Hive Management and Beekeeping

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CHAPTER 1

AN OVERVIEW OF THE TECHNOLOGICAL ASPECTS OF BEEKEEPING

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ABSTRACT:

History portrays people as stewards of nature, using it for human wealth. However, in order to benefit from honeybee products or their pollination services, people must care for and help the bees rather than harming, murdering, or dominating them. The first beekeepers were motivated by their desire for survival, sweetness, and adventure. There is no question that the first interactions between hunter cultures and beehives in the African woodland, savannah, or on the tops of mountain cliffs were excruciatingly unpleasant. The habitat is supported by people while the bees continue to behave organically. Prior to the direct husbandry of bees by humans, "honey hunting" was the preferred technique for obtaining wild honey. From ancient times, honeybees were maintained in Egypt. Ancient Egyptian artifacts from the Old Kingdom provide the oldest evidence of hive beekeeping. The wisdom and observations of several beekeepers from antiquity were used to create the mobile hives. These hives could all be transported on boats and pack animals. In Egypt, traditional pipe hives built of mud or clay are still used by peasant beekeepers today. They are piled together to mimic logs and are approximately a meter long.

KEYWORDS:

Beekeeping Technology, Hive Monitoring Systems, Beehive Automation, Beekeeping Innovations, Apiary Technology.

INTRODUCTION

Beekeeping as a profession is not a recent development. It is one of the earliest known processes for producing food. Drawings from the Late Paleolithic or possibly Mesolithic periods show that prehistoric man was familiar with wild bees and honey. The first indication of beekeeping dates to around 13,000 BC and is seen in rock paintings. It was especially well-developed in Egypt, and the Roman authors Virgil, Gaius Julius Hyginus, Varro, and Columella all wrote about it. The Hindu scriptures, the Vedas, describe honey gathering using cane ladders by putting bees to sleep with smoke and bringing down the comb in animal skin containers. That significant Neolithic Revolution in the Near East, which established and settled man as a farmer, very likely included the semi-domestication of bees [1]. Bronze castings, which were used in the late Bronze Age that followed, included covering a clay model with wax, showing that bronze-smiths would not have depended only on a supply from wild bees. There are over 30,000 species of bees with names. The majority of bee species are solitary, yet many of them gather nectar that they turn into honey and store as a food source. Only the enormous colonies created by sociable species are able to store significant amounts of honey. These bees are stingless bees from the genera Trigona and Melipona, and some of them are honey bees from the genus Apis. Man has been using these creatures for thousands of years as a resource.

Tomb paintings in Egypt that depict beekeeping as far back as the Minoan period illustrate the practice of managed honey production. Jewish rules from approximately 597 B.C. include

more evidence and address issues like gathering honey on the Sabbath and the distance between hives and residences [2]. All of these cultures tried to use a similar strategy to attract honey bees, storing combs in wooden boxes or clay or mud cylinders. The oldest and most primitive techniques of beekeeping were developed by ancient cultures by building these artificial dwellings. Except for a few tiny openings that let bees through, the ends are sealed. This influenced the development of migratory beekeeping today. Unfortunately, contemporary agricultural and beekeeping methods have lost this traditional wisdom, and this loss has had a negative impact on bees on a number of levels. Bees continue to behave naturally, but humans have created a supportive atmosphere for them. Therefore, in order to fix what is flawed and incorrect and overcome these issues, beekeepers must revisit their traditions and history [2].

Bees are exploited by humans in a variety of ways for their honey and other items. Taking into account the diverse bee practices that are still practiced around the world and that can be divided into three working definitions: honey hunting, beekeeping, and a third category, here referred to as "bee maintaining," which lies in between honey hunting and beekeeping - where the beekeeper provides a nest site or protects a colony of wild bees for later plundering that facilitated biological. These techniques simultaneously affected honey bee evolution and raised the value of honey bees in agricultural societies. The honey bees employed in beekeeping nowadays are mostly from Europe, Asia, and Africa. European bees were brought to the Americas, Australia, New Zealand, and the Pacific islands throughout the last four centuries; these locations do not natively contain them. European bees have also been imported to most Asian nations during the last 50 years. The majority of beekeeping and research literature in industrialized nations solely discusses the European honey bee, for which all beekeeping equipment has been designed. However, Apis kerana, which is common in all of the Himalayan nations as well as Indonesia, Japan, Malaysia, Papua New Guinea, Thailand, Vietnam, and presumably more countries, has also been the subject of beekeeping methods that have been developed or are being developed. Because it is simple to do, beekeeping with Apis cerana has become a significant source of revenue for mountain farmers, particularly the poor and excluded [3], [4].

Unknown how many Apis cerana colonies are maintained by farmers nationwide, although sources suggest that there are 120,000 in Nepal and 1.5 million in China's Himalayan area, including 780,000 of them in Yunnan province. In Australia and Central America, non-Apis types of honeybees commonly referred to as stingless bees have also been maintained since ancient times, however these customs are dwindling and the Trigonine and Meliponine species utilized are endangered. John Gedde, who resided close to Falkland in Fifeshire, was one of the pioneers of modern beekeeping and invented a modern hive that made it easier to observe biological processes. In order to give the bees more space, he added a little straw ring, known as a "eke," beneath the hive in 1765. This finally resulted in distinct areas for the honey and the brood. People started learning more about the honey bee's life cycle much later in the Middle Ages. This caused bee farming to significantly grow. The introduction of bees by pilgrims to America in the 1820s sparked a resurgence in interest in beekeeping. People soon started experimenting with different beehive designs. Beekeepers in Europe were employing an open-sided hive, but it wasn't until the middle of the nineteenth century that the modern beekeeping revolution really began.

The development of hinged frames by Geneva's blind Francois Huber at the tail end of the eighteenth century, with the help of a devoted friend and servant, allowed for the study of the bees' internal economics. The American scientist L.L. Langstroth developed the bee-space in 1851, which is the foundation of the contemporary moveable frame hive. He noticed that the

bees wouldn't try to fill the hole with wax if there was a little opening between the frame's combs and the hive's walls. With the advent of the moveable frame, bee colonies could now be managed to a greater extent. It was a significant development in the old skill of the beemaster [4], [5]. Since K. von Frisch's discovery that bees can discriminate between colors in 1915, entrances to hives lined up in a row have regularly been painted in various hues to help bees locate their own colony more quickly and easily. Soon later, it was discovered that by providing them with a wax foundation to build on, bees could be coerced into constructing a straight frame hive. Later, the smoker was developed, and this proved to be a useful safety tool for avoiding stings. Beekeeping has advanced considerably. There are presently thought to be 200,000 active beekeepers and more than three million hives in the USA alone.

The next significant development, pre-fabricated wax "foundation," gave the beekeeper even more control. Bees were thought to spend an excessive amount of time and energy creating wax comb, and if they could be "helped along" by the supply of thin sheets of wax, they should be imprinted with an appropriate hexagonal design. A flood of inventors and innovators who refined beehive design and production, management and husbandry methods, stock enhancement via selective breeding, honey extraction, and marketing emerged throughout the nineteenth century. Among them, Jan Dzieron was revered as the founder of contemporary apiculture and apiology. All beehives in use today are descended from his invention. The renowned Langstroth is known as the "father of American apiculture". The Hive and Honey-bee, his best-selling novel, was released in 1853. Moses Quinby, regarded as the founder of American commercial beekeeping, wrote the book Mysteries of Bee-Keeping Explained. The production of hives and the marketing of bee-packages in the United States were pioneered by Amos Root, author of the book A B C of Bee Culture. C.C. Miller, one of the first businesspeople to truly earn a livelihood from apiculture, penned the classic book Fifty Years with the Bees. Major Francesco De Hruschka created a simple device that uses centrifugal force to remove honey from the comb. The contemporary honey business was sparked by this one innovation, which significantly increased the efficiency of honey gathering. Walter T. Kelley, an American who considerably improved beekeeping gear and attire, was a pioneer of modern beekeeping [6].

History of Beekeeping in Asia

Man collected honey from Asian bees via honey hunting, which is the looting of their hives. Initially, societies scavenged for honey in trees and around rocky outcrops where bees often constructed hives. Honey needed to be easily available for collecting since it was employed not just as a food source but also as a component of religious rites and a medicine. Everywhere the giant honey bee is found in Asia, including the Gurung tribesmen in the Himalayas, the Sundarbans of Bangladesh, the people who live in the rain forests, Malaysia, and the river deltas of southern Vietnam, honey hunters have their own traditions for taking advantage of the bees[7]. Because Apis kerana, like European Apis mellifera, can be housed and controlled within a hive, it is also known as the Asian Hive Bee. Since European Apis mellifera was transported to much of Asia, it's possible that it currently predominates in China, Japan, Thailand, and other Asian nations.

i. Afghanistan

In various regions of Afghanistan, including Nuristan, Kunar, Nanghahar, and Pakitia province, traditional beekeeping with kerana bees is practiced. With Turkey's assistance, modern beekeeping began in 1940 but did not provide much honey. The FAO bought 100 colonies of Italian bees in 1953. Since then, 4,000 hives have produced 60 tons of honey as Apis mellifera grew. However, the ensuing conflict in 1979 caused the destruction of

numerous colonies, and a large number of expert beekeepers moved to Pakistan. A beekeeping center opened in Darulaman in 1987. Iran once again provided 100 hives with tools and equipment in 2002, and beekeeping operations were resumed[8].

ii. Bangladesh: Beekeeping and Honey Production

The practice of beekeeping dates back at least 400 years. In the nation, searching for honey is an almost ancient tradition. Beekeeping or bee raising in wooden hives likely began in 1940 under Mahatma Gandhi's self-reliance program. In the Sylthet district's tea-growing regions in the 1950s, experimental beekeeping was conducted. In the 1960s, BSCIC began beekeeping in the Bagerhat district's Jatrapur. Due to unsuitable technology, the outcome was unsatisfactory over this whole era. BSCIC restarted beekeeping in 1977 in a contemporary and scientific manner. BSCIC has taught about 18,000 target individuals in beekeeping since its beginnings. Today, several additional governmental and non-governmental organizations have successfully launched beekeeping programs. Three different bee species, Apis dorsata, Apis cerana, and Apis florea, are present in Bangladesh. In addition to these bee species, Apis mellifera was experimentally introduced in Bangladesh in 1992, and thanks to a better honey output, it is currently becoming more and more well-liked throughout the nation. Understanding the seasons for honey and pollen flow requires knowledge of the plants that are good bee feed and how long they blossom for. Just 9% of the total land area is covered by forests. Bangladesh produces the majority of its honey from Apis dorsata. The overall honey output in the nation grew from 596.20 tons in 2002 to 1109.50 tonnes in 2005 as a result of the joint efforts of organizations like the Bangladesh Institute of Apiculture, Bangladesh Small and Cottage Industries Corporation, and other National and International organizations. Despite the fact that the nation's projected honey consumption is 2,500 MT, it is also steadily rising [8].

Beekeepers work in the beekeeping industry, and 1,000 of them use scientific beekeeping management techniques to produce commercial honey. Around 800-900 MT of honey are produced in this nation. The majority of bee hunters use conventional techniques to harvest honey from these colonies. Locally, harvested honey is offered for sale at a discount. Although there are many colonies of these bees in the Sunder ban mangrove forest, they are present across Bangladesh in their natural state. There are now 12 subspecies of A. cerana known to science in Bangladesh. In Bangladesh's sunder ban desert, apis florea may also be found. There are many flowering plants all throughout the country that bloom throughout the year and provide honeybees a significant amount of pollen and nectar. Brassica napus, Litchi chinensis, Zizyphus jujuba, Moringa oleifera, Cocos nucifera, Helianthus annus, Eugenia jamolana, Coriandrum sativum, Citrus sp., and Sesamum indicum are a few of the most significant bee plant species. Raphanus sativus, Brassica sp., Mimosa pudica, Mimusops elengi, Mikania scandens, Musa balbisiana, Mangifera indica, Leucas aspera, and Linum usitatissimum are some more significant sources of honey.

iii. Bhutan: Beekeeping and Honey Production

Bhutan has the largest percentage of forest cover among the other South Asian nations and is ideal for industrial beekeeping. The variety of blooming plants in the nation is vast. These materials may be used to produce organic honey. The Italian bee, Apis mellifera, and the five kinds of honeybees, Apis cerana, Apis florea, Apis dorsata, and Apis laboriosa, are all found throughout the nation. Only the southern foothills support Apis florea. However, from November to March, Apis dorsata may be widely found in forested places. Apis laboriosa is widely distributed in Bhutan's mountainous and temperate regions. Due to severe regulations governing environment protection, honey harvesting is prohibited in Bhutan. According to

the information that is currently available, the honey produced in 16 out of Bhutan's 20 districts is regarded as organic since pesticides are seldom utilized. On the other hand, there is no thorough information on bee flora and the length of their flowering period. Since Mr. Fritz Maurer introduced Apis mellifera beekeeping in 1986, it has been practiced in the area of Bumthang Dzongkhag, which is conveniently positioned. Even though Apis cerana bees are found in all 20 districts of Bhutan, only eight southern foothill districts have Beekeeping with A. cerana. In Bhutan, apis cerana colonies posed no significant risks from illnesses or pests. Due to inadequate colony management, there is an occurrence of European Foul Brood in apis mellifera colonies in Bumthang. As a result, there are no beekeeping training facilities or beekeeping development personnel employed by the Royal Government of Bhutan's Ministry of Agriculture. The sole body in Bhutan that oversees beekeeping development, notably in the Bumthang area, is the Beekeeping Association of Bhutan. In Bhutan's Tsirang, Dagana, and Sarpang provinces, 1,800 Apis cerana colonies are managed by roughly 822 beekeepers. The average annual yield of honey by Apis mellifera colonies in Bumthang ranges from 3 to 40 kilogram. 8,500 kg and 11,753 kg of honey were produced in 1998 and 2005, respectively[9].

iv. Myanmar

500 tonnes of Asian rock bee honey are estimated to be harvested annually in Myanmar by beekeepers. Work on the introduction of European honeybees began in Burma in 1979 under the direction of Polish doctor Cyprian Zmarlicki. He discovered five Australian-sent colonies in 1979, along with one American-sent nucleus colony. The number of European bee colonies in Myanmar is now close to 1,000, taking into account the progress accomplished in the neighboring Thailand. According to estimates, Myanmar has a lot of potential for beekeeping.

v. India

Though it has been practiced scientifically for many years and is mentioned in ancient Vedic and Bodhi texts, the history of scientific beekeeping in India is not very old. Both A. cerana and A. mellifera occupy unique floral and geographic niches. As far as India's flora is concerned, inter-specific competition is not an issue since all of the aforementioned species are renowned for providing crop-specific pollination services. Due to its high production, A. mellifera beekeeping is now widespread across the nation and is quickly becoming established in places like the Punjab, H.P., J&K, Uttrakhand, U.P., West Bengal, Bihar, Jharkhand, Assam, Orissa, A.P., M.P., Rajasthan, Maharashtra, Kerala, etc. In H.P., J&K, Uttaranchal, Assam, A.P., Karnataka, Maharashtra, T.N., Kerala, etc., A. cerana is being hived. The first unsuccessful efforts to retain Apis cerana F. bees in mobile frame hives in India were undertaken in Bengal in 1880 and in Punjab and Kullu Valley in 1883–1844. Rev. Newton began teaching beekeeping in South India in 1911, taught a number of rural residents there, and created the A. cerana hive, which is currently known by his name and was designed specifically for the climate of India [10].

In Travancore and Mysore, respectively, beekeeping practice was started in earnest in 1917 and 1925. Beekeeping in rural India received a boost from the Royal Commission on Agriculture's advice to establish cottage industries. After that, beekeeping practice was really started in Madras in 1931, the Punjab in 1933, 1934, and UP in 1938. The All-India Beekeepers Association was established in 1938–1939 by organized Indian beekeepers. Mahatma Gandhi recognized the value of the beekeeping sector and included it into his plan for rural development. Following independence, the Indian government decided it would be a good idea to restore a number of traditional businesses. To this purpose, the All India Khadi

and Village businesses Board was established. This Board was also given the responsibility of developing the beekeeping business. The Khadi and Village Industries Commission, a statutory agency under the Ministry of Industry, was eventually established from this Board in 1956. The beekeeping sector didn't get major attention for its growth in a coordinated way throughout the nation until the formation of KVIC at the industry level and Khadi and Village Industries Board at the state level.

DISCUSSION

The Khadi and Village Industries Commission founded the Central Bee scientific and Training Institute in Pune in 1962 after realizing the need of a solid scientific foundation for the advancement of beekeeping. The institution, which has been doing bee research and training for 50 years, is now Asia's leading source for information on beekeeping technology and research. Field-oriented research programs were conducted by several scientific fields including apiculture, bee botany and pollination, bee chemistry, entomology, wild bees, and training at CBRTI. In various agroclimatic environments, Zonal Beekeeping Extension Centers and Branch Extension Centers with experimental apiaries have been developed. The organizational structure of CBRTI is distinctive since it handles all connected beekeeping-related issues under one roof[11]. The institution sent the Bureau of Indian Standards around 19 draft standards to help develop Indian Standards for beekeeping tools and bee products.

Organizations like the Bureau of Indian Standards, agmark, and apeda gave cbrti national prominence. It was approved as a Center for Postgraduate Studies by the University of Poona. London is acknowledged as the International Bee Research Association's Asian branch library.From central Iran to the Zagros and Taurus Mountains, through Anatolia and the Levant, and into Egypt, the so-called European honeybee may be found in the Near East. As will be demonstrated, there is convincing evidence that hive beekeeping existed in the ancient Near East. The sole apiaries discovered thus far from excavations in the ancient Near East were found during Mazar's excavations at Tel Rehov in northern Israel. Although beehives and beekeeping facilities are shown in several Egyptian representations and are referenced in manuscripts from different regions of the ancient Near East, archaeologists have not yet discovered any evidence of such a sector of the economy.

The Tel Rehov apiaries were found within a sizable city that was heavily populated and constructed during the tenth and ninth centuries BCE. There are no written references to beekeeping in ancient Syria-Palestine until the late Hellenistic period, despite the fact that the first evidence for hive beekeeping originates from the Old Kingdom of Egypt[12]. The stele of Samas-res-uzur, a regional ruler on the Syrian Euphrates in the middle of the eighth century BC, claims to be the first to have brought bees down from the highlands and contains the first written reference of beekeeping in the cuneiform record: Some prehistoric societies gave bees and bee products a great lot of importance. A plea from beekeepers in the Faiyum oasis asking to have their hives transferred by donkey due to irrigation floods is documented on an Egyptian papyrus from about 250 BC. circa Egypt circa 1740, migratory beekeeping was recorded by a French visitor. While Libyan nomads exchanged honey and wax for sugar, tea, rice, and textiles, Israeli Bedouins moved their hives from the Galilee to the Golan and back. The method used to transfer bee species to new places was migratory beekeeping. For instance, it's believed that Baluchistan in Pakistan brought beekeeping to Iran.

CONCLUSION

For rural and indigenous populations in Malaysia, honey hunting continues to be a secondary source of income. Even while forest honey is often not exported across borders, it nonetheless contributes significantly to local economies. Malaysian apiculture is significantly

undeveloped compared to Thailand and Vietnam, despite government efforts since the 1980s to encourage this sector. As a result of the combined research and development of the Malaysian Beekeeping Research and Development Team, which was financed by the International Dutch Research Council, modern beekeeping has been practiced in Malaysia since 1981. In addition to the Department of Agriculture, organizations like the Rubber Research Institute Malaysia, Rubber Industry Small Holders Development Authority, Malaysian Agricultural Research and Development Institute, and University Petronian Malaysia also provided special-area extension services. The majority of local beekeepers preserve the Asian species Apis cerana. More established apiaries on the West Coast, particularly those in Melaka, Johor, Selangor, Negeri Sembilan, and Perak, include Apis mellifera. In Malaysia, apiaries are mostly small-scale operations that are dispersed across the countryside and suburbs. Migratory/mobile beekeeping is less frequent in Malaysia, despite the fact that it contributes to the achievement of the essential goal of having robust and healthy hives at the beginning of the nectar flow and provides money from honey and pollen harvests. In 2002, 118,801.90 kg of honey were produced in total. For different projects, Apis mellifera generated an average of 25.15 kg of honey per hive, but Apis kerana only produced 2.5 kg per hive annually. Another kind of honey, Apis dorsata, is gathered from wild honeybees. The weather has perhaps the greatest impact on bee nutrition and, therefore, global bee output. The most significant weather factor that has an impact on beekeeping is rainfall. Actually, Malaysia is blessed with a variety of bee plants. Of the 46 species of bee plants examined in Selangor, 21 species were major bee plants, 3 were minor bee plants, and 12 were pollen plants, according to a survey study by Mardan and Osman. It was discovered that 33 of these species continued to bloom throughout the year. In Malaysia, in addition to Apis millifarad, Apis kerana species are also used to produce honey. When compared to major producers throughout the globe, Malaysia produces a relatively little quantity of honey. Malaysia continues to import significant amounts of inferior honey from China, Australia, and the US.

REFERENCES:

[1] R. Kumar Gupta, W. Reybroeck, J. W. Van Veen, and A. Gupta, Beekeeping for poverty alleviation and livelihood security: Vol. 1: Technological aspects of beekeeping. 2014. doi: 10.1007/978-94-017-9199-1.

[2] A. S. Khan, V. D. de Matos, and P. V. P. Sales Lima, “Desempenho da apicultura no estado do Ceará: Competitividade, nível tecnológico e fatores condicionantes,” Rev. Econ. e Sociol. Rural, 2009, doi: 10.1590/S0103-20032009000300006.

[3] R. K. Gupta, “Taxonomy and Distribution of Different Honeybee Species: Vol. 1: Technological Aspects of Beekeeping,” in Beekeeping for Poverty Alleviation and Livelihood Security, 2014.

[4] D. Rutz et al., “Short rotation coppice moving forward in a bio-based ecomony,” in European Biomass Conference and Exhibition Proceedings, 2016.

[5] D. Rutz et al., “Short rotation woody crops: Experiences from the eu project srcplus,” in European Biomass Conference and Exhibition Proceedings, 2017.

[6] P. Zoccali et al., “A novel GIS-based approach to assess beekeeping suitability of Mediterranean lands,” Saudi J. Biol. Sci., 2017, doi: 10.1016/j.sjbs.2017.01.062.

[7] C. Phillips, “Following beekeeping: More-than-human practice in agrifood,” J. Rural Stud., 2014, doi: 10.1016/j.jrurstud.2014.06.013.

[8] A. Zacepins, V. Brusbardis, J. Meitalovs, and E. Stalidzans, “Challenges in the development of Precision Beekeeping,” Biosystems Engineering. 2015. doi: 10.1016/j.biosystemseng.2014.12.001.

[9] S. Lorenz and K. Stark, “Saving the honeybees in Berlin? A case study of the urban beekeeping boom,” Environ. Sociol., 2015, doi: 10.1080/23251042.2015.1008383.

[10] E. E. Stange, G. Zulian, G. M. Rusch, D. N. Barton, and M. Nowell, “Ecosystem services mapping for municipal policy: ESTIMAP and zoning for urban beekeeping,” One Ecosyst., 2017, doi: 10.3897/oneeco.2.e14014.

[11] K. Traynor, “The Tears of Re: Beekeeping in Ancient Egypt,” Am. Entomol., 2016, doi: 10.1093/ae/tmw069.

[12] G. S. Minja and T. J. Nkumilwa, “The Role Of Beekeeping On Forest Conservation And Poverty Alleviation In Moshi Rural District,Tanzania,” Eur. Sci. Journal, ESJ, 2016, doi: 10.19044/esj.2016.v12n23p366.

CHAPTER 2

AN EXPLORATION OF THE HONEYBEE SPECIES

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ABSTRACT:

All three of the island's main honeybee species, Apis cerana, Apis florea, and Apis dorasta, are often seen. Apis florea is the only species found in Sri Lanka's arid climate zones and is largely adapted to all climatic conditions, with the exception of higher altitudes, showing that it does not favor milder climes. Sri Lankan beekeepers focus on the environmentally sound native Apis cerana for the production of commercial honey. About 29.9% of Sri Lanka's total land area is covered by forest. Beekeeping in the nation is supported by the country's primary plantations, including rubber, eucalyptus, and coconut. The nation offers abundant floral resources for eco-friendly beekeeping. There is no accurate data on the number of bee colonies, however it may be estimated that beekeeping produces roughly 40 MT of honey. On the basis of the variety and availability of bee pasture within them, four beekeeping zones in Sri Lanka have been defined. The 161,000-ha rubber zone, which is located in the low, damp zone, is ideal for beekeeping. Although it hasn't been completely explored, it is a viable location for beekeeping and honey production.

KEYWORDS:

Apis Mellifera, Honeybee Diversity, Honeybee Classification, Bee Species, Honeybee Biology, Honeybee Subspecies, Honeybee Evolution.

INTRODUCTION

Approximately 4,500 km2 of the districts of Badulla and Nuwara Eliya are covered by a eucalyptus zone. The area has the potential for beekeeping because of the many types or variations of eucalyptus. Eucalyptus camaldulensis and E. teratorns are the two primary species. In certain sections of the Intermediate zone, small patches of E. citriodora, E. grandis, and E. prophyll have been planted. A healthy colony of Apis cerana might produce 20 kg of honey during the months of August and October, which is when the honey flows. About 25% of Sri Lanka's total land area is in the country's forest zone. Around 1,600,000 acres of the natural forest are covered with a variety of blooming plants that may be used as sources of honey throughout the year[1]. The extent of the coconut zone is around 395,000 acres. In this region, beekeeping has been quite successful since the coconut is the best pollen plant. In locations beyond the Rubber and Eucalyptus zones, it is estimated that 5 to 10 MT of honey are generated year. This is mostly owing to the coconut plant, which acts as a maintenance fodder plant and benefits from the small honey flows of other honey plants. The central organization for the development and promotion of beekeeping is the Ministry of Agriculture. Due to a number of limitations and a lack of training for the inexperienced beekeepers, beekeeping is not well established on the island country.

i.T aiwan:

There has always been a connection between man and bees. On the island where it was customary to obtain honey from wild bees, native local bees do in fact abound. Despite the fact that this native bee also carries the Varroa parasite, infection may be controlled with treatment. These bees produce a highly sought-after honey that costs 10 times as much as honey from European bees. Each hive generates roughly 10 kg, which is just half what a

colony with European bees would produce. These days, we can see a growing level of interest among professionals in these very adorable and gentle young bees [2]. They adapt to our framework hives really quickly, but if you chance to smoke them too much, they may abruptly leave. These little bees are often seen in the various crevices of Buddhist temples, which provide them with a superior haven.

However, the European bee was brought from Italy years ago in order to boost honey production. The island in the China Sea is a splash of lush greenery due to the tropical heat and 2,250 mm of annual rainfall. We may include longani, litchi, citrus fruits, buckwheat, and paper tree as some of the key melliferous plants. Tea, rhus, and rapeseed are among of the sources that are high in pollen. Managed pollination is often used in greenhouses, open fields, and market gardening, such as with strawberry plants, cucumbers, and other plants. There are typically just 200 to 250 hives on a bee farm. The ten-frame Langstroth type hives are managed using a moveable queen-excluder grid [3].

On each side of the cell-cup bars of the frame in the queen less portion are two brood-frames. They are routinely fed sugar syrup every time they are touched. Italian bees, who are exceptionally gentle and have been successfully chosen for years due to their high royal jelly output, are the predominant species in all of these colonies. While just 4,000 metric tons of honey are produced year, approximately 350 metric tons are produced annually from royal jelly. After China, which produces more than 600 metric tons annually under comparable labor circumstances, it is the second-largest producer in the world. The remainder is consumed domestically, with half of the produce going to Europe and Japan. It is believed that Taiwanese royal jelly is of higher quality than that made in China or Thailand. On the international market, it is offered for double the price. The technology for producing royal jelly was primarily developed in Japan in the 1940s. Always keep in mind that this nation still imports more royal jelly than any other, at more than 400 metric tons annually [4].

ii. Thailand:

There are no records to back up the beginning of traditional beekeeping with the native honey bee, Apis cerana, in the coconut plantation regions of Samui Island in southern Thailand. However, records found at the Apiculture Research Institute's bee museum in Beijing, China, indicate that Thai beekeeping really started in Xishuang Banna, in the southern Yunnan province, China, some 1,000 years ago. Additionally, it seems from various old medical texts that honey has been often combined with a number of medicinal plants to create traditional Thai remedies. In Thailand's traditional pharmacy shops, this method is still in use. The variety of honey bee species in Thailand, honey hunting from A. dorsata nests, beekeeping with A. cerana and A. mellifera, bee products in Thailand, and infections, parasites, and predators of honey bees are all covered in this essay[5]. About 60 years ago, Apis mellifera was introduced to Thailand for use in beekeeping. Colonies in North, Central, Northeast, and South Thailand share three common and five uncommon composite haplotypes.

In Thailand, beekeeping using A. mellifera is quite productive. The production of honey from this plant is essential to Thai agriculture. It is used to pollinate various crops, including longans, litchis, durians, and rambutans. Although the primary goal of beekeeping is to produce honey, some beekeepers also concentrate on creating royal jelly, beeswax, bee colonies, or queen bees. Bees are provided by certain beekeepers to pollinate crops. Because each sort of operation involves a unique set of skills and management strategies, beekeepers often focus on only one kind of production. In Thailand, just two thirds of honeybee colonies are employed to pollinate crops. These colonies are mostly used to pollinate bitter weed, sesame, sunflower, longan, and lychee. More than a thousand beekeepers in Thailand

maintain more than 200,000 colonies of A. mellifera Apis cerana. Southern Thailand's major beekeeping regions are Chumphon, Surat Thani, Nakhon Si Thammarat, Trang, Phattalung, and Songkhla[6], [7].

iii. Turkey:

Since the earliest Anatolian traditions, Anatolian Turk Principalities, Seljuk States, and Ottoman States, beekeeping has been a common practice in Turkey. All seven of Turkey's geographical areas have seen rapid growth in the beekeeping industry since the end of World War II due to the country's consistently favorable climatic and environmental conditions for the practice of beekeeping. 40,000 professional beekeepers are in charge of around 4.3 million honeybee hives. The majority of these beekeepers work as farmers, retirees, teachers, or in other occupations. Turkey is home to a variety of bee species, including the Apis mellifera caucasica and Apis mellifera anatoliaca, as well as ecotypes including Mugla, Gokceada Island, Marmara, and Karadeniz. Each race and ecotype of honeybee reflects the endemic range's environmental traits in both its shape and behavior. Papaver, Carduus, Rosa, Tilia, Salix, Quercus, Castenea, Populus, Betula, Tamarix, Ulmus, Picea, Prunus, Pyrus, and Malus all produce considerable volumes of honeydew honey[8].

iv. Vietnam, Laos and Cambodia:

Although some neighboring nations have created strong beekeeping export industries, the destruction of Apis cerana and Apis dorsata colonies in Vietnam, Laos, and Cambodia is the major cause of this. On the other side, beekeeping based on native species like Trigona levies and Apis cerana is promoted. The introduction of Apis mellifera and the growth ofmodern beekeeping practices are at a transitional stage. The keeping of Asian Hive Honeybees has a long history. During the Angkorian period, giant honeybees, known as Apis dorsata in Latin and "Khmoom Thom" in Khmer, were extensively utilized in Vietnam. Their relatives are still being taken advantage of today by honey hunters, whose customs may, for all we know, trace back to Angkorian times. Old-fashioned rafter beekeeping involves luring bees to rest on tree poles, or rafters, by imitating huge tree limbs[9]. This is especially effective in degraded forest regions where the rafters serve as the sole viable nesting places for these bees since they are conveniently located at eye level and provide simple access to the comb.

Sustainable honey-harvesting, a common-sense strategy to safeguard the bees and maximize honey-harvests during their brief migratory stop-over in the community, was developed some years ago, despite the fact that many rafter beekeepers still practice one-cut-take-all non-sustainable honey-harvesting. The procedure is straightforward: burn the bees and just extract the "honey head." This enables the single-comb colonies to be harvested both earlier and more often, which, of course, results in more honey, more income, more bees, and a more balanced ecology, all of which are advantageous to bees and beekeepers. When the Agricultural Ministry decided to transform the Beekeeping Bureau into the Central Honey Bee Company with the primary duties, organized beekeeping activities were launched in 1978[10]. From 1978 on, the Vietnam National Apicultural Company began promoting the growth of beekeeping across the nation by providing beekeeping equipment and supplies to all provincial businesses and collecting honey from them in accordance with the national plan for internal use and export.

