



# Beekeeping Manual for Disabled People



SLOVENIAN  
PARAPLEGIC ASSOCIATION



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*Editor-in-Chief:* Aleš Božovičar

*Team that participated in the preparation of manual:* Aleš Božovičar, Vlado Auguštin, mag. Andreja Kandolf Borovšak, Andrej Sever, Slavko Dunaj, Ljubomir Janežič, Benjamin Krč, Dušan Slana, Damjan Žerjav, Vinko Hren, Feliks Burger.

*Authors:* Tanja Štefančič Smisel, Petra Grabner, Urša Miklič, Marko Vidovič, mag. Andreja Kandolf Borovsak, Vlado Augstin, prof. dr. Borut Juvanec, Dusan Slana, mag. Jadranka Luketa - Markovic, Aleš Božovičar, Mateja Ratiznojnik, dr. vet. honey, cf. Vesna Glavnik, dr. med.

*Photographs and illustrations:* Aleš Božovičič, Vlado Augustin, Simon Golob, Franc Šivic, mag. Jadranka Luketa-Markovič, Suzana Skerbiš, NVI archive, DPPP archive, Andrej Sever, Jugoslav Logar, prof. dr. Borut Juvanec, Stefan Kastelic, Branko Obranovic.

*Lecturer:* Mojca Pipan

*Publishers:* Slovenian Beekeepers' Association, Public Beekeeping Advisory Service and Ministry of Labor, Family, Social Affairs and Equal Opportunities.

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*For the issuer and the client:* Boštjan Noč (President of ČZS)

*Translation:* Anja Lipovšek s.p., Mohit Kishnani

*Design:* Andrejka Čufer s.p.

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# To be Slovenian is to be a beekeeper...

In Slovenia, we call apiculture a poetry of agriculture. Beekeeping in Slovenia is a part of national identity and culture, whether it is a beehive panel, a Slovenian apiary, a honeybread cookie, Dražgoški bread, Champagne from honey, honey wine, excellent Slovenian honey and other bee products, or last but not the least autochthonous Carniolan bee. Slovenian beekeepers simply adore bees. We carry bees in our heart and live with the bees and for the bees. **In Slovenia, beekeeping is not an industrial production of bee products, but it is the way of life of more than 10,000 Slovenian beekeepers and their families.** A Slovenian beekeeper is a respected person in Slovenian society. The last two Presidents of World Beekeeping Organization Apimondia, Mr. Gilles Ratia from France and Mr. Philip McCabe from Ireland, saying **that the foundation of world beekeeping lies in Slovenia says it all.**

Precisely because beekeeping is something for us and because it is not just a business, many ideas and many projects are widely implemented in Slovenia, which are socially useful not only at home in Slovenia, but also worldwide. Projects such as honey breakfast (traditional Slovenian breakfast) and World Bee Day are and will leave traces not only for beekeepers, but also for people in general.

It is therefore not surprising that Slovenian beekeepers have developed a unique project, namely the integration of people with special needs into beekeeping. We have quite a few excellent beekeeping practices in this field, the beginnings of which were mostly in Črnomelj and Ig, now this is already significantly higher. After all, we have »translated« the beekeeper's manual into a language that is understandable to people with disabilities, and we have translated it into English so that it can be available to all such people around the world. The idea of this project was born in Bela Krajina, primarily in Beekeeping Society at Črnomelj (Stanislav Plut, Vlado Auguštin, Dušan Milinkovič, Andrej Sever,... initiated this project). It was presented by Andrej Sever at the World Beekeeping Congress in Ukraine, where it received enormous support and approval.

Long-time beekeeper Andrew Sever and his friends also gave birth to the idea that wheelchair users should also be included in beekeeping. Thus, at his proposal, Slovenian Beekeepers' Association of Slovenia established a section of beekeepers on wheelchairs. In 2017, a document was signed in Celje on the inclusion of disabled people on wheelchairs in beekeeping. In addition to the initiator Andrej Sever, the signatories were also Slovenian Beekeepers'

Association, Beekeeping Society Semič, Paraplegics Association of Slovenia, and Apimondia World Beekeeping Organization.

As a result, in 2018, we made the first apiary in the world adapted for beekeepers on wheelchairs in Murska Sobota. Another very important »project« is precisely this manual, which will help disabled people on wheelchairs to integrate into independent beekeeping. We will also translate this manual into several world languages.

I am convinced that with this manual and the implementation of theoretical and practical seminars in this field, it will be possible for the disabled people on wheelchairs to become independent and successful beekeepers.

In my own name, I sincerely thank all the co-creators of this manual, and above all, **thanks to Andrew Sever for a noble initiative that will leave a lasting trail. I sincerely thank Ales Bozovičar, who took over the work of the editor and expert associate of this very important manual**, which is a unique manual of its kind and with which we give a hand to handicapped people on wheelchairs in Slovenia and around the world. We look forward to including everyone in beekeeping. **Slovenian beekeepers think: To be Slovenian is to be a beekeeper!**

*Boštjan Noč, president of Slovenian Beekeepers' Association*





Apiary adapted for disabled people on wheelchairs



# Introduction

This is a beekeeping manual for educating people with disabilities. It is intended for people who admire nature and work in constant contact with it, and would like to become beekeepers despite the limitations of wheelchair. Beekeeping has a rich tradition in Slovenia. We find rarely elsewhere as many beekeepers as there are in Slovenia. Disabled people on wheelchairs can also be engaged in beekeeping with a little help from others. Many beekeepers on wheelchairs have contributed in the creation of this manual, for which we are thankful to them. In this manual, we present the possible approaches to bees by the disabled people on wheelchairs and what must be done to build an apiary. We also share the experiences of beekeepers on wheelchairs who use customized equipments. We have described functional abilities of people with spinal cord dysfunction and actions in case of bee stings. We have briefly presented the bee colony and the most common diseases affecting bees. Since the principles of beekeeping are same for all the beekeepers, regardless of their way of beekeeping, this topic has not been covered at length. For a basic reading, we warmly recommend *Beekeeping Manual for Beginners* by Vlado Pušnik, *Slovenian Beekeeping in Third Century 1* and *Slovenian Beekeeping in Third Century 2* by editor-in-chief Pavel Zdešar, and *Hazard Analysis and Critical Control Point for Beekeeping* by Slovenian Beekeepers' Association. We also highly recommend visiting the website of Slovenian Beekeepers' Association [www.czs.si](http://www.czs.si) and reading the magazine Slovenski čebelar issued monthly by the Association.

Beekeeping is not just a profession or a hobby, it is a way of life, which usually includes a family. If not otherwise, the whole family participates in extracting honey

# Functional capabilities of people with spinal cord injury

(Tetraplegia/Paraplegia/Palsy)

## Functional capabilities of people with tetraplegia/tetraparesis with levels of spinal cord injury

### **Total injury below C5**

The person is able to sit in a wheelchair with high backrest support, height adjustable armrests, and a table. The person cannot independently change positions (turning, lifting, unloading). The upper limb function is greatly reduced. There is no active mobility in the wrist. The person uses individually designed wrist and fingers. With individually designed small orthotic devices, we can provide greater autonomy in basic daily activities, writing and working with a computer.

For a short range ground mobility, a hand-driven wheelchair with wider hand rings or an optional electric drive unit can be used. When overcoming longer distances, an electric motor wheelchair is more appropriate.

### **Total injury below C6**

Stability in the shoulder ring allows a person greater mobility and stability in a sitting position. The body cannot lift itself from the surface, except partly with the support on one side, which releases the pressure on the other side of the body. A person can become even more independent when moving to a wheelchair using a special board.

The active extension in wrists allows a compensatory movement and thus the grip and handling of larger and lighter objects. Alternative movements, various medical devices, manual wheelchairs, and personal vehicle adaptations enable greater autonomy in mobility in a wider environment.

### **Total injury below C7 and C8**

The person has active mobility in the wrist, but does not have the ability to flex his fingers, fine motor skills (fine grip of objects). The motor control of all hand muscles is retained, except between the fingers. It is possible to extend

the elbow and lift from the base, which makes it easier for the person to change positions. The grip and release of the hand are present, but still not strong enough.

The person can drive a manual wheelchair and operate a customized vehicle.

## **Total injury below Th1**

There is a complete active flexibility of the upper limbs. The person is completely independent in caring for himself, but still has problems due to poor balancing the torso and reduced respiratory reserves.

The person is capable of driving the vehicle operated by hands.

## **Standardized tests and measurements of functional skills in hands**

When testing functional skills and strength in hands, we use standardized tests:

- ▶ SHAP for measuring functional skills in individual hands, rough and fine grips,
- ▶ Measurement of coarse power in hands using a dynamometer (standardized according to gender and age).

In addition to problems with movement in the upper extremities, **changes in perception** are also present (surface and deep sensibility, stereognosis) to which we must pay special attention. Tests that help us identify changes in perception:

- ▶ Surface sensing test (hot/cold, pain),

## **Functional capabilities of people with paraplegia/paraparesis with respect to the level of spinal cord injury**

The person still has problems with balancing the torso, the function and strength in the hands are appropriate.

## **Injury at Th1 to Th8**

The person has difficulty balancing the upper part of torso. Mobility depends on the use of the handheld wheelchair.

## **Injury at Th8 to Th10**

For longer distances, the person needs a handheld wheelchair. The person is able to stand with his hands, however, needs assistance when walking with a leap or jump.

## Injury at Th10 to L2

In addition to walking with a leap, the person is capable of four-point walking with various walkways, which requires good physical balance, strong torso, and shoulder musculature. It is also necessary for orthosis to stabilize the knee joint.

