Review

Beekeeping Industry in Tanzania: Resources, Practices, and Conservation

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Review

Beekeeping Industry in Tanzania: Resources, Practices, and Conservation

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Summary

Beekeeping represents a key economic and conservation activity in Tanzania, supporting over 4% of the country's population across its value chain. However, the absence of updated information on honeybee diversity, products, management practices, and conservation strategies hinders sectoral growth and sustainability. In this study, we synthesized current scientific knowledge on beekeeping management, conservation, production, and the biological and functional properties of bee products in Tanzania. The findings provide evidence-based guidance for policymakers, government agencies, and development partners to strengthen resource conservation, improve management practices, and prioritize future research for a sustainable beekeeping industry.

Abstract

Beekeeping is a widespread economic activity in rural Tanzania, supporting over 2 million livelihoods. The country's extensive forests and woodlands, covering approximately 55% of its land area, provide habitat and forage for an estimated 9.2 million honeybee colonies. This makes Tanzania the second-largest honey producer in Africa and the tenth-largest globally. Despite this potential, comprehensive and current information on the beekeeping industry remains scarce. This review synthesizes scientific insights into Tanzania's beekeeping sector, focusing on honeybee species, bee products, management practices, and conservation measures. Among the three documented subspecies of *Apis mellifera* (Linnaeus, 1758), *A. m. scutellata* is the most widespread and commonly managed by indigenous beekeepers. Tanzania annually produces over 31,000 tonnes of honey and 1800 tonnes of beeswax, generating approximately USD 77.5 million and contributing about 1% to the national GDP. The industry supports livelihoods, food security, biodiversity conservation, and international cooperation. However, its sustained growth requires strengthened legal and administrative frameworks, expanded scientific research, enhanced innovation, coordinated partnerships, and integrated nationwide initiatives.

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1. Introduction

Tanzania is rich in natural resources, including arable lands and forests distributed nationwide, which support abundant wildlife and diverse bee species [1]. Approximately 13 subspecies of the western honeybee (*A. mellifera*) are adapted to various African ecosystems [2, 3]. In Tanzania, three subspecies of *A. mellifera* are well-documented and utilized by indigenous beekeepers [4]. Since 1998, the government has strengthened the sector through the introduction of the National Beekeeping Policy (NBP) [5]. Formation of beekeepers' groups and associations, the creation of community banks,

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the establishment of forest reserves, and awareness campaigns have opened opportunities for women and youth to engage in beekeeping practices [6]. These efforts were set to enhance beekeeping operations, production, and export earnings from honey and beeswax, thereby fostering socio-economic development and environmental conservation [7].

Beekeeping contributes significantly to Tanzania's agricultural sector through enhanced pollination, generates income from the sale of bee products and related services, and supports forest and wildlife conservation, promoting environmental sustainability [8]. Despite these contributions, information on the current status of honeybee species, products, and management practices remains limited. This review presents updated insights into the beekeeping industry and its role in supporting economic growth and conservation. It synthesizes scientific information on honeybee subspecies diversity, forage availability, habitats, beekeeping practices, and the properties and consumption of bee products. The findings offer guidance for policymakers, government institutions, and development partners in planning conservation actions, management strategies, and research priorities for beekeeping resources.

2. Governance and Economic Contribution of the Beekeeping Industry

Formal beekeeping operations in Tanzania began in 1949 with the establishment of the Beekeeping Division under the Ministry of Agriculture to enhance extension services and promote natural resource conservation through honey and beeswax production [9]. A major shift occurred in 1998 following the introduction of the National Beekeeping Policy (NBP), which transferred sectoral oversight to the Ministry of Natural Resources and Tourism (MNRT) [7]. This led to the creation of the Forestry and Beekeeping Division (FDB), mandated to coordinate forestry and beekeeping activities jointly [5]. Through strengthened legal, institutional, and regulatory frameworks, the sector has achieved substantial growth, contributing approximately USD 77.5 million annually, equivalent to 1% of the country's GDP [10]. In 2021, export earnings from honey and beeswax reached about USD 12.9 million, underscoring the industry's role in national foreign currency earnings [10, 11]. The industry employs around 2 million people across its value chain, including 1.2 million beekeepers and 800,000 individuals involved in processing, trade, and other related activities, representing about 4% of the national population [5, 8, 12]. Enhanced coordination among stakeholders and strengthened human resource capacity are essential for the industry's long-term governance, sustainability, and economic contribution.

