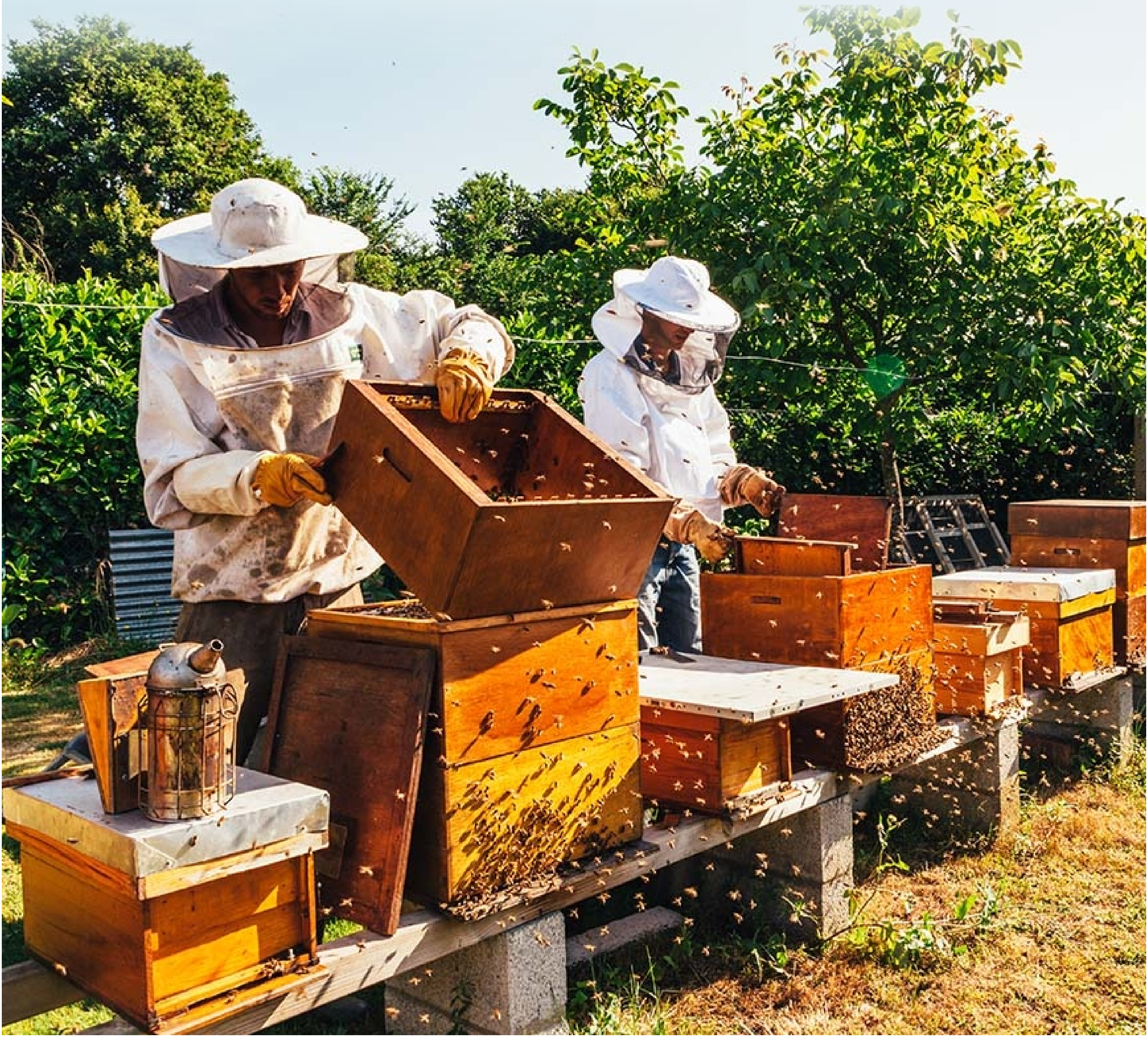
BEEKEEPING INDUSTRY IN RURAL INDUSTRIALIZATION

M. Soundarapandian
Shakuli Saxena



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By M. Soundarapandian, Shakuli Saxena

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CONTENTS

CHAPTER 1

CHALLENGES AND OPPORTUNITIES: INDUSTRIALIZATION FOR SUSTAINABLE RURAL DEVELOPMENT IN INDIA

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ABSTRACT:

A major obstacle to rural development in India has recently been shown to be the dwindling employment opportunities in rural areas. Due to outmoded technology, this problem has resulted in seasonal unemployment, partial unemployment, and the marginalization of craftspeople. As a consequence, a growing number of rural inhabitants, particularly those with less education, have moved to metropolitan regions in search of work, contributing to the worsening of urban poverty.The saddening emigration of farmers from agriculture owing to its alleged lack of profitability is one of the major barriers to rural development. The exploitation of rural resources by corporate interests has made this situation worse by depriving rural people of knowledge, expertise, and technology.Since the 1950s, creating jobs in India's rural regions has been a key objective of rural industrialization. These non-agricultural subsectors, which are sometimes referred to as small-scale, rural, or village industries, seek to generate employment by effectively utilising regional resources, human capital, and indigenous technology. They are distinct from traditional industries in that they priorities mass production and the development of jobs.The benefits of rural industrialization include the ability to alleviate environmental constraints in cities, limit urban migration, boost rural income, and provide jobs for both skilled and unskilled individuals. It may also help fulfil local consumption demands, encourage resource conservation, and contribute to balanced industrialization.Rural industrialization has the potential to have a big economic influence on India, despite obstacles such a variety of technologies, a lack of management skills, restricted access to capital, and poor marketing infrastructure. Government programmes aimed at assisting rural industry include market protection, preference for small-scale enterprises in government contracts, infrastructural assistance, raw material supply, concessional financing, and acclimatization promotion.

KEYWORDS:

Beekeeping, Economic, Growth, Government, Poverty.

INTRODUCTION

The declining job prospects in rural regions are one of the main issues having a substantial impact on rural development. Indian communities often experience seasonal unemployment, partial unemployment, and craftsmen who are marginalized because the technology they use has grown outdated. Any government has the great challenge of finding employment that fit the capabilities of the workforce. It is often believed that agriculture is unprofitable. Due to this, urban migration has greatly increased and urban poverty has become worse.Distressed farmland departure is a recent obstacle to rural development. The contradiction is that corporate interests often abuse resources for economic gain in rural communities. Rural residents are forced to witness their resources, such as land, sand, soil, water, flora, herbs, and trees, being exploited by speculative interests because they lack access to information, expertise, and technology. The rural residents who are illiterate or just partially literate finish up their businesses in the villages and prepare to move to metropolitan areas in quest of jobs. Rural industrialization has been one of India's finest employment-generation tactics since the middle of the 1950s, particularly in rural regions. The industrialization of rural areas and the creation of large-scale job opportunities across the nation have been achieved via a number of ideas, models, and experiments. Additionally, they go by the name non-agricultural sub-sector.

Industries are locations where products are produced for mass consumption. The economy supports the creation of jobs for society. A country's economy may be developed via its industries. Rural industries are non-farm operations that rely on rural resources and are mainly intended to create jobs via the efficient use of locally accessible resources, human capital, and indigenous or homegrown technology. These are small-scale by nature. These are often located in rural areas. As a result, they are sometimes referred to as small-scale, rural, or village industries. Rural businesses often operate with the ideology of mass production, as opposed to mainstream industries, where items are mass manufactured, since job creation is one of their primary goals. It seeks to lower unemployment rates and raise family and individual income levels. Due to the limited scope of the operations, the funding demand is often relatively modest. T M Dak claims that the word rural industries itself lacks a clear, agreed meaning and is often used in conjunction with other phrases like artisan industries etc.[1], [2].

When recommending a plan for rural industries projects in 1962, the Planning Commission used the phrase rural industries for the first time. The Planning Commission (1988) defined rural industries as such types of industries as khadi, Village industries, handloom, handicraft, sericulture, coir and tiny and service industries situated in rural areas in a report on the sector of Village and Small Industries. Rural industrialization therefore encompasses non-agricultural economic activity carried out in communities and ranging in size from homes to small industries. Cottage, tiny, village, and small-scale manufacturing and processing enterprises, as well as a variety of services, are some examples of these activities. Over time, non-household, small-scale businesses have grown while household industries have diminished. Small-scale, full-time, and specialist rural industries are more efficient than cottage businesses, which rely on part-time family employment.

The prefix rural is used to denote a requirement for a different conditionality and connection between industrialization processes and a certain segment of society. The process of industrialization involves employing certain inputs, technology, and manufacturing techniques to produce commodities and services. In the classical sense, rural industry is defined as an economic activity that is marked by characteristics such as ease of entrance, dependence on local resources, small-scale operation, accepted technology, and skills learned outside of the official educational system. However, this sector is plagued by outdated technology, poor output, inefficiency, uneven quality, drudgery, and a reliance on the benevolence of nature. Due to the introduction of new technologies brought about by globalisation and the scaling up of production, technologies utilised in rural sectors must also be innovative or improvised.

The moment has come to distinguish between state-sponsored small-scale industry that serves both rural and semi-rural regions and Rural Industrialization as an effort demanding creativity. The idea of rural industrialization includes making it easier for people to find jobs in widely distributed non-farm activities closer to where the poor live. Additionally, it is believed that increasing the production of consumer goods and wage productswhich may be generated via village industries (VI) or small-scale industries (SSI)would be necessary for a change in the income distribution to benefit the poor. Technology application and the ability to attract prospective customers' attention have become crucial for items from rural sectors as well[3], [4]. According to Chuta and Sethuraman, rural industrialization is a development approach that must obviously emphasize employment, which implies a larger focus on small-scale businesses. These not only provided the rural poor with more work and income options, but also made it easier for them to participate in development.

DISCUSSION

The rural labour force has been expanding quickly in the majority of emerging nations, including India, yet job prospects have been decreasing. If the problem of deteriorating rural poverty is to be addressed, options for non-farm employment must increase as the amount of land available for growth of agriculture becomes more limited. Large-scale urban enterprises are not likely to be able to accommodate the increasing number of employees moving from the rural to the metropolis given their anticipated expansion and makeup. With its enormous social and environmental consequences, such as traffic congestion, air pollution, ballooning land prices, etc., the urbanisation process must be slowed down. Therefore, it is crucial to shift labour from the agricultural sector to the industrial and service sectors. The growth of the industrial sector, particularly in the rural segment, is crucial since employment in the service sector, particularly in rural regions, is restricted. The development of rural industry is seen as a means of providing the rural poor with constructive jobs and income. The following reasons explain why rural industrialisation is significant:

1. They may lessen the negative effects of urbanisation by slowing urban migration.
2. By lowering the concentration of industrial units in large cities, they contribute to environmental improvement.
3. They may boost rural income and provide farmers access to non-farm work.
4. They can lower unemployment among both skilled and unskilled workers.
5. By preventing excessive industrial concentration, they may encourage balanced industrialisation.
6. They are based on local requirements and are better able to satisfy local consumption requirements.

Therefore, one of the greatest feasible growth strategies for a densely populated nation like India is the decentralization of industry to rural regions.

Goals for Village and Small Industry Development

The following are the goals for the growth of small businesses and villages, as stated in one of the five-year plans:

1. To promote the expansion and broad distribution of industry
2. To boost the income levels of craftspeople.
3. To maintain and develop opportunities for self-employment.
4. To guarantee a steady supply of products and services by using local expertise and resources.To promote entrepreneurship alongside better manufacturing techniques by providing the necessary training and incentives.To protect the nation's artistic and artisanal traditions [5], [6].

Rural industries' contribution to development

The landless and other impoverished people have long relied on cottage and village enterprises as a source of income in Indian communities. For them, it is a significant source of money and job chances. In actuality, rural industry and agriculture are mutually beneficial. After agriculture, this industry employs the second-highest percentage of people. Since more than half of those employed are women, minorities, and the underprivileged, it has an impact on the lives of the weaker and less organised segments of society. The majority of micro and small businesses (MSEs), 57%, are single-person-owned businesses. In non-agricultural private unincorporated firms, they make up 32% of the labour force and 29% of the value contributed. Over 40% of the manufacturing industry's gross domestic product, nearly 45% of manufacturing exports, and over 35% of all exports come from this sector.Despite fierce competition from the highly industrialized urban culture, India has a very broad spectrum of industrial enterprises that are still flourishing in the rural. These so-called Traditional craftsmen continue to use their past-down technology, with only minor advancements keeping up with changes in the industry or consumer demand. Activities towards rural industrialisation are supported by the Indian government via a number of institutional organisations and budgetary allocations. These seek to promote rural industrialisation, foster an atmosphere that will stop the rural-to-urban movement, and generate local jobs. In the end, this would increase family and individual earnings, reducing poverty.

Local small enterprises' contribution to India's export

Despite receiving just a little portion of the plan funds, the VSI industry provides to roughly one-third of India's export revenues. Ironically, although having enormous export potential, export promotion has not been included as a goal of sector growth in our five-year agreements. This does not imply that no efforts have been made to encourage this sector's exports, either. Government initiatives to promote the export of VSI items are shown through organisations like the Handicrafts and Handlooms Exports Corporation and Central Industries Corporation. Despite the fact that the village and small industries have a significant export potential, our five-year plans do not include contributing to exports as a key goal of growth. The small business sector had consistent expansion in the number of units, output, employment, and exports from 2000-01 to 2004-05.

Characteristicsof Rural Industries

Rural industrialization's content continues to be challenging due to its extreme variety and dynamic environment. The movement of rural people to metropolitan regions in pursuit of work in the hotel and restaurant industry, for example, is the finest proof of this. The following list of distinctive qualities and significant benefits of rural industry is provided. Due to their high employment potential, the village, khadi, and small industries assume special significance. This is crucial for an economy like India, which is characterised by a plentiful labour supply and concurrent unemployment and underemployment. Currently, nearly 40 million people work full or part time in these sectors. This number is much higher than the entire workforce for the organised manufacturing and mining industries. Unlike agriculture, which only offers seasonal employment, many businesses provide work throughout the off-season as well. In the off-season, the cottage and village industries aid individuals in finding work.

People from special groups, such as women, the elderly, children, physically disabled people, etc., are employed by the cottage, khadi, and village industries. In addition, it creates part-time employment opportunities for people who are employed full-time elsewhere and are looking to supplement their income. The majority of these businesses are situated within residential areas, which is advantageous for those who work there. The cottage and village industries benefit from abundant manpower and capitalscarce economy, such as India. Both the capital-output and capital-labor ratios are quite low in comparison. In other words, the amount of capital investment needed for each unit of employment and the amount needed for each unit of production are both relatively little.They encourage non-inflationary growth because to the low capital-output ratio and short gestation time.It has been discovered that the Khadi and village industries are especially beneficial to the society's weakest groups.These sectors encourage resource conservation and resource use optimisation. To make the most use of the raw resources that are readily accessible locally, adaptive techniques are used. When using unconventional raw resources, waste may sometimes be turned into riches.Because these sectors may grow in practically all places, including underdeveloped, tribal, mountainous, and inaccessible areas, they aid in decreasing regional economic disparities.These industries aid in boosting income and job prospects, hence quickening rural development.Due to the environmental problems that small enterprises produce, they have attracted more attention than major industries.Since the khadi and village industries do not require electric power or oil, or use it in very small quantities, neither an energy crisis nor a foreign currency crisis are created[7], [8].

Rural Industrialization Problems

The following are a few difficulties with rural industrialization:The dualistic nature of technology is a major obstacle to rural industrialisation. For instance, there is hand spinning on the one hand and power spinning, hand weaving, and power weaving on the other. Many rural businesses, including food processing, building, leather products, carpentry, blacksmithing, paper production, food preservation, and processing, exhibit this variety. As a result, it is necessary to set aside certain regions just for SSIs (Small Scale Industries), and it may be appropriate to take into account various protection mechanism concerns like quality standards, production capabilities, price subsidies, and so forth.Different types of rural industries have different requirements for the form of work. Self-employment, wage employment, wage-cum self-employment, etc. are among them. The employment pattern must thus be taken into account while developing rural industry. Research by Algappan indicated that the wage cum self-employment pattern of wage payment proved to be beneficial when looking at employment patterns in rural businesses situated in Keerapalayam panchayat.

Rural entrepreneurs' managerial and entrepreneurial abilitiesin the rural industries is a widespread lack of management and entrepreneurial competence. Due to a shortage of technical talent at the grassroots, the decentralised industrial zation unit lacks business savvy. The craftspeople and business owners in the hamlet need to be educated on different management techniques.For small business owners, obtaining institutional finance is a constant challenge. The majority of rural businesses lack enough financial resources. As a result of globalisation, the credit system is shifting in favour of urban entrepreneurs, and the real estate market is putting rural businesses in a credit crisis.Infrastructure for marketing the items made by rural businesses is a major issue. Rural producers cannot benefit from a healthy market as long as their goods are excluded from the standard supply chain. Without a strong rural marketing infrastructure, rural industrialisation would thus be a complete failure. Chelloppan has encouraged the government to support the goods made via self-help mechanisms, saying that doing so will act as a pain reliever for rural businesses.It is crucial to define rural industries in the perspective of globalisation. Institutional village industries do not fit the 1979 definition of a minor industry. Despite increased overall investment in these sectors, per-capita investment has not increased. The redefining of small, medium, cottage, and tiny enterprises was proposed by T.S. Papola.

The federal and state governments' roles in relation to cottage and small-scale businesses must be clear. The Central government invests in a number of businesses under the Centrally Sponsored Scheme, including coir, sericulture, khadi, and handicraft. The state government, however, is in charge of the implementation. In other words, although the state government handles implementation, the federal government supported these companies with financial aid, tax breaks, and policy assistance. However, it is clear that state governments continue to see its promotion as the responsibility of the federal government. As a consequence, there is ambiguity about the roles of the central and state governments. These are a few of the significant issues with rural industrialization.

Actions To Support Rural Industries

A variety of government-sponsored promotion programmes, including the following, stimulate the development of small-scale industries:

1. The reserve of goods for exclusive manufacture in the small-scale industry, which provides market protection. The list of reserved products has grown significantly over time.As of the end of December 1987, there were 847 things on it.
2. The government gives preference to the small-scale sector when making purchases. A restricted number of commodities (13 in December 1987) are allocated for purchase up to 75 percent, while a number of items (28 in December 1987) are reserved for purchase up to 50 percent. More than 400 items have been reserved under this scheme for exclusive purchase from the small-scale sector.
3. Infrastructure support offered by industrial parks, District Industries Centres (DIC), Small Industries Service Institutes, and other specialist organisations that provide testing facilities, technical support, etc.
4. Plans for the supply of in-demand raw materials.
5. Banks and other financial entities offering concessional financing.
6. Ancillarization promotion strategy.

Official Measures to Encourage Rural Industrialization

The government has a number of organisations that help efforts to industrialize rural areas. There are several such institutions included under the Ministry of Micro, Small and Medium Enterprises. The National Small Industries Corporation Limited (NSIC), KVIC, Coir Board, and others are significant examples. In addition to these, organisations that support rural industrialization include the Council for Advancement of People's Action and Rural Technologies (CAPART), National Bank for Agriculture and Rural Development (NABARD), Small Industries Development Bank of India (SIDBI), and commercial banks. The Ministry of Micro, Small, and Medium Enterprises (or MSME for short) promotes rural industrialisation by offering advice on how to launch a business and help with marketing[9], [10].

KVIC, or Khadi and Village Industries Commission

The Khadi and Village Industries Commission (KVIC) was created with the intention of providing financial and technical support to the implementing organisations, including State KVI Boards, Registered Institutions, Cooperatives, and private people. Through KVIBs and some of the KVIC directly sponsored institutions acknowledged by the KVIC, KVIC often promotes village industry. KVIC offers aid for rural businesses via training and research institutes in addition to financial, technical, and marketing support.

Limited by the National Small Industries Corporation

For the purpose of assisting small businesses, the National Small Industries Corporation Limited (NSIC) was founded in 1955. It is concerned with:

1. Facilitating bank loans for small businesses.
2. Export credit protection.
3. Raw Material Support.

4. Export support.
5. Billing Discounting Programme.
6. Planning both home and foreign exhibitions.
7. Offering informational services.

The NSIC has created a unique programme called the Infomediary Service with the aim of connecting rural businesspeople with global markets if they showed the capacity to grow. Therefore, NSIC has introduced Infomediary Services while keeping in mind the information demands of small enterprises. A one-stop, one-window collection of resources that will provide knowledge on commerce, technology, and finance as well as highlight the key competencies of Indian SMEs in terms of cost and quality, both locally and abroad. For the distribution of critical information, NSIC's Infomediary Services employ a professionally managed human resource (HR) base and contemporary technology, including websites, sector-specific newsletters (both print and electronic), and emails. Entrepreneurs, both established and aspiring, R&D facilities, SME seeking commercial partnership and co-production possibilities, joint ventures, exporters and importers, and those seeking knowledge transfer are potential benefactors.

Recent Governmental Initiatives for Rural Industrialization

The Government of India has implemented a number of policy initiatives to further support this industry, including a plan for integrated infrastructure development, a reduced excise duty rate for unregistered businesses, a programme for quality certification to obtain ISO 9000, an increase in project outlay from Rs. 30 lakh to Rs. 50 lakh under the single window programme, and timely and adequate credit supply in accordance with recommendations made by the Nayak Committee in 1992. In addition, the investment thresholds for small-scale industry (SSI) units have been raised from Rs. 60 lakh to Rs. 3 crore, from Rs. 5 lakh to Rs. 25 lakh, and from Rs. 50,000 to Rs. 2 lakhs for composite loans for SSI units.Given the migration from rural to urban regions in quest of wage jobs in the city, rural industrialization is crucial. Distressing abandonment from agriculture is brought on by its unprofitable character. The Indian government supports farmers in their efforts to make agriculture profitable and feasible, but it also has a policy to reduce the overpopulation of farmers by encouraging rural industrialisation. India's rural industrialisation is supported by a number of government organisations, from the supply of raw materials to marketing help. Many rural enterprises are flourishing in India's free-market economy and globalisation age, particularly in rural regions where they serve certain subsets of metropolitan customers.

CONCLUSION

In conclusion, the dwindling employment opportunities in India's rural areas provide a substantial barrier to rural development. Urban poverty has been made worse by seasonal unemployment, antiquated technologies, and the idea that agriculture is not lucrative. A crucial tactic to overcome these problems and advance balanced development is rural industrialisation. Rural industries, which are often small-scale and resource-reliant, are essential for creating job opportunities and raising family and personal income levels. They also aid in reducing environmental pressures in big cities and slowing the harmful effects of urbanisation. Promoting rural businesses has the potential to reduce unemployment, strengthen marginalised communities, and alleviate regional economic imbalances, among other good effects.In conclusion, rural industrialisation is a crucial part of rural development in India since it has the capacity to alleviate unemployment, strengthen disadvantaged groups, and stop urban migration. Although difficulties still exist, government assistance and continuing programmes are trying to encourage the development of rural industries and create a more balanced and sustainable development in the nation.

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CHAPTER 2

SUSTAINABLE BEEKEEPING: FOOD SECURITY, POVERTY REDUCTION, AND ECONOMIC GROWTH

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ABSTRACT:

In order to solve global issues like food security, poverty reduction, and economic growth, beekeeping is crucial. Throughout the beekeeping value chain, including the supply of a sustainable floral resource base, bee rearing, hive product collection, and the extension of bee services, this article emphasises the need for a creative, sustainable, and comprehensive approach. As important pillars for sustainable beekeeping, the environment, genetics, practises, education, and extension services are noted.External variables, such as biodiversity and environmental conditions, have an effect on feeding patterns and the accessibility of floral resources, which in turn affects the products and services that bees provide. Successful beekeeping depends on the quality and amount of nectar and pollen sources as well as the range of plants that are accessible, both of which are often impacted by human activity.Bee genetics have a vital role in the productivity, wellness, and sustainability of beekeeping operations. For long-term viability, breeding programmes and the protection of regional genetic variety are essential. Because they are more able to adapt to certain environmental circumstances, native bee species are preferred over invasive ones.Successful beekeeping initiatives in several African nations have shown the affordability and sustainability of hives made locally. Market-oriented methods should support moral harvesting and post-harvest processing practises by increasing a knowledge of local market systems.The significance of protecting bee habitats, biodiversity, and resolving supply chain issues in underdeveloped nations is emphasised in this research. It emphasises that beekeeping may flourish in both natural and controlled habitats, provided the certain requirements are satisfied, and it promotes the use of sustainable practises.

KEYWORDS:

Beekeeping,Environment, Economic Growth, Food Security, Poverty Reduction.

INTRODUCTION

Beekeeping makes a significant contribution to food and nutrition security, poverty reduction, and economic development by focusing on the practical management of social bee species, frequently within agricultural systems. Sustainable beekeeping company growth depends on an innovative, sustainable, integrative strategy that takes into account every stage of the beekeeping value chain, from providing a sustainable floral resource basis and rearing bees to collecting hive goods and expanding bee services. The environment, genetics, practises, as well as education and extension services, are the major pillars to take into account for sustainable beekeeping.The external elements, which include environmental conditions and biodiversity, may have an impact on things like foraging behaviour, the accessibility of blooming plants, physical stresses, and ultimately the goods and services that bees provide. The natural environment is one of these external variables. A key factor in the success of beekeeping systems is the quality and quantity of nectar and pollen supplies, as well as the variety of plants accessible to bees. In certain circumstances, these factors may be influenced and regulated by human actions.

The output, health, and sustainability of beekeeping operations depend heavily on bee genetics. Certain qualities may be enhanced by breeding operations in addition to selecting native bees that can survive in a natural and anthropogenically altered habitat. The long-term sustainability of bee species and beekeeping businesses depends on the maintenance of local genetic diversity and indigenous bee species. Locally adapted stock may also be more productive and sustainable in various environmental settings than introduced bee species or genotypes because it is better suited to particular environmental constraints. Authocthonous bees should typically be preferred over allochthonous species[1], [2].

These comprise all beekeeping tasks completed to manage bees for a specific goal, such as proper housing, the use of new technologies and methods, effective beekeeping techniques, and biosecurity precautions. These procedures, when combined, are essential to robust and fruitful beekeeping systems. GBPs are all the general practises that beekeepers use in on-apiary production to provide the greatest possible level of health for people, bees, and the environment. They serve as the foundation for the BMBs, which are all the operational measures taken by beekeepers to lessen the possibility of the introduction and spread of certain bee disease agents.With the aid of these services, beekeepers may significantly increase their knowledge and technical proficiency with GBPs. The adoption and success of beekeeping systems depend on effective and ongoing training activities and extension. These activities can also give beekeepers the chance to form partnerships with researchers, extension units, and other relevant authorities to strengthen the honey value chain and jointly address the sector's new challenges.

To promote the growth of a competitive, resilient, and sustainable apiculture industry that will enable beekeepers to increase the productivity, profitability, and sustainability of their businesses, an effective approach to beekeeping should take into account all of these pillars. By doing this, the beekeeping industry may improve crop productivity, become more effective at offering lucrative bee goods and services, become more robust to shock, seasonality, and stresses, and create income-generating possibilities without accelerating environmental deterioration.This chapter is meant for those who are thinking about using beekeeping as a development intervention. The bees and their hives are just one aspect of the narrative. every enterprise must assure its long-term viability in terms of the environment, the economy, and society. In order to use apiculture to help people escape persistent poverty, a proper scenario analysis and a solid grasp of markets and trade are essential.

Use only native bee species or subspecies, and get knowledge of native bee biology and behaviours. Honeybees often reside in beekeepers' hives or in tree cavities. The species most often utilised is Apis mellifera, which naturally exists in the regions of Europe, the Middle East, and Africa that are north of the Arctic Circle. Since being introduced to the globe, this bee has spread practically everywhere. There are several distinct subspecies with unique traits that allow them to survive in a broad range of climatic conditions, from -20 °C in the winter in Europe to 40 °C in the Middle East. Nevertheless, bees are present everywhere there are blooming plants, and several bee species generate honey, beeswax, and propolis, which are used by humans to support their daily lives.Many developing countries are located in tropical areas of the globe, and tropical bees vary significantly from bees that have evolved to live in places with temperate weather in terms of biology and behaviour. As a result, apicultural methods that are effective in temperate temperatures in industrialised countries may not be suitable for tropical climates and isolated rural locations. Bees can't be confined like other creatures and may forage and reproduce freely in the natural world. Never transfer bees from another location. in recent years, viruses and honeybee parasites have spread this way[1], [3]. Because bees marry normally in the wild, introducing bees is pointless because it requires ongoing, yearly beekeeping, which is not sustainable. Additionally, it disrupts native bee populations that have developed to flourish in the region. However, there is a great deal of wasteful and harmful commerce and movement of bees since individuals may profit by selling bees and praising one kind over another. Contact a reputable organisation like Apimondia for unbiased guidance if you are perplexed or uncertain about the information that is readily accessible locally.

DISCUSSION

Beekeeping is a widespread hobby in underdeveloped rural areas of the globe because it is robust, sustainable, and low-risk. However, apiculture and people are not universal, and subsistence beekeeping does not always lead to financial success. Try to determine the actual obstacles that current neighbourhood beekeepers are experiencing, if any. Recognise that long-term growth takes time, and be ready to spend money on training to ensure that skills are retained over the long haul. A genuinely sustainable beekeeping initiative will capitalise on available local resources, skills, and knowledge while also offering training and follow-up assistance for at least two years. Making choices on how to give training and provide follow-up assistance will be crucial. For example, a concept of lead beekeepers and followers works effectively for Bees for Development's programmes in Ethiopia. It has been found that more formal training provided by knowledgeable local beekeepers has been more successful elsewhere than the paradigm of master beekeepers who are expected to teach novice beekeepers the ropes. this has particularly worked well in Ghana. Finding the optimal model for each environment is crucial. this will rely on a number of regional elements, including as cultural norms, the social structure of village life, prevalent beekeeping skills, and transportation capabilities.

To evaluate the effects of direct costs, selling prices, indirect expenses, and volume, beekeepers require business acumen. According to a business study, raising the total annual revenue from an apiary may be accomplished by concentrating on volume rather than the more typical method of focusing on price per kilogramme. Beekeepers' business skills should be developed as part of projects. A plan for the modernisation of apiculture is also an excellent concept. Many governments establish plans for the modernization of agriculture. In the hope that this would naturally result in more honey, better honey, and higher productivity, there have been several interventions that mainly aim to modify the sorts of hives that beekeepers are utilising. Although it is anticipated that evolving technology would reduce poverty, there hasn't been any analysis of the impact these efforts have had. When the anticipated change has not happened, it is all too often attributed on inadequate training, the weather, or another factor, without consideration of whether trying to alter technology is indeed the best course of action. Projects centred on the supply of equipment are most lucrative for the corporations that make and transport the equipment, as well as consultants who educate others how to use it with bees in their own country or part of the globe.

Many African countries are successfully exporting superior honey and/or beeswax that satisfies the tightest standards for these goods to be marketed in the EU and other international markets. Every bit of this honey and beeswax is extracted from local hives, which are the pinnacle of easy, affordable, sustainable beekeeping. In Africa, frame hives like the Langstroth hive, which the Rev. Langstroth invented in 1852, are sometimes called to asmodern hives. However, it is their inexpensive, simple, accessible, and effective local-style hives that should be given this moniker. We now realise that the widespread practise of basic, natural beekeeping in straightforward, cylindrical beehives accounts for the continued presence of vast numbers of healthy honeybees throughout Africa. Logs, reeds, grass and clay are often utilised as building materials for beehives made in the region. The typical shape is a cylinder, which provides honeybees with a charming nesting area. The bees attach their combs to the cylinder's walls since it has no moving parts. These sorts of hives have been tried and proven over a long period of time, and since they are constructed from naturally occurring materials that are readily available nearby, even the poorest people may afford them and utilise them[4], [5].

Many individuals believe that commercialization necessitates a shift in technology, despite the fact that poor farmers are routinely urged to commercialize in order to enhance their wages. Simple neighbourhood hives are urged to be abandoned in favour of so-called modern hives. This sort of intervention is the consequence of poor situational analysis and is often the wrong course of action. A beekeeper may occasionally recover the cost of a frame hive within a few years, according to cost-benefit calculations, although these projections are seldom based on real-world field data. According to Svensson, beekeeping ventures that were created using subpar research and inaccurate forecasts failed. Even if a beekeeper, for instance, can repay after four years, they are still trapped into debt since they lacked the capital to invest in the first place. It would be challenging to manage the African bees in these [frame] hives, according to Wainwright, who described the producer-owned North Western Bee Products in Zambia in a study. The beekeeper would be burdened with debts that he would be unable to repay due to the high capital cost of the hives, which is the most crucial factor. On the other hand, giving out free hives is never sustainable.

The popularity of beekeeping programmes among funders and non-governmental organisations is well-founded. However, NGOs must create initiatives with observable and quantifiable outcomes due to the requirements and expectations of donor-funded projects. It is simple to create a budget for a certain number of hives, and after they are delivered, they can be tallied and photographed, aiding the NGO in demonstrating that the project was carried out according to plan. A new expertise or a new market relationship is far more difficult to identify and evaluate. In addition to raising project costs, investing in hives complicates neither the design nor the implementation of projects. Simple but pricey initiatives are appealing to implementing organisations that rely on a portion of the project's overall expenses for overhead. However, development initiatives often make the mistaken assumption that modern hives would enable individuals to profit more from beekeeping.

When it comes to product quality, honeybees in frame hives and those in local-style hives are equivalent since they are feeding on the same flora, in the same location, and producing the same things. The techniques used for harvesting and post-harvest processing are different. Some beekeepers harvest irresponsibly and sell low-quality goods to the market using hives made locally. A deeper look, however, reveals that the market in which they operate accepts the caliber of their goods, and beekeepers have no prior knowledge of various market requirements. Project assistance in this area is appropriate and helpful. The total yield from frame hives contains more honey and less beeswax than that from hives made locally because beeswax is recycled in frame hives. Beeswax, on the other hand, is a valuable commodity that is, in many respects, simpler to keep and sell than honey. Additionally, it is now in great demand on the global market. When there is a substantial profit to be made from the sale of beeswax and foundation is either costly or unavailable, recycling comb has no financial advantage.

Bees require wax comb, in response to a Ugandan beekeeper who remarked, I was advised to provide foundation for my bees because then they can spend more energy making honey and I can get more honey more quickly for selling. Furthermore, whereas frame hives allow combs to be examined and put back in the hive, tropical bees are sometimes fast to flee when handled. If I have to give foundation, I have to take money out of my wallet to purchase it. I would prefer the bees make it for themselves for free. Frame hives also allow for the replacement of combs after honey extraction using a centrifugal extractor, but they must be kept and shared centrally since they are costly and may only be used sometimes per year. This requires moving crates filled with frames to the processing facility on foot or by bicycle, which is a costly, time-consuming, and dirty operation.

