

Honey bee and its importance in human food economy

Modul no. 4: Precision Livestock Farming

Dorota Kołodziejczyk

Siedlce University of Natural Sciences and Humanities

Institute of Animal Science and Fisheries



The honey bee is the leader among insects. It pollinates flowers and thanks to its work, the flora is reborn every year. It is to her that we owe not only honey, but also fruits, vegetables...

The share of the honey bee in pollination is 80-90%. The features that predestinate it for this task are: floral fidelity, the ability to communicate and a developed social instinct as well as a large number of.



Co-funded by
the European Union

**When the bees
disappear from the
face of the earth,
man will only have
four years to live**

Albert Einstein



https://upload.wikimedia.org/wikipedia/commons/thumb/3/30/Drinking_Bee.jpg/800px-Drinking_Bee.jpg

Have look at history beekeeping



Painting from Arana cave – Spain

Based on: History of Beekeeping – Beekeeping, Prabucki, 1998

The history of man is closely related to the history of the bee. The oldest existing record of the existence of beekeeping are Paleolithic wall paintings from the Arana cave in the province of Valencia in Spain, depicting honey pickers from the nest of wild bees. They date back to 12,000 years.



Co-funded by
the European Union

The benefits of using the work of bees were known to all ancient civilizations. The ancient Egyptians, Babylonians, Sumerians and Chinese used honey as a healing agent. Honey was also used for embalming corpses. The Babylonians, burying the dead, smeared them with honey - a symbol of eternal happiness. For the ancient Greeks, it was the elixir of life and the nectar of the gods. During feasts, it was used along with water, oil and milk.



Co-funded by
the European Union

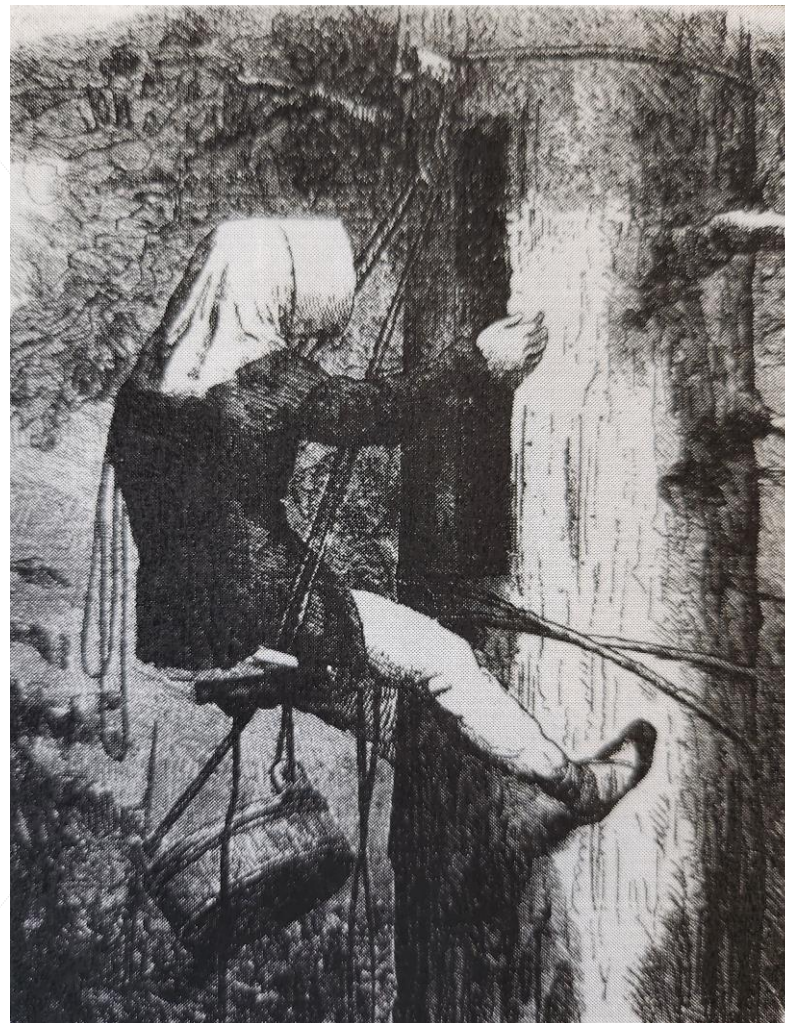
The greatest flourishing of beekeeping was observed in ancient Rome. Numerous beehives made of straw and clay dating back to 900 BC have been discovered in modern-day Israel. Historical data indicate their yield of 500 kg of honey and 70 kg of wax per year.