3. Honeybee Species, Habitat, and Forage Resources

3.1. Honeybee Species Diversity

Tanzania hosts a high diversity of wild and managed bee species [13]. Western honeybee (*A. mellifera*) in Tanzania was initially described in the 1930s as *A. m. adansonii* with attitudinal variations [9, 14, 15]. Subsequent studies using univariate and multivariate morphometric techniques [16], and molecular identification in some areas [3], have recognized three subspecies. These occupy diverse environments from low to high altitudes [3, 4, 17-19], and are utilized by Tanzanian beekeepers [4]. Geographical distribution of these *A. mellifera* subspecies is illustrated in Figure 1. *Apis mellifera monticola* is a large, dark-colored subspecies originating from cool forests on mountain slopes, found at altitudes of 1500–3000 meters on Mt. Kilimanjaro, Mt. Meru, and the Udzungwa Mountains (Figure 1). *Apis mellifera litorea* is a small, yellowish subspecies identified in coastal areas, lower altitudes of the Kilombero River basin, and lowland montane forests (Figure 1) [16].

Apis mellifera scutellata is common in low-altitude savanna areas such as Tabora, Kigoma, and Morogoro, and is characterized by its medium size and yellowish color [3, 4, 17-19]. This prolific and highly productive plateau subspecies is found nationwide (Figure 1) and is commonly utilized by indigenous beekeepers [4, 20]. However, *A. m. scutellata* is known for traits such as absconding in response to pest and predator attacks [21]. Its seasonal migratory swarming behavior is often linked to brood synchronization difficulties during periods of food scarcity [21, 22]. The presence of *A. m.*

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monticola and *A. m. litorea* beyond their native ranges indicates wider distribution. Expanded molecular studies on the biology and biodiversity of *A. mellifera* subspecies would improve management and conservation efforts.

