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Hive Products and Their Uses

Praduman Bhatnagar*, Prem Lata, Fateh Singh, Mamta and Sube Singh

CCSHAU Krishi Vigyan Kendra, Kurukshetra, Haryana
(136 118), India

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Corresponding Author

Praduman Bhatnagar

e-mail: sckvkkurukshetra@gmail.com

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Abstract

The biggest service to human beings by honey bees in the pollination of crops which results into higher productivity of food crops, vegetable and fruit crops. Honey bees contribute to more than 79% in pollination. Besides, apitherapy (use of bee products like honey, pollen, propolis, royal jelly, wax and venom) is used to prevent or treat illness in human beings. Considering the health benefits of honey, pollen and royal jelly, they have been categorised as nutraceuticals. Queen and worker bees can also be regarded as hive products and can also be exploited commercially.

Introduction

Honey bees are a unique blessing to human beings. These tiny creatures remain busy in their own work indirectly and or directly benefitting us. Pollination is one of the biggest accomplishments of honey bees. Out of three chief sources of pollination, insect pollination alone accounts for 91% pollination of all crops, out of which contribution of honey bees is more than 79% (Matto, 2017). This nature's gift produces six different products which are utilized by humans for improving health, curing certain diseases and as industrial use.

Honey

Honey bees collect nectar from flowers. This nectar contains 15-20 % sugars and rest water. Honey bees chemically and mechanically converts their nectar into a super-saturated solution called as honey, which is viscous in nature containing 80-85 % sugars and rest water. Honey is composed of at least 181 components that is why it cannot be compared with any sugary substitute. It contains sugars, vitamins, minerals, amino acids, enzymes, organic acids, pollen, fragrance and flavour compounds. Each 100 gram of honey has 315 calories.

Honey bees have the unique ability to convert complex sugars found in nectar into simple sugars. The complex sugars *i.e.* sucrose or cane sugar (disaccharide) is converted into simple sugars *i.e.* glucose or grape sugar and fructose or fruit sugar (monosaccharide) by the process of hydrolysis.

Invertase enzyme, produced by the salivary glands, present in thorax, is added to nectar in bee crop/ gut, which converts sucrose into equal parts of glucose and fructose. Due to difference in their atomic arrangement fructose is sweeter than glucose and this makes honey sweeter than table sugar. This is why honey is sweeter than table sugar because honey contains more fructose. Another enzyme, amylase, produced by food glands/ hypopharyngeal glands, helps in breakdown of amylose present in nectar into glucose, which is easier to digest.

During the process of conversion into honey, gluconic acid is produced from glucose by a simple oxidation reaction which ensures low pH of honey making it unsuitable for fungi, bacteria and moulds. This reaction is facilitated by the enzyme glucose peroxidase. During this conversion, H_2O_2 is also produced which enhance acidity and stabilizes pH of honey. Yet another enzyme, Catalase changes hydrogen peroxide into water and oxygen and keeps hydrogen peroxide below toxic level (Sharla, 2016).

The process of regurgitation further helps in complete breakdown of sugars. When honey has less than 20% water, it is deposited in comb cells. The water contents are still lowered by the fanning activities of bees and this honey is finally capped.

Constituents (per 100 gram of Honey)

1. Carbohydrates: 82.4 gram
 - a) Glucose: 31.28 gram
 - b) Maltose: 7.31 gram
 - c) Fructose: 38.5 gram
 - d) Sucrose: 1.31 gram
2. Amino acid: 0.3 gram
3. Total acid: 0.57 gram
4. Moisture: 17.1 gram
5. Nitrogen: 0.041 gram
6. Ash: 0.169 gram
7. Calcium: 6.00 mg
8. Phosphorus: 4.00 mg
9. Potassium: 52.00 mg
10. Iron: 0.42 mg
11. Magnesium: 2.00 mg

Uses

Honey is an instant source of energy. It boosts immunity and makes human beings less vulnerable to attack by bacteria and viral pathogens. It acts as an antioxidant, improves haemoglobin and cures anaemic conditions. Honey is used in medicines particularly beauty products and confectionary items. It also improves digestive system, prevent heart diseases and regulates cholesterol levels.

Royal Jelly

It is a white coloured secretion of the hypopharyngeal glands, which are situated in the head region of honey bees. This super food known as Royal Jelly is fed to the larvae of workers and drones upto 3 days. The queen larvae are fed with royal jelly throughout its larval period.

For getting royal jelly on a small scale, a colony is made dequeen and the jelly from queen cells is harvested. However,

on commercial scale, a strong colony can take care of 45 newly grafted cells per day. Each cell (3-4 days old) may contain 250-300 mg royal jelly (Matoo, 2017).

