (hair nets, closed pockets, …) to avoid the loss of hair or articles. ❷
- Free from infectious diseases.❷
- One needs to have a medical certificate of fitness that states the suitability of working with foodstuffs. This certificate must be renewed annually.❷
- Cover the wounds that could tarnish the honey.
- Smoking-, drinking- and eating- prohibition.

Harvesting of honey

Harvesting room

• The requirements imposed on premises used to extracting and conditioning of honey are different depending on the frequency of use of the premises. Such premises can be temporarily or permanently.

Note in the register "HONEY HARVEST":

-the place (address) of the premise

-the data and the identification of lots of the honey

oning

Permanent extraction room

Location

- permanent extraction premises should preferably be built in a place far away from strong or disgusting odors and in any case away from matters that can harm the hygiene of the products harvested.
- The extraction room may not directly lead to premises which can have a contamination source (toilets, garage, workshop, etc.). A full door is good enough for separation.

General characteristics

- In the case of a permanent use of the room, in addition to the requirements listed, the following rules should be applied.
- The room must be reserved exclusively for extracting of honey and other bee products.
- Easy cleaning of the room: avoid inaccessible corners.
- A system for the evacuation of bees is advisable.

Establishment of permanent extraction premises

The floor

- foresee a waterproof and cleanable floor.

- Ideal is a solid floor to easy remove propolis.
- Ideal straight plinths to remove propolis easy...
- a good drainage is needed.

☝ **Walls and doors**

- Provide solid, unpatterned walls.
- The parts that can be contaminated with honey or come into contact with the honey frames must be washable.
- Should consist of strong material (preferably no plaster).

☝ **The ceiling and the lighting**

- It should be easy to undust the ceiling.
- Provide a good lighting.
- Provide a shielding around the light sources (protection against breakage).

☝ **Plumbing, sink**

- Sink:
  - with tap water or water that meets the standards for potable water.
  - ideal is a system for drying the hands that avoids recontamination (paper role with central dewinding devive ...).
  - ideal is a hands free tap
- To get good hygiene: toilets, however, no direct in connection to the extraction room.

Temporarily extraction room

☝ **Use of the premises**

- taking into account that to the production of honey is a seasonal activity and as honey is not susceptible to microbiological risks, locations with another destination can temporarily be used as extraction room on condition that these premises or their condition dot not lead to contamination or deterioration of the honey (bees halls are excluded).
- During the period of harvesting (extraction) and processing of the honey, the room should be reserved exclusively for these functions

☝ **Characteristics of the extraction room**

- the materials in contact with honey should be of food quality (eventually wood), corrosion-resistant and easily washable.
- The surfaces that possibly can be smeared with honey (floor) consist of waterproof and washable, non absorbent material.
- The other surfaces are dedustable.
- A point with hot and cold tap water or water that meets the standard of drinking water meets should be easily accessible in the extraction room or in the vicinity.
- the room must be easy to clean.
- during a period of use, avoid any source of contamination.

✎ **Note in the registry used the "HONEY HARVEST":**

- the used room

- the periods of the use of the room

- the identification of the honey

Nature of the equipment

☝• use equipment, suitable for food, that is resistant to the high acidity of honey.

- ideal is materially in stainless steel, if it comes in contact with honey.
- Parts that come in contact with honey may not exist of wood,.

Control of the nature of the equipment

Replace the equipment which does not meet nutritional standards.

Maintenance of the material

- Check the cleanliness of the equipment before using.
- clean for each harvest the surfaces that come into contact with honey with tap water or water that meets the standards of drinking water and, if necessary with disinfection products approved by ministry of public health.
- the lubrication of the axles and gears of the extractor equipment; above or in contact with the honey, should be done with fats that meets food quality.
- check the condition and cleanliness of the recipients for use. Check for rust or parts that are poorly fixed.

Actions during extraction of the honey

Drying of the honey frames

- Check, unless it already was measured, the moisture content of honey (see earlier and ideal with a refractometer.)

- The honey frames should be dried in function of the humidity:

  - either through a passage of a warm air flow (max 50° C).

  - either by the passage of dry air

Measuring water content:

≤ 20% legal norm

≤ 18% recommend

let dry the honey frames during several days if necessary

De-sealing the honey cells and the extraction:

•any suspected honey (fermentation, abnormal smell …) should be removed before or during the de-sealing or the extraction .

Check the condition of the honey frames (absence of fermentation, abnormal odor or color)

Depending on the nature of the problem the honey can be given back to the bees, preferably after a thorough heating (> 75 ° c for 3 to 4 minutes), or if a there is a danger to the bees, the honey should be destroyed.