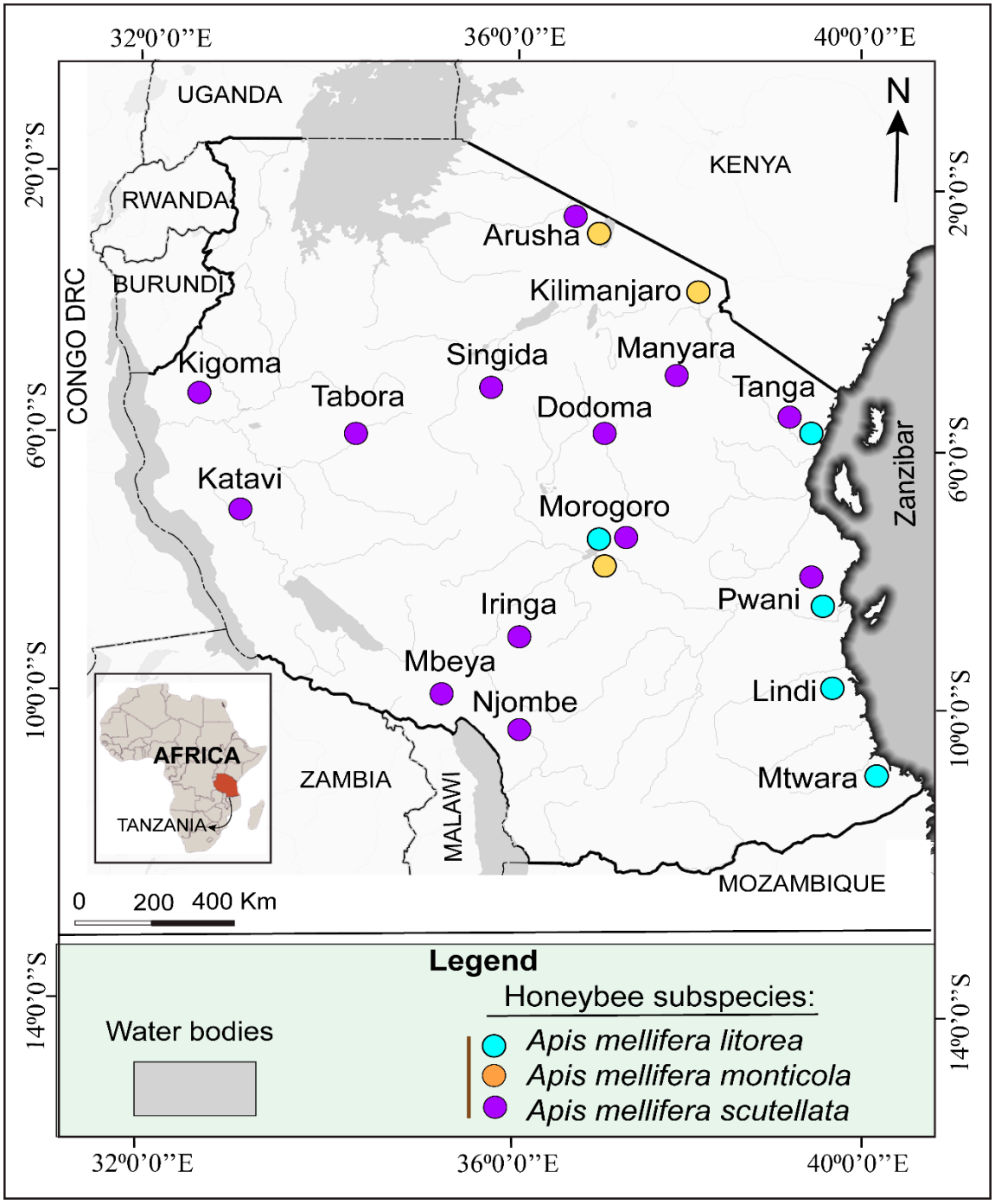

Figure 1. Geographical distribution of documented *A. mellifera* subspecies in Tanzania: the occurrence of *A. m. litorea* in the Morogoro Region indicates an extended range beyond coastal areas. The widespread occurrence of *A. m. scutellata* and absence of subspecies information in island areas highlight the need for molecular studies to confirm nationwide biodiversity.

3.2. Honeybee Habitat and Forage Resources

Tanzania is renowned for its rich biodiversity [23]. Its forests and woodlands extend over 48.1 million hectares, covering about 55% of the country's total land area [24] and harboring an estimated 9.2 million honeybee colonies [5]. Diverse wild plant species, including miombo woodlands, mangroves, and acacias, provide varied habitats and abundant forage resources for honeybees [25].

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Over 95% of beekeeping activities occur in major beekeeping zones within savanna forests, characterized by wet and dry miombo woodlands, particularly in the western zone encompassing Tabora, Katavi, and Kigoma [26]. Optimal utilization of honeybee forage and habitat resources could enable the country to reach an estimated annual maximum production potential of 138,000 tonnes of honey and 9200 tonnes of beeswax [5]. Since the current production levels remain far below this potential [7]. Therefore, structured and coordinated conservation initiatives targeting honeybee forage and habitats are essential to increase national honey and beeswax production.

4. Beekeeping Practices

4.1. Traditional Practices

Honey hunting and gathering were among the earliest beekeeping practices in Tanzania [19]. However, it is still practiced by a few hunter-gatherer ethnic groups, such as the Hadzabe, Sonjo, Ndorobo, Daatoga, and Maasai [27, 28]. Traditional beekeeping methods emerged in the post-honey-hunting era. Increased understanding of honeybee behavior, the desire for higher yields, and growing environmental challenges have led to a decline in honey hunting [29]. More than 75% of indigenous beekeepers in Tanzania rely on traditional practices [24], though the extent of this reliance varies across agroecological zones [11, 30]. For instance, approximately 60% of beekeepers in the Eastern zone, 80% in the Western zone, and 80% in Zanzibar depend on traditional methods [26, 31, 32].

Traditional practices involve hives crafted from materials such as tree bark, logs, dry grasses, old car tires, concrete, pottery, straw, and bamboo [9, 30, 33], as illustrated in Figure 2. Local knowledge guides hive placement and harvest timing; for example, hives are hung on trees to trap wild colonies, and honey is often harvested at night (Figure 2c–e) [5, 22, 34]. Placing hives high on tree branches protects them from fire and predators [9, 21, 30]. Although many beekeepers practice api-agroforestry by suspending hives from tree branches to deter theft and predators [35, 36]. Traditional hives constitute about 90% of all beehives in the country [24], with an estimated 1,506,345 traditional hives (made from logs and bark) and 23,650 improved hives (top-bar or frame hives) documented nationally [10].

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Figure 2. Traditional beekeeping practices in Tanzania: (**a**) an apiary with hives made from cow dung, dry grasses, and sticks in the Western zone; (**b**) a concrete hive suspended from tree branches to deter honey badgers in the Southern highlands; (**c**) log hives hung on trees in the Coastal Zone; and (**d–e**) nighttime honey harvesting from car tire hives managed by Maasai communities in the Northern Zone.