The Central Honey Bee Company has been the first company in Vietnam to export honey and other bee products including royal jelly and bee pollen to countries like Japan, the European Union, the United States, and Canada since 1984. To promote beekeeping in Vietnam, NGO's, the Vietnamese Beekeepers Association, and the Vietnamese Bee Research & Development Center, Hanoi, are now collaborating. The Vietnam National Apicultural Joint

Stock Company developed the Viet GAP between 2007 and 2010 and organized training sessions for beekeepers in the primary producing zones. The whole VINAPI crew has received hygienic and food safety training. It has eight branches spread out across the country of Vietnam and is engaged in breeding honey bees. The main production zones are represented by two enterprises in Hanoi and Ho Chi Minh City that supply raw materials, process, and export honey and bee products[11].

History of Beekeeping in Australasia:

Beginning in the early 1840s, early Australian immigrants successfully started beekeeping in eastern Australia and subsequently in Western Australia. The original honey bees brought were the North European Apis mellifera, but Italian Apis mellifera logistical were imported after significant colony losses in the 1880s, allegedly caused by wax moths. The most often utilized bees are those. The quality of Australian stock has decreased over time since there have been so few importations from Italy.

Once a few colonies were created, they quickly spread out throughout the whole State. Three gallons of honey were retrieved from a "Bee Tree" in the Victoria Plains neighborhood, according to a newspaper article from January 12, 1881. On September 6, the same year, it was claimed that 16 boxes of Swan River honey were sold on the London market. In the latter decade of the nineteenth century, commercial beekeeping saw steady development. The Smith brothers, who were headquartered in the Bakers Hill-Glen Forrest region of Western Australia, imported their bees from the Yorke Peninsula in South Australia. They were perhaps the first migratory bee keepers in Western Australia, transporting hives between bee sites on horseback [9].

Later, they sold their bees to the York-based McNamarra brothers, who continued to produce significant amounts of honey. The Cook cousins, who had previously established their beekeeping skills in New South Wales, assisted the Smiths before eventually establishing their own apiary at Toodyay in the Avon Valley. According to the earliest beekeeping data, which were compiled in 1896, the State's 2,267 hives produced around 38 tonnes of honey. Currently, 40.000 beehives generate around 3,200 tonnes yearly. Exports make up around 40%. Up to the beginning of the 1930s, the industry was mostly unchanged. From 1934 forward, the number of bee colonies climbed by 50%, and by 1936, the output of honey which had previously been produced by roughly 16,000 hives at an average weight of 28 kg each had risen to almost 450 tonnes [12].

After a second phase of relative stagnation that lasted until the conclusion of World War II, the industry saw continuous growth until it reached 32,000 production hives in 1977, producing an average of 76 kg of honey per hive. Since 1977, there have been around 75 professional full-time apiarists, each with more than 200 hives of bees, maintaining a relatively stable number of beekeepers. Since 1965, the number of productive hives has continuously decreased, mostly as a result of bad economic circumstances and the diminishing availability of floral supplies as a result of land clearance.

The Western Australian Apiculture Section of the Western Australian Department of Agriculture developed a bee-breeding program employing artificial insemination, which has aided in maintaining a high level of output in the present population of honey bees for industry. Commercial apiarists sent queens from their finest honey-producing hives to the WA Department of Agriculture's bee breeding program in 1980. At Rottnest Island, the best of these were mated with particular drones to produce daughter queens. There are no wild bee colonies on Rottnest Island. Beekeepers in Australia and abroad purchased queen bees from the breeding program. The initiative was sold to a group of Western Australian beekeepers in

1991, and they presently run it for the industry's benefit. By importing breeding stock, local apiarists can reduce the chance of spreading exotic bee illnesses.European foulbrood and other economically significant invasive bee diseases and pests that might harm the honeybee and horticulture sectors are not present in Western Australia. To stop illnesses and pests from entering, quarantine precautions are in place. According to the Western Australian Beekeepers' Act 1963-1980, bees, beehive products, equipment, and appliances cannot be brought into Western Australia. Laws of Western Australia are in addition to those in the Commonwealth. State laws in Western Australia may prohibit the import of beehive goods, machinery, and appliances that are allowed under federal law.

New Zealand:

In New Zealand, honey bees have been maintained for more than 150 years. Since then, beekeeping has developed from a domestic hobby to a modern enterprise. Today, New Zealand is regarded as one of the most developed beekeeping nations in the world and is a pioneer in a number of significant industries. English missionaries introduced the first honey bees to New Zealand. The first successful transport was two basket hives of bees that landed in Northland in 1839, according to records. Soon after, there were several further importations, and beekeeping gained popularity among residents. In 1848, the first book on beekeeping in New Zealand was released. The Northern European black strain of bees were the initial stocks introduced to the nation. They were maintained in conventional wooden boxes with frames or straw skeps. The first imports of the yellow Italian variety occurred about 1880. They served as the cornerstone for the creation of contemporary commercial beekeeping, together with mobile frame "Langstroth" hives.

Additionally, American foulbrood was unintentionally introduced in some of the initial bee stocks and had spread to several hives by the 1880s. Because combs could not be readily checked for the illness due to the widespread usage of fixed frame hives at the time, beekeeping was severely impacted in many regions of the nation. The latter two decades of the nineteenth century saw Isaac Hopkins, a well-known commercial beekeeper, push for laws to prevent bee diseases. He was designated government apiarist in 1905. The first Apiaries Act was soon after approved. The legislation-imposed measures to control American Foulbrood and made the maintaining of fixed frame hives unlawful. The New Zealand ordinance, combined with a concerted effort to lower the prevalence of the illness, was among the first modern bee disease management regulations anywhere in the world and contributed to the viability of commercial beekeeping as an agricultural endeavor in New Zealand [12].

As additional acreage was created and former troops were taught as beekeepers after the First World War, beekeeping grew quickly. By the end of the 1920s, there were almost 100,000 hives. Marketing groups were employed in the 1930s in an effort to regulate pricing since honey yields are very unpredictable. By 1938, the Internal Marketing Division, a government organization, was buying a significant portion of the New Zealand harvest. After the Second World War, beekeeping grew once again, and by 1950, 7,000 beekeepers were maintaining more than 150,000 hives. The Internal Marketing Division's operations were taken over by the Honey Marketing Authority in 1955, and for the next 25 years, it was essentially the only exporter of extracted honey made in New Zealand. The beekeeping sector saw significant upheaval in the late 1970s and early 1980s. Private people and businesses started exporting New Zealand honey products as soon as the Honey Marketing Authority ended functioning. Due to the need for paid pollination services, the number of hives surged by more than 40%, reaching 335,000.

Additionally, the variety of exports expanded and started to include live bees and a wide variety of honeys. Significant legislative and regulatory developments have had an impact on the sector. The government stopped providing funding for the endemic honey bee illness program in 1991, eliminating taxpayer financing for a program that had been running continuously since 1908. The business decided to use its resources to support contracts for disease management services as well as American foulbrood control [13].

The Bio Security Act and the Commodities Levy Act, among other legislation, had an impact on how the beekeeping sector coordinated its operations. The industry had the option of replacing the hive charge that supported the National Beekeepers' Association with a commodities levy. After then, it was no longer necessary, and NBA membership was once again optional. A directive issued under the Bio Security Act made it possible to create a pest management plan to combat American foulbrood. Eight chosen regional Ward members made up the NBA's Executive Council after it underwent a restructuring in 2005.

DISCUSSION

The honeybee, also known as Apis mellifera in science, is an amazing insect that is essential to both agriculture and our ecology. The honeybee stands out as one of the most crucial for human life among the more than 20,000 species of bees that are currently recognized. This conversation will explore the many facets of the many honeybee species, from their remarkable social systems to their critical function in pollination and honey production. The intricate social structure of honeybee species is one of the most fascinating features. They reside in colonies made up of thousands of individual bees, each of which plays a particular function.

The worker bees are in charge of gathering food, caring for the queen, and watching over the hive. Male bees, or drones, have the main responsibility of mating with the queen. Inspiring illustrations of nature's efficiency may be found in the honeybee colony's complex hierarchy and work division. In addition, honeybees play a crucial role in pollinating a range of plants, including many of the fruits, vegetables, and nuts that constitute an important part of our diet [14]. For food production and biodiversity, their pollination work is essential.

Many crops would have difficulty reproducing without honeybees, perhaps resulting in food shortages and a loss of plant variety. One further amazing feature of honeybee species is their ability to produce honey. Nectar from flowers is collected by bees, who then store and refine it in their hives to produce honey. This procedure results in the production of a nourishing and durable food supply for the colony by evaporating water and adding enzymes.

Since ancient times, people have been gathering honey for its sweet flavor as well as its therapeutic benefits. Honeybees, especially Apis mellifera, are essential to agriculture and our ecology [15]. Both scientists and beekeepers are fascinated by them because of their complex social structures, crucial function in pollination, and ability to produce honey. In addition to being crucial for preserving the delicate balance of nature, protecting and conserving honeybee populations is also crucial for our security of food supply.

CONCLUSION

In conclusion, Apis mellifera, the species of honeybee, serves as a witness to the glories of the natural world. These little insects have a significant influence on both ecosystems and human society because to their complex social structure, vital function in pollination, and production of honey. It is becoming more and more clear that our wellbeing is closely connected to that of the honeybee species as we investigate and learn more about them. It is

important to act quickly and carefully to address the problems they are facing, including as habitat loss, pesticide exposure, and climate change. In addition to being a question of ecological responsibility, it is crucial for the future of our food supply and the ecological balance of our world to maintain the variety and health of honeybee populations. The tale of the honeybee species serves as a moving reminder of the interconnectedness of all life on Earth and emphasizes the significance of our responsibility as stewards of this fragile web of life.

REFERENCES:

[1] P. Pattamayutanon, S. Angeli, P. Thakeow, J. Abraham, T. Disayathanoowat, and P. Chantawannakul, "Biomedical Activity and Related Volatile Compounds of Thai Honeys from 3 Different Honeybee Species," J. Food Sci., 2015, doi: 10.1111/1750-3841.12993.

[2] B. Han et al., "In-depth phosphoproteomic analysis of royal jelly derived from western and eastern honeybee species," J. Proteome Res., 2014, doi: 10.1021/pr500843j.

[3] M. Streinzer, A. Brockmann, N. Nagaraja, and J. Spaethe, "Sex and Caste-Specific Variation in Compound Eye Morphology of Five Honeybee Species," PLoS One, 2013, doi: 10.1371/journal.pone.0057702.

[4] P. Chantawannakul, L. I. de Guzman, J. Li, and G. R. Williams, "Parasites, pathogens, and pests of honeybees in Asia," Apidologie, 2016, doi: 10.1007/s13592-015-0407-5.

[5] J. ichi Takahashi, S. Deowanish, and H. Okuyama, "Analysis of the complete mitochondrial genomes of two dwarf honeybee species, Apis florea and Apis andreniformis (Insecta: Hymenoptera: Apidae), in Thailand," Mitochondrial DNA Part B Resour., 2018, doi: 10.1080/23802359.2018.1450672.

[6] S. Su, F. Cai, A. Si, S. Zhang, J. Tautz, and S. Chen, "East learns from west: Asiatic honeybees can understand dance language of European honeybees," PLoS One, 2008, doi: 10.1371/journal.pone.0002365.

[7] P. Pattamayutanon, S. Angeli, P. Thakeow, J. Abraham, T. Disayathanoowat, and P. Chantawannakul, "Volatile organic compounds of Thai honeys produced from several floral sources by different honey bee species," PLoS One, 2017, doi: 10.1371/journal.pone.0172099.

[8] V. Albertová, S. Su, A. Brockmann, J. Gadau, and Š. Albert, "Organization and potential function of the mrjp3 locus in four honeybee species," J. Agric. Food Chem., 2005, doi: 10.1021/jf051417x.

[9] A. Zewdu et al., "Assessment of Alien Honeybee Species (Apis florea) in North West and Northern Ethiopia," Greener J. Agric. Sci., 2016, doi: 10.15580/gjas.2016.3.012016019.

[10] Y. Le Conte, Z. Y. Huang, M. Roux, Z. J. Zeng, J. P. Christidès, and A. G. Bagnères, "Varroa destructor changes its cuticular hydrocarbons to mimic new hosts," Biol. Lett., 2015, doi: 10.1098/rsbl.2015.0233.

[11] R. Bahadur, "Foraging Behavior of Different Honeybee Species under Natural Condition in Chitwan, Nepal," Eur. J. Acad. Essays ISSN, 2014.

[12] S. R. Won, D. C. Lee, S. H. Ko, J. W. Kim, and H. I. Rhee, “Honey major protein characterization and its application to adulteration detection,” Food Res. Int., 2008, doi: 10.1016/j.foodres.2008.07.014.

[13] M. Beekman and B. P. Oldroyd, “Different bees, different needs: How nest-site requirements have shaped the decision-making processes in homeless honeybees (Apis spp.),” Philos. Trans. R. Soc. B Biol. Sci., 2018, doi: 10.1098/rstb.2017.0010.

[14] H. Okuyama, T. Wakamiya, A. Fujiwara, I. Washitani, and J. ichi Takahashi, “Complete mitochondrial genome of the honeybee Apis cerana native to two remote islands in Japan,” Conserv. Genet. Resour., 2017, doi: 10.1007/s12686-017-0721-5.

[15] H. Koch, D. P. Abrol, J. Li, and P. Schmid-Hempel, “Diversity and evolutionary patterns of bacterial gut associates of corbiculate bees,” Mol. Ecol., 2013, doi: 10.1111/mec.12209.

CHAPTER 3

AN EXPLORATION OF THE HISTORY OF BEEKEEPING IN AFRICA

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ABSTRACT:

In Africa, beekeeping has an almost 5,000-year history. Traditional hives had a hole at the front that allowed bees to fly in and out and a portion that could be removed at the rear that was used to collect honey combs. The illustration of a honey-hunter using fire on a rock may be found in Dr. Eva Crane's Book of Honey and is located close to the Toghwana Dam in the Matopo Hills of Zimbabwe. However, despite their awareness of the nutritional and therapeutic benefits of honey, beekeeping has not yet reached its full potential. Although all tropical honey bee races are more prone to flee their nest or hive if disturbed than temperate bees because they have a better chance of surviving in the tropics, Apis mellifera are also native to tropical Africa. A live flame has been used in honey harvesting for many thousand years. The North Western Province of Zambia became known as the honey province in Africa due to its long history of beeswax trade, isolation, and extensive miombo woods. The gathering of honey from wild bees' nests and subsequently from bark hives beekeeping have long been a part of village life and have now evolved into one of Africa's most prosperous honey producing businesses.

KEYWORDS:

Beekeeping, African beekeeping, Honey production, Traditional beekeeping, Apiculture, Beekeepers, Honeybees.

INTRODUCTION

In civilizations where it is practiced, honey hunting is important because it often offers life-sustaining food during famines. In a whole colony collection, high protein ingredients including brood, royal jelly, and pollen are significant nutritional components. One of the few hunter-gatherer tribes still in existence in East Africa is the Ogiek tribe, which resides in Kenya's Rift Valley. In Ogiek civilization, honey is essential since it is utilized for commerce, food production, and beer brewing[1]. People not only forage for honey, but also keep bees in hollow logs bedded in tree branches. The Ogiek have been fighting for many years to keep their ancestral home in the Mau Mountain Forest safe from settlers, loggers, and tea plantations. They have also been fighting to prevent it from being expelled. Burkina Faso, Egypt, Ethiopia, The Gambia, Ghana, Guinea-Bissau, Kenya, Mali, Morocco, Niger, Senegal, Sudan, Tanzania, and Uganda are a few of the African nations where tests using intermediate beekeeping technology have been documented.

i.A lgeria:

In Algeria's deserts, which experience high temperatures and persistent winds, traditional hives made of rocks and mud have been discovered. Due to the hot climate, current hives in Algeria are of the "Langstroth" type with certain adaptations. These hives may produce a healthy supply of honey. Beekeeping cooperatives are putting forth a lot of effort. The "Institute of Small Animals" is the site of research operations. Algerian honeys' chemical and botanical sources were investigated. Almost only in the North, where floral variety is guaranteed, beekeeping is practiced[2]. More than a million date palm trees grow in southern

Algeria. The primary honey plants are sunflowers, citrus trees, and other wild species. The main honey flow is between February and May. Almonds were pollinated in large part by honeybees. It is possible to raise a pure strain in a solitary oasis in the Algerian desert[3].

ii. Egypt:

The Egyptian bee race was initially kept by the Pharaohs in mud hives that were piled up. There was migratory beekeeping. The monarchs and nobility' favorite meal was honey. Egypt is one of the nations with laws and standards or codex, based on honey to be sold, and it is referenced in pharaonic papyri as a component in remedies and in Holly "Koran". In El-Minia and Assiut, the Coptic Organization for Social Services has distributed hundreds of contemporary hives. Governorates in an effort to boost farmers' income. In Egypt, there are three major honey flows: one from cotton in August-September, one from citrus in April, and two from clover in June. 40% of traditional hives and 70% of contemporary hives are located in Upper Egypt, while 40% are in the Delta, where 60% of the world's honey is produced. In recently recovered grounds, honeybees were used to pollinate certain crops. Bee numbers are increased for pollination by feeding them sugar syrup and supplementation with pollen.

The Egyptian bee race is more successful at pollinating various cultivated crops because it is resistant to Varroa and acarine. This breed was propagated in a remote Siwa oasis. Kenyan top-bar hives and more than 250 contemporary hives were used[4]. The Nile Delta has been shown to be home to Varroa. The author has already pre- pared an evaluation of scientific literature on Varroa in Arabic. In 1988, Cairo hosted the "Fourth International Conference on Apiculture in Tropical Climates." A project was started with the goal of improving honeybee management, disease and pest control, queen raising, and artificial insemination. The primary issues confronting beekeepers in Egypt include a higher concentration of colonies in a less cultivable area, poorer quality queens, pests, illnesses, and chemical toxicity. It is necessary to expand modern beekeeping on newly recovered territory, establish solitary stations for queen raising, and cultivate additional honey plants.

iii. Libya:

While modern beekeeping has only been performed for 30 years, traditional beekeeping was first discovered in ancient times. Two primary honey flow seasons exist. Every year, the number of colonies grows by 20%. In certain southern oases and in northern Libya, beekeeping is practiced. There are typically nine different varieties of honey, including citrus, eucalyptus, and honeys. There is migratory beekeeping. Acacia, Pinus, Cupressus, Thymus, Rosmarinus, Citrus, Eucalyptus, and several wild species are the primary honey plants. Propolis is often used by honeybees as a barrier against invaders. The effective use of contemporary beekeeping techniques was carried out[5].

iv. Morocco:

In Morocco, traditional beekeeping is done using baskets that are 20 to 30 l in capacity. A. mellifera sahariensis is a pure yellow color race found in the southern Atlas Mountains. Bees housed in home wall cavities are well-behaved and superb foragers. The primary honey plants include citrus, thyme, lavender, rosemary, and eucalyptus. For Morocco, one of the subtropics and temperate nations with regulations based on honey to be sold, a list of plants that produce honey is provided.

v. Tunisia:

One of Tunisia's issues with beekeeping is the scarcity of plants that produce honey; one option is to expand the country's woodlands. Also required are cooperatives. Migratory

beekeeping without planning results in the spread of illnesses and lower honey output. It is necessary to have a research team that focuses on managing pests and illnesses, genetically improving bee races, pollination, and bee products. The beekeeping business in Tunisia needs to expand and get training. A German station is used to artificially inseminate Carniolan queens. In Tunisia in 1978, Varroa was identified for the first time in Africa. In order to manage Varroa, an initiative to promote beekeeping in the Sedjenane Region is now under way. Beekeeping organizations underwent privatization[6].

East African Countries:

i. Ethiopia:

Three distinct climatic zones, known as "Kolla," "Wonia Dega," and "Dega," define Ethiopia. The "Kolla" or hot zone is where the principal bee flora species include Acacia, Albizzia, Combretum, Commiphora, and Croton. "Wonia Dega" or the cool-warm zone is home to Acacia, Coffea, Combretum, Croton, Guizotia, Trifolium, Olea, and Veronia. Olea, Rosa abyssinica, Albizzia, and Gizotia are found in the "Dega" or cold zone. In April and September, swarming occurs. "Dega" has year-round blooming and less hostile environment for bees. While the blossoming season in "Kolla" is brief and the bees are active and aggressive. Bees from "Wonia Dega" are either those unproductive swarms from "Dega" or those whose initial, very active, productive swarms were captured in the lowlands ("Kolla"). The annual yield of honey is predicted to reach 26.547 tonnes. Making "tej" accounts for around two thirds. After Tanzania and Angola, Ethiopia is the third-largest exporter of wax in Africa. Gojam leads the world in both beekeeping colonies and honey output. Currently, just 30 beekeepers use contemporary hives [7].

A prospective beekeeping powerhouse is Ethiopia. Many honey bees were seen gathering from open bags of shirro in an Abyssinian grain market as a replacement for pollen. Honey is mostly used to make "tej" and sell it. Beekeeping in Na-kamte and Abyssinia, as well as honey hunting by Majangir and Andaman Island residents, were described. One of A. m. adansonii's homes is Ethiopia. Regular hives are used to keep bees. Ethiopia has one million farmer-beekeepers and over three million traditional hives. In the remainder of Ethiopia, beekeeping is separated into West and South Ethiopia. People in Majangir made use of hollowed-out Cordia africana tree logs. Hives were raised to the tops of tall tree branches. In the South and West, the average production per hive was 4–9 kg, although beekeeping is quite basic across the remainder of Ethiopia and Abyssinia. There are traditional hives employed. As in Kenya, Tigrai residents separated the hives into two sections, one of which is a honey chamber for simpler extraction. Egypt is where the Abyssinian api-culture first emerged. m. fasciata most likely lived in Abyssinia. Before and after the rainy season, honey is gathered twice a year. During dry seasons, farmers pour water near the hives, and when pollen is scarce, they use alternatives.

The "European Development Fund" supported a beekeeping initiative in the Gambella District in 1977. The Messango tribe relies heavily on honey from wild colonies for their food. On Wolayita, a "Beekeeping Development Project" was conducted. Beekeeping is an excellent method for the Wolays to flourish. Modern beekeeping just recently began, and it now faces challenges from wind, insect concerns, and a lack of bee management skills. In 1988, a project titled "Land Potential of Coffee and Oil Crops, Apiculture Component" was started. to determine informally if the "Western Forest of Kaffa" is suitable for growing crops other than coffee. Another project regarding "Assistance in Apiculture Development" to boost honey production in Ethiopia via the use of contemporary beekeeping was also undertaken in 1988. Ethiopian honeys' water content was calculated. Gojjam and Gondar

honey had a moisture percentage of 18.6%, which is within the acceptable range, but Keffa and Sidamo had a moisture content of 21% or more. Compared to contemporary hives, old hives' honeys had a moisture content that was 1.5–3% greater. The "Chika Hives" are utilized in Ethiopia; they are constructed from mud and combine contemporary hives with the basket beekeeping that is done nearby or within homes in Tigray and Eritrea. The 26 top-bars are made of bamboo. The South West and Central Highlands are home to the majority of contemporary hives. The first is the Zander hive, followed by the Langstroth and Dadant hives [7].

90% of foreign currency profits and 41% of the GNP are generated by agriculture. Every year, over 3,000 tons of beeswax are harvested. The quality and market value of honey are impacted by wax, pollen, and other contaminants in Ethiopia, where traditional beekeeping and honey hunting are still practiced. African honey bees were identified as A. monticola when they were discovered at high elevations in the Eastern Mountains. Robbery is a significant barrier to the growth of beekeeping in rural Ethiopia and among beekeepers worldwide. Increased honey production in rural Ethiopia is crucial for reducing childhood malnutrition.

ii. Kenya:

The primary features of apiculture in Kenya were the keeping of bees in conventional hives, moveable comb, frameless hives, Kenya top-bar hives, and Tanzania transitional hives, in which comb is moved in pairs. Traditional hives are being effectively replaced with Kenya top-bar hives. The david hive is somewhat similar to a top-bar hive in Kenya, and whole honey combs are retrieved. Kenya set out a planned study effort on bee selection. Kenya's terrain, including some dry regions, is ideal for beekeeping to an extent of 80%. Even when properly maintained, imported European bees from Europe were not as beneficial in Kenya as African honeybees. African honeybees, which are better adapted to tropical environments, compete with the alien bees in foraging and defense. There are traditional beehives in the Wakamba and Kalenjan. In the Embu District, many tribes maintain traditional beehives. "The 3rd International Conference on Apiculture in Tropical Climates" took place in Nairobi in November 1984. The "Kenya Indigenous Forest Conservation Project" in Na-kuru's main goal was to persuade beekeepers to adopt techniques for gathering materials for hive production while causing the least amount of forest damage possible[8].

A beekeeping initiative with "Ndorobo" beekeepers who live in the forest has been developed and deepened in the Manu Forest. 1995 saw BAC's construction of a new honey refining factory, which is doing quite well. The term "Beekeeping Courses" is growing in popularity.With assistance from IFAD, the "Commercial Insect Project" at the "International Centre of Insect Physiology and Ecology" is concentrating on raising the productivity of commercial insects. In Kenya's semi-arid Samburu District, a project for the preservation of forests and revenue production is established. In 1995, ICIPE included beekeeping to their research agenda. Beekeeping will be included into agroforestry agricultural systems, according to Dr. Herren. Kenya made progress in attempts to supplement traditional hives by spreading Kenya top-bar hives, but inconsistent extension trips, wood prices, and equipment expenses remain limiting problems. Twelve beekeeping cooperatives were run by women's organizations, including the 1981-founded "Kibwezi Women's Beekeeping Co-operative".

A significant producer of honey in Kenya, "Kitui Honey Refinery," which is part of "Tana and Athi Rivers Development Authority," produces 1/3 of all honey. Although conventional hives provide the majority of the honey, there is a drive to adopt Kenya top-bar hives. In 1997, "Ruai Beekeepers Co-operative" was founded. The 800 members, the majority of

whom ran conventional hives, received supplies and financial aid from CIDA. The annual yield is between 6 and 8 tonnes of honey and 1.2 tonnes of wax. In 1950, frames for Kenya top-bar hives were made from the hard and resistant wood of Juniperus procera, following the bee space for African honeybees recommended by Tanzanian researchers[8]. Education, training, and employment of women as beekeepers are more recent than the use of modern hives in Tropical Africa for honey production. Turgen uses traditional hives, which are hollowed-out logs with the center cut off. Larger than the lower part is the higher section. The female portions are cut away during honey harvesting so that the top fixed combs may be seen without being damaged. The conventional multichambered beehive was detailed, along with the difficulties in converting them into more contemporary hives that provide some answers and improve honey outputs of higher quality. A frame for the production of comb honey and Kenya top-bar was introduced in the Laikipia District. Since 1977, "Ruai Farm" has inspired beekeepers to produce honey. Traditional hives may produce "bitter honey" from Euphorbia candelabrum and Acacia mellifera in September, "sweet honey" in October, and mixed floral grass honey in December.

iii. Somalia:

According to some experts, bees traveled from Egypt down the Nile Valley to Ethiopia and then to Somalia. One of the most dangerous pests to honeybee colonies in Somalia is the Somali bee-eater. On behalf of the Somalia agricultural development cooperation, a survey on beekeeping was conducted and suggestions for its potential growth were provided.

iv. Sudan:

In terms of area, Sudan is the biggest nation in Africa. 40% of the country's GNP and more than 50% of its international export revenues come from agriculture. Cotton, peanuts, sorghum, barley, sesame, wheat, and gum arabic are the main crops. The first occurrence was in Africa, close to Khartoum, in November 1985. We made several observations concerning these little bees' biology and behavior. Clay pots, cylindrical log hives, Sudan bark hives, grasses wrapped into mats and folded up, doum palm leaf "tangels" are all examples of traditional beekeeping. Modern, low-tech hives are utilized in Sudan in addition to Gufa basket hives, Omdurman clay hives, Kenya topped bar hives, and Omdurman clay hives. There are no native honey bees north of Khartoum due to the arid nature of the northern Sudan. Rainfall rises towards the south, along with vegetation via savannah and eventually into a rich rain forest close to Sudan's southern borders. In Sudan, there are thousands of beekeepers. African honey bees build their nests in cracks in trees, logs that have fallen, termite mounds, rocks, and rooftops. various characteristics of African honey bees were seen in various regions. In comparison to the Carniolan race, Blue Nile bees, and hybrid colonies, the native Khartoum bee was more aggressive. It was easy to see how the native honeybees were migrating, swarming, and overtaking them [9].

The development of Khartoum and Omdurman hives resulted in the creation of a bee hive for use by Southern Sudanese residents. In-depth research on bees and bee hybrids was carried out in Egypt. Bombus and honeybees are the primary pollinators. Cotton, lucerne, and sunflower were the three plant species most impacted by honeybee pollination. Incubation activity peaked between February and October. Between January and March, pollen was gathered from Talh, an Acacia seyal, and between July and October, from Sunut, an Acacia nilotica. It is advised to grow the curry tree, Hypericum revolutum, which may be found in Sudan, Ethiopia, Kenya, Tanzania, and Uganda and will improve honey output. A project for Southern Sudanese refugees was carried out in a green location. They urged people to plant trees that the UNHCR had provided. In 1986, a beekeeping initiative was carried out in

Kubbum, the primary honey-producing region of West Sudan. Here, where Acacia and other melliferous trees are prevalent, conventional beekeeping has long been practiced. Colonies were destroyed as a consequence of honey seeking. With desertification on the rise, it is obvious that hives need to be set up so that the limited wood may be utilized profitably. The project's goal is to build low-tech bee hives, and 1,600 farmers were taught in the process. Numerous initiatives were carried out in South and North Sudan. A demonstration apiary was created at the Shambat Faculty of Agriculture in Khartoum.

The Sudan National Council for Research and the "Near East Foundation" jointly cosponsored the training and research programmes at the University of Khartoum's Faculty of Agriculture, which pioneered modern beekeeping. The "National Beekeeping Project" was founded by these three organizations. The Sudan - Bee and Agriculture Voluntary Association was founded in 1987 by a group of apiculturists and agriculturalists. A project for the White Nile Agricultural Schemes' small-scale farmers and beekeepers started in the Kosti region in 1987. Due to the extreme heat in Sudan, where a minimal proportion of mating attempts result in newborn nuclei, the majority of individuals have agreed to work on the project. For mating nuclei to properly ventilate is necessary. Between April and August, colonies need more nutrition. The typical honey production in Kosti, Medani, and Shambat was 7.5-22.5 kg/colony. In April through June, eucalyptus is an excellent source of nectar. Swarming happens throughout the months of January through March and September, when Acacia pollen is most plentiful. 2-3 swarms may be released annually by Sudan colonies [10].

v. Tanzania:

Apis mellifera adansonii was used to gather honey of exceptional grade. One of the biggest wax exporters in the world is Tanzania. 275 types of wax were exported in 1973. The typical hive in Handern District produces an average production of 15 kg of honey. There are between 800,000 and a million colonies, assuming that half to three-quarters of the collected wax is used for export. The tanga integrated rural development program in Handeni and northern Tanzania utilized contemporary hives. The beer "pombe" is made with honey. The foundation for computation is a wax to honey ratio of 1:15. The two suggested blank hives are Tanzanian-commercial hive and Tanzanian-traditional hive. Bees and their adversaries, as well as man and his traditions, are all factors in beekeeping program problems. Financial assistance is required. The "NJIRO Wildlife Research Centre, Arusha" offers training in tropical beekeeping. Within the Ministry of Natural Resources and Tourism, there is a "Beekeeping Division". Through G. Ntenga's efforts, the "Tanzanian Beekeepers Association" was established to advance the beekeeping sector in Tanzania. With 100 beekeepers, the "Tabora Beekeepers Co-operative Society" was established in 1962. The Hadza Beekeeping Scheme is funded by the Arusha branch of the Wildlife Conservation Society of Tanzania and helps traditional hunters make sustainable use of their surroundings by producing honey and wax. In 1991, 86.4 tonnes of "organic" honey were shipped from TBCS, Kipalapala, to the UK and Netherlands. However, just 10.6 kg of honey were gathered in 1995.