Walking on shorter distances can already be fully functional, but a wheelchair is still needed to overcome longer distances.

## Injury at L2 to L4

The person needs orthosis for stability of feet, crutches or a walking stick for support. For mobility, a wheelchair is no longer needed.

## Accessing working area for people with physical disabilities

Certain standards are recommended for the regulation of environment for disabled people on wheelchairs:

- ▶ Facilities must be accessible for independent mobility.
- ▶ Flat and hard surface for easy driving with a wheelchair.
- ▶ The objects should be 20 to 30 cm raised from the ground (for easy access with a wheelchair in front).
- ▶ Possibility of a side-by-side approach with a wheelchair.
- ▶ A work desk at a height of 70 to 85 cm while sitting in a wheelchair.
- ▶ Maximum height of reach of 100 to 140 cm from a wheelchair.
- ▶ Storage area under the working height.
- ▶ Preferably under the working surface, an empty space (minimum width 60 cm).



# Bees and bee colonies

The honeybee is divided into 24 races which are further divided into four groups. Slovenia is the place of origin of the Carniolan honeybee or *Apis mellifera carnica*, therefore, only this species of bees is allowed in Slovenia. The Carniolan honeybees are known to be peaceful and hard-working, with a great sense of orientation, and they are also known to have great honeycomb-building skills. They also don't propolise often and are great at over-wintering, since they use very little honey stores during winter. They are known for their vigorous spring build-up and are also very busy in summer. The lack of food, however, can greatly reduce laying of eggs. Due to their adaptability to long and harsh winters, they are mostly kept in areas with more severe winters. An undesirable trait of this species of honeybees is its high swarming impulse. This species has a particularly long proboscis, a darker coloured body. Yellow rings on the abdomen are undesirable.



## Description of a bee colony

Bees live in an organised community called a colony. There can be up to 60,000 **worker bees**, a queen bee, and up to 1000 drones in a single beehive during the largest build-up. The number of bees in a nest depends on the season, the quality of the queen bee, food supplies, the race of the bee, and the beekeeper's experience. The queen bee manages all the other bees by secreting pheromones and her main purpose is to lay eggs. Worker bees take care of all the other tasks. It is generally recognised that task division is linked to ageing and ageing differences are closely linked to hormonal changes. Hormones affect the development and behaviour of individual bees. The most well-known hormone in bees is the juvenile hormone that regulates the ecdysis (moulting) and the metamorphosis of the larvae, and is also important for the development of adult bees.



**The queen bee** doesn't feed by itself, but is rather fed by other bees. What will hatch from an egg, whether a worker bee or a queen bee, depends on the diet when the bee is still in the larval stage. All the bees are initially fed with royal jelly, a secretion from special glands of young honeybees that feed bee larvae. After three days, the larvae which will grow into worker bees are fed with pollen and honey.

Those larvae that will grow into queen bees are further fed with royal jelly. There are also a few drones in a hive and their task is to inseminate the queen bee and, furthermore, other bees gather pollen and build honeycombs more intensively in their presence. A young unmated queen, however, doesn't mate

with the drones in the hive but rather goes out for a mating flight where it mates with several (7–20) other drones. When mated, the queen doesn't fly out of the hive anymore but stays inside where it lays eggs. It lives for 2–3 years and after that the beekeeper replaces the queen with a younger one. It usually doesn't die alone but is, unless replaced by a bee-



keeper beforehand, killed off by other bees because it cannot successfully lay eggs anymore.

**Drones** can be found in the hive only during the swarming fever. In midsummer, around the start or the middle of July, other bees remove them from the hive. The swarming season, the time when bee colonies reproduce, is over. There won't be any more young and unmated queens and the drones are not needed anymore by the colonies. Worker bees live a little over three weeks after the season and those in the second half of summer live longer, and those raised in autumn have to survive until spring.

Due to successfully organised relationships, a bee colony can effectively maintain appropriate temperature, gather a lot of honey and pollen, and defend itself from predators.

Each colony has specific attributes, such as specific scent (pheromones), gathering abilities, honeycomb building, cold resistance, swarming instinct, disease resistance and other attributes. The brood nest usually consists of two parts. The brood is located on the honeycombs in the central part of the bottom chambers of the hive (the brood chamber) where it's easier for bees to maintain appropriate temperature. Pollen is usually stored in cells alongside the brood where nurse bees can access it. Honey is stored in the upper part of the brood nest (the honey chamber) and in the side honeycombs in the brood



chamber. Bees maintain appropriate temperature and humidity in the nest, both of which are necessary for maintaining the brood and storing food. The temperature range in a hive when there is brood within it is 34 to 35°C and during winter, when there is no brood, it's 18 to 30°C. The levels of humidity in the nest are between 65% and 85%.

If there is a queen bee in the nest, the worker bees build honeycombs and gather nectar and pollen. Worker bees are unable to lay eggs and a bee colony without its queen bee perishes.

## Setting up an apiary

The choice and preparation of the space where we will place the beehive is one of the first problems that is faced by beginners, as well as experienced beekeepers and mostly disabled beekeepers on wheelchairs. Like any other living beings, bees are tightly connected to the environment, which must provide them the best possible survival, development, and reproduction capabilities. It is precisely because of this that setting up an apiary in an optimum space is very important, if not a fateful decision, for successful beekeeping. When setting up an apiary, we must take into account several factors such as climate, microclimate, relief, grazing conditions throughout the year, interference, access, neighbours, consent for layout, etc.

The most important factor for successful beekeeping is climbing (climate) of a particular area. Valleys that open towards the south, surrounded by sun, and are not windy certainly have greater advantages for beekeeping than the valleys that are facing the north and are constantly under the influence of cold wind and other cold air currents.

Almost all beekeepers have the opportunity to look after their bees and provide them with the most favourable microclimate, i.e., climate which is supposed to be in the immediate area of an apiary. For the beehive, we need to find a sheltered position at the edge of a forest, a wall or a building, a hill or a hedge. The apiary must stand at a location that is slightly warmer than the surrounding area, but not under a strong sun. The selected location must be open to the south or to the south-east, where we also have to direct the beehive's forehead. It is important that strong winds do not blow in the surroundings of an apiary, as they obstruct bees while flying. An adequate shelter and consequently a microclimate can be provided to the bees by planting a dense hedge on the side of the apiary, which is usually blown by cold wind. For the layout of an

apiary, the most suitable are sheltered valleys under the sun with some smaller deciduous trees, preferably fruit trees.

Many beginners wonder how to turn an apiary. Experienced beekeepers usually recommend orientation towards the sun at 11 o'clock. You need to consider geographical clock or simply point an apiary 15 degrees towards east from the south direction. Some people prefer a more eastern orientation of the apiary so the bees can graze with the first sun rays, while others prefer bees to the west so they would not fly too early when there is no real grazing in nature. When directing an apiary, we must be aware that by doing so we take more or less sun rays to heat the hives, but on the other hand we must also ensure that bees are not directed to major obstacles.

We must evaluate thoroughly grazing conditions in the surroundings of the space where we intend to place an apiary. There are areas where bees are guaranteed of early and vigorous spring development with no more real grazing later. On the other hand, there are also areas where there is no real development in early spring but grazing conditions later compensate for the loss and make honey chambers full.

For successful beekeeping, the most suitable areas are those which allow bees to graze as long as possible throughout the year and provide them one main grazing. Grazing that stimulates bees could be found almost on all meadow and field flowers, fruit and forest trees, alpine flowers, and autumn flowers.

When setting up an apiary, it is important to know the number of bee colonies that will inhabit it and the distance to home from neighbouring apiaries. Regarding distance from the neighbouring apiaries, it is recommended that it is longer than 2.8 km in order to avoid overlapping the border radius of the productive flight of bees and overgrowth of spring grazing. The risk of disease transmission and robbing of bees is also lower.

Bees must have unobstructed access to grazing. Flying over rivers, highways, or valleys, beside which cold wind blows constantly, threatens life of many bees. Of course, an apiary will not be placed near such locations. Likewise, an apiary must not come close to manure, barns, or plants which produce sources that attract bees. We also don't place an apiary in the vicinity of intensively cultivated agricultural land where modern practices take place, especially regular spraying and repeated grass cutting. It is advisable that an apiary stands in the vicinity of running water because bees need water for their existence, especially in early spring. It is also important that the place where we place an apiary is accessible without any major problems throughout the year.

In order to perform his duties in peace, a beekeeper must establish good neighbourly relations. This is especially important if we have decided to set up an apiary near a village. Apiary must be at least 20 m away from our neighbour's land and 50 m from public buildings, paths, playgrounds, etc. It should be noted that many people are afraid of bees, which can lead to an unpredictable panic response. Some people are also allergic to bees and a smaller number of people can also develop anaphylactic shock. Therefore, every beekeeper must make sure to establish good communication with his neighbours and inform them about the use of bees, especially for pollinating. Also, he should educate them on handling a runaway swarm and dangers of a possible bee sting.