Initially man searched for the nests of wild bees and took honey from them, which almost always meant the destruction of the bee colony. However, he quickly tried to gain permanent access to honey. This predatory activity was replaced by over 500 BC. keeping bees in wild conditions.



Co-funded by
the European Union

Honey hunting



Gloger Z., 1900. *Encyklopedia staropolska ilustrowana*
<https://www.sbc.org.pl/dlibra/publication/7356/edition/7359>

Have look at history beekeeping



https://pl.wikipedia.org/wiki/Bar%C4%87#/media/Plik:Bar%C4%87_muzeum_bia%C5%82owie%C5%BCa_p.jpg



https://pl.wikipedia.org/wiki/K%C3%B3szka#/media/Plik:Pletara_sa_p%C4%8Delama.jpg



<https://www.tenpieknyswiat.pl/fotki/albums/kurpie-i-puszcza-zielona/barcie-kadzidlo.jpg>

Working with beehives required a great deal of knowledge, as well as patience, delicacy, attention, and finally experience, so beekeepers were universally respected and admired. This found expression in the old legislation.

Beekeepers were generally free people, they had the right to bear arms, hunt and fish. Separate honey hunting courts and collections of honey hunting laws were also created.

One of the areas of intensive bee-keeping activity was the Białowieża Forest, where you can still find many hundreds of years old bee-keeping trees and traces of bee-keeping activity.



Co-funded by
the European Union

The development of industry and construction caused a greater demand for wood, which contributed to the decline of beekeeping in favor of creating apiaries and home hives. Along with moving bee colonies closer to home, modifications were made to the construction of bee rooms, and more time was devoted to caring for them and observing biology. The monks who kept bees for the sake of the wax needed for the production of candles, seals and honey, a food and medicinal product, contributed in particular to the dissemination of beekeeping.



Co-funded by
the European Union



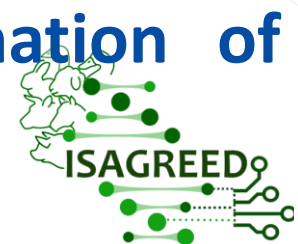
Wooden hives



Baskets

Photo: Own work

In the world, the 16th century brought a lot of information on the biology of bees. It has been discovered that the queen bee is raised from the eggs by the worker bees and is the actual female. In the next century, research was carried out on the anatomy of bees, the sex of drones and workers, the origin of nectar, honeydew and propolis were determined. The 19th century, apart from scientific research, abounded in many inventions and practical conveniences. A hose press, a smoker and a slicer were created. Changes were introduced in the construction of the hive, queen bees were raised in natural and artificial cells [Crane, 1990]. At the beginning of the 20th century, the queen bee was artificially inseminated for the first time, which enabled faster progress in breeding and medicinal product, contributed in particular to the dissemination of beekeeping.



An outstanding personality who combined scientific research with beekeeping practice was Father **JAN DZIERŻON (1811- 1906)** - a world-famous Polish beekeeper who announced and later proved the theory of parthenogenesis (virgin birth) - only drones are born from an unfertilized egg cell.

He dealt with the origin of royal jelly, wax, fat body, construction of hives, he proved the importance of bees as pollinators.



Co-funded by
the European Union

The honey bee is one of the many species of the bee superfamily (*Apoidea*). It is the only one that brings so much benefit to man and can be kept under controlled conditions. The honey bee is a farm animal closely related to and dependent on the natural environment. It is difficult to say that it is a domesticated animal like some mammals or birds, although man has been using it for over 10,000 years. But it is safe to say that the bee is a social insect.



