

Beekeeping in Bangladesh-Status and Prospect

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ABSTRACT

Beekeeping or apiculture is the maintenance of honey bee colonies, commonly in hives made by humans. Honey is a much sought-after food item and there is a high demand in the local and foreign markets. Beekeeping is a vast scientific subject, related to agriculture, food, nutrition, medicine, industrial products and environment. Bangladesh has a large unrealized potential for the production of honey, bee wax, crops, fruits and other bee products in the field of beekeeping. Sustainable beekeeping demand is increasing day by day because of its quality products, lower investment and higher profitability. Due to availability of four different species of honeybees, different multifarious plants, local market consumption and labour there will be a unique opportunity for rural development through the promotion and extension of beekeeping in Bangladesh. Keeping above views in mind, the attempt was made to review and accommodated the facts and findings on beekeeping of Bangladesh in this article. All the information was collected from secondary sources in order to prepare this paper. Various relevant books, journals, thesis works of different universities, reports, information from internet, print and social media as well as personal communication with experienced personnel were used for the preparation of this article. Beekeeping status and prospect indicated the potentiality of honey bee farming for rural employment generation and development in Bangladesh.

Key words: Bangladesh, beekeeping, honeybee

INTRODUCTION

Beekeeping or Apiculture is the maintenance of honey bee colonies, commonly in hives made by humans. A beekeeper or apiarist keeps bees in order to collect honey and other products that the hive produces. Commercial beekeeping in Bangladesh (Anon, 2012) as well as beekeeping research is not still adequately organized and advanced. At present, bee farming using different types of bee boxes is gaining huge popularity among a section of young farmers in the country. Nowadays, a number of mobile farmers from various places move from district to district to find the areas where flowers are available in abundance and they can harvest honey with their domesticated bees. They usually assemble and set up their wooden boxes with bee colonies near the places like a Mustard field, a cropland of Coriander, Black cumin, Niger, Kheshari and Litchi gardens to collect quality honey during the peak season which starts from mid-November till to the beginning of May of the next year followed by Sundarbans. Beekeeping requires very little capital to start-up; little and less labour and can easily be practiced by men and women; youth and people with disabilities alike (Khan and Khan, 2018). Beekeeping needs low capital and little time, but promises a high return (Moniruzzaman and Rahman, 2009). According to Nyatsande *et al.* (2014), the advantages are it requires low investment, does not compete with other farming activities for resources and there is no sophisticated machinery or

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equipment needed. In order to start honey farming a beekeeper needs to collect some necessary materials. First of all, he will need to buy some instruments and equipment to work with. For example, bee boxes, frames, honey extracting machine, smoker, a mask and protective cloths to protect from the bee stings, brushes to remove the honey bees from the comb, bee wax etc. are the most common things that a honey grower will require for the farming. Besides, a mobile honey grower, who travels from district to district, may also need tent, kitchen essentials etc.

Apart from that, bee collecting is an important task for someone who wants to start bee farming, can purchase a package of nuclear colony having a queen bee, a male bee and worker bees from a local apiary. It is also possible to capture tiny wild honey bee from the hives is an easy technique to do so. Simply what you have to do is to catch the queen bee (the biggest bee in a hive) and to put it inside a box. After that all the worker bees and the male bees will follow her and get inside the box automatically. However, it may be a bit risky for an inexperienced person to catch wild bees in such a way.

Honey is a much sought-after food item and there is a high demand in the local and foreign markets. Hive products like pure honey is a traditional remedy for many ailments, and it is also used to make delicious sweet and savoury dishes. While the honey growers can make good amount of profit by selling honey, scientists suggest that bee farming benefits crops a lot. In addition, bees wax made from honey comb is a major ingredient in various products, including cosmetics and candles. Beekeeping can help unemployed or landless villagers become self-reliant. It can also be a profitable export business. Thus, we can earn foreign currency by selling raw honey to countries like India and Japan (Debnath, 2018).