The beekeeping sector is significant to the economy of dry regions. Tanzania discovered twelve different species of African honeybees. Compared to European races, A.M. scutellata is better. The majority of honeybee races in Africa swarm, migrate, and flee from hives. They protect themselves against intrusions. Selective breeding may produce genetic material. Njiro Centre conducted research on foraging behavior. The Arusha Beekeepers Association, which conducted a conference in October 1993, highlighted beekeeping instruction, research on African honeybees, and the use of propolis in medicine in the Kilimanjaro area. 1994 was a bad year for honey production in Tabora. Due to a lack of rain, less than a tonne of the

anticipated 360 tonnes of honey could be gathered in this region. In 1996, "Tropical Beekeeping" training was offered at Njiro Center. "Bee-keeping in Rural Development" courses were offered in August 1998 and August 2000 at Cardiff University in the UK and the Njiro Center. Researchers looked at the drawbacks of utilizing contemporary hives with African honeybees. FAIDERS sponsored a symposium in Biharamulo in 1997 to examine contemporary beekeeping techniques and equipment for producing high-quality bee products in larger numbers. In the hollow trees of Tarangaire and Manyra National Parks, bee nests may be found. Ocimeras suave, a shrub with a strong aroma, is used by beekeepers in Gorowa and Iraq to bait bees. Large amounts of organic honey may be produced by TBCS individual beekeepers and sold on worldwide markets [11].

Small-scale beekeepers in Tanzania who use conventional hives for African honeybees are essential to the country's honey supply. The majority of beekeeping is done in the "Miombo Woodlands" of Savannah Forests, with the remainder being done in banana and coffee plantations and in areas where trees are utilized to hang hives. Using conventional hives, an A. m. scutellata colony produced an average of 15 kg of honey and 1 kilogram of wax each year. There were several examples of how honey and wax were traditionally combined to create treatments for different illnesses. North Tanzanian beekeeping was given a flower calendar. Various signs are used by traditional beekeepers to decide when honey should be harvested. In field tests, the effectiveness of upgraded traditional hives was investigated. The length of the side wall must have a little slope in order to lessen the degree of comb attachment. In North Tanzania, traditional beehives with 20 bars are advised. Ideal entrance hole size is 8 mm in diameter.

DISCUSSION

Teso and West Nile regions have traditional beekeeping practices. While in the Kigezi region, crops, grassland, weeds, and exotic trees predominate, trees are the major source of fodder. It was stated how modern beekeeping came to Uganda. Uganda has begun a marketing initiative with CARE, the YMCA, and the Red Cross to bring more productive modern beekeeping. 14 apiary demonstration companies are being formed, where four significant honey refining units are being built. The uganda beekeeping association was established in 1986, and CARE-Uganda helped print the inaugural issue of their newsletter[12].

In Kampala's Ministry of Animal Industry and Fisheries,Apiculture Section was founded. Kampala, Uganda's CARE-Uganda, performed its apiculture project. Beekeeping began in Bunyaruguru County-Bushenyi in 1990. People are consuming local beer that has been sweetened with honey. In the Luwero District of Kampala, the UBA started aBeekeeping Research Project" in September 1995. A firm focuses on expanding beekeeping and employs 70 women with the goal of obtaining big amounts of honey and wax. More than 2,500 colonies and 150 beekeepers are present. Orders for honey came in from Germany, France, and Arabia.

The majority of the hives are conventional, but they want to get additional Tanzanian beehives. More than 200 people make up UBA, which aims to enhance the quality and marketing of bee products.

Beekeeping is done by the atek development association in the East UGA neighborhood of Soroti. Production of beeswax and honey more than doubled. In Uganda, UHA works with a wide range of rural beekeepers and has developed a program for apiculture development centered on improving UHA cooperation at the national level, with districts and villages setting up honey refining facilities for export-grade bee products.

DISCUSSION

In conclusion, beekeeping in Africa has a long and intriguing history that reflects the continent's many cultures, habitats, and the complex interaction between people and honeybees. Africa has seen the growth of beekeeping as a crucial source of food, trade, and conservation, from ancient traditions anchored in indigenous knowledge to contemporary beekeeping techniques. We have seen how African beekeepers have adapted to their particular habitats throughout the course of history, using the advantages of honey production while safeguarding the delicate balance of nature. The tale of beekeeping in Africa is a monument to the resourcefulness and fortitude of people. It emphasizes the value of bees in supporting livelihoods throughout the continent by pollinating crops, preserving biodiversity, and producing honey in addition to other products. As we consider this history, it becomes clear that beekeeping in Africa is not only a past tale but also a current one, with chances for innovation and environmentally friendly methods that may help people and the environment. Understanding the history of beekeeping in Africa is more important than ever in the modern world, when the importance of bees in ensuring global food security and environmental protection is becoming more evident. It imparts priceless lessons about living in harmony with nature, encourages environmentally friendly beekeeping methods, and ensures the survival of this crucial heritage for next generations. It is crucial that we maintain capturing, researching, and celebrating the many customs and inventions of African beekeeping as we go forward.

By doing this, we may not only pay homage to the past but also work toward a more sustainable and peaceful future in which bees and people can coexist in peace on the African continent and beyond.

REFERENCES:

[1] F. du Preez and J. Moodie, “The History Of Beekeeping In South Africa,” Bee World, 2011, doi: 10.1080/0005772x.2011.11417398.

[2] M. Keshlaf, “Pasado y presente de la apicultura en Libia,” Journal of Apicultural Research. 2017. doi: 10.1080/00218839.2017.1306372.

[3] M. H. Hussein, “Beekeeping in Africa,” Apiacta, 2001.

[4] V. Dietemann, C. W. W. Pirk, and R. Crewe, “Is there a need for conservation of honeybees in Africa?,” Apidologie. 2009. doi: 10.1051/apido/2009013.

[5] Charles and K. Lorence, “Beekeeping in South Africa,” American Bee Journal. 2005.

[6] İ. Çakmak and S. Sevençakmak, “Beekeeping and recent colony losses in Turkey,” Uludağ Arıcılık Derg., 2016.

[7] H. Human, C. W. W. Pirk, R. M. Crewe, and V. Dietemann, “The honeybee disease american foulbrood an African perspective,” African Entomology. 2011. doi: 10.4001/003.019.0301.

[8] S. O. Adjare, “Beekeeping in Africa,” Apiacta. 2001.

[9] L. Deirdre, “Factors of Success in Beekeeping Development Projects and their Application to South Africa ’ s Beekeeping Industry,” Pomona Sr. Theses, 2014.

[10] M. S. Dhooria, “Important Acarine Families,” in Fundamentals of Applied Acarology, 2016. doi: 10.1007/978-981-10-1594-6_6.

[11] P. Zoccali et al., “A novel GIS-based approach to assess beekeeping suitability of Mediterranean lands,” Saudi J. Biol. Sci., 2017, doi: 10.1016/j.sjbs.2017.01.062.

[12] R. Jaffé et al., “Bees for development: Brazilian survey reveals how to optimize stingless beekeeping,” PLoS One, 2015, doi: 10.1371/journal.pone.0121157.

CHAPTER 4

BEEKEEPING IN WEST AFRICAN COUNTRIES

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ABSTRACT:

In West African nations, beekeeping has enormous promise as a sustainable and profitable agricultural enterprise. The main elements and difficulties of beekeeping in this area are summarized in this abstract. The distinctive biological diversity of West Africa, which includes a range of climatic conditions and plant kinds, provides the perfect environment for beekeeping activity. Generations of people have used traditional beekeeping practices including building hives and extracting honey, but there is rising interest in upgrading beekeeping methods to increase production and raise the quality of bee products. The subject matter emphasizes how important bees are to pollinating crops, ensuring food security and preserving biodiversity in West Africa. Bee products, such as honey, beeswax, pollen, and propolis, are significant from a cultural and economic standpoint and have the potential to bring in money for rural areas. However, beekeeping in West Africa confronts difficulties including insufficient instruction and training, a lack of access to cutting-edge equipment, and dangers from pests and illnesses.

KEYWORDS:

Agriculture, Apiculture, Bee Products, Biodiversity, Economic Development, Hive Construction.

INTRODUCTION

The ancient agricultural activity of beekeeping, commonly referred to as apiculture, has flourished within the varied and dynamic landscapes of West African nations. This area provides a fertile environment for the pursuit of beekeeping as both a traditional way of life and a contemporary route for sustainable agricultural development because of its complex tapestry of cultures, climates, and biological variety [1].This paper offers a thorough examination of the complex apiculture industry in this distinctive region of Africa. From the dry Sahelian zone in the north to the lush tropical rainforests in the south, West Africa, which includes nations like Nigeria, Ghana, Senegal, Mali, the Ivory Coast, and Burkina Faso, presents a remarkable variety in climates. Because of the optimum conditions that are created by this geographic diversity for a range of bee species to flourish, beekeeping has become an integral part of West African agricultural practices [2]. West Africa's traditional beekeeping techniques are as varied as the continent itself. Over many decades, local communities have perfected the craft of building hives, extracting honey, and using bee products, passing down knowledge and methods from one generation to the next. These customs, which are firmly ingrained in culture and tradition, have supported livelihoods while also fostering a special bond between people and bees.

Although West African nations have a rich tapestry of heritage, there is a growing interest in upgrading beekeeping methods. This modernisation effort aims to increase production in beekeeping, raise the quality of bee products, and incorporate apiculture into larger agricultural systems. As the importance of bees in pollinating crops and maintaining food security becomes more widely acknowledged, West Africa is on the verge of realizing the

potential of its native bee populations to meet both regional and global demands [3]. This extensive analysis of beekeeping in West African nations looks into the key features that characterize this profession. It explores the ecological role of bees in boosting food production, conserving regional biodiversity, and pollinating a wide variety of crops in West Africa. Additionally, it explores the cultural and economic significance of bee products in these civilizations, such as honey, beeswax, pollen, and propolis, offering insight on the influence of beekeeping on rural economies [4].

However, despite the potential and promise, beekeeping in West African nations confronts a number of difficulties. The route to sustainable apiculture is hampered by a lack of access to contemporary beekeeping tools, poor instruction and training, and the impending danger of pests and illnesses. This investigation will confront these challenges head-on and go through solutions, promoting the expansion of beekeeping in the area. The significance of apiculture but also the promise it provides for tackling important problems like poverty reduction, gender empowerment, and environmental protection as we set out on our trip through the world of beekeeping in West African nations. We will explore the complex interactions between bees and West Africans, as well as the crucial influence beekeeping has on the future and agricultural environment of the area.

i. Benin:

Agricultural products including maize, cassava, sorghum, coffee, cotton, palm oil, peanuts, avocado, coconuts, guava, and mango provide a livelihood for over 75% of the inhabitants of Benin. Dahome's beekeeping was detailed. The "Benin Integrated Centre for Tropical Beekeeping", or CIAT, was established in Parakou in 1994. In its three years of operation, CIAT not only completed various projects but also successfully trained 384 people. In addition, bee populations that were severely depleted by honey hunting need to be restored. Trained and supported beekeepers also need to earn more money each year, and bee products are widely used in food and medicine[5]. The "West African Beekeepers Association" is a member of the "National Association of Beekeepers" in Cotonou, Benin. In Benin, both conventional and contemporary beekeeping methods were used in the years 1998 and 1999.

In December 1995, the "3rd West African Bee Research Seminar" was held in Cotonou. A.m. adansonii swarms between September and October. As many colonies still reside in tree holes, termite mounds, beneath huge baobab trees, on branches, or on house ceilings, honey seeking is still a common activity. Traditional hives are made out of calabashes, clay pots, gourds, hollowed-out tree trunks, and stems from palm trees. Clay hives, which resemble closed water pots, are constructed directly into the forks of trees in Somba Land[6]. Traditional hives are constructed of wood, cement, and clay. They employ straw-insulated, iron-sheet-based cylindrical hives as insulation. Few apiaries employ modern hives like Dadant, the "France-Congo" hive, or Langstroth hives. From November through April is the best time to collect honey. Honey is mostly obtained via honey hunting.

ii. Burkina-Fasso:

A fruit farmers' cooperative's beekeeping operation was launched in 1977 by American peace crops. Since 1958, an FAO-UNDP beekeeping initiative has been operating in Burkina Faso to encourage the use of traditional bee hives made of lumber or straw covered in cow dung, with sloping sides and 24 top bars. The finest hives for African honey bees are those from Kenya. There were 2,250 beekeepers in 1989 compared to 375 in 1986. So far, over 700 hives have been constructed. The seventh worldwide IFOAM conference took place in January 1989 in Ouagadougou. To increase honey output and build a national center for apiculture, a project for apiculture development was put into action. To boost honey

production at the farm level, another initiative applied apiculture development at that level. The "Intensification of Apiculture at Farm Level" initiative aims to raise the income of 200 farmers annually, particularly women, and to raise their level of employment beginning in the second year of the project[7], [8].

iii. Gambia:

The tiny nation of Gambia is situated in the western Sahel region of Africa. They are farmers who live off the land. Mostly beeswax was exported. Four contemporary hives—the Langstroth, Dadant, Kenya Top Bar, and Zambian—as well as traditional hives are employed by tons of beekeepers. Beekeeping has the ability to advance. Traditional hives are often formed from dead trees of the fan or rum palm and santag. Basket hives are made from the leaves of these trees. Bees are often burned to death during the honey-gathering process in traditional beekeeping. The training curriculum includes both local and contemporary information. To get more honey and ensure a healthy bee population for pollination, honey may be obtained without killing colonies. After the rainy season, which lasts from October to November, traditional hives are mounted on trees. Before harvest, hives were left for 8 to 9 months. Both contemporary and conventional bee hives must be used. NBA was established in 1996 to organize upcoming events. Individual beekeeping should be promoted and utilized for all new endeavors. Marketing and training must be suitable and effective. Beekeeping is encouraged in Ghana, Guinea-Bissau, Mali, and Senegal. There is currently a West African Beekeepers Association. In Brikama, Gambia, queen raising with African honey may be improved utilizing the manipulative management feeding approach, which also decreased absconding[9].

iv. South Africa:

Up until 1907, when modern beekeeping only hives were brought from England and the first official bee keeper organization was established in Johannesburg, the early European immigrants to South Africa did not engage in beekeeping. In South Africa's Western Cape, the official establishment of the fruit business preceded the birth of the beekeeping sector. The wooden crates used to carry paraffin and other timber construction materials were turned into the first bee hives built in South Africa. In South Africa, the use of Langstroth hives and standardized beekeeping equipment was advocated and pushed by Dr. A.E. Lundie, who was appointed the first honey bee expert for the Department of Agriculture in 1923. Since the founding of the South African Beekeepers organization, the country of South Africa's first beekeeping organization, in 1907, other additional groups have developed. While the nectar loss reduced South Africa's ability to produce honey, the fruit industry increased demand for pollination services, which helped the beekeeping sector grow. Since imported Eucalyptus species served as the primary source of honey throughout the 1970s, the honey business in South Africa saw a boom. But as a result of a drought, nectar flies, and young trees, honey production became an issue. It has now further decreased as a result of the eradication of Eucalyptus species under South Africa's water projects and other forage losses[10].

v. Madagascar:

One of the few nations in the world where people regularly interact with bees is Madagascar. Honey hunting is a really rewarding and delightful activity. Today, it is common practice throughout the country's east coast's wooded areas to capture wild swarms. Mpantanely, an experienced beekeeper, used his father's exact motions and expertise to locate bee poop on the leaves. The island has excellent potential for beekeeping; a conventional hive may produce more than 50 kg of honey annually, and the local bee is disease-free and well acclimated to the environment. According to the studies of Douhet and Chandler, Madagascar

is now self-sufficient in honey, providing 4 kg of honey each resident; however, the island will likely increase that to 50 kg in the future. The sight of a swarm leaving a hive is considered unlucky in certain locales, and this anxiety is enough to dissuade farmers from maintaining hives. Some tribes chop the "honey trees" for its wax and honey with little concern for the environment. In addition to posing a threat to beekeeping, the rising number of bush fires on high plateaus hastens the shift of the finest arable ground toward the ocean. Because of the economic and political conditions that encourage vandalism in certain isolated locations, some beekeepers place traps or firearms around their bee yards, sometimes shooting robbers[11].

DISCUSSION

As it covers the nexus of agriculture, biodiversity, and economic growth in an area with a variety of habitats and a rising population, the subject of "Beekeeping in West African Countries" is both topical and important. In West Africa, beekeeping, or the management and cultivation of bee colonies for the production of honey and other products, has the potential to significantly improve food security, provide income for rural populations, and encourage environmental conservation. The vast biodiversity of West Africa is one of the main topics of debate in this context. A large range of blooming plants, some of which are indigenous and exclusive to this location, define the area. For honeybees, these plants provide a varied and plentiful supply of nectar and pollen. Successful beekeeping techniques depend on knowing the precise plant species that are crucial for bee feeding and their distribution in various West African nations [12]. Additionally, beekeeping's economic effects must not be disregarded. Smallholder farmers and rural communities may benefit financially from beekeeping since honey and other bee products may be marketed both domestically and abroad. For West African nations to expand beekeeping as a sustainable source of income and to reduce poverty, it is crucial to talk about the difficulties and potential for doing so.

A further essential factor to take into account is the function of beekeeping in environmental protection. For many crops, including fruits, vegetables, and nuts, bees are crucial pollinators. West African nations may increase agricultural yields, guarantee food security, and safeguard their distinctive ecosystems by encouraging beekeeping and protecting natural areas. Additionally, by assisting in the maintenance of pollinator species populations, beekeeping may support the conservation of biodiversity. The difficulties that beekeepers in West Africa encounter must also be included in this debate. These difficulties can include restricted access to contemporary beekeeping methods and tools, bee colony-damaging pests and illnesses, and possible effects of climate change on beekeeping operations. For beekeeping to expand sustainably in the area, it is essential to recognize these obstacles and consider solutions. Overall, the subject of "Beekeeping in West African Countries" involves a wide variety of challenges, from food security and environmental sustainability to biodiversity conservation and economic growth. A thorough examination of this subject may illuminate the potential advantages and difficulties of beekeeping in West Africa and provide insightful information for practitioners, researchers, and policymakers involved in this sector.

CONCLUSION

In conclusion, the investigation into beekeeping in west African countries offers a varied and promising path for environmental preservation and sustainable development in the area. The importance of this subject is highlighted by the rich biodiversity of West Africa, the beekeeping industry's economic potential, and beekeeping's critical role in pollination and ecosystem preservation. Although there are clearly issues that need to be resolved, such as poor resource availability and the danger of pests and illnesses, these issues may be resolved

with focused interventions, support, and education. West African nations may reap a variety of advantages by encouraging beekeeping, including improved food security, community revenue production, and the preservation of their distinctive ecologies. Beekeeping essentially provides a way to a more resilient and affluent West Africa. In order to advance sustainable beekeeping methods, stakeholders must work together and share resources and information. West African nations may use beekeeping's potential by working together, assuring a better and more sustainable future for both our people and the environment.

REFERENCES:

[1] M. H. Hussein, "Beekeeping in Africa: I-North, East, North East, West African Countries," in Proceedings of the 37th International Apicultural congress, 2001.

[2] A. A. Paraïso, A. Sossou, D. Iz-Haquou, R. N. Yegbemey, and A. Sanni, "Perceptions and adaptations of beekeepers and honey hunters to climate change: The case of the communes of Natitingou and Tanguieta in Northwest of Benin," African Crop Sci. J., 2012.

[3] S. O. Adjare, "Beekeeping in Africa," Apiacta. 2001.

[4] S. Augustino, J. J. Kashaigili, and E. F. Nzunda, "Impact of traditional beekeeping on Mgori village land forest reserve in Singida District, Tanzania," Tanzania J. For. Nat. Conserv., 2016.

[5] B. Chazovachii, M. Chuma, A. Mushuku, L. Chirenje, L. Chitongo, and R. Mudyariwa, "Livelihood Resilient Strategies through Beekeeping in Chitanga Village, Mwenezi District, Zimbabwe," Sustain. Agric. Res., vol. 2, no. 1, p. 124, 2012, doi: 10.5539/sar.v2n1p124.

[6] B. M. Wambua, N. K. R. Musimba, and E. Muli, "Socioeconomic analysis of beekeeping technologies in Kenya: A case study of Kitui County," Int. J. Educ. Res., 2016.

[7] S. Suraj, "Factors affecting adoption of beekeeping and associated technologies in Kamrup (rural) district, Assam state, India," Biodivers. Int. J., 2018, doi: 10.15406/bij.2018.02.00069.

[8] M. Henry and G. Rodet, "Controlling the impact of the managed honeybee on wild bees in protected areas," Sci. Rep., 2018, doi: 10.1038/s41598-018-27591-y.

[9] P. Zoccali et al., "A novel GIS-based approach to assess beekeeping suitability of Mediterranean lands," Saudi J. Biol. Sci., 2017, doi: 10.1016/j.sjbs.2017.01.062.

[10] W. Reybroeck, E. Daeseleire, H. F. De Brabander, and L. Herman, "Antimicrobials in beekeeping," Veterinary Microbiology. 2012. doi: 10.1016/j.vetmic.2012.01.012.

[11] Z. Grgić, J. Filipi, D. Bićanić, and B. Šakić Bobić, "Opportunities for developing a business model of mediterranean beekeeping," J. Cent. Eur. Agric., 2018, doi: 10.5513/JCEA01/19.1.2038.

[12] B. S. Tessema Zewudu and M. D. Mohammed Aman, "Beekeeping Practices, Production Potential and Challenges of Bee Keeping among Beekeepers in Haramaya District, Eastern Ethiopia," J. Vet. Sci. Technol., 2015, doi: 10.4172/2157-7579.1000255.

CHAPTER 5

HISTORY OF BEEKEEPING IN EUROPE

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ABSTRACT:

Clay pots used to construct the ancient Greeks' horizontal hives were found in the 1960s close to Athens. The Romans also maintained bees in bricks, woven wicker, cork, wood, and earthenware. Beginning with enormous clay hives in Greece and progressing to coiled wicker skeps in Romania and Great Britain that were coated with mud or cow dung to make a more weather-tight colony, early European beekeepers prioritized accessibility. These improvements in honey bee hive stability improved colonies' lifespan over that of wild bees while also making beekeepers' job of collecting honey easier. By changing honey bees' swarming behaviors, European beekeepers also impacted the honey bees' natural ability to disperse. When there is a food scarcity, honeybees often swarm in order to move to an area with more flowers per square mile. Beekeepers in Greece and England often used wine, flute music, and a variety of other strategies to steer bees into a new, local hive and sustain their numbers in order to reduce colony loss.

KEYWORDS:

Apiary Traditions, Beekeeping Evolution, European Beekeeping, Honey Production, Medieval Beekeeping, Modern Beekeeping.

INTRODUCTION

The fascinating historical voyage history of beekeeping in Europe reveals the complex interdependence of people and honeybees on the European continent. This historical story, which spans centuries and includes a tapestry of cultures, customs, and inventions, not only tracks the development of apiculture but also offers important insights into the socio-economic, ecological, and cultural aspects of beekeeping. The practice of beekeeping has a long history in Europe that dates back thousands of years. European civilizations have long appreciated bees and their golden honey, from the humming hives of ancient Greece and Rome to the monastic beekeepers of the Middle Ages [1]. This historical voyage shows how European beekeepers developed their trade, from simple practices to the advanced beekeeping technologies that define the contemporary day.

A great variety of bee species and subspecies, each suited to its own habitat, have developed throughout Europe as a result of the continent's different temperatures and terrain. These many bee populations, which range from the Apis mellifera beeriness of the Iberian Peninsula to the Apis mellifera arnica of the Alps, have helped to increase the regional variety of European apiculture. Additionally, the socio-economic foundation of European civilizations and the history of beekeeping are intricately entwined. Beekeeping and the production of bee products like honey and beeswax have not only been sources of food and sweetness but also of revenue and commerce [2]. While the industrial revolution introduced technology and commercialization to the world of beekeeping, monastic beekeepers in medieval Europe, for instance, were crucial in the development of beekeeping practices and the production of wax for sacred candles. In addition to the practical benefits, beekeeping has influenced European iconography, folklore, and culture. In literature, art, and mythology, bees and their hives have

been portrayed as symbols of work, peace, and assiduity. This cultural importance highlights the long-standing bond between Europeans and their avian friends. A historical trip in this thorough investigation of the "History of Beekeeping in Europe," revealing the turning points, inventions, and difficulties that have influenced apiculture on the continent. This historical narrative will highlight the resilience and adaptability of European beekeepers, illuminating their enduring dedication towards the preservation and agriculture of one of nature's most extraordinary creatures the honeybee from the early beekeepers of antiquity to contemporary the cultivation of bee practices in a rapidly changing world [3].

This encouraged the development of A. mellifera, which deviates from wild bees' habits by having a low inclination to swarm. Its peak as an industry in Eastern Europe most likely occurred between 1,200 and 1,400. The fact that Eastern Europe had bigger, more untouched forestsor at the very least, fewer domesticated animalsmeans that it was likely considerably better at producing honey than Western Europe. Grazing in large amounts will ultimately result in grass, but grazing in lesser quantities will result in blooming ground cover and bee-friendly habitats. The French accounts of the enormous amounts of berries that Russian peasants could harvest, with fruitful regions yielding up to 100 kg/ha of berries per year as well as up to half a ton of mushrooms, etc., were revered by the Germans in classical times. The most remarkable and expensive item was the honey[4].

i. Austria

Beekeeping was a significant industry in Austria, both Upper and Lower, as well as in Salzburg, Tyrol, Voralberg, Styria, Carinthia, Carniola, and the other former provinces of Istria, Dalmatia, Galicia, and Bukowina. There were several agricultural schools and associations, and they held festivals and gatherings often. Since the magnificent Empress Maria Theresa established the Vienna Apicultural College, all members of the Imperial House of Hapsburg have been ardent proponents of apiculture and devotees of honey. The oldest beekeepers stored their colonies in Skeps, which resemble an upside-down basket but lack the removable combs seen in contemporary hives. Long hives, which are being used today to raise bees, were the kind of traditional hives used in earlier times.

Slovenian Anton Jansa was the school's first beekeeping instructor when Austrian Empress Maria Theresa established it in the eighteenth century in Vienna. He was renowned for being an excellent beekeeping thinker and practitioner. Franz von Hruschka of Austria produced the first honey extractor that employed centrifugal force, which is still the technology used today, making modern beekeeping in Austria obvious before 1865. Along with Nikolaas Tinbergen and Konrad Lorenz, Karl Ritter von Frisch shared the 1973 Nobel Prize in Physiology or Medicine for their research on the sensory perceptions of the honey bee. He was also one of the first to interpret the significance of the waggle dance [5]. In many nations, Austrian standard size or Zander size beehouses are appropriate. Around 130 different kinds of bees have been recorded at the University of Vienna's botanical gardens, located in the third district, while the Austrian Horticultural Museum in the 22nd district has an apiary and makes its own honey. And at the Shinbun Zoo, there is a special apiary with glass windows and spyholes that is open to tourists and allows them to see the busy activities within the beehive. On the top of the Vienna State Opera, in the Secession, at the Museum of Natural History, and on the balconies of the Alleghenies Frankenia’s, urban beekeeping is a common activity in Vienna[6].

ii. Cyprus

Cyprus has a long history of producing honey, albeit there isn't much proof of this in ancient literature. Aphrodite was presented with a delicious treat called plakountas that was

composed of dough and honey. In his well-known work, Geoponica, Kassianos Bassou cites Diophanes of the first century AD as saying that "the Cyprus honey from Chytroi is also very good," which is more recent proof. Pliny writes in Naturalis Historia that "otherwhere, in places like Crete and Cyprus, honey is better known for its abundance" and that "Sicilian hives are excellent for their bee wax."

Products of the honey bee, namely honey and wax, were noted as important export goods throughout the medieval era. Russian Basilios Barsky, a well-known traveler and author of the eighteenth century, makes clear mention of the fact that ships were nearing Larnaca port to load the island's primary export goods, especially olive oil, wines, carobs, and honey. Jiovanni Mariti also mentions the wax trade, which included collecting wax in Nicosia, packing it into barrels, and transporting the barrels to the port of Larnaca for shipment. Prussian traveler J. Bramsen lists honey trading as one of the island's principal export industries, while German archaeologist Magda Ohnefalsch-Richter reported that clergymen were in charge of beekeeping and were particularly successful in producing high-quality and scented honey in the hilly areas[7].

Many international tourists who seem to have been astonished by the notion that Cypriots were physically raising bees in their homes have also given the distinctive Cypriot bee hive, known as great acclaim. The Cypriot hives and the native apiculture methods were first thoroughly described by Denis Posset in 1533 and then by Clarke. According to the discovery of ceramic cylinders from 650 to 750 AD, these activities are likely older than that. The original, cylindrical-shaped hives known as tzivertia are 60-90 cm long, composed of clay or a combination of mud and feed, and stacked on top of one another in horizontal rows to cover the whole side of an exterior house wall. Honey was obtained from the rear of the hive, which was situated practically within the house, where bees entered from the outside side of the wall. There were 500,000 of these tzivertia in Cyprus in 1894, according to data from that year. However, when British beekeepers arrived in Cyprus during the early colonial era and introduced the more productive European hive, which eventually supplanted the older traditional kind, the situation altered. Today, just 890 of the 44,338 active hives are of the classic tzivertia variety.

iii. Czech Republic

Traditional beekeeping in Czechoslovakia was carried out by small, mostly artisanal beekeepers, but the nation lost 300,000 hives, or around 1/3 of those present before the revolution. The most popular kind of bee in the Czech Republic, the dark alpine Carniolan bee, has been the subject of controlled breeding for many years. The situation has recently improved thanks to scientific effort from the Bee Research Institute, founded in 1919, and a recent expansion of 60,000 hives. Czech Republic still ranks among the top beekeeping nations in the world, with an average of one beekeeper and ten hives per square kilometer. There are not many Langstroth hives. They are not appropriate for migratory trailers or beehouses, which is one of the reasons. One of the Czechoslovak kinds of hives is used by many beekeepers. Most of them provide entry from both the top and the rear to a single brood chamber. With the help of insulation and a retractable rear barrier, the area in the brood chamber is carefully managed. Up to 14 frames may fit within the brood chamber, depending on the design. A glass pane in the rear wall allows you to see what's happening on the final frame[8].

iv. France

Bees had been important to the Celts for mead, honey and wax, and beekeeping by Gauls may have begun with the influence of the Greeks in the late fifth and sixth centuries BC, or

perhaps with the occupation by Rome in the first to fifth centuries AD. Farming and beekeeping skills were passed on through the fall of the Roman Empire and the Germanic invasions of the Merovingian Dynasty of the Franks that began with the conquests of Clovis in the mid-fifth century, and ended with the final expansion of the great medieval king, Charlemagne in the mid ninth century. Around 794 AD this king specified estate management and revenue collection rules for royal estates. He specifies a beekeeper be assigned to each estate and a tally of income from honey, wax and mead be kept. The early Merovingians were fascinated by bees. Discovered in the Merovingian tomb of Childeric I, the father of Clovis, in 1653 by a mason working on the reconstruction of the church of Saint-Brice in Tournai, were several gold items including 300 golden bees. The Merovingian Bees influenced Napoleon, who, looking for a heraldic symbol different from the fleur-de-lys, used them as an inspiration for his own personal symbol and were incorporated into the Coat of Arms of the new Napoleonic French empire [9].

v. Germany

In Germany's peat bogs, simple wood hives dating back 1,500 years or more have been discovered. It was constructed from beech wood, and wooden pegs held the cover in place. It came in three sections, which assembled to create a hollow log. The Staatliche Museum in Oldenburg, Germany, presently houses this beehive. The crownpiece on early skeps, which was used to support the skep, was known as the skep. These early baskets resembled tepees in form. Later baskets developed the distinctive crown or dome that we see in modern skeps because they were made of coils of straw by trained artisans. Examining the evolution of the coil straw skep is fascinating. At some time, beekeepers came to the conclusion that, rather than sulfuring the hive to extract the honey, something could be inserted on top of the skep or the skep could be positioned on another coil and the honey could be gathered in these containers. Because of its great value, honey was often utilized as payment, homage, or an offering. German peasants used honey and beeswax to pay their feudal lords in the eleventh century A.D.

The first person to introduce the world to this unique kind of bee was the Carniolan baron Emil Roth Schutz from Postrema near Visna Gora. He discussed a local bee that he named "krainische" in an essay titled "Aus Unterkrain" that appeared in the Bienenzeitung journal from Eichstedt in 1857. Despite baron Berlepsch's unfavorable judgment, who at the time was unquestionably the foremost German expert on beekeeping and one of the producers of the aforementioned journal, the story generated significant interest in this newly found bee. The bee began to pique the curiosity of beekeepers across Europe. Dr. Ziwanski of Brno suggested that a commercial beekeeping center be built in Podsmreka, next to Vinja Gora, and it did so quite quickly. Approximately 3,000 colonies containing queen bees were dispersed throughout the first three years of its existence. Over 100,000 bee colony distributions were made by the group overall. The basic, unassuming beehive afterwards known as "kranjic" served as the foundation for this lucrative commerce. It could be transported and stacked with ease. Carniolan bees caught the attention of international specialists. "The value of different breeds and their variations according to reputable bee-keepers" was a book written by Pollmann in 1879. He discusses the Carniolan bee in this work, among other things, and calls it by the scientific names Apis mellificacarnica and Die krainische Biene or Die krainer Biene in German[10].

vi. Hungary

The beekeeping industry in Hungary has a lengthy history: Archaeologists have discovered forms for making parliament cakes at Aquincum, the capital of the Roman province of

Pannonia. Later, bee hunting replaced other methods as the primary way to get honey. The colony was able to survive the winter because the honey hunters did not outright steal the bees. Also stated on the warrant of the Abbey of Tihany were several steps. The guardians of Fortress Nandorfehervar cast down skeps upon the obsidians in a crucial fight. Vendors imported and exported Hungarian honey throughout the Middle Ages. The book about beekeeping by Nicholas Horhi was published in the seventeenth century. This book, titled Tractatum de Apibus, included several beliefs.