Co-funded by
the European Union

Polymorphism



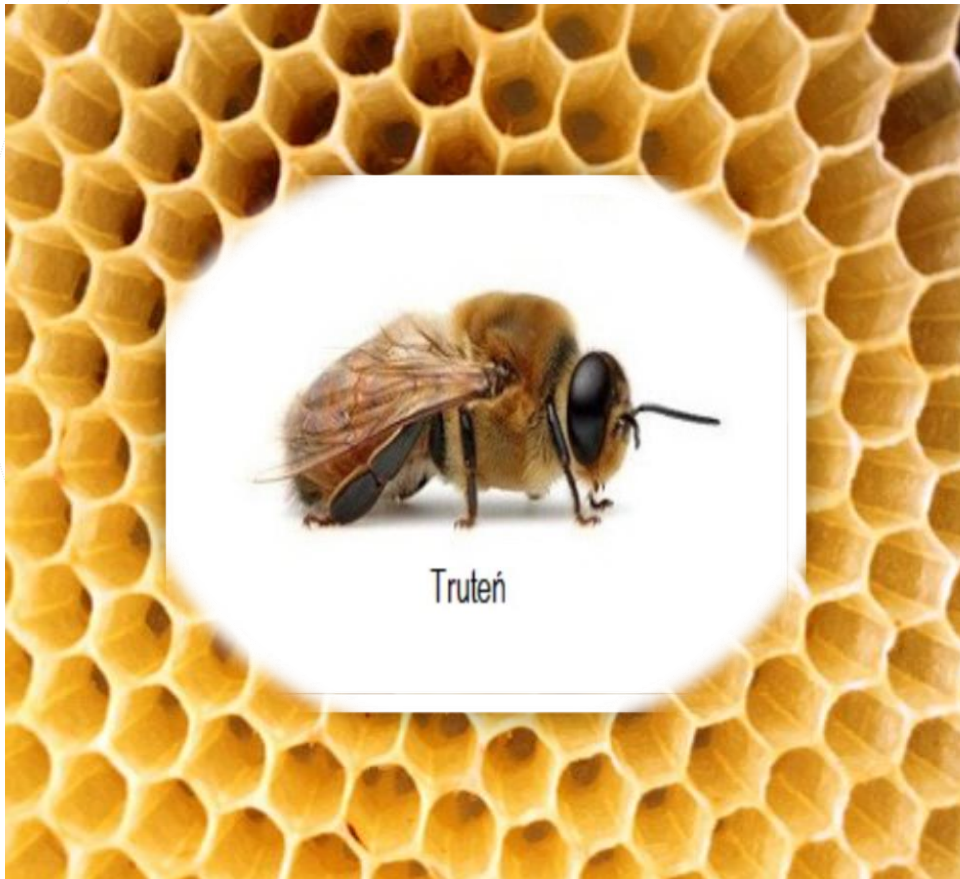
Queen

The individual that gathers and unites the whole family is the queen bee.

She lives the longest in the whole family (4 -5 years).

Polymorphism

Drone



- The does not do any work in the family (no wax glands, no baskets on the legs, too short proboscis, small goiter)
- adapted for successful fertilization

Polymorphism

Worker



- Collects nectar, pollen, honeydew, water and balsamic substances
- It exchanges food, transmits information and maternal substance
- Cleans cells from exudate, feces, remnants of the cap.
- She feeds the larvae
- Processes food
- He patrols and defends the nest
- He builds slices
- Cleaning



Co-funded by
the European Union

In addition to the honey bee (*Apis mellifera*), the genus *Apis* L. includes 6 species [Ruttner, 1992]:

- bush bee (*Apis andreniformis*),
- red bee (*Apis koschevnikowi*),
- dwarf bee (*Apis florea*),
- giant bee (*Apis dorsata*),
- rock bee (*Apis laboriosa*),
- eastern bee (*Apis cerana*).



https://www.dpi.nsw.gov.au/__data/assets/image/0010/1200115/Apisflorea2.jpg



<https://upload.wikimedia.org/wikipedia/commons/4/4d/ApisDorsataHive.jpg>



<https://upload.wikimedia.org/wikipedia/commons/thumb/e/ec/Cerana.jpg/800px-Cerana.jpg>



Co-funded by
the European Union

All species of the bee genus form well-organized communities, build wax combs for raising offspring and storing food. They feed on pollen, nectar and honeydew. They form families consisting of 20-80 thousand individuals that can adapt to changing environmental conditions. They differ in anatomy and morphology, range of occurrence, different ways of nesting (places, number and size of combs), ways of coping with lack of food and environmental conditions (winter, seasonal migrations). All species except the honey bee are of little economic importance as they cannot be kept under controlled.