Apiculture, or beekeeping for honey cultivation, can play an important role in conserving our environment. Beekeeping provides an array of opportunities for creating a framework for forestry management (Nyatsande *et al.*, 2014) and climate change adaptation. Mustard seed cultivation and bee farming go hand in hand because the bees help pollination of the flowers boosting Mustard production. So, Honey farming can be an enterprise of possibility for many self-dependent, freedom loving youths and such initiative will ultimately contribute to the economic development of our country (Islam, 2018). Honey bee not only increases yield of crops as pollinators it helps to protect crops from other enemies. It was observed that in Litchi Garden, inflorescence and leaves were free from dry sticky honey, fungi and attack of bat flock (Saifullah, 2017). The abundance of bee forage plants throughout the year determines the growth of bee colony and hence the productivity of beekeeping. Many forest-based and cultivated plants can provide nectar and pollen for foraging bees (Sabir *et al.*, 2000). Utilizing the natural environment of our country, it may be possible to produce more than 100,000 (one lakh) tons of honey every year (Aminuzzaman, 2018). It will be possible if the existing carrying capacity increases by well organized beekeeping and planting bee loving plants throughout the country for long run.

Beekeeping is a vast scientific subject, related to agriculture, food, nutrition, medicine, industrial products and environment. Bangladesh has a large unrealized potential for the production of honey, bee wax, crops, fruits and other bee products in the field of beekeeping (Saha, 1990). Sustainable beekeeping demand is increasing day by day because of its quality products, lower investment and higher profitability (Islam *et al.*, 2015). Due to availability of four different species of honey bees, different multifarious plants, local market consumption and labour there will be a unique opportunity for rural development through the promotion and extension of beekeeping in Bangladesh (Saha, 1990). Keeping above views in mind, the attempt was made to review and accommodated the facts and findings on beekeeping of Bangladesh in this article.

MATERIALS AND METHODS

This is completely a review paper. Therefore, all the information was collected from secondary sources in order to prepare this paper. Various relevant books, journals, thesis works of different universities, reports, information from internet, print and social media as well as personal communication with experienced personnel were used for the preparation of this article.

History of beekeeping

History of beekeeping is very ancient. Depictions of humans collecting honey from wild bees date to 10,000 years ago (Dams and Dams, 1977). Beekeeping in pottery vessels began about 9,000 years ago in North Africa (Roffet-Salque *et al.*, 2016). Domestication of bees is shown in Egyptian art from around 4,500 years ago (Crane, 1999). However, systematic beekeeping was started in USA at 1638 (Khan, 1996). After that there was no remarkable development found following 200 years (Khan, 2016). In 1840 Moses Quinby an American beekeeper started beekeeping scientifically and modern beekeeping was introduced by Langstroth in 1853 who was also an American and called the father of modern beekeeping (Khan, 2009). Doklas an English man first introduced beekeeping in Indo-Pak Subcontinent and hives suitable for this region was developed by Newton in 1911 who was also an Englishman (Hannan and Hossain, 2006; Khan, 2009). Beekeeping is long-standing practice in the rural communities especially in Sundarbans of Bangladesh and this has become a part of ancient history of the country (Hossain, *et al.*, 2017). The practices as early time could be classified as bee hunting (Islam, 1997). It was done mainly for honey collection and this hunting is found even in the present time (Saha, 1990; Islam, 1997). Keeping or rearing bees in wooden hives probably started in the country at the time of self-reliant movement of Mahatma Gandhi in 1940. Before this, people used to keep bees in wooden logs, clay pots, bamboo and straw baskets etc. In 1950's the then Government came to know and understand the feasibility and necessity of beekeeping in the country (Saha, 1990). Managed beekeeping was first experimentally started in 1950 in Sylhet district and failed due to unskilled personnel, insufficient use of technology and improper planning (Hossain, *et al.*, 2017). Attempt was also made to introduce beekeeping in Bangladesh by Bangladesh Academy of Rural Development (BARD) in 1958.