Marshall & Trade

Make every effort to comprehend the local market structure before starting any interventions. When your project starts, provide a supportive atmosphere, pay attention to beekeepers, and track your progress by reviewing it. Achieving size and efficiency in beekeeping involves making it commercial. For a product to be profitable, real manufacturing costs must be calculated. Due to their lower production costs, local-style hives are more profitable than frame hives, and despite claims and assertions, there is no proof that frame-hive beekeepers in sub-Saharan Africa produce higher overall honey yields than beekeepers using a lot of local-style hives. Beekeepers will increase their investment in beekeeping if markets are open, lucrative, trustworthy, and fair. Poor market knowledge and connectivity, a lack of operating capital, a shortage of containers, low investment, and poor communication all contribute to supply chain issues, which are common in developing countries. Therefore, these issues should be the main emphasis of projects.Any beekeeper who adheres to basic, ethical principles may produce high-quality honey that is packed and labelled in accordance with retail standards. In order to enable product traceability, all projects should make an investment in teaching beekeepers and collection centre workers on the proper ways to harvest from any kind of hive, record-keeping, and post-harvest handling and storage.

The planet is home to wild bees, but very few human communities have been able to raise and care for bees to meet their requirements. Beekeeping for honey using local bees has been undertaken by mankind since the dawn of time. Modern beekeeping is a widespread practise that mostly uses the Afro-European honeybee, Apis mellifera. More than 20,000 species of bees are thought to exist in the globe, yet many regions are losing their natural bee habitats. Bees are now recognised for their pollination work as much as their honey. Only particular social bees with colonies and a queen, which will be discussed in this chapter, combine these two crucial tasks. Honeybees, bumblebees, and stingless honey-making bees are the three types of honey-making bees that reside in colonies. Approximately 100,000,000 years ago, they initially appeared. The majority of bees met today are of the roughly 1000 species of honey-producing bees that are still existing and flourishing on Earth. Naturally, they did not all develop at the same time or in the same locations, and this large and significant group's biology differs. Flowers must have nectar for bees to produce honey, and pollen must have protein for the brood. These plants also have unique distribution patterns, occurrence rates, and blooming times. We make an effort to give information about bees and allied plants as succinctly as we can in this area. Bee distribution is well recognised, as are many bee conservation and management challenges, and our knowledge of bee populations andfunctional groups is growing[6], [7].

Bees In Every Country

The ruins of the former supercontinent Gondwana, which formerly included South America, Africa, Antarctica, India, Australia, New Zealand, and Ara- bia, are where the first social bees initially emerged. Bee colonies have spread across incredible distances in their honey-filled nests on floating island mats, on solitary trees, through rivers, and across seas. They were alive throughout the period of the dinosaurs and experienced mass extinctions. About 65 million years ago, towards the very end of the dinosaur era, a large asteroid collided with

Earth near the Yucatán Peninsula in what is now the Gulf of Mexico. Another was close to India. Even while we still don't fully understand all of the changes it brought about; we do know that 70% of all speciesundoubtedly including beeswere wiped off. The following are some of the most significant generalisations we can make regarding honey-making bees in the modern era:

1. Most of them are tropical.
2. Honeybees form flying reproductive swarms and are often migratory.
3. Swarms of stingless bees that immediately enter a new nest proliferate.
4. Stingless bees have the greatest number of species, the widest geographic spread, and the oldest origin.
5. Despite being important pollinators, bumblebee colonies typically only retain a little amount of honey and have a one-year lifespan. The distribution of bees across the globe varies noticeably.

One species of honeybee predominates in terms of geographic distribution, and it lives in Australia, the Americas, and the Western Old World. Three to five local honeybee species may often be seen coexisting throughout Asia. The most species-diverse bees are stingless. fewer species are found in Africa than Asia, which has fewer than tropical America. The variety of the bee fauna is fairly equivalent to the botanical richness of different regions, therefore these discrepancies cannot be attributed to disparities in land area or continental size. With the exception of the Andes, where Bombus just made its way there around 8 million years ago, the mountains of Asia, the north temperate zone, and the Americas are home to the most species of bumblebees. Natural vegetation and plant biodiversity are often diminished in places that are either agriculturally or intensively inhabited. There are thus fewer bee species. By protecting natural habitats, restricting the use of pesticides, and reducing pollution, bee numbers may be kept under check in these places. Regional biodiversity varies tremendously. Notably, individual species are more intensively exploited by pronounced dry seasons than by continuous, prolonged blooming times in less seasonal conditions.

There are 100 species of bees in an 8 km2 patch of rainforest in the Neotropical Bee Diversity Hotspot in Amazonian Ecuador. There are around 3000 tree, 600 liana, and 500 plant species. The Old-World African honeybee has just lately reached there, and it is still uncommon. The Panamanian lowlands, in comparison, have a wide range of plant and bee diversity and rainfall. Along the protected Panama Canal watershed, they support roughly 2000 species of woody plants and 200 species of herbs. In lowland Pacific forests and the more humid Caribbean lowlands, the variety of honey-producing bees is around half that in those areas. A mere 76 km long and home to 32 species in the centre of the Panama Isthmus, 22 in the Pacific, 46 throughout the Caribbean, and a total of around 56 species of honey-making bees. Higher latitudes and altitudes have fewer social bee species, but areas with significantly different terrain and elevation, like Costa Rica, have more species per unit area at a particular latitudinal range.

All beekeepers rely on blooming plants, and these species are often more abundant in open, disturbed settings. In areas with greater sunlight, such as regenerating forests, natural grasslands, or steppes, there will be more flowers and nectar to be found. In certain instances, fire is essential to establishing an open, fruitful environment for blooming plants. As a result, changed but undamaged habitats are often preferred for preserving social bee colonies. There, a variety of honey-producing bee species or genera, including those introduced from other continents, may flourish. The undetected expansion of non-native bees, especially honeybees and bumblebees imported to assist agricultural production of seed or fruit crops, has been a source of worry. Concern regarding the alleged spillover of diseases or disease-transmitting organisms like parasites among native and alien species is understandable. There is no evidence that native bee diseases or parasites are spread to or introduced into non-native bees. on the contrary, the opposite has been shown. Only bees that produce stingless honey seem to be virtually disease-free and are unable to transmit illness in temperate regions[8], [9].In conclusion, honey production in wilderness close to certain disturbed but managed regions may be higher than expected for large, untamed wildlands. The fauna, including bees and the blooming plants they rely on, has not yet reached an equilibrium or stable condition, which is one of the causes. It's possible that native species don't need or use all of the floral resources. Bees can adjust to satisfy any restrictions on bee populations or the number of species that may coexist amid flowering plants.

There are several varieties of flowers that are particularly alluring to bees in tropical and temperate farmland areas. However, we lack the knowledge to estimate the number of plants and pollinators that would be needed, either in the short or long term. For example, a simple multiplication of floral resources by open flowers cannot even approximate the number of bees or other pollinators that can be maintained or replenished. Whether or whether they are native, bees may multiply due to their diverse nature. When they have sufficient nesting locations, little to no pesticide intervention, little to no threat from natural enemies, or are properly managed and cared for by humans, this occurs.Currently, disposable pollination units include Apis, Bombus, Megachile, Osmia, and a few others, largely in the temperate zone, on much smaller sizes. Since the solitary bees have insufficient food to live when their applied pollination activity is through, beekeepers are sometimes obliged to employ and then destroy these colonies or nests of solitary bees. Honeybees are an exception. they are relocated after pollinating a large area. In contrast, long-lived apis or meliponine colonies may flourish in the tropics provided they are sheltered, close to enough greenery, and devoid of pesticides and the other stressors described.

CONCLUSION

In conclusion, beekeeping is a significant factor in promoting economic growth, eradicating poverty, and ensuring food and nutrition security. It is a multidimensional project that covers a range of topics, including sustainable practises, genetics, education, and extension services in addition to the management of social bee species. Sustainable beekeeping requires a comprehensive strategy that takes into account every link in the beekeeping value chain.External elements like the environment and biodiversity have a big influence on beekeeping since they have an effect on how foragers behave, how readily available floral supplies are, and how healthy bee populations are as a whole. Maintaining a healthy floral resource base is thus crucial, as is ensuring the preservation of regional genetic diversity and indigenous bee species. The productivity, well-being, and sustainability of beekeeping operations are all significantly influenced by bee genetics. Long-term success depends on choosing and developing bees that are suitable to the particular environmental circumstances in the area.In conclusion, beekeeping has the ability to positively impact local economies and social structures all around the globe. But it need an all-encompassing strategy that considers the environment, genetics, practises, education, and market forces. Beekeeping may continue to significantly contribute to food security, poverty reduction, and economic development by embracing sustainability and adjusting to local circumstances.

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CHAPTER 3

EXPLORING THE DIVERSITY AND CONSERVATION OF BEE COLONIES

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ABSTRACT:

The variety, distribution, and conservation of honey-making bees are briefly discussed in this abstract, with an emphasis on several species and their distinctive traits. It opens by emphasising the presence of large bee colonies, many of which have never been handled, as well as the strong need for these bees because of their function in pollination services.The abstract analyses the regional differences in the variety of honey-making bees and offers an ecological hierarchy as the main justification for patterns of distribution and abundance. Additionally, it notes exceptions in remote areas such marine islands and areas with natural obstacles.The categorization of honey-producing bees is discussed, with a focus on the subfamily Apinae, which contains, among other things, meliponines, bumblebees, and honeybees. The abstract explores the production of honey in temperate places, the dominance of Apis mellifera, the Western honeybee, and the historical human dispersal of this species.The issues encountered by honeybees, such as habitat degradation, chemical products, climate change, and pandemic limitations, are briefly mentioned in the abstract. Additionally, it draws attention to other non-tropical honey-producing bees that may be found in places like Australia, Laos, northern India, and Nepal.With an emphasis on their prevalence at high elevations, the abstract also examines the distribution of stingless bees in a number of areas, including the Neotropical area, Indo-Malaysian/Australasian area, and Africa.The significance of genetic variety for honeybee adaptability is emphasised, as well as the need of protecting genetic resources to maintain the species' resistance to future threats. The approaches of ex situ in vivo conservation and cryo conservation are described as means of preserving honeybee genetic variation.

KEYWORDS:

Bee,Colonies, Distribution, Honey, Honey-Producing.

INTRODUCTION

There are many different bee colonies that may be used or exploited locally, yet the majority have never been handled. There are ten kinds of honey-making bees in many natural regions, between 20 and 50 in others, and between 50 and 100 in a few. Because they are movable pollination units, these bees are also among those that are most in demand for pollination services. Insects that visit flowers reflect the variety of their floral resources, as has previously been established, and honey-making bee diversity varies geographically. The best explanation for distribution and abundance patterns seems to be an ecological hierarchy in which one Apis replaces many stingless bees, which in turn replace several other bee species. The exceptions to this rule include isolated locations, including oceanic islands or regions bounded by other obstacles. Each group of these bees also has a genus name that is a component of a tribe and belongs to a subfamily. The majority of these bees also have a local and scientific name. The subfamily Apinae of the bee family Apidae contains all honey-producing bees. Honeybees belong to the genus Apis, bumblebees to the genus Bombus, and meliponines to one of numerous genera.

In temperate regions, only a small number of bees produce substantial quantities of honey. This implies that there are more individuals per species when fewer species are present. Apis mellifera, the Western honeybee, is mostly an African species. Its subspecies have recently migrated from Africa into the temperate zone, making it the bee that is maintained the most extensively on Earth. The species was spread by humans, and it flourished in the Americas and certain regions of Australia. The environment will once again change because to habitat modification, chemical products in the air, water, and land. climate change. and, most recently, pandemic limits and circumstances. A stingless bee in Australia, a honeybee in Laos, northern India, and Nepal, as well as the majority of bumblebees, are the only true non-tropical honey-producing bees in addition to Apis mellifera. In the American tropics, a few Bombus inhabit lowlands. According to the number of bee species that coexist in each region, there are ten in Africa and between 20 and 100 in the lowlands of tropical America. There are thought to be 5 to 30 species in other places, such as on smaller islands or locations separated by steep mountains or the sea[1], [2].

In the Neotropical area, stingless bees may be found from 34.90°S in Uruguay to 27.03°N in Mexico. They may be found in the Indo-Malaysian/Australasian area from 36.41°S in Australia up to 24.23 °N in Taiwan, whereas in Africa they can be found from 28.54°S in South Africa to 18.00°N in Sierra Leone. However, Dehra Dun, Uttar Pradesh in India has the northernmost records for stingless bees, and there are numerous additional Indian records over 28°N. The majority of the Indian subcontinent is home to stingless bees, at least up to 1000 m above sea level in India and Nepal. They are uncommon over 2500 metres above sea level in South America and Asia, however remarkably, they have been found as high as 4000 metres above sea level in the Andes of Peru and Bolivia.Only a limited amount of information exists about the exact distribution of stingless bees in India. The fact that a gregarious insect with a poor tolerance for cold weather spends significant amounts of time in such northern latitudes, where it is often below freezing, should spur further behavioural and physiological research in northern India.

Bumblebees

Some species of bumblebees are common in areas of the globe with dense populations, and they are generally well recognised. They are huge and often have vibrant colours. The majority of bumble bee species belong to the genus Bombus in the family Apidae, however some also belong to the subgenus Psithyrus. Globally, there are around 250 species, with northern temperate zones having the most variety. Most of Europe, North America, and Asia are home to bumblebees. Although they are uncommon in hotter regions like the Mediterranean, some do live in the lowland tropics of Southeast Asia, Central America, and South America. These mostly northern creatures have been able to cross the equator because to the mountain ranges that nearly continually extend from North to South America. The Andes, which stretch from Venezuela to Chile, contain a moderate amount of biological variety. They are often exclusively found at elevations between around 1 000 m and 5 600 m in the Himalayas and the tropics. Mountains east of Tibet and those in Central Asia have the highest levels of species diversity. In flower-rich meadows in the higher woodland and subalpine zones of Europe, species diversity tends to be at its highest.

Because of how much more basic their social structure is compared to honeybees, bumblebees are thought to be primitively eusocial. Without assistance from a worker caste, their queen establishes a colony and forages on her own. In a similar vein, the majority of bumblebee species have an annual cycle, unlike stingless bees and honeybees. However, certain tropical bumblebee species start new colonies by swarming, much as honeybees do. One queen often reigns over colonies. Similar to stingless bees, they practise cooperative brood raising, with sterile workers caring for the brood, maintaining the nest, defending it, and foraging. Despite not producing enough honey for people to commercially gather, bumblebees are crucial for pollinating crops. Around the globe, at least five species are now raised commercially in artificial environments for use in plastic tunnels and greenhouses. In Mexico and South America, two other species are raised on a semi-commercial basis[3], [4].

Honeybees

Although honeybees are native to Eurasia and Africa, humans have spread them to all four continents. They are renowned for building wax-based, perpetual colony nests, for the size of their colonies, and for the excess honey they produce and store. At the Eocene-Oligocene border, the first Apis bees are first recorded in the fossil record. There are presently 12 recognised species and several subspecies of honeybee. The Western honeybee, which is raised for honey production and agricultural pollination, is the most well-known kind of honeybee. A. laboriosa honey gathering is a widespread practise in the Nepalese Himalayas, however the only other honeybee handled is the Eastern honeybee, which is located throughout Asia. Contrary to widespread belief that the species is in danger of extinction, the number of honeybee hives is decreasing in certain regions of the globe while rising overall.

DISCUSSION

Even though the honeybee has roughly 30 subspecies and a wide range, only a small portion of this variety is used in contemporary beekeeping. The distribution of the species and often also the genetic make-up of honeybee populations within its native range have undergone major modifications as a result of the need for excellent economic performance from bee colonies and desirable behavioural characteristics. Breeding efforts have centred on features with high economic value, often employing inter-subspecies crosses and mass reproduction from small stocks, which has resulted in hybridization or even replacement of the native honeybee population in many locations.Additionally, A. mellifera was introduced into the native allopatric range of other species of honeybees in Asia, leading to resource rivalry and disease exchange. The ectoparasitic mite Varroa destructor's host switch from the Asian A. cerana to A. mellifera is the most notable example of pathogen exchange, which led to the parasite's almost universal expansion and severe consequences for beekeeping across the globe. Local adaptation is now widely recognised as a crucial element determining the survival and productivity of honeybee colonies, nevertheless, given honeybee health and colony losses in recent decades.Native honeybee populations are probably well adapted to the current environmental circumstances, such as the climate and vegetation, pests and diseases, in locations where they are still largely unaltered. The honeybee is not native to much of its present range, however. Moreover, the original indigenous population has been hybridised or supplanted in numerous areas, particularly in large portions of Central and Northern Europe. In these areas, honey-bee strains that have been raised and bred in one place for a number of generations might be regarded as regionally adapted.

Genetic Variation

Protecting the honeybee species' capacity for adaptation entails safeguarding its genetic resources. It is preferable to preserve a range of populations across the globe that are suited to varied settings in order to deal with future challenges that may occur from causes like climate change and new infections, as well as changes in market requirements. These populations may act as a gene pool, including genes that could be useful in the future. High genetic variety makes honeybees more hardy, and preserving honeybee genetic resources is crucial to sustained growth. Additionally, when undesirable alleles are progressively eliminated from the population by selection in honeybee breeding programmes, the genetic diversity of the breeding population may gradually decline. In certain instances, rigorous selection might result in the depressive consequences of inbreeding. Due to complementary sex determination, honeybees are more susceptible to inbreeding than other animals. In certain circumstances, it is advantageous to add more genetic variety to the current breeding population in order to mitigate these impacts. Maintaining source populations with significant genetic variety in this manner is essential. Tropical to temperate climates are among the many habitats where honeybees may be found. Chapter 4 has further details. Keep in mind that further studies on honeybee genetic diversity are required in certain areas, and that new sources may be found in the future[2], [5].

Discovery

Honeybee species and sub-species were first described scientifically in the 1800s. Early accounts, however, often lacked objectivity and scientific rigour. For instance, until the middle of the 20th century, A. cerana's species status was up for discussion, and it wasn't until 1983 that experimental evidence of the two species' reproductive isolation from one another was published. Similar to this, the Russian Ural Mountains were thought to be the eastern limit of A. mellifera for many years. Only recently were indigenous A. mellifera subspecies found in Central Asia, expanding the species' range by thousands of km. Our understanding of the distribution and subspecies diversity of A. mellifera still has several limitations. However, the danger that many species and sub-species may become extinct before they are identified is alarmingly real given the constant increase in honeybee trade and movement caused by economic need.

The earliest articles on variation based on morphometric measurements of a few body sections were published in the 1920s, marking the beginning of the characterization and description of honeybee variety. Later, morphometrics was developed utilising an expanded range of morphological features and improved statistical analytic tools, and starting in the 1960s, it was the accepted technique for analysing geographic variation and diversity in honeybee populations. In 1988, a thorough monograph describing the overall pattern of honeybee biodiversity was released. The development of molecular tools and their application to the study of honeybee biodiversity have advanced significantly during the 1990s. In the near future, diagnostic technologies based on single nucleotide polymorphism analysis will make it possible to accurately divide unidentified honeybee material into subspecies from a single study. Notably, behavioural categorization of honeybee populations and subspecies is becoming more and more important. Examples include seasonal brood cycles, swarming behaviour, nest defence, and mating conduct.

Honey production, inclination to swarm, and docility are just a few of the commercially significant features that commercial honeybees are expected to excel at. These qualities have long been improved continuously by selective breeding in various parts of the globe. In recent years, breeding projects throughout the globe have begun to place more emphasis on and include features relevant to colony health, such as enhanced resistance to parasites or illnesses.The utilisation of commercially generated genetic material, international commerce in queens, and migratory beekeeping are examples of modern beekeeping techniques that contribute to the introgression and hybridization of native honeybee populations. Large-scale occurrences of this, especially when the native population is tiny, may result in the loss of certain adaptations to the environment or possibly put the whole population in risk. Many places have established conservation zones to safeguard indigenous populations against the introduction of alien genetic material. indigenous beekeepers often took the initiative to establish these areas. These areas typically consist of a protected zone where only colonies with the genetic origins under protection may be kept and where commercial or migratory beekeeping activities using commercial or imported stock are prohibited. One example of a successful conservation project that was started by beekeepers and subsequently formally taken up by government officials is the preservation of the almost extinct indigenous honeybee of Sicily, A. m. sicil-iana.

In a few instances, whole nations made the decision to enact laws governing the importation and exchange of honeybee genetic material in order to save their indigenous bee populations. For instance, because AM Carnica is the original language in Slovenia and Croatia, it is prohibited to import anything other. The Danish island of Laes is another well-known example of a conservation area. Here, a tiny remnant population of pure native A. mellifera persists and is guarded from hybridization by neighbouring invasive A. m. ligustica and Buckfast stock.The preservation of honeybee populations in the areas of their native range is referred to as in situ conservation. Establishing protected spaces is one popular method of honeybee in-situ conservation. In addition to protecting plants that provide pollen and nectar, which are essential for colony survival, designated protected areas also stop non-local populations from hybridizing with local populations via a process known as reproductive isolation. If physical separation is not feasible, then geographic distance may be the cause of the isolation. It is advised to keep non-local people out of a 6-7 km radius around the population that is being protected.

Beekeepers may contribute to the genetic improvement of local populations, or conservation by utilisation, to the protection of local honeybees in addition to protected regions. Implementing local population-based breeding initiatives may enhance their performance, giving them a better option for local beekeepers who would otherwise import queens from other sources, particularly from highly chosen stock. Due to competition and possible genetic stock hybridization, local populations may get affected. Therefore, sustainable conservation is made possible by beekeepers' ongoing usage of local honeybees. The genetic diversity and integrity of local populations should be carefully observed while they are being maintained. Monitoring using morphometrical and genetic techniques may provide crucial information about the population's present condition and serve as the foundation for choosing what has to be done if the population is in danger[1], [6].

Ex situ in vivo conservation is the preservation of living honeybees outside of their natural habitats, which often vary from their native habitats. Ex situ in vivo conservation may support in situ conservation even though it is often the favoured option. It is particularly beneficial for endangered honeybee populations since they have relatively tiny populations and a significant risk of losing genetic variety owing to viral illnesses, natural catastrophes, or genetic drift. In such cases, populations from ex situ in vivo conservation may bring back the original population. Ex situ in vivo conservation may be expensive for population maintenance; hence its effective implementation needs long-term financial assistance.Another method of ex situ conservation is cryo-conservation, which includes storing genetic material in cryo-banks after being frozen. Although cryo-conservation needs specialised methods and facilities, if they are in place, maintenance costs for the preservation materials are minimal. Cyro-conservation may protect genetic diversity from infectious illnesses and environmental calamities, similar to ex situ in vivo conservation. Genetic resources may be gathered and stored for many generations, allowing for the reuse of resources from earlier generations that are no longer alive. The retention of these alleles may increase genetic diversity in the future.

Older generations may possess alleles that, as a result of genetic drift, are not present in the current population. Research may follow changes in a population's genetic makeup by cryopreservation of materials from previous generations, providing insight into the population's trend and guiding future action. Since semen is utilised in honeybee cryoconservation, live queens, which may originate from populations under other modes of conservation, are needed for population reconstitution following cryoconservation. Therefore, it is advised to combine cryoconservation with in situ or ex situ in vivo conservation given present technology. Only a few cryobanks are now operational in the developing area of honeybee cryoconservation. Recently, techniques for successfully cryopreserving honeybee semen have been developed and verified, and initiatives to create medium- to long-term storage of honeybee semen for the preservation of priceless or endangered genetic material are now underway. Cryopreservation of honeybee embryos is another topic of research, however there isn't currently a proven technique accessible. In addition to sperm banks, there are several scientific collections made up of honeybee samples and data, the majority of which are managed by research institutes. While China has the biggest gene bank dedicated to the preservation of honeybees and pollinators, neither Europe nor the United States have national collections.

Beekeeping techniques

A simple, locally constructed hive in which the bees connect their combs to the ceiling is known as a local-style hive or a native hive. Because they have been used for a long time, they are also sometimes referred to as traditional hives. Since the bees kept in these hives are healthy and live normally, they have the potential to serve as the foundation for big, thriving, and genetically robust bee populations. A beekeeper that uses this kind of hive could have several hundred of them since they are inexpensive. These hives are a good option for many settings, particularly in rural regions, since they are very sustainable and environmentally and economically viable.Beekeeping is believed to have started in the earliest ancient civilizations that existed in regions with a plentiful supply of nectareous plants and honeybees. These areas with abundant vegetation supported human populations, giving rise to agriculture. One of these was the Fertile Crescent, which is an area in the Middle East that bends in a crescent form from the Persian Gulf to contemporary southern Iraq, Syria, Lebanon, Jordan, Israel, and northern Egypt. It is also referred to as the cradle of civilization and is located in the region now occupied by Israel. The ancient civilizations of Mesopotamia, Egypt, and the Levant, which comprised the Sumerians, Babylonians, Assyrians, Egyptians, and Phoenicians, are known for their significant contributions to global culture.

The lush valleys of the four major rivers in the area, where the earliest agricultural civilizations emerged, are included in the lush Crescent, which has played an important role in human history from the Neolithic Age through the Bronze and Iron Ages.Buildings for storing food were necessary when certain human populations gave up their nomadic hunter-gatherer lifestyles and moved permanently to become farmers. This allowed them to have access to seasonal foods all year round. Because social bees like to build their nests in cavities, beekeeping may have started by accident. Humans have created several tools throughout history, with containers being one of the most significant. But because we were nomads and lacked pack animals and carriages, these containers had to be compact, light, and most likely transient. As a result of settling, it was possible to create containers with a higher capacity composed of more durable, sturdy materials. Some of these containers were the ideal size for Western honeybees to establish new colonies and construct their homes in. Many academics think that bees intentionally entered some of these vessels. The significant environmental influence that agriculture may have had on the area might also help to explain why they chose to nest here.

A crucial coincidence for the development of beekeeping was the production of containers with capacities of 30 to 50 litres, a size close to that favoured by bees. Humans may then create specially designed containers for the swarms after seeing bees using these containers as nests. The types of hives used to house bees evolved as beekeeping moved to new regions based on the availability of local resources and the location. Swarm traps and the method of swarm collecting were first used in beekeeping. Swarm trapping is the practise of luring bees to strategically placed traps when they are in the colony-level reproductive period and looking for a new nest site. Because it might be difficult to get rid of them, bees are caught before they locate a place to nest.

There are several books that trace the development of beekeeping from its beginnings to the present, but Eva Crane's The global history of beekeeping and honey hunting is particularly interesting to read[7], [8].The phrase traditional hives is often used to describe certain hives that are prevalent in particular areas or in communities that are frequently connected to emerging regions. It has been mistakenly assumed that this makes it unusable in the current world. Thus, the phrase should be changed tolocal-style hives to indicate hives constructed from materials that are readily accessible locally. Local-style hives may be divided into two major categories:

1. Vertical hives that have fixed combs. The bees freely construct combs and fasten them to the hive's roof. Normally, the bees are tended to from below.
2. Horizontal hives with fixed combs set in overlapping rows. The bees freely construct combs and fasten them to the hive's roof. Typically, both sides can control the bees.

Since then, the Mediterranean region has seen a widespread adoption of horizontal hives from the Fertile Crescent. The most typical style of hive used in traditional beekeeping today is still horizontal, and it may be found in many different designs and construction materials across Africa, the Middle East, and certain nations in southern Europe. These divisions are obviously not rigidly defined. For instance, Sicilian beekeepers built their natural hives out of enormous fennel hives, which they still sometimes use today. They may split the mother log hive in half or disassemble a log hive comb by comb.Hives managed locally differ from those with moveable frames in terms of management. a believe that they need more expertise in beekeeping methods, however with a basic skill training, they are simple to utilise. Only locally available natural materials are used for construction, which makes them more affordable and accessible in big quantities while making up for their lower honey production. The next subsections provide a more thorough explanation and examples of various local-style hives used across the globe.

With the likely assistance of the Phoenicians, beekeeping extended from Asia Minor to the Aegean area, eventually across Greece, through Magna Graecia, and along the Mediterranean, from Malta to Spain.

Depending on the temperature and the availability of local resources, various regions of Europe employed log hives constructed of terracotta, stone, wood, cork, straw, and other materials, frequently treated with clay mud, lime, or dung to weatherproof them and boost their thermal insulation. Our understanding of beekeeping and honeybees is greatly owed to the ancient Roman civilization, which later expanded across the Mediterranean region. Most scientific and technological advancements occurred after the seventeenth century[9], [10].Even though there are relatively few archaeological remains and very few photos of Roman hives, we may infer from accounts that the majority of them were horizontal. To make sure that the bees had enough food for survival, only the honey-filled combs from horizontal and vertical hives were removed. With the spread of apicide after the collapse of the Roman Empire, beekeeping saw a decrease. This is a part of traditional beekeeping that is sometimes neglected. Bees are taken out of their hives at this time to harvest honey and wax.

CONCLUSION

In conclusion, the world of bee colonies is a complex and diversified one, with numerous species and subspecies dispersed over various geographic areas. In addition to being intriguing, this variety is crucial for maintaining the ecological balance and increasing agricultural output. Bees, especially honey-producing bees, are very significant to ecosystems and the production of food for humans because they provide essential pollination services.Geographical variations in the quantity and distribution of honey-producing bees are caused by biological causes, habitat changes, climate change, and human activities. While honeybees, in especially Apis mellifera, have expanded over the world as a result of human influence, other honey-producing bee species, such as stingless bees in Australia and several bumblebee species in temperate zones, remain limited to those areas. The health and sustainability of bee populations over the long run depend on our capacity to comprehend and protect this variety.

In conclusion, the world of bee colonies is diverse and important from an ecological standpoint. Understanding, protecting, and ethically managing this variety is crucial for keeping ecological balance, healthy bee populations, and pollination services for agriculture. Traditional and contemporary beekeeping techniques continue to be essential to accomplishing these objectives while adjusting to the changing economic and environmental conditions.

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CHAPTER 4

EVOLUTION OF BEEHIVES: FROM LOCAL-STYLE VARIETIES TO MODERN MOVABLE-FRAME HIVES

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ABSTRACT:

The development of beekeeping and hive designs in many parts of the globe offers insightful information on the long history and variety of beekeeping practises. The numerous hive kinds that evolved throughout time and were popular in Europe, Africa, Latin America, the Middle East, Oceania, and Asia are highlighted in this abstract.Over time, the usage of hives in Europe saw modifications in design and materials, as well as labelling and use. Large tree trunks were difficult to reach in certain regions, thus mud- or dung-covered basket hives became common. Vertical wooden hives sometimes evolved from horizontal ones for practical reasons. Horizontal hives are still common in the Alps and in southern Italy. However, since they are so easily industrialized and standardized, movable-frame hives have already essentially supplanted regionally specific hives across Europe.Africa has a long history of beekeeping, with many cultures depending on honey for nutrition via honey hunting and subsequently through the construction of hives. Based on the resources available, several communities constructed distinctive local-style hives.Over 90% of the honey exported from Africa in recent years has come from conventional hives. The size of these hives varies, however, depending on the material or kind of tree trunk employed.Additionally included in the abstract are other types of movable-frame hives, including as top-bar hives, vertical modular hives, and horizontal hives. These hive types provide versatility in colony management and honey output to accommodate various beekeeping demands and tastes.

KEYWORDS:

Beekeeping,Beehives, Development, Growth, Honey.

INTRODUCTION

The several varieties of hives that gained popularity across Europe in the years after the collapse of the Western Roman Empire did not alter in design or material, but they were often utilised and labelled differently. In lowland locations where it was difficult to acquire large enough trunks, basket hives covered in mud or dung became widespread. For practical reasons, horizontal wooden hives often became vertical at this location. Only southern Italy and the Alps have a long history of using horizontal hives. Since then, movable-frame hives have mostly replaced local-style hives throughout Europe. These hives are simpler to industrialize, standardize, and get better performance from.Numerous rock drawings show that beekeeping has been performed for ages in numerous nations, and Africa has been the home of bee species for thousands of years. Many African tribes consumed honey throughout the early stages of civilization, which they would get via honey hunting. Communities began building hives for the purpose of maintaining bees as tools and equipment for an easier living developed. There are many distinct local-style hives because various kinds of hives have been utilised for many generations depending on the resources available to the different communities.

Africa has experienced a sharp growth in honey exports to the European market and other regions that appreciate the distinctiveness of African honey as the demand for natural honey rises on the global market. Over 90% of the honey exported from Africa is taken from traditional hives that have been in use for many years. These hives enable Africa to generate a significant amount of beeswax, which is then sold to several nations across the world. Due to a variety of reasons, local-style hives in many African communities do not adhere to criteria, resulting in different-sized hives. The kind of tree trunk, bark, or substance that is accessible is one of these criteria. A log hive, for instance, might be anywhere between 50 cm and 1.5 m long. Additionally, their diameter may range from 25 cm to 50 cm[1], [2].Depending on the woods in the distinct communities or countries, these hives are constructed from logs of various trees. Some groups chop down trees and chisel the trunk to create the hollow, while others use dead wood with a hollow in the centre owing to the kind of tree used. A prepared wood is sealed at both ends with curved pieces of skillfully woven cloth, leaving an opening for the bees to enter and exit. For security reasons, log hives are often positioned high in the trees, frequently at a height of 3 meters or more.

This is a hive created from a particular kind of tree's bark. The form of the bark is preserved throughout harvest. Curved wood, braided grass, or tiny tree twigs are used to close the hive's ends. The Miombo tree is the most often used for bark hives, particularly in Southern and East Africa. Bark hives are often positioned in trees at a typical height of 3 m above the ground, similar to log hives. These hives are constructed from braided reeds, grass, bamboo, and twigs. for added durability, the hives are sometimes cemented with cow dung or clay soil. The two ends are sealed by a curved piece of wood, woven grass, or twigs. They have the same form as a log or bark hive. Some resemble baskets. Many African societies were skilled potters who produced a variety of implements out of clay. Sometimes hives were made from of broken or useless pots that had formerly held water. There would be some purpose-built clay hives. A common fruit from the pumpkin family known as a gourd is used to store water and tiny grains. Communities could utilise some of them as beehives.With the advent of European immigrants, who brought honeybees with hives manufactured in their own countries, the breeding of Apis mellifera in Latin America started. There are nolocal-style hives for rearing Apis mellifera in Latin America since in certain areas, hives were fashioned from clay, ceramics, or stranded reeds because there was an availability of other materials. However, these hives always followed the measurements and patterns of European nations. Stingless bees of the genera Trigona and Melipona are the native bees of Latin America. We may notice several hive forms for these bees, not only by geography but also by species. They keep food in various methods and come in various forms, sizes, and materials.