Seal wax

- After extraction the removed cell seals are kept in closed recipients.
- The wax of the cell seals is handled as quickly as possible (centrifuged, remelted).
- In the case of recovery of honey for consumption from the cell seal wax, this shall be done within the week.

Sieving the honey

- Check the condition of the sieve before each use.

- Ideal is to sieve the honey in multiple steps: coarse, medium and fine sieving. The finest sieve (except for heather honey) must have a mesh size between 0.5 and 0.2 mm.
- the sieve must retain all visible particles in the honey.
- one should observe the sieve constantly to prevent overflow of the sieve.

Check the condition of the sieve

The honey should be sieved again or given back to the bees.

Clarifying and ripening the honey

- after sieving one preferably places the honey at a temperature above 20 ° c to remove the air bubbles and small particles in the honey. The duration for this depends on the volume of honey.
- the foam formed on the surface of the honey and the small particles will be removed (clarification). During this de-foaming one should avoide mixing of foam and honey...

Conditioning the honey

Processing the honey

•**Generosities**

- after the sieving and the ripening, all recipients will be covered and the necessary measures are taken to prevent foreign particles to get into the honey.
- Avoid the occurrence of insects.

☝•**Stirring**

- use proper tools that generates no dust and that exclusive is uses for this action (specific material: drilling machine ...).
- Do not scratch wit the rudder components against the walls of the container.
- Avoid the insertion of air in the honey.

☝•**Blending and grafting**

- never add honey without a complete analysis report if one has no knowledge of:
  - the production steps (traceability) of honey (risk of residues).
  - the geographical origin (country).
- check before mixing the different batches of honey on the absence of gross errors (fermentation, strange smells, etc.).

☝•**Re- liquefaction**

- Avoid warming up the honey with inappropriate equipment that can cause an overheating and a deterioration of the honey.
- warming happens as less and as short as possible.

☒ determining the HMF content in a lab.

🛠 If ≥ 40 mg/kg (legal norm): industry honey or give it back to the bees. This parameter has no influence on health of the human population.

Tracebility

☝•Each recipient that contains honey will have a label on the side (not on the lid) that its traceability ensures:

- identification of the harvest (honey bees from the same State and same pendulum turn).
- identification of lot (honey coming from multiple extraction or a mixture of different types of honey).

• An example of traceability is mentioned into the production register.

Filling of the jars

☝• **Honey jars**

• Use jars that only are use to have honey ❷

• Glass honey jars must be intact.

• Use only recipients that are perfectly clean. ❷

• Glass honey jars should be washed and rinsed with potable water before filling. ❷

☝• **Lids**

• Honey pots must be sealed hermetically.

• On pots with a screw system, preferably hermetically sealed screw lids are used. ❸

• Ideal is not to use plastic click lids.

• Metal lids cannot be reused.

• Check the foodproof quality of the plastic lids.

👓 Doubt about the cleanliness:
🛠 Do not use

Conditioning of other products

Conditioning of other products

☝•**Premises and equipment**

- All articles that come into contact with pollen must be of foodproof quality and resistant to acids.
- Conditioning of pollen may only be carried out in premises which meet the requirements as defined for permanent extraction premises . A special attention should be paid to the absence of contamination sources.
- Conditioning of pollen is carried out, either in a specially designed premise, either in the extraction-or honey- room in a period where the room is not in use for the processing of honey.

☝• **Drying**

- For a preservation at room temperature the pollen should be dried directly after harvest (within 24 h).
- To do this, the pollen are spread as a thin layer in a sieve and slowly dried by a dry filtered air flow at an optimum temperature of 40 ° C.
- The moisture content of the pollen should be less than 6%. To check that, the water content of the pollen nuggets is measured by defining the weight variation, before and after drying (110 ° C for 1 hour).

☝• **Cleaning**

- It is recommended to use an appliance that removes the impurities from the pollen (dirt from the bees, metal particles ...), on the basis of density differences and magnetism.
- A visual final inspection is necessary to remove the dirt particles (limebrood...) that have the same density and volume as the pollen nuggets.

• **Freezing**

- After purification, pollen can be frozen in bags or jars. Make sure that the cold chain is not broken.

•**Potting process**

- the potting process can happen in clean and sealed jars from a UV-not permeable material.

• **Blending with honey**

- It is possible to mix the pollen with honey and to preserve as such.

Note in the register "POLLEN HARVEST":

- address of premise
- data of the harvest of pollen and used beehives
- references of the harvest (lots-numbers)
- moisture content of the pollen, before and after drying
- quantities -date of freezing

Conditioning van comb (section) honey

• the boxes used for the commercialization of comb honey must be of food proof quality and sealable.

Conditioning of royal jelly

•**Hygiene of premises and equipment**

- Conditioning of royal jelly may only be carried out in premises which meet the requirements as defined for permanent extraction premises
- Conditioning of royal jelly is carried out, either in a specially designed room, either in the extraction-or honey-

room in a period where the room is not in use for the processing of honey.