Co-funded by
the European Union

The honey bee (*Apis mellifera* L) is native to Europe and Africa. It is also found in the Americas, Australia, South and East Asia, where it was introduced by man. In the honey bee species, 25 populations were distinguished, which, due to their behavior and geographical spread, were divided into 4 groups [Ruttner, 1992].

In Poland, 4 geographical breeds are allowed for breeding [Skowronek, 1997]:

- Central European (*Apis mellifera mellifera*) - from the group of European and North African bees,
- Carniolan (*Apis mellifera carnica*) - from the group of Balkan bees,
- Italian (*Apis mellifera ligustica*) - from the group of Balkan bees,
- Caucasian (*Apis mellifera caucasica*) - from the group of oriental bees.



Co-funded by
the European Union

Bee breeding work

An important place is occupied by research on the biological characteristics and behavior of bees. The role of breeding work is genetic improvement of the bee population, which leads to an increase in their utility value. The evaluation of the value in use comes down to the measurement of the basic functional characteristics: honey and wax yield.

Additional functional features are:

- gentleness,
- Low tendency to robbery,
- sticking to combs,
- non-swarming.



Co-funded by
the European Union

Bee breeding work

Breeding work is carried out in two main ways.

- Bees are perfected in small, regional, closed populations, for a specific environment and in one direction. Additive volatility is used. The population is closed to the flow of genes from the outside, although such a possibility is allowed. The breeder must fight inbreeding and maintain variability within sex alleles. It is necessary to use artificial insemination.
- The second way is to introduce a program based on hybridization, the use of heterosis and the compensatory effects of different races. There is a need to maintain different lines and thus large populations. This requires large expenditures. Programs of this type are implemented in the USA and Australia.



Co-funded by
the European Union

Insemination of bees



The everted copulatory organ of a drone



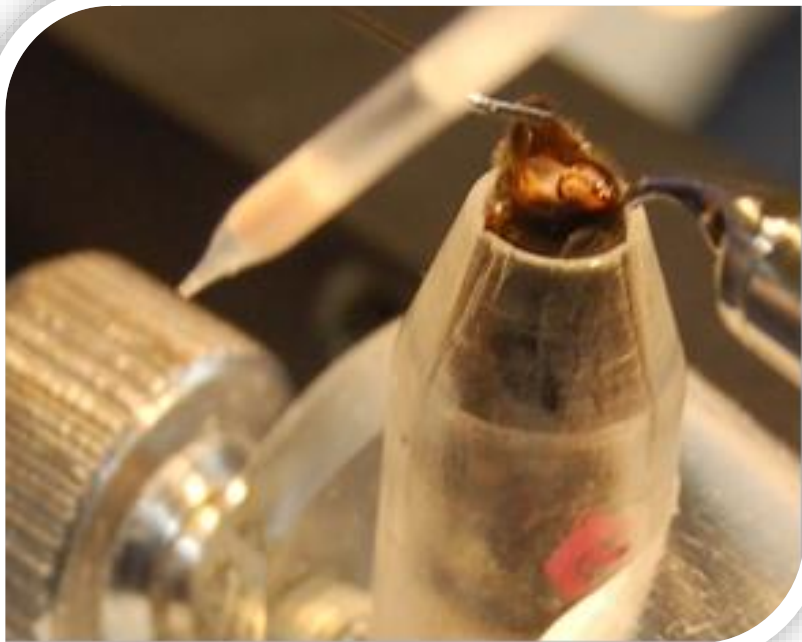
Retrieving sperm from a drone

Photo: Own work



Dormant mother placed in a cage

Insemination of bees



**Opening the abdomen
of a queen bee**



**Artificial insemination
of the queen bee**

Photo: Own work

Economic importance of bees

- Proper nutrition and leading a proper lifestyle are the basic conditions for maintaining health and longevity. It is important to ensure that our daily diet contains a complete set of ingredients necessary for the proper functioning of the body. In highly developed countries, there is no problem with food shortage, but there are difficulties in choosing valuable foodstuffs. More and more consumers realize that they eat inadequately and look for healthy food products.