The tube hives controlled in overlapping rows utilised in Ancient Egypt 4500 years ago are still in use in the Middle East. A. Depending on the regionally accessible materials, cerana local-style hives vary widely, much like A. melissifera, A. Cerana has a wide range of climatic conditions and inhabits a wide area, from tropical to temperate zones. The log hive is one of the most popular varieties. To keep them off the ground, hives are often stacked on top of supporting items. They are positioned on roofs or attached to walls in certain areas. Communities in Southeast Asia still engage in A wild harvesting. cerana. Beehives come in a variety of shapes and sizes, from basic mud, bamboo, and grass hives to hollowed-out logs, detachable frames, and top-bar hives.The introduction of honeybees and beekeeping were only two examples of how European immigrants' entrance dramatically changed Oceania's social, environmental, political, and agricultural landscape. Oceania is home to a wide variety of native bee species, however no native honeybees exist east of the Wallace Line, which runs along the western border of Sulawesi and Lombok in Indonesia. Due to the lack of a historical social and cultural tradition of beekeeping with honeybees in this area, beekeeping for development projects must take this into account. This has an impact on the region's prevailing indigenous technical knowledge, social perceptions, roles, and acceptance of beekeeping, bee collection and management, bee hive construction, and practises and uses related to the use of bee products. Apis mellifera colonies have been introduced into Oceania throughout the last two centuries in skep hives at various times in time, with variable degrees of uptake and success[3], [4]. A. mellifera was successfully introduced for the first time into Launceston, Tasmania in Australia in 1831. Later, in 1839, it was successfully brought into Mangungu Mission Station in Hokianga, New Zealand. Before Langstroth hives were adopted, another 50 years or so passed.

DISCUSSION

The variety of hive designs seen throughout the globe demonstrates how crucial it is to take local factors and customs into account when creating beekeeping programmes. For many communities to produce honey, beeswax, and other bee products sustainably, local-style hives have proved essential. The size and materials used to build these hives often vary, reflecting the distinctive qualities of each locale.Beekeeping was significantly impacted by the introduction of European honeybees and movable-frame hives in many regions of the globe, including Latin America, Oceania, and Asia. These hives made bee management more effective, improved honey extraction, and improved colony health. However, since they needed early investments and modifications to local practises, their acceptance wasn't without difficulties.The invention of movable-frame hives, notably the Langstroth hive, revolutionised beekeeping by enabling improved honey output and enabling beekeepers to check hives without endangering the bees. This invention widened the market for honey and laid the path for contemporary beekeeping techniques.

Honeybees were first imported to Australia and New Zealand from England, which is the home of European or British black bees. In 1862, the Ligurian Bee, another name for the Italian honeybee, was brought to Australia. It has shown adaptable to most climes, from subtropical to chilly temperatures, and is perhaps the subspecies that is maintained the most often over the globe. Later on, more subspecies were introduced, including as Carniolan and Caucasian honeybees. Since European honeybees were imported to Australia, escaping colonies have often mated with wild bees, resulting in hybrids, making it difficult to discover many subspecies in their pure form.After 1840, and in many nations only after 1950, apis mellifera was introduced to additional Pacific Island Countries and Territories. The sorts of hive technologies used in the introductions of Apis mellifera across Oceania are poorly documented. nevertheless, dates earlier than 1880 are unlikely to have been in Langstroth hives. Most PICTs use A. mellifera was brought to the United States via bilateral assistance initiatives from Australia and/or New Zealand. Hive technologies in Oceania's developing countries should concentrate on fostering local economies while using local resources and expertise to design and construct beehives that are appropriate for the area's particular social and environmental conditions.

The purpose of this section was to provide a broad picture of how regionally specific hives evolved around the globe. Considering the local-style hives should always be a consideration for policymakers and project managers, based on the environmental, economic, social, and cultural setting. They may serve as the foundation for large, wholesome, and genetically robust bee populations and are environmentally sustainable. In every situation, it is preferable to employ environmentally friendly technologies, regionally adapted honeybee species, and renewable natural construction materials for hives. For beekeeping programmes in rural development regions, local hives and bees are essential, and decision-making should constantly be influenced by the setting in which the project will take shape. This includes knowledge about local technical expertise, societal perspectives, beekeeping roles and acceptability, prices of hives and their potential production, and the usage of bee products as food and medicine, as well as their other potential markets.

The evolution of beekeeping through time from local-style hives led to the development of mobile-frame hives. In essence, beekeepers can see what is occurring within moving-frame hives by just opening them. As a result, they can administer treatments more readily and avoid harming honeycombs without the need for an apicide. Additionally, it enables them to multiply colonies. All of this leads to an improvement in the quantity and quality of honey. They may also make it possible to use various beekeeping methods and provide pollination services.In addition to offering bee colonies a comfortable place to live, mobile-frame hives also make it easier to produce and collect bee products. A colony may be fixed in situ by a beekeeper, sheltering it from bad weather or predators, enabling closer health monitoring, and enabling simple storage and bee product harvesting. However, movable-frame beekeeping requires initial funding and materials that aren't often accessible in remote regions. You should first confirm that beekeepers can independently access the materials required for more technologically sophisticated beekeeping and that rural people are receptive to new beekeeping techniques before choosing mobile-frame hives.

Hives that depended on this method were the most common in Europe throughout the Middle Ages, and the honey and wax business in this area was at a full loss since it requires suppressing or chasing away all the bees to extract honey and wax. Many researchers in the fifteenth and sixteenth centuries who were reading Latin writings on bees and beekeeping came to the conclusion that ancient beekeeping was far more lucrative and that bees were never slaughtered to get their priceless goods[5], [6].Greek hives, according to George Wheler and Jacob Spon in the seventeenth century, allowed for significant honey gathering and intentional colony division to prevent swarming. A proposal fora hive that I have devised to multiply swarms, following the method... adopted today by the inhabitants of Crete was published in a three-volume treatise by the Abbot Della Rocca in 1790. As a result, it was commonly known starting in the seventeenth century that hives with combs that could be removed from above, as discovered by Wheler and Spon 130 years earlier, were also common in the Cyclades and in Crete. The Enlightenment saw an increase in scholars competing to define new types of hives that would both enable the regrettable practise of apicide to be abolished and make beekeeping more lucrative as a result of growing awareness of the absurdity of apicide and knowledge of practical alternatives. It is necessary to provide only one of the several historical books that outline the characteristics that such a hive must possess:

1. In addition to being made smaller, something may also be made larger to accommodate for a population that is more or less substantial.
2. It may be opened by itself without disturbing the bees, allowing for cleaning, the formation of artificial swarms, the creation of many swarms from a single swarm, or the placement of winter-appropriate food.
3. That the honey may be harvested from the hive with as little harm to the bees as feasible.
4. That it may be flawless, clean, and free of cracks on the inside.

Real scientific study on honeybees also received a substantial increase during the Enlightenment, in addition to studies for more effective beekeeping. It was possible to learn a lot about the biology of Apis mellifera by using observation hives and microscopes. The discovery of the intercomb distance, or how honeybees construct their combs with just enough space between them to for two bees to travel through back-to-back, served as further inspiration for the creation of movable-frame hives. The Ukrainian beekeeper Petro Prokopovych, who developed his own movable-frame hive and maintained as many as a few thousand colonies in his apiaries, is widely regarded as one of the pioneers of professional and commercial beekeeping.

Pastor Lorenzo Lorraine Langstroth was a Protestant from Massachusetts. He spent his whole life researching bees and, building on numerous prior models, created a hive with replaceable combs. He discoveredbee space in 1851, which is the exact opening that bees never fill with wax or propolis in a hive or nest. A gap of this size between frames prevents bees from creating honeycombs or bridges, and since the frame is movable, honeycomb extraction does not require the destruction of honeycombs. The contemporary beehive is largely credited to Langstroth as its creator. He improved and standardised the measurements, putting them together into a hive model that serves as the foundation for the majority of hives in use today.However, without the development of the waxy sheet by Johannes Mehring and the centrifugal honey extractor by Frantiek Hruschka, the success of movable-frame hives cannot be fully understood[7], [8].

Varieties of portable-frame hives

Amovable-frame hive is any hive in which the frames are not fixed and may be taken out and replaced by the beekeeper, or even relocated to another colony. This enables the beekeeper, as was previously indicated, to examine the hive, identify and treat bee ailments, and use count-less beekeeping methods. The size of the colony may be adjusted during the year in some of these hives, allowing the bees to have more or less space depending on their requirements. Some vertical forms of hives' honey chambers may be built using the same modular design. The productivity of the indigenous bees used in hives is adapted. Depending on the particular demands of the colony, the size of the frames and the quantity within each module may change. Since there is no need to destroy combs, movable-frame hives often provide better quantities of high-quality honey than local-style hives. One or two chambers may be found in movable-frame hives:

Hives with a single chamber: vertical hives

hive with top bars. Bee management is usually done from above. There are no frames in these hives. simply top bars on which the honeybees construct their organic honeycombs. This indicates that, unlike in natural hives, the combs are mobile rather than anchored to the interior walls of the hive. Because they are in between local-style hives and other varieties of movable frames hives, they are also known as transitional hives. Kenyan top-bar hives and Tanzanian top-bar hives are the two major groups of top-bar hives. In contrast to traditional local-style hives, they are simple to examine. While the Tanzania model features perpendicular long walls, the Kenya model is characterised by slanted long walls. Corwin Bell's modern cathedral hive is one of the further advancements of the top-bar hive. Numerous horizontal hive frame layouts have been adopted by local beekeepers in several nations since top-bar hives in recent years. The hive of Layens. The horizontal hive seen here was Georges de Layens' idea. 20 huge frames may fit on one level. Depending on the local bee flow, the number of frames may be less or more. It is opened for honey collection in the late summer or early fall after being loaded with frames in the spring.

Two-chamber beehives: horizontal hives

One of the most popular types of hives in the world are vertical modular hives, which include moveable frames that are separated into chambers. The brood chamber, which lies on the bottom, is where the bee colony and its offspring are gathered. One or more nest modules may be used to create it. The super is the upper chamber, where the bees store any extra honey and the beekeeper lays the modules for honey deposition and eventual honey collection. These modules for gathering honey might be smaller or the same height as the nest modules. Since it prevents the queen from laying in the super, a queen exclusion grid is often positioned between the brood chamber and the super to restrict brood space to the brood chamber.

In order to prevent the hive from becoming insulated and to allow the bees to create an air current between the roof and the top chamber, there is a space above the chambers that serves as an air chamber. A sheet metal roof, either straight or gabled in regions with a lot of snow, covers the top of the hive. Since the lowest half of the hive is prone to dampness, the foundation or floor is often built of hardwood or high-density fiberboard. Additionally, there are little pieces of brood chamber detritus on the ground. The Warré hive, the Langstroth hive, the Zander hive, the standard hive, and the Dadant hive are the most often used vertical modular hives worldwide.

One of the most well-known movable-frame modular hives is the Warré hive. The hives of the eighteenth century are their source. The honey chamber is in the bottom, while the brood chamber is at the top. It enables the beekeeper to separate colonies artificially and gather honey without seriously upsetting the bees. Since the chambers of the Langstroth hive are the same size, they may be switched around. This is more challenging if additional modules aren't added to the honey chamber in a Dadant or Jumbo hive since the honey chamber is shorter than the brood chamber. The size of the hive varies depending on how productive the colony is and how much room is required to store honey. The most well-liked modular vertical hives worldwide are Langstroth hives. The beekeeper may add additional nest components since they are customisable. The brood chamber in the original Langstroth hive design is 24 cm high, 51.5 cm long, and 43 cm broad. Ten frames measuring 23 cm tall each include four wires, a head or top strip measuring 47.8 cm, and a bottom strip measuring 44.7 cm. This results in a final capacity for breeding of 44 litres for the hive.

When compared to a naturally spherical swarm, this form of hive's nest has a tendency to be oval, and the three-dimensional connection is not optimal. Beekeepers and technicians aim to have the most bees in hives maintained for production objectives at the height of nectar flow. The queen needs space to lay as many eggs as she can one month before to the peak flow. However, many think that the Langstroth hives' limited size and cell count is what makes the queen ascend to the second chamber in the first place. This leads to the usage of a queen excluder grid, however this is dangerous since the queen prefers to swarm when she is restricted to less area than she requires. Beekeepers often relocate some capped broodstocks into the honey chamber, which is blocked by the exclusion grid, during the advanced spring season to avoid this from occurring, and then replace them with empty or waxed honeycombs to ensure the queen continues to lay eggs. This procedure is known asframe rotation. One of its downsides is the possibility that pests like wax moths, acaricides for Varroa treatment, or sugar syrup that the bees did not eat may have come into touch with brood combs. These combs have a higher likelihood of carrying sugar syrup residues or some other sort of acaricide residue as they accumulate. Because of this, beekeepers should take care to use low-impact acaricides to treat varroa[9], [10].

Bees maintain less honey reserves throughout the winter because they have less room in the hive, but in temperate and cold temperate areas, these reserves are not enough to sustain them until the next active season. Beekeepers in these areas are thus compelled to feed the bees or store food in the honey chamber. Avoiding dietary stress is also advised since it makes bees more vulnerable to infectious diseases.Although it has been said that Langstroth hive chambers are the same size, a shorter honey chamber, known as a half-rise or three-quarter-rise, is employed in Langstroth hives because of the hive's weight when filled with honey.

Half-rises are the same size as a regular chamber in terms of length and breadth, but they have a 14.5 cm box and 14.5 cm of height. As an alternative, a queen excluder grid must be used with a normal chamber for honey and a half-rise as the brood chamber. It is possible to employ a variety of chambers or half-rises and stack them as required.A standard-rise honey chamber has the benefit of being considerably simpler for bees to fill, which makes it popular for the production of miofloral honeys. Beekeepers also employ honey chambers with the same measurements as the brood chamber, but since there is no industry standard for height, they may range from 16 to 17 cm. Only for honey production, which encourages bigger frames, are these measures employed. Additionally, a three-quarter rise that has a wider lower slat and wider sides and only eight frames per rise requires special measurements.

The wires zigzag downward to upward. As a consequence, more wax and honey are produced. The Zander hive and the British National hive, which also allow for many brood chambers, are similar to Langstroth in idea and administration. There are several varieties of the Dadant hive, which is also quite common. It is distinguished by nest frames that are bigger than those found in a Langstroth hive as well as by super frames that are only half as tall as the nest frames. The brood chamber is 30.8 cm high, 51.5 cm long, and 43 cm broad in the original Dadant hive design. The head or top slat is 47.8 cm in height, the bottom slat 44.7 cm, and the squares are 29.6 cm high. Its four distinct wires are spaced 5.5 cm apart. It has a capacity of around 54 litres. The Dadant hive originally had 12 frames, which meant that its breadth fluctuated.Its increased height provides it the perfect proportions to sustain a large brood nest that is naturally spherical in form, and it offers the queen adequate space to lay eggs without having to switch chambers. However, since the super is only 16 cm in diameter, the chambers cannot be switched around as in a Langstroth hive. As a result of the larger amount, more honey reserves may be preserved for the winter and artificial feeding is often unnecessary. The size and weight of the Dadant hive are its only drawbacks, making it very difficult for nomadic beekeeping, which is crucial for crop pollination as well as honey production.

Half-rise supers are located on top of the brood chamber in the pastoral Layens hive. The modules and frames of the divisible Layes hive, on the other hand, are all half as tall as the frames. The Layens hive has a square portion in both variations. The Jumbo or Yumbo hive is another. The brood chamber of the Langstroth hive is too tiny for effective egg-laying queens, and swarming is frequent when it exceeds 60,000 bees, which is a huge injustice, according to several American beekeepers. As a result, A.N. Draper simply increased the height of the Langstroth brood chamber from 24.0 cm to 29.5 cm while maintaining the same supers, and the issue was resolved. The hive is 43 cm broad and 51.5 cm long. It is 27.7 cm tall and contains 10 frames with four wires each. Its head, or higher slat, is 48.1 cm, while its lower slat is 45 cm. It has the optimum accommodations at this size to store the brood nest and winter honey supplies. It is comparable to the Dadant but more portable since it is lighter and smaller. Bee homes are vertical hives with overlapping, non-divisible sections that are the last kind of structure. They are effectively built pillars that were produced by enclosed hives.

CONCLUSION

In conclusion, the evolution of beekeeping and hive designs has been a fascinating journey that illustrates the creativity and flexibility of many societies. The development of beekeeping techniques has been influenced by a mix of environmental variables, resource availability, and the goal for increased honey production and bee management, from the early usage of local-style hives manufactured from varied materials to the introduction of movable-frame hives.In conclusion, beekeeping has a long and varied history, with hive designs changing to accommodate various cultures and geographic conditions. Beekeeping is still a crucial activity in the modern world for the creation of honey, the provision of pollination services, and the preservation of bee populations. To guarantee the future success of beekeeping across the globe, it is imperative that contemporary practises are balanced with respect for regional customs and environmental sustainability.

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CHAPTER 5

A GLOBAL PERSPECTIVE: MODERN AND TRADITIONAL BEEKEEPING PRACTICES

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ABSTRACT:

In recent decades, there has been a rise in the development of novel beehive designs, ranging from those inspired by natural forms to those adding cutting-edge technology. This sketch covers various types of beehives and their spread across different areas of the world.One type of beehives emphasizes naturalness, illustrated by the complex Solar Hive created by German artist Günther Mancke. This circular hive, positioned at a height of approximately 2.5 meters above the ground, challenges easy detection due to its funnel-shaped opening and semi-elliptical frames within which bees build honeycombs. Such hives, marked by their complexity and inspection problems, do not fit the standard movable-frame or local-style hive groups.On the other end of the range are technological beehives like the Revolving Hive and Flow Hive. The Revolving Hive uses an electric motor, driven by electricity or solar panels, to slowly spin honeycombs, lowering problems related to the Varroa destructor mite and swarms. However, the scientific proof backing their effectiveness is missing, leaving many to view them as beekeeping novelties. The Flow Hive, built for simpler honey extraction, can fool newbies into thinking beekeeping requires minimal effort, hiding the challenges posed by factors like Varroa infestations.Across Europe, a number of beehive types are in use, with the Langstroth and Dadant hives being popular picks. Meanwhile, the British National hive and Zander hive are dominant in the UK and Austria, respectively. In areas like the Iberian Peninsula and Central and Northern Europe, Layens bees are common.

KEYWORDS:

Beekeeping, Development, Hives, Honey, Market.

INTRODUCTION

In recent decades, a number of novel hives have been developed. Some of these hives, like the aforementioned cathedral hive, which is based on the top-bar hive, are motivated by a desire for more naturalness, while others are built on cutting-edge technology. The intricate solar hive, created by German artist Günther Mancke, is one example of a natural beehive. Bees construct honeycombs within semi-elliptical frames inside this circular beehive. It is intended to be positioned at a height of around 2.5 metres above the ground and has a funnel-shaped entrance at the bottom, making it incredibly challenging to find. Due to the intricacy of its construction and the difficulty of inspecting it, it cannot be classified as a movable-frame hive or a local-style hive.The revolving hive and the flow hive are examples of technological hives. The circular frames of the rotating hive are turned slowly and constantly by an electric motor that is either driven by electricity or a tiny solar panel. In addition to preventing swarming, the rotating honeycombs also lessen the negative effects of the parasite mite Varroa destructor. But because there is no scientific proof of their efficacy and they are not grounded in honeybee biology, this complicated, pricey hive is mainly regarded as one of the numerous gimmicks that beekeepers love to create and experiment with. Another variety of technology hives, most notably the flow hive, have been developed with automated or eased honey extraction for family honeybee management. These self-harvesting hives, however, are deceptive since they imply that all beekeeping involves is placing bees in a box and there would be enough honey for a whole family. In actuality, beekeeping entails actively participating in the care of the bees, particularly at the present, when Varroa is widespread over most of the globe. Both of these concepts are often regarded as novelty hive models rather than actual productive solutions[1], [2].

With several regional names, bee residences or bee hotels are notably common in Slovenia, Austria, Germany, and Switzerland. In Italy, they are no longer in use. Most European nations choose the Langstroth and Dadant hives. Nevertheless, the British National hive and the Zander hive, both of which enable the brood chamber to be enlarged, are both widely used in the UK and Austria, respectively, while the Dadant hive is the norm in Italy. The Iberian Peninsula, as well as Central and Northern Europe, have the greatest density of either kind of Layens hive.With the aid of development partners who are helping them with beekeeping initiatives as a method of combating severe poverty and hunger, what is now known asmodern technology is gaining traction in many African beekeeping communities. This has led to the development of commercial-level beekeeping initiatives, where propermodern beekeeping techniques are used to increase honey production for commercial retailing, provide movable colony stocks for pollination services, multiply the colonies through queen-rearing and colony-splitting, and more. The Langstroth hive and the top-bar hive are the two movable-frame hives that are most often employed in Africa. The latter is more often used because to cheaper construction and administration expenses for the hive and companies. Due to the high cost of Langstroth technology, many community beekeepers choose to use top-bar hives and local-style hives instead.

Many beekeepers in Africa are selecting hives with particular requirements to optimise their bee colonies with the assistance of development partners and the purchase of modern beekeeping technology. Only hives using cutting-edge technology, such as the top-bar and Langstroth hives, have specifications. Table 5 lists the standard specs, however some communities continue to manufacture these hives to differing standards. Communities that adhere to the requirements construct acceptable hives using locally accessible materials and shared beekeeping expertise. The Tanzanian top-bar hive, which is a box hive with top bars and a hybrid of the top-bar and Langstroth, and the Malawian top-bar hive, which is broader and longer than the typical Kenyan top-bar hive, are two examples.Now the middle of the 1880s, beekeepers have been able to boost productivity, identify queen bees more quickly, gather honey, and check for pests and illnesses thanks to the introduction of the Langstroth hive and moveable hive technology in Australia and New Zealand. These innovations have now spread across the Pacific area. While Western honeybees have been present in Australia and New Zealand for around 190 years, during the last 80 years, both their range and abundance have significantly expanded.

While Australia and New Zealand produce the most honey, some PICTs, including the Cook Islands, the Fiji Islands, French Polynesia, Kiribati, Niue, Palau, Papua New Guinea, the Pitcairn Islands, Samoa, the Solomon Islands, Tonga, Tuvalu, and Vanuatu, are also known to produce honey for market. Large-scale migratory commercial beekeeping operations focusing on Langstroth hives are practised in both Australia and New Zealand. Commercial beekeepers typically utilise 8-frame boxes in Australia's cooler southern regions, and more and more companies are switching to 10-frame boxes in the country's more northern areas. Similar to this, beekeepers in colder regions prefer to utilise optimal depth frames and boxes, whereas those in northern states often use full-depth frames and boxes. Australian commercial beekeepers now use pallets for around 70% of their hives, up steadily from 40% about three decades ago. Queen excluders are presently used by the beekeeping industry in around 95% of cases, and their popularity has grown over the last 40 years[3], [4].

In Australia and New Zealand, beekeepers primarily employ wooden hives and frames with beeswax foundation, while more and more people are choosing to use plastic and polystyrene hive boxes. In the past, beekeepers in these nations put a lot of effort into building and maintaining their own lumber hives. Commercial beekeepers are also increasingly adopting horizontal extractors and mechanised loaders, which means fewer humans are needed to run the honey extraction and processing lines.Commercial beekeepers with more than 200 hives are responsible for managing more than 70% of the hives in Australia. Some commercial beekeepers maintain more than 3000 hives, although most manage between 400 and 800 hives. 85 percent of all beekeepers in New Zealand are classified as hobbyist beekeepers if they have 50 or less bee colonies. In contrast, 77 percent of beekeeper registrations in Australia are from amateur or hobbyist beekeepers, who often have less than 11 colonies. The commercial sectors of these two nations, as well as Hawaii, also benefit greatly from the industries that produce wax, pack-age bees, and queen bees.

Smallholder producers with less than 20 colonies are characteristic in beekeeping in Melanesia, Polynesia, and Micronesia. Almost all beekeeping systems are based on Langstroth hive designs, however access to honey extractors may be problematic for communities who are geographically isolated and inputs are sometimes costly and difficult to get. Since many beekeepers do not actively maintain hives to optimise output, these beekeeping systems often need modest input, even when start-up expenses are substantial. This lowers operational costs. Although Langstroth hives offer numerous advantages, low-income farmers may not be able to afford them unless there is fierce competition among input providers. Alternative business structures and hive designs could be appropriate for certain populations in isolated and rural settings, but caution should be used when attempting to integrate these ideas into preexisting knowledge, extension, and management systems.In the Americas, there are now three different types of mobile frame hives in use. The Dadant hive, which is still in use in certain parts of North America, is third most popular, followed by the Langstroth hive and the Jumbo or Yumbo hive, which are hybrids of both and are used in Mexico, the United States, and several Central American and Caribbean nations. Since they have Africanized bees and have attempted to import hives similar to those used in Africa, other nations in the area, including Colombia, utilise alternative hives like the Kenyan top-bar hive because they believe they are more suited for that kind. Since they were established as part of extension efforts, there are, however, just a few of these hives.

DISCUSSION

Beekeepers have updated various materials, such as the floors or bases and ceilings or coverings, as a result of the rise in the number of transfers they do, particularly for pollination services. Typically, the flooring feature two bottom slats that directly hold the pallet or platforms used to move the beehives.Another extremely popular alteration is the adoption of thicker wood-en lids or ceilings with no sides so that the hives may be placed together on a pallet or platform with no room in between. In this manner, they support may stack more readily and remain on the pallet or platform more uniformly on the ceilings, maximising the available area.In the Americas, beekeepers employ a variety of specialised materials for their various activities, such as various kinds of feeders, boxes or frames for rearing queen bees, and smaller hives for reproduction like core drawers. They may consist of one, two, or even five paintings, each with a separate floor and ceiling. The fertilisation hives, also known as micro-hives or baby hives, are a heading with a lot of different options. These tiny hives come in a huge variety of designs and are made of the most unusual materials, including wood, plastic, expanded polypropylene, etc.

In Asia, movable-frame hives are employed for both A. cerana and A. mellifera. Depending on the nation A. mellifera was brought from, many kinds of hives are utilised, although the Langstroth is by far the most popular. Hive sizes for A. cerana have been altered to accommodate its biology, and there are several variations in use.Always take into account the geographical setting, customs, and history of the local populace before choosing movable-frame hives for your beekeeping enterprise. As we've seen, there are benefits and drawbacks to this kind of hive. The major benefit is that they are more prolific than hives made in the neighbourhood. Additionally, using movable frames makes it simpler to carry out numerous tasks, including colony inspection, finding and inspecting the queen bee, keeping track of reserves, monitoring bee health, and applying treatments to control bee diseases, as well as a number of other beekeeping techniques like artificial swarming and queen caging. On the other hand, drawbacks include the need for standardised beekeeping tools, operator training, and production-guaranteed materials. This kind of beekeeping thrives in more developed nations where beekeepers have the financial means to purchase the necessary tools and where access to apiaries and honey homes by automobile is convenient.

Beekeeping has been performed for many ages in Africa, largely for food and medical reasons according to study and direct proof from many African communities. In some communities in East and North Africa, honey was used for cultural reasons such as paying dowry and making traditional brew. With the increase in demand for honey regionally and nationally and access to knowledge about the health benefits of organic honey, there has been a surge in com- munities taking up beekeeping as an income-generating project from which to earn a living. Many villages in Africa have been able to send their children to school using cash made from honey sales. As an 85-year-old farmer from Kitui, Kenya, puts it,Since, I took over beekeeping as a young man, I have never cultivated any crop in my farm[5], [6]. I have always fed my family by selling the honey I harvest to buy food, clothes and pay school fees for my children. Many communities have realized that beekeeping offers the chance to make a living given the wealth of natural bee environments surrounding them in the form of woods, rivers and mountains, and the strong wild bee colonies at their disposal. Many countries are beginning to invest in beekeeping as a plan for:

1. Poverty removal in rural areas.
2. Job growth.
3. Economic freedom for women and young people.
4. Pollination of food and ornamental crops.
5. Environmental saving.

Thus, resources are being directed through appropriate government offices and development partners to capacitate community beekeeping projects so that communal beekeeping initiatives can be upscaled from a hobby to business companies that are sustainable and protect the environment. This came after the understanding that many natural woods were being killed across Africa for a number of reasons, but a major one being charcoal trade as communities were trying to make a living. Many communities have also been cutting down trees to reach wild bee homes for their honey , reducing the indigenous tree population. This is a wasteful practice, exposing trees to flames which do major damage to ecosystems, hence the attempts to teach, train and capacity communities with modern beekeeping practices.

These efforts include the promotion of bee-friendly tree-planting initiatives, to reforest areas that have been cleared while also providing extra bee food to support community farming initiatives. In this way, many com- munities in Africa are moving away from traditional bee-keeping practices to modern farming practices with movable-frame hives, which are showing to be successful and sustainable.

Strategies to help the growth of Africa's farming industry. Africa has huge promise as a honey producer given the abundant resources at its disposal. These include natural woods, water, healthy bee populations and good weather conditions year-round which are beneficial for beekeepers. However, there are a number of areas needing action before the continent can reach this promise and become one of the biggest makers of natural honey in the world. These areas are as follows:Many towns in Africa are fighting to meet the basic needs of their families, with many living below the poverty line. Yet these communities are surrounded by rich natural resources that could provide them with income-generating projects such as beekeeping, and other related support services such as hive-making, equipment manufacturing and protected clothing production.

There is a need for teaching efforts regarding two parts of beekeeping:The value of bees to the world, including their fertilisation services for plants and food crops. This effort should not not only target bee- keepers but also lawmakers so that all agriculture and environmental policies made take into account the role of bees and the need to protect them. It could also include GBPs that not only protect bees and the environment but also improve honey production in a sustainable way.The benefits of honey in food and for healing reasons. A society that understands the value of honey will see growing demand, sparking honey production at the neighbourhood level.There are very few countries in Africa with clear policies on beekeeping to the point of having a specific budget to support the business. As a result, the sector counts on development partners who often see beekeeping merely as a complementary project and provide little cash support. This has slowed the growth of the sector, with some policies negatively affecting the bees especially excessive use of agrochemicals to boost food production. Many projects in Africa are ignored in terms of funds and value and rely on political support to be continued. Beekeeping is one such industry. Despite the important role bees play in fertilization, attempts by Ministries of Agriculture to actively protect insects, including bees, are non-existent.

A number of countries are facing major deforestation on account of charcoal trade and other human activities. Government action, namely approval and enforcement of environmental protection rules and promotion of tree planting, is needed to maintain the environment and protect bee sites. This will directly help beekeeping, since enough bee food will be available to support extensive beekeeping operations. Government and government backing is also needed in the form of rewards for beekeepers and other important supply-chain players to promote farming in Africa. These include relief of beekeeping tools from tax so that beekeeping and honey-processing equipment are cheap. This would increase honey output and improve the quality of prepared honey, which could be shipped to international markets and make foreign currency.Many towns in Africa rely on food handouts from the government and NGOs, a situation that has caused serious dependence syndrome. While gifts are necessary, if groups are capacitated in beekeeping, they can earn a living from the hives for years to come. Capacity-building should comprise:

Training of communities on bees so that they can gain from their natural surroundings. This will have extra benefits of community control of their local environmental saving and protection. This method has worked very well in Ethiopia where community members are allowed to mount hives in woods they help to protect.Provision of simple beekeeping tools so that they can engage in beekeeping. Some community members do not have the means to buy hives and start beekeeping after training. This is especially important since laws prevent hacking down trees for reasons such as making log or bark hives, which was once a cheaper choice.Formation and strengthening of apiculture peak boards. A number of African countries do not have fully working, sector-wide official national groups, or apiculture top boards, which can drive the growth of the sector and coordinate with government offices on policy development. The rise of the sector needs the creation of official structures, starting with a plan to encourage local clubs, groups and or societies to set up provincial/regional structures which will then make the national association. In countries that already have national groups, there is a need to improve capability so that they have the necessary skills and resources to grow the business.

Traditional African farming methods need to be documented, particularly practices that have been passed from generation to generation, since this may improve the longevity of the African bee species. Many parts of the world are using bee species with desirable characteristics that support commercial beekeepng, while African bees have their own characteristics based on their natural environment. Complete shift from traditional/African beekeeping systems to modern beekeeping systems without considering its possible effects on the behaviour of African bees may cause unforeseen challenges. African beekeeping systems should therefore be developed by building on good traditional practices and combining them with modern practices, to support marketing without badly impacting on the physiological make-up of African bee species. It is for this reason that the Apimondia Regional Commission for Africa has set up a Regional Working Group on African Beekeeping Systems, which will provide data and studies to teach the region of the different African bee- keeping systems that are popular throughout the continent. In this way, it tries to provide a scientific base on which developments/improvements can be applied to boost African honey output without negatively effecting the bees.

Support has been given for bees in a number of areas in Africa. However, the rise in honey has caused a problem in terms of promotion, with help only given for training and bees for some farmers. There is therefore a need to provide fair support for distributors and manufacturers so that they can take up the honey made by farmers. In most cases, companies lack access to enough funds to buy all the honey avail- able since honey is seasonal. This has resulted in a significant amount of honey not being gathered for processing, leaving beekeepers with no choice but to process it the usual way and sell it in their local communities. Funding models need to be developed to allow processors and beekeeping industry partners to support beekeepers by bulking their produce at competitive prices. This will make gardening projects affordable[7], [8].Africa is known for making natural honey and beeswax with minimal amounts of metals and medicines. This is mainly because more than 80 percent of African honey is made in community areas where farms do not use agrochemicals and beekeepers do not actively feed their bees or treat them with medicines. Yet, despite its high quality, the price given for Afri- can honey and beeswax is very low. Support is needed to establish the medical and nutritional value of honey from different parts of the continent so that African farmers can be paid a price that is commensurate with the value of their honey.

The European Union is the biggest single market of honey and beeswax in the world. However, very few African countries are able to send to the European Union due to lack of support for the third-country listing process, which is expensive and needs teamwork at the national level between government offices and beekeeping stake- holders. Most African countries do not have strong national groups with enough funds to support the process as it includes expert activities and extensive involvement from all parties. Support for such an important process would see many countries growing their honey output, since there would be a ready market for large amounts of honey and beeswax. Furthermore, a constant market with stable prices would build beekeeper trust in the longevity of the initiatives/projects, leading more to join the field and resulting in better environmental management.

Strategies to help Oceania's farming businesses

Further study and growth of beekeeping businesses in PICTs has significant potential to improve and broaden wages for rural farmers, boost food security and add to national and local economies. The out- comes of study in apiculture in the region also have significant worldwide implications for building the best honey- bee protection practice. It is extremely important for industry survival that development projects focus on building capacity and skills rather than giving farming inputs. The following strategy objectives may help to beat obstacles and improve results for smallholder farmers:Beekeeping businesses need capacity-building pro- grammes to make flower calendars and develop capacity for controlling honeybee feeding. Enhanced post-harvest handling and quality assurance methods are needed to ensure and improve selling possibilities. Beekeeping businesses need help to develop integrated pest management strategies for regional pest and disease pressures which are context-specific and consider the social and economic limits of adoption. Regional biosecurity knowledge-sharing and capacity-building needs to be improved for successful defence of growing farming businesses and approval for market entry. Introductions of new genetic stock may offer some answers to present bad genetics, but any genetic introductions should face thorough risk assessment and long-term tracking and evaluation to ensure that pest and disease threats are reduced.Beekeeping projects should have strong social research ability and skills in community development to ensure participation and engagement of industry partners in all parts of the project. Better methods are needed for improving the agency of women and other disadvantaged groups, improving social relations and finding key changing structures to beat hurdles to participation in and benefit from beekeeping businesses[1], [9]. Projects should also seek to improve ability for beekeeping teachers and groups to give inclusive training and growth.