- All articles that come into contact with royal jelly (extraction-and filtration equipment, larvae needle, pots, cups ...) must be of food-proof quality. They must be clean and easy to clean and disinfected immediately after use.

☝•**Headings of the royal cups**

- One must avoid heated equipment to come in contact with the royal jelly.

☝•**Removing the larvae**

- From cups in which is a dead larvae, one may not be harvest the royal jelly.
- Removal of the larva is mandatory before extraction of the jelly. Beware not to damage the larva (release of hemolymph).

☝•**Extraction**

- the extraction can be done using a spatula, a vacuum pump or with a small centrifuge.
- The extraction of the royal jelly must be carried out without delay, the same day of removing the cultivation slats.

☝•**Filtration**

- in order to remove foreign particles and in particular particles of wax, it is advisable to filter the royal jelly, immediately after the extraction or later during the day of the extraction. The filter fabric must have a mesh size between 0.4 and 0.7 mm.

•Freezing

- Royal jelly may be frozen (-18 ° C). Make sure that the cold chain is not broken. A maximum shelf-life should be respected .

•Potting process

- the potting process can happen in clean and sealed jars.

Note in the register of "HARVEST QUEENS":

- address of extraction room
- data of extraction and used beehives identification
- references of the harvest (lot numbers)
- harvested quantities
- date of freezing

Labelling

• Mentioned information should be mentioned on the label according the law:

- name of the product: honey (or flower honey or nectar honey or dew honey) -expiry date (maximum 2 years after potting) and storage condition-net weight,
- the name and address of the beekeeper (producer or supplier),
- country of origin of honey,
- lot number or another number (for example, ≪analysis≫) in order to ensure traceability, In the case of a mixture with a honey that was not harvested in the country, the countries of origin must be indicated on the label.

- One can add the geographical origin on the condition that all honey is produced in the same region.

- There can be a botanical origin (mono floral, double designation or a detail of the visited flowers). In that case, a specific analysis is required.
- One can mention quality criteria if they are verifiable and contribute to the improvement of the base product.

☝• Designations as ≪ pure ≫, ≪ natural≫, ≪ from bees ≫, are not allowed.

The presence of illegal information:

Change the labels so that they meet the legal criteria

Labelling of pollen

☝• legal notices below must appear the label:

- name of the product: dried pollen (pollen) or deep-frozen pollen (pollen) -expiry date: dried pollen: maximum 1 year after the harvest date, deep-frozen pollen: maximum 18 months after the harvest date, -storage conditions. for deep-frozen pollen one should list: ≪not refreeze after thawing and consume within five days (storage in the fridge ≫, net weight, -name and address of the beekeeper (producer or supplier),
- country of origin (optional),
- lot number or other number in order to ensure traceability,

☝• it is recommended to indicate on the label that the product is a potential allergen for persons susceptible to food allergy.

☝• only claims on health or nutritional value, admitted by the authorities, may be used.

☝• the presence of more than 0.9% of GMO-pollen requires a specific labelling: “GMO product”.

Labelling of royal jelly

☝• Legal notice below must appear on the label:

- name of the product: fresh or frozen royal jelly
- expiry date: fresh royal jelly maximum 6 months
- frozen royal jelly: maximum 18 months after the harvest date. This date must be a specific day, month and year
- storage temperature:-fresh: between 2 and 5 ° C, -frozen: <-18 ° C
- net weight,
- the name and address of the beekeeper (producer or supplier),
- country of origin (optional),
- lot number or production date,
- royal jelly after thawing must not be frozen again.

☝• Only nutritional- and health- claims, licensed by the authorities, may be used.

Storage and commercialisation

Long-term preservation

☝•**Storage of honey**

- store in a dry and cool room (ideal ± 15 ° C) and sheltered from direct sunlight. This temperature may vary but must be the most of the time under 22 ° C.
- Honey with a water content > 19% should be kept at temperature not lower than 11 ° c. If the honey contains honeydew the same advice is given as for honey with 18% moisture.

☝•**Preservation of pollen**

- Dried pollen must be kept in a dry, cooled room (ideal: < 15 ° C) and sheltered from the light.
- Frozen pollen must be kept at a temperature lower than - 18 ° C.

☝•**Storage of royal jelly**

- Pre-packed royal jelly should always be stored (also in commercial stores) well sheltered from light and kept at a temperature between 2 ° and 5 ° C.
- Frozen royal jelly must be kept at a temperature lower than -18 ° C (maximum 18 months after harvest date).

Purchase/sale

☝• Information to customers and merchants (keep in cool places, no exposure to sunlight, etc.).
- Supply preferably several small quantities instead of a large amount.