Hive stocking typically involves trapping honeybee colonies using bait materials like beeswax, cow dung, leaves, and grasses [7]. Although traditional fixed-comb hives can lead to colony and product losses [37]. Conserving traditional practices through semi-modern approaches is necessary to align with honeybee behavior, facilitate colony occupancy, enhance performance and security, support api-agroforestry, and accommodate natural swarming and absconding tendencies.

4.2. Commercialization and Modern Practices

Tanzania's beekeeping relies on small-scale beekeepers using traditional tools. This reflects a significant technological gap that hinders production, harvesting, quality, and access to lucrative international markets [38]. Improved beehives used in Tanzania are either imported or locally manufactured based on dimensions suited to western honeybees [39]. Modernization efforts are driven by collaborations among government institutions, the private sector, and NGOs [40, 41], as illustrated in Figure 3. However, the commercialization potential of beekeeping remains largely untapped, despite initiatives such as cooperatives and contract farming that foster economic viability and investment [8, 38]. Modern technologies and practices have demonstrated higher productivity and income generation in regions like Tabora and Katavi [26]. Access to modern technologies, innovation, and skilled guidance is crucial for advancing beekeeping modernization. Semi-modern practices that align with local honeybee ecology and behavior, forest-based practices, security, and protection of hive resources should also be emphasized.

Figure 3. Commercialization of beekeeping practices in Tanzania: materials and technical support from (a) OIKOS East Africa and (b) WWF Tanzania encouraging Maasai youth and women's participation in conservation-focused beekeeping; (c) training and consultancy services provided by Apis Bee Company, focusing on the anthropometric contributions of honeybees to human sociality, the economy, and biodiversity;

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and (d) TAFORI's nationwide survey of beekeepers' knowledge and the hive types and dimensions used in traditional and modern beekeeping practices.

4.3. Apiaries and Bee Reserves

Apiaries have been established in various locations across Tanzania, including bee reserves, forest reserves, farmlands, and wildlife-protected areas [42]. Over 1533 apiaries are managed by government agencies, private institutions, NGOs, and individual beekeepers [43]. Bee reserves have been designated to support sustainable beekeeping in different parts of the country [5, 41], following the National Beekeeping Act No. 15 of 2002 [44], which mandates sufficient forest allocation for honeybee development [43]. The Tanzania Forestry Services Agency (TFS) has designated nine official bee reserves and one privately owned reserve, covering a total area exceeding 18,472 hectares [10]. TFS manages 205 apiaries with 14,292 beehives nationwide and has allocated approximately 1.2 million hectares of forest for apiaries and bee reserves to support sustainable resource utilization [10]. Moreover, the Village Land Act [45] empowers local government councils to manage communal resources, including Village bee reserves [41, 44]. Nationwide implementation of community-based beekeeping initiatives can enhance the sustainable establishment and management of apiaries and bee reserves.

4.4. Honeybee Pests, Parasites, and Predators

Beekeepers frequently report the honey badger (*Mellivora capensis*) as a significant predator that destroys hives, endangering wild beekeeping in Tanzania [46]. Reports of honey badgers span across the southern highlands [47], northern [48], and western [49] zones. Arthropods such as ants, bee lice, wasps, wax moths, and hive beetles are recognized as major pests [49], while birds, spiders, lizards, and honey badgers are primary predators affecting indigenous beekeeping practices [20, 49]. These pests, parasites, and predators are categorized as natural honeybee enemies, as shown in Figure 4.