Co-funded by
the European Union

Economic importance of bees

- HONEY is a natural food product with high nutritional, medicinal and caloric value, with health-promoting properties.
- Other products of bee origin used in the agri-food, pharmaceutical or cosmetic industries are also valuable, namely propolis, royal jelly, pollen, bee bread, wax and bee venom.



Honey

- The basic components of honey are carbohydrates and water. .
- The monosaccharides present in honey in the greatest amount are glucose and fructose, which are reducing sugars. In the case of disaccharides, it is mainly maltose. Sucrose, on the other hand, is a non-reducing disaccharide
- Other sugars, occurring in smaller amounts, are tri- and polysaccharides.



<https://ireland.apollo.olxcdn.com/v1/files/bcijhp4w6mdu2-PL/image;s=1000x700>

- Honey also contains:
 - ✓ organic acids from various aliphatic and aromatic groups that affect the overall acidity of honey: lactic, malic, formic, succinic, citric, butyric, gluconic,
 - ✓ mineral compounds: potassium, iron, calcium, sodium, manganese, phosphorus, cobalt, copper,
 - ✓ vitamins: B, C, E, H, PP
 - ✓ nitrogen compounds.



Co-funded by
the European Union

Types of honey	Honey varieties
nectar	rapeseed, acacia, linden, buckwheat, heather, multiflorous
honeydew	fir, spruce, pine, larch, birch, maple
nectar-honeydew	linden

Healing effect of honey

- ✓ lowers blood pressure and dilates blood vessels,
- ✓ inhibits the atherosclerotic process,
- ✓ has antibiotic, anti-inflammatory, expectorant and regenerating effects,
- ✓ acts on pathogenic microorganisms in the respiratory tract,
- ✓ the contained essential oils act on microbes in the epithelium of the mucous membrane



https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcSZaedvcblMw6tfXDerIIUTU9S4IQNrRAeiMfhkpA3BAVHCiFvyvmhY_F9Rb9HSXh38Qag&usqp=CAU

- ✓ has anti-allergic properties,
- ✓ works on the liver, bile ducts, kidneys, urinary tract, prevents urolithiasis,
- ✓ helps in the treatment of diabetes,
- ✓ causes rapid healing of wounds, purulent wounds and burns.
- ✓ prevents tooth decay,
- ✓ anti-inflammatory and regenerating,
- ✓ relieves muscle cramps,
- ✓ suitable for compresses for bruises and petechiae,



Co-funded by
the European Union

Bee wax

- Beeswax is secreted by the wax glands of worker bees, flows out of the tubules and solidifies in the form of thin, white scales upon contact with air. The main raw material during its production is carbohydrates.



- Bees use about 4 kg of honey to produce 1 kg of this product [Żółty, 2005]. The amount of wax produced during a bee's lifetime does not exceed half of its body weight.

Bee wax

- Wax consists of hydrocarbons, fatty acids, hydroxy acids, alcohols and esters
- It is a solid, melts at 62.3°C - 65.2°C , dissolves in organic solvents,
- it has a pleasant smell and color from almost white through various shades of yellow and green to brown.



<https://www.augustus-oils.ltd.uk/wp-content/uploads/2018/10/128px-Beeswax.jpg>



https://upload.wikimedia.org/wikipedia/commons/f/f7/Honey_comb.jpg

- it is used for the production of hoses, in the pharmaceutical and chemical industries (paste, varnish, polish), machine industry (preservative pastes and lubricants), as well as for the production of candles, souvenirs, etc.

Pollen

- Pollen is an excellent product supplementing deficiencies in the human diet. It contains essential amino acids, vitamins, bioelements and phytohormones that regulate life processes, as well as bactericidal and fungicidal substances.
- Pollen is used to alleviate many ailments, such as: anemia, hypertension, atherosclerosis, high cholesterol, neurosis and many others.