CONCLUSION

In conclusion, the world of beekeeping is varied and ever-evolving, with various hive designs and practices suited to different areas and goals. From the traditional methods of Africa to the advanced tools of Australia and New Zealand, beekeepers worldwide are finding new ways to handle beehive colonies and make honey.In recent decades, there has been a rise in the development of new hive designs, driven by a desire for more naturalness and cutting-edge technology. Examples like the cathedral hive and solar hive showcase the innovation and variety in bee building.

However, some of these hives, such as the rotating hive and flow hive, are often seen as novelties rather than useful answers due to their complexity and lack of scientific proof of effectiveness.Different areas have their tastes when it comes to farming bees. European countries generally use Langstroth and Dadant hives, while the British National hive and Zander hive are popular in the UK and Austria, respectively. African beekeepers are increasingly accepting modern technology, with the Langstroth and top-bar hives being the most widely used. Oceanic countries, especially Australia and New Zealand, have adopted movable-frame bees, leading to increased output and honey production.Asia also sees the use of movable-frame hives, with the Langstroth being a popular choice. However, hive designs and practices are often adapted to the local climate and bee species, stressing the value of considering regional factors.

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CHAPTER 6

ROLE OF ENVIRONMENTAL MANAGEMENT IN BEEKEEPING AND BEE WELFARE

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ABSTRACT:

Bees, important pollinators and contributors to natural balance, are deeply affected by their surroundings. This impact stretches to both their health and productivity, making site selection a crucial factor for beekeepers. Bee groups receive food from their surroundings while reciprocally improving the environment through fertilization. Environmental pollution pose a significant danger to bees and hive products, underlining the importance of careful hive placement. Beekeepers must seek optimum environments, unless bees are used for environmental tracking. Effective hive-environment management often necessitates cooperation with other parties in complete landscape management.External factors play a key part, with their effect growing as closeness to the hive reduces. Flight distance limitations, usually around three kilometers from the apiary, constrain certain natural factors. Local microclimates, affected by environment elements such as slope, plant structure, and direction, significantly affect hive performance and survival. These neighbourhood factors can mitigate the unfavourable effects of area temperature conditions.Pesticides, including pesticides, acaricides, fungicides, herbicides, and antibiotics, produce extensive and often harmful effects on bees, leading to acute poisoning, chronic sicknesses, and deaths. Despite a trend towards decreased pesticide usage, honeybee deaths continue, driven by more lethal poison families. Pesticides not only risk bee health but also threaten ecosystems and human health through decreased insect numbers.Local plant richness is important as bees must access necessary nutrient resources regularly. The abundance of varied, high-quality food and pollen sources throughout the bee season is essential for hive survival and breeding. Bees must find delayed growing plants within reach during times of high demand. This supports biodiversity in wild and semi-natural environments and encourages farming fields to mix crops with nearby natural areas for hunting.

KEYWORDS:

Beekeeping, Bee Welfare, Environmental,Honey, Management.

INTRODUCTION

Bees rely extensively on their surroundings. It directly affects both the health and output of bees as well. The bee colony obtains nourishment from its surroundings and, in exchange, makes an important pollination contribution to the environment's function and health. Pollutants in the environment may also have a significant impact on bees and hive products. Because of these factors, beekeepers should always give great thought to where they put their hives. It is in the beekeeper's best interests to choose the ideal habitat for the hive, with the exception of situations when bees are utilized to monitor the environment. In addition to bee management expertise, proper hive-environment management sometimes entails building collaborations with other stakeholders in more comprehensive landscape management.From the regional to the local level, the environment that bees interact with may be thought of, and the inputs become more obvious the closer they are to the hive. Some inputs are dependent on the bees' ability to fly, and as a result, are limited by their maximum flying distance, which is around three kilometers from the apiary. Some inputs are dependent on the bees' ability to fly, and as a result, are limited by their maximum flying distance, which is around three kilometers from the apiary. The effect of climate on hives depends on its physical characteristics and local microclimate in addition to the regional climate. The topography of the landscape, its direction, and the structure of the surrounding vegetation are examples of physical characteristics. These control how much of the hive is exposed to the light, shade, wind, humidity, and frost, and they also provide a local microclimate that affects the hive's performance and even survival. These local factors will have a greater or less significant role in reducing the negative impacts of the climate, depending on the area climate.

Honeybees and other pollinators are the beneficiaries of all the direct and indirect impacts of the many kinds of pesticides used in agriculture, even though they are not the intended insects. Insecticides, acaricides, fungicides, herbicides, and antibiotics are examples of these chemicals/pesticides. Their effects on bees range from acute poisoning and instant death of adult bees and developing forms to chronic and fatal effects that are varied, occasionally very unfavourable, and difficult to quantify. Using more pesticides is often required in intensive agricultural practises. Although there has been a trend in recent decades to use less pesticides overall, honeybee losses are still rising as a result of the usage of new, more lethal insecticide families. The effects of pesticides on pollinators are extensive, obvious, and becoming more and more well-documented. Pesticides are a major hazard to the environment, ecosystems, and public health because of the reduction of honeybees and other pollinators[1], [2].Because bees must be able to access essential nutritional supplies, the abundance of the local plants is also essential. For the colony to survive and reproduce, there must be a sufficient variety, quality, and quantity of these supplies accessible throughout the bee season. In certain blooms, bees will discover a lot of nectar, while in others, they'll find a lot of pollen. The demands of the bees might vary depending on the season and the precise tasks to be performed inside the colony, necessitating the need for various, sometimes unique plant species.

The demands of the bees cannot be met during the full prospecting period, however, since each flower has a specific blooming season. Therefore, during their time of need, bees must be able to locate plants with staggered blooming that are accessible from their colony at a distance. The beekeeper will also be interested in this staggered blossoming since he or she will be able to get honey with unique taste and qualities because of the particular flowers involved. Due to all of these considerations, the habitat in wild and semi-natural places must be adequately biodiverse, and agricultural landscapes must have a variety of crops, preferably blended with nearby natural areas for foraging.The primary function of bees in the environment is flower pollination. Bees pollinate a large number of blooming plants, including many food crops and wild species. Approximately 80% of flowering plant species are thought to be adapted for animal pollination, mostly by insects. Bees move pollen from the male to the female parts of flowers as they gather nectar and pollen, allowing the female portion of the flower to bear fruit. The reproduction of terrestrial natural ecosystems, and therefore their regeneration and sustainability, depends on the production of fruit. Fruits guarantee the ecosystem's functioning by spawning new plants or by being eaten. Bees enable cross-pollination of flowers by flying from blossom to bloom, which encourages genetic variation and plant diversity.

Additionally, the functioning and resilience of ecosystems are derived from this genetic diversity. Some flowers even need specific plants to cross-fertilize them, which makes bees even more necessary.It has been shown that honeybees have a substantial impact on agricultural pollination. In addition to raising the percentage of flowers that are pollinated, which results in more fruits and seeds, they also raise the quality of fruits and seeds by pollinating flowers or inflorescences. As pollination decreases, beekeepers are being paid more and more to place their hives close to agricultural areas. It should be emphasised that pollination is projected to have a far higher economic value than bee products on a worldwide basis. However, bee products often serve as the incentive for beekeepers and support neighbourhood services such as food security, income, and health[3], [4]. Bees and their products may contribute to the environment's food chain. Bee reserves may be attacked by predators, and bees themselves may be consumed by birds, hornets, or parasites.

DISCUSSION

Bees and the vegetation they rely on are both affected by the climate. Bee physiology, bee activity, and vegetation are all impacted. Flowering patterns may alter over time as a result of climate change, which may shorten the time that bees have access to nectar and pollen. With shorter blooming times, longer intervals between flowering periods, and inadequate products in terms of quality and quantity, this scenario might become catastrophic, particularly if the number and diversity of species decreases. Reduced crop variety, larger plot sizes, and removal of flower-rich natural areas near or within agricultural landscapes all have an adverse effect on biodiversity and, as a result, the availability of sufficient supplies for bees, leading to a reduction in pollinators and bee populations. Reduced variety is also caused by chemical treatments and the excessive or incorrect use of pesticides, which in certain situations are even directly linked to bee death. The same is true for bee illnesses, which are also a result of globalisation, as well as exotic species that affect biodiversity.

The ecosystem might be negatively impacted by honeybees as well. The honeybee benefits from being a generalist since it may consume nectar and pollen from a variety of blooms belonging to various plant species. On the other hand, certain local bees or wild pollinators are more specific or less adaptive. A decrease in the variety of plant resources may result in the disappearance of the host plant or increasing competition among pollinators for the host plant. It has been discovered that wild pollinators often outperform honeybees in pollinating some plants or situations. Honeybees are not the best pollinators for certain flowers because they may harm the reproductive organs and reduce fructification. There are instances when the influx of honeybees results in aggressive behaviour and conflict with wild bees. Beekeepers must think carefully and rationally when deciding where to put their hives for all of the aforementioned reasons.

Materials in the environment must be accessible for bees. The same is true for wild pollinators, which utilise the environment both as a source of food and as a place to lay their eggs. Environmental resources are dependent on both the connection between these habitats and the diversity of the habitats in the immediate area. Pollinators are negatively impacted by the fragmentation of the environment, which separates habitats and limits their ability to travel. Hedgerows and other larger natural or semi-natural regions, as well as pollination-friendly landscape management techniques like intercropping and nectar-rich crop provision, are beneficial to pollinators, especially when diverse natural habitats are otherwise constrained and isolated in plant production systems. Examining pollinator variety and abundance in the environment, learning about their biology, using and integrating possible indigenous local knowledge, and tracking their numbers through time are all highly helpful at the same time. Fortunately, there are tools available to assist in identifying populations, creating monitoring procedures, and managing landscapes sustainably with the goal of improving pollinator health and supply.

These assessment and monitoring techniques and tools should be required in situations when foreign bees are brought into an ecosystem, the number of colonies is raised, or there is a huge influx of bees in order to avoid environmental deterioration. Both controlled and wild pollinators may be monitored using simple-to-use instruments. Beekeepers are significant environmental stakeholders who may have a significant impact on how a landscape is managed. They may enhance the environment and persuade others to do the same by their frequent observations of nature, their knowledge, their contacts with other stakeholders, their legitimacy with shared benefits from their bees and partnerships, and their awareness-raising. Beekeepers, farmers, pastoralists, forestry professionals, indigenous knowledge holders, watershed managers, and scientists are just a few of the many diverse players that might contribute to the management of the landscape[5], [6].

At the landscape level, it is advised to preserve, promote, and secure links between some of the essential elements on which pollinators rely, particularly to avoid the construction of large distances without good habitats. This may be done by establishing natural spaces with native flora that has a variety of densely packed blooming plants that can act as nectarines. Natural spaces may grow along streams, surrounding or inside fields or populated areas with hedges, trees, uncultivated regions, or woodlands in agricultural and urban environments. When agricultural systems are maintained using an ecological strategy, pollinators may also profit from the interactions between agroecosystems and weed control. For nesting and foraging, many pollinators rely significantly on forests, and the number of forests in a landscape affects the pollination services provided to many wild plants and crops.It is also advised to use diversified management that considers ground-nesting bees and blooming seasons in order to maintain and promote landscape heterogeneity and patchiness with tiny plots of different plants. This broadens the variety and interconnectedness of habitats and supplies for floral pollinator nesting. Ecosystems must be kept in good working order in all types of weather, particularly in areas where honeybees are transported periodically to provide effective pollination services.

In farming, in addition to these landscape practises, geographical and temporal variety may be combined to promote variability and connection within fields. In order to produce diversity in flora, flowers, and soil, several agricultural practises may be used to cultivate a variety of crops on small, spaced-out plots. By cultivating crops that blossom at various times, staggered mowing or harvesting, and intermediate flowering crops, temporal variety may be produced.Forest management in forestry may promote spatial and temporal variation in tree communities and habitats, repair damaged forests, and have a big impact on pollinator diversity and abundance. Selective logging, thinning, or coppicing. controlled mowing or grazing. or planned burning, maintaining a mosaic of burnt and unburned regions, may all be used to increase heterogeneity. In particular, cavity-nesting and ground-nesting bees may benefit by maintaining standing and laying dead wood in forests and making sure there is enough bare ground. Bees are remarkable animals not just for their organisation and collective intellect, but also because they pollinate plants, which is a crucial function for both people and environment. For many beekeepers, keeping bees gives them both joy and food and money. But if beekeeping is to be sustainable, bees and the environment must work together for the sake of both.

Beekeepers must be conscious of the local effects their managed bees may have on the environment. They have a duty to protect the environment from their honeybee colonies' damage and to modify their methods in order to preserve the ecosystem's sustainability. They have the power to enhance the environment and intervene in landscape management, fostering biodiversity that helps bees, other pollinators, and nature in general.On the other hand, producers must also be conscious of the negative impact that pesticides and all other environmental toxins have on bees. The ministries of every nation must make sure that any pesticides that enter the market have no negative impact on the environment, the health of people or animals, or any other unwanted repercussions. Together with policy makers, beekeepers, farmers, and other stakeholders should take responsible action to safeguard bee populations, environmental quality, and biodiversity. That is likely the only way to guarantee food security for next generations.

Only eight out of the 20,000 species of bees, with a total of 43 subspecies, are honeybees: Apis cerana, Apis dorsata, Apis florea, Apis andreni-formis, Apis koschevnikovi, Apis laboriosa, Apis mellifera, and Apis nigrocincta. An summary of honeybee behaviours, ecology, feeding, and reproduction follows at the beginning of this chapter. The emphasis shifts to include Apis mellifera, Apis cerana, Micrapis, and Megapis after that. The goal of this chapter is to provide a short overview of the behavioural ecology, nutrition, and breeding habits of Western and Eastern honeybees. It primarily focuses on social and behavioural qualities that may be threatened by contemporary dangers such pesticide exposure, nutrient-poor environments, and unpredictable weather. Additionally, it offers suggestions on how to enhance bee welfare by outlining recommended practises for sustainable beekeeping and healthy bee behaviour.A superorganism is made up of many people who have similar traits cooperating together. Eusocial insects like the honeybee, which depend on work division among specialised units, are the ideal illustration of such complex systems.

Each unit relies on the health and efficiency of the others in order to survive, and they all work together to create the organised colony dynamic. A healthy hive of honeybees normally has three adult castes: the queen, workers, and male bees, sometimes known as drones. The average number of honeybees in a healthy hive is between 5,000 and 65,000. The queen bee, who may produce up to 250 000 eggs a year, is the only actively reproductive female in the beehive. The biggest caste, which is solely composed of infertile females and forms the foundation of the colony, is the labour caste. Worker bees are assigned responsibilities inside the hive based on their age. Bees advance from inside-the-hive chores to those outside the hive, albeit this follows a rather flexible pattern. Younger bees often begin by cleaning and capping cells before moving on to brood and queen caring. They proceed to nest-building and food-handling duties after that, followed by hive guarding. Older bees are in charge of outside tasks including foraging. While drones immediately perish after mating, they are in charge of fertilizing virgin queens during their nuptial trip. This technique allows for the selection of advantageous features across many generations and guarantees that the beehive has sufficient genetic variety. When food becomes limited, drones who are unsuccessful during mating season are expelled from the colony[7], [8].

Caste-specific pheromones are secreted by honeybees to communicate. The queen bee emits a complex blend of pheromones supporting workers and drones, known as queen signals. She regulates behavioural and physiological functions to uphold social peace, establish reproductive hierarchy, and maintain stable circumstances inside the beehive via this chemical communication. This entails controlling worker behaviours, preventing worker reproduction, and preventing the raising of fresh queens. The degenerative dynamics that occur after the queen's unintentional death provide as proof of the pheromones' exclusive function. If the colony is unable to produce a new queen, the extended absence of queen signals causes the castes to be unable to carry out their individual duties and ultimately results in the colony's demise. Although worker pheromones are not as important as the queen's signals, they are just as important for sustaining colony dynamics, helping to control worker behaviour, and connecting with food marking and foraging. They also exhibit protective behaviours as a result of hiding alarm pheromones. Drone pheromones are mostly associated with mating, highlighting the comparatively little role played by male bees in the dynamics of the colony. Honeybees also employ dancing, a highly specialised form of communication. It is believed that ritualized dances, which are essential to nest-site construction, developed in this environment. Foragers employ the waggle dance to communicate details about the whereabouts, nature, and aroma of a food source. The returning worker inserts herself in a certain location of the hive and starts waggling her abdomen while walking straight. This is done when a new food source is discovered. She then makes her way back to where she started by roughly following the shape of an eight. The direction and distance from the nest to the foraging area are communicated via the waggle dance. Depending on the quality and accessibility of the food supply, it may be repeated. When supplies are harder to obtain, geographically grouped, or of varying quality, this nest-based communication is useful for foraging.

A honeybee brain has a volume of around 1 mm. Bees possess exceptional cognitive skills that were originally thought to be unique to creatures with bigger and more sophisticated brains, despite their little size. To better understand its principles and processes, honeybee cognition has been the subject of several investigations in well-regulated lab settings. The first person to explain bees' capacity to recognised various flower designs was Karl von Frisch. Further research indicated that honeybees are also capable of learning the orientation of such patterns as well as other qualities like symmetry, with a preference for radial and circular symmetries that are more reminiscent of floral symmetry. Additionally, honeybees may be taught to navigate labyrinths and mazes by imitating colors and symbols, and more recent research has shown that they are capable of counting up to four items while flying. Bee cognition has been extensively studied in the literature, and it is unquestionably regarded as a distinguishing trait of the species.

Foraging success depends on the ability to learn and remember. Bees learn to correlate fragrance, colour, texture, and patterns with favourable rewards, such as nectar and pollen, by observing the visual and olfactory cues used by flowering plants to entice pollinators. But how can a bee choose among so many distinct flowers, each with a unique look and reward characteristics? The most valued flowers in terms of nectar and pollen are finally chosen by bees. They are drawn to flowers at first by their intrinsic inclinations and then come back to them because of their experiences. In order to identify and recognised significant forage items and maximise the effectiveness of each foraging excursion, bees depend on the integration of these multisensory signals. The diversity of the cues affecting bees' decision-making has been further highlighted by studies that identify blossom temperature as another characteristic influencing this reward-driven process. Bees' cognitive skills let them function well in a challenging, often disorganized environment of sensory stimuli. We shall discuss how human and environmental stresses are now threatening these brain processes later on in this chapter.

In the study of behavioural ecology, personality is defined as a collection of behavioural traits that are seen to persist through time and context in an individual's life. Worker bees have previously shown how they switch between tasks based on their age, displaying a unique behavioural repertoire that is task-specific. Even among individual workers doing the same activity, persistent personality variations in bees have been seen in a variety of circumstances. People may have aggressive tendencies, execute activities with varying degrees of energy, and be more or less socially interactive. The idea of personality may be used at the colony level in highly integrated eusocial insect systems. Natural selection is thought to play a significant role at the colony level, so different colony personalities may result in differences in reproductive success and survival. Different colonies are known to have different temperaments and activity levels, showing variation in foraging intensity, defensive response, comb repair and undertaking. Colonies that are collectively more active when foraging have better access to the resources needed to maintain the hive's structure and provide food for its inhabitants, which leads to a hive that is more productive. Even though the relationship between higher defensive reaction rates and increased survival chances is less clear, they are related. The study of individual and group personality in honeybees is crucial from a scientific standpoint, but it also helps us protect bees and, hopefully, stop their further decline by providing a more sophisticated understanding of how colony temperament and performance may be harmed by environmental and human-made changes.Threats to honeybee behavioural performance Since it was discovered that numbers of honeybees and other pollinators were dropping in an alarming manner, a lot of attention has been given to potential dangers to those insects' health. Many have been noted, such as the depletion of floral resources in the environment, climatic stressors, and chemical exposure. All of these elements work together to reduce bees' general fitness and raise their vulnerability to illness and colony collapse.

Pesticides may be especially hazardous because they obstruct the cognitive functions that allow superorganism survival at the behavioural level. The primary active ingredients of many commonly used pesticides are neurotoxins, which have deadly or non-lethal effects on the neurological systems of bees. A sublethal amount of exposure may not cause the bee's immediate death, but it can harm its cognitive functions, often resulting in behavioural impairment. Regardless of the drug administered, adverse effects all have an influence on general cognitive function, with learning and memory processes being consistently harmed. The memory mechanisms required for navigation from the hive to flowers may be interfered with, and the bee may lose the ability to properly interpret sensory signals leading to lucrative foraging resources. Additionally, navigation may be hampered, especially in terms of energy consumption and the transport of food back to the hive. As the colony's overall health declines, so does the desire to forage. The outcome is irreversible decrease, which finally results in colony extinction. Recent research has also shown how the queen's exposure to pesticides throughout her development alters her pheromone production and mating behaviours, potentially leading to colony collapse. Therefore, there is a need for more precise pesticide control in agriculture to safeguard pollinators from dangerous substances that might lower their overall fitness and prevent the physiological development of structures that are essential to their behavioural ecology[9], [10]. A concern to the quality and security of bee products is pesticide exposure. Pesticides should be tested on bee products before they are sold to consumers. Furthermore, beekeepers often use miticides, which infect young bees and bee products, to fight pests like the mite Varroa destructor. The prudent use of medications to bees is essential for this reason as well.

CONCLUSION

To build bee-friendly settings, materials must be available for both controlled and wild bees. Landscape management techniques, including shrub protection, intercropping, and nectar-rich crop farming, support bee environments. Monitoring insect variety, learning about their behaviour, and using local knowledge add to informed field management.Assessing and tracking pollinator populations becomes important when adding foreign bees, growing hive numbers, or having substantial bee influxes. Beekeepers play a vital role in field management through observations, relationships, and awareness-raising.Preserving important natural links, promoting diversity within areas, and considering nesting and growing seasons are recommended practices. These methods improve ecosystem variety and connections while supporting flower insect nesting. Sustainable field management is important for ensuring bee health and the supply of pollination services.In conclusion, farmers and environmental groups must cooperate to protect bees and their environments. The drop in bee numbers poses threats to food security and natural safety. Strategic management, responsible pesticide use, and habitat protection are important for supporting the delicate balance between bees and their surroundings.

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CHAPTER 7

NAVIGATING CLIMATE CHANGE CHALLENGES FOR HONEYBEE WELLBEING AND LANDSCAPE PRESERVATION

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ABSTRACT:

Climate change is having a deep effect on the makeup of areas, changing the availability of supplies for honeybees and other wildlife. This paper studies the complex link between climate change and landscape makeup, showing the possible risks it presents to honeybee colonies and their ability to adjust to changing environments. It studies the impact of environmental factors, such as temperature, humidity, water supply, CO2 levels, and UV rays, on the quality of nectar and pollen made by plants. To minimise these risks, beekeepers and experts are urged to cooperate on data collection and environmental tracking. The paper also emphasizes the important role of beekeepers in keeping honeybee populations and explains best practices for supporting bee well-being, including promoting different farming practices, reducing stress factors, and avoiding chemical exposure. Ultimately, the paper underscores the importance of community efforts to protect honeybee health, encourage sustainable beekeeping, and raise knowledge about the important ecological role of bees and the need for healthy pollinators in our modern society.

KEYWORDS:

Agricultural, Climate Change, Honeybee, Healthy, Wellbeing.

INTRODUCTION

The conduct and productivity of the colony are greatly influenced by the surroundings. Honeybees have a wide range of adaptations that enable them to live in a variety of habitats. Nevertheless, honeybees are becoming more and more harmed by environments with limited resources. Ecological deserts are often produced by intensive agriculture and poorly managed semi-natural regions, which fail to feed honeybees and other wild animals with enough nutrients, causing habitat loss and resource fragmentation. When these variables are added to the existing climate uncertainty, they all become much more worrying. Researchers wonder whether changes in climatic factors including temperature, humidity, water availability, CO2 levels, and UV radiation may influence plants' capacity to produce high-quality nectar and pollen. To better understand the connection between climate change and honey production, beekeepers may work with scientists to collect data and monitor environmental factors. The possible harm that a changing climate might have to the well-being of honeybees is difficult to quantify. We must be careful when deciding which factors may further affect bees' capacity to adapt to resource scarcity given how degraded contemporary environments already are. Environments that are now lucrative might gradually stop producing, which would lead to less effective production and even colony collapse.

Beekeepers have a very important and responsible role to play in sustainability and bee care. Current concern for pollinator welfare has sparked scientific inquiry, inspired national and international organisations to look into the factors contributing to the fall in bee numbers, and encouraged spending on bee conservation. To assist beekeepers better comprehend dangers and guard against them impairing colony health, knowledge should be made available to them. Behavioural and activity changes may be used to forecast colony demise. Beekeepers are familiar with and attentive to their colonies, and they may be crucial in identifying the first indications of behavioural disturbance, which point to ill health[1], [2].

Encourage bee wellbeing

A successful sustainable beekeeping model should constantly priorities actions that support biologically sound and secure environments, enable the expression of inherent behaviour, and lessen pain and discomfort. Although hives provide the bees a good habitat, as was addressed in chapter 7, the environmental and human-induced constraints on the surrounding landscapes nevertheless have a significant influence on their wellbeing. The key to physiological health and well-balanced nutrition is creating an environment that is appropriate with a variety of foraging materials accessible throughout the foraging sea- son. This is why we advise beekeepers to think about involving agricultural producers and organisations in their framework for responsible beekeeping. The public might provide a lot of assistance as honeybees become a more prominent species. It is now hard to decrease market demand for goods that depend heavily on honeybee labour, but changing that demand to sustainably produced bee products could be a viable option. Campaigns to educate the public about bees, biodiversity, and organic foods will also help them understand the issue. Similarly, raising consumer demand for sustainably produced beekeeping goods might benefit the interests of bees, beekeepers, and the environment by raising awareness of the need of healthy bees and sustainability.

Protecting floral variety can help bees' diet and health.Depending on the plant type, pollen has a wide range of nutritional value. Adult worker bees depend on flowers' nectar and pollen supplies. These foods provide the protein, carbs, fats, and other nutrients needed to sustain normal biological functions. The mass blooming crops that are mostly grown in monoculture farming could not provide enough nutrition for a balanced diet of honeybees. It has been shown that nutritional deficiencies make bees more vulnerable to infections and susceptible to illness. Beekeepers need to be mindful of the effects that a nutrient-poor environment might have on the health and productivity of their hives. Crop rotation and organic farming are examples of agricultural pollinator-friendly practises that should be supported and valued in a sustainable beekeeping strategy. Beekeepers should be encouraged to locate their hives next to agricultural polycultures that support a variety of plants and animals. Including wildflower patches among agricultural cultures may also assist to guarantee a diverse bee diet. Adding spaces appropriate for nesting and foraging, boosting the supply and accessibility of natural shelters, and creating corridors to reconnect fragmented habitats are all measures that may be put into practise in urban and semi-natural environments.

Control stress factors and avoid pesticide exposure Beekeepers should think about how stress affects honeybee wellbeing in order to maximise production and protect a colony. The detrimental consequences of oxidative stress on a variety of physiological processes in bees are well-known. As was already noted, large-scale agriculture relies on pollination, and it has been shown that migratory beekeeping practises are linked to higher exposure to stressors and shorter lifespans. Oxidative stress, which has both modest and significant detrimental impacts on bee health, is a consequence of poor nutrition due to nutrient-limited availability, recurrent evaluation and readjustment to new environmental settings, and increasing exposure to agricultural chemicals. Chronic stresses are considered to be linked to colony failure because they may impair the immune system, metabolic functions, and cognitive function. Therefore, it bears emphasising how important pre-venting pesticide exposure is. A network of communication between beekeepers and nearby farmers would provide efficient communication and permit the temporary transfer of bee colonies in situations when the use of pesticides may be absolutely essential[3], [4]. Cooperation between beekeepers and farmers would grow if more information on the importance of bees for pollinating certain crops was made available to farmers. Finally, beekeepers may work together to develop regional databases that monitor threats as well as positive or negative trends in bee production and overall health conditions.

DISCUSSION

Improving the health and well-being of honeybees is a job that takes a great deal of community work. In giving this list of possible answers, we must also stress that many natural and man-made obstacles may combine in ways that we cannot prevent. With these limits in mind, sustain- able beekeeping should focus around honeybee behavioural ecosystem. In short, we should support organically managed areas around apiaries, ensure that food diversity is kept, and consider the introduction of bee-friendly plants while also pre-serving naturally occurring wild plant species. Beekeepers should be taught on how to keep strong and healthy bees, and a rewards system should be in place for beekeepers and farms dealing with low-impact care of their animals and/or plants. A tracking system should be developed to identify abnormal death rates linked with the misuse of pesticides, with investment in technologies aimed at building a reliable network of data concerning population trends. Veterinarians should be trained to effec tively assist beekeepers, ensuring that veterinary goods are used properly. The acceptance of local bees should be supported, as they are better able to deal with the limits of their natural area. More generally, public understanding should be raised through efforts on the vital ecological services carried out by bees and the important need for healthy pollinators and wildlife in our modern soci- ety. Finally, we need to push market goods from properly managed resources of farming or animal origin. A more ecologycentred method can only benefit the present situation, raising awareness and building the knowledge necessary for success and further real action.

Feeding honeybee colonies: best practices Beekeeping is an old form of animal care. How-ever, when compared with other modern animal or food production methods, it is far behind in its use of technology. As part of the agricultural industry, which is an important part of food production systems, beekeeping supports jobs in rural areas and naturally promotes safe farming practices. It is essential that states support measures that can develop it further to improve resiliency. One way to do this is by building links between the beekeeping sector and other farming businesses, especially food production since this directly affects the well-being of honeybees and their feeding sources.Farming practices directly impact honeybee health and diet. Farmers must try to lessen their use of bug poisons where possible. Planting flowering plants in field edges boosts food. These techniques are especially important for tree and food crops. Ground greenery provides a rich and diverse source of nutrients for all insects and also improves total colony yields. Furthermore, cultivating flowery bushes around the fields helps to avoid the spread of dangerous pests through crops, while also increasing the food available to pollinators. Such practices are already being adopted in several European countries such as the Germany, Portugal and the United Kingdom.

Promotion of knowledge-sharing and communication centres: One main obstacle to good farming is the lack of spread of up-to-date information on changes in the industry. Promoting local beekeeping groups and organizations helps the spread of information on better feeding practices to all farmers. Such organizations should have a top-down method. Central/national beekeeping organizations could collect the latest science information on bee feeding and relay this to farmers in a digestible manner. They could also perform quality control of feed on the market, which is currently not tightly regulated. In addition, these groups could send local cli- mate and flower information to their local networks telling them of food conditions and when to feed the colonies with vitamins. Some make a local flower schedule, which helps beekeepers proactively plan their apiary management for upcoming gathering season.

Establishment of buying infrastructures: One problem we have seen in beekeeping groups is purchasing beehive things at a fair price. Having a single group, like a union, that can bring together food goods for several beekeepers, would help handle costs. Syrup quality can also be better controlled by bigger organisations. Cooperatives are useful for centralizing buying and selling farm beekeeping goods like honey to different markets. Without such facilities, some farmers might be limited to their local markets and have extra difficulties in selling their goods. Several small farmers combining have more strength than just one big farmer. Establishment of a crisis framework: In the summer of 2017, Portugal was destroyed by forest fires, with 70 people killed and more than 440 000 hectares burned. Soon after, beekeepers fought to keep their bees healthy and wanted government help. This led to the creation of a beekeeping crisis framework, where beekeepers have access to highly supported feed items to nourish their bees. The framework is still in place, and if a similar event happens, it will be revived so that local beekeepers' groups can quickly assign food goods to bees in need. Similar action has been taken in France, Italy and Spain, and it is a lifesaver for bees in times of trouble. Such action can also be adapted in times of extreme flooding or heatwaves[5], [6].

Honeybees take sweet solutions and pollen from plants, and water from the surroundings to meet their food needs. Nectar is dried, enhanced with enzymes and stored as honey, and pollen is mixed with honey and kept as bee bread. Honey powers bee catabolism by giving energy from carbs, especially during hunger times lasting months at a time, such as winter. Bee bread, which is largely eaten by nurse-age adults, is honeybees' source of protein, which is needed for mammary growth to make brood food . In a general way, it can be said that the feeding of a colony is necessary whenever it is empty of feed or close to be. Supplemental food of bees may be necessary to assure suitable stores for wintering. It is also needed in times of food shortage due to weather factors or when breaking groups to form new ones. Providing bees with a setting where hunger is alleviated by the presence of varied and plentiful plant supplies should be the top goal of all beekeepers. High-quality and diverse flower products best support colo- ny growth and bee health. This chapter shows how to spot hunger in a colony and how beekeepers can act to support them by feeding humanmanufactured carbohydrates and proteins. This is a best practice for cattle based on the concept that animals should be free from hunger, malnutrition and thirst. It also covers measures taken to protect hive products for human consumption from feed adulteration when colonies are supplied.

Keeping honeybee colonies properly fed is essential. In mild regions, there are two periods in which colony losses are most common due to serious food short- age: first, during the summer peak and, secondly, over the winter period . Beekeepers should always pay special attention to the hive's nutritional state, to ensure that colonies are capable of beating the nutritional stress caused by lack of food, heavy farming and climate change. Assuming that all diseases are in check, a group needs to have sufficient food stores and a healthy population to overcome times of shortage. A minimum population covering five frames of bees and six frames of food stores is considered the standard to ensure colony survival when overwintering in Mediterranean climates. In areas with more lengthy and colder winter seasons, colonies will require bigger numbers and food stores to survive the extra months without hunting.These include knowledge about how to spot when groups are hungry for sugars and proteins. The most serious food starvation happens when bees consume the brood and the hive is totally empty of honey stores. This part aims to help beekeepers in different conditions and areas keep their colonies well fed. It gives suggestions on how to spot and improve lack of food throughout the year. However, we are faced with a very real problem: hives come in different shapes and designs. We have therefore not included colony weight as a measure of colony food state, but rather bee-frame area coverage and honeybee activity inside and outside the hive. Learning how toread bee frames and hive opening behaviour is a critical skill for every farmer.

Sugar starvation

Honeybees fill combs with food sources such as honey, sap and bee bread. Recently gathered nectar is a bright shiny liquid found inside empty comb cells. Bees remove the water from the nectar to prepare it and turn it into honey. In situations of major food flow, bees start making pure white wax, which is clearly noticed when they are cap- ping their honey or building new combs. When all frames in the brood nest are full of honey, beekeepers usually place a super on top to make honey for human consumption. It is important for a colony to keep its nutritional homeo- stasis with ufficient honey stores. not having enough stores, especially near the brood area, is the first sign of a chain of colony problems. For instance, healthy brood frames have bee bread and honey surrounding the centre brood area to provide enough energy for their kids. Ideally, a group should hold sufficient food stores all year round. This is a problem because of stress factors such as anthropo- genic-driven changes to landscapes and growing season- ality. When the growing season ends, beekeepers collect honey and ideally leave all frames in the brood nest untouched. It is important not to over-harvest honey and to pay special attention to the colony’s nutritional state when checking it. Colony food starvation comes on gradually, and there are early signs that you can spot before they get to a critical stage. These are based on two observation levels: before and after opening the hive. Remember to record the observation date of nectar flow and wax production on your food log and keep an eye on colony hunting activity[7], [8].