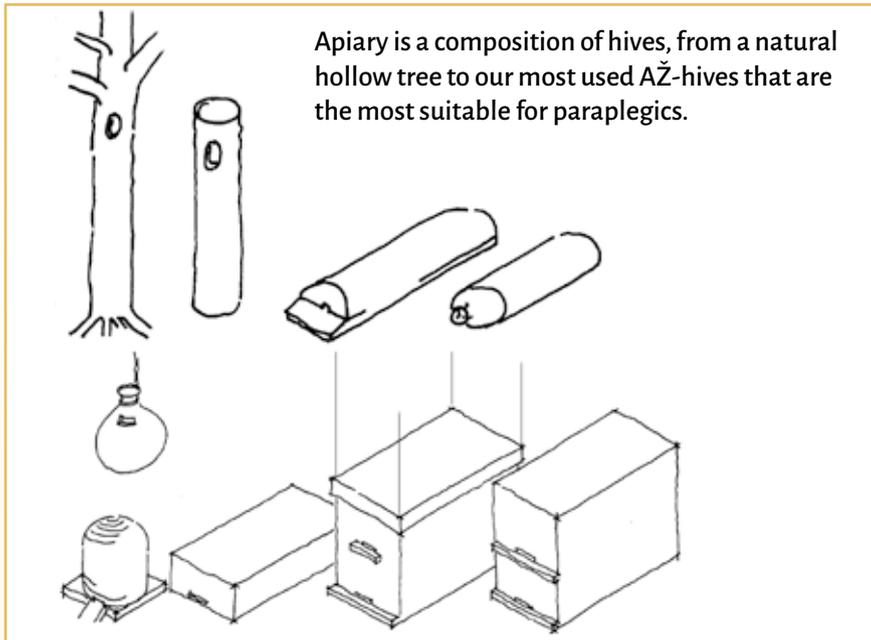


**Registration number of an apiary**

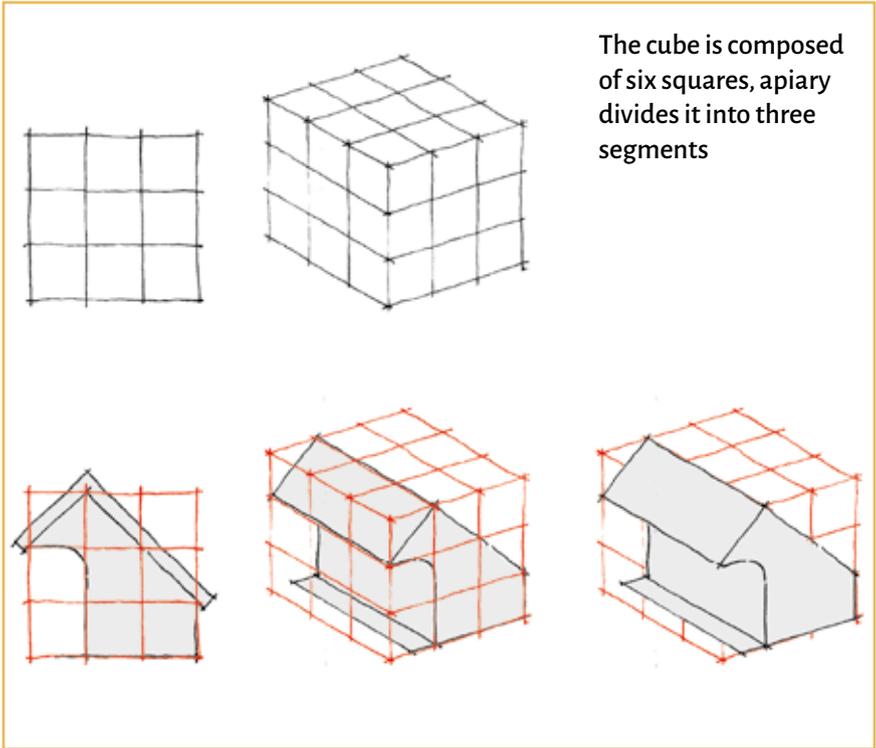


# Traditional Slovenian apiary, adapted for paraplegics

Our apiary is certainly a speciality and represents an exceptional cultural heritage on a global scale. Around the world there are apiaries - hives, stands, huts for bees, but nowhere else do beekeepers have a systemic solution that our grandfathers carefully clinged to.



Wood is home-made, a local material that can be shaped easily; therefore, the composition is extremely ecological. The layout of an apiary is, of course as they say, “on the front side of the sun.” It’s the southeast that catches the morning sun and keeps warm even in the afternoon when the sun goes down. The advantage of construction is that the roof protects against the strong sun and rain, with a lower runway which is usually intended for bees, but benefits from the power of the sunrays. It is also important to round the roof edges to allows buoyancy. In an angular roof edge, the flow of air would be thickened and vortexed, stopping the air flow from below. The ramp for landing is a moving board directed by a beekeeper in such a way that it represents ideal angle for directing the sun-rays to generate heat and buoyancy that helps bees to falls jadedly before the



The cube is composed of six squares, apiary divides it into three segments

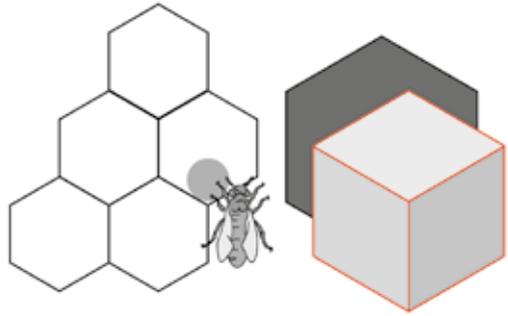
entrance of the hive. When bees regain their strength, buoyancy allows them to take off again so that they can reach the right hives with their heavy loads.

The cube, three-thirds, cut in height and depth, also determines the slope of the roof. That's one to one or 45 degrees. This is also an ideal slope for roof tiles, whether it is straw, wooden shingles, or boards. A true Slovenian apiary is a top-class set of economy, ecology, and harmony – beautiful!

In Slovenia, beekeeping is very developed, especially under the guidance of Slovenian Beekeepers' Association, which invests a lot of effort for the development of beekeeping and apiaries.

When it comes to apiaries as a cultural heritage, it is the jurisdiction of the Institute for the Protection of Cultural Heritage of Slovenia. The apiary is mentioned 92 times, but the data is incomplete with no element of evaluation or any response. Therefore, this information for the apiary as a typical object of our culture is completely useless. This important role has been taken over by Slovenian Beekeepers' Association with a campaign of collecting data from important apiaries.

The data is divided into three categories: the most typical, the oldest, and the one with specialties. The apiaries also receive an honourable mention. The owner is registered in the Register of Apiaries, the recognition is affixed to the apiary that confirms his value, an important factor for visitors in determining the quality and value of an apiary. All this makes the beekeeper proud.



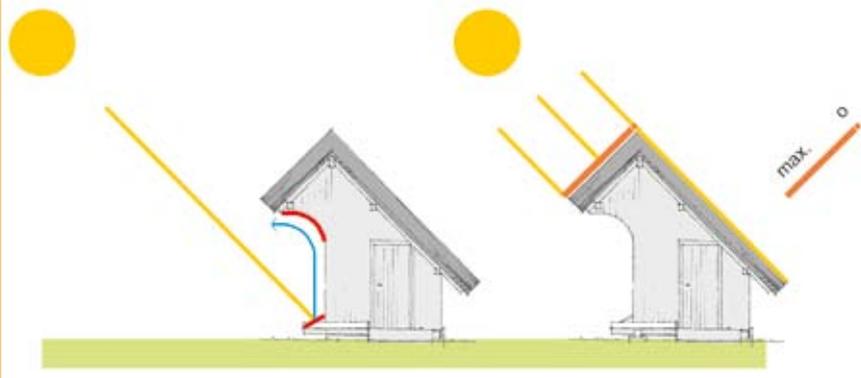
**The hexagon is adapted to the size of bees and larvae. It is so unique that it sets the basis for drawing in three dimensions: the cube in an example..**

## **PARAPLEGICS, WISHES AND POSSIBILITIES**

Besides exceptionally positive characteristics of the apiary, a Slovenian beekeeper also has some limitations, not for the bees but for the man. The design of a typical apiary extends very low at the back. This limits work in standing position, however, we must be aware that inspecting frames is a work while sitting, which is definitely allowed by the construction of the apiary.

The most common disabled people with limited mobility are paraplegics. These are people on wheelchairs with full mental abilities and working upper body, especially hands. Moreover, the upper extremities develop further. That also means the mind which desires activities that are possible. I have already mentioned that the apiary as an object restricts even a healthy man. That is why we have to help people with limited abilities in the adjustment of existing details that are otherwise manageable easily.

**Apiary is an extremely ecological composition: the sun is used for buoyancy and heating lower roofs with the exception of the backside**



The other side is the ethics of society, which should also enable these people to participate in as much work as possible. Yet again, we can learn from bees and their organization : Paraplegics, society, and professions must work in harmony. A good example of this is the efforts of Slovenian Beekeepers' Association by setting up apiaries adapted for these people with disabilities.

## **APIARY ADAPTED FOR PARAPLEGICS**

Disabled people use wheelchairs. Their dimensions and ability to move and turn around are basic standard SIST ISO 21542, which determine ramps with a width of at least 120 cm, not more than 6% decline, sides with a protective edge of 15 cm, and doorstep at a maximum height of 15 mm. The turning radius can be at least 140 cm while the reach of a person on wheelchair is between 50 and 150 cm. We must also be careful with equipment's that follow the mentioned data, so windows must have openings on the lower third. All this is intended to working normally in an apiary, while the maintenance of the apiary is a matter of a healthy person with no limitations.

The adapted apiary in construction is in alignment with the present conditions of beekeeping and in composition is a true Slovenian apiary, bearing a seal of use of the old order, mostly squares and cubes, and in technique is a simplest incision at right angles with diagonals of 45 degrees ensuring the use of simple tools, especially symmetry, which significantly simplifies work.



A completely wooden object has a structure of supporting columns of  $16 \times 16$  cm, while the base beams are of dimension  $16 \times 18$  cm, cut in 6 cm. The pillars are placed on a crosslink with a dowel, which is made as a steel thread with a thread that fixes the base beams. The internal construction is made of bars of  $8 \times 16$  cm, the bearing part of the hives is  $8 \times 12$  cm, and rafters are  $6 \times 12$  cm. Covering is on the roof.