Fot. © Maria i Eugeniusz Sapiotko
https://pasieka24.pl/images/stories/Pasieka/K129_Wielki-poradnik-pasieczny/r09_01.jpg



Co-funded by
the European Union

Royal jelly

- Royal jelly is a secretion of the throat glands of worker bees, it is used to feed the larvae, queen bees, it can also be eaten by worker bees and drones. It has a white or slightly yellow color and a bitter-sour, slightly sweet taste.
- It contains many substances that have a beneficial effect on human health, including:
 - ✓ carbohydrates,
 - ✓ exogenous amino acids,
 - ✓ protein substances,
 - ✓ natural dyes,
 - ✓ minerals,
 - ✓ fatty acids,
 - ✓ enzymes,
 - ✓ vitamins and female hormones [Oberrisser, 2009].



<https://www.slideshare.net/>



Co-funded by
the European Union

Royal jelly

- It is used both internally and externally. It has strong bactericidal properties, fights viruses from group A and B, inhibits the growth of mold and yeast. It protects the liver against poisoning with toxic substances and supports it in states of failure. It lowers cholesterol in coronary vessels.
- It has high nutritional values, has a beneficial effect on metabolism and in the treatment of anemia and diseases of old age. Royal jelly also fights numerous skin ailments and is used in cosmetics as an ingredient in many cosmetics.



<https://allegro.pl/oferta/krem-z-miodem-mleczko-pszczele-50ml-pasieka-barc-10157804140>



<https://image.ceneostatic.pl/data/products/153892250/i-mleczko-pszczele-royal-w-kapsulkach-suplement-diety-bartpol-30-kapsulek.jpg>



Co-funded by
the European Union

Propolis

- Propolis is made of resinous substances collected and processed by bees. It is used to disinfect all parts of the bee's nest, including the combs, to seal the openings, especially before winter, and to embalm too large impurities that are impossible to remove.
- Propolis contains:
 - ✓ 50%-80% of resins,
 - ✓ 4%-15% of essential oils,
 - ✓ 12%-40% of waxes,
 - ✓ 4%-10% of tannins,
 - ✓ 5%-11% of pollen,
 - ✓ acids,
 - ✓ alcohols,
 - ✓ flavonoids,
 - ✓ terpens,
 - ✓ mechanical impurities.



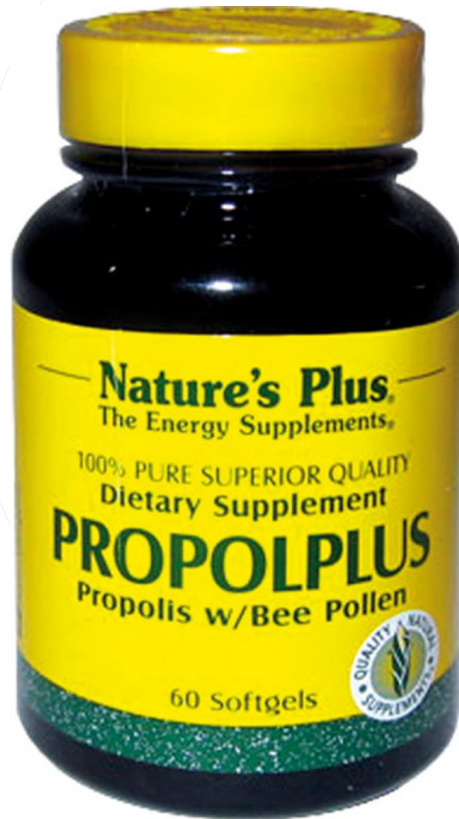
<https://www.wapteka.pl/blog/artukul/propolis-wlasciwosci-zdrowotne-i-zastosowanie-kitu-pszczelego>



Co-funded by
the European Union

Propolis

- Propolis extracts have a bactericidal and bacteriostatic effect.
- Due to its properties, propolis is used e.g. in diseases:



<https://www.naturitas.pl>

- ✓ Cardiovascular
- ✓ otolaryngology
- ✓ dermatological
- ✓ layout genitourinary
- ✓ layout respiratory
- ✓ layout food.



Economic importance of bees

- All obtained bee products are used as a medicinal agent or medicinal food. Originally, the products were used in natural medicine, now they are more and more often used in unconventional medicine or as a supplement to traditional pharmacological treatment called apitherapy.