☝• It is not recommended to give honey to infants younger than 1 year, to reduce the risk of infant botulism. Information can be given to the customer or a listing on the label, for example, ≪ not suitable for children younger than 1jaar ≫

Note in the registry "PURCHASES/SALES":

Purchases:

- the date
- identification of the supplier
- identification of the purchased honey
- the quantity
- the geographical origin of the honey

Sales (except to individuals):

- the date-identification of the buyer
- the quantity
- identification of the lot of the harvest
- the coordinates of the place of delivery

In the case of products with a food risk:

• In the event that the honey is a food risk: get in contact without delay with the responsible services.

Secondary products

Related persons

• You are, according the law, no longer considered as a primary producer, but a secondary producer:

- if you have your products mixed with honey, pollen or royal jelly coming from another beekeeper,
- if your extraction room also is used by other beekeepers,
- if you transform the products of your bees into other products (gingerbread, nougat, ...).

Relaxations

• As a secondary producer you should work out your own risk analysis and HACCP (analysis of critical control points). This userguide does not give the necessary elements for the realization of such a study. However, the legislator provided relaxations for small producers:

- producers that supply directly to the consumer and business with a surface smaller than 400 m2 or with a number of corporate members of up to 5 full-time equivalents;

- supplying to other companies and work with a maximum of 2 people (full-time equivalents). These relaxations, in addition to this guide of good beekeepers practices include:
- all measures for the prevention, elimination or reduction of risk to an acceptable level,
- the registration of all problems (non conformalities),
- a retention period of documents of minimum 6 months after the expiry date.

Mixtures of products

☝ •**Honey**

- This guide deals with all the necessary elements (blending and grafting composition of labels, purchase of honey).
- An analysis of the critical points (HACCP) is mentioned later in this guide.

Royal jelly and pollen

- The general principles for honey also apply to royal jelly and pollen. Nevertheless, a specific risk analysis has to be worked out.

Common extraction-and honey- premises

☝• A common extraction -or honey premise shall meet the same requirements as for permanent equipped premises.
- A specific register on the use of the room must be maintained in which one specifically mentions the name and address of the user, the date of the use and the amount of harvested honey.

- A specific procedure concerning the cleaning of the room and equipment between the various users should be drawn up.
- Later in this guide, a draft of an analysis of the critical points (HACCP) is presented.

Transformation of products

☝ • The only transformations covered in this guide are: treatment of honey for other beekeepers, mixing of honey from own production with honey of other beekeepers.
- All other transformations do not fall under the scope of this guide. Each transformed product is the subject of a specific legislation. In relation of each product and its specific production conditions an analysis of critical points (HACCP) is necessary

Production register

Basic information **Year**……………

(to be kept for 5 years)

Bee Keeper

Name, first name: …………………

…………………

Address ……………………..

…………………….

Postal code and town ……………..

Tel/Fax …………………………

…………………………..

Stand(s) of the bee hive(s)

Name ……………………..

Address ……………………..

Number and codes of the wintered hives and six frames………………

………………..

………………..

………………..

………………..

Name ……………………..

Address ……………………..

Number and codes of the wintered hives and six frames………………

………………..

………………..

………………..

………………..

Name ……………………..

Address ……………………..

Number and codes of the wintered hives and six frames………………

………………..

………………..

………………..

………………..

Stand(s) of the travel bee hive(s)

Name ……………………..
Address ……………………..
Number and codes of the wintered hives and six frames ……………….
………………..
………………..
………………..
………………..
Date of travel ………………..
Pesticides(agriculture) ……………
Date of treatment ……………

Name ……………………..
Address ……………………..
Number and codes of the wintered hives and six frames ……………….
………………..
………………..
………………..
………………..
Date of travel ………………..
Pesticides(agriculture) ……………
Date of treatment ……………

Name ……………………..
Address ……………………..
Number and codes of the wintered hives and six frames ……………….
………………..
………………..
………………..
………………..
Date of travel ………………..
Pesticides(agriculture) ……………
Date of treatment ……………

Harvesting of honey

<u>Honey production premise</u>

Address ……………………
……………………

<u>Harvest</u>

Harvest number ………………..
Date of harvest ………………..
Reference of the harvest …………..
Quantity ………………..

Harvest number ………………..
Date of harvest ………………..
Reference of the harvest …………..
Quantity ………………..

Harvest number ………………..
Date of harvest ………………..
Reference of the harvest ………….
Quantity ………………..

Quan

Harvest number ………………..
Date of harvest ………………..
Reference of the harvest ………….
Quantity ………………..

Harvest number ………………..
Date of harvest ………………..
Reference of the harvest ………….
Quantity ………………..