Queen Mary-Theresa established a school for beekeepers in 1770. The lecturers gave the kids instructions on how to utilize tools, equipment, raise queens, capture swarms, and gather honey. The so-called Georgicon, the first agricultural college in Europe, included beekeeping in its curriculum in 1789. The traditional beekeepers killed their bees and then removed the skep's combs to extract honey. Samuel Tessedik began keeping bees without using this technique in 1794. He exerted a lot of effort in Hungary to establish Acacia and other beneficial nectar sources. Beekeeping became a pastime for professors, clergymen, and landowners in the nineteenth century since it was not a livelihood for the people. In the latter part of the century, in the town of Komárom, Josef Jakab housed his bees in hives that comprised frames with honeycomb. According to some historians, the year was 1840. The first time Boczonadi displayed his hive was in 1913. It comprises 24 frames, each measuring 42 by 36 centimeters. Actually, this hive is usually utilized. Hungary now has 690,400 hives and 16,700 beekeepers. 41 hives on average are kept by each beekeeper. Only a few beekeepers with 400–700 hives operate here full-time. The colonies generate 10–17,000 tonnes of honey each year for the domestic and international markets. Every year, 7–15,000 tonnes of honey are produced[11], [12].

vii. Poland

In Poland, beekeeping has a lengthy history that dates to the thirteenth century, the time of the Slavic tribes. At that time, the first communities of forest beekeepers were established, with its residents' raising bees in tree trunk hollows. Forest beekeepers were given a great deal of respect and were given particular rights and privileges. Poland was well-known across Europe for its mead and wax up to the seventeenth century. Bee raising in the neighborhood of the home eventually replaced forest beekeeping in the nineteenth century to become beekeeping as we know it today. Despite the fact that Poland did not yet have an independent state at the time, Poles were responsible for many of the field's notable accomplishments. The national beekeeping groups and unions, as well as educational institutions, intensified their efforts to develop and disseminate beekeeping expertise after Poland regained its freedom in 1918. Unfortunately, many of the projects launched were halted by years of conflict and occupation.

The Institute of Apiculture, Poland's first autonomous scientific beekeeping organization, wasn't founded until February 1st, 1946 in Lublin. It wasn't included as a Division of Agriculture into the National Institute for Agricultural Sciences, which is located in Puawy until after two years. The Division of Apiculture was then moved to one of these institutions, specifically the National Research Institute of Animal Production in Cracow, in 1950 as a consequence of the NIAS's division into three distinct institutes. The Research Institute of Pomology was founded in Skierniewice in 1951 at the initiative of Professor S. A. Ionize. That same year, the Division of Apiculture was added to the organization of this institution. The Institute of Pomology's fast growth necessitated the expansion of the scientific infrastructure, including the experimental field base. As a result, the Division of Apiculture was relocated back to Puawy in 1965 while staying inside institution structures. History has completed a circle in this fashion. The Research Institute of Pomology and Floriculture was

established in 1978 as a result of the inclusion of decorative plant research under the Institute of Pomology's framework since 1967. The institution's name was once again changed in 2009 to the Szczepan Pieniek Research Institute of Pomology and Floriculture in honor of the institution's founder and first director after the passing of Professor Pieniek[13], [14].

viii. Russia

Honey was a crucial commodity for Russian survival for many years. From the eleventh century until far into the seventeenth century, people kept a lot of bees in Russian woodlands. During that time, bees were kept in logs or naturally occurring cavities in forest trees. Honey gatherers sometimes made bees artificial holes as well. The number of log beekeeping operations rose throughout the ages to the point that Russia could provide other nations with beeswax. Many individuals in rural Russia used to maintain bees as a source of income. When the legal laws, Russaya Pravda, were created in the eleventh century, bees were included in them. Laws against bee-tree destruction were also established in Lithuanian regulations in 1529, stating that you may not plow too closely or set fire to the tree. A bee was one of the main factors in the final Russian invasion into Siberia and supplied the most valuable forest resource in terms of economics. A significant commercial good in both Russia and Lithuania was still honey. In Russia, there have been periods when peasants were required to pay the crown half of their honey profits, making honey a lucrative industry for everyone from peasants to czars. Peasants were hired in certain locations to care for the crown's bee-trees and even to build new ones.

The quantity of honey produced was one thing, but beeswax was also purchased and sold. During the first six weeks of the sixteenth century, 600 tonnes of beeswax were reported as having passed through on boats traveling down the Neman River to Königsberg. People did not begin raising bees in specialized bee gardens with many wood hives until the seventeenth century. The earliest hints of contemporary beekeeping in apiaries emerged in the nineteenth century, and wooden frame-removable hives were created. People continued to experiment with hive designs throughout this time, ultimately coming up with the idea of multi-story hives. Prime honey areas were migrating east and south along with the growth of the commerce even in the seventeenth century to the south and east. At that time, the Voronezh Province exported 900 tonnes of honey annually. Thus, it was not difficult to see why bees were of interest to both the nobility and the peasantry.

With Russia's expansion from the sixteenth to the twentieth century, beekeeping has increasingly been concentrated on the country's borders as the interior's forest quality has deteriorated. Frame beekeeping developed into a very productive area of agriculture in many nations with the introduction of the frame hive by the Russian beekeeper P. I. Prokopovich in 1814 and the honey extractor by the Bohemian apiarist F. von Hruschka in 1865. A. M. Butlerov, M. A. Dernov, I. A. Kablukov, N. M. Kulagin, G. A. Kozhevnikov, and A. F. Iubin, among other Russian scientists and public personalities, made significant contributions to the creation and promotion of the scientific principles of beekeeping. The Tula Experimental Beekeeping Station and the Moscow Agricultural Station's beekeeping section combined to become the Institute of Beekeeping in 1930.

In 1974, it featured sections on bee biology, feed supplies for beekeeping, bee pollination of entomophiles agricultural plants, bee raising and care, selection, prevention and management of bee illnesses, automation on bee farms, and bee farming economics[15]. The institution oversees five reference centers, five experimental and commercial farms, one experimental station, and one experimental station. It covers topics including the technology for making beekeeping goods, the development of new bee strains and the upgrading of current ones, and

the thorough automation of production procedures. Higher-level and middle-level beekeepers get their education in agricultural and zootechnical technicism and institutes, while those with lesser degrees are taught in vocational training schools and apicultural schools. The Scientific Research Institute of Beekeeping in Rybnoe, Riazan' Oblast, as well as experimental and selection stations in several republics, conduct research. There is published research, reference, and production literature on beekeeping. Information about apicultural accomplishments both within and outside the USSR is published in the publication Pchelovodstvo. With its successes, beekeeping has become a significant enterprise in the Far East, the Urals, Siberia, Azerbaijan, Kirghizia, eastern Kazakhstan, and Armenia, where there are considerable expanses of wild nectareous plants. At the top apiaries, each hive may produce 150 kg or more of honey.

DISCUSSION

Europe's leading producer of honey One of the most powerful empires in medieval Europe a thousand years ago produced honey and wax as its principal exports, supplying them to all of the Old World's nations while also serving as the foundation of its own internal economy. When Petro Prokopovych created the first dismountable frame beehive in history, it marked a turning point in beekeeping history and signaled the start of the rational beekeeping age. This invention allowed beekeepers to actively regulate the growth of their industry and to control bee populations. Millions of beekeepers use it now, all over the globe. In terms of Ukrainian beekeeping today, the sector is growing quickly. Both local and international markets are seeing an increase in demand for Ukrainian honey[16]. The amount of honey that Ukrainians consume each year rises by 10% to 15%. Over 400,000 people maintain bees in Ukraine, a large portion of them are farmers, private landowners, and proprietors of small beekeeping operations. The production of honey is a job for 1.5% of Ukrainians, according to recent figures.

Additionally, Ukraine is among the top five nations in the world and the top country in Europe in terms of gross honey production, producing 75,000 metric tonnes yearly. According to data on beekeeping, Ukraine now has five million honeybee colonies, an increase over the previous several years. Sainfoin honey, sweet clover honey, Buckwheat, honey, echium vulgare honey, linden honey, thistle honey, sunflower honey, and monofloral honey are the most significant and well-liked honeys in Ukraine. However, honey from acacia blossoms is the most popular and well-known kind of honey. Eighty-three percent of the goods used in beekeeping are exported from the various areas of Europe to nations like Germany, Poland, France, Slovakia, Spain, Hungary, Austria, the Czech Republic, Cyprus, Estonia, Switzerland, Italy, and Denmark. Russia, Belarus, Azerbaijan, and Moldova are among the post-Soviet nations that make up another market for honey goods. Additionally, a significant amount of honey is shipped to Canada, Panama, and the United States[17]. Honey exports are anticipated to increase from 30 to 40% annually over the next several years, mostly as a result of the potential of the European markets to which Ukraine now has access as a member of the free trade area.

CONCLUSION

Around the Sokhumi area, the first commercial queen raising farms appeared around 1886. A few beekeepers maintained tens of thousands of hives. Some of those queens were brought back to the United States in 1906 by F. Benton, who had travelled the globe in pursuit of the perfect bee. Georgia's diverse terrain, temperature changes, protracted droughts during the nectar-gathering season, combined with abrupt rain-falls and gales, were all noted as unfavorable natural circumstances in 1971. Through the millennia, these extreme climatic

circumstances have chosen the positive traits that have made the so-called grey bee a recognized bee. The Georgian bee has a substantially better output than other races while living in an environment with abundant melliferous supplies and a generally stable climate. Malta is an island in the Mediterranean Sea that serves as an important cultural and commercial crossroads for commerce between Africa and Europe. A massive Roman-era archaeological monument that served as a beautiful backdrop for an intricate network of apiaries that the researchers have traced back to at least 3,000 years ago has only lately been discovered in this little region. These are bee-houses that were totally cut out of "globigerina" stone and had 500 bee colonies that were raised inside using a horizontal clay tunnel system. When Malta was known as Melita in Roman times, it was a significant hub for the production of honey. These locations still have names that are definitely related to the historical advancements in beekeeping in Maltese: On contemporary geographic maps, the place names Imgiebah and Wied-il-Ghasel attest to the locations where these priceless artifacts from a millennia-old history of beekeeping activity have been discovered. The Italian Beekeepers' Federation, who were the first to see and report on this astonishing news, believes it may be the most significant beekeeping archaeological find of the third century.

REFERENCES

[1] P. De La Rúa, R. Jaffé, R. Dall'Olio, I. Muñoz, and J. Serrano, "Biodiversity, conservation and current threats to European honeybees," Apidologie. 2009. doi: 10.1051/apido/2009027.

[2] M. P. Chauzat, L. Cauquil, L. Roy, S. Franco, P. Hendrikx, and M. Ribière-Chabert, "Demographics of the European apicultural industry," PLoS One, 2013, doi: 10.1371/journal.pone.0079018.

[3] M. Lodesani and C. Costa, "Bee breeding and genetics in Europe," Bee World. 2003. doi: 10.1080/0005772X.2003.11099579.

[4] J. Rodolfo and M. Irene, "Review article Biodiversity , conservation and current threats to European honeybees * Pilar D," Apidologie.Org, 2009.

[5] S. Campbell and E. Crane, "The Archaeology of Beekeeping," Gard. Hist., 1984, doi: 10.2307/1586797.

[6] P. Kasangaki, A. Sarah Otim, P. P'Odyek Abila, C. Angiro, M. Chemurot, and R. Kajobe, "The presence of varroa in Uganda and knowledge about it by the beekeeping industry," J. Apic. Res., 2015, doi: 10.1080/00218839.2016.1159858.

[7] R. JAFFÉ et al., "Estimating the Density of Honeybee Colonies across Their Natural Range to Fill the Gap in Pollinator Decline Censuses," Conserv. Biol., 2010, doi: 10.1111/j.1523-1739.2009.01331.x.

[8] P. Fontana et al., "Appeal for biodiversity protection of native honey bee subspecies of apis mellifera in Italy (San michele all'Adige declaration)," Bull. Insectology, 2018.

[9] I. Muñoz, D. Henriques, J. S. Johnston, J. Chávez-Galarza, P. Kryger, and M. A. Pinto, "Reduced SNP panels for genetic identification and introgression analysis in the dark honey bee (Apis mellifera mellifera)," PLoS One, 2015, doi: 10.1371/journal.pone.0124365.

[10] M. Higes, R. Martín-Hernández, E. Garrido-Bailón, P. García-Palencia, and A. Meana, "Detection of infective Nosema ceranae (Microsporidia) spores in corbicular pollen of forager honeybees," J. Invertebr. Pathol., 2008, doi: 10.1016/j.jip.2007.06.002.

[11] D. Downey, S. Chun, and P. Follett, “Radiobiology of Small Hive Beetle (Coleoptera: Nitidulidae) and Prospects for Management Using Sterile Insect Releases,” J. Econ. Entomol., 2015, doi: 10.1093/jee/tov068.

[12] A. Couto, K. Monceau, O. Bonnard, D. Thiéry, and J. C. Sandoz, “Olfactory attraction of the hornet Vespa velutina to honeybee colony odors and pheromones,” PLoS ONE. 2014. doi: 10.1371/journal.pone.0115943.

[13] T. D. Seeley, D. R. Tarpy, S. R. Griffin, A. Carcione, and D. A. Delaney, “A survivor population of wild colonies of European honeybees in the northeastern United States: investigating its genetic structure,” Apidologie, 2015, doi: 10.1007/s13592-015-0355-0.

[14] P. Kasangaki, A. Sarah Otim, P. P’Odyek Abila, C. Angiro, M. Chemurot, and R. Kajobe, “Presencia de Varroa en Uganda y su conocimiento por parte de la industria apícola,” J. Apic. Res., 2015, doi: 10.1080/00218839.2016.1159858.

[15] A. Lecocq, P. Kryger, F. Vejsnæs, and A. B. Jensen, “Weight watching and the effect of landscape on honeybee colony productivity: Investigating the value of colony weight monitoring for the beekeeping industry,” PLoS One, 2015, doi: 10.1371/journal.pone.0132473.

[16] K. Monceau, O. Bonnard, and D. Thiéry, “Vespa velutina: A new invasive predator of honeybees in Europe,” Journal of Pest Science. 2014. doi: 10.1007/s10340-013-0537-3.

[17] V. Dietemann, C. W. W. Pirk, and R. Crewe, “Is there a need for conservation of honeybees in Africa?,” Apidologie. 2009. doi: 10.1051/apido/2009013.

CHAPTER 6

AN EVOLUTION OF THE BEEKEEPING IN THE AMERICA

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ABSTRACT:

The practice of beekeeping in the Americas has a long history that dates back thousands of years and has experienced considerable changes. This thorough investigation looks at how beekeeping methods have changed through time in North, Central, and South America as well as the effects they have had on society. This paper explores the original beekeeping practices of native societies before exploring how the appearance of European honeybee species transformed apiculture in the Americas. The study charts the development of beekeeping techniques from the early days of colonization to the present, emphasizing significant breakthroughs and difficulties experienced by beekeepers. It looks at beekeeping's economic, environmental, and cultural aspects, highlighting how important it is to agriculture, biodiversity preservation, and local economies. This research also offers insight on the different elements, such as climate, geography, and cultural history, that have affected the geographical variety of beekeeping techniques. Additionally, it covers the present-day problems that beekeepers in the Americas must deal with, including as the risks presented by pests, illnesses, and habitat loss, as well as the initiatives taken to deal with these concerns via sustainable and conservation-focused beekeeping.

KEYWORDS:

Agriculture, Apiculture, Beekeeping History, Biodiversity, Colonial Beekeeping, Conservation, Indigenous Beekeeping.

INTRODUCTION

The Americas do not have any native honey bee species. Instead, several species of stingless bees filled its biological role. In certain regions, these bees are still exploited for their honey, which is prized in particular for its therapeutic qualities. European immigrants brought European honey bees with them long ago, unaware of the local bees, and an industry centered on this bee arose. The first European honey bees are brought to South America by the Spanish in 1538. Brazil first received some tropical, African Apis mellifera bees in 1956. These bees fared better than their European Apis mellifera forebears in the tropical Brazil. Through tropical regions of South and Central America, these Africanized bees have already reached the southern United States [1]. Beekeepers in Brazil and the surrounding nations created innovative management techniques and today make wonderful livings from these bees. Beekeepers will need to adapt their methods to suit the nature of these tropical bees, yet the bees' presence in the southern US states is raising concerns. The European honey bee thrives in the wet pampa, but there is also a tropical region of Argentina to the north, close to its borders with Paraguay and Brazil, where Africanized honey bees live. But even there, the majority of beekeepers still choose European bees because they produce more honey [2].

Dr. Warwick Kerr's research has recently focused on the keeping of native stingless bees to Brazil. Dr. Paulo Nogueira Neto is another pioneer in the field and has conducted substantial research into creating suitable nesting boxes. The honey produced by these insects is substantially different from that made by Apis bees, has a local reputation for health

advantages, and is much more costly since the bees produce much less honey. The attention generated by this activity led to the Natal conference being co-named the first to be devoted to meliponiculture.

Drs. Kerr and Nogueira Neto both gave information on this activity, the latter discussing regulation of the activity to preserve the resource while the former focused on Amazonian Indians cultivating native bees. A local stingless beekeeper, described the activity in the state of Rio Grande do Norte. In a recent census, 4,446 colonies were being managed by 86 stingless beekeepers [3]. The majority of beekeepers retained the jandara species, although a few other species, notably Scaptotrigona sp. and Melipona scutellaris, are also kept. The only native bee of the Sertao is the jandaira. However, little is known about its biology, and the custom of collecting its eggs from the forest might lead to a sharp loss in this resource. Therefore, several research are now being conducted to make sure that this bee's culture can be sustained.

i. Argentina:

In Argentina's center area of beekeeping started in earnest and is being practiced today. It all began in the 1930s when Raimundo Urmente Gil took over management of a little apiary close to Victoria. Through the 1950s and 1960s, the activity gradually increased. The first Italian queens were brought in in 1967, and beekeeping expanded rapidly in the 1970s. Beekeepers dramatically increased throughout the 1980s. During the lengthy growth season, colonies produced between 80 and 90 kg of honey, and there were few bugs to be concerned about. It was a golden age. Unfortunately, production fell with the introduction of Varroa destructor in the late 1980s. A number of restrictions were created as a consequence of the issues the Varroa mite caused. Nevertheless, there was a steady increase in interest in beekeeping, and both universities and the business sector offered a variety of courses. In 1984, the inaugural "Apiculture in the Pampa" conference was held.

As Argentina became and remains one of the world's top producers and exporters of honey, the 1990s saw even greater increase. Beekeepers received financial assistance and credit, and the federal government became engaged via the Instituto Nacional de Tecnologa Agropecuaria, which is the equivalent of the Research Service of the United States Department of Agriculture and is this year commemorating its 50th anniversary. In 1993, the first cooperative dedicated only to beekeeping was founded[4]. Cooperativa Apicola de Winifreda followed it in 1999. In the province of La Pampa, the number of beekeepers climbed from 498 in 1990 to 1,200 in 2001, while the number of colonies rose from 57,270 to 170,000. Although there have been fluctuations in output throughout the yearsfrom 60 kg in 1990 to a low of 35 kgtotal honey production has steadily increased from 3,436 to 7,000 tonnes.

ii. Brazil:

The trade was established in the 1830s when immigrants from the Old World brought the first honey bees over from Europe. This is the same honey bee that was brought to the United States and is often referred to as the German or black bee. Italian and Carniolan were quickly introduced, similar to most other areas in the New World. Beekeeping was mostly a religious pursuit and/or a pastime during the period, hence it was sedentary and of little significance. Less than 400 tonnes of honey were produced each year. Dr. Warwick Kerr brought African honey bees to Brazil in 1956. The rush of scientific research that is the result of the introduction of the Africanized honey bee into that nation is one of the causes for Brazil's advancements in apiculture. Originally known as Apis mellifera adansonii, they have subsequently been renamed to Apis mellifera scutellate. The Brazilian government first

requested that geneticist Dr. Warwick Kerr bring queens from Angola, South Africa, and Tanzania. Although the offspring seemed to be more prolific, they were regrettably quite defensive[5].

Everything was going well until a visiting beekeeper removed the barricades preventing the queens from escaping one day in the autumn of 1957. In addition to swarms of workers, 26 of the queens are thought to have abandoned these hives and are the source of the so-called Africanized honey bee. Dr. Kerr's reputation has changed over the years from pariah to savior as a result of the controversy this introduction sparked. The quick transition from the behavior of the European temperate honey bee to that of the African tropical honey bee was the cause of the alterations that Dr. Kerr's introduction to Brazil sparked. Defensive conduct was the one characteristic that attracted the bulk of early attention and continued to dominate the conversation for many years. The wave of the continents' transition to Africanized honey bees has caused many wild and, more significantly, controlled colonies by beekeepers in Brazil and other American tropics to become considerably more defensive. Stinging occurrences as a result, however more severe than those brought on by European bees, have often been exaggerated by Brazilian and other media sources[5].

Due to its ability to adapt to many of the environments in the nation and its innate resistance for parasites and diseases, Brazilians have grown to love this bee. Brazilians continue to be surprised and delighted by the fact that the Varroa mite, although being abundant everywhere, does not cause colonies to die in large numbers. There is no need to chemically treat cities as a consequence. Arlindo and Arnaldo Wenzel, brothers, imported 300 colonies of Apis bees from the southern states of So Paulo and Américo in December 1977 and raised them in Langstroth hives. The outcomes were nothing short of amazing. They produced as much honey in three months as was produced in So Paulo state in a whole year. Since then, the Wenzels' 5,000 colonies have produced an average of 200 tonnes of honey year, with a peak harvest of 375 tonnes in 1988. The practice of beekeeping is continuing to grow across the northeast, particularly into the states of Ceara and Rio Grande do Norte, which have larger population densities and are located closer to important ports than the majority of Piaui. The area is poised for significant expansion, particularly in the export market, as a result of this. Almost everyone who studies the beekeeping sector in this region of the globe comes to the opinion that Brazil is about to take over[6].

iii. **Nicaragua**:

In the middle of North and South America lies Nicaragua. It is a place of volcanoes, lakes, and woods. There has been beekeeping going back to pre-Hispanic times. Long before the entrance of the Spanish invaders in the sixteenth century, the indigenous bee was nurtured. The bee represents the sun for the native people. This magnificent sculpture may be seen in the Laguna Asososca, not far from Managua. A bee is shown in this sculpture adjacent to the well-known feathered serpent Quetzalcoatl. The gold standard for medicinal products was the honey made by native bees, known as jicote. It comes from both regular hives, where these little stingless bees were grown, as well as swarms gathered in the wild.

Contrary to Brazil and Venezuela, Nicaragua uses this lovely bee relatively little nowadays, although street vendors in the capital city of Managua still sell two different kinds of honey. One is derived from traditional Africanized bees, while the other is derived from "jicotes". Due to its scarcity and reputation for having superior therapeutic qualities, the second kind is often more costly. By placing a few drops of honey straight into the eye, conjunctivitis may be treated. To get rid of parasites in the mouth, moms in certain parts of the nation massage a cloth dipped in honey on their infant's tongue[7].

iv. North America

The first A. mellifera arrived in North America in 1622, transported by British colonists who were in need of honey. A. mellifera is one of the best studied domesticated bees since the European racial lines have been pretty well preserved, even though regulated mating between bee races has happened since their introduction and selection pressures have been applied by queen breeders. The earliest known instance of controlled bee keeping in colonies was a 1,641-court lawsuit in Massachusetts, where honey bees were formerly restricted to wild hives in hollow trees. Up until the end of the eighteenth century, honey huntingfollowing a bee back to its hiveor opportunistic honey gatheringremained the most common methods of obtaining honey, which is one of the reasons honey bees in North America are closely related to their English ancestors while English honey bees are very different from their African relatives. This is also due to the fact that many beekeepers in North America choose their hives based on color and striping, which have been demonstrated to have no effect on honey output or any other behavioral attributes[8].

v. Mexico:

The story is based on a discovery made on Cozumel Island, which is off the Yucatan peninsula's east coast. Although stingless beekeeping is mentioned in later sixteenth-century texts from Mexico, meliponiculture most likely started much earlier. The techniques and technologies used in stingless are not well described in these sixteenth- and seventeenth-century publications. The dissemination of stingless beekeeping may be traced back using the information in these narratives, and they also provide light on the historical significance of bee products as well as their usage. The Matricula de Tributos, which seems to have been a record of tribute given to the Triple Alliance in the Valley of Mexico, was one of the oldest records pointing to the significance of honey in the Balsas River valley. Indians in the Valley of Mexico created the record for Cortés around 1,520 years ago. The Yucatan Peninsula, which is currently Mexico's leading center for stingless bee culture, the Gulf Coastal sandy bottoms of Veracruz, and eastern San Luis Potos, the Pacific lowlands of Sinaloa and Nayarit, and the Balsas River basin of Michoacán, Guerrero, and the State of Mexico are apparently the four regions where stingless beekeeping, or meliponiculture, was significant during the sixteenth and seventeenth centuries. In many regions of Mexico today, stingless beekeeping is still practiced by indigenous people, and meliponid honey is highly valued for its therapeutic, culinary, and commerce uses. It is also sometimes allowed to ferment.

Compared to stingless beekeeping, honeybeekeeping is more common now, and honeybees now provide a crucial role in the agriculture-related ecosystems of the eastern Balsas basin. Traditional agricultural- ists still keep both the native stingless bee and the European honeybee in the Balsas River basin of southern Mexico. Since Hendrichs' discovery almost 50 years ago, the significance of stingless beekeeping and its spread in the Balsas River watershed have altered significantly. He discovered that just 28% of stingless beekeeping communities currently retain stingless bees.

Other areas of the eastern basin have also seen decreases of a similar kind. The spread of the stinging European honeybee and easier access to the Balsas River basin are to blame for the decrease of stingless beekeeping.

Because honeybees generate more honey each year than stingless bees do, Stingless beekeeping's significance in the local economy has significantly decreased as a result of these operations. Today, there is at least one honeybee keeper in almost every pueblo in the central and eastern basins, although stingless beekeeping seems to merely be a pastime for a select few people[9].

vi. Peru and Ecuador:

Peru has a bright future in beekeeping because to its large honey production potential. Its numerous temperatures, together with its huge, diversified, and untainted natural environment devoid of businesses and pesticide treatments, enable the plentiful harvesting of a wide variety of high-quality honeys. Although "Melliponiculture" tradition was already present, the first Spanish immigrants brought the black bee across from Europe. Since then, a variety of Italian and, to a lesser degree, Creolian bee supplies have helped to create the so-called "Creolian" bee that is now widespread throughout the nation. The fluvalinate molecule or covering the frames with cotton cords dipped in petroleum jelly were used to manage the Varroa illness in the recent past due to the Creolian bee's highly evolved natural cleaning habit. Bernard, a nobleman of France, was born in 1090. He was a poet for a time before deciding to join the Cistercians, a Benedictine monastic order.

Bernard quickly established his own monastery and shown clear leadership skills in the monastic world. Because of his "honey-sweet" approach to preaching and writing, his symbol was a beehive. St. Bernard is still revered as the presiding saint of bees and beekeepers. The Africanized bee gradually swarmed into Ecuador from nearby nations along its borders. The area with the greatest concentration of beekeepers is unquestionably the coastal plain. Bees have access to nectar flows from citrus fruit orchards, avocado trees, medlar trees, and mango trees from August, which is in the Southern Hemisphere's Winter. The area where the most significant honey harvests are gathered is in the northern part of that coastal zone, which borders Ecuador. Carob tree blossoming has been followed by harvests that may reach 45 kg per hive. Additionally, transhumance is used by beekeepers in this area. There are several beekeeping development initiatives underway. A significant part of that demanding endeavor involves beekeeping.

Recently, more than 2,000 beehives were dispersed over the Huallaga valley. A number of uplifting instances demonstrate once again how beekeeping is a very practical choice. In a nation where eviction from the land is a problem that becomes worse every year, beekeeping may contribute to assisting locals in remaining on the property. Between 10,000 and 12,000 beekeepers are thought to be in existence overall. The majority of them maintain a dozen hives as hobby beekeepers. Only around half of them are experts in bees. Less than 5% of beekeepers are professionals. Over 1,000 hives are located on six coastal bee farms. The Langstroth-style hives have Hoffmann frames. Around 25 kilogram of output per hive is the average. The most recent harvests barely produced a dozen kilograms, which is a reduced yield. Royal jelly is made by certain beekeepers. The kilo of fresh jelly selling for 30 Euros and the 10 g for 8 Euros demonstrate the flourishing local market. Sometimes the hives are placed on roofs to lower the significant danger of theft. Additionally, Bolivian and Ecuadorian beekeepers are receiving training in the production of honey[10], [11].

vii. United States:

In 1622, the Virginia colony, home to a large Native American population, welcomed the first European honeybees to North America. Later supplies reached Massachusetts by 1638. Wooden boxes with detachable frames were popular in the 1800s; Lorenzo L. Langstroth invented and patented the present design in 1852. With the aid of this model, beekeepers could obtain the honey and beeswax without needing to put the insects to death. All prior artificial hives were superseded by this one, and many iterations of Langstroth's design are still in use today. A. mellifera is one of the best studied domesticated bees since the European racial lines have been pretty well preserved, even though regulated mating between bee races has happened since their introduction and selection pressures have been applied by queen

breeders. At the beginning of the nineteenth century, improvements in the domestication of honey bees in the United States may primarily be credited to happenstance. Approximately 80% of all domesticated hives were accidentally killed within two years by the larger wax moth, which prompted beekeepers to experiment with hive architecture. While wild honey bees continue to experience significant hive collapse, beekeepers improved the fitness of their more docile, weather-resistant domesticated bees by building an artificial hive with a slanted bottom to release the moth larvae. Honey bees were taught to alter their typical comb-building patterns when moveable-comb hives were developed. This modification was implemented gradually by emulating the natural spacing of wild bee combs. This opened up new opportunities for beekeeping and made it more lucrative for a beekeeper to manage a lot of hives, which ultimately gave rise to the large-scale hive management practiced in the United States today.

Most likely, European dark bees were the first honey bee species introduced. Later, Caucasian, Italian, and honeybees that hunt carnivores were introduced. Additionally, Ukrainian immigrants introduced Western honeybees to the Primrosy Krai in Russia in the 1850s. From the Vladivostok area of Eastern Russia, these Russian honey bees that resemble Carniolan bees were brought into the US in 1990. Russian honey bees have shown to be more tolerant of Varroa destructor and Acarapis woodi, two bee parasites. Prior to the 1980s, the majority of hobby beekeepers in the US were farmers or related to farmers who lived in rural regions and managed bees using methods that had been handed down through the generations. The majority of these beekeepers were eliminated when tracheal mites, Varroa mites, and tiny hive beetles arrived in the 1980s and 1990s, respectively, since they were ill-prepared to cope with the new parasites and their bees perished[12].

viii. Pacific Countries:

In the middle of the nineteenth century, European missionaries most likely brought honey bees to the Pacific for the first time. Before programs were started in Niue, Papua New Guinea, Samoa, and Fiji in the 1970s, early efforts to develop national apiculture enterprises were mainly unsuccessful. These initiatives showed that commercial honey production was a profitable business that could both serve local markets and make money from exports. Apiculture has been shown to be a suitable occupation for Pacific Islanders who live in rural areas by the NZ-funded apiculture development initiative in the Solomon Islands. These are all growing beekeeping sectors, although it should be emphasized that the sizes of these industries vary greatly. Some of these nations' beekeeping industry may never develop beyond their infancy, and somelike Tongahave already started to decline. Individual producers within nations have tried to create markets for live bees, queens, and nucleus colonies in addition to the export of honey. Limited success has shown the requirement for educated government personnel and well-established surveillance and monitoring systems for honey bee diseases that can provide the certification needed by exporters and trade partners. The hives in the Pacific must be constructed on platforms up to 500 mm high due to toad damage. Cyclones may topple hives, harm bees' nectar supplies, and harm honey production for up to a year after they occur[12], [13]. The biggest issue is with termites, wax moths, hornets, ants, and hornet nests. The economic life of the woodware is reduced by rotting of hive pieces, particularly if they were constructed from imported softwoods. Local hardwoods can be tougher, but they might weigh twice as much as an empty hive box.