During this whole time beekeepers-cum-catchers-cum-amateurs were trying to keep bees in hives. A few of them were partly successful but diseases with other problems again resulted in failure. In 1963 Bangladesh Small and Cottage Industries Corporation (BSCIC) started beekeeping in wooden hives at Jatrapur under Bagerhat (the then Khulna district) district, motivate people for beekeeping and at first started training on modern beekeeping techniques (Khan, 2009). The result at that time was not also satisfactory due to inappropriate technology and ultimately the activities were stopped in the same decade (Saha, 2003).

In 1977 BSCIC again started beekeeping in modern and scientific way and got success with *Apis cerana* and till then, managed beekeeping was started in the country (Hossain *et al.*, 2017). BSCIC started training activities on scientific method of beekeeping at Konabari of Gazipur in 1977. Having successful efforts promotion and extension of beekeeping activities is being launched by BSCIC throughout the country since 1977 (Saha, 1990). From 1980 the programme was executed in all over the country (Hannan and Hossain, 2006).

To give administration and institutional support in favour of beekeeping efforts, Bangladesh Institute of Apiculture (BIA) was formed with the leadership of Mr. S. M. A. Latif Dewan in 1981 (Islam, 1997). BIA is a non-government organization which has a central concept of research followed by dissemination of information and knowledge on Apiculture (Islam, 1997). Realizing the importance and utility of honey, other bee products and beekeeping, many other organizations started and assisted modern beekeeping in the country (Saha, 1990). Government, semi-government, autonomous and non-government organizations (NGOs) such as Department of Agricultural Extension (DAE), Bangladesh Rural Development Board (BRDB), Grameen Bank, Proshika, BRAC, CARE, CCDB, Caritas, Bangladesh Institute of Apiculture (BIA) and some social welfare organizations have taken over the Apiculture Programme (Hannan and Hossain, 2006). Some International organizations have taken collaborative programme with organizations of the country such as Denmark with BSCIC, FAO/UNDP with DAE, Canadian international organization with BRDB (Hannan and Hossain, 2006).

Beekeeping in Bangladesh from 1963 to 1995 was practiced using *Apis cerana* only (Khan, 2017) and were suffering from diseases and pests. In 1989 beekeeping industry was severely damaged by the attack of 'sac brood virus' disease and about 80% of managed *Apis cerana* colonies were collapsed (Hossain *et al.*, 2017). Beekeepers sought to get disease and pest tolerant or resistant high yielding honey bee for managed beekeeping. In 1990 two beekeepers named 'Ayub' and 'Sunil' introduced European bee, *Apis mellifera* from the neighboring country (Hossain *et al.*, 2017). In 1992 Proshika, a non-government organization, collected some *Apis mellifera* beehives from those beekeepers and started managed beekeeping (Hossain *et al.*, 2017). From 1995 Proshika started multidimensional activities using *Apis mellifera* in beekeeping. In 1996 BSCIC introduced *Apis mellifera* in Divisional Centers and is being advanced successfully.

Managed beekeeping then spread all over the country with the help of BSCIC, Proshika and BIA (Hossain *et al.*, 2017) as well as beekeepers.