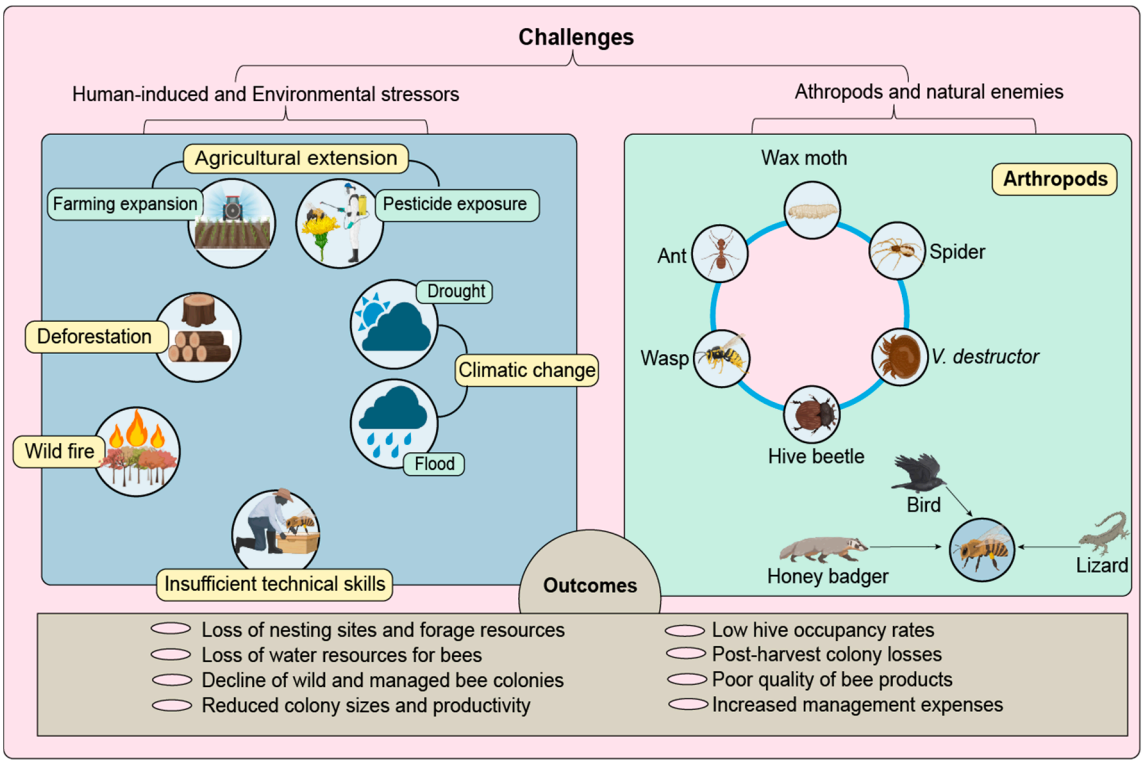

Figure 4. Anthropogenic (human-induced) factors, environmental stressors, arthropod pests and parasites, and natural enemies have been identified as challenges to beekeeping management across various regions of the country. However, despite the presence of these threats, no documented cases of significant economic losses or colony collapse have been reported in either wild or managed bee populations.

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In recent decades, studies have confirmed the nationwide presence of *Varroa destructor* (Mesostigmata: Varroidae) [20, 50], with altitudinal variation in infestation levels [50, 51]. Honeybee colony performance and populations in Tanzania appear largely unaffected by mite infestations, likely due to colony adaptation and an inherent capacity to coexist with the parasite [20]. However, further research is needed to understand the full impact of pests, parasites, and predators on honeybee health and productivity rather than their existence status.

4.5. Pesticide Exposure

Tanzanian government encourages apiary establishment on agricultural land to enhance bee product yields and pollination services, supporting crop production and food security [5]. For example, honeybee colonies have been introduced to sunflower farms in southern [52] and and western [53] Tanzania to improve yields, while honeybee-pollinated watermelons in the northern zone produce superior-quality fruits [54]. Conversely, studies from central Tanzania report pesticide contamination of honeybees and hive products, including insecticides, fungicides, and herbicides commonly used in agriculture [55].

Furthermore, agrochemical exposure can degrade the quantity and quality of floral resources (nectar and pollen), reducing honeybee species richness, diversity, and abundance in agricultural landscapes, particularly in southern Tanzania [56]. Laboratory analyses detected 252 pesticide residues in beeswax from the Singida Region, averaging 0.03 mg/kg, with lambda-cyhalothrin as the predominant compound [55]. In this regard, indigenous beekeepers are advised by the government to establish apiaries at least 7 kilometers from farmlands and tobacco-growing areas to reduce agrochemical exposure [57]. The absence of comprehensive data on pesticide exposure in beekeeping underscores the need for further research on the risks of pesticide residues to honeybee health, forage resources, and products.

5. Bee Product Industry

5.1. Production and Processing of Bee Products

Tanzania is endowed with warm temperatures, adequate sunlight, and well-distributed rainfall, which create a conducive climate for bee product production [58]. Honey and beeswax are produced in significant quantities [12]. In 2021, approximately 31 179 tonnes of honey and 1865 tonnes of beeswax were produced, ranking Tanzania as the second-largest honey producer in Africa and the tenth-largest globally [7, 59]. This production primarily comes from ten high-potential regions: Tabora, Katavi, Kigoma, Shinyanga, Geita, Kagera, Rukwa, Songwe, Mbeya, and Singida [60]. The national average hive productivity is 15 kg of honey and 2 kg of beeswax per hive per year [24, 60]. Although, beekeepers adopting modern practices, such as improved hives and apiary management, produce approximately 16 kg of honey and 7 kg of beeswax per colony in the western zone [61]. Harvests exceed 20 kg of honey per hive in the northern zone [62], and 15 kg in central zones [63].