Constituents

1. Water: 67%
2. Protein: 12.5%
3. Sucrose: 11%
4. Fructose: 6%
5. Glucose: 4.2%
6. Others: 0.8%
7. Fat: 5%
 - a) Hydroxy Dec-2-enic acid: 31.8% of 5%
 - b) 10-Hydroxy Decanic acid: 21.6% of 5%
 - c) Other hydroxy fatty acid: 9.5% of 5%
 - d) Dicarboxylic acid: 4.5% of 5%
 - e) Gluconic acid: 24% of 5%
 - f) Other: 8.6% of 5%
8. Minerals (K, Mg, Na, Ca, Zn, Cu, Mn): < 1%
9. Vitamins (B-1,2,6,12, Folic acid): < 0.1%
10. Sterol: 3.5%

Uses

Royal Jelly improves body metabolism, appetite, vitality and immunity. It regulates working of endocrine glands and relieve of high blood pressure.

Wax

Wax is produced by workers bees in age group of 13-17 days, from 4 pair of wax glands situated on the ventral side of four to seven abdominal segments. These wax glands produce liquid wax which solidifies on exposure to air. The secretion of mandibular glands located in head cavity is taken up by mandibles to soften the wax to make it workable. This masticated wax is used for comb construction, sealing of honey cells and repair of comb cells. Honey bees consume 6-8 Kg honey to produce 1.0 Kg wax. Each 100 Kg extracted honey corresponds to 2.5 Kg wax produced. Wax is collected mechanically from old/ damaged comb sheets and caps after decapping honey cells etc.

Constituents

1. Monoesters: 35-40 %
2. Diesters: 14%
3. Triesters: 3%
4. Hydroxy esters and Polyesters: 12%
5. Acid esters and Polyesters: 3%
6. Hydrocarbons (Long chain): 14%
7. Fatty acids (Long chain): 12%

Medicinal Uses

Wax has been used for mummification in Egypt since long. Hippocrates used to heal open sores, ulcers. In Europe, it has been used to relieve inflammation and fever. During World War II, Wax has been used to dress wounds in battles. Wax has been in use to fight TB, colitis, viruses (including flu virus) and acne. It has antibiotic effect over wide range including Staphylococcus. Bee wax is a rich source of Vitamin-A. One hundred gram of bee wax contains 4096 IU Vitamin-A. Vitamin-A, present in wax easily enters the body through skin. Other uses of wax include throat ache, stiffness in chest, cleaning of teeth and strengthening gums.

Commercial Uses

Bees wax has more than 300 industrial uses. It is used in leather, electrical, textile and musical industry. It is used for coating on iron, furniture polish, beauty products, shoe polish, carbon paper, archery and grafting of trees. It is also used for water proofing, printing press, polishing optical lenses etc. This wax is widely used in chewing gums, candy etc. Cosmetics and pharmaceuticals account for 70% of world trade of wax.

Bee Propolis

Propolis is collected by bees from exudates of tree trunks, bark or wound of plants like buds of poplar, cone bearing trees etc. It is used to plug the cracks and crevices in the hive, polishing the comb and also as repellent. *A. mellifera* uses it to fill small gaps upto 6 mm while larger spaces are generally filled with bees wax. Propolis provides structural stability and thermal insulation to the hive. It makes hive uncongenial for development of fungi and bacteria. This 'bee glue' is generally a dark brown, resinous mixture that honey bees produce by mixing saliva and bees wax with collected exudates. About 300 g propolis can be collected per colony per year.

Constituents

1. Resin and Balsum: 55%
2. Oil and waxes: 30-35%
3. Pollen: 5%
4. Other compound: 5% (includes, Amino acids, Teepanes, Minerals, Sugar, Vitamin B Complex, Vitamin C Complex, Vitamin E Complex, Phenols, Flavonoids-Flavones, favonols, flavanones, neoflavouaids etc., Phenolic acids, Tannius, Stlbenes, Curcuminoids, Coumarius, Coumarius, Quiuones, Bee propolis also contains Coversatin, Pinosambrin, Caffeic acid, Fantheilic ester, Acosatin and Pinosoabin.)

Medicinal Uses

Its use date back to 350 BC, Greeks used it for abscesses, Assyrians have used it for healing wounds and tumours and Egyptians used it for mummification. It is also known as Natures Germ Fighter. It has antimicrobial, antiviral,

anti-inflammatory, antispasmodic and anaesthetic activity. It is used as hepato-protective agent in viral and bacterial infections and in tumours, oxidative stress and inflammation. It raises body's natural resistance, lowers BP and Cholesterol levels, and reduces nitric oxide production.