During the period, associations of beekeepers and foundations of beekeepers have been formed. About seven beekeeping societies are existed in the country such as Bangladesh Beekeepers Association (BBKA), Dhaka; Beekeepers Welfare Society (BWS), Gazipur; Chittagong Mouchashi Somitee, Mirashwarai, Chittagong; Gazipur Mouchashi Somitee, Gazipur; Uttorbongo Mouchashi Somitee, Hatikumrul, Sirajgonj; Sundarban Mouchashi Somitee, Horinagar, Shatkhira and Narail Mouchashi Somitee, Raghunathpur Narail (Hossain *et al.*, 2017). Uttorbongo Mouchashi Somitee is now being performing activities successfully at Chatmohar and Ishurdi Upazilla of Pabna. BBKA is the member of the World Apimondia Congress. BWS is the registered beekeepers organization in the country. All the beekeepers are the members of BBKA and BWS. Each of the member of unregistered beekeepers is the members of BWS. The Government organizations such as DAE has been taken over extension and training on beekeeping. Bangladesh Agricultural University (BAU), Sher-e-Bangla Agricultural University (SAU), Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), University of Rajshahi (RU), Bangladesh Agricultural Research Institute (BARI), some other Universities and organizations are being undertaken research on beekeeping in Bangladesh. Sher-e-Bangla Agricultural University (SAU) apiary is furnished with different types of bee boxes and bee stocks. Research and development programme is in progress in SAU apiary for queen breeding and drone breeding purposes (Fazlullah, 2017) under the leadership of Professor Dr. Mohammed Sakhawat Hossain.

Beekeeping is an important sub sector of agriculture and honey bees are the most crucial pollinator of agricultural crops. More than 80% of agricultural crops are more or less dependent on bee pollination (Fazlullah, 2017). Government of Bangladesh is giving attention for beekeeping through the Ministry of Agriculture executing projects for extension, research and development. Under the Ministry of Agriculture, Bangladesh Sugarcrop Research Institute is mandated to develop technologies and techniques in order to produce honey which is mentioned in Article 5(2) of Bangladesh Sugarcrop Research Institute Act, 2019" (Bangladesh Gazette, Extraordinary, Published by the Authority, Monday, November 18, 2019, ACT NO XVII OF 2019, Bangladesh Government Press, 2019). As per mandate, Bangladesh Sugarcrop Research Institute is undertaking research for development of technologies and techniques in order to produce honey and honey bee improvement.

RESEARCH AND DEVELOPMENT

Systematic research and development on beekeeping is not solicited in Bangladesh. Different universities conducted research on beekeeping through 'Thesis' works for academic purpose. Some findings of these academic researches may be transformed to technologies for beekeeping in Bangladesh.

Beekeeping was started at Bangladesh Agricultural University in 1986 (personal communication) and systematic research on beekeeping was initiated since 1993. Research for 'Thesis' works such as Rearing and management of *Apis cerana* (F.) (Hymenoptera: Apidae) in beekeeping boxes; Study on the disease and pests of *Apis cerana* and their control; Rearing and management of *Apis cerana* (F.) and analysis of honey collected from different plant sources were undertaken under supervision of professor Mosharraf Hossain (1993; 1993; 1999). Analysis of honey and incidence of diseases, pests and predators in the colony of honey bee, *Apis cerana* (F.) (Hymenoptera: Apidae) reported by Ansary (1996). Comparative performance of two honeybee species *Apis cerana* F. and *Apis mellifera* L. in two nectar flow season reported by Uddin (2004).

Different types of unifloral honey available in Rajshahi through Apiculture is reported by Ahmed (2004). In this research *Apis cerana* and *Apis mellifera* were used to collect honey from Plum, Mustard and Litchi flowers and found that water content, pH, electric conductivity, hygroscopicity, relative gravity, viscosity, Ash content, Lipid content, total Protein content, total Sugar content, vitamin content, Calcium and Iron content were varied among honey bee species and flowers of plants. Results indicated the quality honey was produced from Rajshahi region. Attack on ectoparasitic mite *Tropilaelaps clereae* on honey bee *Apis mellifera* L. colonies its effects and management tactics reported by Islam in 2005. Amin (2006) studied effects of food substitutes on honey bee *Apis mellifera* L. colonies for maintaining their population. Effects of artificial foods during the dearth period for the population development of honey bee (*Apis mellifera* L.) was studied by Rahman (2006). Intercropping of Mustard and its effect on Aphid and honey bee studied by Afrin (2013). Rokonzaman (2015) reported rearing efficiency, foraging behaviour and food management of honey bee (*Apis mellifera* L.) during dearth period. Study on pollen collection efficiency of European honey bee (*Apis mellifera*) from Mustard flower was done by Ahmed (2016).