The foundations are concrete and extend 80 cm deep to overcome the freezing zone. On the periphery, they have a water stream, which prevents access to ants.

The frame structure is covered on both sides of circumference with boards of 2 cm, the floor is 3 cm thick at the longitudinal beams, everything is covered with vinyl plates for better hygiene.

The front part of the transverse beams extends 60 cm from the construction: floor boards cover transverse beams. The console is covered with an inertia plate mounted above the hinges so that the slope can be changed according to the angle of the sun.

The apiary is adapted for disabled people on wheelchairs and hence the slopes have a maximum decline of 6%, before door is a platform of 150 cm in width - the same is inside - to allow the wheelchairs to turn. The door is open 80 cm, the doorstep of 1.5 cm is worn out to not stop the wheels. The outer platform is trimmed with 25 cm thick boards that form an edge of 15 cm. The roof platform is enlarged at the entrance to allow paraplegic overview over the front of the apiary. This is necessary for control.

The interior of the apiary is 157 cm wide, the height of the hoisting structure is 78 cm, and all eight hives stand in one row. Under and above them is room for disposal. Possible shelves over the hives are on the cradles so that beekeepers can access them under a height of 150 cm. All openings, windows, and vents are equipped with insect nets.

Also, this apiary is, according to the patterns, caught in squares and cubes. The outer dimensions of the carpentry structures are the same: width, height, and depth. The cube is divided into three thirds: the first one intended for bees to fly, the second one for bees in the hives and within the reach of a beekeeper, and the third one for the beekeeper.

All composition uses the characteristics of a square,  $\sqrt{2}$  that we know today from mathematics. Long ago it was put to practice when the square profile of the beam was tied from the round trunk. This is a diagonal of a square that runs at an angle of 45 degrees, which ensures the simplification of sawing and above all symmetry.

The adapted apiary corresponds to paraplegics, but at the same time it is still characterized by vernacular architecture which in Slovenia represents an important characteristic and recognition of the country, the nation, and its culture.

## Beekeeping in apiary adapted for disabled people on wheelchairs

For a person on wheelchair, beekeeping is a real challenge, as he faces several obstacles. The first among them is certainly accessibility to apiary or to the hives in the apiary. Thus, beekeepers on wheelchairs need a flat and solid access to the apiary and a lot more space to work in it than other beekeepers on their feet. The width of a beehive must therefore be appropriate so that the beekeepers can move normally and rotate on the wheelchairs. Thus, when entering a learning apiary, we must have a small ramp that facilitates entering in and out of the apiary. Equally important is the width of the front door, which must be 90 cm.

Having a source of fresh water adjacent to the apiary is also of a great importance, as the transfer of water to the place of preparation of sugar solution is a major problem during the feeding season. Equally important is fresh water in the summer given to the bees for drinking. As a



Hives placed in one row



successful solution, we discovered using droppers that are used to water the plants. For this purpose, we placed a pipe before the learning apiary, before which we placed a slanted board. A drip tray was installed on the board, allowing the bees fresh water all day long. We also dug a water fountain whose primary task was provision of drinking water in case of water shortage. This is



Members of beekeeping section in front of apiary adapted for disabled people on wheelchairs



how the bees always have fresh drinking water. While talking about the work of beekeepers on wheelchairs, it is also important that we pay attention to the type and height of the hives. For disabled people on wheelchairs, AŽ-hives are the most appropriate because working with them does not involve lifting more than 3 kg. We can easily inspect and shift the frames in these hives, unlike the loading hives in which heavy loads need to be raised, which can weigh more than 30 kg. Also, this system makes it difficult to see from the wheelchair the very top of the hive, making regular checks of bee colonies difficult. Therefore, in a learning apiary, we work with AŽ hives that are placed in one row and are accessible from the height of a wheelchair. All other equipments and tools for beekeeping are basically the same as those used by other beekeepers. Important is only an appropriate height at which the tools are placed so that people on wheelchairs can access them easily. For sweeping bees off of frames, a closed-type container is used so that the beekeepers on wheelchairs do not drive over the bees while inspecting frames or preparing frames for extraction. A special wheelchair is used for transportation of frames from the apiary to the extraction site. Upon using it, we found out that the wheelchair was too small, as it could only load 10 frames, which is not enough during extraction. Honey extraction is currently carried out with a four-frame manual extractor. The extractor is of standard size and height, but we miss the electric engine for running it and also the safety switch to stops the machine when the cover opens.

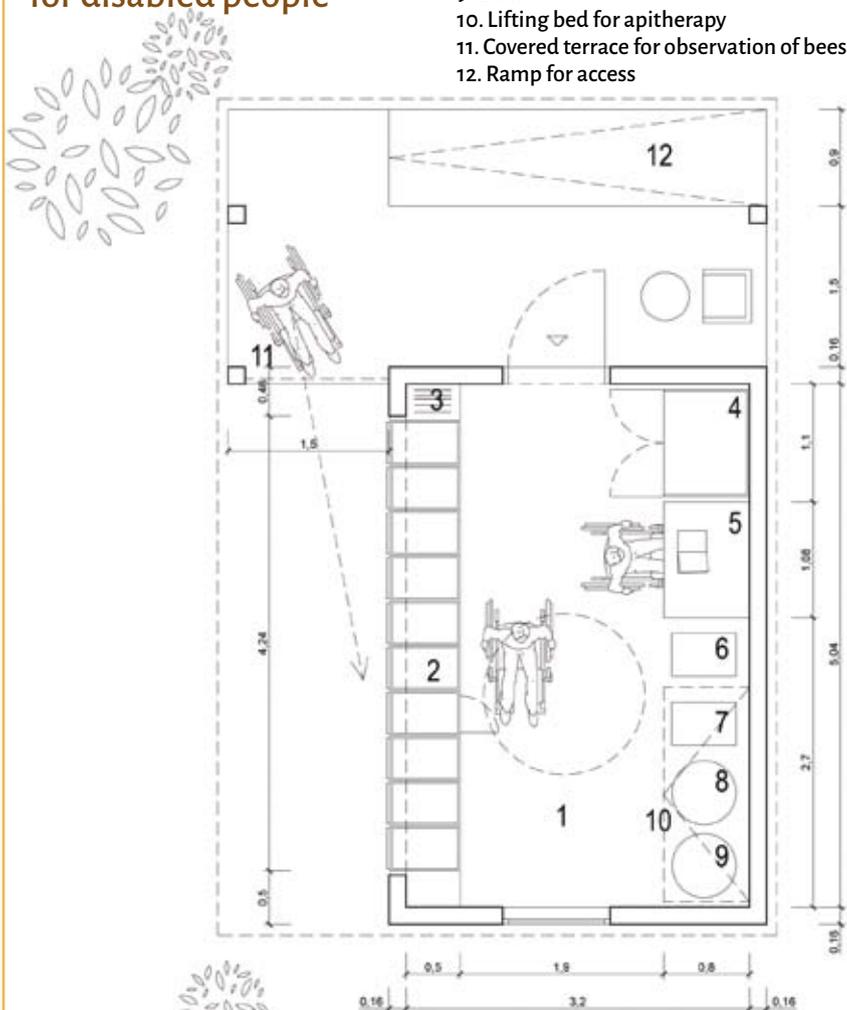
Solar energy is used for melting old honeycombs, since we use a solar heater with a stand. In this way, the melting of old honeycombs is very simple and inexpensive. For the needs of beekeepers on wheelchairs, wheels would also be needed on the stand of the meter, which would make it easier to move the melter and use solar energy more efficiently.

We can conclude that the apiary for us beekeepers on wheelchairs is very important. Not only can we normally have beekeeping in it, but it allows us to connect with nature in harmony regardless of the accident that had made us wheelchair bound. Caring for bees is not just an activity for us beekeepers, whether on a wheelchair or not, but is a mission that everyone carries with a whole heart. Beekeepers on wheelchairs require some adjustments in their work so that they can be equivalent to other beekeepers. That is precisely what we were able to do with the installation of the first learning apiary adapted for wheelchair users, for which we are extremely pleased and grateful. Thus, we feel useful, despite our disability, which further strengthens our self-confidence and greatly influences our mental health.

# Version of apiary adapted for disabled people on wheelchairs

## Learning Apiary for disabled people

1. Apiary 16.1 m<sup>2</sup>
2. AŽ hives
3. Space for spare frames
4. Closet for tools and costume
5. Working area
6. Container
7. Stand for frames
8. Honey extractor
9. Bulk
10. Lifting bed for apitherapy
11. Covered terrace for observation of bees
12. Ramp for access



Learning Apiary 1:50  
 Ideas by Andrej Sever, beekeeper  
 Drawing by Jure Heisman



## My beekeeping experience

Ms. Jadranka Luketa-Marković has devoted much of her work, in addition to her dedication to the bees, to pedagogical and apitherapy work with disabled people, children, elderly people, and their families. According to her, she inherited disability from her father and ability and energy to deal with the disease from her mother. She is very successful. She is a professor of art history, literature, a master of methodology of teaching with the use of teaching aids, a journalist, a beekeeper, and an apitherapist. Her beekeeping started with a love story when she met and fell in love with a beekeeper during her stay in the hospital, Zvonimir Šver, doctor of veterinary medicine, assistant at the Veterinary Faculty in Zagreb and the beginner of the Beekeeping Institute in Hvar. Thus, she left the work of a journalist and moved to beekeeping. She adjusted her work in the

apiary to her abilities and introduced many changes that made her work easier with bees. Hence, she transfers her knowledge and experience forward according to the wishes and needs of individuals.