It contains Vitamin A, B₁, B₂, B₃, C, Biotin, flavonoids, Ca, Mg, and Fe. It is a curative agent for cold, sore throat, skin problems, stomach ulcers, burns, haemorrhoids and used as herbal medicine. However, it may cause allergy to some persons.

Commercial Uses

It is used in gum paints, ointments, paints and varnishes. Its tincture extracted in alcohol is used in beauty products such as creams, lipsticks, shampoos and toothpastes, chewing gums etc.

Bee Venom

It is produced by the venom gland situated in the last abdominal segment, which is modified into a sting apparatus, through which bee venom is injected into the victim while stinging as defence. Bee Venom is extracted using a venom extractor, which is an electrically charged grid to give a mild electric shock to the worker bees. Bees sting the surface beneath and venom is falls on a glass plate, dries up and is collected by scrapping.

Constituents

It is composed of 63 components in total and is a complex mixture of enzymes and peptides.

1. Peptides

- (a) Melittin: Major component that consists of 26 amino acids comprises about 50% of dry wt. of venom
- (b) Apamin
- (c) Adolapin
- (d) Spamin
- (e) Mast cell degranulating peptide, adolapin, tertiapin, sccapin, cardiopep
- (f) Engymes: Phospholipase A₂, Phospholipase B, Hyaluronidase, Phosphatase & alpha glucosidase.

2. Non Peptide Compounds

- (a) Amines
- (b) Histamine
- (c) Dopamine

3. Others

- (a) Formic acid
- (b) Hydrochloric acid
- (c) Ortho-phosphoric acid
- (d) Sulphur
- (e) Proteins

(f) Volatile oils

(g) Water: 80%

Medicinal Uses

Bee venom therapy has been used for more than 1000 years as a natural treatment for various diseases. Bee venom has antiviral, antibacterial and anticancer properties. It acts as an antioxidant and is used for curing rheumatoid arthritis, nervous disorders, multiple sclerosis and reducing the severity of allergic reactions to bee sting (Burdoelc, 1998). It stimulates the production of erythrocytes and red blood corpuscles and lowers the blood cholesterol levels.

Commercial Uses

It is added in skin health products for reducing inflammation, providing antibacterial effects and reducing wrinkles and treating acne.

Pollen Grains

When a honey bee visits a flower for nectar collection, it also collects pollen from stamens of flower. The pollen grains get filled in the specialized basket shaped structures of the hind legs of honey bees and when the bee returns to the comb, these pollen grains are deposited in the comb cells. The foraging bees collect nectar and pollen from the same species during a single trip. This specificity is maintained till the flora in the region is exhausted. The pollen grains mixed with honey are fed to the young worker bees. Pollen is collected by installing pollen traps at the entrance of hive and collected pollen is dried quickly to stop the growth of microbials. Ideally, packed pollen contains 5-8% moisture.

Medicinal Uses

Pollen grains are a rich source of protein and have anti-biotic activity. It improves appetite, increase body weight and removes constipation. It is helpful in

reducing blood pressure, anaemia and liver problems. It also boosts immunity by increasing erythrocyte count in blood. It has beneficial effect on prostate gland.

Commercial Uses

It is widely used in artificial diet of poultry and experimental birds, bats, aquaculture and honey bees itself. Beside above products, there is a rapid increase in colony size under favourable conditions. These worker bees can be sold to new entrepreneurs. In addition, the queen honey bee can also be obtained in large numbers and is being exploited commercially adding to the income of the entrepreneur.

Conclusion

Honey bees are a unique blessing to living beings. They are mainly responsible for pollination of diverse range of crops thereby helping to boost productivity. Hive products viz. honey, royal jelly, bee propolis, bee venom, pollen grains and wax have diverse uses from nutraceuticals (antimicrobial antiviral, anti-inflammatory, antispasmodic, anesthetic, antioxidant and ant allergic etc.) to industrial components (leather, electrical, textile and music industry etc.) and beauty products (cream, lipsticks and shampoo etc.).

References

- Burdoelc, G.A., 1998. Review of the biological properties and toxicity of bee products. *Food chem. Toxicol*, 36: 347-363.
- Matto, V.K., 2017. Working group report on promotion of honey bee keeping in Haryana. Haryana Kisan Ayog. Panchkula pp. 87.
- Sharla, R., 2016. The chemistry of honey. *Bee culture*. 12-14.