Composition of the honey production

<u>(if blended)</u>

Lot number …………………………
Composition of lot …………………..
Quantity …………………..
Analysis number …………………..

Lot number …………………………
Composition of lot …………………..
Quantity …………………..
Analysis number …………………..

Lot number …………………………
Composition of lot …………………..
Quantity …………………..
Analysis number …………………..

Lotnumber	....
Composition of lot	....
Quantity	....
Analysis number	....

Lot number	....
Composition of lot	....
Quantity	....
Analysis number	....

Cleaning of production room

Date of cleaning ....

....

....

Treatments and veterinary products

Diseases (observed or suspicious)

Type of disease ……………………..
☐ All colonies of the stand

☐ Hive numbers ………………..
Compulsory report yes☐ … no ☐
Date ……………….
……………….

Type of disease ……………………..
☐ All colonies of the stand

☐ Hive numbers ………………..
Compulsory report yes☐ … no ☐
Date ……………….
……………….

Type of disease ……………………..
☐ All colonies of the stand

☐ Hive numbers ………………..
Compulsory report yes☐ … no ☐
Date ……………….
……………….

Type of disease ……………………..
☐ All colonies of the stand

☐ Hive numbers ………………..
Compulsory report yes☐ … no ☐
Date ……………….
……………….

Treatment of colonies

☐ All colonies of the stand

☐ Hive numbers …………………….
Product name …………………….
Doses …………………….
Method …………………….
Date (and hour) …………………….
Veterinary prescription …………….

……………………
Remarks ……………………

☐ All colonies of the stand

☐ Hive numbers …………………….
Product name …………………….
Doses …………………….
Method …………………….
Date (and hour) …………………….
Veterinary prescription …………….
……………………
Remarks ……………………

☐ All colonies of the stand

☐ Hive numbers …………………….
Product name …………………….
Doses …………………….
Method …………………….
Date (and hour) …………………….
Veterinary prescription …………….
……………………
Remarks ……………………

☐ All colonies of the stand

☐ Hive numbers …………………….
Product name …………………….
Doses …………………….
Method …………………….
Date (and hour) …………………….
Veterinary prescription …………….
……………………
Remarks ……………………

Treatments and veterinary products

Treatment of naked swarms

(without frames)

☐All frames in stock…………………

☐ % of hive numbers…………………

Product name…………………………

Dose..………………………………..

Method ………………………………

Date (and hour) ……………………..

Remarks ……………………………

………………………………………..

Treatment of stored frames

☐All frames in stock…………………

☐ % of hive numbers…………………

Product name…………………………

Dose..………………………………..

Method ………………………………

Date (and hour) ……………………..

Remarks ……………………………

………………………………………..

☐All frames in stock…………………

☐ % of hive numbers…………………

Product name…………………………

Dose..………………………………..

Method ………………………………

Date (and hour) ……………………..

Remarks ……………………………

………………………………………..

Register of the used products

Stock on 1/1/….

Veterinary products..…………….

Quantity …………………………..

Remarks ………………………….

Veterinary products..…………….

Quantity …………………………..

Remarks ………………………….

Veterinary products..…………….

Quantity …………………………..

Remarks ………………………….

Date of purchase **…**……………………..
Veterinary products..…………….
Quantity …………………………..
Remarks ………………………….
Date of purchase ………………….
Veterinary products..…………….
Quantity …………………………..
Remarks ………………………….
Date of purchase **…**……………………
Veterinary products..…………….
Quantity …………………………..
Remarks ………………………….

Stock on 31/12/….
Veterinary products..…………….
Quantity …………………………..
Remarks ………………………….
Veterinary products..…………….
Quantity …………………………..
Remarks ………………………….
Veterinary products..…………….
Quantity …………………………..
Remarks ………………………….

Purchase and selling
Naked swarms, colonies,

<u>**queens, bee-parcel**</u>

Purchase of **…………………..**
Date ………………………………..
Seller ……………………………
Quantity …………………………..
Source ……………………………..
Destination ……………………..
Remarks ………………………..
…………………………………….

Purchase of **…………………..**
Date ………………………………..
Seller ……………………………
Quantity …………………………..
Source ……………………………..
Destination ……………………..
Remarks ………………………..
…………………………………….

Purchase of **…………………..**
Date ………………………………..
Seller ……………………………
Quantity …………………………..
Source ……………………………..
Destination ……………………..
Remarks ………………………..
…………………………………….

Purchase of **…………………..**
Date ………………………………..
Seller ……………………………
Quantity …………………………..
Source ……………………………..
Destination ……………………..
Remarks ………………………..

Bee wax: supply

 Own production …………………..
Supply seller ………………………
Date …………………………………..
Number of wax waffles and/or Kg …
Remarks …………………………….
…………………………………….