Akter and others (2019) identified a total of 11 bee species belonging to two families Apidae and Megachilidae. The identified species were *Apis dorsata*, *Apis mellifera*, *Apis cerana*, *Apis florea*, *Ceratina binghami*, *Ceratina nigrolateralis*, *Xylocopa aestuans*, *Xylocopa violacea*, *Xylocopa latipes*, *Megachile disjuncta* and *Megachile umbripennis* from three areas of Dhaka city - Curzon Hall, Ramna Park and Sher-e-Bangla Agricultural University from October 2017 to May 2018. During the study period it was observed that the availability of bee species was found maximum during the month of October (31.01%) and was more abundant in Curzon Hall and Sher-e-Bangla Agricultural University area than that of Ramna Park area. The bee *A. dorsata* was the most abundant (about 36.23% of the total population) and *M. umbripennis* was the least abundant (about 1.74% of the total population) species in the study areas. It was also observed that bee species were more attracted to the yellow flowers specially *Cosmos sulphureus* and *Tecoma stans* than the other coloured flowers.

Study on the effect of propolis on the bee health was reported by Alam (2016). Result revealed that there was no propolis production in traditional bee hive.

Poly hive produced 17.22g, 25.31g and 26.03g propolis in Sirajganj, Gazipur and Shatkhira districts. In case of poly hives pest and disease attack were low in comparison to traditional ones. Results demonstrated that netting with honey bee for engaging pollination gave higher yield and better quality of Mustard than open field and the field where honey bee pollination was restricted by netting. Study on pollen efficiency of European honey bee (*Apis mellifera*) from Litchi flower was reported by Rahim (2017). He found that as high as 13 number of *Apis mellifera* visited per m² per minute covering 25 number of flower per minute at the peak time of bloom. The highest number of pollen loaded were at 9.00-10.00 and 11.00-12.00 am. There was no significant difference observed between poly hives and conventional hives in respect of pollen collection. Fazlullah (2017) conducted research on the study on honey production by using wooden and poly hive in different seasons in Bangladesh. It was found that during day time between the hours 11.00 and 13.00 the bee foraging was higher in comparison to other time of the day. For nectar harvesting, best time was in 11.00 hour of day time. The modern poly hive super was significantly efficient in terms of honey production. There was a significance difference of honey production in wooden traditional hives and the poly hive super boxes. Ploy hive super box provides bees a good environment to raise and keep the population strong due to its high-tech internal facilities and sanitary system. Paul (2017) reported effect of pesticide application timing on honey bee foraging in Mustard field and role of honey bee on Mustard yield. At the hour of 10.30 am to 2.30 pm, the highest number of honey bees was recorded in Mustard field. Cited from Crane and Walker (1983) Saifullah (2017) reported that insecticides of non-persistent compound may be applied at evening or at night. Therefore, it may be suggested to apply pesticides in Mustard field after 4.00 pm during Rabi Season in Bangladesh.

Result revealed that honey bee helped Mustard pollination, decreased the flowering period and increased the number of pods per plant, pods length leading to considerably higher yield of Mustard. Hossain (2017) studied the role of honey bee as pollinator in contributing yield of Mustard. Reproductive potential difference of artificially inseminated and naturally mated honey bee queens (*Apis mellifera* L.) was reported by Hasnat (2018). The findings encouraged beekeepers for practicing grafting procedure as the better queen rearing procedure in field condition. However, the artificially inseminated queens also could be used for stock improvement and bee research because of its control mating system.