Pollen starvation

Pollen is collected by foragers and stored inside the comb cells as bee bread. Pollen gives the colony with protein, fat and other vitamins, and is necessary for a honey- bee colony to make new brood. Flowering plants vary in the quality and amount of pollen they provide for hungry bees. For this reason, it is important to keep bees in a diverse setting. Nevertheless, it is often difficult to keep apiaries in perfect natural conditions. As a result, some beekeepers are migratory and move their bees to different areas to follow the growing season.Adult nurse bees eat bee bread to make brood food, a milky protein-rich substance that they feed to the larvae . The absence of pollen entering the hive and a following lack of bee bread badly affects the colony’s brood-rearing ability, even in the presence of abundant honey stores. This is especially important in fall, when winter is coming and pollen sources are scarce, and also in summer in dry areas. This effect is worsened in monocultures where blooms ends suddenly, leaving strong hives with big bee numbers but limited food stores. If a colony is without bee bread or pollen for more than a week, it will stop feeding its larvae, losing its ability to make more children. Adult honeybees can live on a strict sugar diet for up to 60 days straight.

Water is an important nutrient for honeybees, and they will search especially for it. It is important that beekeepers ensure there are fresh water sources near their apiaries, especially during the summer season or in usually dry desert areas. Water is a key component for in-hive thermoregulation and allows bees to lower brood temperature on hot days. It is also needed to make brood food, and is a source of important mineral elements such as salt. For this rea- son, you might find bees drinking water from small ponds, rocky cracks and even seawater from coastal beaches. Water loss can cause very dry, pasty stools, a sickness that some European countries call May disease. Only baby bees are affected, and it can be managed by giving highly diluted sugar to water solution. Beekeepers should look out for spreading movement at the hive door. This is when groups of bees gather at the door on hot days and start hitting their wings with their legs stretched out and their abdomens looking upwards. Observation should cause you to ensure that water sources are refilled with fresh water and provide extra water sources near your apiaries. This will lower bees' trip time to collect water, making the process more efficient. Add floating objects as bases for bees to land on to prevent them from dying.

Nectar is mainly made of water, simple sugars and double sugars . Nectar chemical composition varies according to plant species. Nectar can contain other simple and double sugars, sugar alcohols and oligosaccharides in small amounts. Not all naturally occurring sugars are good for honeybees, and some, such as the simple sugar galactose or the disaccharide lactose, are poisonous if above 4 percent. Work- er bees add invertase enzymes to nectar to break down disaccharides and lower its water content to make honey. Differences in the nutritional value of honey and that of food sources supplied by farmers are highly discussed. This is an important problem because if honey is harvested, giving processed sugars is often inevitable. This part does not describe the differences between giving honey and sugar, but instead gives suggestions based on scientific study.Sugars used to feed colonies can be taken from several plant sources. A range of syrups have been used over time and in different areas. In some areas, processed sugars may not be available or economically feasible, so syrups from different fruit or grains are used. It is important to say that not all of these syrups are acceptable. Plant-derived sugars are chemically the same as those found in nectar, but syrups can vary in their sugar makeup. Sugar makeup influences the physico-chemical qualities of syrups and their draw to honeybees. For example, syrups containing glucose solidify quickly, making it unusable as food. Furthermore, any substances harmful for honeybees that include the sugars stated earlier should be avoided.

Where processed sugars are available, the huge choice of goods can be confusing. Although differences arising from giving different sugar-based goods have been reported, these differences are not always stable. This has led in a lack of agreement on which sugars to suggest. Probably the most common syrups are self-made sucrose solutions produced from sugar beet or sugar cane. Sucrose solution is made in 1:1 to 3:2 sugar to water ratios. It is important to remember that this amount mostly relies on the aim of food and the surroundings. For example, package bees or nuclei are sometimes fed with smaller amounts than colonies ready for winter. Solutions made straight from sucrose crystals usually contain negligible amounts of other sugars or toxic toxins . Sucrose liquids are steady for the short time bees take to eat it.

In the twentieth century, molecular reversal of sucrose into its two simple sugars, glucose and fructose, became possible, which is similar to what the bees do when they make honey. Inverted syrup is now commonly commercially available and has several advantages over sucrose, such as longer shelf life. However, if inverted syrup is made using heat or acid, this can make by-products such as hydroxy meethylfurfural. This substance is poisonous to honeybees even at low amounts. when a syrup is bought this should be below 0.003 percent. New production ways of inverted sugars make low amounts of HMF. However, if in doubt, we suggest getting a data sheet from the maker. Similarly, high-fructose corn syrups are made from corn starch, which is broken down into glucose and fructose. For safety and other reasons, makers sometimes add sugar to the end product. Both inverted sugar syrup and high-fructose corn syrups contain the three most important sugars: glucose, fructose and sucrose, in different amounts. How- ever, these solutions lack the secondary plant chemicals of honey, which do not have calorific value but have been shown to trigger physiological effects on beekeepers[9], [10].

Syrups are eaten by worker bees and kept in cells, similar to what they would do with arriving nectar. However, a downside of syrups is that they can contaminate honey and drown the bees. The use of Good Beekeeping Practices saves honey purity and quality and the good image of honey widely. The product and amount given, the time of feeding, the consumption of feed by bees, and the technique to test honey will decide the chance of discovery of foreign sugars in honey. Only items with a uniform makeup should be used for bee food. Fondant is an option which works well when feeding bees during cold spring snaps. Fondant includes microscopically fine sugar crystals in a film of syrup, often wrapped in plastic and put on the top bars of a hive. It is widely sold or can be home-made.Syrups should contain only sugars suitable for honeybees. It is important to point out that HMF concentration can rise during storage, especially when syrup is kept at higher temperatures. We therefore recommend keeping feed in a cool, dark place. Another common problem is fermentation of syrups in the colony, which can be avoided by:

1. Using goods and clean feeders not contaminated with mould.
2. Using more potent syrups.
3. Giving bees with amounts they can eat with- in a week.
4. Removing any syrups that show signs of fermentation.

A number of feeders have been developed to feed honeybees. Syrup can be fed using specially modified frame feeders or top hive feeders. Feeding outside the hive should be avoided because it causes robbing behaviour and aids the spread of diseases. Spilled sugar also boosts robbing and should be cleaned up where possible. One way to avoid robbing habits is to feed in the evening. Fondant wrapped in plastic can be put on top of frames and is useful during dearth times due to its slow release and low water content. It is also important to protect hive products from adulteration by not feeding honeybees with syrup prior to a honey harvest or during a possible honey harvest. While it is not damaging to consumer health, very few amounts of sugar syrup can be identified by current equipment. Timing of feeding is important and honey pollution risks need to be judged by both time of year, nectar flow and hive strength. A risk estimate of extra feeding is always strongly urged.

Timing and amount of food is as important as the choice of feed. Acute food shortages can only be partly handled by feedings, as colonies will not always drink syrups. It is therefore recommended to tailor food to local factors. In northern mild regions, for example, core feeding happens after honey gathering, when empty food stores are replenished with syrup. Depending on the local conditions, 10 to 20 kg of dry sugar in the form of syrup should be fed to each colony. This should be done before temperatures are too cold for bees to take up the juice and store it in cells. Another important time is when colonies risk running out of food stores at the end of winter, before enough new forage is available. Food stores should be managed by moving colonies or using a bee scale. Fondant can be given if the bees need feeding.Pollen is a complicated food source that includes a mixture of protein, carbs, fats and vitamins. It is a bee colony’s only natural protein and fat source, and nurse bees use this food to make brood food to grow their babies and keep healthy young bee populations. Each bee can take up to 10–20 mg of pollen, and colonies generally store a maximum of about 1 kg. Over the course of a year, single 10-frame sized colony needs approximately 13–18 kg of pollen to maintain good growth. Disruption of pollen flow is caused by foreign sources that cannot be controlled by beekeepers. However, having many bees in a single place and overharvesting pollen can also regularly cause limited pollen supply. Protein shortage is well known in expert apiculture. Several companies sell pollen replacements to boost colonies made of plant protein powders such as soy, wheat or pea protein. algae, and/or brewer's yeast.

These feed products can come in different forms. Liquid meals are given as a concentrated addition that bees dissolve in sugar syrup. Powder additives are a meal that is turned into a cake when it is mixed with sugar syrup. Pre-made burgers can also be bought straight from several makers. However, many of these companies have recycled feeds from other animal feed markets with few or no changes for bee behaviour. Moreover, some make extraordinary claims about their products' positive effect on colony health and growth. Such claims should not be taken at face value because few countries control what is fed to honeybees and few have been independently tried by scientists. Furthermore, some pollen alternatives may also be made with allergens, which must be stated on labels in many countries because they can cause serious allergy responses and death. Honey testing should be carried out prior to sale to the customer to ensure no contamination.Finally, the case of bee feeds containing ingredients from GMOs should be considered since they can constitute a source of contamination of the bee products where GMOs are forbidden. Currently, there are no bee feed products on the market that are comparable with the chemical composition of natural pollen. It is possible to make cakes out of honey- bee-collected pollen. However, feeding colonies with honeybee-collected pollen made into patties can be both expensive and dangerous due to the chance of cross infection if the pollen is bought from another geographic area.

Providing energy after winter increases the colony number for the upcoming spring season, while eating during a dearth period will keep the colony healthy until conditions improve. Beekeepers should not feed protein when colonies have naturally stopped their brood-rearing cycle, as happens every year during winter. Commercial pollen replacements contain an average of 15 percent protein mixed with other fats and minerals. Beekeepers can make their own pollen replacements.The main goal of giving protein to your colonies in the form of a pollen replacement is to keep or increase brood production. Brood production is important for preparing colonies for pollinating, honey production, queen-rearing, and making new colonies. For example, commercial beekeepers in California may feed their colonies protein from October to February to promote colony growth and achieve healthy 10-frame hives for almond pollination. In comparison, beekeepers in Mediterranean Europe feed their colonies protein between February and April, just before the spring bloom, to improve colony health for honey production. As for carbs, eating during nectar flow or before the honey harvest carries the risk of honey contamination.

CONCLUSION

In conclusion, climate change offers major challenges to the well-being and longevity of honeybee hives, changing their food sources, environment, and general health. The effects of climate change on landscape makeup are far-reaching, with consequences for both wild and controlled honeybee populations. In the face of climate change and its effects on honeybee environments and food sources, healthy farming practices, environmental protection, and joint efforts are important to ensure the survival and well-being of these crucial insects. Beekeepers, experts, lawmakers, and the public all have a part to play in saving beehive numbers and keeping variety in our environments.The two times when beekeepers should consider feeding pollen substitutes to colonies are soon after winter and when the brood cycle is being disturbed by lack. To sum up, climate change brings difficult and diverse challenges for the health of honeybees and preserving the environment. Increasingly hot weather, changing patterns of climate, and the loss of places for them to live all pose a danger to honeybee populations and the environments they help sustain. But, if we work together, we can reduce these challenges.

It is very important to address climate change by reducing greenhouse gases and taking care of the land in a sustainable way. Moreover, it is crucial to help bees stay healthy by using pesticides responsibly and restoring their habitats. Working together with scientists, policymakers, farmers, and the public is very important for finding long-term solutions.The future of honeybee health and protecting nature's beauty depends on finding a good balance between taking care of the environment and how we manage farms and crops. If we all work together, we can make sure that honeybees keep doing well, which will help our environment and also make sure we have enough food worldwide.

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CHAPTER 8

COMPREHENSIVE INSIGHTS INTO HONEYBEE BREEDING, MANAGEMENT, AND GOOD FARMING PRACTICES

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ABSTRACT:

This abstract offer a thorough summary of numerous topics pertaining to beekeeping, honeybee breeding, and ethical agricultural practises. It addresses issues like bee nutrition, reproduction tactics, managed mating, and hive management. To preserve the long-term health of honeybee populations, the abstract highlights the significance of locally adapted bee populations, sustainable breeding techniques, and the necessity to strike a balance between selection strength and genetic variety.The abstract also examines how policymakers, breeding specialists, and beekeepers all play important roles in carrying out successful honeybee breeding strategies. It emphasises the importance of assessing breeding programmes of all kinds, including commercial, scientific, and conservational endeavours.Additionally, the abstract covers topics like apiary site, hive management, disease control, and honey harvesting as they pertain to the significance of good farming practises for beekeepers. It emphasises how important it is for beekeepers to keep their colonies healthy and safeguard them from dangers like Varroa mites.Overall, this abstract offer useful insights into the intricate world of beekeeping, honeybee breeding, and the crucial procedures that support the sustainability of beekeeping operations and the health of honeybee populations.

KEYWORDS:

Bees,Breeding, Farming, Honeybee, Management.

INTRODUCTION

Bees eat pollen replacements in situ if they are put on the top of the frames or in a top feeder within the hive. In our experience, they do not store the pollen replacement in the comb as they do with pollen. Instead, they eat it themselves to make brood food or feed it to late-stage worker larvae. Even so, sugars from the product can be found in the honey shops. When there is sufficient pollen available in the surroundings, honeybees are likely to reject any pollen replacements given. For this reason, the best time to feed protein is before the pollen flow or when hives are in protein shortage, which usually happens when beekeepers make large colony splits. Any extra pollen substitute should be removed from hives because it can become mould or a base for bugs like the small hive beetle. A well-functioning honeybee breeding plan needs organised inputs from multiple parties, including officials representing the State/country, individual bee- keepers and their breeding/regional groups which usually act as a management board, and breeding experts. The three groups work jointly to ensure proper implementation of the plan. Beekeepers are responsible for actions at the apiary level, including. The suggestions in this part are meant for the Western honeybee , but most can also be applied to the Eastern honeybee . Management of test apiaries, efficiency testing and queen production.

A breeding/regional group, which has a key place in the breeding infrastructure and which often includes beekeepers and breeding experts, is involved in planning mating control, queen selection and queen exchange. Policymakers are responsible for funding and ensuring the longevity of such projects, as well as the will of the country to keep and improve local hon- eybee stock. The breeding/regional group is also usually in charge of programme management, synchronization and harmonization of activities, and capacity-building, and takes part in the review and decision-making process of the project's breeding goal and overall performance. Finally, data review and estimates of breeding values are carried out by the breeding experts and scientists.Local honeybees are better adapted to their original environment through long-term natural selection. The predominant role of place in colony success makes using locally adapted people in a breeding plan the clear choice. In areas with native honeybees, local groups should ideally be used.Several studies on gene by environment have shown that local honeybee groups beat non-local ones in developmental, social and functional traits. A Europe-wide experiment showed that although both local and non-local bees suffer from parasites and pathogens, local colonies lasted substantially longer in the lack of treatment against Varroa destructor. Colonies with a pure start also seem to be less aggressive than mixed colonies[1], [2].

A breeding plan based on local bees not only takes advantage of suited features of local bees, but also improves the success of local lines by further improving their performance and leads to sustainable protection of local genetic resources. In this way, breeding schemes for protection should also consider improving the main traits of economic interest for beekeepers.

Last but not least, energy is an important selection factor, regardless of the type of breeding plan.In areas where honeybees are not local, it is still a good idea to start the breeding plan from the current population, as some change may have already happened. However, it is important to keep the amount of genetic variation and control the degree of inbreeding.Breeding involves reduction or removal of undesirable genes, leading to reduced genetic variety and in extreme situations, inbreeding in the group used in the selection process. The honeybee is especially sensitive to inbreeding due to its additional sex determination system. Sustainable breeding needs a balance between selection strength and degree of inbreeding. While high selection strength gives fast breeding progress in the short term, it also hurts the long-term potential of the population due to inbreeding. Genetic progress should not be made at the cost of excessive inbreeding, and responsible breeding includes control over the amount of inbreeding and sustainable progress over an extended time frame. This is especially important in small groups where it is not possible to bring external stocks into the existing breeding population.

The subspecies A. M. Siciliana and A. M. Ruttneri are examples of such cases: these two types are endemic in Medterranean islands Sicily and Malta, and both feared extinctions. Breeding efforts are important for choosing traits that can make bees more attractive to farmers, but genetic variation must be kept. For A. M. Sicilia na, one method has been to protect different lines on different small islands, and to make crosses between these lines. Another method is to use a high number of individual colonies for queen and drone generation and accept that selection progress will be slower.The first step of a breeding plan is to identify the breeding goal. This is a vital step that needs careful thought and a long-term strategy. Decisions on traits to improve and their relative importance must be made based on various factors, including economic importance, scientific data, real experience, management practices and organization of beekeeping operations. It is important to keep in mind that DNA changes are slow and build over generations. The breeding goal will be achieved in the future and it should stay consistent in the long run.A variety of features may be of interest, based on present wants and demands and those of the foreseeable future. Preferred traits usually include motions. Through the adoption of testing procedures, groups being tested can receive an objective evaluation. See the smartbees project for an example of speed testing instructions[3], [4].

DISCUSSION

Some traits are inversely linked, and improvement in one may result in the worsening of another. For example, in 2014, Uzunov, Costa and their coworkers found a negative link between kindness and clean behaviour. The opposite may also happen, with selection success for one trait aligning with improvement of another.However, these relationships are not general and may change in different populations/subspecies. Therefore, as a rule of thumb, several physiologically and economically important traits should be included in the evaluation as well as the chosen ones, to determine the existence of relationships in the considered mating population.The precision of performance testing is an important part of the process. As the saying goes, an analysis is only as good as the data on which it is based, and the quality of the performance data affects the correctness and reliability of the expected breeding values and ultimately breeding plan success. Measures should be taken to ensure the quality of performance tests, which for honeybees, unlike other farm animals, are at the hive level. Guidelines should be made for performance tests, and bees should be taught to put the advice into practice. Here, uniformity and harmonization of the testing methods within the breeding group is essential. Testing apiaries should meet the basic standards for apiaries in general: steady nectar and pollen sources throughout the busy season, access to clean water, and distance from heavy farming, chemicals and other stresses.

Aim to choose a spot in which natural conditions are adequate for colony growth and production, in the same way as a normal non-migratory apiary site is normally picked.Colonies from the same testing apiary should be put in the same hive type and treated in the same way as much as possible. A colony is a unique creature, and the exchange of combs/bees between colonies is not recommended since it changes the neutrality of tests. The number of colonies in each testing apiary is open, although it is recommended to have 10 to 20 test colonies at each place for statistical significance. Each apiary should have groups of queens from at least three different sources to allow comparison. Location, direction and coloration of bees in the same apiary should be varied. Migration is only allowed if all groups of an apiary are moved together.Accurate, accurate and uniform recording of observations is a prerequisite for building a database with relevant information for reliable breeding value projections. Due to the actual limits of the research, notes are frequently logged on tailor-made hard-copy sheets that support the database. However, today's wide- spread use of digital tools, especially those containing set control instruments, may improve precision and task.Breeding value estimate comes after effectiveness testing. The breeding value of an individual refers to its worth in the breeding plan, which is determined based on the success of the individual and its relatives, and subtracting the effects of the surroundings.

Results of performance tests, genetic data and other information are put into a specific formula, with which breeding values for people can be calculated for each trait. A specialized programme can handle data processing, including the management of results of performance tests and estimate of breeding values. A great example of such a system is beebread, an online library that saves performance testing data, and calculates breeding values and later publishes them. Beebread uses a version of the Best Linear Unbiased Prediction Animal Model modified for honeybee biology to estimate the breeding value of an individual, taking into account the colony's individual performance as well as the performance of other colonies in the same environment and of all other colonies present in the database that are in any way related to the individual colony. Comparison of the colony's performance with that of colonies in different test apiaries shows differences caused by beekeeping techniques, weather, food sources and other factors. Bielefeld, Büchler , Brascamp and Tiesler have written interesting work on this topic. In addition, the China Honeybee Genetic Improvement

Programme has developed a new database for estimating breeding values, covering two honeybee species. The last allows educated decisions to be made on which queens to pick to produce the next generation. Queens are ranked based on their scores for different traits, or a single total breeding value may be calculated, with different weight given to different traits. Breeding values are important for choosing queens to make the next generation of queens and drone-producing queens. Breeders tend to decide which queens to select for producing the next generation of queens, while area groups tend to decide what queens to select for making drone-producing queens. Individual breeders may include extra factors. Once queens are chosen, controlled mating methods are used to produce children with the desired genetic mix[5], [6].

Controlled mating is a necessity for genetic growth of a community. Honeybees have specific sexual habits which makes mating control a real problem. As a result, special care needs to be given to con- trolled mating in a honeybee breeding plan. Mating stations and instrumental insemination are the two standard ways for controlled mating of honeybee queens. A breeding station is an area of land with a radius of usually 6–7 km in which only honeybee colonies with the genotypes chosen for mating are present. In this area, young queens, put in drone-free breeding boxes, are paired with drones from the so-called drone colonies. The mating station can be separated in two conventional ways: physical distance and obstacles and human-driven actions such as regulatory control of the area, whereby only the breeding groups are allowed in the area.Using specialised gear, mature drones' semen is harvested for injection into virgin queens during instrumental insemination. On the one hand, this allows for complete control over mating and might even achieve crossing that is impossible in the natural world. Semen from cryopreservation can also be used for artificial insemination. However, it requires a lot of time and work, and operators must have rigorous training to assure proper insemination. With the exception of a few Central European nations with a lengthy tradition in this area, instrumental insemination cannot be scaled up readily due to these restrictions.Expansion and use among a larger demographic In the end, it's important to mainstream genetic advancements made in breeding populations, and this requires multiplying selected stocks. The propagation of chosen stock is essential to transferring the value of genetic advancements to the beekeeping business, yet it frequently receives less attention than it should. Larvae, queen cells, queens, and drone semen are just a few of the different ways that organisms can reproduce.

Using organised regional mating stations where beekeepers can bring drone-free mating boxes with virgin queens to mate with drones from the chosen stock is the most effective and prolific method.Programme evaluation and execution in breeding. Breeding projects should be evaluated frequently to make sure the results live up to expectations. Every component of a breeding programme should be assessed to find possible areas for improvement, and strategic objectives and expectations for the future should also be reviewed. Depending on the objectives of the breeding operations, periodical genetic analyses of animals should also be conducted to evaluate the results. The breeding programme can only be implemented successfully with the collaboration and coordination of these parties. Meetings should be scheduled frequently to coordinate activities, share information and ideas, and talk about potential implementation challenges.

There are many different kinds of breeding projects, but the commercial, conservation, and scientific breeding initiatives are the most prevalent. The most prevalent breeding projects are commercial ones, and their main goal is to enhance qualities that are crucial for business, including honey output and/or gentleness. In order to boost beekeeper acceptance and, ultimately, the preservation of honeybee populations, conservation breeding initiatives are utilised to improve and valorize these populations. Last but not least, study breeding plans are made to respond to certain scientific queries, including identifying the genes accountable for a particular conduct. These programmes can be bidirectional in some cases since the extreme phenotypes allow for parameter comparison and correlation with the behaviour under study. These programmes are typically offered by academic institutions and are short-term. A successful breeding programme is not strictly time-limited, and its sustainability depends on all stakeholders. In particular, it depends on the commitment of beekeepers andbee-managers to preserve and enhance local honeybee stocks. This is something that policymakers and project planners should bear in mind.

There are some fundamentals of beekeeping that remain constant despite the fact that methods might vary greatly based on the location and level of production. The gbps for the Western honeybee are examined in this chapter. This word disintegrative activities that beekeepers apply for on-apiary production to attain optimal health for humans, honeybees, and the environment. The application of gaps favours excellent production standards while also having a good impact on colony health and society. Additionally, gbps assist beekeepers in deciding on the most robust and sustainable tactics at the apiary level. The following general advice, when appropriately adopted, can help in preventing or at least reducing harm to honeybee colonies, even though each unique honeybee illness or parasite requires its own specific control strategies. Gbps fall under the following categories, according to the World Organisation for Animal Health-FAO classification of good farming practises: general apiary management, veterinary medications, disease treatment, hygiene, bee feeding and watering, record-keeping, and training[7], [8].

Choose apiary locations carefully, staying away from windy, excessively humid, or flood-prone areas. Aim to locate the apiary as far away from pollution sources as you can, preferably in a location with lots of melliferous and pollinizers plants and next to a road. Put the apiary in a stable location that is easy to access and enables for winter checks. When necessary, do beehive maintenance. Beehives shouldn't be set up on the ground. When the threat of predators necessitates taking these precautions, bees should be maintained on stands and hives should be safely enclosed. When visiting honeybee hives, wear safety shoes and personal protection gear. Avoid working by yourself in the apiary, and choose locations with guaranteed mobile reception. Keep a safe distance from the apiary and take note of any nearby residences, buildings, or schools. The apiary should generally be at least 5 to 10 meters away from nearby properties or roadways, but you should always check your local or national laws to make sure that legal distances are also observed.

Consider the area's capacity for mellifera and pollen as well as the availability of water resources. Install a number of hives that does not exceed the capacity of the environment, and select areas with a variety of sources that can sustain the bees all season. Do not leave beekeeping supplies in the apiary. maintain it clean, and make sure the hive entrances are not blocked by bushes or thick grass. Regularly cutting the grass in front of the hives can assist identify unusual bee mortality. Maintain a healthy balance between the number of hives and the quantity of pollen-producing plants in the area. This can be inferred from your hives' output. Manage hives based on the area, the season, and the colony's health. To maintain healthy colonies, replace queens at least every two to three years. Prevent swarming through colony splitting, installing supers, adding fresh wax foundations, removing entrance reducers, and choosing queens with a low propensity to swarm.

To reduce comb in the honey chamber and improve honey quality, use a queen excluder. During the warmer months, enlarge the hive entrance. Maintain active colonies with plenty of healthy workers, good laying queens, and enough honey and pollen reserves. Only a steady, ample supply of pollen and nectar can allow for this. Identify the queen bee based on her birth year. Place hive openings so that the sun may shine on them all day long, beginning in the morning. This makes it possible for the bees to begin working as soon as possible, even on colder days. To simply keep track of combs and make sure they are replaced on a regular basis, mark the age of the combs on the top bar of the frame.Check to see if the hive has enough supplies. To preserve the operators' health, have corticosteroids or other medications on hand during apiary inspections. Installing hives in a way that offers the best working circumstances is important. This includes avoiding slopes and soil that is uneven or slippery, adjusting the height of hive stands to promote proper back posture while working, limiting the weight that may be lifted, and using back protection devices as necessary. Keep your workspace tidy. To lessen risks from ticks, snakes, and fires, mow the grass occasionally.

The beekeeper should check on each hive during this phase to confirm the presence of the queen and keep an eye out for disease activity. The optimum time of year to change frames and conduct swarming prevention measures is now. Make sure there are adequate supplies available and be ready to supplement to prevent famine, especially after many days of continuous rain, as colonies grow in population. At each apiary visit, beekeepers should check for pests and diseases. If necessary, treat colonies for Varroa. Beekeepers have the option of producing their own queens, nuclei, and bee stocks, or they can buy them. Beekeepers must carefully choose a provider and make sure that the bee population is healthy before making these purchases or harvesting them from the natural environment. Put bees under quarantine and, if necessary, treat them for Varroa.The beekeeper can super the hives to collect the honey after the colonies are large enough to fill them. The beekeeper should check on the state of less productive hives with empty or less filled supers, and add empty supers when the existing ones are full while the bees are producing honey. The beekeeper should remove the supers once the combs are full of mature honey. Honey is gathered as the stage's last product. Use of the queen excluder is crucial at this point to prevent issues with the honey supers, lower the need for pesticides and preservatives, lower storage costs, and enhance honey quality. Finally, it's critical to evaluate swarming behaviour as soon as the honey flow begins.

Retaining colonies over the summer after super removal Colonies are often at their strongest during this period, and at the same time, the Varroa infestation is so severe that the colonies may perish. By using the right remedies, hives must be safeguarded from this insect. Hive inspection is advised at this phase to ensure the queen is present, there are no viruses or diseases present, and there are enough honey and pollen stores in the brood box to endure the winter. If supplies are low, the beekeeper must supply additional feed. Autumn is a crucial time for Varroa mite treatments since the bee brood is least, if at all, present in the hive, allowing for maximal exposure of the mites to the treatment.Natural selection has improved local honeybee populations' climatic adaptation, making them the best candidates for breeding programmes. Local honeybee groups perform better than non-local ones in a number of features and are more resistant to parasites and diseases, according to studies.Breeding initiatives should focus on enhancing particular characteristics that are economically significant to beekeepers while preserving genetic diversity and preventing excessive inbreeding. Particularly in small populations, sustainable breeding necessitates striking a compromise between the level of inbreeding and the strength of selection[9], [10].

Clearly defining breeding goals based on economic significance, empirical evidence, and managerial techniques is the first stage in developing a breeding strategy. Critical steps in the procedure ensure that the appropriate individuals are chosen for breeding through performance testing and the evaluation of breeding values.To preserve genetic development and stop undesired mating, controlled mating techniques like mating stations and artificial insemination are required. To introduce genetic improvements to the beekeeping sector, selected stock must be propagated.The success and sustainability of breeding programmes depend on regular review and cooperation among stakeholders. Initiatives for commerce, conservation, and research breeding have distinct goals but all support the maintenance and expansion of honeybee populations.

CONCLUSION

In conclusion, managing and raising honeybees is a difficult, diverse task that demands careful organisation, planning, and execution. The general well-being and productivity of honeybee colonies are greatly influenced by beekeepers, and breeding programme success is directly influenced by what they do at the apiary level. To guarantee the correct execution of breeding plans, it is crucial that numerous parties, including beekeepers, breeding/regional groups, and policymakers, are involved.Finally, healthy beehive colonies must be maintained in order to ensure their long-term success. This includes apiary management, disease control, and appropriate feeding. Beekeepers must take precautions to safeguard their hives from predators, maintain ideal apiary settings, and give their bees enough food and shelter.To conserve these important pollinators and support the beekeeping sector, good honeybee breeding and management require a combination of science, cooperation, and ethical beekeeping practises.

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CHAPTER 9

COMPREHENSIVE BEEKEEPING PRACTICES FOR HEALTH AND PRODUCTIVITY: MANAGING BEES AND COMBATTING THREATS

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ABSTRACT:

Beekeeping is a sensitive activity, and beekeepers must use a variety of tactics and safety measures to guarantee the wellbeing of their honeybee colonies. This thorough overview explains important factors for beekeepers, covering winter cluster management, hive upkeep, disease prevention, and hygiene. The identification and management of several illnesses, parasites, and pests, including the Varroa mite, Nosema species, and the Small Hive Beetle, are also highlighted. The abstract highlights the significance of a balanced strategy that incorporates biological control techniques with cautious drug use, while also guaranteeing the security of bee products and abiding by veterinary standards. In the end, this abstract offers a useful tool for beekeepers, both inexperienced and seasoned, who want to manage healthy bee colonies.In order to prevent fires, beekeepers should stay away from places with dangerous or allergic plants and use caution when using a smoker. To prevent pesticide poisoning in bee colonies, it is essential to regularly check the usage of pesticides in their foraging areas.It is essential to use veterinary medications just as prescribed and to adhere to all safety precautions. Beekeepers should maintain thorough records of all treatments and make sure their tools are appropriate and accurately calibrated. To stop the transmission of disease, hygiene procedures, such as washing and sanitizing equipment, are crucial.Isolation and meticulous disease inspection are essential when introducing new colonies or bees. Utilising integrated pest management techniques can help prevent the need for pointless treatments and the emergence of drug resistance.

KEYWORDS:

Beekeeping, Health,Hives, Productivity, Treatment.

INTRODUCTION

The bees form a cluster in their hives throughout the winter, especially when the outside temperature is low, and they consume honey to generate heat and keep the colony warm. Since bees are currently dormant, it is best to restrict examination to prevent cold stress and potential winter cluster rupture.

During extremely cold and rainy seasons, it is advised to regularly feed the weaker colonies with hard candy. It is crucial to check your beekeeping equipment before the winter season and take specific precautions, such as reducing empty space in the hive and the size of the hive entrance. performing hive box maintenance. verifying the external position of the frames with stores in the hive. reducing the number of frames in the hive box and/or inserting a divider board to reduce hive nest volume. or moving the colony to a smaller box. Some regions urge beekeepers to wrap the hive in black tar paper.

Avoid regions where there are significant amounts of poisonous or allergic plants. Consider carefully where you want to set the smoker. For probable fires, be sure to have water or a fire extinguisher on available. Adjust the number of combs and hive boxes according to the colony's size. Conduct regular surveys of the amount and types of pesticides used in the bees' area of forage to protect colonies from pesticide poisoning. Hives should be handled carefully. The least amount possible of hive disturbances by beekeepers, visitors, and/or other non-beekeepers should occur.

Veterinarian drugs

GBPs are generally the best method for preventing disease and can lower the need for medication. Don't treat bees with substances that are prohibited or unlicensed. Use only veterinary drugs approved particularly for honeybees in your country or those that have been lawfully imported. Don't use unapproved treatments, and make sure you follow the directions when doing any surgeries or treatments. Always heed the advice of your supplier, and utilise safety equipment when necessary[1], [2].When choosing and utilising medications for disease control, use extreme caution because many of these compounds easily contaminate honey and hive equipment, breed diseases with heightened resistance, and weaken bees. Only administer treatments when necessary. The choice should be made with low-impact medications in mind. Mechanical/ biological control may be the best first and second option. it is undoubtedly the safest in terms of hive product contamination with drugs and risk to human health. Organic beekeeping practises rely on pest management techniques that are good for bees, bee products, and human health. Before selling bee products, appropriate testing needs to be done to confirm that there are no residues.

Keep track of therapies in a special diary. Make sure that any equipment you use for application are suitable and properly calibrated for use. Use bio secure disposal techniques when discarding used tools and equipment. Always check the expiration date and observe the necessary storage requirements for veterinary medications and food. Keep newly introduced colonies isolated from the current stock for an appropriate period of time to monitor them for diseases and prevent transmission. Purchase new bee colonies from local suppliers only after comprehensive inspection for bee diseases, preferably with a health certificate. Maintain only robust, healthy colonies in the apiary: Use young worker bees or combs with hatching bees to boost weak colonies. balance colony strength among colonies but keep the ratio of nurse bees to brood balanced. Monitor the health of the hives by doing thorough inspections on a regular basis. An integrated pest management strategy eliminates the need for pointless treatments and the emergence of medication resistance. Follow the guidelines provided by the relevant authorities and veterinary regulations in cases of notifiable diseases, and abide by any limits placed on the movement of animals by law. Before supervising, thoroughly check hives for the presence of the queen and clinical indications of bee diseases. In the spring and at the conclusion of the beekeeping season, thoroughly inspect hives for the presence of the queen and clinical indicators of bee diseases. If sick hives are discovered, isolate them and take precautions to stop the spread of the disease.