DISCUSSION

On the island of O'ahu, the Royal Hawaiian Agricultural Society undertook the first unsuccessful effort to introduce bees in August 1851. In 1853, another effort to transport bees

from the American Mainland was launched, this time out of Boston. After a brief period of survival, the bees perished. William Buck of San Jose, California sent three hives of German black bees, Apis mellifera, to Honolulu aboard the American steamer Fanny Major on October 21, 1857. Soon, more types of honey bees were introduced to the Islands. Apis mellifera linguistic Italian bees were bought in Los Angeles and brought to San Francisco. After honey bees were successfully introduced in Hawaii in 1857, healthy colonies split out from the nine in Nuuanu Valley and developed feral colonies in the woods, which were suddenly teeming with a variety of vegetation. Hawaiian honey bees were only found in swarms or the few hives kept by enthusiasts prior to the industry's explosive rise at the turn of the 20th century[14], [15]. The beekeeping business grew as a result of the growing of sugarcane and the unintentional introduction of the sugarcane leafhopper Perkinsville saccharic Kirkaldy. Leafhoppers consume sugarcane, and their excretory honeydew is delicious. In regions where sugarcane was grown, bees discovered honeydew to be an alluring nectar replacement. Even while bees preferred the nectar from blooming flowers, they often switched to gathering honeydew when blossoms were not present. Leafhopper populations were high, which encouraged nectar collection and increased honey output. Colonies expanded quickly and split off to form new colonies. Kiawe was another common source of nectar[16].

CONCLUSION

In conclusion, the history of beekeeping in the Americas spans millennia and is rich and intriguing. It has been influenced by cultural, environmental, and technical variables. From the earliest customs of indigenous peoples to the adoption of European honeybees' species, beekeeping has been essential for ecosystem health and pollination in addition to producing honey and wax. Beekeepers have modified their tactics and technology throughout time, adopting contemporary ideas while also overcoming difficulties including illness, pesticide use, and habitat degradation.

The state of beekeeping in the Americas is critical right now. As the importance of bees in agriculture and biodiversity is being more widely recognized, sustainable and conservation-oriented beekeeping techniques are becoming more and more important. This change is a result of a more extensive worldwide effort to save beekeepers and their habitats. In order to guarantee that beekeeping is successful, that bee populations are preserved, and that our natural habitats are protected in the future, it is crucial that we keep doing research, developing new ideas, and working together.Beekeeping in the Americas is a continuing narrative that emphasizes the connections between people, bees, and the environment. It is not just a historical account. We can create a more sustainable and peaceful future for beekeepers, our ecosystems, and the priceless services offered by these wonderful animals by accepting the lessons of the past and the potential of the present.

REFERENCES:

[1] F. Requier et al., "Trends in beekeeping and honey bee colony losses in Latin America," J. Apic. Res., 2018, doi: 10.1080/00218839.2018.1494919.

[2] W. M. Hood, "Mammals and their effect on beekeeping in North America," Am. Bee J., 1996.

[3] F. O. Francisco, L. R. Santiago, Y. M. Mizusawa, B. P. Oldroyd, and M. C. Arias, "Population structuring of the ubiquitous stingless bee Tetragonisca angustula in southern Brazil as revealed by microsatellite and mitochondrial markers," Insect Sci., 2017, doi: 10.1111/1744-7917.12371.

[4] P. Kasangaki, A. Sarah Otim, P. P'Odyek Abila, C. Angiro, M. Chemurot, and R. Kajobe, "The presence of varroa in Uganda and knowledge about it by the beekeeping industry," J. Apic. Res., 2015, doi: 10.1080/00218839.2016.1159858.

[5] R. Vandame and M. A. Palacio, "Preserved honey bee health in Latin America: A fragile equilibrium due to low-intensity agriculture and beekeeping?," Apidologie. 2010. doi: 10.1051/apido/2010025.

[6] R. B. Kent, "Mesoamerican Stingless Beekeeping," J. Cult. Geogr., 1984, doi: 10.1080/08873638409478571.

[7] P. Fontana et al., "Appeal for biodiversity protection of native honey bee subspecies of apis mellifera in Italy (San michele all'Adige declaration)," Bull. Insectology, 2018.

[8] G. Nates-Parra and J. M. Rosso-Londoño, "Diversidad de abejas sin aguijón (Hymenoptera:Meliponini) utilizadas en meliponicultura en Colombia," Acta Biol. Colomb., 2013.

[9] D. Vanengelsdorp, R. Underwood, D. Caron, and J. Hayes, "An estimate of managed colony losses in the winter of 2006 - 2007: A report commissioned by the apiary inspectors of America," American Bee Journal. 2007.

[10] T. D. Seeley, D. R. Tarpy, S. R. Griffin, A. Carcione, and D. A. Delaney, "A survivor population of wild colonies of European honeybees in the northeastern United States: investigating its genetic structure," Apidologie, 2015, doi: 10.1007/s13592-015-0355-0.

[11] R. Owen, "Role of Human Action in the Spread of Honey Bee (Hymenoptera: Apidae) Pathogens," J. Econ. Entomol., 2017, doi: 10.1093/jee/tox075.

[12] M. Sandker, "Reforestation with major bee food trees in El Salvador," Apimondia, 2004.

[13] F. A. Cappelari, A. P. Turcatto, M. M. Morais, and D. De Jong, "Africanized honey bees more efficiently convert protein diets into hemolymph protein than do Carniolan bees (Apis mellifera carnica)," Genet. Mol. Res., 2009, doi: 10.4238/vol8-4gmr628.

[14] J. J. G. Quezada-Euán, G. Nates-Parra, M. M. Maués, V. L. Imperatriz-Fonseca, and D. W. Roubik, "Economic and cultural values of stingless bees (hymenoptera: Meliponini) among ethnic groups of tropical America," Sociobiology. 2018. doi: 10.13102/sociobiology.v65i4.3447.

[15] V. M. Tibatá, E. Arias, M. Corona, F. Ariza Botero, J. Figueroa-Ramírez, and H. Junca, "Determinación de los mitotipos de africanización en poblaciones de abejas Apis mellifera L. en Colombia," J. Apic. Res., 2018, doi: 10.1080/00218839.2017.1409065.

[16] E. Genersch et al., "The German bee monitoring project: A long term study to understand periodically high winter losses of honey bee colonies," Apidologie. 2010. doi: 10.1051/apido/2010014.

CHAPTER 7

BALANCING TRADITIONAL AND MODERN BEEKEEPING FOR SUSTAINABLE APICULTURE DEVELOPMENT IN DEVELOPING COUNTRIES

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ABSTRACT:

It has become more difficult for beekeepers to maintain a harmonic balance between traditional and contemporary beekeeping techniques in order to preserve the long-term sustainability of apiculture due to the fast change of apiculture practices in recent decades. In the context of apiculture sustainability, this research examines the complex interaction between traditional beekeeping practices and cutting-edge, technologically driven alternatives. This research outlines the benefits and drawbacks of both conventional and contemporary beekeeping techniques, emphasizing the effects on the environment, the economy, and society. It does so by drawing on a thorough assessment of the body of current literature and case studies from different geographical areas. It also looks at the synergies that may be achieved by combining these two strategies to build a more resilient and sustainable apiculture sector. This study gives useful insights into the practical tactics and policy implications required for beekeepers, academics, and policymakers to manage the shifting terrain of apiculture and encourage its long-term survival by integrating information from many sources. In the end, it emphasizes how important it is to strike a balance between tradition and innovation as a foundation for furthering sustainable apiculture growth in a constantly changing environment.

KEYWORDS:

Sustainable development, Traditional practices, Modern techniques, Beekeeping sustainability, Apiculture methods, Traditional beekeeping.

INTRODUCTION

History has shown us that natural beekeeping with wild swarms often caused little harm. Since migratory beekeeping was adopted to solve more serious issues a century or so later, modern beekeeping has developed with it. Chandler claims that "movable frames and foundation" free from the taint of artificial drugs, improper housing, and improper breeding practices. had given rise to a number of new issues, notably in the nations where modern breeding techniques were most prevalent. For instance, brood illnesses got so severe in America that regulation was required. Similar to how the Isle of Wight illness ravaged apiaries throughout England, Nosema disease has also plagued apiarists on the continent of Europe[1]. As a result, the ancient practices used in poor countries may provide answers to the current issues. Always keep in mind that in areas of evolution, nature will choose for the capacity for adaptation and survival, not for the greatest degree of human convenience.

In addition, bee breeding and intercontinental migration have contributed to the spread of several pests and illnesses. The commercial bee trade is directly responsible for the spread of the Varroa mite from its native Asia and its original host species, the Asian bee Apis cerana. The so-called "Colony Collapse Disorder," which has devastated the North American beekeeping sector and seems to be somewhat impacting Europe, made headlines during the

summer of 2007 as yet another honeybee calamity[2]. There are many investigations into the cause of CCD, and some beekeepers believe that the widely used GM crops, pesticides like Bayer's Imidacloprid, and a general decline in bee health as a result of long-term stresses from being farmed on an inappropriately commercial scale are to blame. The future beekeepers must bear in mind that a natural approach to beekeeping using local bees would be more lucrative in the long run. To ensure that bees that have developed over countless years in the form of local ecotypes within a nation are man- aged suitably to generate food not only for themselves but for humans as well, current beekeeping techniques should be used after being refined for existing bee species or races[3].

Significance of Apiculture in Developing Countries

The major source of poverty in emerging nations is the movement of rural residents to urban areas, therefore facilitating manufacturing for instant cash income has the potential to stop this outflow of people. This makes apiculture a sort of economic activity that is likely to have an immediate impact on regional development. Furthermore, considering the purchase of pricey hives and the introduction of foreign honey bee species would not be justified in a development project that aims for regional growth and is supportive of sustainable development. As a result, hives will need to be built locally, and if any natural colonies can be located nearby, they should be used [4]. Although very precise carpentry skills are required to construct a multipurpose hive of the highest quality, if goals are well defined and taken into account the local circumstances, it is not always necessary to introduce multifunctional beehives. The plan will also provide local carpenters the chance to embark on brand-new careers creating honey bee colonies. The program will also result in a subsequent phase of raising the standard of living in local communities through farmers' self-help efforts by teaching them the carpentry skills required to construct beehives, which may eventually be used to repair their homes independently. Where carpenters with abilities at a level sufficient to construct regular homes are present, fabrication is not too difficult if the beehive to be made may be of a type with a single purpose or of a basic type enabling a certain number of reduced needs [5].

Development of apiculture without the introduction of foreign honey bee colonies is predicated on the presence of native wild honey bees as local resources and the presence of traditional beekeeping techniques among the local population. It begins with the action of catching wild honey bees, which is essentially the direct use of methods for conventional beekeeping relying on spontaneous settlement of wild colonies to start the process [6]. As a result, apiculture development projects in these regions often use a method that falls in between traditional beekeeping and contemporary apiculture. From the perspectives of not only passing down traditions but also maintaining technological continuity, this method of transferring technology is ideal since it allows for the use of current technology systems to be further developed into new, more sophisticated technology systems. The benefit of the progressive method is that farmers may easily adopt a new technological system while maintaining their self-esteem by seeing the attention given to their traditions [7].

However, there are a lot of drawbacks to introducing foreign honey bee species. First of all, it necessarily highlights the fact that honey bees are an expensive basic production input, and secondly, it raises the issue that, since they are alien species, it is vital to take the local ecosystem's effects into account. Additionally, when there are few newly introduced colonies, cross mating between closely related strains emerges, which in certain circumstances may result in genetic deterioration [8]. Consequently, fresh honeybee lines must be imported on a regular basis even after the apiculture system has been established. The use of native honey bees will also contribute to the economic sustainability of the community's citizens as well as

the ecological sustainability of the area in which they live [9]. Regarding beehive equipment, since it was created in Kenya, a form of hive with top bars that may implement the fundamental idea of a contemporary beehive, namely the independent manipulation of individual honeycombs, has been invented in Africa. In contrast to contemporary beehives, which have moveable frames to contain different honeycombs, this one just has top bars. A honeycomb attached to each of the top bars hangs down from the main body of the hive and has a certain profile with a cross section that has a trapezoidal shape so that bees' honeycombs cannot be bonded to the hive walls. Since each honeycomb unit in a hive may be handled separately, beekeepers can simply split the colony during the propagation season or just remove the honeycombs that are packed with honey from the hive [10]. In order to enhance the number of honeycombs for honey storage, it is also feasible to use a queen excluder to lock the queen bee within a specific area of the hive. Because a top bar hive does not employ the comb foundation, unlike the method using moveable frames, the centrifuge used for honey extraction kills honeycombs. Broken sections of honeycombs may often be gathered as beeswax since it permits honey extraction using the conventional technique of compression as well.

The task of moving a bee colony that has established itself in a conventional hive to a contemporary hive is incidentally known as a colony relocation operation. This phase is absent from the typical modern beekeeping method, which begins with an existing hive with an established colony [11]. As a result, only a small number of apiculture specialists have firsthand knowledge of this activity. Contrarily, in local communities, the operation is crucial for improving the profitability of traditional beekeeping as well as for boosting the technical level of apiculture as a significant economic sector, therefore how to close this technical gap is a crucial concern. This technology, however, has the traits of an intermediate technology that has developed and been produced concurrently and independently in numerous versions in accordance with beekeeping factors unique to each region, such as the nature of honey bees, the style of traditional hives, or the shape of introduced hives. In essence, it would be necessary to collect and organize these many technologies [12].

Advancement of Balancing Traditional and Modern Beekeeping

In order to ensure the success of beekeeping methods and the maintenance of bee populations, advancements in the subject of "Balancing Traditional and Modern Beekeeping for Sustainable Apiculture Development" have been essential. These developments resulted from a convergence of technical innovation, sustainable agricultural techniques, and a clearer understanding of the connections between conventional and contemporary approaches. Here are some of the major developments in this area:

i. IPM stands for integrated pest management:

IPM techniques are being used more often by beekeepers to control illnesses and pests. This entails combining organic techniques, including employing beneficial insects and natural predators to manage hazardous pests, with the cautious use of chemicals, if needed. The detrimental effects of conventional insecticides on bee health are reduced by this strategy.

ii. Precision Beekeeping:

Beekeeping has incorporated modern technologies, such as sensors and data analytics. Beekeepers can measure hive variables in real time, such as temperature, humidity, and bee activity, thanks to hive monitoring equipment. Beekeepers may use this information to make educated choices and react quickly to any problems[13].

iii. **Programs for Selective Breeding:**

Genetic developments have made it possible to create bee breeds with desired characteristics including illness resistance, greater honey output, and gentle demeanor. The development of bees that are more adapted to both conventional and contemporary beekeeping techniques has resulted from these selective breeding operations.

iv. Honeybee Nutrition:

With a better knowledge of bee nutrition, specific diets and supplements have been created to maintain bee colonies during times of shortage, including the winter or seasons when nectar is scarce. By doing this, bee colonies are more likely to survive and be healthy[14].

v. Bee-Friendly Agriculture:

Agriculture that is bee-friendly Beekeeping is increasingly being included into sustainable agricultural techniques including organic farming and the production of foods that are beneficial to bees. Beekeepers and farmers are increasingly collaborating to design landscapes that provide plenty of feed for bees.

vi. Integration of Traditional Knowledge:

A determined attempt has been made to integrate traditional beekeeping methods into contemporary apiculture in recognition of the significance of indigenous and traditional knowledge. This helps to promote sustainable beekeeping techniques while also preserving cultural heritage.

vii. Training and Education:

Currently, beekeepers are more knowledgeable and skilled thanks to educational resources and training programs. This contains both inherited conventional wisdom and cutting-edge scientific ideas[15].

viii. Environmental Protection:

Environmentalists and beekeepers have teamed together to save and rehabilitate bees' natural habitats. The preservation of bees depends heavily on programs like establishing pollinator-friendly gardens and reviving wildflower meadows.

ix. Market Entry:

Thanks to developments in transportation and e-commerce, more bee products, including honey, beeswax, and propolis, are now accessible on a worldwide scale. As a result, beekeepers now have greater prospects for sustainable economic growth and revenue production.

x. Support for Policy:

The significance of beekeeping for ecological and food security has been acknowledged by governments and international organizations. Sustainable apiculture techniques are supported by more and more laws and regulations[16].

In conclusion, the development of balancing traditional and modern beekeeping for sustainable apiculture development entails a harmonic fusion of traditional knowledge with cutting-edge innovation. Beekeepers and academics are collaborating to maintain the longevity and vitality of beekeeping, which in turn promotes world biodiversity and food security, by adopting both traditional and new practices.

DISCUSSION

The debate over Balancing Traditional and Modern Beekeeping for Sustainable Apiculture Development highlights how crucial it is to strike a balance between traditional beekeeping methods and cutting-edge contemporary methods. The need to adapt to shifting climatic circumstances and the needs of a rising global population has led to considerable changes in beekeeping, an ancient agricultural activity. A crucial component in ensuring the sustainable growth of apiculture, with significant ramifications for both ecological stability and human lives, is the balance between tradition and modernity [17]. Traditional beekeeping techniques that have been handed down through the centuries are intrinsically valuable for sustaining biodiversity and protecting cultural heritage. They often have complex relationships with the regional ecosystems and indigenous knowledge systems. These procedures often put the health of the bees and the preservation of their natural habitats first, indicating a comprehensive approach to beekeeping. However, they could potentially have production and disease control difficulties, particularly in light of changing environmental hazards. On the other hand, contemporary beekeeping techniques make use of scientific research, technical advancements, and business interests to maximize honey output and hive management. These methods provide apiculturists more control over a variety of apicultural practices, from sensor-based hive monitoring to deliberate breeding schemes that result in bee strains with desired characteristics. Modern techniques have obviously increased output, but they may also give rise to worries about their effects on the environment, particularly when chemical treatments and monoculture crops are used [18]. Finding solutions to balance traditional and contemporary beekeeping's strengths and flaws is key to maintaining the delicate balance. Integrative strategies have acquired popularity in contemporary beekeeping frameworks, such as the adoption of organic and sustainable methods. Initiatives to integrate conventional wisdom into contemporary structures recognize the importance of indigenous knowledge in preserving ecological harmony. In this conversation, education and training are also crucial. Beekeepers need to be knowledgeable about everything from age-old methods based on local wisdom to the most recent findings in science. This guarantees that they can make wise choices that support bee health, increase production, and aid in pollinator and habitat protection. Balancing traditional and modern beekeeping for sustainable apiculture development is crucial in the modern world since food security and ecosystem health are directly impacted by the destiny of honeybees and other pollinators. In order to achieve this balance, one must take a careful, comprehensive approach that honors prior knowledge while seizing the potential of the future. By finding this balance, we can aim to create a more resilient and sustainable apiculture sector that benefits both people and the environment [19].

CONCLUSION

In conclusion, the goal of balancing traditional and conventional beekeeping for sustainable agriculture development marks an essential step in the right direction toward ensuring the welfare of honeybees and people alike. This careful balance between time-honored traditions and cutting-edge technology emerges as the key to sustainable apiculture as we traverse the complexity of a constantly changing environment. It must use traditional beekeeping techniques to support biodiversity and habitat preservation because they have inherent worth and are rooted in ecological knowledge and cultural history. At the same time, embracing contemporary developments in beekeeping technology, genetics, and logistics enables us to fulfill the expanding demand for bee products and guarantee beekeepers' financial sustainability.This conversation highlights how vital it is to combine these two strategies. By doing this, we can make sure that beekeeping continues to be a crucial component of environmental stability and food security worldwide. It is an appeal for cooperation between

beekeepers, researchers, decision-makers, and communities all around the globe. Together, we can create a future where the ancient hum of bees and contemporary innovation coexist, promoting the sustainable growth of apiculture for the good of everyone.

REFERENCES:

[1] M. Lopes, S. I. Falcão, M. Dimou, A. Thrasyvoulou, and M. Vilas-Boas, "Impact of traditional and modern beekeeping technologies on the quality of honey of Guinea-Bissau," J. Apic. Res., 2018, doi: 10.1080/00218839.2018.1430979.

[2] T. Kumsa and D. Takele, "Assessment of the Effect of Seasonal Honeybee Management on Honey Production of Ethiopian Honeybee (Apis mellifera) in Modern Beekeeping in Jimma Zone," Greener J. Plant Breed. Crop Sci., 2014, doi: 10.15580/gjpbcs.2014.3.010314013.

[3] W. I. W. Ismail, "A review on beekeeping in Malaysia: History, importance and future directions," J. Sustain. Sci. Manag., 2016.

[4] D. Pattinson, "Pre-modern beekeeping in China: A short history," Agric. Hist., 2012, doi: 10.3098/ah.2012.86.4.235.

[5] N. T. Yap and J. F. Devlin, "Beekeeping innovation for sustaining rural livelihoods. A success story," Int. J. Innov. Sustain. Dev., 2015, doi: 10.1504/IJISD.2015.068771.

[6] A. Berhe, A. Asale, and D. Yewhalaw, "Community Perception on Beekeeping Practices, Management, and Constraints in Termaber and Basona Werena Districts, Central Ethiopia," Adv. Agric., 2016, doi: 10.1155/2016/4106043.

[7] H. D. Affognon et al., "Adoption of modern beekeeping and its impact on honey production in the former Mwingi District of Kenya: Assessment using theory-based impact evaluation approach," Int. J. Trop. Insect Sci., 2015, doi: 10.1017/S1742758415000156.

[8] G. Enbiyale, "Assessment of Honey Production System, Constraints and Opportunities in Ethiopia," Pharm. Pharmacol. Int. J., 2018, doi: 10.15406/ppij.2018.06.00153.

[9] A. Alemayehu, T. Yilma, E. Yohannes, F. Mulisa, and A. Habtamu, "Analysis of honey production systems in three agro-ecologies of Benishangul-Gumuz, Western Ethiopia," J. Agric. Ext. Rural Dev., 2016, doi: 10.5897/jaerd2015.0705.

[10] K. Aregawi, W. Zewdu, and T. Woreknesh, "Challenges and opportunities of honey production in north- east dry land areas of Amhara National Regional State, Ethiopia," J. Agric. Biotechnol. Sustain. Dev., 2018, doi: 10.5897/jabsd2018.0308.

[11] G. Guesh, B. Amssalu, M. Hailu, and T. Yayneshet, "Beekeeping management practices and gap analysis of beekeepers at different agro-ecological zones of Tigray region, Northern Ethiopia," J. Agric. Ext. Rural Dev., 2018, doi: 10.5897/jaerd2018.0978.

[12] T. Gebiso, "Adoption of Modern Bee Hive in Arsi Zone of Oromia Region: Determinants and Financial Benefits," Agric. Sci., 2015, doi: 10.4236/as.2015.63038.

[13] M. H. Hussein, "Beekeeping in Africa," Apiacta, 2001.

[14] S. Guyo and S. Legesse, "REVIEW ON BEEKEEPING ACTIVITIES , OPPORTUNITIES , CHALLENGES AND Journal Of Harmonized Research in Applied Sciences," J. Harmon. Res. Appl. Sci., 2015.

[15] A. Abera, H. and Yakob, and G. Yasin, “Assessment of production system and constraints of bee keeping practices in damot gale woreda, wolaita zone, southern ethiopia.,” J. Biol. Agric. Healthc., 2016.

[16] N. Zogovic, M. Mladenovic, and S. Rašić, “From Primitive to Cyber-Physical Beekeeping,” 7th Int. Conf. Inf. Soc. Technol., 2017.

[17] S. F. G. Yusuf, F. S. Lategan, and I. A. Ayinde, “Creating youth employment through modern beekeeping: Case study of selected youth trained in Moro Local Government, Kwara State, Nigeria,” S.Afr. Tydskr. Landbouvoorl./S. Afr. J. Agric. Ext., 2014.

[18] F. Eforuoku and M. Etukudo, “Attitudinal Disposition of Trained Beekeepers towards Use of Modern Beekeeping Technologies in Oyo State, Nigeria,” Asian J. Agric. Extension, Econ. Sociol., 2017, doi: 10.9734/ajaees/2017/26931.

[19] B. Bianco, R. T. Alexander and G. Rayson, “Beekeeping Practices in Modern and Ancient Yucatán:,” The Value of Things, 2017.

CHAPTER 8

AN OVERVIEW OF THE TAXONOMY AND DISTRIBUTION OF DIFFERENT HONEYBEE SPECIES

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ABSTRACT:

Bee protection is essential for both human wellbeing and the health of plant ecosystems. A pollination issue has unfortunately resulted from bee population decline in several places of the planet. Locally adapted honeybee strains, subspecies, and ecotypes are less vulnerable to increased losses than nonnative bee species. Therefore, it is crucial to preserve them as a genetic resource for the breeding of strains that are resistant to illness and stress. Determining how and when these adaptations emerged also requires a thorough study of the origin and spread of bees. Understanding these bees' evolutionary ties would serve as a foundation for behavioral investigations within an evolutionary framework, shedding light on the evolutionary roots of complex social behavior including the use of dance and music to signal the location of food or refuge. Estimates of divergence periods and the ancestor biogeographic ranges of the key groupings would be provided along with a global phylogeny. This chapter covers the history, taxonomic makeup, and geographic distribution of honeybees.

KEYWORDS:

Apis Cerana, Apis Dorsata, Apis Mellifera, Beekeeping, Biodiversity, Insects.

INTRODUCTION

A taxonomy classification system organizes the evolutionary links between every species on earth. The highest categories in a taxonomy are the most inclusive, whereas the lowest categories are the most restrictive. Domain, kingdom, phylum, class, order, family, genus, and species are the names of the categories. Bacteria, Archaea, and Eukaryotes are the three categories of life. Bees are an animal and are a part of the Eukaryota domain. More than 70 million years ago, during the Cretaceous epoch, the current bee fauna first appeared. Bees belong to the kingdom Animalia, the class Insecta, the phylum Arthropoda, and the order Hymenoptera. Over 100,000 distinct species of bees, wasps, ants, and sawflies have been recognized and documented for this order. For the layperson, the "wasp waist," or the small region between the thorax and the abdomen, is the most distinguishing feature of the majority of members of this group. They all, of course, have two pairs of wings, multi-segmented antennae, and, in some cases, piercing ovipositors [1].

Hymenoptera completely metamorphose, and typically, unfertilized eggs are the source of the male development. This order has several sociable animals that may form fairly huge colonies. Ten species of honeybees from the genus Apis have been identified to yet. Three separate groups cavity-nesting bees, gigantic bees, and dwarf bees are firmly supported by phylogenetic studies based on nuclear DNA and mitochondrial markers. The lineage that gave birth to contemporary A. mellifera indicates an early divergence from other cavity-nesting bees, and as all of these species, with the exception of A. mellifera, are now restricted to Asia, it is most probable that A. mellifera may eventually trace its origin to Asia [2]. The taxonomy of other animals whose genomes have previously been mapped is also undergoing

change, and this is also true for the evolutionary connections among the thousands of bee species that have been recognized. Apis mellifera, the Western honeybee, is a species of significant commercial, agricultural, and environmental significance [3]. It is currently found all over the globe thanks to beekeepers' efforts, but its original range was vast and varied, encompassing Europe, Africa, and the Middle East. The 236 million base genome sequencing of the European Honeybee Apis mellifera took four years and the labor of hundreds of experts to finish.

Over 10,000 genes that affect social behavior and physiology have already been discovered, and this insect is the sixth to have its genome sequenced to far. For the purpose of facilitating future research by scientists from all around the globe, this new knowledge has been hierarchically structured into a system called Proto Bee. Because of climate and ecological changes during the last ice age, an Early Pleistocene radiation is likely to blame for the variety of subspecies [4]. Recently, it has been hypothesized that desertification in the Middle East and neighboring regions, which resulted in the decline of food plants and trees that provided nest sites, eventually caused gene flow to cease, separating the ancestral stock of cave-nesting Honeybees into the Western group of E Africa and the Eastern group of tropical Asia.

The Origins of Honeybees:

Bees likely entered the world at the same time as flowering plants during the Cretaceous era, 146-74 mya, despite the lack of fossil evidence. Bee evolution is intimately related to a shift in food sources from insect prey to pollen and nectar found in angiosperm blossoms. Bees are believed to have originated from hunting wasps that developed a liking for honey and opted to become vegetarian. Some wasps' feeding behavior shifted from a predatory life on larvae to one of nectar and pollen collection as a result of the availability of nectar and pollen. The honeybee evolved its morphologies, such as enhanced fuzzyness, pollen baskets, longer tongues, and colonies to store resources, about 120 mya with a focus on collecting pollen and nectar [5].

Trigona prisca, a stingless fossil bee that lived between 96 and 74 million years ago, was discovered in the Upper Cretaceous of New Jersey, United States. It cannot be distinguished from contemporary Trigona. It has been impossible to determine when bees of the A. mellifera/A. cerana type originally originated on Earth, despite the presence of a smaller, smaller bee that resembled Apis dorsata in the Upper Miocene. Apis florea and Apis dorsata, on the other hand, may have existed as distinct species as early as the Oligocene era. Also thought to have developed distinct identities in the later Tertiary period are A. mellifera and A. cerana [6]. The two species seem to have been physically separated during the last glacier, and interaction between them has only recently been made possible by human intervention. Both A. mellifera and A. cerana have evolved into geographical subspecies, or races, throughout the post-glacial period. Given that all but one of the existing species are indigenous to southeast Asia, including the most rudimentary surviving species, honeybees as a group are likely to have originated there. The ancestor of honeybees may have existed at this time, but fossils of the real Apis bees can be found in deposits from the Eocene period, 40 million years ago. However, just because these fossils are from Europe does not necessarily mean that Europe is where the genus originated, even if southeast Asia was the true origin [7].

Honeybee Speciation and Adaptation

For taxonomists, the genus Apis and the family Apidae in particular, are a perennial source of frustration. There are thousands of species, and even within a single group, the size of the

anatomy may vary dramatically, making it difficult to distinguish between a specimen's belonging to one species or another. There are an estimated 40,000 species of bees in existence worldwide, with around 25,000 recognized species. Because of this, behavioral traits play a big role in defining taxonomy[7]. In addition to the morphological distinctions between subspecies and their current geographic distribution, a thorough categorization must take into consideration the geological data pertaining to the subspecies' origins, subsequent evolution, and distribution.

i. As mentioned before in this paper, honeybees initially evolved during the Cretaceous era after deriving from short-tongued, perciform wasps. At that time, Gondwana was the name given to the landmass that included the modern continents of Africa, India, South America, Australia, and Antarctica. Angiosperms, blooming plants with colorful and intricately patterned petals that produce copious amounts of nectar to entice bees and other insects, originated as a result of the tropical dry environment that prevailed throughout the Gondwanan period. Although there is currently a dearth of evidence, open-nesting honeybees may have developed before cavity-nesting bees, most likely in India. In any case, approximately six mya ago, a cavity-nesting honeybee expanded to the east and north [8].

ii. European honeybees were extinct during the Oligocene-Miocene period, around 35–40 mya, but Indo-European honeybees persisted and started to diversify. This occurred when Gondwana moved apart and temperatures dropped sharply.

iii. This bee migrated west into Europe and subsequently into Africa during a Pleistocene warming approximately 2-3 mya, eventually evolving into A. mellifera. The fossil record reveals that the region of earth that is now Europe formerly had a tropical climate. The only way the open nesting species would have survived as the environment became colder would have been to migrate to the tropical area of Southern Asia [9].

iv. Africa was mostly cut off from Europe throughout the Tertiary period by the sea, and even when a land bridge was built, no Tertiary varieties of honeybee made it to Africa.

It's possible that the Pre-Pastoni an glacial period followed a vast and widespread divide in the pre-florea or andreni form is during the early Pleistocene. The two species, A. cerana and A. mellifera, are thought to still be in the early stages of speciation. Since their presence in the temperate zone is evidence of a postglacial pattern, they have only been there for 50,000 years or so. The evolution of multi-comb nesting and thermoregulation in the Apinae family is perhaps the most significant modification or adaptation to the physiology and behavior of this group of organisms. These advancements made it possible for the Apis to adapt to various climatic conditions, which greatly increased species and sub-species diversity. The glaciations that occurred throughout the Pleistocene era are likely to have caused a physical split into two groups, which were then held apart during subsequent warm times by desert and semi-desert. However, alternative theories based on phylogenetic trees made from genetic markers and suggesting an out-of-Africa expansion for the origin of A. mellifera have also been put forward. The most recent findings are theoretically compatible with a number of ideas for honeybee evolution, including an expansion out of Asia, and do not definitively situate the root of the tree of the A. mellifera subspecies inside Africa [10]. However, hybrid bees known as Africanized Honeybees were imported into Brazil in the 1950s in an effort to breed a bee better suited to the tropical climate of South America. These bees eventually

made it to the Brazilian wild in 1957 and then spread south and north until they were recognized by the United States on October 19, 1990.