Books in Bengali language have been written by some authors such as Razzaque (1987) Mou Biggan (Bee-science); Khan (1992) Moumachi Manusher Bondhu (Prothom Khondo); Khan (1996) Moumachi Palon Nirdeshika; Hannan and Hossain (2006) Moumachi O Moumachi Palon; Saifullah (2007) Moumachi Paloner Kalakaushal; Khan (2009) Boiganik Paddhatit-e Moumachi Palon; Bandayapaddaya (2012) Modhu; Khan (2016) Moumachi O Modhu; Dalim (2015) Moumachi Paloner Kotha; Saifullah (2017) Moumachir Khamar Babostapona; Khan (2017) Modhu O Mou Ponna; Hossain (2018) Modhu Chash O Shastho; Islam (2018) Adhunik Podhotite Moumachi Palon; Azad (2019) Moumachi Palon O Modhu Songroho. These books described about technologies and techniques including honey bee capture, collection,

management, protection from diseases and pest, conventional honey processing, preservation, quality controls, marketing and economics of beekeeping in simple language and perceptible way. The initiative taken by different Government, Non-Government Organizations (NGOs) as well as Private Organizations catered beekeeping in Bangladesh. Beekeepers under different societies and/or individually started beekeeping for their earning as small industries in the village area. There were 1551 active beekeepers and 42911 boxes in Bangladesh (Hossain *et al.*, 2017). The highest number (16766) of bee boxes are recorded in Uttar Bongo Mouchashi Somitee. BSCIC's record revealed that this organization trained 25000 beekeepers in the country up to 2012 but only 1551 are active in the country. DAE has trained (ToT) 500 BCS (Agriculture) officers through the project "Production, Storage & Distribution of Quality Seeds of Pulses, Oils & Onion (2nd phase-1st revised)" at farmers' level. Around 70,000 farmers included in their field day and highlighted on beekeeping techniques. BSRI also arranged training of beekeepers every year. Research led by professor, Dr. Mohammad Sakhawat Hossain as well as BSRI, other organizations, books and articles writers and involvement of DAE inspiring beekeeping significantly in Bangladesh. By social media communication of Bir Sen Chakma a primary school teacher, it was informed that he has no formal training on beekeeping. He read the books of different writers and in pursuance with other beekeepers established an apiary of 20 boxes of *Apis cerana* and producing pure honey. Having no formal training following him and reading books 50 bee farmers established apiary and producing quality honey in Rangamati. Reading books and emulate of experience beekeepers many apiaries become established. Concomitant with formal and practical training through different organizations epilogue the beekeeping in Bangladesh.

Diseases and pests that effect honey bees are complex and sometimes difficult to understand, yet it is important to beekeepers to be aware of the diseases and pests that can afflict a colony (Hossain *et al.*, 2017). Diseases and pests such as Wax Moth, Wax Beetle, American Foul Brood (AFB), European Foul Brood (EFB), Sac Brood, Chalk Brood, Chilled Brood, Bald Brood, Nosema, Dysentery, Virus Paralysis, Acarine (tracheal mite), *Varroa destructor*, Parasitic Mite Syndrome (PMS), *Tropilaelaps clareae* mite, Small Hive Beetle (SHB), Colony Collaps Disorder (CCD), Bee eaters, other birds and animals have been reported (Khan, 2016; Hossain *et al.*, 2017). Identification, management and control measures of diseases, pests and problems have also been reported (Khan, 2016; Hossain *et al.*, 2017). Integrated beekeeping is environment friendly sustainable activity that can easily be integrated with farming system and biodiversity conservation of Bangladesh. Thus, it could be one of the most important interventions for sustainable development of rural economy and could contribute in poverty alleviation through employment generation. Bangladesh is endowed with varied ecological zones with different bee crops and flora, therefore, it has a huge potential for beekeeping.

