INNOVATIVE USING FACILITIES OF BEE VENOM

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Summary

Venom production from honeybees has been done since ancient times. Techniques for obtaining bee venom have been developed to the present day. With the new techniques, higher quality and purity medicinal bee venom can be obtained. Bee venom is a colorless, sharp and bitter taste, raw banana odor and slightly acidic (pH 5.0-5.5) structure bee product. It contains peptides, active amine and enzymes such as histamine, mellitin, apamin, MCD peptide, phospholipase-A, hyaluronidase. Bee venom dries in a short time and crystallizes. Bee venom quality varies depending on the technical structure of the collection unit and method, nectar flow, type and amount of pollens, weather conditions, age of bees and strength of the colony. If the bee venom is exposed to oxidation and moisture, its color will change and its medicinal quality will deteriorate. Improper methods can reduce the effectiveness of bee venom. Although it's a new sector in our country, bee venom has a developing market trend in the world. It's evaluated in the pharmaceutical industry, especially because its use in Apitherapy. Creams, ointments and needle solutions are produced from bee venom, and these are used successfully in treatment of neurodegenerative diseases such as MS, Alzheimer's and rheumatic diseases. Developing nano-bee venom production technology shows promising results in treatment of geriatric and cancer diseases. Beekeepers' problems in production and marketing of bee venom can be overcome with support and governmental incentives. The development of advanced bee venom innovative products will open new market opportunities in bee products industry.

Key words: *Honey bee, bee venom, innovation, marketing, health*

Introduction

Obtaining venom from honey bees dates back to ancient times. It is known that in ancient Rome and Egypt, bee venom was obtained and used in the treatment of various diseases. The techniques of producing bee venom have changed in the process that has lasted until today. In the past, obtaining bee venom, which caused bee loss, is now carried out with modern techniques and devices in a way that allows bees to continue their lives. Bee venom is produced in bees' acid and alkaline glands connected to the venom gland by a canal and stored in the venom sac. Bee venom is a bee product with

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a colorless, sharp and bitter taste, raw banana odor, slightly acidic (pH 5.0-5.5) structure. It contains peptides, active amine and enzymes such as histamine, mellitin, apamin, MCD peptide, phospholipase-A, hyolodinase. Bee venom, which is clear and acidic, dries in a short time and crystallizes. After drying, it loses 65-70% of its weight in 20 minutes at room temperature. The amount of venom of an individual honey bee varies from 0.05 to 0.3 ml/bee, depending on the season and the age of the bee. However, after drying, approximately 0.1 ml of pure dried bee venom is obtained per bee. Accordingly, it is possible to obtain 1 g of bee venom from 10,000 bees. In bee venom solutions, 0.1 ml venom solution has the venom effect of approximately one bee.

Factors Affecting Bee Venom Collection

The technical structure of the bee venom collection unit, the collection method, nectar flow, the weather conditions, and the chronological age of the bees in the hive during collecting venom have a direct effect on the bee venom quality. The most suitable season for collecting bee venom is early spring and late autumn. During these periods, the amount of pollen coming from the environment is quite high. Pollen is the most important food ingredient in the formation of bee venom. The higher the amount of pollen in the environment, the higher the quantity and quality of bee venom is expected. Therefore, prolonged nectar flow periods are very economical for bee venom production.

In honeybees, the venom sac is filled with venom again within 3 to 6 days, depending on the weather conditions, the nectar and most importantly the state of the pollen sources. However, to obtain the highest amount and good quality of bee venom from the same colony, it is recommended to leave an interval of 10-14 days between two collection times. In addition, it has been determined that in case of frequent production, bees learn to be more careful about releasing their venom and they tend not to leave their venom. For the bees to erase this information in their memories, it is recommended to obtain venom at the earliest 14-18 days after the same colony (Simics, 1998).

There is a small amount of bee venom in newly matured 1-day old bees, but they are not able to sting because the sting is not yet hard enough during this period. After second day, the activity of the acid gland increases, and the production of bee venom reaches its highest level in 16-19 days old bees. For this reason, a large amount of bee venom can be collected in colonies which has a high number of guard bees.

The highest quality bee venom is obtained from strong and healthy colonies. The venom collection unit can be placed in front of the hive (flying board), inside the hive (between frames) or at the top of the hive (cover). The collectors that placed in front of the hive has a risk of contamination with the waste of the bees, with nectar or pollen. Besides, although with a lower risk of contamination, the cover ones, have the limitation that the collector area is restricted by the down face size, because it works as a cover at the top of the hive (Serrinha *et al*., 2019). It has been determined by studies that after venom collecting, the normal life cycle of bees continues. In addition, it was determined that

there was an increase in feed conception after venom collecting, it that seems to the alarming or stimulation of worker honey bee by electrical impulses from bee venom collector so, it increasing the worker hoarding behavior (El-Saeady *et al*., 2016).