Therefore, it seems probable that Southern Asia, maybe in the Himalayan area, was the location where honeybees first developed the superior thermal homeostasis that allowed them to live in chilly temperate zones. The Apis species was able to live independently of their surroundings as a result. They were able to survive in a wide range of conditions because to it. As a result, new habits emerged, such as multi-comb nesting and the capacity to hibernate for months during cold weather. The success of these adaptations contributed to the general expansion of the Apis range and the diversification of its species. The cavity-nesting A. cerana/A. mellifera type would ultimately colonize both tropic and cold temperate zones after becoming established and spreading east and west. Apis mellifera has a wide geographic distribution and habitat range. There are many different subspecies throughout the globe. They are spread over several continents, including Europe, Asia, North and South America, and even the Arctic Circle. The Mediterranean and deserts are typical habitats for apis mellifera, which prefers mild to warm climes [11].

Although they may survive everywhere from high mountain ranges to low, thick tropics, they most often occur in the Northern climatic zones. It is thought that Apis mellifera moved south via the Arabian Peninsula to colonize Central and Southern Africa then westward through Asia Minor to colonize the Balkans and the Mediterranean area. Similarities between nearby subspecies also point to North African colonization of the Iberian Peninsula and Southern France. At the period of the most recent Ice Age, there might have been no honeybees north of the Mediterranean area, the Iberian Peninsula, and South Western France. Even though the ice sheet's greatest extent in Western Europe about 18,000 years ago only extended as far as Northern Britain, the region to the south remained barren tundra for hundreds of kilometers. The ice sheet progressively receded during the mild era that followed the Ice Age, and broad-leaved oak, birch, pine, hazel, and elm woods replaced the tundra. Once again, the Western Honeybee was able to extend its territory throughout Europe. Due to a lack of appropriate nesting places in the steppes of Southern Russia, it proved unable to progress eastward through the Caucasian area [12]. The bees of the Balkan region expanded northward to inhabit the Western beaches of the Black Sea, the Eastern Alpine valleys up to the 50th parallel of latitude, and Central Europe. The bees that had sought sanctuary in Southern France during the Ice Age ultimately migrated throughout Europe north of the Alps and took up residence in a region that stretched from the Atlantic coast to the Ural Mountains in the West. Although honeybees were not known to exist in Norway until the nineteenth century, honeybee remnants dating back to about 1,200 have been discovered in an archaeological excavation in Oslo, suggesting that Southern Norway may have been the region's northernmost boundary. The Alps and Pyrenees Mountain ranges prevented bees from migrating northward in the peninsulas of Italy and Spain. A. mellifera, however, had to adapt to a wide range of habitats and climates, from the Continental climate of Eastern Europe with its harsh winters, late springs, and hot, dry summers, through Alpine, cool temperate, maritime, Mediterranean, semi-desert, and tropical environments, in order to colonize this vast territory that stretches from the Urals to the Cape of Good Hope. Natural selection, which created around two dozen subspecies or races, helped the body adapt. Given the correct circumstances, all of the A. mellifera group's subspecies may interbreed, although the crosses display hybridity traits [13].

DISCUSSION

A varied species of insects known as honeybees are essential for pollination and honey production on a global scale. For ecological and agricultural objectives, it is essential to

comprehend the taxonomy and distribution of various honeybee species. The taxonomy and geographic range of these fascinating insects will be covered in detail in this talk, which will also emphasize their usefulness to different ecosystems.

i. Honeybee Species Taxonomy:

The study of honeybees is a complicated discipline that has developed through time as our knowledge of science has grown. There are seven known species in the genus Apis as of my most recent update in September 2017. Subspecies of these species are also possible. The Western honeybee, Apis mellifera, the Eastern honeybee, and the Giant honeybee are a few of the most well-known honeybee species. Based on physical, behavioral, and genetic traits, honeybees are categorized [14].

ii. Honeybee Species Distribution:

There are many different places in the globe where honeybee species may be found. Environmental elements including temperature, vegetation, and the availability of habitat have an impact on their dispersal. Here are some crucial details about where various types of honeybees are found:

a. Apis Mellifera

Although it originated in Europe, Africa, and the Middle East, this species has since been imported to North and South America, Australia, and portions of Asia. There are many different types of honeybees because different subspecies of A. mellifera have adapted to various geographic areas.

b. Apis Cerana:

A. cerana is a native of Southeast Asia and may be found there as well as in Indonesia, China, and India. Additionally, it has spread to other regions of Asia [15].

c. Apis Dorsata:

Mostly widespread in South and Southeast Asia, the Giant honeybee builds huge, open nests on tree branches.

d. Additional Apis Species:

Apis florea and Apis andreniformis are two more lesser-known honeybee species with more restricted populations in regions of Asia.

iii. Relevance and Ecological Function:

Honeybees are essential pollinators in many ecosystems, ensuring the production of fruits, vegetables, and nuts as well as fertilizing blooming plants. They play a crucial function in agriculture since they help many different crops reproduce, which is why they are crucial for ensuring the safety of the world's food supply. Honeybees are essential for the production of honey as well as other bee products like beeswax and royal jelly in addition to pollination. These goods are important economically and culturally in many countries [16].

iv. Conservation and Difficulties:

The ecological and monetary significance of honeybee species makes their preservation imperative. Recent years have seen a number of difficulties for honeybee populations, including habitat loss, pesticide exposure, diseases, and climate change. Some honeybee populations have decreased as a result of these issues. Restoration of habitat, pesticide

management, illness prevention, and public awareness-building are all part of efforts to protect honeybee species. Honeybee conservation is also aided by beekeeping methods, since controlled colonies may maintain wild populations.

v. Upcoming Research:

For a complete knowledge of these insects, more study into the taxonomy, behavior, and genetics of honeybee species is needed. Studying their reactions to changes in the environment and human activity will also help with the creation of conservation plans and sustainable beekeeping techniques.

The taxonomy and distribution of many honeybee species is crucial for understanding ecology, agriculture, and conservation. For the sake of our world and future generations, it is crucial that we continue to research and conserve these amazing insects since they have a tremendous impact on our ecosystems and economy [17]. In conclusion, it is critical for our knowledge of honeybees to grasp the taxonomy and distribution of the many species. We have obtained insights into the vast world of honeybees and their importance in numerous ecosystems via thorough scientific categorization and geographic analysis [18]. Although complicated, the taxonomy of honeybee species offers a framework for recognizing and classifying the distinctive traits and behaviors of these insects. Our understanding of their evolutionary history, genetic diversity, and environment-specific adaptations is aided by this categorization [19]. In addition to being useful for academic reasons, this information is also important for beekeepers, ecologists, and conservationists who fight to protect the welfare of these important pollinators.

The global distribution of honeybee species demonstrates their resilience and impact on regional ecosystems. Each species of honeybee performs a unique function in pollination, honey production, and ecological interactions, from the Western honeybee's worldwide spread to the Giant honeybee's presence in Asian forests [20].

CONCLUSION

It is essential to comprehend these distribution patterns in order to put effective conservation measures into practice, save native species, and advance sustainable agriculture. The value of honeybees to the environment cannot be emphasized. They are essential pollinators that help various plant species reproduce and considerably increase the world's food output. Additionally, the production of their honey, beeswax, and other goods is important to global economies and cultures.

Nevertheless, threats to honeybee populations persist, such as illness, pesticide exposure, and habitat degradation. Collaborative efforts are necessary for the protection of these species, ranging from disease control and public awareness campaigns to habitat restoration and ethical pesticide usage. Managed beekeeping techniques are essential for maintaining populations of both wild and domesticated honeybees. Future studies will further our knowledge of the taxonomy, behavior, genetics, and reactions to environmental changes in honeybees.

These investigations will be crucial for developing efficient conservation tactics and environmentally friendly beekeeping procedures, eventually protecting these important insects and the environments they live in.

The taxonomy and distribution of several honeybee species highlight the relevance of these little but formidable organisms in a world where ecological balance and food security are of growing concern.

Our ongoing commitment to their study and preservation is not just a commitment to science, but also to the sustainability of our world and future generations.

REFERENCES:

[1] P. Pattamayutanon, S. Angeli, P. Thakeow, J. Abraham, T. Disayathanoowat, and P. Chantawannakul, "Biomedical Activity and Related Volatile Compounds of Thai Honeys from 3 Different Honeybee Species," J. Food Sci., 2015, doi: 10.1111/1750-3841.12993.

[2] B. Han et al., "In-depth phosphoproteomic analysis of royal jelly derived from western and eastern honeybee species," J. Proteome Res., 2014, doi: 10.1021/pr500843j.

[3] M. Streinzer, A. Brockmann, N. Nagaraja, and J. Spaethe, "Sex and Caste-Specific Variation in Compound Eye Morphology of Five Honeybee Species," PLoS One, 2013, doi: 10.1371/journal.pone.0057702.

[4] P. Chantawannakul, L. I. de Guzman, J. Li, and G. R. Williams, "Parasites, pathogens, and pests of honeybees in Asia," Apidologie, 2016, doi: 10.1007/s13592-015-0407-5.

[5] D. P. Abrol, "Diversity of pollinating insects visiting litchi flowers (litchi chinensis sonn.) and path analysis of environmental factors influencing foraging behaviour of four honeybee species," J. Apic. Res., 2006, doi: 10.1080/00218839.2006.11101345.

[6] J. ichi Takahashi, S. Deowanish, and H. Okuyama, "Analysis of the complete mitochondrial genomes of two dwarf honeybee species, Apis florea and Apis andreniformis (Insecta: Hymenoptera: Apidae), in Thailand," Mitochondrial DNA Part B Resour., 2018, doi: 10.1080/23802359.2018.1450672.

[7] D. P. Abrol and S. K. Kakroo, "Observations on concurrent parasitism by mites on four honeybee species in India," Trop. Agric., 1997.

[8] V. Chaimanee, N. Warrit, and P. Chantawannakul, "Infections of Nosema ceranae in four different honeybee species," J. Invertebr. Pathol., 2010, doi: 10.1016/j.jip.2010.06.005.

[9] H. Schlüns, R. F. A. Moritz, H. M. G. Lattorff, and G. Koeniger, "Paternity skew in seven species of honeybees (Hymenoptera: Apidae: Apis)," Apidologie, 2005, doi: 10.1051/apido:2005006.

[10] S. Su, F. Cai, A. Si, S. Zhang, J. Tautz, and S. Chen, "East learns from west: Asiatic honeybees can understand dance language of European honeybees," PLoS One, 2008, doi: 10.1371/journal.pone.0002365.

[11] P. Pattamayutanon, S. Angeli, P. Thakeow, J. Abraham, T. Disayathanoowat, and P. Chantawannakul, "Volatile organic compounds of Thai honeys produced from several floral sources by different honey bee species," PLoS One, 2017, doi: 10.1371/journal.pone.0172099.

[12] V. Albertová, S. Su, A. Brockmann, J. Gadau, and Š. Albert, "Organization and potential function of the mrjp3 locus in four honeybee species," J. Agric. Food Chem., 2005, doi: 10.1021/jf051417x.

[13] A. Vásquez et al., "Symbionts as major modulators of insect health: Lactic acid bacteria and honeybees," PLoS One, 2012, doi: 10.1371/journal.pone.0033188.

[14] M. Beekman and B. P. Oldroyd, "Different bees, different needs: How nest-site requirements have shaped the decision-making processes in homeless honeybees (Apis spp.)," Philos. Trans. R. Soc. B Biol. Sci., 2018, doi: 10.1098/rstb.2017.0010.

[15] H. Human, “Honeybee health in Africa—a review,” Apidologie. 2016. doi: 10.1007/s13592-015-0406-6.

[16] N. Koeniger and G. Koeniger, “Reproductive isolation among species of the genus Apis,” Apidologie. 2000. doi: 10.1051/apido:2000125.

[17] P. Xu, M. Shi, and X. X. Chen, “Antimicrobial peptide evolution in the Asiatic honey bee Apis cerana,” PLoS One, 2009, doi: 10.1371/journal.pone.0004239.

[18] M. Filipiak et al., “Ecological stoichiometry of the honeybee: Pollen diversity and adequate species composition are needed to mitigate limitations imposed on the growth and development of bees by pollen quality,” PLoS One, 2017, doi: 10.1371/journal.pone.0183236.

[19] D. J. Martins, “Foraging patterns of managed honeybees and wild bee species in an arid African environment: Ecology, biodiversity and competition,” Int. J. Trop. Insect Sci., 2004, doi: 10.1079/IJT200411.

[20] H. Okuyama, T. Wakamiya, A. Fujiwara, I. Washitani, and J. ichi Takahashi, “Complete mitochondrial genome of the honeybee Apis cerana native to two remote islands in Japan,” Conserv. Genet. Resour., 2017, doi: 10.1007/s12686-017-0721-5.

CHAPTER 9

AN ELABORATION OF THE DESCRIPTIONANDDISTRIBUTIONOFHONEYBEES

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ABSTRACT:

Apis mellifera, or honeybees, are critical for pollinating a variety of agricultural crops and for ensuring the safety of the world's food supply. This paper offers a thorough analysis of the many honeybee species, concentrating on their thorough descriptions and patterns of worldwide distribution. We examine honeybees' complex anatomy, behavior, and ecological relevance in order to offer understanding on their crucial contribution to ecosystem health and human nourishment. This publication provides insights into the numerous species within the Apis genus, emphasizing their distinctive traits and adaptations, by integrating the most recent scientific studies and data. In addition, we investigate how honeybee populations are distributed geographically while accounting for environmental variables, climate change, and human activities that affect their habitat. It is essential to comprehend honeybees' complicated characteristics and range in order to protect these vital pollinators. This study adds to our understanding of these intriguing insects and highlights the need for sustainable approaches to protect both their numbers and the natural environments they support.

KEYWORDS:

Apis Mellifera, Bee Species, Distribution Patterns, Honeybee Anatomy, Honeybee Behavior, Honeybee Conservation.

INTRODUCTION

In the intricate web of life that exists on our planet, honeybees, also known as Apis mellifera in the scientific community, perform a unique and important function. They have an incredible ability to pollinate a wide variety of plants, which makes them crucial to both the global ecosystem and agriculture[1]. We go on a journey to learn about the numerous characteristics of these interesting insects with the Description and Distribution of Honeybees, captivating ourselves in their detailed descriptions and the intricate network of their dissemination over our diverse planet. The genus Apis has a number of species, but Apis mellifera, or the Western honeybee, stands out as the most well-known and well-studied. These extraordinary animals have a sophisticated social structure, sophisticated communication system, and intricate behavioral patterns that allow them to plan their activities with astonishing precision. Understanding honeybee anatomy and behavior is not just a scientific endeavor, but it is also a crucial first step in realizing their importance to our ecosystems and human civilization. We want to provide a complete picture of honeybees in this exhaustive examination, from their physical traits to their ecological significance[2].

We'll dig deeper into honeybee anatomy to reveal the incredible adaptations that enable bees to thrive in a variety of environments. We'll also delve into the intriguing world of honeybee behavior, unraveling the mysteries of colony dynamics, eating patterns, and their vital pollination role. In addition to their intriguing biology, this research examines the global patterns that influence the presence of honeybees in diverse habitats. The distribution of honeybee populations has changed throughout time as a result of variables including as

climate, habitat suitability, and human impact. For conservation efforts, sustainable agriculture, and scientific knowledge, it is crucial to comprehend these tendencies. the critical importance of these fascinating creatures as we embark on our exploration of the world of honeybees[3]. Through their pollination services, honeybees significantly contribute to global food security by preserving the reproduction of a number of crop species. Since they act as environmental sentinels and are sensitive to environmental changes, they are a crucial indicator of the health of the ecosystem. Honeybee population protection is more important than ever, particularly in light of the growing prevalence of problems including habitat loss, pesticide use, and climate change. We may better prepare ourselves to undertake conservation plans that will save these beautiful species in the future by better knowing their range and descriptions. This study is more than just a scholastic endeavor; it is an invitation to recognise the importance of preserving nature's most devoted pollinators and to appreciate the rich beauty of their multifaceted beauty[4].

Honeybee Species

Over the last two decades, there has been discussion on the number of Recent species of Apis and their corresponding diagnosis. The latest were 10 or 11 interpretations, ranging from as many as 24 at the upper extreme to six or seven species on the conservative end. The status of several Southeast Asian groups is the subject of the majority of the debate. Despite the fact that the phylogeny of the Apis species has been the subject of several studies, the species identified in the combined Engel and Schultz research were Apis mellifera, Apis florea Fabricius, Apis andreniformis Smith, Apis koschevnikovi, Apis cerana, and Apis dorsata. However, as seen in Figure 1, Apis nigrocincta was later included to this list of honeybee diversity[5].

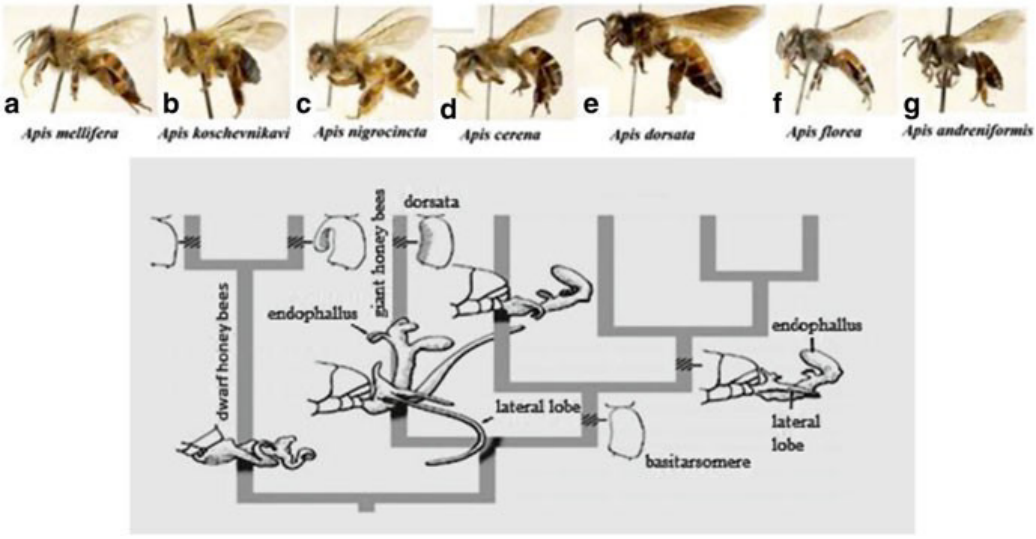

Figure 1: Illustrated the Modern Honeybee Diversity[6]**.**

The first five of these nine species have many combs and nest in cavities. The last four have a single comb and are nestled in the open. Apis species are split into three lineages: huge and cavity-nesting Apis dorsata and A. laboriosa; open-nesting Apis florea and A. andreniformis; and cavity-nesting Apis mellifera, A. cerana, A. koschevnikovi, A. nigrocincta, and A. nuluensis. Only two of the nine species, A. mellifera and A. cerana, have been long-term "domesticated" The majority of studies concur that the giant Apis dorsata and its predecessors diverged from the common ancestor of a clade that included Apis mellifera and the "cerana" group of species, while the lineage of dwarf Apis florea and Apis andreniformis diverged early from the rest of Recent Apis clades. Micrapis Ashmead, Megapis Ashmead,

and Apis s.str. are the three groupings that are sometimes given subgeneric rank, however other less often used classifications have treated them as distinct genera in their own right[7]. The tiniest bee in the world, Apis andreniformis Smith, with a black body color and a home in Southeast Asia, was verified as a distinct species from Apis florea Fab in 1987. In 1980, the biggest bee species in the world, Apis laboriosa Smith, was reconfirmed at higher altitudes of Nepal. Similar to this, in 1988, Apis koschevnikovi Enderlein, a red honeybee, was found in Sabah, East Malaysia and was another distinct species from Apis cerana Fab[8]. Then, in 1996, two additional speciesApis nigrocinta Smith on Sulawasi Island in Indonesia and Apis nuluensis Lin in the same region as Apis koschevnikovi Enderlein's habitatwere reported. Because eight of these nine species are found in Asian nations, beekeepers and crop producers must understand their economic significance. They might then be used for pollination under various agroclimatic situations. Additionally, it's important to protect the 20,000-40,000 different species of honeybees that exist in the globe and use them for pollination.

Distribution

Almost everything on the earth is now populated with honeybee bees. They reside in both chilly, harsh winter conditions and tropical locations where winters never happen and summer temperatures are often greater. The capacity of bees to adapt to many temperatures and settings has shown to be very extraordinary. Throughout the course of their evolutionary history, honeybees evolved into different breeds as a consequence of unique climatic circumstances and characteristics of nectariferous plants[9]. The most common of these species is Apis mellifera, which may be found in Europe, Africa, northernwestern Asia, the Levant, Caucasia, the Iranian Plateau, as well as sporadically in the Americas and Australia. the remainder With the exception of Apis florea, which is also known from Jordan, the eastern Arabian Peninsula, and northern Africa, modern honeybees are mostly limited to Asia[8]. Otis, Engel, Oldroyd and Wongsiri, as well as Hepburn and Radloff have compiled the exact distributions of the remaining Asian species and morphotypes, which are shown in Figure 2.

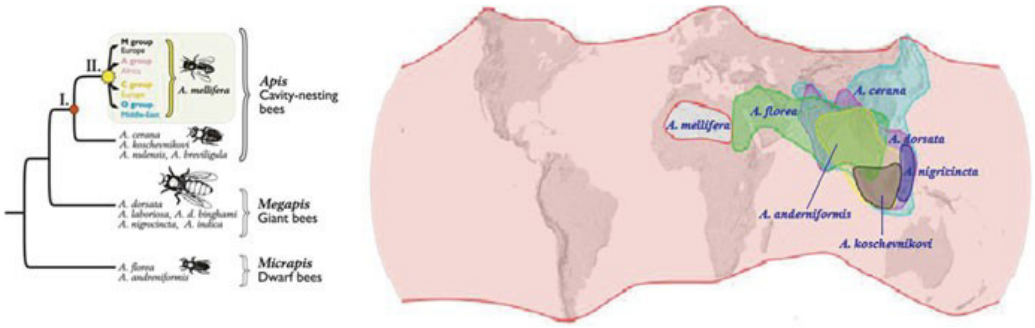

Figure 2: Illustrated the Distribution of Honeybee Species[9]**.**

Subgenus Micrapis: Dwarf Honeybees

The sibling species of dwarf honeybees, Apis andreniformis and Apis florea, are found largely sympatrically in southern Asia. The more common multiple-comb, cavity-dwelling honeybee species are found in cooler areas, whereas these subtropical and tropical honeybees build a single comb in the open. Despite geographical variations in their tendency and frequency of swarming and migration, it is usually always connected to the progression of rainfall > blossoming > swarming or migration. Swarming and migration are resource-related, seasonal movements of tropical honeybee colonies that enhance colonization of new regions and provide a cycle of spatial re-fueling that is unmistakably influenced by r-

selection. From the eastern slopes of the Himalayas eastward to Indochina, Sundaland, and the Philippines, the dwarf honeybee, A. andreniformis, may be found. Eastward in the foothills of the Himalayas, A. florea travels from eastern Oman through southern Iran before suddenly terminating in southern Thailand. An early Pleistocene divide between the pre-florea and pre-andreniformis species, followed by the Pre-Pastonian glaciation, may have created a significant barrier to gene flow for the then-evolving proto-populations of A. andreniformis and A. florea. They are the oldest living lineage of honeybees, perhaps separating from other lineages in the Bartonian, however there is no evidence that this happened before the Neogene[10]. Unfortunately, due to the worker bees' physical similarity, reliable identifications of the dwarf honeybees in older literature are sometimes difficult to evaluate. However, it is now widely recognized that A. florea and A. andreniformis are both different, legitimate biological species. Following a review, the following traits were found to be the most effective in quickly differentiating between A. florea and A. andreniformis:

a) In drones, A. florea has a substantially longer "thumb" on the bifurcated basitarsus of the hind leg than A. andreniformis.

b) The endophallus has a specific structure.

c) The cubital index in worker bees, which is around three in A. florea and approximately six in A. andreniformis, is much lower in the former species.

d) The jugal-vannal ratio of the hindwing, which is higher in A. florea than A. andreniformis, at roughly 75 compared to 65.

e) The second abdominal tergite, which is strongly punctate in A. andreniformis as opposed to A. florea.

f) In sclerotized, non-callow individuals, the marginal setae on the hind tibiae of A. andreniformis are dark-brown to blackish as opposed to being wholly white in A. florea.

DwarfHoneybeeApisfloreaFabricius1787

A. florea's geographic range is mostly restricted to regions with warm weather. The species may be found in the warmer regions of Oman, Iran, and Pakistan in the west, as well as Sri Lanka and the Indian subcontinent. Although it may be found as far east as Indonesia, Southeast Asia is where it is mostly distributed. The bee is missing north of the Himalayas and is seldom encountered at elevations more than 1,500 m. It may commonly be found in wooded regions, tropical forests, and even agricultural areas. It is very universal in Southeast Asia. It is the tiniest species of honeybee, as its name suggests, both in terms of the size of its nest and the body size of its workers. Despite being little, it gets along nicely with the other Apis species. The Persian Gulf, Pakistan, India, Sri Lanka, Thailand, Malaysia, Indonesia, and the Philippines coastlines are all home to A. florea. The dwarf bee can endure conditions that are very hot and dry, with daytime highs of at least 50 °C. Similar to other bees, larger species may be found in the north and smaller types in the south [11].

Due of limited data, phenotypic variation among A. florea has not been fully characterized. Ruttner claims that there are three geographic kinds of A. florea, with one being dispersed across Sri Lanka and South India, one throughout Iran, Oman, and Pakistan, and a third occurring in Thailand. It's conceivable that all three of these varieties are present in India, in which case the following description of A. florea also applies to the other two. Florea populations that are geographically distinct from one another are compared, and the results are morphoclusters that show sampling errors. Although they overlap when the whole

database is included in the same main component analysis, these morphoclusters alter clinally with latitude. Florea is, in the end, a single species made up of three distinct morphoclusters. A morphocluster is made up of the bees in the northwest:

a) Statistically, it is considerably different from the situation to the southeast.

b) There are vast expanses of transitional forms connecting them; they are not isolated.

c) As a result, this panmictic species' morphometric features have been continuously declining.

There are reports of the existence of another species of dwarf bee in tropical semi-evergreen forests in the Western and Eastern Ghats, which is similar to A. florea but darker and somewhat larger than it. This species' abdomen has a dark brownish black color, while A. florea's has white and orange stripes that alternate. It hasn't been seen in populated or farmed regions. Through the years, a number of univariate morphometric investigations on a regional or national basis have been published, but they have had little impact on the taxonomy of the species [12].

With the exception of the honey storage area, which is located at the top and is enclosed by honey cells where the support is exposed from above, the comb construction is identical to that of other Apis species. A healthy colony of bees has roughly 10,000 bees. It is normally half that number in tiny colonies. The queen typically produces 350–700 eggs daily. Worker bees typically survive for around 60 days, which is longer than those of other Apis. The forage is only accessible for brief times in locations where A. florea typically flourishes. As a result, the bee often moves from one region with possibilities for foraging to another. The bees' flying distance from the nest is typically just around 100 meters. It may typically fly less than 750 meters away from the nest to go hunting. Because of this, even when there are many floral sources, the honey it stores is often unifloral. The honey cap in the nest has a storage capacity of 500–1,000 g or more. Large colonies have been observed to generate up to 4 kg of honey apiece in forage-rich locations [13].

DISCUSSION

Honeybees, also known as Apis mellifera in the scientific world, play a special and crucial role in the complex web of life that exists on our planet. They are essential to the global environment and agriculture because of their extraordinary capacity to pollinate a broad range of plants. With the Description and Distribution of Honeybees set out on an adventure to discover the many facets of these fascinating insects, engrossing ourselves in their in-depth descriptions and the complex web of their dispersal over our varied globe. There are various species in the genus Apis, but Apis mellifera, the Western honeybee, stands out as the best recognized and most extensively researched[14]. These amazing organisms have a sophisticated communication system, a complex social structure, and detailed behavioral patterns that enable them to plan their actions with astounding accuracy. In addition to being a scientific activity, understanding honeybee anatomy and behavior is also a necessary first step toward grasping their significance to our ecosystems and human society.

In this thorough investigation, we want to provide a full picture of honeybees, from their physical characteristics to their ecological importance. We will delve deeply into honeybee anatomy, illuminating the amazing adaptations that allow bees to flourish in a range of situations. We will also explore the fascinating realm of honeybee behavior, solving the puzzles of colony dynamics, feeding habits, and their crucial function as pollinators. This paper explores honeybee dispersion, looking at the worldwide patterns that determine their

existence in various environments, in addition to their fascinating biology[15]. Over time, factors including temperature, habitat appropriateness, and human impact have influenced how honeybee populations are distributed. Understanding these trends is essential for sustainable agriculture, conservation initiatives, and scientific understanding. The crucial relevance of these fascinating insects as we set off on our adventure into the world of honeybees. By maintaining the reproduction of several crop species, honeybees make a substantial contribution to global food security via their pollination services. They serve as environmental sentinels, sensitive to changes in their environment, and are hence an important gauge of ecosystem health. The need to protect honeybee populations has never been greater, especially at a time when issues like habitat loss, pesticide usage, and climate change are becoming more and more prevalent. By understanding their range and descriptions in more detail, we can better prepare ourselves to implement conservation strategies that will protect these amazing animals in the future and it is an invitation to acknowledge the need of maintaining nature's most dedicated pollinators and to savor the complex beauty of their intricate beauty.

CONCLUSION

In this section the author concluded that the fascinating world of these wonderful insects in the thorough investigation of Honeybees. Honeybees are a living example of the wonders of nature because to their complex social structures, complicated anatomy, and crucial pollination function. Their importance has been highlighted by this study, both in terms of their contributions to global agriculture and their critical function in preserving ecosystem variety and health and have stressed the significant effects of honeybee populations on human civilization throughout our talk. Their priceless pollination assistance immediately contributes to the production of a wide variety of crops that provide for us. It is impossible to emphasize the economic value of these services, which highlights the real connection between honeybees and human wellbeing. It looked at the ecological significance of honeybees as keystone species in many ecosystems, which goes beyond economics. Their actions have an impact on how well plants reproduce and sustain the wide variety of species that depends on these plants for food. Honeybees play a crucial role in maintaining the delicate balance of life on Earth. The problems that honeybee populations are now confronting are enormous and varied. Threats to its survival and spread include climate change, habitat loss, pesticide usage, illnesses, and pests. These difficulties serve as a reminder of how susceptible even the hardiest animals are to the stresses of the contemporary world. Our study emphasizes the urgent necessity for conservation efforts and sustainable behaviors in light of these difficulties. It takes a coordinated effort from people, communities, and politicians to maintain honeybee populations. To ensure the health of honeybees and, by extension, our own, responsible land management, decreased pesticide use, and the construction of pollinator-friendly habitats are crucial measures. Finally, a call to action as much as a scientific study. It urges us to understand the need of safeguarding these pollinators' significance in our planet and to admire the complex beauty of nature's most dedicated creatures. Honeybees serve as a symbol of our interdependence with the natural world and the duty we have to preserve its delicate balance. We fight to protect honeybees' future as we protect our own future, the future of our planet's health, and the future of honeybees.

REFERENCES:

[1] S. Mwalusepo et al., “Potential distribution dataset of honeybees in Indian Ocean Islands: Case study of Zanzibar Island,” Data Br., 2017, doi: 10.1016/j.dib.2017.08.024.

[2] M. V. C. Vital, R. Hepburn, S. Radloff, and S. Fuchs, "Geographic distribution of africanized honeybees (Apis mellifera) reflects niche characteristics of ancestral African subspecies," Nat. a Conserv., 2012, doi: 10.4322/natcon.2012.021.

[3] A. A. M. A. Al-Chzawi, S. T. Zaitoun, and H. K. Shannag, "Incidence and geographical distribution of honeybee (apis mellifera l.) pests in jordan," Ann. la Soc. Entomol. Fr., 2009, doi: 10.1080/00379271.2009.10697615.

[4] G. Abdullahi, H. Sule, and I. A. Chimoya, "Diversity and relative Distribution of Honeybees Foraging Plants in some selected Reserves in Mubi Region , Sudan Savannah Ecological zone of Nigeria," Adv. Appl. Sci. Res., 2011.

[5] R. Kumar Gupta, "Taxonomy and distribution of different honeybee species," in Beekeeping for Poverty Alleviation and Livelihood Security: Vol. 1: Technological Aspects of Beekeeping, 2014. doi: 10.1007/978-94-017-9199-1_2.