Before establishing new colonies, remove any beekeeping equipment and thoroughly clean the area if there are any contagious diseases present.Take considerable caution when moving combs and hives. To prevent the transmission of diseases, only healthy hives should be used for migratory beekeeping. In the same way, avoid moving sick combs across apiaries or from one hive to another. If the health of the hives is unknown, avoid moving frames, hives, or any other biological material between them. Ask your wax provider for the lab analysis results regarding residues and composition if wax foundations are offered. Use only bees and brood combs from healthy colonies for starting fresh nuclei. Make sure to properly inspect them to rule out any signs of illnesses or parasites.Consult with specialists when necessary because it is much simpler to avoid a mistake than to fix the harm it has caused. Make an effort to arrange the hives so that every bee in the apiary may easily return to its own hive. By doing this, disease and drift transfer between colonies will be reduced. Avoid cramming apiaries or keeping too many colonies in a single row. Maintain a spacing of at least one metre between hives. Paint numbers or identification signs on the entrances of the hives.

By raising hive entrance sizes in the warm season and decreasing them in the cold, thermal strains can be reduced. To prevent heatstroke, move or transport bees during the cooler parts of the day and make sure the hives have enough openings for air flow. To avoid robbery and the potential for persistent infections to move among colonies or to other apiaries, do not dispose of honeycomb, wax, propolis, or other hive products close to the apiary. Equipment for the beehive should be clean, including gloves. To avoid spreading the infection to the healthy hives, only check on diseased hives at the conclusion of apiary inspection. Additionally, after looking over an infected colony, clean the tools you used and, if possible, use disposable tools like rubber gloves.If necessary, burn infested colonies in situations of transmissible diseases. Never give honey from an unknown source to bees. Close the hive until a sample of the comb or the bees have been examined if a colony dies for unidentified reasons. Stop thieves from plundering the hive's remaining stores. To ensure that the queen is present and the colony is robust, productive, and healthy, regularly check brood combs for illness indications, especially during the active season. Keep an eye out for illnesses, parasites, and predators that could seriously weaken colonies in hives, and treat them immediately and effectively if you find them.

Hygiene

Keep the hive tidy. Beekeeping tools and hive parts should always be kept clean and in good functioning order. Equipment should be regularly cleaned, sterilized using an autoclave or gamma rays, and disinfected whenever possible using a torch, NaOH, or hypochlorite. Clean used apiary equipment and old hive parts that were purchased or obtained from dubious sources.Control unidentified swarms or hives for honeybee diseases while keeping them in a quarantine apiary to make sure the bees are healthy before bringing them to the apiary. In situations of contagious infections, use hot, high-pressure water to disinfect hives and hive gear. Observe the norms of hygiene.When working with dead cities, use good hygiene. After inspecting hives harboring contagious diseases, sterilize any levers and other potentially contaminated machinery. Keep track of all records pertaining to cleaning and disinfecting equipment or beehives, as well as all records demonstrating that these processes have been successfully carried out. Record the source and use of all disinfectants and consumable products. To prevent interaction of honey with C. botulinum spores, do not place honey supers directly on the ground and keep supers away from dust when moving supers from the apiary to the honey house. Make sure you are knowledgeable with the production of hygienic honey, including hygienic honey extraction and handling[3], [4].

Feeding and watering bees

Feed the honey and pollen to the bees only if you are certain or have proof that there are no pathogens present. Make sure the bees can access clean, flowing water. To avoid robbing and the spread of disease, don't feed bees in the open on the field. Instead, put syrup or sweets within the hive itself or in a feeder that is made appropriately. If necessary, provide enough water while being transported. To lessen nutritional stress, provide hives, nuclei, and swarms enough food, especially during the cold season or if they must endure rain, and return honey and pollen as needed. Verify the bees have adequate reserves for the winter season.To improve agricultural practises and, as a result, better forage and less toxicity for bees, educate neighbours, farmers, and other people about the advantages of bees for pollination. This preventive approach is incredibly effective and boosts productivity.Beekeepers must maintain a healthy population of honeybees in order for them to perform their necessary and useful functions. The main barrier to improving the quality of honey production is illness and pests, which are present in many nations. Research to discover methods of preventing or controlling them is ongoing in many parts of the world, but because the Asian and African bee industries are still developing, there hasn't been much done to study bee diseases there, especially in Africa. Africa is home to the majority of the viruses, parasites, pests, and predators that have an impact on the health of honeybee populations worldwide.

Southeast Asia is home to most honeybee species, and some parasitic mite species have Asian honeybees as their natural hosts. In Asia, the cohabitation of many honeybee species and the parasitic mites that accompany them may encourage the interchange of parasites between species as well as concurrent infestations by various mite species at the colony or individual levels. The ability of the beekeeper to implement appropriate methods to control illnesses and pests has a significant role in whether or not beekeeping with the Apis mellifera is successful in many regions of Asia. Since A. mellifera is the only honeybee species that has been introduced to a continent that already has many native species of Apis, colonies of this species are vulnerable to invasion and attack from both their own natural enemies and those of the local bee species. Bee mites, hornets, and microbiological illnesses are perhaps the most significant, however wax moths, birds, and mammals also present a threat. Evaluation of bee health in South America is challenging due to the continent's size and extreme diversity, which includes a wide range of climates, elevations, and beekeeper types. Additionally, there is a dearth of published data on the health of honey bees in South American nations.

Honeybees can contract bacterial, viral, or fungal illnesses while they are in the brood stage. Healthy, good queens use sterile cells to lay their eggs in. It is important to pay attention to the laying pattern, which often consists of concentric circles. The first eggs are laid in the comb's core, and the other eggs are gradually laid in rings more outward to the comb's margins. The pupae are capped in the same manner, starting in the core and moving outward. It's important to take note of the brood's regularity in the cells. Before they are sealed, healthy brood comb cells are typically densely filled by the fifth and sixth day. Brood sickness may be indicated by an uneven brood comb. When it comes to larvae, a healthy larva coils inside the cell like a comma and appears meaty, shiny, and white. In the cell, it stays still. The seal should also not be pierced or sunken, and pupae should continue to be covered.

AFB is a terrible disease that affects honeybee brood and significantly reduces the population of the colony. It spreads swiftly and readily from one apiary to another and has the ability to eradicate not just one colony but all colonies in an apiary. It can happen all year round and has no season. Paenibacillus larvae, a bacteria that produces potent, resistant spores, is what causes the illness. When P. larval spores are consumed at a very young age, bee larvae become infected. After being capped, infected larvae eventually die and, if they were not removed by worker bees beforehand, are broken down by P. larvae into a brownish, semi-fluid, glue-like colloid. Eventually, this colloid dries up and transforms into a hard scale on the lower cell wall that is challenging to remove. This scale can lay dormant for several decades and is very contagious. It also carries millions of spores[5], [6].

The normally convex cell cap turns soggy, black, and sunken that it eventually becomes punctured. The workers' attempt to uncap the cell to remove the decomposing remains led to the hole of the cap. Because of the deceased larvae, the brood combs of an impacted colony take on a patchwork appearance. It smells bad when the brood is decomposed. A ropy thread several centimetres long emerges from the decomposed pupa's cell when a matchstick is inserted into it. Beekeepers should get in touch with their regional apiculture office if they suspect AFB. In the event that this is not possible, the bees should be killed. the beehive and all of its components, such as the bees, combs, top bars, and frames, should be destroyed. and the ashes should be buried far beneath the soil. Sulfathiazole and oxytetracycline are two antibiotics that are not advised for use as either a preventative measure or a treatment since they are ineffective against spores and could contaminate the honey.

DISCUSSION

Although Melissococcus plutonius is the main culprit, other bacteria are also present, which complicates the illness pattern. The bacteria proliferate in the gut of young larvae after they become infected by eating food containing the germs. The larvae die before capping, and worker bees may leave the cells holding the deceased larvae uncapped. Sometimes the diseased larvae don't pass away until they are sealed, which can lead to sunken and functional cappings. A larva with EFB moves inside its cell just before it dies. The deceased larva is occasionally discovered stretched lengthwise from the base to the mouth of its cell or in an unnaturally coiled configuration across the opening of its cell. The deceased larva looks like oatmeal and appears to have broken down. It has lost its chubby, fleshy aspect. It develops a yellowish-brown colour before drying out to form brown scale. In cells with sunken caps, ill larvae occasionally can be spotted resting there. The predictable pattern of laying has disappeared, and the comb is now dispersed with individuals of various ages. Depending on the type of secondary bacterium that invades the dead larvae, the smell of the decaying larvae differs. The sickness is seasonal and typically manifests during and just after seasonal rainfall before gradually fading until the colony's population starts to increase once more in October. The damaged colony's honey production will decrease. As a conditioned disease, it is not advised to treat it with bacteriostatic or bactericidal medications because doing so could contaminate honey. Requeening the colony is advised as soon as the sickness has subsided.

Stonebrood and chalkbrood

In humid environments, the fungal pathogen Ascophaera apis can seriously harm bee colonies. With the brood diet are ingested fungus spores. The spores grow in the intestine, and when the fungus spreads, it kills the brood in the prepupal stage, leaving behind chalky dead brood. In A. mellifera, chalk-brood can decrease colony output but infrequently causes colony demise. Similarly, while being claimed to be more widespread than stonebrood, which is brought on by fungi of the genus Aspergillus, it is not regarded as a serious illness in Asia and Africa. The larva is attacked by Aspergillus, which turns it into a hard, stone-like object that is found lying in open cells. Adult bees may potentially contract the illness and die.

Viruses

With over 23 viruses that affect honeybees isolated thus far, they are almost universally present. Black queen cell virus, deformed wing virus, Kashmir bee virus, sacbrood virus, acute bee paralysis virus, chronic bee paralysis virus, and Israeli acute paralysis virus are the seven that are most prevalent. SBV and DWV are grouped under the Iflaviridae family based on their genomic architecture, whereas BQCV, ABPV, KBV, and IAPV are included under the Dicistroviridae family. They can hurt honeybees on their own or in conjunction with a nose-mosis or Varroa mite infestation. The World Organisation for Animal Health's list of ailments affecting honeybees does not yet include bee viruses.

Mite parasites

The parasitic bee mites Varroa destructor and Tropilaelaps species are both significant economically. .only T. of the latter. T and Clareae. A is known to be harmed by Mercedes. lifera, Mel. Tropilaelaps spp. are present on all continents, whereas the Varroa mite is absent from Antarctica and Australia. are only found in tropical and subtropical Asia, either within or close to the area of their original host, Apis dorsata. However, the mites also exit from their cells in search of more bee brood cells nearby. Some adult female mites that have been mating cling to humans or drones' bodies. The mites are transferred to neighbouring colonies through drifting, robbing, bee colony trade, and migratory beekeeping.The fact that Tropilaelaps can only survive for seven to nine days without food, unlike Varroa, which may consume adult bees, may be the reason for its limited global distribution. Tropilaelaps is a more manageable parasite than Varroa, but that does not mean it is any less of a dangerous pest. While typically interpreted as a symptom of poor egg-laying queens, a strewn pattern of sealed and unsealed brood chambers is frequently a result of mite infestation.

The first telltale indication of a late-stage, severe infestation is frequently adult bees with malformed wings and/or shorter abdomens. Direct sample through arbitrary opening of brood cells, especially drone cells, is the most accurate and possibly time-consuming technique of identifying mites. This process gets simpler as the larvae or pupae get older. Using tiny forceps, the brood is extracted from the cell, and the mites are then checked for in the cell. Before the degree of mite infestation can be determined, between 100 and 200 cells must be opened. Bees are removed from the brood combs and placed in jars with soaped water or alcohol to be examined as adults. Given that Tropilaelaps spp. is only effective against Varroa, which is uncommonly encountered in mature bees. The bees are killed, the jar is shaken, and the mites float to the top. The Varroa mites can also be extracted through a net that replaces the jar cover and counted after 300 bees are placed in a jar, sprinkled with sugar powder, and removed. The bees are after that brought back to the colony. Another method is to install a white or light-colored tray the same size as the bottom board on the hives' bottom boards. The tray should be fitted with a screen of mesh no thicker than 2 mm that is mounted about 1 cm above the tray floor. One to three days later, the tray is checked for the presence of dead mites. Bees are unable to remove the dead mites from the tray because of the screen[7], [8].

One of the most challenging challenges for beekeepers worldwide is varroa control. The mite's life cycle is closely synchronized with that of its host, making it a very successful parasite. Drug control and hive manipulation techniques, also referred to as biological control, are the two main control strategies now in use. The most often used mite-controlling medications are organophosphates, synthetic pyrethroids, ethereal oils, organic acids, and amitraz. There is no one ideal method for mite control. Many beekeepers turn to pharmacological therapy, but doing so runs the danger of tainted honey and other hive products as well as chemoresistance. A good balance is a combination of scientific biological measures and medication. The majority of treatments target A. mellifera. to shield A. from varroosis. cerana, get rid of A. Cerana male brood combs occasionally to maintain healthy hives. Acarapis woodi, a tracheal mite, is also controlled by some medications such formic acids and ethereal oils in addition to V. destruc- tor and Tropilaelaps species.

Asia's subtropics, where T. T and Clareae. Mercedesae frequently offer a greater threat than V. destructor, so beekeepers who choose not to use acaricides employ a biological control strategy that involves brood management. The majority of the mite population will starve to death if bee brood is not available for a few days since Tropilaelaps adults can only survive without it for seven to nine days. In addition to moving the brood combs to an empty hive box or starting new colonies with them, the beekeeper confines the queen to a confined area for egg-laying. Some beekeepers pair this method with drug rehab.The damaged bee makes very little royal jelly or brood food because it is unable to use its protein reserves. Only a small portion of the potential brood can therefore be raised. Young bees with the disease grow too quickly and begin foraging earlier than usual. Her life span is drastically shortened. She starts to feel tired and may start to soil the hive. Eventually, she collapses and starts to crawl. The damaged queen bee's ovaries quickly deteriorate. Her egg production gradually declines and then completely quits. Her longevity is also shortened, which could leave the colony without a queen or cause the aged queen to be replaced by supersedure.

Spores are found using a microscope for diagnosis, and molecular biology methods are used to distinguish between the two species. N. A pis infection is characterised by enlarged abdomens and diarrhea, and it typically occurs in cold climes. N doesn't really exhibit any clinical symptoms. From early spring through late summer, ceranae infection occurs. The only observable symptom is a gradually deteriorating colony since the bees do not increase their population when conditions are favourable, leaving the hive with unfinished food storage, unattended brood, and a large number of bees.No damage to bee colonies has been recorded as a result of N in South American locations where Africanized bees are common. ceranae. Unfortunately, there is little information on the presence and distribution of either Nosema species in Africa. nonetheless, there haven't been any negative effects on African subspecies that have been documented. The best way to treat osmosis is to requeen the hive and replace the combs. Additionally, fumagillin, an antibiotic that is still available in some nations, can be given to the infected colony. It has variable degrees of effectiveness against both species. Antibiotics must be used carefully to prevent contaminating honey and other bee products since they are ineffective against spores.

Acarapis woodii is a minute mite that multiplies inside the bee's respiratory system and obstructs the bee from breathing normally. Additionally, it feeds on the host's hemolymph. The bee's ability to fly is significantly hampered. it starts to crawl and eventually perishes. The illness may not completely wipe out a colony in a single year and may linger for a number of years while doing minimal harm. However, if other illnesses and/or bad bee seasons are present, the colony may weaken to the point of death. Other colonies may become infected by rogue or wandering bees. Nearly all beekeeping nations in the world originally had the mite, but in countries where Varroa is treated, A. Woodii is almost extinct.Aethina tumida, also known as the SHB, was first discovered solely in sub-Saharan Africa. In 1996, it first arose outside of Africa in the southern United States. Since then, it has expanded globally. Only weak colonies or storage combs are impacted in Africa. Outside of Africa, however, ordinary-strength colonies are susceptible. The primary cause of this appears to be the various defensive strategies used by European bees. Rooms used for collecting and storing honey are also invaded by the beetle, where mass reproduction may take place.

SHB thrives and grows both inside and outside bee hives. Within a bee colony, in cracks and nooks where the bees cannot reach, the beetle deposits nests of eggs. The larvae prefer to reside on, in, and in honeycombs and pollen. Larvae that are ready to pupate exit the hive. From egg to adult beetle, the development process takes at least four to five weeks. Both within and outside the apiary, the beetles and their larvae can infest honeycombs and bee brood. They create eating canals and demolish the cell covers there. Due to fermentation brought on by the faeces of larvae, the honey's colour and flavour alter, and the combs take on a viscous appearance. Dark brown to black in colour, the mature beetle measures around 5 mm long and 3 mm wide. The beetle can be found anywhere in the beehive, unlike the larvae, which are mostly located in the combs. When the larvae reach their roaming stage and are about 11 mm long, they depart the hive and pupate in the ground. They have three pairs of legs, no pseudopods, a double row of spines on their back, and they do not spin cocoons, making them immediately distinguishable from wax moths. Because the beetles instantly hide in the shadows, it can be challenging to spot a modest infestation. When the dead beetles are visible on the bottom insert following chemical treatment, SHB can be accurately detected by carefully scrutinising the hive[2], [9].

Keeping colonies strong and removing weak ones from an apiary are the greatest ways to prevent SHB invasion. One to two days after the honey supers have been harvested, honey should be extracted.

They can also be kept at or below 10 °C in a dry environment with less than 50% relative humidity. Mechanical traps can also aid in the management of SHB. There are specific medications and pesticides based on coumaphos and fipronil that are accessible in various countries.Hornets are a severe threat to honeybee colonies in many regions of Asia and other parts of the world after the arrival of an invasive foreign species like Vespa velutina. The best strategy to manage them is to destroy their nests, however due to their wide flight range, these are typically challenging to locate. Serious destruction can often be avoided by shrinking hive entrance sizes and making an effort to capture hornets that feed nearby. Additionally, hornet nest members might be poisoned using toxic baits.

CONCLUSION

In conclusion, to ensure the wellbeing and productivity of bee colonies, successful beekeeping necessitates close attention to a number of elements. Responsible beekeeping involves taking the necessary precautions for the winter, maintaining the hives, and preventing disease.To avoid cold stress and cluster rupture throughout the winter, it's critical to let bees form a cluster inside of their hives and to limit disturbances. During severely cold and rainy seasons, feeding weaker colonies with hard candy can help them survive.Colony health can be influenced by proper hive maintenance, which includes eliminating empty space, verifying frame positioning, and adjusting hive entrances. In some areas, tar paper wrapping of hives may be required to protect them from the cold.To sustain healthy and productive bee colonies, effective beekeeping necessitates a combination of proactive hive management, disease control, and careful attention to environmental factors. Beekeepers should be knowledgeable about best practises and be ready to modify their plans in response to the unique requirements of their hives and the surrounding environment.

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CHAPTER 10

FACTORS AFFECTING DISEASE TRANSMISSION: BEES AND THE ROLE OF BEEKEEPERS

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ABSTRACT:
Several factors, with beekeepers and honeybees playing a key role, affect how illnesses spread among bees, colonies, and apiaries. This in-depth analysis investigates the complex interactions between these variables and their effects on the beekeeping sector. By bringing infected spores, scales, and dead larvae into the hive, bees unintentionally spread disease. Additionally, workers and drones have a tendency to stray into other colonies, which can help spread disease. Whether they are aware of it or not, beekeepers can help spread disease by using infected honeycombs, bee products, and colony management techniques.The industry's primary tool for managing and preventing disease is the Beekeeping Management Best Practises (BMBs). The systematic adoption of Good Beekeeping Practises (GBPs) by beekeepers is essential for the effective application of BMBs. Any disease control effort must prioritise biosecurity, underscoring the need of providing beekeepers with the right instruction and training so they can identify disease symptoms and use context-specific management techniques.The beekeeping industry has changed as a result of globalisation, climate change, and increased mobility, which has raised the risk of disease transmission. The hybrid honeybee subspecies introduced to Brazil that has beenAfricanized offers particular difficulties and possibilities. Effective management, especially in tropical and subtropical areas, depends on an understanding of how it differs from European bees. Africanized bees have proven to be resilient and adaptable, producing more honey in harsh conditions.The establishment of international organisations to foster knowledge exchange and research, responsible gene transfer, disease management devoid of antibiotics, standardised hive designs for A. cerana, improved post-harvest handling, and enhanced post-harvest handling are among the main proposals. In the end, comprehensive approaches and teamwork are necessary to ensure the viability and sustainability of beekeeping in a changing environment.

KEYWORDS:

Bees, Disease,Honey, Transmission.

INTRODUCTION

Beekeeping biosecurity practises for the major Apis mellifera illnesses. The two main factors in the transmission of diseases among bees, as well as between colonies and apiaries, are the beekeeper and the honeybee. Before being discarded, workers may drag dead larvae, spores, and dry scale down the combs. Diseases are also transferred by drones and workers that wander into neighbouring colonies. A healthy colony may be fed honey tainted with spores and parasites, or the beekeeper may scatter contaminated honeycombs and bee products where bees would loot them. If a beekeeper is not certain that both colonies are healthy, they should never switch combs between them. Comparably, moving bees and combs from one apiary to another occasionally also spreads disease.

The primary element that has a direct or indirect impact on the growth, viability, and economic viability of the beekeeping industry is honeybee illness. BMBs are built on top of GBPs. BMBs are all the steps beekeepers should take to stop and slow the spread of diseases that affect honeybees. The effective adoption of BMBs depends on beekeepers systematically implementing GBPs. Any disease control effort, regardless of the type of malicious species, must priorities biosecurity. The use of treatments at the apiary level can be minimized with proper biosecurity measures implementation. Each of the four most prevalent honey-bee diseasesvarroosis, AFB, EFB, and nosemosishas a list of BMBs.

Following globalisation, climate change, and increased mobility of people, goods, animals, and products, the beekeeping sector has been changing for a number of years. The likelihood of bee illnesses spreading has significantly increased as a result. A. was additionally first used in Asia. mellifera is now vulnerable to additional pests and parasites, like as Varroa and N, that are carried by native honeybees. ceranae. Today, some honeybee diseases, pests, and predators are widespread, such as Varroa, while others, such the Tropilaelaps spp., are only well-established in particular regions. Mite, along with other pests that were originally localised to particular areas, including A. both Vespa velutina and tumida[1], [2].

In many regions, keeping bees successfully or unsuccessfully depends on A. mellifera is primarily dependent on the beekeeper's capacity to implement effective pest and disease management strategies. In order to prevent the spread of these diseases, beekeepers must be properly educated and trained to recognise the symptoms of the major honeybee diseases and to use the tools available for managing and treating them in accordance with the environmental context and the country's beekeeping industry. Information on honeybee pests and parasites in some regions of the world must therefore be made available.The information on the Africanized honeybee is covered in the following chapter. It is a hybrid bee subspecies that was unintentionally released in Brazil in the 1950s and consists of European and African bee subspecies. In addition to most of South and Central America, it has expanded as far south as northern Argentina and as far north as the United States. Even though the experiences described here were primarily obtained in Brazil, the advice given for the particular care of that bee can be regarded as being generally relevant.

In Brazil, Africanized bees primarily produce honey, propolis, beeswax, pollen, royal jelly, and bee venom, in that order of economic importance. Although bees are also used to pollinate other crops including coffee, strawberries, and some others, pollination can be a significant source of income in specific parts of the country, particularly for melons in the north-east and apples in the south.Understanding how Africanized bees differ from European bees, for which the majority of beekeeping techniques were created, is crucial to managing them effectively. Africanized bees are a hybrid of different European and African bee subspecies. Because Africanized bees prevail in tropical and subtropical environments, they are known asAfricanized bees. They are genetically 85–90% African in these climates of South America. In their native climes, Africanized honeybees outperform temperate-climate bees in terms of defence and productivity, but they are noticeably gentler in cooler climates. Africanized bees tend to be more protective around the equator and at lower elevations, and less so when placed in high altitudes and less tropical areas.

Although Africanized honeybees were initially thought to be a problem in Brazil, it soon became clear that they had many benefits, one of which was that they produced more honey than the European bees that they replaced. Beekeepers also started to adapt and develop the necessary technology to handle them. When Africanized bees first started to spread over Brazil in the early 1960s, some beekeepers kept them in simple box hives and other locally created hive designs. However, it quickly became clear that movable-frame hives were the only practical way to handle these new bees, and the nation's only choice was the widely utilised Langstroth hive, which was already dominant.Gaining new swarms and expanding colony size are simple processes. Africanized bees can reproduce rapidly, and in the wild, colonies and swarms are frequent occurrences. Because of this, many beekeepers use bait hives to attract the colonies they need to maintain or grow their hive numbers rather than purchasing or dividing colonies. Beginners can just purchase or construct an empty hive and draw a swarm rather than having to purchase bees[3], [4].

5-frame or full 10-frame hives can be used as bait hives. Due to the bees' attraction to the scent of wax and propolis, older hives perform better than new ones. A piece of old beeswax can be added to a new box to add appeal, or the entrance can be sprayed with an extract consisting of propolis and old beeswax. Beekeepers insert a thin strip of beeswax foundation into each frame to encourage new swarms to construct their combs there. These bait hives can be positioned on the ground in the shade or suspended from trees. The first blooms opening during a strong honey flow, especially following a period of scarcity, is the greatest time to put bait hives. Beekeepers become familiar with the swarming paths and seasons in their area. The ideal locations for bait hives are a clearing in a forest, the edge of a woodland or under a tree in a field. Additionally, they can be positioned in suburban and urban areas to draw swarms that would otherwise invade structures. It takes a lot less effort to catch a swarm in a bait hive than it does to remove a colony from a roof or another area of a structure. Because of their more advanced hygiene practises, they promptly remove aberrant brood, breaking the infectious cycle of disease organisms. Africanized bees are Varroa-resistant. These bees have lower infection rates than European bees do. Antibiotics and acaricides are not used to treat colonies. As a result, there are no leftovers from these ingredients in the honey that is produced.

DISCUSSION

The Africanized bee utilises propolis lavishly, occasionally even blocking much of the entrance, unlike many varieties of European bees that have historically been bred for reduced propolis production. This is probably a reaction to the unfavourable climatic conditions in their natural habitat, where bees can somewhat control weather patterns and pests like ants by plugging holes and crevices with propolis. Propolis is currently regarded as one of the most significant beehive products in Brazil, and vast amounts are used to produce a variety of extracts for pharmaceutical and therapeutic use. Brazil has recently started exporting both raw and processed propolis to nations like China, South Korea, Japan, and others. Much of it is used to make skin cream, shampoo, toothpaste, and other items that are sold domestically as alcohol extracts or aqueous mouthwashes, occasionally combined with medicinal plants.

Africanized bees flourish and produce honey in environments where European bees cannot. Many of Brazil's biological zones, including the country's tropical rainforests and, in particular, the arid, savannah-like Cerrado and Caatinga, were unsuitable for beekeeping since the environment was too harsh for European bees to survive. On the other hand, Africanized bees thrive in these kinds of climates, and colonies managed in these places produce a lot of honey. When producing honey requires strong colonies, this facilitates the beekeeper's task. Compared to European bees, relatively tiny swarms grow into robust, productive colonies faster. Africanized bees have more nimble foraging abilities, more prolific queens, and a quicker growth rate for the worker brood. European bees hang onto the combs more firmly than Africanized bees do. Shaking them off the frames is a common method for collecting honey, and it is quite simple for the beekeeper. Nearly all bees can be removed from a comb with a simple shake, but European bees must be removed using a brush, which is time-consuming, difficult, and, in the case of Africanized bees, enrages them.

Apiaries were previously situated close to homes and domestic animals, until Africanized bees arrived in Brazil. On shared hive stands, the hives were kept near to one another. However, beekeepers had to shift their apiaries further away from enclosed animals and people after observing that the new bees actively defended themselves. Additionally, they discovered that it was ideal to keep the colonies farther apart since if one colony was handled, the bees from nearby colonies would become agitated. Similar issues existed with colonies kept on numerous hive stands. All the colonies on the stand would be alerted by the vibrations produced when handling one colony, hence many colonies had to be managed simultaneously. In order to prevent the bees from seeing and attacking neighbouring animals and people when the hives are handled or otherwise disturbed, it is helpful to surround the apiary with bushes that are at least 2 metres high[5], [6].

Defensive bees attack dark, textured clothing aggressively and preferentially. A light-colored straw hat or helmet and a strong, sturdy veil constructed of metal screening that is painted black just on the inside of the front panel to assist vision are both examples of good modern protective gear. Outside-dark veils, such as those that are frequently worn, draw enraged stinging bees. These bees can be alarming as they cling to the veil and buzz aggressively, even though they cannot sting the beekeeper. This does not occur when there is a light-colored screen on the outside. Light, smooth-textured clothing is preferred. In general, beekeepers should wear a large, white or light-colored overall with elasticized wrists and ankles that is zipper-closed.

When wearing gloves, they should be made of supple leather, translucent plastic, or rubber. These materials don't typically harm the bees, and unlike rough leather gloves, they don't readily hold onto alarm pheromones. Additionally, light-colored, silky shoes and boots are recommended. Suede, which is a rough type of leather, quickly develops stinging. Brazil has accepted the white butcher's boots made of rubber because they are affordable and reliable. If exposed, socks should be tidy and light in colour.The smoker used to manage European bee colonies is insufficient to manage Africanized bee colonies. Beekeepers soon discovered that the only smoker that would allow them to control the bees was significantly bigger and more effective. Smoking the bees before they get out of control is a key rule because it's typically too late after they do.

Strategies for managing the Africanized honeybee more effectively and efficiently. Honeybees from Africa are highly reactive and sensitive. Every action a beekeeper takes with European bee colonies must be taken with greater caution while treating Africanized bee colonies. The smoker and its use are highly crucial. Beekeepers should always keep it lit, huge, and equipped with an effective bellows because Africanized bees need more smoke, especially when they are first acclimating to them. Keep extra charcoal nearby for the smoker. Africanized bees require smoke to be applied before touching the hive, unlike European bees, which can be opened and smoke applied as needed based on the bees' behaviour. Bees will immediately start to fly out and sting if the beekeeper delays to apply smoke, making it impossible for him or her to control them. Work in the apiary is substantially facilitated by using smoke appropriately before the hive is opened and for the first minute after.

Africanized bees are good teachers since they react fast to any mistakes made by the beekeeper. Beekeepers can use this to their advantage to learn how to work with these bees. When working with aggressive bees, beekeepers typically wear sturdy, thick bee jackets, veils that are extremely well-sealed, and hefty gloves. Near-perfect protection can be counterproductive since the beekeeper loses awareness of the bees' reactions, even though it is the best method for preventing stings. When at all possible, working without gloves is preferred. Gloves for beekeepers should be kept in their pockets and only be used when absolutely necessary. When disturbed, the bees will sting the beekeeper's hands, warning them and allowing them to apply smoke and handle the bees with greater care. Beekeepers can feel the bees by exposing their palms. They will gradually adjust their handling methods subconsciously until they can interact with the colonies without causing too much disruption[7], [8].

The typical well-sealed bee suit, on the other hand, makes the beekeeper look more like a bear tearing apart the colony, which irritates the bees. Aside from the beekeeper experiencing an unpleasant swarm of enraged bees trying to pierce their clothing and an apiary of colonies that remain uneasy for hours or days after, enraged bees will fly far outside the boundaries of the apiary and sting neighbours and other people who are not wearing bee suits and veils. The way we treat bees has a significant impact on their protective conduct.Bees defend themselves if humans treat them rudely. Their goal is to get the invader to leave. The bees will continue and step up their defence of their colony provided beekeepers are persistent and well-protected with gloves and a bee suit. With clouds of bees surrounding each intruder and frequently gathering on the veil, many other colonies may soon become aware and join in, making work in the apiary uncomfortable and dangerous. A hundred or even hundreds of metres away, people or animals may be assaulted. If the bees pose a threat to the neighbours, the beekeeper can then be required to relocate the apiary.

Therefore, beekeepers need to understand how to manage their colonies without upsetting them. Smoke should be the first thing to contact the hive. Make sure not to disrupt any beehives that are nearby. If they are nearby, smoke them as well. To prevent the bees from being disturbed by vibrations, hive stands should be robust and unique. Smoke into the opening of the hive cover after doing so, then into the entrance. The bees will be forced to descend and be encouraged to feed on honey if the cover is removed after that. When beginning to remove a super, each fresh opening needs to be smoked. The smoke should be directed so that it penetrates the top of the hive box below as well as the bottom of the super being removed. To avoid leaving the hive open for an extended period of time, go steadily and rapidly. An expert beekeeper can accomplish this on their own, but it's simpler to handle if one person smokes while the other removes supers and frames. This bee control procedure calls for a sizable, effective smoker. The initial stages are crucial for smoking. It is too late to calm the bees down once they are attacking in the air, so it is preferable to close the hive. These measures may take a little more time at first, but with practise, handling bees in this way becomes usual and effective.

Giving the bees the appropriate amount of room at the appropriate time is a crucial component of regular management. There should always be enough supers to prevent overcrowding in the colonies. In order to ensure that the bees never run out of space once a honey flow begins, beekeepers must build extra supers and harvest the honey regularly enough. Africanized bees can swarm extremely quickly, which significantly lowers honey production. Additionally, following the honey flow, make sure the bees have enough food. Africanized bees will elope, leaving the apiary in search of better bee pastures, as opposed to European bees, which merely deteriorate into a small colony.In an apiary, one or a few colonies are frequently more resilient than the others. If these colonies are disturbed, they may attack the beekeeper and cause the remainder of the apiary to defend itself. It is advisable to manage these hives last because of this. Requeening or evicting these hives from the apiary might significantly alter the behaviour of the bees. This can be viewed as a form of negative selection and is simpler and more fruitful than attempting to reproduce the least defensive colonies. The general conduct of the bees in the apiary can be improved quickly if the few most defensive colonies are consistently removed. But how does one requeen a sizable, very protective colony? This can be done more easily thanks to a number of techniques. The defensive hive might be relocated to a different area of the apiary throughout the day as one alternative. The powerful colony will be weakened when the foraging bees return to the previous location[9], [10].

Brood combs that have been sealed up can also be taken out and added to other colonies. The colony will grow quite weak and less defensive if the hive is repeatedly moved about the apiary or if brood is removed, which will make it simpler to locate the queen. The bees can also be tossed onto a vacant hive with combs, covered with a queen excluder and an empty box, and then smoked down to trap the queen on the excluder and make her removal easier. A extremely defensive apiary can be greatly and quickly calmed down with the right handling and care, as well as by requeening the most defensive colonies.Beekeepers must be quick and effective in order to fully benefit from Africanized bees' speed and efficiency. If not, the hive will quickly become overrun with bees, which will cause the colony to become significantly less productive and swarm. The foundation of the global beekeeping industry is a lengthy history of technical advancements made for European bee races. As a result, bees have been chosen for their kindness and productivity, and efficient equipment has been developed for the production of honey, royal jelly, and other hive products. However, the Africanized honeybee is sufficiently distinct from the native honeybee that these methods are ineffective when used on it.