Furthermore, other products, such as bee pollen, royal jelly, bee venom, and propolis, are produced in minute quantities [64], and remain underexploited and undocumented [24]. In 2019, the government proactively established five modern honey processing factories in high-potential districts, including Sikonge, Mlele, Bukombe, and Kibondo [60]. These factories are expected to enhance product quality [10, 65]. However, majority of indigenous beekeepers still use both traditional and commercial methods for processing honey and beeswax [66, 67]. For instance, beeswax from modern hives in northeastern and coastal regions is often processed using traditional techniques like the Tanganyika method [22]. Tax exemptions on imported and locally manufactured beekeeping equipment and materials could enhance the quality and quantity of the country's bee products.

5.2. Bee Products Quality and Properties

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Tanzania has high potential for producing safe, high-quality bee products due to predominantly wild-based, chemical-free beekeeping practices in miombo woodlands [68]. Figure 5 illustrates the visual characteristics of honey, beeswax, and propolis from various vegetation types across the country. Tanzanian honey and beeswax generally comply with local and export quality standards [69]. This adherence is promoted through continuous training sessions and enhanced use of improved beekeeping tools [70]. The honey typically exhibits water content below 20%, sugar levels above 65%, ash content below 0.5%, acidity below 40 meq/kg, and hydroxymethylfurfural (HMF) levels below 40 mg/kg [69, 71, 72].

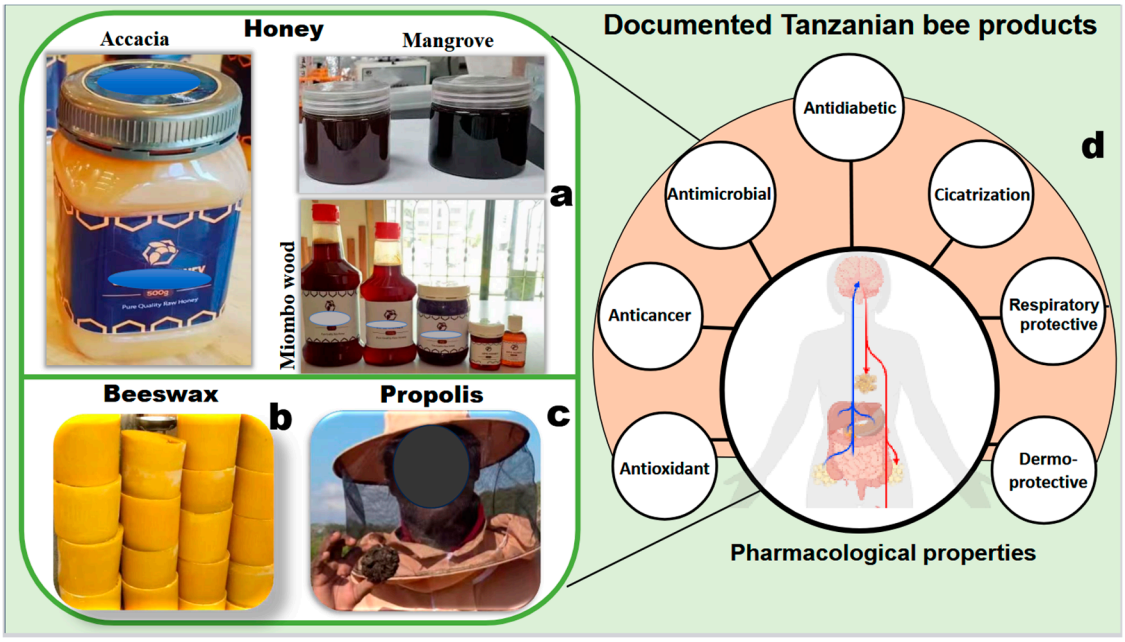

Figure 5. Visual characteristics of bee products derived from different vegetation types in Tanzania: (**a**) variation in honey color from acacia, miombo woodlands, and mangrove forests, including stingless bee honey from miombo; (**b**) beeswax from miombo woodlands of western and southern highlands; (**c**) propolis from mangrove-associated marine ecosystems; and (**d**) pharmacological properties identified across Tanzanian bee products.