**SO SMALL, SO
IMPORTANT**

<https://www.oseko.pl/wp-content/uploads/2015/07/znaczenie-pszczol.png>

- However, it should be emphasized that bees bring more benefits to humans as pollinators of plants than as suppliers of honey and other products.

BIBLIOGRAPHY

- Crane E., 1990: Bees and Beekeeping science, practice and Word reseuerces. Comstock Publishing Associates of Cornell University Press New York.
- Gloger Z., 1900. Encyklopedia staropolska ilustrowana. <https://www.sbc.org.pl/dlibra/publication/7356/edition/7359>
- <https://allegro.pl/oferta/krem-z-miodem-mleczko-pszczele-50ml-pasieka-barc-10157804140>
- https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcSZaedvcbIMw6tfXDerIU9S4IQNrRAeIMfhkpA3BAVHCiFvyvmhY_F9Rb9HSXh38Qag&usqp=CAU
- <https://image.ceneostatic.pl/data/products/153892250/i-mleczko-pszczele-royal-w-kapsulkach-suplement-diety-bartpol-30-kapsulek.jpg>
- <https://ireland.apollo.olxcdn.com/v1/files/bcijhp4w6mdu2-PL/image;s=1000x700>
- https://pasieka24.pl/images/stories/Pasieka/K129_Wielki-poradnik-pasieczny/r09_01.jpg
- https://pl.wikipedia.org/wiki/K%C3%B3szka#/media/Plik:Pletara_sa_p%C4%8Delama.jpg
- https://pl.wikipedia.org/wiki/Bar%C4%87#/media/Plik:Bar%C4%87_muzeum_bia%C5%82owie%C5%BCa_p.jpg
- <https://sklep.ocean-tech.pl>
- <https://upload.wikimedia.org/wikipedia/commons/thumb/e/ec/Cerana.jpg/800px-Cerana.jpg>
- <https://upload.wikimedia.org/wikipedia/commons/4/4d/ApisDorsataHive.jpg>
- https://upload.wikimedia.org/wikipedia/commons/thumb/3/30/Drinking_Bee.jpg/800px-Drinking_Bee.jpg
- https://upload.wikimedia.org/wikipedia/commons/f/f7/Honey_comb.jpg
- <https://www.augustus-oils.ltd.uk/wp-content/uploads/2018/10/128px-Beeswax.jpg>
- https://www.dpi.nsw.gov.au/__data/assets/image/0010/1200115/Apisflore2.jpg
- <https://www.naturitas.pl>
- <https://www.slideshare.net/>
- <https://www.tenpieknyswiat.pl/fotki/albums/kurpie-i-puszcza-zielona/barcie-kadzidlo.jpg>
- <https://www.wapteka.pl/blog/artikul/propolis-wlasciwosci-zdrowotne-i-zastosowanie-kitu-pszczelego>
- Oberrisser W., 2009. Miód. Propolis, pyłek, wosk. MULTICO Oficyna Wydawnicza. Warszawa.
- Prabucki J., 1998. Historia pszczelarstwa – Pszczelnictwo, praca zbiorowa pod red. J. Prabucki. Wydawnictwo ALBATROS.
- Ruttner F., 1992. Naturgeschichte der Honigbienen. Ehrenwirth Verlag, München.
- Skowronek W., 1997. Rasy pszczoły miodnej. Instytut Sadownictwa i Kwiaciarstwa . Zakład Upowszechniania Postępu, 220, 5-14.
- Żółty K., 2005. Produkty pszczele skarbnicą zdrowia. Wydawnictwo Czuwajmy. Kraków.



Co-funded by
the European Union

Partners:



Siedlce University
of Natural Sciences
and Humanities

Mendel
University
in Brno



Czech University
of Life Sciences Prague



Thank you for your attention!

This presentation has been supported by the Erasmus+ KA2 Cooperation Partnerships grant no. 2021-1-SK01-KA220-HED-000032068 "Innovation of the structure and content of study programs in the field of animal genetic and food resources management with the use of digitalisation - Inovácia obsahu a štruktúry študijných programov v oblasti manažmentu živočíšnych genetických a potravinových zdrojov s využitím digitalizácie". The European Commission support for the production of this presentation does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Dorota Kołodziejczyk



dorota.kolodziejczyk@uph.edu.pl



Co-funded by
the European Union