[6] N. E. Gary, P. C. Witherell, J. M. Marston, and P. C. Witherell, "The inter—and intra-orchard distribution of honeybees during almond pollination," J. Apic. Res., 1976, doi: 10.1080/00218839.1976.11099832.

[7] P. Chantawannakul, L. I. de Guzman, J. Li, and G. R. Williams, "Parasites, pathogens, and pests of honeybees in Asia," Apidologie, 2016, doi: 10.1007/s13592-015-0407-5.

[8] F. N. Mumoki, A. Fombong, E. Muli, A. W. T. Muigai, and D. Masiga, "An inventory of documented diseases of african honeybees," African Entomology. 2014. doi: 10.4001/003.022.0313.

[9] M. Abd Al-Fattah, A. El-Shemy, and M. El-Masarawy, "The Spatial Distribution of Honeybee Apis mellifera L. Drones in Their Colony," Egypt. Acad. J. Biol. Sci. A, Entomol., 2016, doi: 10.21608/eajbsa.2016.12857.

[10] I. T. Gajger, O. Vugrek, D. Grilec, and Z. Petrinec, "Prevalence and distribution of Nosema ceranae in Croatian honeybee colonies," Vet. Med. (Praha)., 2010, doi: 10.17221/2983-VETMED.

[11] M. Yoshiyama and K. Kimura, "Distribution of Nosema ceranae in the European honeybee, Apis mellifera in Japan," J. Invertebr. Pathol., 2011, doi: 10.1016/j.jip.2010.10.010.

[12] C. A. Kwadha, G. O. Ong'Amo, P. N. Ndegwa, S. K. Raina, and A. T. Fombong, "The biology and control of the greater wax moth, Galleria mellonella," Insects. 2017. doi: 10.3390/insects8020061.

[13] C. Feigenbaum and D. Naug, "The influence of social hunger on food distribution and its implications for disease transmission in a honeybee colony," Insectes Soc., 2010, doi: 10.1007/s00040-010-0073-6.

[14] J. C. O. Rumkee, M. A. Becher, P. Thorbek, and J. L. Osborne, "Modeling Effects of Honeybee Behaviors on the Distribution of Pesticide in Nectar within a Hive and Resultant in-Hive Exposure," Environ. Sci. Technol., 2017, doi: 10.1021/acs.est.6b04206.

[15] C. S. Jarnevich et al., "Regional distribution models with lack of proximate predictors: Africanized honeybees expanding north," Divers. Distrib., 2014, doi: 10.1111/ddi.12143.

CHAPTER 10

TAXONOMY DISTRIBUTION OF ASIAN HONEYBEE SPECIES

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ABSTRACT:

The classification and geographic range of Asian honeybee species. The biology and identification of important honeybee species in Asia, such as Apis andreniformis, Apis dorsata, and Apis laboriosa, are examined. It is investigated how these species are distributed geographically across Asia's tropical and subtropical areas, including Southeast China, India, Burma, Laos, Vietnam, Malaysia, Indonesia, and the Philippines. The research also explores the genetic differences among these species and their nesting practices. Giant honeybees are given special consideration, especially Apis dorsata, which is renowned for its distinctive nesting habits and defensive responses. The Himalayan Cliff Bee, Apis laboriosa, is also discussed in the study. Its distinctive traits and importance for honey production are highlighted. The paper also discusses probable species difference among certain honeybee populations and taxonomic difficulties. This thorough investigation aids in improving knowledge of the many Asian honeybee species and their ecological importance.

KEYOWRDS:

Asian Honeybee, Honeybee Taxonomy, Honeybee Species, Geographic Distribution, Asian Apis Species**.**

INTRODUCTION

The A. andreniformis was the second species of honeybee to be identified, and several writers have noted its biology, geographic range, and distinct status. Although there are locations where A. andreniformis and A. florea co-occur, it must be noted that the species was just recently split from Apis florea. Both species are found in Southeast China, India, Burma, Laos, Vietnam, Malaysia, Indonesia, and the Philippines, as well as other countries in tropical and subtropical Asia [1].There has only ever been one univariate morphometric comparison of the populations of Palawan Island in the Philippines and South Eastern Thailand. Only a few traits relating to wing and metatarsal lengths distinguished these two geographically distinct groups, suggesting that the species is probably relatively similar. Similarly, estimates of the mt DNA haplotype difference within the species were around 2% for A. florea and 0.5% for A. andreni- formis, showing rather homogenous populations in both instances. Rattanawannee et al. showed genetic variation based on the sequencing analysis of the mitochondrial oxidase subunit b, which produced two groups. This finding is considered provisional requiring more thorough investigations over the whole region of A. andreniformis distribution [2].

The height at which a hive may be constructed ranges from 1 to 15 meters, with 2.5 meters being the norm. It is known that this bee, which is typically more protective than A. florea, would attack when there are disturbances 3–4 meters away from the hive. It does not, however, exhibit "trembling" or "shimmering" behavior as a protective reaction, making it less aggressive. The public is still not really at risk from these bees' nests, unless one is situated in a low shrub that someone may accidently knock into [3]. Although these bees' stings are not very painful, they do cause a surprising amount of edema. Their stings are not

long enough to readily pierce the skin of a typical adult. They only sting once because they, like regular honeybees, leave their sting in the wound. Unfortunately, moving these bees is not yet an option. This is due to the fact that after being transported, they would only swarm to a new spot, often returning to an area close to a human settlement. They typically settle on damp areas of the ground to gather water during very hot weather. To ward off ants, workers-built resin bands. To ward off hornets, they shone and formed a tail. When exposed to sunlight during the hottest part of the day, workers on the mantle ventilated sat with their heads down. On the swarm's crown, dancing was seen; all but one of the observed dances were brief [4]. One lengthier, staggered dance could have signaled the swarm was about to move.

Subgenus Megapis Giant Honeybees

One species is known to form a single or a few exposed combs on tall tree branches, cliffs, and sometimes on structures. They are often rather vicious. When disturbed, colonieswhich are often plundered of their honey by human honey hunterscan easily sting a person to death. They are just somewhat more recent as a distinct lineage than the dwarf honeybees. While Apis dorsata, the actual Giant Honeybee, is native to and common throughout the majority of South and Southeast Asia, Apis dorsata binghami is either categorized as the Giant Honeybee's Indonesian subspecies or a separate species; in the latter case, A. d. breviligula and/or other lineages would likely also need to be considered species[5]. The Himalayan Honeybee, Apis dorsata laboriosa, was first identified as a separate species. Though writers using a genetic species concept have indicated it should be designated a species, it was later placed in A. dorsata based on the biological species concept as a subspecies. It is mostly found in the Himalayas and looks quite similar to the Giant Honeybee, but it has substantial behavioral adaptations that allow it to build open nests at high elevations despite the cold weather. It is the biggest honeybee still alive.

Giant or rockbees are names for the species Apis dorsata and A. laboriosa Smith. The size of the latter species is the greatest among honeybees. It is frequent between 1,200 and 4100 meters above sea level. While A. dorsata is more abundant at lower altitudes and on plains and has a lighter orange-brown or tawny body color, it is rarely encountered in tropical lowlands. Similar to the dwarf honeybee, the gigantic honeybee's range extends from Pakistan in the west, via Sri Lanka and the Indian subcontinent, to Indonesia and certain areas of the Philippines in the east. Its distribution runs from southern China to Indonesia in a north-south direction; neither New Guinea nor Australia contain it[5]. Despite not being found in Iran or the Arabian Peninsula, A. dorsata is dispersed in South China, Celebes, and Timor. Recently, the Himalayan and Nepali giant honeybees were reclassified as A. laboriosa. Despite slight differences in morphological, physiological, and behavioral traits, all of the basic biological features of the various geographical races of gigantic honeybees are largely the same.

Giant or Rockbee, Apis dorsata F.

The bee suspends its nest from the underside of its support, such as a tree limb or cliff, and shares Apis florea's open-air, single-comb nesting behaviors. A. dorsata typically builds its nests between 3 and 25 meters above the ground. A. dorsata nests may be found alone or in clusters, and it's not unusual to find 10-20 nests in a single tall treelocally referred to as a bee treein one location[6]. There are sometimes trees in or close to tropical forests in India and Thailand that are home to more than 100 nests. The single-comb nest, which lacks the characteristic crest of honey-storage cells seen in A. florea nests, may sometimes be up to 1 m wide. The arrangement of the comb is identical to that of the other species of honeybees,

with worker and drone broods below pollen storage and honey storage above it[7]. The mouthof the nest, where workers take off and land, is where the colony is most active. It is also where scouts perform communication dances to announce the discovery of new food sources. The bees must have a good view of the sky in order to determine the precise position of the sun during this dance, which is performed on the vertical surface of the comb. However, A. dorsata workers may fly at night when the moonlight is sufficient. When its nest is disrupted, it is widely renowned for its viciousness: the mass of defensive workers may chase intruders over great distances, often more than 100 meters[7].

Despite its fury, this bee's honey is highly valued locally, often commanding the highest prices in neighborhood markets. The behavior of A. dorsata is notable for two factors. They start out with a well-planned mass defensive response. An invader who has been stung and left behind the scent of a particular pheromone is tracked for kilometers. Second, this A. dorsata migrates annually to distances of 100 to 200 km. The beginning of each new season corresponds with the time of migration. Different subspecies of Apis dorsata are supported by morphometric data, and they may ultimately be determined to constitute distinct species. The biggest honeybee is A. dorsata. A. dorsata has two recognized subspecies: A. dorsata breviligula, with a short tongue and medium-length forewing, is found in the Philippines beyond the Meryll line in the east, while A. dorsata binghami, with a long tongue and long forewing, is found in Celebes beyond the Wallace line in the east. huge trees have huge combs attached to the bottom of their horizontal, broad limbs. On these bee trees, there can be sixty or more nests.

The Himalayan Cliff Be

The cliff bee, which may grow to a length of 3 cm, is the biggest honeybee in the world. It has been found in mountainous regions of Nepal, Bhutan, India, and Yunnan in western China, between 1,200 and 3,500 meters above sea level. It is thought to reside in various Himalayan regions. It has been reported that it typically constructs brood nests behind overhangs on steep cliff faces, nests usually between 2,500 and 3,500 meters above sea level, and forages up to 4100 meters. Despite the lack of biological knowledge, laboriosa is undoubtedly a species that can survive in harsh ecological settings. The isolation and historical age of the type define the taxonomy rank rather than the morphometric distance[8]. A. laboriosa builds its nests on rocks that face south. Each honeybee colony is made up of a group of worker and drone bees and one queen. They coexist to meet one another's requirements and work together to nurture the young.A single, substantial wax comb with a thick honey storage region at the top and a thinner brood part below constitutes the nest that each colony develops.

A strip separating the honey storage from the brood comb contains pollen.Depending on the total size of the comb and the possibilities for nectar flow in the region, the honey part is typically approximately 15 cm thick. Nepal exports significant quantities of Apis laboriosa spring honey to Japan, Korea, and Hong Kong. Red honey is highly valued in Korea for its therapeutic properties and commands a premium price; therefore, Korean businesses purchase a significant amount of this honey in advance. In Nepal, India, Southern Arabia, and South Africa, traditional honey hunting is still practiced. The Gurung tribe in central Nepal is mostly where the honey hunters in that region come from[9]. The biggest honeybee in the world, Apis laboriosa, builds eggs atop cliffs where honey hunters in Nepal collect honey. Harvesters use bamboo sticks to maneuver baskets into place under the combs as they descend rope ladders that have been dropped from the top of the cliff. The comb is then severed, causing it to drop into the basket. At the bottom of the cliff, fires are lit to somewhat calm the bees.

Some writers have identified Apis binghami Cockerell 1906 of Sulawes, neighboring Sula island, and Butang, and Apis brevligula Maa 1953 of the Philippines as two more morphotypes of gigantic honeybees. Both are completely black with noticeable white stripes on their abdomens, making them fairly similar in color. Both are known to feed at night and have elevated ocelli, much like A. dorsata. Ruttner's summary of some of Maa's distinctions shows that A. breviligula is somewhat shorter than A. binghami, but has a larger belly and much shorter mouth parts. Brevligula and Binghami have not shown nesting aggrega- tions, which are typical for Dorsata. These two morphotypes have isolated populations and different morphological characteristics, leading some to propose that they should be regarded as separate species. However, because of how allopatric their ranges are to those of A. dorsata, the designation of their position as a species is likely to remain arbitrary[10], [11].

DISCUSSION

The examination of the taxonomy and distribution of Asian honeybees provides significant insights into the wide range of these important pollinators on the Asian continent. The taxonomy of Asian honeybee species is a challenging and expanding field of study. Our research has shown that the genus Apis has many distinct species and subspecies across Asia. Important species with specific characteristics, such as Apis andreniformis, Apis dorsata, and Apis laboriosa, have been discovered and studied. However, Apis dorsata binghami and Apis laboriosa provide as instances of how difficult it may be to define certain populations due to their restricted ranges and morphological variances. Geographically, Asian honeybees inhabit a range of tropical and subtropical habitats in Southeast China, India, Burma, Laos, Vietnam, Malaysia, Indonesia, and the Philippines[12], [13]. The dispersal of these species over the Asian continent demonstrates how well they can adapt to various ecological niches. at contrast to the Giant Honeybee, Apis dorsata, which is prevalent at lower altitudes and plains, the Himalayan Cliff Bee, Apis laboriosa, thrives at high elevations in the Himalayan region, displaying exceptional adaptations to hard environmental conditions. Through genetic research, the relationships and differences between different honeybee populations have been made clear.

Even while certain genetic variations have been discovered, the overall genetic homogeneity across species like Apis andreniformis and Apis dorsata suggests a very stable genetic structure. The classification of certain subspecies and the potential of producing new genetic findings, however, still need additional study. The discussion also emphasizes the importance of distinct honeybee species to local ecosystems and economy. Their role as pollinators is crucial for the biodiversity and agricultural development of the places where they inhabit. Additionally, many Asian cultures greatly respect the honey made by these bees, especially the prized spring honey produced by Apis laboriosa[14], [15]. Finally, investigations into potential species differentiation and taxonomic issues are now being conducted as part of ongoing study on the taxonomy and distribution of Asian honeybee species. Understanding their ecological roles and variation is crucial in order to preserve these honeybees and optimize their considerable benefits to agriculture and local economies throughout Asia. More investigation and cooperative efforts are needed to fully comprehend these remarkable insects and their intricate significance in Asian ecology.

CONCLUSION

The study of the taxonomy and geographic distribution of Asian honeybee species, in conclusion, throws light on the interesting variety and ecological relevance of these important pollinators on the Asian continent. We have learned about the intricate world of honeybee taxonomy in which several species and subspecies coexist, each with its own distinctive

characteristics and adaptations. In particular, species with distinctive traits have been discovered and examined, including Apis andreniformis, Apis dorsata, and Apis laboriosa. Geographically, Asian honeybees live in a variety of environments and are successful in Southeast Asian countries including China, India, Burma, Laos, Vietnam, Malaysia, Indonesia, and the Philippines that are tropical or subtropical. Their capacity to adapt to different ecological niches highlights how crucial they are to preserving these areas' agricultural output and biodiversity. In contrast to Apis laboriosa's tenacity in the difficult high-altitude Himalayan area, Apis dorsata's predominance at lower altitudes and plains demonstrates their exceptional adaptability to a variety of environmental circumstances. The relatedness and divergence of these honeybee populations have been clarified by genetic analysis. Even while certain genetic differences have been found, many species' general genetic homogeneity emphasizes how stable their genetic structure is. However, continuous investigation into subspecies and genetic variety continues to be an important field of study. The ecological and economic importance of these honeybee species must also be understood. They are crucial pollinators that ensure the production of fruits, vegetables, and a variety of crops, which in turn supports local ecosystems and agricultural systems. Additionally, honey production is significant from a cultural and economic standpoint in many Asian societies, particularly with regard to the highly prized Apis laboriosa spring honey. It is crucial to comprehend their variety, ecological functions, and genetic make-up in order to preserve them and use their crucial contributions to agriculture and local economies across Asia. These amazing insects' complex role in the Asian ecology continues to be the focus of continuing study, highlighting the need for cooperation and more investigation to learn more about them and assure their survival.

REFERENCES:

[1] S. Zhou, X. Zhu, X. Xu, X. Zheng, and B. Zhou, “Assessing of Geometric Morphometrics Analyses in Microtaxonomy of the Apis cerana Fabricius (Hymenoptera: Apidae) within China,” J. Kansas Entomol. Soc., 2016, doi: 10.2317/0022-8567-89.4.297.

[2] N.V. Niem, “Morphological comparison of three asian native honey bees (apis cerana, a. dorsata, a. florea) in northern vietnam and thailand,” Biotropia (Bogor)., 1999, doi: 10.11598/btb.1999.0.14.153.

[3] A. A. Ahmed and H. K. Abd-Elhady, “Efficacy of two fungus-based biopesticide against the honeybee ectoparasitic mite, Varroa destructor,” Pakistan J. Biol. Sci., 2013, doi: 10.3923/pjbs.2013.819.825.

[4] A. S. Alqarni, “Influence of some protein diets on the longevity and some physiological conditions of honeybee Apis mellifera L. workers,” J. Biol. Sci., 2006, doi: 10.3923/jbs.2006.734.737.

[5] C. M. Aurori, L. A. M. Dezmirean, Daniel S, and R. F. A. Moritz, “Nosema apis and N . ceranae in Western Honeybee (Apis mellifera) – Geographical Distribution and Current Methods of Diagnosis,” Bull. UASVM Anim. Sci. Biotechnol., 2011.

[6] S. Kantabutra and G. Avery, “Sustainable leadership: Honeybee practices at a leading Asian industrial conglomerate,” Asia-Pacific J. Bus. Adm., 2013, doi: 10.1108/17574321311304521.

[7] M. Pattabhiramaiah, D. Brueckner, and M. Reddy, “Absence of Wolbachia in the workers of Asian honeybee, Apis cerana indica,” Int. J. Life Sci., 2012, doi: 10.3126/ijls.v5i1.5230.

[8] J. M. K. Roberts, D. L. Anderson, and W. T. Tay, "Multiple host shifts by the emerging honeybee parasite, Varroa jacobsoni," Mol. Ecol., 2015, doi: 10.1111/mec.13185.

[9] R. Tandon, K. R. Shivanna, and H. Y. Mohan Ram, "Pollination biology and breeding system of Acacia senegal," Bot. J. Linn. Soc., 2001, doi: 10.1006/bojl.2000.0401.

[10] S. M. Han et al., "Effect of venom from the asian honeybee (apis cerana fab.) on lps-induced nitric oxide and tumor necrosis factor-α production in RAW 264.7 cell line," J. Apic. Res., 2006, doi: 10.1080/00218839.2006.11101331.

[11] W. J. Kim et al., "Comparative Transcriptome Analysis of Queen, Worker, and Larva of Asian Honeybee, Apis cerana," Int. J. Ind. Entomol., 2013, doi: 10.7852/ijie.2013.27.2.271.

[12] S. Koyama, T. Takagi, S. J. Martin, T. Yoshida, and J. Takahashi, "Absence of reproductive conflict during queen rearing in Apis cerana," Insectes Soc., 2009, doi: 10.1007/s00040-009-0008-2.

[13] L. N. Chen, Y. Z. Cui, K. M. Wong, D. Z. Li, and H. Q. Yang, "Breeding system and pollination of two closely related bamboo species," AoB Plants, 2017, doi: 10.1093/aobpla/plx021.

[14] Z. Tapaszti, P. Forgách, C. Kovágó, L. Békési, T. Bakonyi, and M. Rusvai, "First detection and dominance of Nosema ceranae in Hungarian honeybee colonies," Acta Vet. Hung., 2009, doi: 10.1556/AVet.57.2009.3.4.

[15] J. L. Gould, " Honeybee Ecology: A Study of Adaptation in Social Life. Thomas D. Seeley ," Q. Rev. Biol., 1986, doi: 10.1086/415116.

CHAPTER 11

THE DIVERSITY AND GEOGRAPHIC OF THE ASIATIC HONEYBEE

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ABSTRACT:

The Apis cerana, or Asiatic honeybee, has a remarkable range of variety and a large geographic distribution over southern and south-eastern Asia. This article sheds insight on the complex subspecies and races of Apis cerana by examining the species' distinctive traits, ecological adaptations, and regional differences. The diversity of the Asiatic honeybee is a tribute to its capacity to live in a variety of habitats, from its inherent defensive systems against pests to its distinctive behavioral patterns in different places. This thorough analysis sheds light on the genetic, morphological, and ecological characteristics of Apis cerana while emphasizing its value in relation to local beekeeping customs and conservation initiatives.

KEYWORDS:

Apis Cerana, Asian Honeybee, Bee Species, Geographic Distribution, Honeybee Subspecies, Asiatic Honeybee, Honeybee Ecology.

INTRODUCTION

The Asiatic honeybee, also known as Apis cerana, is a tiny honeybee found in countries across southern and south-eastern Asia, including China, India, Japan, Malaysia, Nepal, Bangladesh, and Papua New Guinea. This species is related to Apis koschevnikovi, and both are members of the same subgenus as Apis mellifera, the European honeybee. Because A. cerana can only be found in Asia, from Iran in the east to Pakistan in the west and from Japan in the north to the Philippines in the south, it is also known as the Asiatic honeybee or the Oriental honeybee. As a result, A. cerana inhabits not only tropical and subtropical regions of Asia but also frigid locales like Siberia, Northern China, and the Himalayan high mountains[1].

An A. cerana colony's many combs are constructed parallel to one another, and a standard gap known as the "bee space" is maintained between them. The workers of this tree have significantly smaller bodies than the workers of A. dorsata, and their brood combs are made up of cells of two different sizes: smaller cells for the worker brood and bigger cells for the drone brood. On the bottom border of the comb, the queen cells are constructed. Honey is stored in the top portion of the combs, like in the other Apis species, as well as in the outside combs, close to the hive walls.

In several Asian countries, traditional beekeeping with A. cerana has been partially replaced by this modern method since the creation of the movable-frame hive for the European honeybee about a century ago.

At the same time, efforts have been made - with varying degrees of success - to improve hiving techniques and colony management. Although they produce less honey, beeswax from them is used to cure and mend wounds. Varroa destructor, a major pest of the European honeybee, naturally inhabits Apis cerana. A. cerana, which coevolved with this mite, grooms itself more meticulously than A. mellifera, and as a result, has an excellent defense mechanism against Varroa that prevents the mite from becoming destructive[2].

Subspecies/RacesofApiscerana

Cerana bees and mellifera bees must have had a common ancestor, but they have since diverged into different species. Even with artificial insemination, it is impossible to cross Cerana with Melifera since the two species are now genetically incompatible and the cross-fertilization does not produce healthy offspring. They also respond differently to pests, illnesses, and predators, among other things. In contrast to mellifera bees, Apis cerana can tolerate Varroa and has evolved a successful defense against the Giant Hornet.

The acarine mite, which entered cerana area with the introduction of mellifera bees, is very dangerous to them. It is also quite vulnerable to foul and sac brood, but not particularly to Nosema[3]. The ecological diversity of A. cerana is likely reflected in the significant degree of variation in size and coloring. In Vietnam, it was discovered that latitude and altitude had an impact on the size of worker bees. Due to this large range, the bee's geographical races have undergone significant changes. In particular, there are significant differences between the tropical and temperate races in terms of worker body size, nest size, colony density, and swarming and absconding behavior. While the tropical races are more mobile than the former, preferring to swarm, abscond, and move relatively often, they also seem to store more food than the temperate and subtropical races.

There is doubt and change about the intraspecific categorization of the Asiatic honeybee species, A. cerana. According to research done by the International Centre for Integrated Mountain Development, there are three subspecies of Apis cerana populations: Apis cerana cerana, Apis cerana himalaya, and Apis cerana indica[4]. Of these, Apis cerana cerana is found in the Jumla area of Nepal, the North-West Frontier Province of Pakistan, and the Indian Himalayas. While Apis cerana himalaya is found in the slopes and plains of the region, Apis cerana indica is found in the hills of Nepal, Uttar Pradesh, the North-East Himalayas, and Bhutan. Five subspecies of Apis cerana have been found, according to similar investigations done in China. Apis cerana cerana, Apis cerana skorikovi, Apis cerana abaensis, Apis cerana hainanensis, and Apis cerana indica are a few of these species.

The trinomials of Apis cerana F., published since 1970, were not legitimate under current ICZN regulations, 4th edition, 1999, and according to nomenclatural standing in Apis classification, among the 13 putative subspecies names of Apis cerana in China since 1944[5].

The morphometric investigation of Apis cerana F. in China demonstrated that the "South Yunnan race" and "Aba race" could be distinguished from the "Chinese Eastern race" belonging to "Apis cerana cerana" and the "South Yunnan race" being "Apis cerana indica". However, the "South Yunnan race," "Hainan race," and "Tibet race" were not taken into account in this research. The mitochondrial genotypes of Apis cerana were identical to those of all samples from India, Japan, and Korea, without variation, and belonged to the "Mainland Asia" group of Apis cerana, according to molecular analysis. It was determined that the Southern Gansu and Northern Aba regions were rich in A. cerana mitochondrial genotypes. There is no doubt that individuals of the "Aba race" existed in China. The following species are described in the literature:

i. Apis cerana cerana:

This A. cerana subspecies, which has the largest body size, is found in northern China, northwest India, northern Pakistan and Afghanistan, and northern Vietnam. In Afghanistan, Pakistan, north India, China, and north Vietnam, the proboscis and forewing lengths are 5.25 and 8.63 mm, respectively[6].

ii. Apis cerana indica:

The subspecies with the tiniest bodies is this one. It is found in the southern regions of India, Thailand, Cambodia, and Vietnam as well as Malaysia, Indonesia, and the Philippines. Forewing and proboscis lengths are 4.58 to 4.78 mm and 7.42 to 7.78 mm, respectively. It is sold in the Philippines, Malaysia, Sri Lanka, Bangladesh, Burma, and South India.

iii. Apis cerana japonica:

Except for Hokkaido, this subspecies is restricted to Japan's temperate regions. There are two distinct ecotypes of this subspecies: Honshi and Tsushima. With an average proboscis length of 5.18 mm and an average fore-wing length of 8.69 mm, Apis cerana japonica has a sizeable body. japonica has been progressively replaced by A. mellifera, which was introduced[7].

iv. Apis cerana skorikovi or Apis cerana himalayana:

This subspecies has a body size that falls in between cerana and indica. From Nepal to northern Thailand, it occurs in the eastern Himalayas. The lengths of the proboscis and forewing are 5.14 mm and 8.03 mm, respectively, on average. It is indigenous to Asia, from northern Russia and China to southern Indonesia, and between Afghanistan and Japan. Running in the Central and East Himalayan highlands, recently brought to Papua New Guinea. In a hollow, the apis cerana constructs a nest that resembles the apis mellifera in that it is made of a succession of parallel combs.

v. Apis cerana nuluensis:

It is a honeybee subspecies that Tingek, Koeniger, and Koeniger first described in 1996. The south-east Asian island of Borneo, which is politically split between Indonesia, Malaysia, and Brunei, is where the subspecies is geographically distributed. nuluensis is one of several Asiatic honeybee species, which also includes the less well-known Apis koschevnikovi and Apis nigrocincta. Although this was formerly classified as a species, it has recently been shown to correspond to a geographical race of the common A. cerana. Nuluensis, like many other honeybees, is susceptible to infection by the parasitic Varroa mite, however in this instance it is Varroa underwoodi [8].

This bee was categorized by the author into six clusters, as follows:

a) Morphocluster I:

Northern cerana is its name. The bee's range starts in northern Afghanistan and Pakistan and continues through northwest India, southern Tibet, northern Myanmar, China, and finally, northeasterly, into Korea, far eastern Russia, and Japan. Morphocluster I bees have been previously named as follows: skorikovi, abansis, abanensis, bijjieca, cathayca, cerana, fantsun, hainana, hainanensis, heimifeng, indica, japon- ica, javana, kweiyanga, maerkang, pekinga, peroni, skorikovi, shankianga and twolareca.

Within this morphocluster, six subclusters or populations may be identified morphometrically:

a. an “Indus” group in Afghanistan, Pakistan and Kashmir.

b. a “Himachali” group in Himachal Pradesh, India.

c. an “Aba” group in southern Ganshu and central and northern Sichuan provinces in China, northern China and Russia.

d. a subcluster in central and eastern China.

e. a “southern” cerana subcluster in southern Yunnan, Guangdong, Guangxi and Hainan in China.

f. a “Japonica” group in Japan and Korea.

b) Morphocluster II:

Here named “Himalayan cerana”. This includes the bees of northern India:northwest, northeast; and some of southern Tibet and Nepal. Morphocluster II bees have previously been named skorikovi, indica, himalayana, and himalaya.

Two subclusters are discernible within this morphocluster:

a) the bees of the northwest the “Hills” group, and

b) those of the northeast, the “Ganges” group.

c) Morphocluster III:

Within this morphocluster, six subclusters or populations may be identified morphometrically:Here titled "Indian Plains cerana," which has been referred to as "plains cerana" for this subcontinent for a long time, is found across the plains of central and southern India and Sri Lanka. Only indica bees from Morphocluster III have previously been given that name.

d) Morphocluster IV:

A contiguous group of people known as "Indo-Chinese cerana" live in Myanmar, northern Thailand, Laos, Cambodia, and more southern Vietnam. Indica and javana are historical names for morphocluster IV bees.

e) Morphocluster V:

The term "Philippine cerana" refers only to the Philippines, omitting much of the island of Palawan. Previous names for the bees in this cluster include A. philippina, philippina, and samarensis. There are subclusters inside these islands, which we refer to as "Luzon" bees, "Mindanao" bees, and "Visayas" bees, respectively, after the largest island groupings there.

f) Morphocluster VI:

An area from southern Thailand to Malaysia and Indonesia is referred to as the "Indo-Malayan cerana" here. Below the South China Sea, this vast region is made up of a morphometrically relatively homogenous beetle. A. cerana, A. indica, A. javana, johni, lieftincki, peroni, vechti linda, and vechti are names used for morphocluster VI bees[9].

Three subclusters are discernible within this morphocluster:

a) Philippines, Malaysia, Indonesia bees.

b) Malay Peninsula, Sumatera, and some Sulawesi bees.

c) Indonesia bees.

Due to its astounding variety and wide geographic distribution across southern and south-eastern Asia, the Asiatic honeybee, also known as Apis cerana, has drawn the interest of scientists and environmentalists. This introduction lays the groundwork for a thorough

investigation of Apis cerana's distinctive traits, ecological adaptations, subspecies differentiation, and geographic range, illuminating its significance in relation to local beekeeping practices, ecosystem dynamics, and conservation initiatives.

DISCUSSION

The topic of "Diversity and Geographic of the Asiatic Honeybee" focuses on the intriguing characteristics, geographic range, and ecological adaptations of Apis cerana, most often known as the Asiatic honeybee. This species of honeybee has fascinated scientists and environmentalists because of its remarkable diversity, which is closely connected to its broad geographic distribution spanning southern and south-eastern Asia. The ability of Apis cerana to adapt to many environments, from the tropical and subtropical parts of Asia to the frigid regions of Siberia, Northern China, and the Himalayan high ranges, is what has made it so well-known. Its ability to thrive in a range of environmental circumstances highlights its versatility and ecological worth within these areas [10].

A. cerana demonstrates its capacity for environmental adaptation by displaying regional variation in addition to population variability in size, colour, and behavioral traits. One of the key findings of the study is the existence of many subspecies and races within the species Apis cerana. In addition to behavioral differences, these subspecies also differ from one another genetically in terms of nest architecture and behavior. It is interesting to note that the temperate and tropical races of A. cerana exhibit a variety of behaviors, including as swarming and absconding, which have an impact on colony management and beekeeping traditions in different regions. The investigation also looks at the evolutionary relationships between Apis cerana and other species of honeybee, such as Apis mellifera and Apis dorsata. Understanding these relationships may help us understand how bees evolved and why they split into different species. The genetic incompatibility of A. cerana and A. mellifera, for example, highlights the vast evolutionary processes that have developed each species' unique features [11].

In terms of conservation, the discussion strongly emphasizes the need of preserving the genetic diversity of Apis cerana populations, especially in light of the ecological advantages they provide as pollinators and their participation in local beekeeping practices. Healthy bee populations and the surroundings they occupy must be safeguarded against threats like Varroa destructor, acarine mites, and filthy brood for A. cerana. The diversity and geographic range of the Asian honeybee, Apis cerana, are of significant scientific interest and importance for conservation. This discussion is centered on the many characteristics of the variation of A. cerana, its regional adaptations, and its relevance in connection to the evolution of bee species generally as well as conservation efforts across Asia. Understanding these complications is essential for the proper management and conservation of this rare and ecologically significant honeybee species [12].