 Own production …………………..
Supply seller ………………………
Date …………………………………..
Number of wax waffles and/or Kg …
Remarks …………………………….
…………………………………….

 Own production …………………..
Supply seller ………………………
Date …………………………………..
Number of wax waffles and/or Kg …
Remarks …………………………….
…………………………………….

Bee wax: selling

Selling – buyer ……………………..
Date…………………………………..
Raw wax (kg)………………………..
Wax combs…………………………..
Remarks……………………………..
………………………………………..

Purchase and selling

Purchase of honey

Date…………………………………..
Buyer…………………………………
Quantity………………………………
(Lot)…………………………………..
Remarks……………………………..
…………………………………………..

Date…………………………………..
Buyer…………………………………
Quantity………………………………
(Lot)…………………………………..
Remarks……………………………..
…………………………………………..

Date…………………………………..
Buyer…………………………………
Quantity………………………………
(Lot)…………………………………..
Remarks……………………………..
…………………………………………..

Date…………………………………..
Buyer…………………………………
Quantity………………………………
(Lot)…………………………………..
Remarks……………………………..
…………………………………………..

Date…………………………………..
Buyer…………………………………
Quantity………………………………
(Lot)…………………………………..
Remarks……………………………..
…………………………………………..

Selling of honey (only when to companies)

Date…………………………………..

Buyer…………………………………
Quantity………………………………
Lot……………………………………….
Remarks……………………………..
………………………………………..

Date…………………………………..
Buyer…………………………………
Quantity………………………………
Lot……………………………………….
Remarks……………………………..
………………………………………..

Date…………………………………..
Buyer…………………………………
Quantity………………………………
Lot……………………………………….
Remarks……………………………..
………………………………………..

Date…………………………………..
Buyer…………………………………
Quantity………………………………
Lot……………………………………….
Remarks……………………………..
………………………………………..

Date…………………………………..
Buyer…………………………………
Quantity………………………………
Lot……………………………………….
Remarks……………………………..
………………………………………..

Feeding/all kinds of

Feeding, stimulation

☐ All hives of the stand(s)
☐ Hive numbers ……………………
Product name………………………
Quantity ……………………………..
Period ……………………………….
Date of purchase ………………..
Seller ……………………………..
In case of commercial product
Lot number ……………………….
Remarks …………………………….

☐ All hives of the stand(s)
☐ Hive numbers ……………………
Product name………………………
Quantity ……………………………..
Period ……………………………….
Date of purchase ………………..
Seller ……………………………..
In case of commercial product
Lot number ……………………….
Remarks …………………………….

☐ All hives of the stand(s)
☐ Hive numbers ……………………
Product name………………………
Quantity ……………………………..
Period ……………………………….
Date of purchase ………………..
Seller ……………………………..
In case of commercial product
Lot number ……………………….
Remarks …………………………….

☐ All hives of the stand(s)
☐ Hive numbers ……………………
Product name………………………
Quantity ……………………………..

Period ……………………………….
Date of purchase ………………..
Seller ……………………………..
In case of commercial product
Lot number ……………………….
Remarks …………………………….

Perfumes/aromas/lures

Used products in the smoker ……..
………………………………..
………………………………..
………………………………..

These files register the production data are given as information only.The same information can be mentioned on the hive filing card. These documents have to be stored for 5 years.

Example

Beekeeper

Name, first name: John Bee Tamer
Adresse: Flowerlane
Postcode and place:2440 Honeytown
Tel/Fax 003214797204

Stand of the bees

Name: home
Adres:
Total and number of wintered hives and six-frames:4 hives (nr.1 to 4)

Production room

Adres: kitchen in the house

Honey harvest

Harvest number: spring
Date of harvest: 15 June XXXX
Reference of harvest: spring XXXX
Quantity: 55 kg

Harvest number: spring
Date of harvest: 15 june XXXX
Reference of harvest: spring XXXX
Quantity: 55 kg

Treatment of colonys

All colonies of the stand
Productname: Tymovar
Dose: 1.5 strip X 2
Method: according prescription
Date (and duration): 15/07-30/8 and 1/9-10/10/XXXX
Veterinary prescription: n.a.
Remarks:

All colonies of the stand
Productname: oxalic acid
Dose: 50mL/colony
Date (and duration): 15/12/XXXX
Veterinary prescription: added.
Remarks:

Naked swarms

Introduction: swarm
Date: 15/05/XXXX
Origin: own bee stand

Treatment of naked swarms without frames

 All swarms
 Swarms number: swarm on hive 4
Veterinary product: Perizin
Dose: 30 mL
Method: dripping
Date (and duration): 15/05/XXXX
Veterinary prescription: added
Remarks:

Treatment of stored frames

 All frames in stock: X
 % of hivenumbers
Product name: sulferstick
Dose: 1 stick/5 supers
Method: fumigation
Date (and duration) sept and dec XX
Remarks:

Bee wax purchase

Own production
 Purchase Seller: X, beeshop Maya
Date: 05/02/XXXX
Number of wax waffles and/or kg: 2kg
Remarks: used in spring

Feeding, stimulation

Alle hives of the stand: X
Hive number:
Produc tname: sugarsirop 50/50
Quantity: 20L/hive
Period: 20/08-15/09
Date of purchase: 25/07/XXXX
Distributor: Macro

Perfumes/aromas/lures

Used production:
 Purchase – seller: nihil

Combustion for the smoker

Used product in the smoker: straw
Supplier: Api 16
Lot number: YYYY

Production of royal jelly

Beekeeper

Name, first name: ………………….

……………………

Address ……………………..

……………………..

Postal code and town: ……………..

Tel/fax: ……………………..

Bee stand(s)

Name of bee stand…………………

Address ………………….

Quantity and number of the hives in production

…………………....

……………………

……………………

……………………

Name of bee stand…………………

Address ………………….

Quantity and number of the hives in production

…………………....

……………………

……………………

……………………

Name of bee stand…………………

Address ………………….

Quantity and number of the hives in production

…………………....

……………………

……………………

……………………

Extraction room

Address ……………………….

……………………….

……………………….

Harvest

Day ………………………
Bee stand ………………………
Reference of harvest ………………
Freezing yes ☐ no ☐
Quantity ………………………

Day ………………………
Bee stand ………………………
Reference of harvest ………………
Freezing yes ☐ no ☐
Quantity ………………………

Day ………………………
Bee stand ………………………
Reference of harvest ………………
Freezing yes ☐ no ☐
Quantity ………………………

Day ………………………
Bee stand ………………………
Reference of harvest ………………
Freezing yes ☐ no ☐
Quantity ………………………

Day ………………………
Bee stand ………………………
Reference of harvest ………………
Freezing yes ☐ no ☐
Quantity

Analysis of the critical control points for honey (CCP) 1. Microbiological

Danger	Target vulue for the KCP	Frequency	Cause	Severity	Probability	Detection	SxPxD	Measures	Register	Corriganting measures
Botulism for infant	100 spores/kg	49 cases in Europe in 24 years	Mainly soil bacteria	5	1	4	20	Prevent putting suppers on ground Inform clients on the risk of botulism (or put it on the label)	/	
Pathogene germs No microbiological analyses is required for honey		Value not known for honey, but lower than for other food products because of: anaerobic environment, very high sugar content, low in protein, increased acidity, presence of hydrogen peroxide	Use of not-drinkable water	3	1	4	12	Use water that meets the requirements: -for the sprayer -for the maintenance of the material	/	
			Lack of hygiene in room	3	1	4	12	Use a premise that is easily to clean. The premises are cleaned before and after every activity	harvest	
			Lack of hygiene of material	3	1	4	12	Control of the general condition and cleanliness of material	/	
			Contamination by staff	3	1	4	12	Free of contamination Clean work outfit Good personal hygiene	/	

			Contaminated sugar (for feeding in winter)	3	1	4	12	Storage of sugar protected from mice, insects	/	
Osmophylic yeast Risk if water content in honey: <17%: no risk 17-<18%:if 1000 yeastcells/g If honey >19%:if 1 yeastcell present	>20 % legal limit Yeasting of honey	27.1 % of honey >18% 9.5% of honey >19% 3.3% of honey >20%	Harvest of honey that is too wet Production room has too high relative humidity during extraction,packaging	3 3	3 2	3 2	27 12	Do not use water when removing the supers Remove supers only after high percentage of sealing Dry the supers some days before processing Work in dry pre mises	/ /	All fermented honey will be destroyed All fermented honey will be destroyed

The risk is based on a company where the beekeeper works according measures guidelines as described in this guide. If the beekeeper does not work according this guide, the risk will increase.

Severity (S)	**Probability (P)**	**Detection (D)**
1 not existing 2 unpleasant 3 out of legal limit 4 dangerous 5 deadly	1 weak 2 average 3 frequent 4 very frequent 5 continuously	1 on sight 2 simple test 3 detailed test 4 analysis 5 not detectable

S x P x D > 50: critical point

Severity x Probability															
Detection		**1**	**2**	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**12**	**15**	**16**	**20**	**25**
	1	1	2	3	4	6	6	8	9	10	12	15	16	20	25
	2	2	4	6	8	12	12	16	18	20	24	30	32	40	50
	3	3	6	9	12	18	18	24	27	30	36	45	48	60	75
	4	4	8	12	16	20	24	32	36	40	48	60	64	80	100
	5	5	10	15	20	25	30	40	45	50	60	75	80	100	125