The content of her contribution, which follows in the manual, is intended for people with disabilities who are interested in working in nature and with the bees. It is also intended for their families, caretakers, and beekeeping mentors.

**Like bee colonies, we are all different. We have different desires, abilities, and capabilities. Therefore, everyone makes, arranges and organizes the space of the apiary, beekeeping aids, and helps with the beekeeping accordingly.**

## THE GROUND ON WHICH AN APIARY STANDS

According to my experience, the ground on which a bee house is build is as flat as possible, the surface is beautifully mowed, and the paths are paved with concrete and are accessible by vehicle, which helps us to overcome longer distances.

### Molehills

The first problem I encountered at the apiary was the molehills. My husband, Zvonimir Sver, had neurological problems with fine motor skills in the lower extremities. In the morning, I drove with a wheelchair around the apiary while inspecting the bee



colonies as a basis to assess the situation in the bee colonies. I levelled the molehills with rakes, so that my husband who carried the boxes of hives full of honey or brood would not stumble, but I could not get rid of the molehills. I tried to push the bottles into the molehills. The bottle put into molehills produce sounds that disturb the moles. I also tried to get rid of them with spinning wheels made of bottles. Upon rotating, these spinning wheels produced a sound which made the moles flee approximately three meters away.

## Driving around the apiary on wheels

I also stumbled on the uneven ground and was tripping over with an electric wheelchair. That is why at the first opportunity, with the plod, I aligned the surface for safer movement on foot and with movement aids.



Our stationary beehive with hundreds of hives took up a lot of space. During work, there is always a need for some part of work of hives, utilities or accessories that are never there. In order to safely ride across the apiary with electric wheelchairs without falling, we had to level the ground. We also needed ramps to access

the terrace and to enter the beekeeping spaces with electric wheelchairs, which also facilitated manoeuvring with trailers. With the income from beekeeping, we made an elevator going from the beekeeping workshop for extracting honey and storage to the residential area. I also levelled the uneven floor with a plod and made a slight tilt so that no water would remain on the floor or mud that hinders walking and clings to the wheel of tools. The wheels sink into the mud and prevent movement and the mud cuts into their spaces. Wheels are not within our reach, so we cannot clean them ourselves. Unfortunately, there is no service for cleaning these muddy wheels, but we cannot enter the room with muddy wheels and shoes. That is why I paved the way to the hives and their surroundings with concrete slabs so that the wheels would not sink into the mud or slide through it, and that the mud on the wheels would not be transferred to the apartment and to the apiary spaces..

## SELECTING THE TYPE OF HIVES

### Working in a sitting position with a leaf hive

For my work I chose traditional AŽ hives because they work with comb frames, which are usually not heavier than 2 kg. I also chose the AŽ hives because when examining the bee colony, they open up as leaves on a steel rod (which is why they are called leaf hives), which means that everyone who works in a sitting position requires less physical effort.

### Working in a seated position with a loading hive

I also work with loading hives, of course with carefully selected ones, in the utilities described below. Depending on the changing space, I use them as a secured storage for comb frames designed to prevent swarming. With the

accessories and plastic hangers, I adjusted the LR-edges in height and width to the dimension of the standard AŽ frame. Thus, I have only one type and size of the honeycomb in the beehive, which is very important while working.



## ADJUSTING THE HEIGHT OF THE HIVES FOR WORKING IN SITTING POSITION

### Leaf hive

According to my instructions, on the basis of experience, we raised the hives, as I wrote in 1999, to a height of 70 cm, i.e., to a height within reach in a sitting position. These are the measures prescribed in the aforementioned rules on **the requirements for free access to, entry to and use of public buildings and facilities and multi-apartment buildings**. Hence, I made a breeding station from the seven AŽ transport hives, which I raised in two rows to a height of 70 cm. At the same height in one row, there are two-storey AŽ hives of bee colonies. At the same height, I also set up a three-level AŽ hives for school practice in one row. For all three versions, the AŽ hive comb frames are accessible both from the sitting and standing positions. In a sitting position, the legs are under or adjacent to the hive and all the frames in the hive are within reach. Such a universal setting of hives allows working with bee colonies in a standing or sitting position, i.e., the person feels comfortable at work without any pain

or other health problems, and working with bees is available for people with various bodily problems. Such a universal layout of the hive is accessible from the sitting position to both healthy people and those with different problems of the spine, hips, people with amputated legs and arms, broken muscles, and other injuries and pains.

### Loading hive

LR boxes full of honey weigh 40 kg, which is much harder than a cement bag weighing only 25 kg. Boxes filled with honey which is what we wish for are too heavy and unsuitable for working with hands in a bending position. Usually manual work with LR boxes threatens the health of a beekeeper due to their weight and curved spine while lifting the boxes. The work is not adapted to the ergonomic requirements and requirements for occupational safety. Due to the possibility of disability, the work is totally unsuitable for older people and for people with any kind of physical impairment. Using the lift and working in a sitting position can prevent the occurrence of further disability.



## Advantages and Limitations of leaf and loading hive systems

### Leaf hive:

#### Advantages

- ▶ Comb frames up to 2 kg are lifted.
- ▶ Hives allow you to check the brood chamber without lifting heavy boxes.
- ▶ Hives at a height of 70 cm make it easy to sit and work.
- ▶ Hives are placed in the apiary, which protects them against weather and extends their lifespan.
- ▶ Apiary floor allows unhindered wheelchair movement.
- ▶ We can store tools and equipments in the apiary that we need while working.
- ▶ Easier feeding only by opening the rear hatch of the hive.
- ▶ Better surface utilization, as the hives are stacked next to each other.

#### Limitations

- ▶ The hive has a limited space, which can trigger a faster swarming fever of the bee colony.
- ▶ Since the hives are placed in the apiary, they have a smaller source of daylight.
- ▶ The combs in the hives are arranged by frame spacing, which requires more precise and time-consuming work by inserting comb frames back inside the hives.

## Loading hives:

### Advantages

- ▶ Easily insert and distribute honeycombs.
- ▶ Due to outdoor work, they provide more daylight.
- ▶ By removing the roof of the hives we have a direct insight into the bee colonies from the top.
- ▶ Easier access to the test panel for monitoring the condition of the brood in the bee colony.
- ▶ The size of the hive space can be adapted to the strength of the colony.
- ▶ Cheaper initial investment.
- ▶ Simpler Varroa control.
- ▶ The use of specialized tools facilitates brushing the bees off of combs while extracting honey.

### Limitations

- ▶ During the hive examination, the honey super must be removed, which can be up to 40 kg.
- ▶ The hives are stand alone hives, which need more surface than the hives that are stuck together.
- ▶ The hives are outdoors. Therefore, the beekeeper is exposed to weather conditions during working hours. Exposure to weather shortens the lifespan of hives.



# UTILITIES

## Aids for transport

### Scooter trailer

I solved the problem of transporting convenient combs or beekeeping tools from the beekeeper's workshop and storage to the apiary by upgrading the trailer from the bike to a scooter. In a trailer, I transported honeycombs filled with honey to an extracting room when I had to take a small number of combs to make space for bees in the hives during intense grazing.



Trailer for transporting honeycombs or beekeeping tools

## Cardboard boxes

I solved the problem of storing and transporting frames with honeycombs and pollen by using oil boxes of appropriate dimensions. Eight AŽ frames can fit in each box. The boxes are easy to carry on a scooter to a storage unit or apiary. In addition, the frames disinfected with 80% acetic acid are well protected from waxed moles in a tightly-sealed box bonded with an adhesive tape. The boxes facilitate the work of wiring and waxing of smaller quantities of frames. My husband brought me boxes with frames in a warm room and then carried these boxes with wired and waxed frames. During winter, in the pleasant comfort of



Box for artificial swarm

the room, I prepared frames for hundreds of bee colonies. Thus, these packed frames with wax foundation save space and the wax foundation is not damaged and can be transported easily to the apiary.

## Box for artificial swarms

It is a folding box with a feeder and is intended for the settlement and transfer of packaged swarms. I use it for transporting bees without frames.



Lift, leaning against the tree

## Tools for working with bee colonies

### Lift

In order to enable my husband, whose health deteriorated greatly, to work independently with LR boxes and shallow boxes, I was happy to buy him a lift for his birthday with faith in the future of our beekeeping. The lift was lying there unused leaning against the tree for two seasons.

My husband preferred beekeeping in a group with young beekeepers rather than using a lift. I used the lift in case of emergency when my husband was in the hospital and I had to take care of the bees in loading hives as well. Now that my husband is gone, I work with the lift in the Beekeeping



Practice for the Ecological and Conventional Beekeeping Schools for Disabled People, where I repeat the experience while socializing and educating beekeepers who want to acquire knowledge and valuable beekeeping experience in physically less strenuous work while handling the LR hives.

I adjusted the work technology to my physical abilities and working methods. I use AŽ comb frames with honey, pollen and the brood a lot in nurturing queen bees, building breeding stations, and preventing swarming. For this purpose, AŽ frames are stored in the storage unit adapted to LR hives, in which the AŽ frames are suspended on plastic holders. So I lift the adjusted LR boxes with the help of a lift.

## Tools for examining a bee colony

### Hive tool

The hive tool is the most sought after beekeeping tool. It always gets misplaced. One of my students plastered it with an insulating tape in red and yellow. I immediately liked this idea because it could be spotted immediately by both me and my visually impaired students.



### Headlight

In order to reduce physical effort of taking the frame from the AŽ hives during the examination of a bee colony, I placed a head light, which helps me to recognize the state of a colony in the darkness. When examining bees, brood, honey and pollen, I do not need to take the frames out of the hive, so there is no effort at work. Since I do not take the frames out from the hives, this is also less stressful for bee colonies. In the illuminated frame with a brood, it is easier to recognize the eggs and hence the presence of queen bee in the hive.