Apis cerana has six distinct morpho clusters and is indigenous to South, Southeast, and East Asia. A. cerana was recently brought to areas that are east of its natural distribution, from Indonesia into Papua New Guinea, the Solomon Islands, and Vanuatu. It was also discovered in Australia's Far North Queensland and Northern Territory. When compared to its Western equivalent, A. mellifera, research on the genetic diversity of A. cerana is scant. Recent studies on the A. cerana population in China reveal great genetic variety and call for more investigation, particularly in mountainous areas like the Tibetan Plateau and islands. The fall of There are a number of ailments, parasites, and pests that are unique to A. cerana and do not impact A. mellifera, and they constitute a severe danger to output and productivity. This is especially critical in light of these issues. It is possible to spot wax moth damage all the way through the production process. Sacbrood and EFB are two common brood infectious diseases that can both cause significant harm to colonies. ABPV, DWV, CBPV, nosemosis, and other common adult bee diseases are these.

A. cerana primarily produces honey, beeswax, and pollen from its hives. Absconding is a frequent issue that beekeepers who are in charge of A. cerana report. It is the colony's natural reaction to unfavourable conditions like food scarcity or pressure from pests and diseases. Additionally, unsuitable hive designs, subpar management strategies, and a lack of knowledge regarding honeybee nutrition worsen this behaviour. To some extent, fixing these issues can stop the colony from fleeing. This problem could be resolved by offering suitable instruction, educational resources, and extension services for enhancing fundamental beekeeping, supplementing feeding during times of famine, and managing pests and illnesses. It should be remembered that smallholder farmers frequently have complicated and diverse portfolios of livelihoods. They are resistant to pressures and shocks because of their intricacy. Despite the best efforts of numerous programmes, Improved technology is frequently marketed to rural farmers as a remedy for their poverty and poor honey production. There are numerous benefits to these technology. For disadvantaged rural beekeepers, they can also result in numerous limits and elevated financial risks, as well as the need for numerous additional inputs. Comb honey can occasionally sell for more money than strained honey, and this can outweigh the costs and risks of investing in resource-intensive management systems. Hive designs made from locally sourced inputs and stocked with local bees can often obtain higher returns on investment thanmodern beekeeping approach- es.

After *Apis mellifera, A. cerana* is perhaps the second-most productive cavity-nesting honeybee species worldwide. Even though studies have shown that it produces less honey than A. mellifera, studies also show that by using better management and harvesting techniques as well as selective breeding programmes, honey production and other desirable traits can be boosted. In Guangdong, China, Wongsiri reported in 1992 that better management practises and selective breeding initiatives led to colony sizes increasing from 2000 to 6000 bees and honey yield increasing by 5 to 50 kg year. A. mellifera produced honey in amounts comparable to those of modern tropical strains of A. cerana before selective breeding. While the fundamentals of grafting can be seen locally, training and extension are necessary to raise queen breeding success rates and the calibre of current stock. Improved grafting techniques and the rearing of queens from more fruitful colonies may result in higher honey production and a decline in elopement.

The beekeeping of A. cerana has substantial prospects for smallholder beekeepers to generate money as well as significant room for growth. Major drawbacks of raising this species include the need for better understanding of bee space, absconding frequently, unstandardized hive design, and the high moisture content of its honey, which can lead to fermentation. Future beekeeping research on A. cerana would benefit from further study comparing the labour and financial returns on investment of various beekeeping systems. Although A. cerana honey production is less than that of A. mellifera, honey prices in some countries, like Indonesia, greatly increase household incomes. Smallholder beekeeping operations across the species range would benefit from enhanced productivity and profitability if instructional materials, training, workshops, and increased accountability and efficacy of extension services were developed[11], [12].

The following tactics are advised to improve beekeeping and conservation outcomes:Move A. cerana genes carefully across geographic boundaries since they can pose a serious danger to local populations' genetic integrity and the spread of honeybee illnesses and pests. When transferring genes for queen-bee breeding initiatives, adhere to stringent biosecurity measures, and do risk assessments before importing new genetic material. Avoid using antibiotics to treat populations of A. cerana with bacterial brood illnesses such AFB, EFB, and nosemosis. Find organic substances, best practises, and IPM tactics specific to A. cerana anywhere chemicals are used to combat honeybee pests and diseases. Spreading best practises and biosecurity precautions among smallholder beekeepers will require increased teaching and extension activities by beekeepers. Harvest only fully developed honey. In an effort to boost productivity, some beekeepers take honey from colonies far too frequently. Due to its immaturity and excessive moisture content, this honey is poor quality and highly fermentable. Honey should be extracted from sealed cells and allowed to mature naturally if it is to be of high quality. Strong colonies and improved stocks with early and enhanced honey production are advised for beekeepers wanting high honey production.

To increase capacity among rural beekeepers on effective post-harvest handling, improve education and extension support. This will lessen the problems that arise when beekeepers harvest honey before the comb is sealed, such as weakened quality control and ensuing marketing drawbacks as a result of fermentation. Create a global organisation for A. cerana beekeepers to advance information sharing, encourage research on best practises for conservation and management, and establish strategic goals for the corresponding sectors.Increase research on standardised hive designs for A. cerana morphoclusters, including frame size, hive capacity, and wax foundation cell sizes. Even if movable-frame hive designs do make management more efficient, a cost-benefit analysis should always be carried out before attempting to introduce new technologies to communities, as these can increase financial risks for vulnerable farmers and are frequently an inefficient and inappropriate mechanism for economic and social development. Create and enhance A. cerana-specific supplementary feeding programmes that take into account local meteorological conditions and the availability of floral sources.

CONCLUSION

In conclusion, beekeeping operations' productivity, the health of bee colonies, and the preservation of these significant pollinators all depend on the management of honeybee populations, whether they be Apis mellifera or Apis cerana. A complex issue driven both beekeeping techniques and the bees themselves is the spread of diseases among bees, colonies, and apiaries.The introduction of hybrid honeybees called Africanized honeybees has presented beekeepers with both opportunities and challenges. These bees have proven to be highly productive in some areas and have shown their ability to adapt to different conditions. Requeening and other hive management strategies, along with an understanding of their special traits, are essential to maximising their potential while preserving safety and production.The management of Apis cerana, another significant bee species, too has its own unique potential and challenges. The effectiveness of beekeeping operations utilising Apis cerana depends on careful consideration of hive designs, disease management methods, and honey harvesting procedures unique to this species.Overall, whether working with Apis mellifera, Africanized honeybees, or Apis cerana, beekeeping techniques should be adapted to the unique requirements and traits of the bee species in question. Beekeeping operations may become more sustainable and lucrative while also helping to preserve these important pollinators by putting an emphasis on education, research, and the sharing of best practises.

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CHAPTER 11

BIODIVERSITY AND CULTURAL SIGNIFICANCE OF DWARF HONEYBEES, GIANT HONEYBEES

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ABSTRACT:

These little bees have migratory habits and build their nests on tree branches, bushes, or protected buildings. Dwarf honeybees are not kept for commercial purposes, and honey hunters gather their honey in the old-fashioned way. The therapeutic and nutritional benefits of the honey are highly valued.The gigantic honeybee is recognized for its seasonal movement patterns and builds huge open-air nests in high elevations. These bees produce a huge amount of honey and contribute significantly to pollination. However, because of the height of their nests and the fact that they cannot be handled like Western honeybees, it is dangerous to extract honey from giant honeybees.Meliponini family members called stingless bees flourish in tropical climates and make honey, pollen, and propolis. They provide worthwhile items and are significant pollinators. In a number of Asian nations, such as Malaysia, Thailand, Japan, Indonesia, and the Philippines, initiatives are being made to take advantage of their potential for pollination and honey production. Africa has a large variety of stingless bee species. however, they are yet largely unexplored.In conclusion, the numerous bee species found in Asia and Africa have a tremendous impact on ecosystems and human livelihoods. It is vital for their continued survival and the advantages they provide to civilization to promote sustainable practices, comprehend their biology, and protect their habitats.

KEYWORDS:

Bees, Biodiversity, Cultural, Honeybees.

INTRODUCTION

With their tiny nests, diminutive bodies, and migratory patterns, both honeybee species are adapted to tropical climes. As the seasons and flowering cycles change, the bees migrate back and forth between the highlands and the plains. In June, they start to cluster together in swarms. They construct the nest as a solitary comb suspended from a tiny tree branch, a shrub, or a creeper in a stand of thick shrubs. Buildings that are sheltered from predators and poor weather are their favorite nesting locations, followed by trees and, occasionally, rocks. They will go back to the place where they nested the previous year if they can. They never construct nests on weakened, old structures or fallen trees that cannot sustain the weight of the nest, or on the remains of a previous colony that was burned, chemically treated, or enamel-painted. Since dwarf honeybees are feral and not kept for commercial purposes, farmers with competence in honey hunting can obtain the products. To remove the bees from their combs, they typically employ a smoker or a grass-fueled torch. The honey is then filtered via a mesh filter after the combs are crushed. Honey can be gathered three times a year from each colony, which generates roughly 1-2 kg every harvest from March to May. Seasonally, its coloration changes from brownish red in the summer to yellowish white in the winter. Additionally, it is very healthy and abundant in vitamin B6. Locals believe it to be a herbal remedy, which is reflected in its cost: it is more expensive than A per kilogramme, costing around 120 yuan. m. The price of ligustica honey is only 20 CNY per kilogramme.

Establishing an apiary in a heavily populated region is not advised since bees may cause problems. Place manageable rafters in the apiary since dwarf honeybees are a wild species that migrate in accordance with the seasons and nectar flow. Place combs from the nest in the hive to attract colonies, as they frequently return to the nest they constructed the previous year. Within 30 days of its establishment, the apiary must be registered with the local beekeeping association. It must then be re-registered in accordance with local laws. Wear appropriate safety equipment if handling bees. This comprises thick socks, dungarees or boots that reach the ankle or calf, a long-sleeved shirt and a bee veil.When handling the bees, use a bee smoker that can spew out puffs of thick, moderate smoke. All reusable tools and supplies should be cleaned and put away right away. Burn all useless items and equipment since they could attract pests. During the honey flow season, only remove ripened honey from the colony. By using the smoker, followed by a cut from where they hang from a tree branch or another place, remove ripe combs. Using a bee brush, remove any residual bees from the combs. Always keep the equipment and facility for extracting honey clean[1], [2].

Use storage tanks and containers made of food-grade materials. stainless steel is ideal because it is easy to clean. To allow honey to be withdrawn without disturbing sediments at the top, attach a gate valve or honey gate to the lower end of the containers. Keep honey in sealed containers and away from substances that could contaminate it. Honey must be kept at room temperature. The use of A is becoming more popular. A. and Flora. antenniform's for apitourism, educational honey-hunting excursions, and/or the manufacture of therapeutic honey. Greater efforts are also required to educate local residents on how to properly manage dwarf honey bees and their habitat.Throughout South and Southeast Asia, the enormous honeybee is a natural species that is common. With huge nests, a massive body, and seasonal migration, it has developed to adapt to highlands or tropical climates.

The species makes 1.5 m-diameter, open-air, single-comb nests that are typically strung from cliffs or tree branches, frequently 3 to 50 metres above the ground. About 54 and 34 drones, respectively, mate with queens each day. A. After dusk, you can see dorsata drone congregation places beneath the spreading limbs of towering trees that protrude well beyond the main forest canopy. But there's no A. Areas where laboriosa drones congregate have not yet been found. A colony can store 4.09 2.56 kg of honey in the comb three to four weeks after nesting, however the largest production documented in literature is close to 16 kg.A. Dorsata employees react aggressively defensively. Giant honeybees move from one location to another during the reproductive season depending on the availability of nectar and pollen supplies. Open-air migration nesting type A. and A. A minimum of twice a year, laboriosa migrate. Both worker and drone brood are hexagonal in shape and are identical in size at 0.3 cm length, 0.6 cm broad, and 1.5 cm deep[3], [4]. The swarm queen cells are 1.5 cm deep, have a 0.8 cm diameter at the opening point, and have 0.1 cm thick walls.

DISCUSSION

Harvesting from gigantic honeybees is frequently perilous because to the height of nests. Due to the species' migratory nature and the fact that it is not a cavity-nesting species, Megapis cannot be domesticated or managed in the same way that the Western honeybee has. The ways in which this plant is harvested, how it is managed, and how important its products are to rural livelihoods vary widely across its native locations.

Systems of management and harvesting

Giant honeybees are lured into man-made nesting sites or rafters in some villages in Vietnam, Indonesia, Cambodia, and Thailand. In lowland settings where colonies occupy lower flora, such as mangrove woods, rafters are more frequently utilized and colonies can be more easily accessed. Honey hunters in mountainous places frequently need ropes and ladders to access enormous honeybee nests. The usage of safety ropes and other protective gear, such as veils and gloves, is uncommon among honey hunters.

Cultural and social values

Rural communities place a high importance on their cultural heritage, and as a result, local elders or shamans frequently pass on their knowledge of beekeeping and cultural customs to initiates from their village. For instance, honey hunters in Indonesia claim that honey trees are thought to house guardian spirits and have diverse personalities, which are reflected in the personalities of the bees. Indigenous Tagbanua people of the Philippines practice thelambay rite, in which bees are conjured, and use beeswax in their rituals. The preservation of indigenous technical and ecological expertise can be aided by honey-hunting, and the value of this knowledge for community forest management initiatives should not be understated. Foreigners are interested in honey-hunting cultural practices as well. This is evident in Nepal, where a growing ecotourism sector based on apiculture attracts tourists willing to spend between US$250 and US$1000 to enjoy honey-hunting from Himalayan cliff bees. For further details on apiculture tourism, go to chapter X.

The pursuit of honey considerably supports rural economic growth and monetary incomes. A. d. Binghami meets around 80% of Indonesia's demand for wild honey, with Sumbawa providing the majority of the honey. According to the Forestry Office of West Nusa Tenggara, Sum-bawa produces 40 tonnes of honey annually with a market value of 3 billion rupiah. On average, 68 percent of annual cash profits for 83% of honey hunters in Sumbawa were found to originate from honey sales.In West Kalimantan, De Mol in 1934 and Peters in 2000 estimated average annual honey production of 53-267 kg, valued at USD 0.75 per kg. According to these reports, honey income is comparable to the average annual cash income of a smallholder farmer in the area. Numerous indigenous groups in the Philippines view honey hunting as one of their lucrative livelihood options. 2015 had a gross margin of US$0.61 per kg of honey for the native Tagbanuas. Nearly 12 tonnes of forest honey were collected by indigenous people on the island of Palawan.

According to reports, honey-hunters who manage rafters in Thailand's Songkhla Province collect colonies 4-5 times a year at intervals of 20 days, with annual yields of 12–18 litres per colony and individual harvests of 3–3.75 litres from a single colony.According to Tan and Ha's assessment from 2002, honey hunters in Vietnam typically install 7–10 rafters per hectare of forest, and depending on experience and time available, they may own 25–200 rafters. Each season, 60 to 80 percent of the rafters are typically occupied, and for the area, yields per colony are reported to be 3-5 kg with 2-3 harvests annually. Individual honey hunters reportedly collected up to 1000 litres of honey in 2002, which is worth $2800 annually. Honey made up 30% of families that hunted for honey, on average, according to household surveys. among hobbyists and professional hunters, the percentage ranged from 5% to 60%. The typical annual yield of honey from A. According to reports, laboriosa weighs 15–50 kg from A and 25–60 kilogramme per colony. dorsata. In Nepal, enormous honeybees create 36% of the country's annual honey production. Honey hunters in India are thought to capture 22,000 tonnes of wild honey each year, which is twice as much honey as is made by the beekeeping industry[5], [6].

One of the main causes of extinctions worldwide is the clearing of land and deforestation for agriculture. Megapis are impacted by the loss of forest cover in three ways: by lowering their access to a variety of floral supplies. by reducing the number of nesting sites that are available in residential areas. and by reducing the number of congregation stopover sites where colonies pause while migrating. Additionally, giant honeybees may favour nesting in particular species of trees.Honey-hunting activities can sometimes harm honey trees, such as when bamboo pegs or nails are driven into the trunks. The effect on a species' resilience may be enhanced in areas where vital flora is declining. Although rural honey-hunters claim that the forest is a key component of their livelihood strategy and that maintaining it is crucial for generating revenue, additional research is required to ascertain the ways in which honey income may encourage communities to preserve or lessen destruction.

Harvesting difficulties and best practises

Even though collecting Megapis honey is frequently a damaging operation, there have been increased initiatives to support environmentally friendly harvesting practises. These include harvesting without the use of fire or smoke, only taking the section of the comb that holds honey, and leaving the brood unharmed. Although these efforts are appreciated, they rarely include details about the practicality, transferability, and incentives for adoption of practises. This is crucial in cases when low-income groups cannot instantly see the benefits of such practises. The competition for resources with non-participating organisations may make it difficult for beekeepers to apply sustainable best practises, even if they attend sustainable harvesting training and agree with them. To ensure the financial security of their own families, this puts more pressure on them to overuse resources.

There is a system of customary law that establishes who owns honey trees and who has the right to gather from them in Central Sulawesi and West Kalimantan. This is comparable to Philippine honey-hunting. Other regions, like Sumbawa, practise opportunistic harvesting, frequently from well-known and occupied trees along well-traveled hunting pathways. Those who arrive first have the right to collect honey from honey trees in locations where there is no obvious claim of ownership. This method puts more dependent communities at risk because there is no certainty of how many colonies are available to harvest from or of reaching resources first, which increases the pressure to overexploit resources and collect the honey before it is mature.

The lack of fundamental information on the ecology of gigantic honeybee populations and sustainable harvesting levels presents a significant challenge in the development of best practise management and harvesting systems. In order to determine baseline recolonization rates, it might be necessary to test and monitor a variety of harvesting techniques. The rates of recolonization and survival may also be increased by abstaining from smoking or by recognising the queen bee before smoking. To address the issues of sustainable honey harvesting, future management plans might also need to look into the tenure of honey trees. To address the views, values, and interests of these communities, consultation is necessary. In this situation, knowledge exchange between internal and external players is likely to support local forest management systems' viability. Honey-hunters require village-specific assistance and stronger social ties with cooperatives in order to increase quality and supply among honey cooperatives, including:

1. Financial assistance for the formation of farmer organisations and the purchase of tools. such as sealable buckets and strainers, for sanitary harvesting and post-harvesting.
2. Enhanced transportation and collection services for honey.
3. Better extension and education services.
4. Strengthening of honey value chains through enhanced networking, communication, and price transparency.
5. Future research, development, and extension initiatives.

6. Look into how honey can encourage communities to maintain flower-rich regions for honey production and income and to improve forest conservation outcomes.
7. If harvesting quotas based on seasonal population and recolonization rates could be developed.
8. To better comprehend the giant honeybee's migration patterns and the consequences for protecting significant stopover places and vital floral resources.
9. Analyse the honey value chain to find major players, obstacles, and opportunities.
10. Analyse the prevalence, genetic sequencing, and effects of illnesses and pests affecting megapis, including viruses that affect honeybees[7], [8].

The complicated problems associated with conventional social systems and the scarcity of basic ecological knowledge regarding the population ecology of the species are the primary drivers of the sustainability of honey-hunting. Future conservation and research activities should support both biodiversity and the importance of indigenous systems and innovations for management, given the close ties between rural honey hunters' traditional practises, knowledge, and beliefs and forestry and land-use practises. Megapis conservation is essential for the sustainability of the eco-system and rural lives, and measures to preserve it, including ethical honey production, are a global duty.Compared to honeybees, stingless bees have a wide range of species. Unlike stingless bees, which are part of the Meliponini family and have more than 60 genera and almost 500 species, most of which are found in the New World tropics, honeybees only have one genus and a very small number of known species. They also differ greatly in terms of colony size, body size, and colour. In contrast to honeybees, stingless bees have either no sting or a sting that is so weak it cannot be used for defence, yet they may still deliver a devastating bite if their nest is disturbed. Most tropical or subtropical areas of the planet, including Africa, Australia, Southeast Asia, and the Americas, are home to stingless bees.

Only a few species have mandibular secretions that include formic acid and result in painful blisters. Stingless bees may establish very big colonies that are robust due to the quantity of defenders, despite the fact that they lack stingers. However, they have also been found in wall cavities, old trash bins, water metres, and storage drums. Sting-less bees typically build their nests in hollow tree trunks, tree branches, under-ground cavities, termite nests, or rock crevices. Queens only conjugate with one male. It is easier to manage the hive if all beekeepers leave the bees in their original log hive or move them to a wooden box. Some beekeepers place the hives in bamboo, flowerpots, coconut shells, and various recycling bins like water jugs, broken guitars, and other secure bins.Stingless bees generate an abundance of honey and pollen, which enables the colony to endure times of scarcity. Beyond their immediate demands, workers gather floral resources, which leads to targeted visits to preferred flowers. They are able to tell other foragers of distance and direction. By enlisting nestmates, one can increase pollination efficiency and maximise nectar and pollen collection. According to Kajobe & Roubik, there is still a lot of research to be done on the biology of stingless bees, including topics such nest formation and the structures that result, defence, foraging, reproduction, caste and sex determination, and reproduction.

Except for the Neotropics, where stingless honeybee domestication is widespread, the other tropics, especially Africa, have not been able to successfully harness the products from these bees due to a lack of basic understanding of their biology and behaviour. Because the colonies are perpetual, stingless bee multiplication methods are environmentally friendly. They are easily mass-produced utilising straightforward techniques. Because there are constantly new queens available, the colonies are self-sufficient.Only a small number of stingless bees generate enough honey for humans to keep. In huge, egg-shaped containers made of beeswax blended with various kinds of plant resin, which is also referred to ascerumen, the bees normally store pollen and honey. The horizontal brood combs in the centre of the arrangement, which houses the larvae, are frequently surrounded by the pots. Depending on the species, hives can house 300–80.000 workers at once. A mixture of secreted wax, propolis, and other materials, like as animal excrement, typically lines the rest of the nest chamber, including the entry tubes.Meliponine honey is treasured as a medicine in many African cultures and in South America, despite the limited amounts produced. It is used to reduce fever, cure enteric disorders, coughs, and throat infections, as well as to improve fertility. Numerous research have demonstrated that it might have positive effects. In comparison to Apis mellifera honey, stingless bee honey has a higher moisture content, greater acidity, lower sugar composition, and reduced enzyme activity. A harmonised worldwide quality standard for stingless bee honey was proposed by Nordin et al in 2018. Although stingless bees are highly coveted, they have long been underappreciated by commercial honeybees and sometimes overlooked by pot-honey standards. These bees and their honey are currently seeing a rebirth in popularity.

All bees provide good pollination services. Since there is always a match between pollinators and their flowers, each bee has a specific specialisation in the pollination world. Stingless bees are crucial pollinators in tropical ecosystems and visit a variety of flowering plants to gather pollen and/or nectar. They then go from flower to flower before returning to their nests with the materials they have collected. Stingless bees are important pollinators of a wide range of plants, including mango, avocado, lansones, rambutan, strawberry, lychee, and macadamia. Tetragonula biroi, a species of stingless bee, has a limited flying range of 250–500 metres, whereas T. carbonaria has been found to have a typical and maximum homing range of 333 and 712 metres, respectively. Their limited flight range may be the reason they take advantage of richer floraral resources nearby. However, they show floral constancy when viewed at the level of the individual bee.For pollination work, stingless bee colonies can be kept in hives and moved with ease. The colonies may be evenly placed throughout the farm thanks to their short flight range, which makes sure that all of the flowers are seen. Stingless bees can also successfully pollinate plants produced in greenhouses.

Tetragonula biroi was found to boost pepper, Capsicum annum, fruit set by 74% in a recent study. Tomato buzz pollination, in particular, can be accomplished with Melipona species. The uses of stingless bee cerumen and honey, as well as their significance as pollinators, require further study.The stingless bee is a significant species that is well suited to tropical regions. It is locally known aslebah kelulut in Malaysia,channarong in Thailand, andlukot orkiwot in the Philippines. It has proven to be a successful pollinator of both domesticated and untamed plants and a producer of priceless goods like honey, pollen, and propolis. Because of the nar- row gene pool of the exotic A. mellifera, beekeepers in the majority of Asian nations import queens. A. mellifera, however, cannot thrive in the wild in many areas of Asia due to pressure from parasites and predators. Other issues with Apis mellifera propagation include competition with native Asian bees for nesting sites or floral resources, invasion by pathogens and parasites, pollination by invasive weeds, genetic introgression affecting native plant species, and changes in the structure of native pollination networks. As a result, stingless bees are now being used in Malaysia, Thailand, Japan, Indonesia, and the Philippines for pollination. In 2017, Malaysia established the first national standard for honey made by stingless bees. The first standard forkelulut was based on the work [9], [10].

The diversity of stingless bee species and genera is highest in the equatorial areas, with the Afrotropical region having the fewest species and genera. African stingless bees are smaller than Apis mellifera, the indigenous African honeybee. Stingless bees in the Afrotropical region were the subject of comparatively few studies up until recently. With the aid of local guides and indigenous peoples, stingless bee species can be identified. The Batwa pygmies of Uganda, who seek for honey in the area of Bwindi Impenetrable National Park, assisted in classifying stingless bees by examining characteristics including size, colour, and markings. Indicator pumilio, a little bird native to the Albertine Rift Mountains, a miniature honey guide, has occasionally assisted researchers in identifying stingless bee nest locations.

Since species names have evolved over time and different writers hold divergent perspectives on phylogeny and classification, the taxonomy of stingless bees can occasionally be unclear. The majority of genera in the majority of locations have not been sufficiently examined to identify their forms. The most thorough taxonomy of the African stingless bee to date was published by Eardley in 2004. Although it is now thought that the author understated the true richness of tropical Africa, he claimed there were six genera and 19 species there. Due to a lack of research in this area, the precise number of stingless bee species in Africa is unknown. Before Eardley's publication in 2004, in 1964, Kerr and Maule identified 42 different species of stingless bees in Africa. Axestotrigona, Dactylurina, Hypotrigona, Liotrigona, Meliplebeia, Meliponula, Plebeiella, and Plebeina are among Michener's subgenera that he claimed were valid at the genus level. Michener listed five genera in 2007, but Kajobe and Roubik suggested there are actually eight, including the 24 species that are currently recognised, in 2017. Further investigation is necessary in order to properly classify the genus Apotrigona. DNA barcodes, a technique that employs a brief genetic sequence to identify an organism, are the greatest tool for differentiating visually identical stingless bee species.

Throughout Africa, there are various genera and species of stingless bees. For instance, in 2013 Pauly and Hora identified six species of stingless honeybees in Ethiopia and six species of stingless honeybees in Tanzania. Six stingless bee species from four genera were discovered in the Bamenda Afromontane Forests of Cameroon, and six more were discovered in the Kakamega Forest of Kenya. Meanwhile, discussed five genera that included 11 species from Ghana, demonstrating the country's exceptional diversity. In comparison, only five species from two genera were discovered in Uganda's Bwindi Impenetrable National Park. The majority of tropical Africa is home, which is renowned for its honey. One nest is said to produce 5 to 18 liters of good honey, and the bees are manageable.The nests of stingless bees can be used to identify them. Nests are significant in taxonomy, particularly in the little-studied equatorial tropical Africa. Excellent insulation is one of the characteristics of the majority of stingless bee nesting areas. Particularly well-insulated nests are those that are in big trunks or the ground. Many species, especially those from the humid tropics, cannot survive the cold. Brood cells and food storage containers are arranged and shaped differently inside the nest. Ripe honey or nectar is kept on the edges of nest cavities, and some even surrounds the brood area.

CONCLUSION

The diverse world of bees, including the dwarf honeybees, giant honeybees, and stingless bees (Meliponini family), therefore, plays a crucial role in the ecosystems and cultures of tropical regions throughout Asia, Africa, and beyond. These intriguing behaviours and adaptations to their particular surroundings make these bees essential to both biodiversity and human subsistence.Tropical Asia is home to many dwarf honeybee species, with A. florea and A. andreniformis flourishing in various areas. They build little nests and migrate according to the seasons, giving knowledgeable farmers the chance to collect honey. Locals view the honey they make as a herbal treatment in addition to being a major source of money.The enormous nests and seasonal movements of giant honeybees are well-known facts. They build their combs in a variety of places, frequently at great heights. These colonies produce a substantial amount of honey, making honey extraction risky but rewarding.In conclusion, efforts to comprehend, safeguard, and sustainably utilise these fascinating organisms are essential for the health of ecosystems and human cultures alike. The variegated world of tropical bees reflects a delicate and linked web of life.

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CHAPTER 12

EXPLORING THE POTENTIAL OF MELIPONICULTURE IN AFRICA: NEST ARCHITECTURE, CONSERVATION, AND ECONOMIC OPPORTUNITIES

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ABSTRACT:
Due to the distinctive nesting behaviors of these bees, meliponiculture, or stingless beekeeping, is not frequently practise in Africa. Given that the majority of stingless bee nests are not kept in box hives, a fuller understanding of the nest architecture of different stingless bee species is crucial to fostering their expansion. Assisting in species characterization and management for pollination and honey production, nest architecture provides vital information about nest size, entry design, insulation, drainage, brood comb, food storage, temperature tolerance, and defensive mechanisms. Different species have different nest entrances, defensive strategies, and reactions to microscopic predators, which are all governed by ecological conditions. Compared to West and Southern Africa, East Africa has showed more interest in meliponiculture, with Tanzania showing good potential for beekeeping due to its numerous species. Pot-honey, often referred to as stingless bee honey, has cultural significance and is used in traditional African medicine for a number of health advantages. For East African honey, standards and controls are being established, emphasising the significance of stingless bees for conservation. More study on meliponines is required in Africa because of the importance of these bees to crop productivity. Pests, predators, habitat destruction, and human interference are some of the threats affecting African stingless bees. Stingless beekeeping has a long history in the Americas, where some species have been raised for centuries. These bees have the potential to be successful pollinators of particular crops. The study of their use in agriculture, however, is still in its infancy.

KEYWORDS:

Bees, Economic,Health,Honey, Meliponiculture.

INTRODUCTION

Meliponiculture is not typically used widely in Africa. Because many stingless bee species construct their nests underground or in tree trunks, honey harvesting is damaging. For stingless beekeeping, a deeper comprehension of the species' nest design is required because the majority of nests are not retained in box hives. A species-specific property called nest architecture can support the characterization of a species. It offers details on the size or volume of the nest cavity, the size of the entry tube, colony insulation, drainage and waste facilities, the size and layout of the brood comb and food storage pots, temperature tolerance, defensive systems, and reactions to certain nest locations. It can also be used to help decide how a species should be raised for pollination and honey production. The internal nest design and protective behaviours, like as attack or quick retreat, are only visible when nests are opened. Rarely examined are protective reactions to specific tiny predators, such as insects that capture bees in their nests. In a thorough investigation conducted in Africa in 2009, Mogho Njoya discovered that the arrangement of brood cells, arrangement of storage pots, nest entrance shapes, and nest building of six species of stingless bees all exhibited distinctive design traits. Clusters, horizontal combs, or vertical combs can be used to arrange brood cells. The size and structure of the cells vary, and the involucrum occasionally serves as protection for the brood area. Meliplebeia beccarii is an African species of obligate ground-nesting bee that builds nests in the soil that have architectural characteristics shared with Plebeiella and Plebeina. Having stated that, Meliplebeia beccarii nests have three main areas: the brood region, the involucrum layer area, and the storage pot area. While cells are being created simultaneously, the combs are horizontal and constructed concentrically[1], [2].

In terms of the ecology of stingless bee nesting in Africa, nests are perennial structures that have the ability to last a long time, much like trees in the woodlands where meliponines dwell. A balance between nesting material, nest location, and a combative versus cryptic colony profile can be seen in the locations and construction of stingless bee colonial nests. Honey hunters, including primates and maybe other animals, use nest openings to find hives by hearing or seeing bees flying overhead or by venting the nest. From simple holes to dome- or trumpet-shaped entrances, stingless bee nest entrances vary between species. Small bee colony entrances are simple to protect because of their size. Traffic congestion and crashes during times of heavy foraging activity are one trade-off for this. Regardless of colony or bee size, African stingless bee colonies feature modest or discrete nest entrances. Chimpanzees prey on many of these colonies, using sticks to remove pollen pots, brood, and honey from different bee nests. In contrast to the stingless bees found in Asia or the Americas, this may have resulted in more covert nest entrances and activity. The diversity of nesting habits of African meliponines, notably their usage of sizable termite or ant mounds, may have been influenced by the added threat posed by huge mammals in Africa, including aardvarks, mustelids, civets, apes, and humans. These animals often avoid biting large vertebrates.

East Africa is more well-known for meliponiculture than West or Southern Africa is in the Afrotropics. In Tanzanian experimental hives, Marcelian et al. evaluated the honey productivity per colony. The average yields varied depending on the species: for Meliponula ogouensis, 2.7 litres. for Meliponula lendliana. for Dactylurina schmidti. and for Plebeina hildebrandti, 0.6 litres. These results suggest that Tanzania, which has the highest species variety of stingless bees, has good potential for beekeeping. Stingless beekeeping has only recently started in Ghana as an addition to Apis beekeeping. Stingless bees' honey can be obtained without harming the colony if the bees are properly managed and sensible hives are utilised. Nowadays, log hives and boxes are employed in many parts of Africa. These hives have a central flight entrance and closures constructed of woven or wood discs that have been precisely cut at each end. Urbanisation and intensive vegetation removal in some areas have reduced the amount of forage and potential nesting locations that could serve as a source of stock for beekeeping operations. Numerous bee colonies have also been decimated by the indiscriminate application of agrochemicals and general pollution. Competition for fodder is the largest issue for beekeeping, though.

Bee stingless honey

Pot-honey, also known as stingless bee honey, is somewhat more acidic and has a larger water content than honeybee honey, but it is still highly sweet and palatable. Numerous stingless bee species forage beyond the nectar, pollen, and honeydew that serve as the foundation for honeybee products. However, stingless bee production is substantially lower than that of honeybees.Pot-honey is highly sought after since it is thought to have therapeutic powers and is used extensively in traditional African medicine. In conjunction with jungle herbs, stingless bee honey is used to cure fevers, throat infections, and coughs as well as to improve fertility. The honey has also been used to cure digestive issues like diarrhoea and intestinal worms. Due to its cultural significance, stingless bee honey commands a greater price in Africa than honeybee honey. However, it has long been overtaken by commercial honeybees and somewhat disregarded in honey standards. These bees and their honey are currently seeing a rebirth in popularity.To make East African honey a marketable product, efforts are being made to establish controls and standards. This would significantly increase many regions' economies, but more importantly, it would highlight the importance of stingless bee conservation and demonstrate the value of these bees. A uniform stingless bee honey standard has been created by the East African Community. The standard states that when tested using the approved test procedures, honey must meet specific parameters.