Taxonomical position and distribution

The genus name *Apis* is Latin for "Bee" (Harper, 2019). Although modern dictionaries may refer to *Apis* as either honey bee or honeybee, entomologist Robert Snodgrass asserts that correct usage requires two words, i.e. honey bee, as it is a

kind or type of bee, whereas it is incorrect to run the two words together, as in Dragonfly or Butterfly, because the latter are not flies Snodgrass (1984). Honey bee, not honeybee, is the listed common name in the Integrated Taxonomic Information System, the Entomological Society of America, Common Names of Insects Database, and the Tree of Life Web Project (Anon., 2008; Anon., 2016; Anon., 2016). However, in the common usage both honey bee and honeybee are used.

Honey bees appear to have their center of origin in South and Southeast Asia (including the Philippines), as all the extant species except *Apis mellifera* are native to that region. Notably, living representatives of the earliest lineages to diverge (*Apis florea* and *Apis andreniformis*) have their center of origin there (Deborah, 2000). Scientific classification of honey bee is described as Kingdom: Animalia, Phylum: Arthropoda, Class: Insecta, Order: Hymenoptera, Suborder: Apocrita, Infraorder: Aculeata, Superfamily: Apoidea, Clade: Anthophila, Family: Apidae, Genus: *Apis*, Subgenus: *Apis*. Honey bee belongs to the genus *Apis*. Characteristic feature of this genus is vertical wax comb with hexagonal cells on its both sides. In the genus *Apis* there are three extant sub genera and eight extant species. Sub genus Micrapis (Ashmead) includes *Apis andreniformis* (Smith) and *Apis florea* (Fabricius). Sub genus Megapis (Ashmead) includes *Apis dorsata* (Fabricius) and *Apis laboriosa* (Smith). Sub genus *Apis* (Linnaeus) includes *Apis cerana* (Fabricius), *Apis koschevnikovi* (Enderlein), *Apis mellifera* (Linnaeus) and *Apis nigrocincta* (Smith) (Engel and Schultz, 1997). However, four species of honey bees are mainly considering for honey production in Bangladesh, such as *Apis dorsata*, *Apis cerana*, *Apis florea* and *Apis mellifera* (Razzaque, 1987; Khan, 1996). Among them, *Apis mellifera* introduced in Bangladesh in 1992 for experimental basis which have originated from Africa, Europe and Middle East (Sivaram, 2012). Three other species are Asian native and available in Bangladesh. *Trigona fuscobaltiata* has been reported from the Southern-Eastern hilly regions; small in size, bees of this species make nests in tree holes, Bamboo stems used as pillars of houses, spaces of wooden walls, cracks or crevices of rocks, holes, etc. Like honey bee they have a caste system and division of labour. They also store honey and pollen in their nests, and usually occur in colonies (Hannan, 2015). There are five honey producing bees are present in Bangladesh such as *Apis dorsata*, *Apis cerana*, *Apis florea* and *Apis mellifera* and *Trigona fuscobaltiata* (Khan, 1996).

Ancestors of honey bees emerged 40 million years ago, with a modern type of open nesting species appearing in South East Asia around 10 million years ago. Subsequently species that nested inside cavities appeared, eventually spreading throughout tropical and temperate Asia and into Europe. These European bees became isolated from the Asian species as desert developed in the Middle East, and evolved into the species that we know today as *Apis mellifera*, with an indigenous distribution stretching from the Arctic Circle to South Africa, and with Eastern limits of the Ural Mountains in the North and the central deserts of Afghanistan in the South. The cavity nesting bees in Asia evolved into *Apis cerana* and the several other cavity nesting species of *Apis* are known today. The open nesting species gave rise to the several types of open nesting species existing today. Thus, Asia has a diversity of *Apis* species, while Europe and Africa have just one species. However, it is this single

species, *Apis mellifera*, upon which the World's industrialised beekeeping sector is based (<http://www.beesfordevelopment.org/categories/distribution-of-honey-bees/>) including Bangladesh.