This light has made work easier for many of my students with visual impairment as well as for those with problems in handling the frames.

### Magnifying glass

I used a magnifying glass in counting the natural waste of the Varroa mites on the bottom board by controlling the Varroa mites. Now I also suggest to people, as long as they are not yet sufficiently skilled, using magnifying glass to count the natural waste of Varroa, which are eliminated with chemicals, acid, sugar, etc. Magnifying glass is a very important tool for those who are visually impaired in order for them to examine



the bee colonies and check the presence of eggs in the comb cells.

## Frame holders

The frame holder is essential in hygienic handling of bee colonies. In case of comb frames, there are brood and food, so it is not appropriate to dispose them on the ground or lean them on the outside of the hives. The standard frame holder for AŽ frames, which can be purchased in our shops, is low so placing the frames represents a considerable effort and pressure for the spine and muscles. That is why I ergonomically raised the length of the frame holder up to the height of the forearms in a sitting position, putting frames on a holder thus became much easier in standing as well as in sitting positions. For this, I used a folding chair for children that has wheels that I found from the waste storage. The yard with waste recyclable materials is often the source of my new personal tools.

## Work desk

In order to avoid bending and thus stressing the backbone, I have a special tool for storing things - an old kitchen desk, which I also found in a recyclable yard. It is where I leave my beekeeping appliances, the hive tool, smokers, notes, beekeepers' diaries... as well as a work desk for different works, such as larvae transposition or loading the ergonomic height.



## Jester kit for breeding queen bees

When the beekeeper assistants who helped us in breeding queen bees and transplanting larvae, gained enough knowledge and started to bee keep themselves, I had to take this work upon myself. I was not accustomed to this work and method, nor was I prepared to perform it, and consequently only a handful of hundreds of transplanted larvae took hold. So I contacted the German beekeeper and innovator Karl Jester. Due to his health problems, he patented a queen bee isolator - a special breeding cassette with a PVC comb frame. A millimetre long larvae can be moved safely within a few seconds by a person with reduced mobility of the hands or visual impairment without the use of an original royal jelly. The patent also has a plastic plug that allows people with reduced coordination of movements of the hands and visual impairment to safely transfer the small cellular bottoms with a day-old larvae into waxed queen cells that have been previously cleaned and accepted in the target bee colony.

Socializing with an eighty year-old and his expert advice was motivation and an incentive for further work. That is why we shared this positive experience with Croatian and Slovenian beekeepers and organized various lectures at different places. Working with his tool enabled us to participate in registering reproduction of selective queen bees for several years now. With this simple way and utility, I teach my students and disabled people about raising queen bees.



Transposition of larvae

## Additional aids

### Gathering tools

In order for my husband to reach a bee swarm on the branch, he helped himself with a stool with three legs, of course at the risk of falling. That is why I bought him a ladder. Since it was not safe on the ladder, I also got a fruit-picker with a long handle on which I installed a cloth bag for collecting swarms. For me, this was too heavy as well, so I used the experience of older beekeepers. For a few days before the swarming, scout bees are looking for a suitable place for the settlement of the swarm, which is cleared before its arrival. Therefore, in anticipation of the swarm, I applied the leaves of lemon balm on the hive and fastened it to a branch within the reach of my hands. The bees were attracted by the smell of lemon balm and they recognized the hive as a new comfortable place, and in such a way, often without special effort, I had a swarm in the hive within my reach.

### Honey buckets with a tap

The weight of the honey is a problem in transport and handling. Therefore, I store it in plastic containers labelled as food products on which I install a tap for honey. I fill them with 10 kg of honey because this is the weight I can still manage. I pour the honey into small glasses, which I carry more easily, but at the same time I get a better price. I often have to wash the containers. From the liquid that remains in the containers in which the honey was, I make honey vinegar. I pour the filtered vinegar without sediment into small bottles and give it to customers and friends as vinegar, which is equal to or almost the same as that of vinegar from Modena.





From all of the above, we can conclude how important beekeeping utilities are for older people and people with disabilities. The utilities will allow many people to be able to work with the bee colonies. To many people these utilities will help in professional growth and lifelong beekeeping practices.

### **"Utilities" for good neighbourly relations**

Disabled people with beekeeping can only deal with an accessible apiary, usually in tight urban conditions. There is always a possibility that a neighbour may complain

about the proximity of bees, but we are trying to eliminate this discomfort. That is why I have a hygienic water trough, so that the bees do not seek water from their neighbours. We talk to neighbours about the benefits of bees, as they pollinate their orchards, gardens and greenhouses, and we also give them apitherapy products. In addition, we also organize a small beekeeping school in which children from the neighbourhood come to play educational games. We plant flowers beneficial for bees and we eat honey with the combs or with milk and honeybread cookies. If necessary we quench the bee thirst with juice (sugar syrup). We photograph our activities and then laminate the photos and display them on the walls of the apiary to make our neighbours proud of our bees.

### **Personal approach in selling**

From my husband I inherited his lifelong customers. I suggested them home delivery of honey. It was a business for everyone's satisfaction. Customers experience this as a visit with a pleasant chat about apitherapy where I give them new products and explain their healing effects. Customers enriched with knowledge are buying more and more targeted products. To me, as a pedagogic teacher, this represents a pleasant contact with people who want new information and knowledge. These meetings with people spread my horizons, make me rich, and bring new people into my life. I help them with tips as an apitherapist, exchange experience, and through socializing and conversations we enrich each other.

## Help

In addition to tools, disabled people sometimes need help from others for certain beekeeping tasks. According to my experience, the help of other beekeepers physically and mentally means more than any other tools. That is why I am accepting the goodness of volunteers, students of agronomy, veterinary and social work, beginners in beekeeping and those who are experienced, since all of us gain something from the exchange of goods, helping each other, and exchanging knowledge. I will use my husband's method, which I will describe it like: At our practice, there were students involved in breeding practices who praised strongly to others about it. The question followed: How much did you have to pay for this? Nothing because I helped with beekeeping. How much did you earn? Also nothing, but this nothing includes knowledge, kindness, and exchange of positive energy with which we have all been enriched.

With such motivation and energy we have built an apiary for everyone, the place of integration and therapy for improving the quality of life according to our own needs and abilities. Disabled people need help and experiences with us help create a new knowledge and attitude for students who study social work or agronomy as well as for beekeepers. Some students have already been employed due to their significant knowledge and experience.



In order to be more efficient, I hired help. People with health issues reluctantly seek help and accept it, but when it comes to paying for the service which makes their beekeeping possible, this represents a totally different situation from a psychological point of view.

I am trying to spread the idea that new beekeepers should practice with experienced beekeepers who, due to their age or health reasons, need help for extracting honey, moving, swarming, and other beekeeping tasks. Such services are already offered by some websites, even for the rest of the world.

Help may also be of a psychic nature. After the loss of my husband Zvonimir Šver and his beekeeping support, I asked friends, excellent beekeepers in connection with some questionable beekeeping procedure. At the end of the discussion, the following was the conclusion: I could do it one way or the other, but under the given conditions and possibilities, I made the best decision. For me, these supports and beekeeping discussions have been priceless.

## CONCLUSION

From experience I know that we have those who are different, with different needs, desires, and possibilities. Everyone paves the way for themselves, which is most often full of obstacles. The experience of others is foreign to us; therefore, only people with a strong personality can learn from foreign experience. Therefore, I would be delighted if anyone could take advantage of any idea or lesson from my experience in improving the quality of beekeeping and hence my own life.



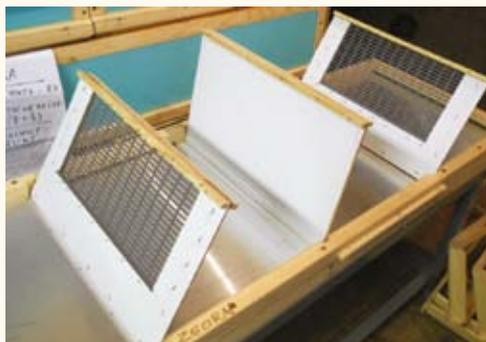
# Customized beekeeping equipments

Beekeeper Mr. Štefan Kastelic from Kočevje made a hive for his daughter with lightly extruded polystyrene (styrofoam). The entrance to the hive and side wall of the beehives are reinforced with wood. The hive is made according to the principles of a loading hive, so that bees can be reached from the top of the hive after removing the roof. The hive contains four entrances and exits, one on each side, which can be closed or opened at any time. With the use of dummy frames, the hive can be divided into four spaces and inhabited by four bee colonies or



Hive from extruded polystyrene (Styrofoam)

Extremely light roof makes it easy to move



**Brood chamber and honey chamber separated by queen excluders**



**Frame feeders installed in the hive**



**Bottom board installation method**



**Screened bottom board of the hive**

we can make space for one colony only by removing all the dummy frames. The hive is mounted on a stable iron construction, which allows wheelchair access.