CONCLUSION

In conclusion, the study of the diversity and geographic distribution of the Asiatic honeybee, Apis cerana, has provided valuable insights into the complex world of this remarkable species. Apis cerana's ability to thrive across a vast and varied geographical range, from tropical regions to high mountainous areas, underscores its adaptability and ecological resilience. This adaptability is further reflected in the diversity of subspecies and races, each uniquely suited to its local environment. The intricate interplay of genetics, behavior, and environmental factors has shaped the evolution of Apis cerana and its divergence from other honeybee species. Genetic incompatibility with Apis mellifera, as well as distinct responses to pests and predators, highlights the species' long history of coevolution with its

environment. The conservation of Apis cerana and its genetic diversity is of paramount importance, given its role as a vital pollinator and its significance in traditional beekeeping practices across Asia. Ongoing efforts to protect A. cerana from threats like Varroa destructor and acarine mites are essential for safeguarding these essential pollinators and the ecosystems they support. In summary, the diversity and geographic distribution of the Asiatic honeybee, Apis cerana, provide a fascinating glimpse into the intricate web of life in Asia's diverse landscapes. Understanding and preserving this diversity is not only crucial for the species' survival but also for the health and stability of the ecosystems they inhabit and the agricultural systems they support. As we continue to explore and appreciate the world of Apis cerana, we are reminded of the intricate relationships between species, environments, and the delicate balance that sustains life on our planet.

REFERENCES:

[1] M. M. Saberioon, M. Mardan, L. Nordin, M. S. Alias, and A. Gholizadeh, “Predict location(s) of Apis dorsata nesting sites using remote sensing and geographic information system in Melaleuca forest,” Am. J. Appl. Sci., 2010, doi: 10.3844/ajassp.2010.252.259.

[2] L. P. Porrini et al., “First identification of nosema ceranae (Microsporidia) infecting apis mellifera in Venezuela,” J. Apic. Sci., 2017, doi: 10.1515/JAS-2017-0010.

[3] C. Schwartz, C. Villemant, Q. Rome, and F. Muller, “Vespa velutina (frelon asiatique)□: Un nouvel hyménoptère en France,” Revue Francaise d’Allergologie. 2012. doi: 10.1016/j.reval.2012.06.002.

[4] E. D. Stover, R. R. Stange, T. G. Mccollum, J. Jaynes, M. Irey, and E. Mirkov, “Screening antimicrobial peptides in vitro for use in developing transgenic citrus resistant to huanglongbing and citrus canker,” J. Am. Soc. Hortic. Sci., 2013, doi: 10.21273/jashs.138.2.142.

[5] A. S. Tanda and N. P. Goyal, “Insect pollination in asiatic cotton (gossypium arboreum),” J. Apic. Res., 1979, doi: 10.1080/00218839.1979.11099946.

[6] N. Koeniger and H. N. P. Wijayagunasekera, “Time of drone flight in the three asiatic honeybee species (apis cerana, apis florea, apis dorsata),” J. Apic. Res., 1976, doi: 10.1080/00218839.1976.11099837.

[7] R. W. K. Punchihewa, N. Koeniger, P. G. Kevan, and R. M. Gadawski, “Observations on the dance communication and natural foraging ranges of apis cerana, apis dorsata and apis florea in Sri Lanka,” J. Apic. Res., 1985, doi: 10.1080/00218839.1985.11100667.

[8] A. Basukriadi, W. Sjamsuridzal, And B. Beristama Putra, “Molecular Identification and Diversity of Yeasts Associated with Apis cerana Foraging on Flowers of Jatropha integerrima,” Microbiol. Indones., 2010, doi: 10.5454/mi.4.1.9.

[9] N. Tajabadi, M. Mardan, M. Y. Abdul Manap, M. Shuhaimi, A. Meimandipour, and L. Nateghi, “Detection and identification of Lactobacillus bacteria found in the honey stomach of the giant honeybee Apis dorsata,” Apidologie, 2011, doi: 10.1007/s13592-011-0069-x.

[10] H. W. Tan et al., “The complete mitochondrial genome of the asiatic cavity-nesting honeybee Apis cerana (Hymenoptera: Apidae),” PLoS One, 2011, doi: 10.1371/journal.pone.0023008.

[11] G. Suwannapong, P. Seanbualuang, S. V. Gowda, and M. E. Benbow, “Detection of odor perception in Asiatic honeybee (Apis cerana Fabricius, 1793) workers by changing membrane potential of the antennal sensilla,” J. Asia. Pac. Entomol., 2010, doi: 10.1016/j.aspen.2010.03.001.

[12] K. S. Lee, B. Y. Kim, H. J. Yoon, Y. S. Choi, and B. R. Jin, “Secapin, a bee venom peptide, exhibits anti-fibrinolytic, anti-elastolytic, and anti-microbial activities,” Dev. Comp. Immunol., 2016, doi: 10.1016/j.dci.2016.05.011.

CHAPTER 12

AN OVERVIEW OF THE DISTINCT CHARACTERISTICS AND DIVERSITY OF HONEYBEE SPECIES

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ABSTRACT:

A. cerana in India has intra-specific diversity that may be divided into seven ecotypes and races, according to thorough studies on its biology and taxonomy. Additional ecotypes and races may be discovered via further in-depth research. The Philippine islands of Mindanao and Sangihe, as well as the Indonesian islands of Celebes or Sulawesi, are home to the honeybee species Apis nigrocincta. Like its closely related cousin, the Apis cerana, this species makes its nests in cavities. In reality, there aren't many significant distinctions between the two species; for instance, the genitalia of each drone species are the same. However, there are minor physical variations, mitochondrial DNA genetic polymorphism, and behavioral variations. When A. cerana and A. nigrocincta coexist in an area, they are most easily identified by their size and coloration: A. cerana is often darker and smaller, whilst A. nigrocincta is typically bigger and has a yellowish clypeus on the bottom part of the face.

KEYWORDS:

Apis Cerana, Apis Koschevnikovi, Apis Mellifera, Bee Species, Diversity,Honeybee Behavior.

INTRODUCTION

Another distinction between the colonies is their architectural design: the drone cell of A. cerana has a waxy entrance that is covered by a conical cocoon with a central hole or pore. However, the drone cell of A. nigrocincta has a tiny entrance and no hard wax cap or hole. Additionally, compared to A. cerana, A. nigrocincta queens often produce colonies with more drones. The time of day that they prefer to collect pollen is another distinct behavioral variation between the species. By hosting the Varroa underwoodi species of mite, A. nigrocincta gets the parasite-caused honeybee illness varroatosis. They share this characteristic with Apis cerana nuluensis, a species that is similarly vulnerable to the same kind of parasite[1].

ApiskoschevnikoviButtel-Reepen,1906

Apis koschevnikovi, also known as Koschevnikov's Bee, is a species of honeybee that may be found in Sabah, Malaysian Borneo, and Indonesian Borneo, where it coexists alongside Apis cerana and other honeybee species. The colonies are identical in size and structure, with the exception of the fact that the individual bees are somewhat bigger than Apis cerana found in the same area. The red bee has several names. The species was first described by Buttel-Reepen, who gave it the name Koschevnikov in honor of the pioneering honeybee morphologist of the nineteenth century. In 1953, Maa provided a new description of the species under the name Apis vechti. Tingek et al. made the ultimate rediscovery in 1988.

A. koschevnikovi is the host of Varroa rindereri, a rare species of the honeybee parasite Varroa. Although this parasite species and Varroa jacobsoni are relatively similar, they may be easily distinguished. It has only been noted in A. koschevnikovi colonies in Borneo, and it

seems to be unique to those colonies since it has never been seen transferring to colonies of A. cerana, even when both colonies coexist in the same apiary[2].

TheEuropean,Honeybee,ApismelliferaLinnaeus1758

Since the Latin word "Mellifera" (honey-carrying) refers to the western honeybee, "Apis mellifera" is the honey-carrying bee. The term was first used in print by Carolus Linnaeus in 1758, however he referred to it as mellifica in a later publication. The earlier name retains precedence, while some Europeans continue to use the inaccurate following spelling. The majority of Europe, the Middle East, and Africa are home to this species of honeybee. Man has brought it to the Americas, Australasia, and a large portion of the rest of the planet. There are several subspecies that have adapted to the regional climatic and geographic conditions. When comparing other species to Apis mellifera, they are often categorized as "large" or "small" honeybees. Similar to A. cerana, A. mellifera uses caves, rock crevices, and hollow trees as its natural nesting locations. The nests have a very consistent bee area and are made up of many parallel combs. Usually, there is just one entrance to the nest. The temperate races avoid nest cavities less than 10, or greater than 100 l, and choose ones with a capacity of approximately 45 l. The populations of European colonial communities are typically between 15,000 and 60,000. According to anthropomorphic theory, the temperate races' behavior is unquestionably advantageous for evolution since, without it, the colony would be in danger of starving during the chilly winter months when food is scarce and it's too cold to engage in normal flying activity[3].

Subspecies or Races

There are multiple subspecies or races that make up the Western honeybee, often known as the European honeybee. On the basis of morphometry, at least 29 subspecies of A. mellifera have been identified. With the help of morphometric and genetic studies, as well as analyses of ecological, physiological, and behavioral traits, these subspecies are now typically divided into four major groupings: group A, which includes subspecies from all over Africa; group M, which includes subspecies from western and northern Europe; group C, which includes subspecies from eastern Europe; and group O, which includes species from Turkey and the Middle East. Apis mellifera comes in a variety of races, some tropical and others temperate. Tropical African Apis mellifera is the ancestor of the Africanized honeybees found in South and Central America. The size of individual bees and colonies varies amongst Apis mellifera races. The colonies shown in Figure 1 seem to be under rigorous natural- selection pressures because of the scarcity of natural fodder and the low temperatures that persist from late October to early spring. Because of this, temperate-zone A. mellifera colonies are less likely to elope than their tropical counterparts, whether they are wild or hived. As this bee migrated from Asia to Europe and Africa, it was divided into geographical subspecies[4]. Currently, 28 subspecies of Apis mellifera are identified, mostly as a result of these geographical variances. Apis mellifera adansonii, A. m. scutellata, A. m. littorea, A. m. monticola, A. m. unicolor, A. m. lamarkii, A. m. major, A. m. yementica, A. m. major, A. m. capensis, and A. m. intermissa are among the species.

It has been discovered that this subspecies has unique morphological and behavioral traits. Every subspecies may reproduce with another. Geographic isolation caused this species to adapt widely at the local level as it dispersed following the previous ice age. These adaptations include coordinated brood cycles with the local flora's blooming season, gathering in groups throughout the winter in colder climes, migratory swarming in Africa, improved foraging skills in arid environments, and several other hereditary features. Based on Ruttner's research, the 28 sub-species may be classified into one of four primary branches,

which was later supported by mitochondrial DNA testing. Subspecies from Africa are placed in branch A, those from northwest Europe in branch M, those from southwest Europe in branch C, and those from the Middle East in branch O. There are lists and groups of the subspecies. The third insect whose genome has been mapped is the western honeybee. There are unusually few transposons in the genome. The western Honeybee is thought to have originated in Africa and moved to Europe through two prehistoric migrations, according to researchers who examined its genetic code. Additionally, researchers have shown that honeybees have more genes connected to smell than taste. The genome sequencing showed that several gene families were more closely connected to vertebrates than other insects, particularly the genes involved in circadian rhythms. Vertebrate-like genes also connected to the enzymes that regulate other genes.

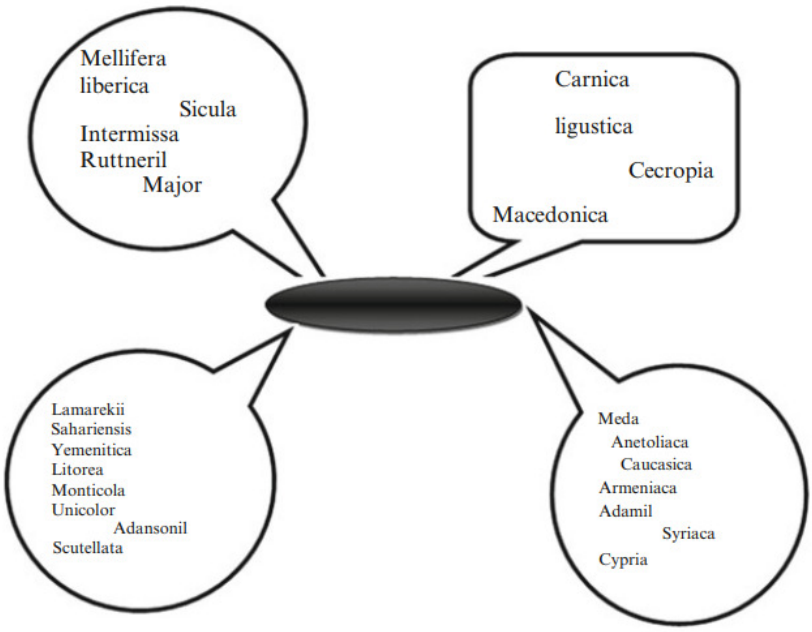

Figure 1: Illustrated theEvolutionofHoneybeeSpecies[5]**.**

Subspecies Originating in Europe

The complex of interbreeding European subspecies that make up European honey bees has been widely dispersed outside of its native area. All continents except Antarctica now have naturalized populations of European honey bees.

i. Subspecies Originating inAfrica:

Multivariable analysis may be used to differentiate the tropical African races as a separate group. The distribution of these races is shown in Figure 1, and Figure 2 presents the measured values of significant traits. The two most common species of A. mellifera in Africa are A. m. adansonii, which predominates in West Africa, and A. m. scutel- lata, which is found in East Africa from Ethiopia to Southern Africa[6].

Compared to the European Honeybee, both species are smaller, and their colonies generate more swarms.

For instance, A. m. intermissa is found from the Libyan Desert to the Atlantic coast, but A. m. lamarckii is a tiny, somewhat defensive breed located in the lower Nile river. They are a black race that makes a lot of propolis and stings easily. A.M. scutellata is the race that is both the most researched and often employed in beekeeping development programs. From

Ethiopia to South Africa, this race is spreading. Despite the absence of physical obstacles, there is a clear spatial variation in honeybee races in tropical Africa. Fletcher claims that the process causing isolation is the selective adaptation of bee race populations to certain biotopes.

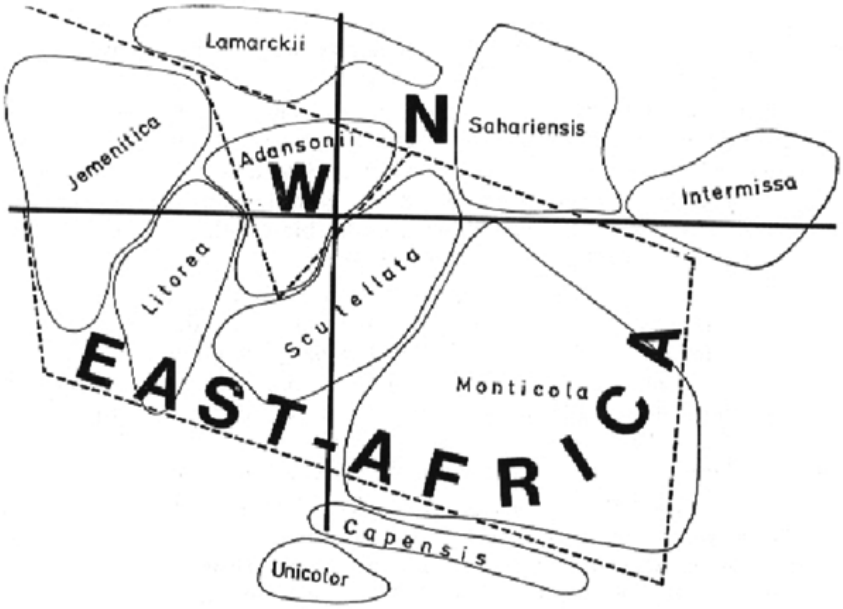

Figure 2: Represented theDistributionofAfrican racesaccording todirectioninAfrica[7]**.**

According to the information that is currently available, honeybee races in Africa are highly unpredictable in their defensive behavior, which has led to a great deal of worry in the beekeeping community owing to the number of documented human and domestic animal fatalities. For instance, honeybees in Uganda have been shown to be more aggressive in western Uganda at higher elevations than they are in other parts of the nation. In tropical Africa, a direct link between climate and morphometric traits has also been discovered. These bee races in East Africa, which span a distance of 250 km between the shore of the Indian Ocean and the tropical rain forest of Kilimanjaro, have shown this.

The smaller races in this area take place in the hottest locales, while the bigger ones at cooler, higher altitudes. Recent research has shown that certain races that were formerly assumed to be localized are not homogeneous. It is still disputed whether a subspecies or race is based on the identification of a unique population and should vary from the nearby populations. As an example, the intermissa, a northwest race in Africa, has two morphoclusters that have been discovered using multivariate approaches. The available research makes it clear that each sub-species of African honeybees varies morphologically and behaviorally, and that variety has some consequences for beekeeping techniques. A common feature of the African subspecies, called absconding, is described by a number of researchers and beekeepers. Africanized honeybee colonies tend to leave the hive when food supplies are low, as opposed to European colonies, which often do not[8]. Therefore, there is a definite ecological diversification and isolation in the variety of African tropical bees, and there is a considerably stronger link in tropical Africa than elsewhere in the world between adaptive traits and environmental conditions.

The observed regional variation between the subspecies improves the maintenance of gene pools for the East African beekeeping business. Additionally, the created hybrids or intermediates live in transitional regions that mirror intermediate ecological regions. Some races may be distinguished and are categorized regionally as:

A. Saki:

In Kitui, this race of honeybee is most prevalent. Small yet fierce in character. There is a yellow stripe on the abdomen. While having a smaller body than group 2 nzingu, it creates a larger hive.

B. Nzingu:

In comparison to saki dyed entirely black, it is somewhat bigger and has a gentler character.

C. Ikalamata:

Compared to group 2, this one is much bigger. Having hair that is reddish brown and yellow. Legs in particular have abundant hair covering them. While dozing off, wings do not sleep.

D. Wuli:

The group 1 saki is bigger and has a reddish body. Only one of its large, egg-laying queen bees may be located in the beehive's center.

Subspecies Originating in the Middle East andAsia

A region of considerable morphological diversity and evolution for honeybees includes the Middle East and Asia. This area, which has a variety of ecosystems, has given rise to several visibly unique races. These honeybee subspecies seem to have their genetic core in Asia Minor, which includes Anatolia. The subspecies Apis mellifera anatoliaca, A. m. caucasica, A. m. meda, and A. m. syriaca, which were regarded by Ruttner to represent a basal branch of the species, are among the honeybee races found in this area. Colonies in the central Anatolia area of Turkey and Iraq are typical of the Apis mellifera anatolica species, according to Maa. Although it has many positive traits, handling it in and around the hive may be fairly unpleasant. By Skorikov in 1829, the Near East and Palestine included Apis mellifera syriaca. Another subspecies that may be found is Apis mellifera mace-donia, which was identified in Northern Greece by Ruttner in 1988. Apis mellifera armeniaca, Middle East, Caucasus, Armenia; Apis mellifera ruttneri, classified by Sheppard, Arias, Grech, and Meixner in 1997; Apis mellifera adamii, described by Ruttner in 1977; Yemen; and Oman; and Apis mellifera yementica. Sheppard and Meixner categorized Apis mellifera pomonella as an endemic honeybee of the Tien Shan Mountains in Central Asia in 2003. The distribution of this subspecies of Apis mellifera extends to the furthest East Sources. The majority of these species resemble languages in appearance. However, nothing is known about their biology. However, several nations manage them for honey production[9].

Hybridization

In certain instances, hybridization has led to the evolution of new species. For instance, the northern Iberian Peninsula, a site of hybridization between the north of Africa and Europe, is home to the species Apis mellifera mellifera, Apis mellifera intermissa, and A. In nature, m. Iberiensis may also be found. A. m. The iberica haplotype is found in the western United States, where honeybees are not native and were imported from Spain during the conquest of America. exhibits six different hap- lotypes, five of which are connected to evolutionary lineages with African origins and one with European origins. This shows that this subspecies is a hybrid, with a North African component dominating in the southern Iberian Peninsula and subsequently being replaced in the northern region by the lineage of Apis mellifera mellifera. The number of alleles discovered and the chromosomal microsatellite genetic diversity values are equivalent to those of African populations.

Physiological characteristics may often be used to discriminate between the several races of A. mellifera. Bees used to warmer climates tend to be smaller and lighter in color than those adapted to colder climates, however this is not always the case. Similar effects to those of increasing latitude seem to be produced by elevation. Accurate separation of races with similar looks requires a thorough morphometric analysis of representative samples of bees. Biological and natural history differences between races also exist. Certain subspecies swarm more often than others; some swarms generate a large number of young queens, while others only produce a small number. As a kind of protection against predators or in reaction to a food deficit brought on by a drought or another circumstance, tropical honeybees often "abscond" or relocate. In reaction to intense predation, certain races, like the bees of tropical Africa, evolved a potent defensive system. Bees living in warmer climates don't need as tight of a clustering as those kept inside during long, harsh winters. For growing broods, the indigenous flora is used to its fullest potential. Bees of the same race have produced local strains that have adapted to the varied habitat types where they have lived in a variety of them[10]. Honeybees of various races that have lived in comparable environments have acquired similar behavioral features.

Because different races may have evolved to forage at diverse distances from the nest, even the "dance language" used by honeybees to communicate where food sources are located may vary in specifics across races. It is difficult for a colony to swiftly adjust itself when put in a new kind of habitat since the behavioral features of the distinct races and strains, such as brood rearing pattern, foraging behavior, clustering, etc., are fixed genetically. Despite the fact that the Dark European Honeybee, Apis mellifera mellifera, has just recently begun to diversify into regional varieties, strain variations may be seen within this race. In France, where the bee has been domesticated for the longest, the mellifera bees of the Landes region in the Southwest, the bees of the Paris region, and the bees of Corsica demonstrate significant variances in brood rearing behaviors. The Landes bees are typical "heather bees," used to a significant nectar flow at the end of the summer and the start of the autumn. In the Paris area, there is no summer nectar flow, and the bees have already begun early spring brood activities.

A colony swap between Paris and the Landes led to subpar results. The mellifera bees of Corsica produce little to no brood in the summer and surge again in the autumn, following a Mediterranean cycle. The tropics of South America provide a striking example of what occurs when bees are exposed to environments to which they are not accustomed. Despite being reared in Brazil for centuries, European honeybees have not been able to establish a natural colony there. It only took a few years for "Africanized bees" to travel north and south across the Amazon rain forest when a few queens of a tropical African breed were introduced to the country, wiping out all European bees in the process. The behavioral patterns that have evolved in the many races have ensured the survival of the various subspecies in their native environments, and some of these patterns may be replicated in other races. One race, although having minimal economic influence, seems to possess a distinctive biological characteristic that is essential to the study of honeybee genetics. A colony of any other race may begin to generate laying workers that can only lay drone eggs after it loses its queen[11].

When a colony of A. m. capensis, the Cape Bee, is without a queen, a laying worker soon appears who, for a time, is able to produce only diploid worker eggs. The colony's queenly status might be restored if these eggs grow into mature, fertile queens. Two traits of honeybees that have proved essential to their growth and biology are their tendency to cluster and, particularly in the case of cavity-nesting species, their ability to cool the nest by evaporating water accumulated outside. Due of these traits, colonies are able to control the temperature in the nest to a great extent independent of the weather outside. The genus Apis

was able to colonize a variety of settings as a consequence, from warm tropical to frigid temperate. Because they lack this ability, the Meliponinae are only found in tropical environments. Another distinctive feature of honeybees is the communication of information about food sources and the recruitment of foragers via "dance language."

When accurate information about the position and distance of foraging locations is extensively distributed, food sources are utilised efficiently. Physically, they resemble modern honeybees nearly perfectly and seem to have evolved social behavior approximately 30 million years ago. Because they nest in holes and have several combs, the more recent species in the genus were much easier to domesticate. The genus's older species produce single, exposed combs. Significant progress was achieved in the systematic classification of genuine honeybees in the latter two decades of the 20th century. This classification was mostly based on morphological and behavioral evaluations with aid from several genetic methodologies. The Apini tribe is made up of only one tiny monophyletic genus, Apis, which contains nine species of honeybees. During pregnancy, isolation was essential for this progress. Physiological barriers, postzygotic barriers, copulatory barriers, and behavioral barriers are some of the many mating behaviors. Adjustable A. The mellifera and allopatric populations of the other species regularly mated in the afternoon hours. The main criterion used to classify sympatric honeybee species was the length of the daily mating period. The mating season varies among populations of the same species from diverse locations.

DISCUSSION

This Apis mellifera subspecies is found in the furthest East Sources. The bulk of these animals seem similar to languages. But nothing is understood about their biology. But some countries control them to produce honey. In certain instances, hybridization has led to the evolution of new species. For instance, the northern Iberian Peninsula, a site of hybridization between the north of Africa and Europe, is home to the species Apis mellifera mellifera, Apis mellifera intermissa, and A. In nature, m. Iberiensis may also be found. A. m. The iberica haplotype is found in the western United States, where honeybees are not native and were imported from Spain during the conquest of America. exhibits six different hap- lotypes, five of which are connected to evolutionary lineages with African origins and one with European origins. This shows that this subspecies is a hybrid, with a North African component dominating in the southern Iberian Peninsula and subsequently being replaced in the northern region by the lineage of Apis mellifera mellifera. The number of alleles discovered and the chromosomal microsatellite genetic diversity values are equivalent to those of African populations. Physiological characteristics may often be used to discriminate between the several races of A. mellifera. Bees used to warmer climates tend to be smaller and lighter in color than those adapted to colder climates, however this is not always the case. Similar effects to those of increasing latitude seem to be produced by elevation[12].

Accurate separation of races with similar looks requires a thorough morphometric analysis of representative samples of bees. Biological and natural history differences between races also exist. Certain subspecies swarm more often than others; some swarms generate a large number of young queens, while others only produce a small number. As a kind of protection against predators or in reaction to a food deficit brought on by a drought or another circumstance, tropical honeybees often "abscond" or relocate. In reaction to intense predation, certain races, like the bees of tropical Africa, evolved a potent defensive system. Bees living in warmer climates don't need as tight of a clustering as those kept inside during long, harsh winters. For growing broods, the indigenous flora is used to its fullest potential. Bees of the same race have produced local strains that have adapted to the varied habitat types where they have lived in a variety of them. Honeybees of various races that have lived

in comparable environments have acquired similar behavioral features. Because different races may have evolved to forage at diverse distances from the nest, even the "dance language" used by honeybees to communicate where food sources are located may vary in specifics across races. It is difficult for a colony to adapt fast to a new environment since the behavioral aspects of the different races and strains, such as brood rearing behaviors, foraging preferences, clustering, etc., are genetically ingrained[13]. Despite the fact that the Dark European Honeybee, Apis mellifera mellifera, has just recently begun to diversify into regional varieties, strain variations may be seen within this race. In France, where the bee has been domesticated for the longest, the mellifera bees of the Landes region in the Southwest, the bees of the Paris region, and the bees of Corsica have quite diverse brood rearing behaviors. The Landes bees are typical "heather bees," used to a significant nectar flow at the end of the summer and the start of the autumn.

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One race, although having minimal economic influence, seems to possess a distinctive biological characteristic that is essential to the study of honeybee genetics. A colony of any other race may begin to generate laying workers that can only lay drone eggs after it loses its queen. When a colony of A. m. capensis, the Cape Bee, is without a queen, a laying worker soon appears who, for a time, is able to produce only diploid worker eggs. The colony's queenly status might be restored if these eggs grow into mature, fertile queens. Two traits of honeybees that have proved essential to their growth and biology are their tendency to cluster and, particularly in the case of cavity-nesting species, their ability to cool the nest by evaporating water accumulated outside. Due of these traits, colonies are able to control the temperature in the nest to a great extent independent of the weather outside. The genus Apis was able to colonize a variety of settings as a consequence, from warm tropical to frigid temperate. Because they lack this ability, the Meliponinae are only found in tropical environments. Another distinctive feature of honeybees is the communication of information about food sources and the recruitment of foragers via "dance language." When accurate information about the position and distance of foraging locations is extensively distributed, food sources are utilised efficiently.

CONCLUSION

Physically, they resemble modern honeybees nearly perfectly and seem to have evolved social behavior approximately 30 million years ago. Because they nest in holes and have several combs, the more recent species in the genus were much easier to domesticate. The genus's older species produce single, exposed combs. Significant progress was achieved in the systematic classification of genuine honeybees in the latter two decades of the 20th century. This classification was mostly based on morphological and behavioral evaluations with aid from several genetic methodologies. The Apini tribe is made up of only one tiny monophyletic genus, Apis, which contains nine species of honeybees. During pregnancy,

isolation was essential for this progress. Postzygotic barriers, copulatory barriers, behavioral mating barriers, and physiological barriers are only a few of the many mating activities. Adjustable A. The mellifera and allopatric populations of the other species regularly mated in the afternoon hours. The main criterion used to classify sympatric honeybee species was the length of the daily mating period. The mating season varies among populations of the same species from diverse locations. A relationship between taxonomy and size was found in the order of the mating times recorded from Sri Lanka, Thailand, and Sabah, where dwarf bees grabbed the top spot just after noon. The second mating season included cavity-dwelling bees, and at nightfall, A. Dorsata drones flew into the air to mate. The studied honeybee species have also been demonstrated to face a number of non-behavioural mating barriers.

REFERENCES:

[1] K. Raymann, L. M. Bobay, and N. A. Moran, “Antibiotics reduce genetic diversity of core species in the honeybee gut microbiome,” Mol. Ecol., 2018, doi: 10.1111/mec.14434.

[2] H. Human, “Honeybee health in Africa—a review,” Apidologie. 2016. doi: 10.1007/s13592-015-0406-6.

[3] M. Filipiak et al., “Ecological stoichiometry of the honeybee: Pollen diversity and adequate species composition are needed to mitigate limitations imposed on the growth and development of bees by pollen quality,” PLoS One, 2017, doi: 10.1371/journal.pone.0183236.

[4] K. M. Ellegaard and P. Engel, “Beyond 16S rRNA community profiling: Intra-species diversity in the gut microbiota,” Frontiers in Microbiology. 2016. doi: 10.3389/fmicb.2016.01475.

[5] B. Gunnarsson and L. M. Federsel, “Bumblebees in the city: abundance, species richness and diversity in two urban habitats,” J. Insect Conserv., 2014, doi: 10.1007/s10841-014-9729-2.

[6] J. A. Weissmann, A. Picanço, P. A. V. Borges, and H. Schaefer, “Bees of the azores: An annotated checklist (Apidae, Hymenoptera),” Zookeys, 2017, doi: 10.3897/zookeys.642.10773.

[7] C. A. Kearns, D. W. Inouye, and N. M. Waser, “Endangered mutualisms: The conservation of plant-pollinator interactions,” Annu. Rev. Ecol. Syst., 1998, doi: 10.1146/annurev.ecolsys.29.1.83.

[8] D. Alomar, M. A. González-Estévez, A. Traveset, and A. Lázaro, “The intertwined effects of natural vegetation, local flower community, and pollinator diversity on the production of almond trees,” Agric. Ecosyst. Environ., 2018, doi: 10.1016/j.agee.2018.05.004.

[9] V. Y. Vavilova, I. Konopatskaia, S. L. Luzyanin, M. Woyciechowski, and A. G. Blinov, “Parasites of the genus Nosema, Crithidia and Lotmaria in the honeybee and bumblebee populations: A case study in India,” Vavilovskii Zhurnal Genet. Selektsii, 2017, doi: 10.18699/VJ17.317.

[10] M. Miñarro and D. García, “Complementarity and redundancy in the functional niche of cider apple pollinators,” Apidologie, 2018, doi: 10.1007/s13592-018-0600-4.

[11] S. M. Barribeau et al., “A depauperate immune repertoire precedes evolution of sociality in bees,” Genome Biol., 2015, doi: 10.1186/s13059-015-0628-y.

[12] C. Venjakob, A. M. Klein, A. Ebeling, T. Tscharntke, and C. Scherber, “Plant diversity increases spatio-temporal niche complementarity in plant-pollinator interactions,” Ecol. Evol., 2016, doi: 10.1002/ece3.2026.

[13] D. Goulson, J. C. Stout, and A. R. Kells, “Do exotic bumblebees and honeybees compete with native flower-visiting insects in Tasmania,” J. Insect Conserv., 2002, doi: 10.1023/A:1023239221447.