Innovation in Bee Venom Collection

Obtaining bee venom to be used in biochemical and medical research was facilitated by the realization that electric shock induces stinging. This method was later used to collect venom from both honeybees and other stinging bees without causing them to die. Besides, some volatile components such as histamine can disappear when bee venom is collected by electrical stimulation (Abd El-Wahed *et al*., 2017).
In general, bee venom collectors have four parts as, battery of 12–15V and 2 Amp; AC 25V; 1200 Hz powered by, or directly plugged into the power grid; electrical impulse generation with frequency from 50to 1000 Hz, duration of 2–3 sec and pauses of 3–6 sec; Electrical stimulator–surface that consists of stretched uninsulated wires, at a distance of 3–4 mm from each other and glass slide on which the bee venom is secreted (Bogdanov, 2017). The device that is used to collect venom consists It consists of a main frame measuring 42.54 X 36.20 cm, on which copper or steel wires are stretched at 3.18 mm intervals. It is framed under the wires with laths 6.35 mm wide and 3.96 mm deep on a piece of plywood measuring 37.07 X 40.32 cm and 15.88 mm thick. A piece of glass of 40.00 X 30.80 X 1.57 mm is also placed inside the frame, between the frame and the board. A taffeta cloth is stretched over the glass surface and fastened tightly with a fastener. (The reason why taffeta fabric is preferred is that it is slippery, and the needles of the bees cannot cling to the fabric). The board is raised so that the taffeta touches the bottom surface of the strings. The most suitable material used to obtain bee venom is taffeta, but sometimes thin rubber-like rubber can also be used. Bees cannot get between the nylon threads of the fabric, but they get into the needle pores. The pores of the taffeta weave are 0.18-0.22 mm wide between the longitudinal threads and the gap between the transverse threads is 0.3-0.32 mm. Tissue eyes are rectangular and square in shape. The thickness of the fabric is approximately 0.035 mm and generally varies between 0.02-0.05 mm. The optimal time for electro-stimulation is 30–60 min, while the optimal break time is 45–90 min (de Graaf *et al*., 2020). The collection frames are connected by wires and are connected to the control panel. The venom collection process takes 30 minutes and during this time, the wires are automatically given current at short intervals. When the bee completes the circuit by touching the two wires, it receives a mild electric shock. As a result of this, the bee starts to insert its stinger on the glass surface. Only 5-15 bees are lost per hive in the 30-minute process of obtaining bee venom. This number reveals that there is an average loss of 6.8 bees per hive. With the help of this advanced tool, many criteria such as frequency, voltage, wave length and time intervals can be evaluated. Another benefit is that with a single control panel, a number of aggregation frames ranging from 1 to 40 can be processed simultaneously. This also saves time. The taffeta fabric used protects the bee venom from contamination. Thus, the bee venom is stored between the glass and the taffeta

fabric. The alarm pheromone in bee venom alerts other bees to sting their stings on the same surface. After about 30 minutes, the frames are taken from the hive, placed near the hive entrance hole, left for 10 minutes and the bees are allowed to return to their hives. The frames are collected and packed in their boxes and taken to their storage locations.

Bee venom dries easily under protective material. Taffeta can get wet because more bee venom is obtained from some colonies than others. In this case, the cloth is ventilated for a few minutes and used after drying. If this is not done, the bees will become extremely aggressive. Bee venom that dries on the glass under taffeta is easily removed by scraping with a razor blade. During the procedure, the venom can make the beekeeper sneeze and irritate the eyes. Bee venom is obtained in the form of crystals. With the fully computer-controlled venom collection units developed in recent years, higher quality and purity, higher therapeutic power can be obtained.

Innovation in Conservation of Bee Venom

Harvested bee venom must be stored in a cool and shaded place, in dark-colored amber bottles sealed with wax and delivered to the buyer. The most important point here is to obtain pure dry bee venom. In other words, the bee venom must be protected against any risk of contamination.

Pure bee venom is normally a colorless liquid. It is snow-white when dried, and bee venom solutions prepared from this venom have water clarity, even in very high concentrations. It has been proven in studies that high quality and pure bee venom solutions can maintain their effect for many years. If the bee venom is exposed to oxidation, moisture, its color changes to brown-yellow. Color-changed bee venom has less healing power.