Beekeeper Mar. Damjan Žerjal, from the vicinity of Kozina, made several adjustments to his beekeeping. In addition to raising the hives to 75 cm, which allows working with bees in a seated position, Mr. Damjan also covered the apiary with a transparent roofing, which provides a lot of daylight and thus makes inspection of bee colonies easier. Surely what stands out the most is the electric wheelchair that Mr. Damjan upgraded with the help of his friends. It enabled

Beekeeper Dammmam  
Žerjav with  
a transport cart

Wooden box with  
frame holders  
for transporting  
honeycombs

The shelf on which  
the hives are  
installed is slightly  
wider, which makes  
it easier to store  
the tools



Transparent roofing that  
facilitates inspection work



An upgraded electric  
wheelchair with  
a remote control

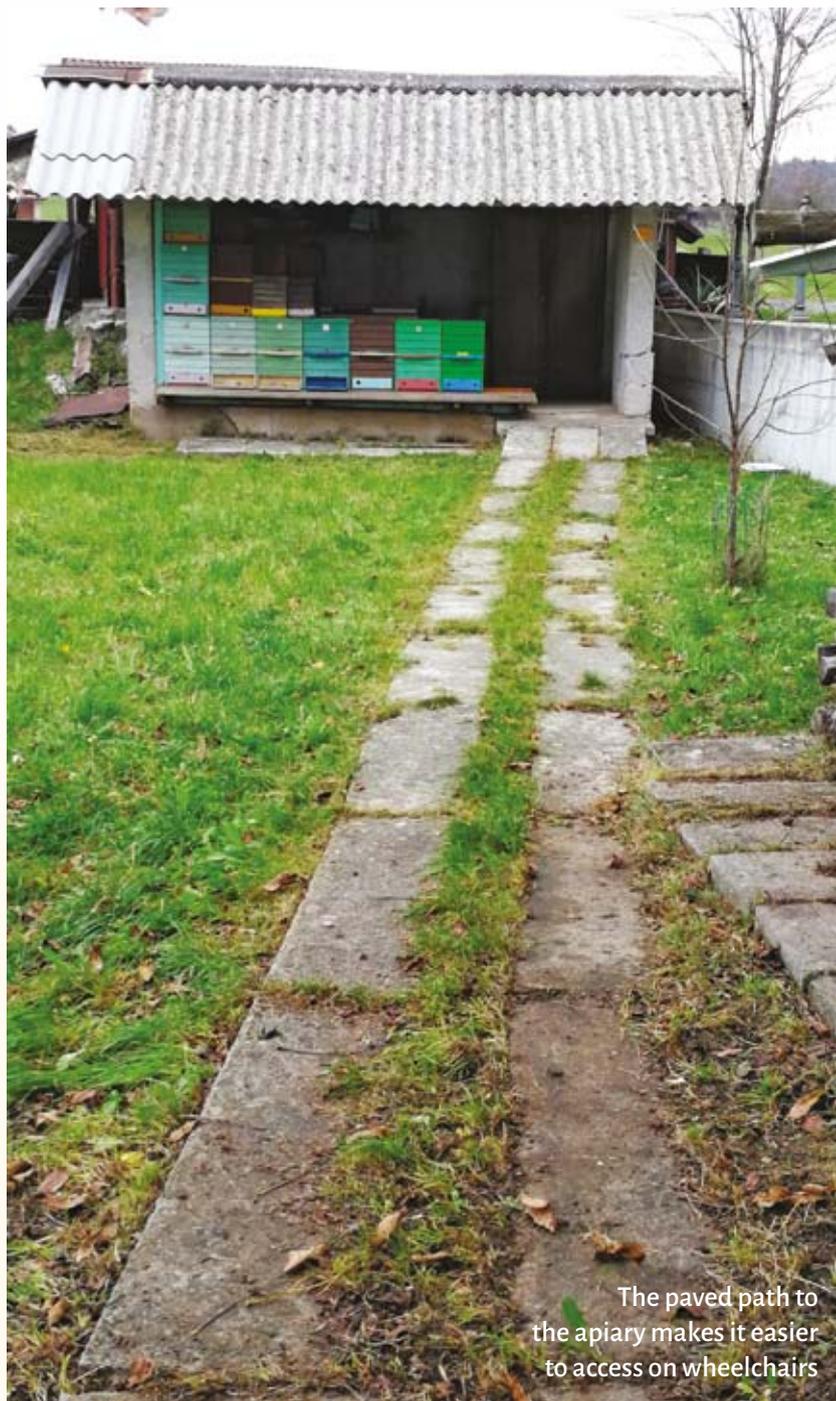
Jože Abram at work with bees



better control of the wheelchair. He placed a wooden box in the seat of the wheelchair where he could place the honeycombs on top of each other. Using the remote control, the wheelchair simply leads from the apiary to the storage unit and vice versa.

Late Mr. Abram from Pivka adapted beekeeping to his needs. For his perseverance and ingenuity, he received an honorary diploma Anton Žnidaršič. After a severe illness, he was left without legs, so he adjusted the seat with a belt to work in the apiary, which enabled him to check bee colonies in the lower rows of the apiary.

His wife helping him with feeding bees



The paved path to the apiary makes it easier to access on wheelchairs

# THE MOST COMMON DISEASES OF HONEY BEES

## AMERICAN FOULBROOD

American foulbrood is a very infectious disease of the bee brood caused by bacterium *Paenibacillus larvae*. Young larvae from 24 to 48 hours old are infected by ingesting food contaminated with spores. When the bees cover the brood, the bacteria cause death and decay of the larvae. The sources of the infection are infected or sick bee colonies, especially the brood and food supplies from such a colony, and all the beekeeping equipments and accessories used in working

with the infected colonies. Inside the apiary, the disease is usually spread by the beekeeper himself by swapping infected brood frames between colonies, feeding bees with honey or pollens from infected colonies, and using an infected tool. From one apiary to another, the disease is most often spread by robbing, selling/buying sick colonies, having contaminated swarms, using queen bees from infected colonies, using borrowed contaminated equipment's, honeycombs or hives, and by investigation of bees. The disease can spread rapidly outside in the surrounding nature where a large number of bee colonies are grazing, especially if there is nothing much to collect, and there are sick colonies among them.



**Brood frame with spaces in between**

American foulbrood is clinically expressed in honeycomb with covered brood, where among the healthy cells are seen distinctly modified cells with darker covers, which are seemingly moist, inverted, and with holes often on their surface. The longer the disease lasts the more cells are affected and the brood appears to have spaces in between. The larvae in the cells turn into a formless, light to dark brown stretching mass. If a toothpick is inserted in such an altered cell, the content is pulled along the path, which is a sign of the disease. If the bees do not cleanse the dead larvae, they dry and stick onto the cell wall, which

makes the cells appear empty. If it is a very serious infection, a distinctive odor can be detected in the hive. Once clinical signs of the disease occur, the disease progresses irresistibly. In an infected colony, there are less and less bees in the hive and more and more covered dead brood. The colony weakens and becomes either a target of robbing bees or is abandoned by the remaining bees.

### Preventive Measures

It is necessary to have strong and healthy bee colonies, inspect them regularly, replace honeycombs in the hives (at least 1/3 per year), and buy beeswax at registered manufacturers.

Special caution is required when swapping honeycombs with brood, which is the most common source of infection. Honey and pollen of unknown origin contaminated with spores must never be fed to the bees. The swarms should be placed in quarantine and then moved into disinfected hives and on new frames. The bees must be cured in time against Varroa and robbing must be prevented. We should not bring anything to the beehive, which could be contaminated with spores of American foulbrood. Purchased queen bees and bee colonies should be free of diseases. Before each transfer of bees to another location, a certificate from a veterinarian must be provided.

### Measures in case of disease suspicion

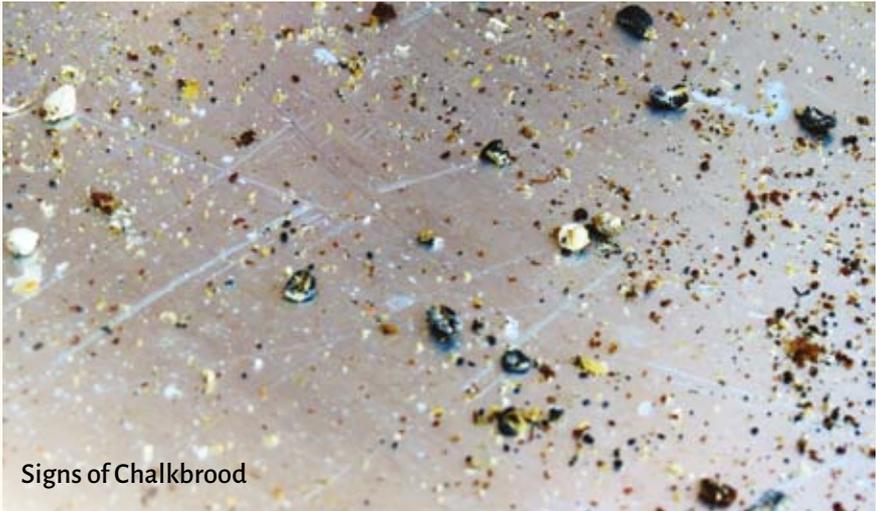
The disease must be treated by law and it is compulsory to immediately notify a competent veterinarian.



Signs of American foulbrood

## CHALKBROOD

Chalkbrood is a conditional infectious disease caused by spores of mold *Ascosphaera apis*. Young larvae infected by ingesting infected food are susceptible to infection. The dead larvae have an overgrowth of white mycelium, then they dry out and harden as a stone and become gray or black in color. These modified larvae are called mummies and are a characteristic of the disease.



**Signs of Chalkbrood**

We see them at the entrance and the bottom of the hives. At the honeycombs with brood, the affected cells can be seen with concave and pierced covers. If such cells are uncovered, we find in them larvae at different stages of the disease. In the later phases of the disease, brood is visible with spaces in between.