Potential perspective for rural development

Beekeeping has a potential perspective for rural development in the context of agro based major employment and economy of Bangladesh. Because beekeeping as a family based activity having 1-5 colonies does not require any specific land. About 5,21,638 hectare of land was under Mustard cultivation in cropping season 2018-2019. If half of the land was possible to furnish with bee hives about 78,245 MT of honey was produced. We have about 16,554 hectare of Litchi Orchard (BBS, 2018). From this about 16,554 MT of honey is possible to produce. Except Mustard and Litchi Black Cumin, Coriander, Niger, Sesame, and Sundarban are also the potential sources of honey collection. Our existing carrying capacity of honey production is about 20,000-25,000 MT. It can be 100,000 MT if the beekeeping is organized and bee loving flora will be planted throughout the country. Utilizing the natural environment of our country, it is possible to produce more than 100,000 (one lakh) tons of honey every year (Aminuzzaman, 2018). Which helps to create employment and income generation in rural areas of Bangladesh.

Beekeeping is a family based activity, very easy, acceptable and less expensive than any other income generating activity which may be substantial and/or fulltime income generating source for rural people. It may be mentioned here that in most of the 87,223 villages in Bangladesh (BBS, 2019) beekeeping is more or less feasible on the basis of existing natural bee plants. So, it is to be expected that if there would be at least 5 beekeepers in each village in average then there would be more than 0.4 million people to be engaged in beekeeping activities. By way of this 0.4 million people to be engaged in keeping bees and when each beekeeper on average will produce 10 kg of honey then there would be a total honey production of about 4,000 metric tons which is worth Taka 800 million (US\$ 14 million) per year. On the other hands additional crop, vegetable and fruit production as per scientific record is to be worth Taka 8000 million (US\$ 140 million) by way of pollination through beekeeping activities in the country. So, it is to be appreciable that through the scientific and proper implementation and expansion of beekeeping through research and demonstration in the country there will be a good amount of honey production with enhanced crop, vegetable and fruit production. Subsequently a large number of employment generation is also to be happened as well (Aminuzzaman, 2018).

Nevertheless, in the context of large unrealized potentiality of rural beekeeping in Bangladesh the socio-economic benefits can be achieved such as promotion and enhancement of agricultural production; enhancement of the quality and production of fruits; promotion and expansion of forest wealth; increasing plant community in the environment; saving and/or earning foreign currency by producing and exporting honey and other bee products; prevention of diseases by taking pure honey regularly; curing of some particular diseases; promotion and increasing the nutrition value of

food; use of wax and other bee products in various industrial products; promotion of medicine quality; upgrading the quality and standard of food in the view point of taste and nutrition; increasing the rural based cottage industry in the country; family solvency through additional income broadly in the rural areas; new employment generation by way of rural beekeeping extension; and therefore, accelerating the development of national economy will be accelerated.

Beekeeping is a very useful occupation in the rural areas of Bangladesh. Beekeeping in Bangladesh ran a long journey to come in present position though the optimization deserves due research, development and extension. Organizational support through training, distribution of bee hive, learning from books and personal communication bring off the present footing. Books in Bengali and forthcoming academic research of different universities and research organizations are also obvious. Beekeeping generates employment and provides income to community of rural area which alleviates poverty in the long run. Beekeeping provides nutritional and ecological security to the rural communities at the household level in the rural area. Beekeeping plays key role in pollination and enhancing the agricultural production. Beekeeping supply honey and by products to the community which is very important for the control of health diseases. The investment in this business is very less and everyone can start easily in the rural area. The major constraints in beekeeping are the diseases and pest attack, lack of modern production and rearing technologies, techniques, and trainings which could overcome by a comprehensive programme focusing on the development of low cost technologies, techniques, trainings, and value chain market facilities at rural, urban and export level. Network of transportation facilities should be developed for enhancing honey production and marketing. Credit facilities on low interest rate should be provided to beekeepers for development of honey production. Nectar producing plants and crops as well their availability should be maintained and multiplied for enhancement of honey production in Bangladesh.

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