Nonetheless, high-quality beeswax is commonly produced in the widely distributed miombo woodlands (Figure 5b) [73]. The country's propolis is rich in bioactive compounds, making it valuable for local pharmacological applications (Figure 5c–d) (Figure 5c-d) [64, 74, 75]. Expanded scientific studies are needed to address knowledge gaps regarding the production, characteristics, qualities, and applications of bee products other than honey

5.3. Consumption of Bee Products

Tanzanian honey exhibits a distinctive phytochemical profile reflecting the country's diverse vegetation and mineral-rich environments [69, 76]. Inductively coupled plasma-mass spectrometry analysis of multifloral honey from various agroecological zones revealed high concentrations of manganese, iron, zinc, and copper [77]. Dark-colored miombo woodland honey (Figure 5a) is particularly esteemed for its medicinal qualities and global demand, containing essential minerals and vitamins that enhance health benefits [69, 71]. It demonstrates significant antimicrobial activity against pathogens such as *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, and *Candida albicans* [78, 79]. Its antioxidant capacity and phenolic content contribute to efficacy against communicable and non-communicable diseases [80].

Nonetheless, Tanzanian propolis also exhibits antimicrobial properties against bacteria, fungi, and protozoans, shows potential antidiabetic and anticancer activity, and is used locally to treat skin diseases, wounds, and respiratory issues (Figure 5d) [64, 74, 75]. Expanding research into the

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biological activity, clinical efficacy, and pharmacological properties of honey and other bee products would encourage their increased consumption within and outside the country.

6. Beekeeping-Based Conservation Initiatives

Beekeeping supports biodiversity conservation in Tanzania by protecting forest ecosystems, sustaining wildlife, and promoting environmentally responsible resource management (Figure 6). The Forestry and Beekeeping Division (FDB) promotes landscape restoration, ensures fodder plant availability, and encourages api-agroforestry and reforestation initiatives nationwide [9]. Since the 1990s, communities have received financial incentives to participate in environmental protection through beekeeping integrated into forest and wildlife management projects [81, 82].

Figure 6. Utilization of beekeeping resources for natural resources conservation in Tanzania: (**a**) protection of forest ecosystems through enhanced community-based beekeeping practices in the Western zone; (**b**) application of beekeeping for restoration and conservation of mangroves ecosystem along coastal mainland and island areas; (**c**) TFS-supported rural beekeeping initiatives mitigating human–elephant conflicts around Nyerere National Park; and (**d**) community-based beekeeping programs at Gombe National Park strengthening wildlife management through collaboration between park authorities (TANAPA) and adjacent local communities.

Historically, beekeeping has contributed to preserving Tanzanian forests and biodiversity through community-based forest initiatives and the establishment of bee reserves and beekeeping zones [12]. For instance, in the western zone, the Association for the Development of Protected Areas (ADAP) programs encouraged villages adjacent to miombo woodlands to adopt beekeeping as an alternative to environmentally destructive activities [41]. In the northern zone, OIKOS East Africa and WWF Tanzania launched conservation projects to restore degraded land by establishing community-based forest reserves. This was achieved by promoting small to medium scale beekeeping enterprises among Village Game Scouts (VGS) and Village Cooperative Society Groups (VCS) in Maasai communities (Figure 3a–b). In addition, beekeeper groups and TFS actively work to prevent bushfires and protect forest ecosystems through beekeeping practices across the country (Figure 6a–b) [35].

Nonetheless, beekeeping initiatives in areas such as Udzungwa, Ruaha, Kitulo, Serengeti, Ngorongoro, Nyerere, Gombe, Ugala, and Mkomazi have helped mitigate human–wildlife conflicts

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and strengthened collaboration between conservation authorities and local communities (Figure 6c–d) [4, 31, 42]. Beehive fences have been successfully implemented to deter large wildlife, including elephants and gorillas, reducing human–wildlife conflict around Nyerere and Gombe National Parks (Figure 6c). Utilizing beekeeping resources as a community income venture helps safeguard forest ecosystems, wildlife, and protected areas by promoting conservation-focused livelihoods.

7. Challenges Facing Beekeeping Industry

The beekeeping industry in Tanzania faces numerous challenges from both human-induced and natural factors, as illustrated in Figure 4. These challenges are categorized into four main groups.