In every dead larvae, millions of spores remain infectious for many years. When the bees remove mummies from the hive, they spread diseases all over the apiary, which is how the sickness spreads and stays. Chalkbrood is transmitted by hands, infected equipments, adult bees, infected honeycombs, and swapping brood between infected colonies. The disease can also be spread by wind. The disease occurs most likely during spring, in sudden changes of warm and cold weather, when there is already a lot of brood in the hive but not enough bees to efficiently heat the entire hive. The disease usually disappears when the weather becomes stable and the bees start grazing significantly. In warm part of the year, the disease occurs if grazing conditions are poor or due to other causes, or if due to other causes the number of bees in a hive is reduced.

## **Preventive Measures**

It is necessary to maintain strong bee colonies, remove spores of the disease from the hives, and reduce stress. Weak bee colonies and new bee colonies are more at risk for diseases, so the size of the beehive must be adapted. The apiary should stand in a sunny place and the hives must be airy and dry. We should avoid inspection of hives in bad weather, frequent migration of bees, and regular changing of honeycombs. We should also disinfect empty honeycombs from the infected colonies.

## Measures in case of disease suspicion

In the early stages of the disease, it is often helpful to add young bees and the addition of brood in combination with the feeding of sugar syrup. The disease usually fades away when grazing begins. In a small proportion, there are colonies where Chalkbrood appears throughout the season. If the disease persists, a veterinarian should be consulted.

## NOSEMA DISEASE

*Nosema apis* is a disease of adult bees, drones, and queen bees. It is caused by microscopic small parasites *Nosema apis* and *Nosema ceranae*, which are propagated in the intestinal cells and form spores for their reproduction that represent the source of new infection. Bees are infected by ingesting contaminated foods, water, or cleansing the excrement of sick bees inside the hives. The disease is transmitted between colonies through the movement of infected honeycombs, sick bees, contaminated honey, equipments, robbing, or contaminated drinking sites. The disease is accelerated by negative external factors such as rapid temperature changes, poor grazing, long winters and poor weather in the spring, which prevents cleansing trips, irregular switching of honeycombs, and plenty of interventions in the hive during unfavorable weather conditions.

Clear signs of the disease are visible only at *N. apis*, where there is a characteristic dysentery with bees having tangled back and eroding in the hive and its surroundings. The infection reaches the top early in the spring, in times of adverse weather, when the weather improves, the bees on the grazing excursions get sick and the disease is clinically gone. There are non specific symptoms in



*N. ceranae*, such as colony weakness and reduced yields. For *Nosema* there is a shorter life expectancy of summer and winter bees, the disappearance of grazing bees, and disrupted supply of brood, which leads to poor development of the bee colonies. In cases of sick queen bees, the fertility is greatly reduced.

### Preventive Measures

Bees need to be provided with hygienic water supplies, proper and timely supply of food, and regular replacement of old honeycombs and queen bees. Apiary should be in a dry, sunny position, avoiding various stress factors. The infection is reduced by individual feeding of mixtures, and the disinfection of honeycombs is also helpful. To monitor the situation in colonies, a microscopic examination of the bees is recommended twice a year by a veterinarian.

### Measures in case of disease suspicion

Beekeepers should call the veterinarian, who will perform a clinical examination of bee colonies and take samples for laboratory examination.



## VARROOSIS

The disease is caused by the external parasite *Varroa destructor*, which feeds on adult bees and in brood. When a small number of *Varroa* is present in a bee colony, we are talking only about invading with *Varroa*, but when the number of *Varroa* is increased and the clinical signs of the disease appear, we are talking about the disease varroosis.



### Varroa on test panel



The damage is mainly reflected in the collapse of bee colonies, which can occur in any season, most often in autumn or winter.

Adult female Varroa are reddish brown in color and visible to the naked eye. Male and immature females are smaller, pale, and do not survive outside the brood. For most of their life, Varroa are in covered brood where it also reproduces. It prefers drone brood over bee brood for reproduction. In each reproduction cycle (every month), the number of Varroa in a colony is doubled. When there is no brood in a bee colony, all the Varroa are on the bees. Among colonies, Varroa is transmitted through direct contact between bees or brood, for example, by moving to other hives, bee swarms, robberies, meeting during grazing, and by shifting infected covered brood to other hives. For infection, transportation of bees to other feeding sites is also critical.

Clinical signs depend on the severity of the infection. The colonies with a small number of Varroa do not show signs. The more there is Varroa in the hives the more noticeable the clinical signs are. These are reflected by a brood with empty spaces in between, pierced covers of cells, and in the cells is a dead and deformed brood with Varroa. At the front of the hives and inside, we find affected adult bees with deformed wings that cannot fly. The bee colony visibly weakens and soon collapses, and most likely becomes the target to robbing.

## **Preventive Measures**

The beekeeper must regularly monitor the number of Varroa in the colonies throughout the year, perform technical measures and perform the prescribed treatment for bee colonies (summer suppression, additional autumn and obligatory winter). There are several registered medicines available in Slovenia for treatment against Varroa. Bee colonies should be treated as soon as the attack exceeds the upper critical threshold, or immediately after the last extraction, with removed honey frames. Before treatment, consult a veterinarian responsible for the health of bees, who will advise you on the choice of medicine and give instructions for its use.

## **Measures in case of disease suspicion**

In Slovenia, Varroosis must be treated by the law and is a compulsorily notifiable disease, therefore, it is necessary to inform a competent veterinarian.

# REACTION AND FIRST-AID IN CASE OF BEE STINGS

## LOCAL REACTIONS

Most people do not have major problems because of the insect stings (bees, wasps, hornets and bumblebees), although they are always slightly painful. Due to the direct action of the poison, there is itching, redness, and swelling with a diameter of a few centimeters, which disappears after a few hours. Exceptionally, a larger swelling appears.

If an insect stings a person in the mouth or neck, local swelling due to obstruction in the airway could make it difficult to breathe, which may even cause suffocation.

If a person is stung by many insects at the same time, systemic poisoning occurs due to the action of poisons.

A healthy adult can safely tolerate more than a hundred bee stings, but only a few can be fatal for a child.

## ALLERGIC REACTIONS

In some worst cases, the bee poison could be quite dangerous to humans, because if it is not quickly treated, a single bee sting can be fatal. Allergic reactions usually occur shortly after a sting, maybe within a few minutes, but usually in less than an hour.

### Signs of allergic reactions

Most allergic reactions are mild, last a few hours to a few days, and spontaneously fade away. The most common are **rash** (hives), red spots on the skin. They appear all over the body, fade, and then reappear. Usually other patients have no problems. However, symptoms may quickly follow each other: from **itching of the skin, redness, hives, swelling of the subcutaneous tissue, swelling of the lips or the tongue, feeling of a lump in the throat, hoarseness, restlessness, fear, vomiting, diarrhea, stomach cramps, cough, wheezing, dyspnea, weak pulse, dizziness, loss of consciousness, or an anaphylactic shock.**

An anaphylactic reaction occurs suddenly and is an extremely dynamic process that can affect all organ systems in a very short time and even cause the patient to die, but most of the time it disappears spontaneously.

If the reactions are mild, treat with fast-acting antihistamines and corticosteroids.

The only medicine that can stop the development of an anaphylactic reaction, if given at the correct dose and at the right time, is adrenaline. Therefore, the key point of recommendations is the regulation of the EpiPen adrenaline Auto-Injector. Simultaneously with the adrenaline Auto-Injector, the patient must receive precise instructions on when and how to use it.

The allergic person, who is prescribed adrenaline Auto-Injector, must have the Auto-Injector EpiPen permanently with himself.

## **ACTIONS TO BE TAKEN IN CASE OF ALLERGY TO BEE POISON**

**In which cases, if we have an allergic reaction, we cannot wait ?**

If we see that the reaction is turbulent, advancing quickly from a first few minutes of skin itchiness initially on the scalp, hands, and soles to anxiety, sneezing, coughing and hives followed by swelling, feeling of fear, hoarseness, feelings of “a lump in the throat,” dizziness, vomiting, diarrhea, cough, suffocation, cramps, loss of consciousness, this is a severe systemic allergic reaction, i.e., an anaphylactic reaction that can endanger life. In this case, decisive, timely, fast and proper action is crucial. življenje. V tem primeru je odločilno pravočasno, hitro in pravilno ukrepanje.

### **FIRST-AID AFTER A BEE STING**

- ▶ Remove the stinger immediately if it remains in the skin. Make sure you do not squeeze the stinger, as there is still poison in it.
- ▶ If swelling occurs, use a cold compress and a corticosteroid ointment. If swelling increases, you should use antihistamine. If the condition worsens, you should seek medical attention.



## FOR PEOPLE WITH ALLERGIES

- ▶ Remove the stinger immediately if it remains in the skin. Be careful not to squeeze the toxic stinger.
- ▶ Immediately after being stung, take the tablets from the set: antihistamine and corticosteroid.
- ▶ Prepare an EpiPen adrenaline Auto-Injector that you always have with you.
- ▶ Call emergency service immediately (at phone number **112**).
- ▶ If you are breathing heavily, sit or lay down if possible.
- ▶ If a severe systemic allergic reaction (severe drowsiness, dizziness, or feeling of loss of consciousness) develops despite antihistamine and glucocorticoid tablets, adrenaline injection into the muscle on the outer upper quadrant of the thigh is necessary.
- ▶ With the help of a person, you lay down on your back, lift your feet from the ground so that the legs are raised to chest level. This will increase the blood flow to the heart and brain (Trendelenburg status).



In the name of the working group that prepared the manual,  
**we invite and request all beekeepers, manufacturers  
of beekeeping equipments, and innovators from different fields**  
to share their knowledge, experience and the possibility of  
adjusting apiculture equipments that could be helpful to disabled  
beekeepers.

Your could send suggestions to  
**info@czs.si**

or write to us at

**Slovenian Beekeepers' Association, Brdo 8, 1225 Lukovica.**