Analysis of the critical control points for honey (KCP) 2. Physical

Danger	Target vulue for the KCP	Frequency	Cause	Severity	Probability	Detection	SxPxD	Measures	Register	Corriganting **measures**
Presence of wax or other biological material	Insoluble material <0.1% legal limit Particles < 500 P Absence of strange elements	Systematically	De-sealing of honey cells	2	5	1	20	Filtration: Filter the honey correctly Avoid visible particles to come into the honey Check the state of the sieves, prevent overlflow Ripening and de-foaming of the honey	/	Re-filter the honey
Presence of brood	Aromas and strange forbidden products	No information	Brood in the supers	3	3	1	9	Use a queen grid Do not process frames with brood	/	Give the honey to the bees
Strange particles (stone, metal, sharp pieces)	Insoluble material <0.1% legal limit Particles < 500 P Absence of strange elements	No information	**After filtration** Bees, other insects	3	3	1	9	Filtration is compulsory Avoid presence of insects Keep all recipients closed and avoid contamination by strange elements	Harvest	Filtration after re-melting or give the honey to the bees
			Material	4	2	2	16	Check material before use Use clean equipment that produce no dust Do not scratch material against the sidewall of containers	/	Filtration after re-melting or give the honey to the bees

			Staff	4	2	2	16	Appropriate work outfit (hair cap, closed pockets…)	/	Filtration after re-melting or give the honey to the bees
			Premise (light…)	4	1	2	8	Avoid glass splinters of broken lamps by installing protection shields Maintain walls and ceiling properly Keep all recipients closed and avoid contamination	Harvest	Filtration after re-melting or give the honey to the bees
			Jars	4	2	1	8	Glass jars may not have mistakes Use only very clean jars		Every broken pot should be destroyed. Filtration after re-melting or give the honey to the bees

Analysis of the critical control points for honey (KCP). 3. Chemical

Danger	Target vulue for the KCP	Frequency	Cause	Severity	Probability	Detection	SxPxD	Measures	Register	Corriganting measures
Forbidden products	0(MRLP:.03 ppb Chlooramphenicol; 1 ppb Nitrofuransl	Chlooramphenicol 0/349	Blending with honey of unknown origin	5	1	4	20	Do not feed bees with honey from other company	FOOD	Destroy honey
Treatment products fluvalinate, flumethrine, thymol, menthol, eucalyptus, campher, oxalic acid, formic acid, lactic acid	MRL: 100 ppb coumafos, 200ppb amitraz Actionlimit: 20 ppb streptomicyne,tetracyclines,sulfonamides	Streptomycine 4/368 Tetracyclines 2/192 Sulfonamides 18/406 E-lactamates 0/50	Treatment of colony	4	3	4	32	Use only certified products for beekeeping Respect the relay time No treatment with antibiotics No preventive treatments	TREATMENT	Destroy honey
			Feeding	4	2	4	16	Do no feed with honey from other company No additives, unless of foodproof quality Feeding only with sugar of foodproof quality and out of the period of supers	FEEDING	Destroy honey
			Blending with honey of unknown origin	4	2	4216		No blending with unknown honey	HARVEST	
			Introduction of frames of uncontrolled origin	4	2	4	16		SUPPLY	
			Treatment of wax against wax moth	4	3	1	12	No naphtaline,paradichlorobenzene	TREATMENT	

Repellents, smoke		Strange aromas 1/20	Activities at the hives (joining of colonies)	3	3	2	18	Products of feeding quality	DIVERSE	
			Combustion for smoker	3	4	1	12	The use of oil- resin containing products, hardboard, are not advised	DIVERSE	
			Feeding	3	1	4	12	Storage in a way that contamination is avoided	FEEDING	
			Production premise	3	1	4	12	Absence of sourses of dust, vapours, exhaust gases. No smoking. No storage of chemical products	/	
Heavy metals, paint, cleaning products		Data not available	Material suitable for beekeeping	3	1	4	12	Paint with lead is forbitten. Plastic that is suitable for beehives	/	
			Material and recipients in production premise	4	2	4	16	All materials that come in contact with honey should be foodproof quality	HONEY HARVEST	
			Polluted environment	4	1	4	16	Avoid placing hives in environment that is polluted with heavy metals	BASIC DATA	Replace the stand
Fyto sanitary products	10 ppb fyto sanitary products	Not data available	Horticulture and agriculture	4	2	4	32	Remove colonies during treatments; if not possible, close the hives	BASIC DATA	If impossible to remove pollution, replace the stand
HMF	≤ 40 mg/kg	0/351 above limit	Heating of the honey	3	2	4	24	Avoid over heating	/	Giveback the honey to the bees

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