(i) Loss of habitat and forage resources. Agricultural expansion and certain cultural practices drive deforestation [83]. Forests are cleared and burned for charcoal production, agriculture, and due to cultural beliefs [84], resulting in the loss of bee nesting sites and forage resources [83]. Increasingly frequent and prolonged droughts in various regions further affect the availability of honeybee forage and water resources [49].

(ii) Honeybee colony losses**.** Both natural and human-induced factors contribute to the decline of wild and managed colonies. Suspicions exist regarding the potential presence of European Foulbrood (*Melissococcus plutonius*), nosemosis (*Nosema apis* and *N. ceranae*), and honeybee viruses from neighboring countries [85]. Although there is no definitive evidence that these pathogens have been documented in Tanzania to date [86]. However, environmental stressors are associated with increased seasonal migration, absconding, pest attacks, predator pressure, and cross-combing, all contributing to colony losses in regions like Katavi and Tabora Regions [49]. Declines in natural swarms, reduced colony sizes, low hive occupancy, and post-harvest colony losses are reported challenges nationwide [7, 63].

(iii) Low skills and technological development. Limited technological advancement restricts Tanzania's ability to fully exploit its beekeeping potential [7, 62]. Traditional hives are not conducive to systematic colony management [87], and vary in size and shape, making them incompatible with modern extraction and processing technologies [12]. Additionally, the industry suffers from a shortage of skilled practitioners, as most beekeepers are rural, low-income, and possess limited technical skills [61]. Inadequate facilities and unskilled labor contribute to substandard product quality and hinder effective honeybee conservation [11].

(iv) Governance and human resources. Persistent challenges include inadequate intellectual property rights laws and insufficient organic certifications [88]. An absence of scientific knowledge, information, and human resources limits the standardization, value addition, and diversification of beekeeping practices [24]. Limited awareness of supportive policies, guidelines, regulations, and development projects, coupled with weakly organized community groups and cooperatives, reduces the effectiveness of beekeeping operations [62, 87]. Addressing these limitations requires investment in sectoral policies, legal and regulatory reforms, enhanced research and dissemination, promotion of beekeeping expertise, and better coordination among beekeeping stakeholders.

8. Future Directions

The beekeeping industry holds substantial potential to contribute to Tanzania's economy, food security, environmental sustainability, and natural resource conservation. Realizing this potential requires significant effort. Priority should be given to scientific research on honeybee health, biology, taxonomy, habitats, forage resources, species diversity, population dynamics, productivity potential, genetics, and breeding. Disseminating research findings can provide evidence-based solutions to persistent challenges such as colony swarming, absconding, habitat loss, and reliance on traditional tools. Such studies will also support honeybee health management by improving the understanding of diseases, infestations, and control strategies for pests, parasites, and predators.

Collaboration among government agencies, private sector stakeholders, and development partners is critical to empower indigenous beekeepers. This should facilitate investment in modern

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technologies across extension services, training, production, processing, value addition, and quality control. Efforts should modernize traditional hives and practices into semi-modern systems suited to the ecological and behavioral characteristics of honeybees in specific regions. This approach can maximize production, increase beekeepers' incomes, and optimize the use of beekeeping resources for forest conservation, wildlife management, and apitourism development.

Strengthening beekeeping training and research centers with advanced laboratories and facilities will support breeding programs and enhance the production and application of diverse bee products, including honey, beeswax, pollen, venom, propolis, and royal jelly. It will also benefit pollination services, apitherapy, and apitourism.

Establishing a national beekeeping experts association is crucial to connect experts, researchers, investors, and public officials, promoting information sharing. It will facilitate addressing operational challenges and fostering cross-sector collaboration with agriculture, forestry, wildlife, health, and manufacturing industries. International partnerships with technologically advanced countries, such as China, should emphasize research on honeybee health, ecology, productivity, biomedical applications of bee products, and the expansion of global markets.

Finally, achieving sustainable advancement will require skilled human resources, targeted financial investment, and comprehensive legal, regulatory, and administrative reforms to unlock the transformative potential of Tanzania's beekeeping industry.

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Abbreviations

The following abbreviations are used in this manuscript:

ADAP: Association for the Development of Protected Areas
BTI: Beekeeping Training Institute, Tabora
MNRT: Ministry of Natural Resources and Tourism
NBP: National Beekeeping Policy
NGO: Non-Governmental Organization
TAFORI: Tanzania Forest Research Institute
TANAPA: Tanzania National Parks Authority
TFS: Tanzania Forest Services Agency
URT: United Republic of Tanzania
VCS: Village Cooperative Society
VGS: Village Game Scouts
WWF: World Wildlife Fund

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