Although there has been an increase in interest in studying meliponines as pollinators, there are currently no reliable data for Africa. Although the exact number of bee species in sub-Saharan Africa is unknown, 2600 species have so far been identified there. All of these, with the exception of 80 parasitic bee taxa, are effective pollinators. Stingless bees may be easier to handle than solitary bees since they are gregarious, and meliponiculture should be expanded to agriculture, according to new research. The tropics have been an ideal evolutionary playground for the development of a spectacular diversity of plant-insect, plant-plant, and insect-insect interactions because of their rich diversity of flowering plants and flower-visiting insects. These interactions are driven by the constant struggle for survival and successful reproduction. In instance, plants have developed an amazing array of floral forms, flowering characteristics, and phenological tactics to outcompete one other and other species for pollinators.

Bees are the most common flower visitors in all tropical ecosystems, especially eusocial corbiculate bees like stingless bees, bumblebees, and honeybees. A bee colony's ability to survive is largely dependent on how well its foragers gather proteins and carbs. The amount and quality of crop output are both impacted by the availability of pollinators and their pollination services. To help commercial farmers increase horticultural production and fruit quality, Asiko conducted a study in Kenya in 2012 to compare the pollination abilities of three stingless bee species and the honeybee, Apis mellifera scutellata, on two strawberry varieties. Increased insect pollination/visitation by a variety of pollinators, including stingless bees and honeybees, led to more consistent and marketable strawberries. Strawberries require different honeybee and stingless bee species for optimal pollination. As a result, it was advised that a farmer might grow strawberries employing any or all of the species of bees that were most suited to the local climate[3], [4].

Stingless bees are at risk

Threats to the survival of stingless bees in Africa include pests, predators, and habitat degradation from logging, bushfires, and the harvesting of wild honey. Since most stingless bees are arboreal, colonies are destroyed when trees are torn down. During the dry season, bushfires raging across tropical forests frequently destroy trees or meliponary rustic hives housing stingless bee colonies. Stingless bee nests are known to exist in a large number of rural locations. When collecting honey, people frequently burn the bees, destroying the colonies in the process. Predators and pests, particularly the SHB Aethina tumida Murray, whose larvae decimate entire colonies, are the main challenges faced by domesticated colonies of stingless bees. Adult hive beetles coexist closely with honeybees and stingless bees. If hive beetles have a chance to lay their eggs in a colony, the eggs hatch, the larvae quickly decimate the colony, or the bees flee the nest. Colonies of stingless bees are also under danger from other predators like lizards, ants, and spiders.

Pollination is harmed, even though the impacts of human disturbance on bee communities have not been thoroughly researched. Habitat fragmentation is a result of numerous human activities in Africa, including agricultural production, livestock management, timber harvesting, urbanisation, and basically all human disturbances that cause loss of vegetation.

In this case, vegetation that is different from the original vegetation divides ecosystems into spatially separated remnants. As a result, populations of plants and animals become spatially isolated and dwindle. Over time, fragmentation affects various habitat components in a variety of ways. There has not been enough research done on how bees react to changes in land use and how tropical fragmentation affects entire bee communities.

America has a long history of stingless beekeeping. Meliponiculture likely began in the Yucatán Peninsula of Mexico and in northern Guatemala between 1400 and 1900 years ago, and by the 12th century, it was a prosperous industry. Only two stingless bee species, Melipona beecheii and Scaptotrigona mexicana, have been consistently cultivated in Mesoamerica since before the arrival of the Europeans. Both species use tree cavities for their nests, which may have made it easier to adapt to artificial hives. While Pisil-nek-mej or Taxkat are typically housed indumbbell pairs of clay pots linked at the rim in the highlands of Puebla and Veracruz, Xunan kab colonies are customarily kept in hollow logs in Yucatán. Wooden boxes made expressly for the species are becoming more and more common. In Mesoamerica, particularly in the Maya region, stingless bees gave rise to a rich tradition. The Madrid codex, which depicts M. beecheii being maintained by priests and gods, is perhaps the most notable piece of outstanding evidence that still exists. Pre-European stingless beekeeping was essentially nonexistent outside of Mesoamerica. Stingless bees have been crucial to the ethnobiology of the Kayapó people of the Amazon, who can identify several species and are knowledgeable about many facets of their biology. The Kayapó continue to maintain stingless bee colonies for seasonal harvesting in what might be described as a semi-domesticated manner.

DISCUSSION

Neotropical Meliponini have about 400 documented species and 34 recognised genera, and they are found from Mexico to Argentina in all other nations bar Chile. Paratrigo- noides, a monotypic genus described in 2005 for Colombia, and Plectoplebeia, another monotypic genus described in 2016 for Bolivia and Peru, are recent examples of new genera that have been proposed. Uruguay is the nation in the area with the fewest Meliponini species. Although there are many species on the continent, only a small number are well known and are employed in meliponic culture. In the Andean countries of South America, for instance, 51 species from 13 genera have been recorded as being employed, although in none of the nations for which information is known, the actual percentage of species used of those present does not surpass 50%. Tetragonisca is a genus of four species that includesis the most well-known and often used meliponi in Neotropical culture. In all the nations where it is found, Tetragonisca fiebrigi, a species found from Mexico to Brazil, is grown and raised. Other species are controlled locally, including T. buchwaldi in Panama, Ecuador, and Costa Rica. T. fiebrigi in Paraguay, Brazil, Bolivia, Argentina, and T. Bolivia, Brazil, and Peru all have weyrauchi. There are 74 species in the genus Melipona, which is solely present in the Neotropics. Mexico and Mesoamerica use four different species of Melipona. M.

The most popular kind, beecheii, has been kept for more than 14 centuries. Six of the eight Andean countries under study have recorded the use of fifteen species. Many nations in America continue to use hollow logs for meliponiculture. These logs range in size, but they all have a minimum diameter of roughly 25 cm. Specially made clay pots are also frequently utilised in Mesoamerica. Depending on the size of the species' nest, commercial beekeepers keep their bee colonies in wooden boxes that are typically conventional sizes. These containers are frequently known asration-al hives. Different rational hive models have different food pot placements in relation to the brood. The two primary hive box designs are horizontal and vertical. In vertical models, the brood is kept in a brood chamber at the base of a hive that resembles a tower. Most honey and pollen pots are added above the brood chamber as the colony expands. The food pots are primarily situated near to the brood area in horizontal models. Food pots round the brood on both sides and may eventually cover it as the colony expands. Supers can be added to either model to accommodate the growing brood and food supplies.

The main reason stingless bees are preserved is for their honey, which has therapeutic uses and is crucial to various Mayan rites. Hands-on labour is required to remove honey from logs or clay pots, and the pots in which it is kept are ruptured. Honey can be removed from the hive using a small electric pump or a syringe in more modern beekeeping. With the use of a management system created by a Tutunaku beekeeper in Mexico, honey may now be harvested using a centrifuge similar to those employed by beekeepers of honeybees. From the hives, tiny amounts of pollen and propolis are also extracted[5], [6].Commercial meliponiculture is growing, and it is more advanced in Brazil and Mexico. Many of South America's indigenous peoples valued meliponiculture, but this practise was lost, and now, many young people either don't know stingless bees exist or don't think they're significant. NGOs, educational institutions, and beekeeper associations are attempting to recover and spread both old and new knowledge regarding stingless bees as interest in the topic is growing. Meliponine breeding, management, and research have been conducted in the Misiones area of Argentina for about 30 years. Indigenous and creole communities of the Argentine Chaco produce honey from stingless bees, particularly *T. Scaptotrigona jujuyensis* and *fiebrigi*.

A lot of people are currently interested in meliponiculture, as evidenced by the legalisation of the practise and the permission to procure and sell products in the Colombian Amazon. Resolutions8 have been established by the Corporación para el Desarrollo Sostenible del Sur de la Amazonia [Corporation for the Sustainable Development of the Southern Amazon - Corpoamazonia] and the Corporación para el Desarrollo Sostenible del Norte y el Oriente Amazónico [Corporation for the Sustainable Development of the Northern and Western Amazon - CDA] to establish criteria for melipon Additionally, initiatives for production and conservation are rising to aid populations that are harmed by armed conflict. Local projects in farming villages of various regions are supported by private businesses and a number of NGOs.Scaptotrigona postica was designated a natural and biological cultural heritage of the municipality in Ecuador by the Puyango canton Municipal Council.

In theLas Meliponas Association, permission was gained for the selling of goods and byproducts. Additionally, the Puyango Association of Meliponine Beekeepers was established. In the Amazon region, the Ministry of Agriculture, Livestock, Aquaculture and Fisheries supports meliponi-culture initiatives, particularly those that value honey and disseminate information about the wimal bee. Community meliponiculture programmes are being created in the Peruvian Amazon by NGOs like Centro Urku and civil organisations like Asociación La Restinga. They encourage sensible management techniques for meliponine species, which helps to lessen illogical exploitation and indiscriminate tree-felling for the purpose of gathering wild honey. In Peru, meliponiculture is still in its infancy. In order to communicate knowledge about these bees, use them, and safeguard them and their habitats, assistance is needed for this underappreciated work.

Criollitas, or stingless bees, are handled simply in Venezuela but breeding and management are becoming increasingly common, as in other nations. Different types of activities are held locally with the goal of spreading awareness about Venezuelan meliponines and management techniques. Thanks to Vit's work, the honey of various Venezuelan species, particularly those from the Amazon, has been identified. With 22 species of meliponine, Paraguay favours T and employs the biggest proportion of its species. T. and Angustula. specifically fiebrigi. A nationwide beekeeping and meliponiculture programme was launched in 2009 by the Ministry of Agriculture and Livestock with the goal of enhancing renewable resources and competitiveness for the benefit of 8 000 beekeepers.

Stingless bees produce honey that differs significantly from honey made by the Western honeybee, Apis mellifera, in terms of physical, chemical, microbiological, organoleptic, and pharmacological features. Depending on the species, these distinctions can be seen more or less clearly. Sting-less bee goods are valued for their cultural and religious significance as well as their economic value, and green and ecological markets are becoming more and more interested in these incredibly distinctive products. A legislative structure that safeguards, upholds, and regulates product quality, however, does not exist for meliponiculture or the products it produces. A motion to encourage Neotropical stingless bee products was taken into consideration in 2014 at the Slow Food meeting in Turin. Tetragonisca fiebrigi honey was notable for being added to the Argen- tine Food Code. This interdisciplinary collaboration produced the first national melipo-nine honey legislation in South America. There are laws governing the administration of the stingless bee trade in Amazonian Colombia.

Strategies for enhancing and promoting rational agroecology in the Americas Indigenous farmers commonly practise stingless beekeeping. Fair trade and the preservation of local knowledge and traditions should therefore go hand in hand with the activity. In some areas, rising popularity and quick growth outpace the availability of knowledge and expert training. There should be restrictions on how colonies move between areas. Effective ways to propagate managed colonies are needed for large-scale production of stingless bee products and colonies for pollination in order to relieve strain on natural populations. The manufacture and delivery of stingless bee products must be reliable in order to have a market. Presently, there is little output, little business, and no exports is permitted. With increased supply come storage issues and unstable prices. One approach might be to target niche markets, like those for natural or health products, with stingless bee products. On the biology, pollination, and product characteristics of meliponines, more fundamental, applied, and extensional research is required[2], [7].

Before honeybees evolved there, before Oceania was cut off from the Old World, honeybees did not exist there. Stingless bees, which are present in Australia, Papua New Guinea, West Papua, and the Soloman Islands but absent from New Zealand and the majority of other PICTs, did exist before the continents split. The island ecosystems' ordinarily sparse bee flora might become the most diverse and plentiful due to the introduction of non-native bee species. There is some evidence to suggest that most, if not all, Apid and Megachilid bees in the southwest Pacific Islands of Fiji, Samoa, and Vanuatu have been brought by humans. French Polynesia most certainly has a similar circumstance. There have been 14 non-native bee species found on the Hawaiian Islands, which are thought to have just 69 native bee species.

The islands of Papua New Guinea, which were still a part of the Australasian land mass during the Pleistocene epoch, have comparably few records. In Papua New Guinea, stingless bee nests of the subgenera Tetragonula and Tetragonula have historically been exploited for their honey and wax, and it's possible that their brood was also eaten. The Solomon Islands, which are close to New Guinea, are also said to be home to stingless bees. These cultures are known to have eaten and collected insects, and they may have used stingless bees' products. Although stingless bees are a valuable resource for maintaining plant biodiversity in many natural ecosystems, stingless beekeeping is still primarily an informal activity in developing nations like Papua New Guinea and the Solomon Islands because technical expertise is lacking and management procedures are not standardised. Stingless beekeeping research may offer rural populations alternative, less environmentally damaging income-generating alternatives and improve the security of food and nutrition. Collaborations centred on hive standardisation, pest and disease control, colony splitting, and capacity-building could enable meliponiculture become a significant instrument for boosting food supply and sustainable development in these areas.

11 of the more than 1 700 native bee species in Australia are stingless. The two most prevalent species in this group are Tetragonula carbonaria and Austroplebeia australis. All of these species are members of the genus Tetragonula or Austroplebeia. They go by many different names, such as native bees, sugar-bag bees, sweat bees, and Australian native honeybees. They all have hairy extended hind legs for conveying nectar and pollen, are small, dark in colour, and create their nests out of a range of materials, including hollow trees, old, brittle wood, woody stems, and bare areas of ground. Australian stingless bees were known as Trigona until 1990. In Australia and New Guinea, the genus Austroplebe- ia contains five endemic species, while Tetragonula clypearis and T. Southeast Asia may also be home to sapiens. There are other Tetragonula species that are unique to Australia. The workers of all of these bee species are tiny, measuring between 3.5 and 4.5 mm in length.

The ecology and nesting habits of these insects do differ noticeably, with Austroplebeia essingtoni's nest ranging from one to 10 litres in volume. hockingsi. the brood structure can be composed of normal comb, semi-comb, clusters, or concentric layers. and some species build an external entrance tunnel to ward off predators. The average yearly honey production for native bees is less than 0.5 litres, and it never exceeds two litres. In Australia, the locations with the most rainfall and the regions with the most diversity and wealth of forests are also where stingless bees can be found. In northern Australia's tropical and subtropical regions, stingless bees coexist with T. Because it can withstand cold, carbonaria is the species with the greatest distribution in the south. The majority of stingless bee species are found in Queensland, however A. both T. and essingtoni. Mellipes haven't been spotted in this condition yet. species like the T. In addition to T. Only tropical northern Queensland is home to sapiens, and it is also the location of the recent discovery of a new species of bee[8], [9].

CONCLUSION

Meliponiculture, the practise of raising stingless bees for honey production and pollination, encounters a variety of difficulties and opportunities throughout Africa, the Americas, and Australia. The uncommon nest construction and nesting behaviours of stingless bee species, which make honey collection more difficult, are the main reasons for the limited uptake of meliponiculture in Africa. Recent studies have, however, illuminated the variety of nest patterns among African species, opening the door for more sustainable practises.Important ecological functions of stingless bee breeding in Africa are controlled by factors like nest location and colony behaviour. Predators, habitat degradation, and competition for fodder are some of the threats facing stingless bees in Africa. In nations like Tanzania and Ghana, stingless beekeeping initiatives have showed promise, but obstacles like habitat loss and resource competition still exist.The native stingless bee species of Australia are also attracting interest for their potential as pollinators and honey producers. Although the sector is expanding, research and standardised procedures are still necessary to fully realise its potential.In conclusion, meliponiculture is a method that has important cultural, ecological, and economic effects on diverse parts of the world. While obstacles like habitat loss and competition do exist, there is growing interest in encouraging sustainable stingless beekeeping and utilising the special advantages of these amazing insects. To ensure the success of meliponiculture and the survival of stingless bee species, research and conservation initiatives are crucial.

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CHAPTER 13

COMPREHENSIVE GUIDE TO SUSTAINABLE HONEY MANAGEMENT: FROM HARVESTING TO MARKET PLACEMENT

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ABSTRACT:

This abstract offer a thorough overview of the management of honey, covering a range of topics from the gathering of raw materials to maintaining food safety and quality. It emphasises the significance of using sustainable methods all throughout the production of honey. Harvesting, separation/extraction, decantation, drying, crystallization, melting, storage, and packaging/marketing are some of the crucial steps covered.The significance of collecting mature honeycombs is emphasised in the abstract in order to preserve low moisture level, avoid fermentation, and adhere to legal requirements. It highlights the necessity to avoid exposure to harsh climatic conditions, minimise contamination from multiple sources, and guarantee accurate honeycomb traceability.The abstract also discusses the significance of using the right honey purification methods, such as filtering and decantation, to preserve honey quality. It emphasises the need of observing particular moisture content specifications and preserving the quality of honey throughout the extraction and drying operations.Managing crystallization is another topic covered in the abstract, with a focus on the effects of temperature, water content, and glucose concentration. It goes over how to make creamed honey while preserving its organoleptic properties.To avoid unfavourable chemical changes, temperature control is stressed throughout the honey production process. The pasteurisation procedure is brought up, showing both its industrial application and its departure from ethical beekeeping procedures.In order to preserve quality and avoid contamination, storage conditions for honey are critical, with a focus on cold temperatures and sealed containers. The usefulness of various packing materials for storing honey is also briefly discussed in the abstract.

KEYWORDS:

Bees, Harvesting, Honey, Management, Market.

INTRODUCTION

This section provides a step-by-step breakdown of the management of honey, from the bees' raw material harvest to food safety and the greatest possible preservation of its quality and nutritional worth. Only those methods that can truly achieve this level of quality should be discussed in the context of sustainable development. This chapter specifically addresses harvesting, separation/extraction, decantation, drying, crystallisation, melting, storage, and packaging/marketing. Industrial processes including drying, melting, pasteurization, and ultrafiltration are mostly used to enhance the presentation of honeys or to reintegrate products like unripe or deteriorated honeys that do not comply with international legal standards back into the commercial market. Despite the fact that they are typical in some nations, it should be mentioned that these are not good beekeeping techniques.

The honeycombs with honey that has reached maturity are removed once the bees have been eliminated. The honey's ripeness determines when it should be harvested. Beekeepers who want to make unfloral honeys should think about the necessity to avoid using nectar from other blooms or from those that can impart undesirable organoleptic characteristics. Obtaining unifloral honey at the requisite purity levels shouldn't jeopardise honey maturity, despite the fact that both needs are connected to economically important quality components. Only fully mature honey should be collected, which is represented by combs with more than 75% of the honey cells shut.Anyhow, to prevent the honey's hygroscopicity from causing its water content to increase, harvesting must be done on dry, non-rainy days with low environmental relative humidity. A moisture percentage of less than 18% in the honey may be anticipated when the average air humidity outside the hive is not considerably higher than 60%. Even sealed cells from the aphis mellifera may contain honey with more than 18% moisture in hot and humid regions. Other Apis species' capped honey cells may contain moisture that is considerably higher in those circumstances[1], [2].

Gather mostly capped, matured honeycombs so that the moisture content is kept low enough to prevent fermentation and to meet regulatory requirements. Biological agents, foreign bodies, and substances in solid, liquid, and gaseous form should be kept to a minimum. Use smoke sparingly and only dry, non-resinous plants to produce it. Never place frames on the ground. Avoid applying chemical repellents. Reduce honey's exposure to extreme ambient heat and humidity, especially when in transit. Ensure that honeycombs can be traced and identified correctly. To attain high levels of sustainability, reduce the usage of water, environmentally harmful materials, and non-renewable energy sources.The only steps required by the operator forchunk honey manufacturing are the selection and slicing of the honeycombs. However, before beginning the extraction by draining or centrifuging, it is necessary to remove the cell capping with a hot rod, scraper, or knife in order to separate the honey from the honeycombs. Comb pressing or even melting is still employed to extract wax from honey using conventional methods, but this should only be done as a last resort.

The separation/extraction step should be guided by three main goals: minimising contamination from biological agents, foreign bodies, and substances in solid, liquid, and gaseous form. minimising honey exposure to high environmental temperatures and humidity. ensuring accurate identification and traceability of separated honey. and limiting the use of water, materials with a high ecological footprint, and energy-intensive processes to achieve good levels of purity. Laboratories for the production, preparation, and packaging of food ought to have separate areas for the storage of raw materials, the production, preparation, and packaging of substances meant for consumption, the storage of finished goods, and the storage of substances not meant for food. The architecture and structure of areas where food is prepared and packed should support excellent food hygiene procedures, including protection against contamination between and during activities. Floor and wall surfaces should be kept in good condition and be simple to clean and disinfect as necessary. For this, impermeable, non-absorbent, washable, and non-toxic materials will be needed. ceilings or the interior surface of the roof and overhead fixtures should be constructed and finished so as to prevent the accumulation of dirt and to reduce condensation, the growth of undesirable mould, and the shedding of particles.

Windows and other openings should be constructed to prevent the accumulation of dirt and to reduce condensation, the growth of undesirable mould, and the shedding of particles. Where appropriate, floors are to allow adequate surface drainage, and walls should have a smooth surface up to a height appropriate for the operations. When necessary, those that can be opened to the outside environment should be equipped with insect-proof screens that are simple to remove for cleaning. Doors should be simple to clean and, if necessary, to disinfect. Open windows that could cause contamination are to remain closed and fixed during production. This will call for the use of smooth, non-absorbent surfaces. Surfaces in places where foods are handled, especially those in touch with food, should be kept in good condition and be simple to clean and disinfect as necessary. It will be necessary to utilise materials that are smooth, washable, corrosion-resistant, and non-toxic[3], [4].

DISCUSSION

In principle, all spaces should have proper lighting, ventilation, and cleaning to reduce the danger of contamination, especially from weeds and animals, and they should have the right tools on hand for maintaining hygienic staff.Typically, straining or decantation are used to purify honey. The temperature of the room and the honey's humidity both affect how quickly this process proceeds. Wax flakes and foreign objects can be separated from honey by straining it through a tube sieve or a type of strainer while it is still liquid. This can be done in the honey settling tank. In order for air bubbles and impurities to separate according to their specific weights, the honey must be allowed to stand in a sufficiently large container for an extended period of time at a temperature of about 25 °C. Wax particles, insect parts, and other organic debris float to the surface, while mineral and metallic particles sink to the bottom. Particle size, container size, and honey viscosity all affect the speed of settling, which is typically swift and can be finished in a few days at temperatures of 25 to 30 °C.

The three primary goals for the extraction process should also guide the decantation step.Honey needs to be ripe and have a moisture level under 20 percent, as per the Codex Alimentarius Standard for Honey. Honey's humidity needs to be under 18%, nevertheless, for effective storage. Only internationally recognised techniques could, in extreme circumstances, lower the moisture content of honey still in the combs by a few points in order to avoid fermentation. This is possible before the honey is taken out of the combs. It is possible to decrease the moisture content of honey by a few percentage points by exposing honey combs to low ambient relative humidity. The same three primary goals that guided the extraction, purification, and drying procedures should also guide this one[3], [4].

All honey eventually crystallises, however the process is influenced by several factors. The most significant factors are temperature, water, and glucose concentration. While some producers let honey crystallise naturally, others use alternative methods to manage it and create creamed honey. Typically, they mix freshly gathered liquid honey at 25–27 °C with 5–15% of finely crystallised honey. Temperature reduction to 14 °C is done by adding the mixture to a large blender. Within 4.5 days, the crystals should fully form. In the initial phases of storage, good results can also be obtained by homogenizing the product and letting it ripen for two to three weeks after separation and before packaging at about 15 °C to enhance and homogenize the organoleptic qualities.

Because honey is extremely sensitive to temperatures exceeding 40 °C, exposure to such conditions should only occur in very specific circumstances. The breakdown of honey enzymes like diastase and invertase is directly correlated with time and temperature, as demonstrated by the rise in HMF, which is created from hexoses like fructose. When beekeepers encounter excessive or uneven crystallisation in their honey after harvest, they might melt the honey to lessen it. The honey is heated for the shortest amount of time and at the lowest temperature necessary to do this. In order to stop unintended fermentation by osmophilic yeasts, honey may only be pasteurised by industry. The industrial procedure of pasteurisation falls short of the standards set forth in a good beekeeping practise handbook. The three main goals for the extraction, decantation, and drying phases should also guide the melting/pasteurization step.

Honey is nonetheless subject to physical and chemical changes during storage even though it is microbiologically stable since it is a highly concentrated, slightly acidic solution of fructose and glucose. Any temperature above approximately 5 °C results in changes brought on by heating. Honey should be kept in a refrigerator at or below 20 °C. creamed honey or unstable honeys should be kept at or below 14 °C. Due to its hygroscopic nature, honey must always be stored in well-sealed containers in a dry environment. The following primary goals should guide the storage step: reducing contamination from biological agents, foreign bodies, and substances in solid, liquid, and gaseous form. achieving homogeneity and maintaining the desired organoleptic characteristics in the product. minimising changes brought on by fermentation, granulation, discoloration, flavor damage, enzyme destruction, and HMF production by keeping the honey at cool temperatures.

The industrial operation of ultrafiltration deeply denatures honey and is not in line with good beekeeping practices. The so calledultra-filtered honey is not considered pure honey. In the EU Honey Directive, these honeys must be specifically labeled to inform the consumers. Honey is mainly packaged in metal, glass, waxed paper- board, plastic and pottery containers. Containers suitable for holding an acidic food substance such as honey are made of glass or stainless steel or coated with food-grade plastic, paint or beeswax. Packaging should not impart any hazardous substances, extraneous matter or agents capable of modifying the honey’s organoleptic characteristics. If containers are recycled, care must be taken to ensure that they are completely clean and do not have the slightest residual odour. Containers previously used for toxic chemicals, oils or petroleum products should never be used to store bee products, even after coating with paint, plastic or beeswax. To keep moisture out, lids must be airtight and all products should be kept away from heat and light.

In the environmental conditions of production, storage and market. use of containers with intact and clean surfaces that cannot contaminate honey. Application of maintenance able to maintain the conformity of the containers over time. minimization of honey exposure to high environ- mental temperatures. correct identification and traceability of honey and containers. correct labelling, in compliance with the requirements in force in the marketing areas. limitation of the use of polluting non-renewable energies, materials with a high ecological footprint and water to achieve good levels of sustainability.Some strategies to improve the sustainability of honey are as follows: Promote the use of materials with low environmental impact. Promote the use of renewable energy sources. Promote waste reduction in the honey production process. Promote honey production at short distances. Promote research on new and more sustainable mate- rials and energy sources compatible with hygiene and commercial requirements[5], [6].

Minimum quality and hygienic requirements for honey in international legislation. Honey composition and quality are influenced by factors such as type of bee, source of nectar, flower type, geo- graphical variations, and harvest, extraction and preservation methods. The various types of honey placed on the market have different commercial values, often with marked variations, and safety and authenticity requirements play a very important role in this, providing opportunities or limitations for the entire reference chain, including development of sustainable production. According to the Codex Alimentarius Commission and the European Union , honey is the natural sweet substance produced by Apis mellifera bees from either the nectar of plants, secretions of living parts of plants, or excretions of plant-sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in honeycombs to ripen and mature.

The Chinese standard does not comply with the CODEX standard as the Chinese definition of honey is much broader: it is a sufficiently brewed naturally sweet substance made when bees collect nectar, honeydew secretions or plants, mixed with their own secretions. Generally, it is in the interest of the beekeepers, particularly small businesses that produce high-quality prod- ucts, to have precise requirements that protect their honey and their incomes. In fact, given that the product can easily be substituted and mixed, it should not come as a surprise that it is the third most susceptible food to fraud in the world. A European Union surveillance plan dedicated to honey found that a high number of the samples did not meet the authenticity criteria, highlighting how requirements must be supported by adequate methods to detect and prevent honey fraud.Composition and quality requirements are clearly defined in international standards such as the Codex Alimentarius, The European Directive, the International Organization for Standardization, the USP Identity Standard for Honey, the Deutsches Institut für Normung and guidelines of different trade and beekeeping associations.

Regarding the risk to human consumption posed by microbiological hazards, honey compliant with Codex Alimentarius requirements is not a favourable substrate for microbial growth. No microorganism is believed to develop at water activity values lower than 0.60, which is a water content close to 18 percent , limiting the risk of microbiological hazards. An extensive review of the literature and of epidemiological data revealed Clostridium botulinum and other botulinum toxin-producing clostridia to be the only microbiological hazard in honey. Although Bacillus spp. are often detected in honey, sometimes in high numbers, there is no record of them causing illness. Since there is no process that can eliminate Clostridium botulinum spores, and because of the large numbers of tests that would be required to confirm the absence of Clostridium botulinum in product batches, adding products labels advising against consumption by infants or children under 12 months is the most appropriate action .

As for all beekeeping products, most chemical hazards contaminating honey come from the hive and bees' surrounding territory. However, honey can also be contaminated during post-harvest processes, by surface constituents that come into contact with it and by substances present in the processing and marketing environments. Risk management is based, above all, on the application of good hygienic practices, and hazard analysis and critical control point principles. Given the prevalence of fraud in the honey trade and the complexities involved in applying effective non-conformity detection tests, the beekeeping sector and all stakeholders are starting to integrate traditional control methods with the best and most advanced available methods for the detection of honey fraud, such as: elemental analysis with isotope ratio mass spectrometry , carried out by Association of Official Analytical Chemists Official Method 998.12, C4 plant sugars in honey internal standard stable carbon isotope ratio method.

Origin-linked products typically have qualities that derive from their place of production owing to natural and human factors. Natural factors include different plant or animal species, climate and soil. human factors include local knowledge passed down from generation to generation. These qualities are reflected in the final product's appearance and taste. Local communities may not be aware of the importance of their products from a cultural or marketing perspective, but recognizing this can provide a means of preserving food heritage and support local development.Aboriginal cultural tradition includes a substantial portion of the utilisation of stingless bees and their products. Our earliest information of stingless bee nests in this country comes from written texts that date back to around 1500 AD. Stingless bee nests have been depicted in rock art from Australia. The majority of the historical data in Crane's 1999 outstanding historical account of Aboriginal stingless bee practises in Australia was based mostly on first-person testimonies published by Bodenheimer in 1951 and Tettamanti in 1983. Stingless bees have gone extinct in Tasmania and most likely also in Victoria, contrary to what Charles Darwin said in 1859: In Australia the imported hive bee is rapidly exterminating the small, native bee. Meliponiculture appears to have been more straightforward than searching for honeybee nests in many ways. Nests were typically located closer to the ground and in smaller trees, making it easier to access and access them. The work required minimal equipment, and the bees did not sting. The main equipment was an axe for getting access to nests. smoking the bees was not typically necessary.

Australian stingless bee species are becoming more popular to preserve, and several conservation organisations have been formed as a result. Since 1984, when it was nearly nonexistent, the native bee business has continued to expand quickly. Heard began developing propagation and management methods in 1988, and later others did as well. Educational materials created by the Australian Native Bee Research Centre also helped the sector grow. According to recent research by Halcroftin, the number of beekeepers and domesticated colonies in the Australian stingless bee industry have increased 2.5 and 3.5 times, respectively, over the previous ten years. The sector is still comparatively underdeveloped, however, as only 54% of Australian beekeepers had more than one colony and 78 percent were hobbyists in 2010. The majority of native beekeepers do so for leisure or conservation, highlighting the uniqueness value of the sector. Demand continues to outpace supply even though there is a significant demand for Australian stingless bee colonies and their honey due to the small number of beekeepers that are currently breeding colonies. In Australia, 254 kg of stingless bee honey were produced in 2010[7], [8].

Australia hasn't yet adopted stingless bee pollination techniques that are successfully used abroad. To pollinate their crops, Australian farmers mainly rely on the Western honeybee that was introduced. Native bees, however, might be more effective pollinators for particular crops. Stingless bees may be better suited to pollinating tropical plants because they have evolved with them than Apis mellifera. They have proven to be important pollinators of crops like mangos and macadamias. Strawberries, blueberries, watermelons, citrus fruits, avocados, lychees, and many other fruits and vegetables could potentially benefit. However, less than 4% of the key stingless bee players in the business supplied pollination services in 2010. Stingless bees have a lot of potential, but research into their application for crop pollination in Australia is still in its early stages. Studies have demonstrated these bees' exceptional capacity to function in small spaces, including glasshouses. Stingless bees may be able to make up for some of the anticipated shortfall in honeybee hive numbers, and their effectiveness as pollinators of a variety of other crops calls for further investigation. Prices paid for native bee pollination services in Australia range from 10 to 50 Australian dollars. While these are less accessible than honeybee pollination services, they are still more expensive than honeybee pollination services.

The lack of nesting and feeding options due to land clearing and agriculture, the expansion of exotic plant species, and the effects of climate change are the greatest threats to the local bee biodiversity. Recommendations to strengthen and assist the industry Setting up a code of best practises for stingless beekeeping and standardized standards for stingless bee honey could support the growth and adoption of this type of beekeeping. The following suggestions are made to help the stingless bee industry:Promote no international bee migration, especially the introduction of alien bee species for human consumption, unless rigorous biosecurity measures are in place, thorough impact analyses are carried out, and there is a compelling need. In order to promote sound management practises, lessen the negative effects of pesticides, and supply and conserve essential habitats, community education and extension services for native bees should be improved. Develop better methods for propagation in rural communities that depend on bee products for income creation, and conduct studies to better understand the effects of wild honey and bee collection.Investigate specific management strategies that affect stingless beekeeping systems' productivity and profitability.

Conduct scoping studies to look into the potential of Papua New Guinea and the Solomon Islands developing stingless beekeeping industry. Increase research to advance colony propagation, queen raising, drone rearing, and perhaps artificial insemination procedures.Given their value for tropical locations and ease of movement to places where pollination services are required, stingless bee colonies should be encouraged for use in pollination in order to enhance and support this industry. Asia has already demonstrated that the propagation of stingless bees for pollination services and the manufacture of important hive products is viable. Native species are adapted to grow on native plants and are generally pest and disease resistant.

As opposed to European honeybees, their wide gene pool makes breeding not a problem. The bees could even be used in classrooms to illustrate biological variety because they are harmless for people. Compared to A., the output of honey is very little. mellifera, research have revealed that stingless bee honey has greater medicinal and nutritional benefits. Due to its potential use in apitherapy, propolis has the highest commercial value of all hive products.

CONCLUSION

The management of honey, from the initial bee harvest to the final packaging and marketing of the product, has been thoroughly and in-depth described in this section.

The goal has been to produce honey of the best quality and nutritional value while maintaining food safety and sustainability.Beginning the conversation was the significance of collecting honeycombs at the proper stage of maturity to produce the best possible honey. It emphasised how unfloral honeys shouldn't be made with nectar from other blooms and how to keep moisture levels low to avoid fermentation.

Additionally, the section included a number of processing procedures for honey, such as separation/extraction, decantation, drying, crystallisation, melting, and storage. Specific objectives, such as minimising contamination, maintaining honey quality, and minimising environmental effect, served as the direction for each phase.To further secure the purity and quality of honey, the article emphasised the significance of adhering to international standards and proper beekeeping practises. It placed a strong emphasis on the necessity of suitable storage conditions, avoiding extremely high or low temperatures, and accurate labelling to warn customers.

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