In recent years, it has been shown that bee venom harvesting has a protective effect against varroa in hives. In the researches, it was determined that the varroa population decreased significantly in colonies where bee venom was obtained due to the evaporative smell of bee venom. Also, it was determined that bee venom collecting effects and increases hygienic behavior of honey bees which means have the ability to detect, uncap, and remove diseased brood from their nest before the causative organism reaches the infectious stage (El-Saeady *et al*., 2016).

Although it is a very new issue in our country, it is seen that there is an increasing demand for bee venom in other European and North American countries. Bee venom is offered for sale in different forms such as solution, cream, ointment and injection, depending on the type of disease. However, the most common use in the world is bee venom solution. The solution is very easy to prepare. In this method, called "cold preparation" which frozen dry bee venom is used. It is prepared by adding distilled water in a 1:1 ratio. Another method is to dissolve bee venom in a heated, sterilized isotonic salt solution and filter it through microporous filter paper. However, the disadvantage of this method is that the heated salt solution somewhat destroys the active components in the bee venom. For this reason, its effectiveness is so low that it cannot be compared

with the venom obtained from the live bee. Evaporative fractions in the venom are lost during bee venom milking. However, it is not known for now whether these fractions have a healing effect or not. Improper preparation methods can reduce the effectiveness of bee venom.
It is known that the curative effect of bee venom, which has been oxidized and stored under bad conditions, is less than the bee venom obtained under suitable conditions and stored in healthy conditions (Simics, 1999).

Marketing of Bee Venom

Although it is a very new sector in our country, it is observed that bee venom exhibits a developing market trend in Europe and North America. Bee venom is evaluated in the pharmaceutical industry, especially its usage in apitherapy. The sale price varies depending on the amount, quality, collection time and source of the bee venom. Since there is no bee venom market in our country, no specific sales figures have been found. The most important issue for the manufacturer is to be able to provide the purchasing company with information about the quality of the product, its use, safe dosage adjustments, and health inspection. The most economical way for bee venom producers may be to act with a common sales strategy. Otherwise, it will be necessary to spend a lot of time and effort for this new and slowly developing market. Although it may seem difficult in the short run, acting with a joint sales strategy will bring more profit in the long run. In addition, to ensure that the bee venom produced by beekeepers in our country can be easily marketed, some supportive and encouraging measures should be taken by the state. There are different kinds of venom such as: pure whole dried, whole dried and freeze-dried (lyophilized) bee venom. Optimal quality of bee venom can be achieved when it is harvested correctly. Contamination with bee faeces, dust, pollen, honey and other bee hive components should be avoided (Bogdanov, 2017). The most common bee venom marketing methods today are:
Pure Dried Bee Venom: It is completely snow-white in color and is uncontaminated bee venom. It is characterized as the highest quality (1st class) bee venom. Bee venom requires great care in collecting, processing, and storing.
Dried Bee Venom: Its color is yellowish-brown and may be contaminated with foreign substances. It is characterized as a lower quality (2nd class) bee venom. It is harvested without any preservative on the glass surface. The bees are in direct contact with the glass surface.
Liquid Bee Venom: In this method, bees drain their venom into pure water. With this method, some dry and evaporative substances in the venom are also collected. It is very difficult to obtain. It is not a commonly used method (Simics, 1995).

Innovative Use of Bee Venom in Health

Although it is a new sector in our country, it is observed that bee venom has a developing market trend in the world, and it is evaluated in the pharmaceutical industry, especially

because it is used in Apitherapy. Creams, ointments and injection solutions are produced from bee venom, and these are used successfully in the treatment of neurodegenerative diseases such as Multiple Sclerosis, Alzheimer's and rheumatic diseases. The developed nano-bee venom production technology shows promising results in the treatment of geriatrics and cancer diseases. Mellitin, one of the most important active ingredients of bee venom, has a direct effect on the nervous and muscle systems, helping to treat many diseases of neurological and physical origin. In recent years, bee venom applications have shown promising results in the treatment of various cancer types and AIDS cases.

Conclusion

Marketing of bee products and bee products has become increasingly important in recent years. For our country, which has an extremely large beekeeping potential, the evaluation methods of bee products should be put into practice in a short time. Necessary attention should be given to the subject with the courses to be organized on the acquisition, preservation and marketing of bee venom. The fact that the producer acts with a common sales strategy in bee venom production can bring high profits by allowing the product to be marketed more in the long run. The problems of beekeepers in the production and marketing of bee venom can be overcome with the support and incentives to be provided by the state. The development of advanced bee venom innovative products will open up new market opportunities in the bee products industry.

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