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# TRADITIONAL HONEY COLLECTION OF THE FOREST FRINGE PEOPLES IN THE SUNDARBAN TIGER RESERVE (STR), INDIA

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**RESEARCH ARTICLE**

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**Abstract**

Sundarban is famous for mangrove forests and its world-renowned Bengal tigers. The locals who live close to the forest are engaged in major NTFP (non-timber forest product) collections, like fish, crab, prawns, honey, and bee wax, for their own consumption and subsistence. Among all of these professionals, 'honey collectors' are the most vulnerable. Moulis encounters numerous difficulties throughout their journey to collect honey. The gathering of honey is a very dangerous activity because it involves attacks by man-eating tigers. Bees construct hives in the mangrove forest. Pure honey from the Sundarbans is in high demand both inside and outside of India. This paper aims to inventory traditional wisdom, rituals, experiences, and practices regarding the collection of honey and wax from the deep forest, including challenges and uncertainties, using traditional techniques and contemporary rules and regulations by the Forest Stewardship Council. It examines traditional knowledge, its transmission, and its evolution through generations. Along with the social structure, which segregates people based on gender, there is also a marketing and political system between the forest guards and the local Mahajan. Sundarban honey collection is crucial in ecological, economic, and social dimensions and contributes to the goal of traditional honey extraction knowledge.

**Keywords:** *Moulis, Traditional Knowledge, Rituals, Sundarban, Challenges, Coping Strategies, Politics*

## Introduction

Traditional knowledge (TK) is a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the interactions between living beings (including humans) with one another and their environment (Berkes, 1993). TK are local and community-based in a particular society; practice is derived from historical experience (Ibid); people have lived there for generations, and these places are non-industrial or have less advanced technology (Tharakan, 2015). TK provides the socio-cultural information, geographical context, cultural context, and decision-making at the local level (Ibid), as exemplified in the *panchayathi raj* system of India (Mahesh, 2011). The World Health Organization estimates that nearly 80% of the world's population is still dependent on using natural resources in traditional ways for health care (Upadhaya et al., 2016). In India, an estimated 50 million economically marginalized forest dwellers harvest large amounts of non-timber forest products (NTFPs) for both trade and personal use (Deori, 2016). NTFPs are materials of both plant and animal origin that are obtained from the forest and allied land uses for both daily and income-generating purposes (Dattagupta et al., 2014).

Honey is a delicacy with significant medicinal benefits; as a result, it is in high demand throughout the year, especially for its Ayurvedic health benefits (Demps et al., 2012). In India, the species Apis dorsata, Apis florea, Apis cerana, and Apis mellifera are mainly used to produce honey. Apis cerana and Apis mellifera are among those that are cultivated by humans for the production of honey, while Apis dorsata is a wild rock bee that has not yet been domesticated (Deori et al., 2016). The majority of forest dwellers and tribal communities, including the Jenu Kurumbas, Lambani, Soliga, Hakki Pikki of Karnataka, Mawphlang of Meghalaya, the Irulas of Tamil Nadu and Nilgiris, the Moulis, an indigenous community of the Sundarban, collect honey from forested areas (Zvelebil, 1979; Demps et al., 2012; Sohela, 2013).

The Sundarbans mangrove forest cover an area of 10,284 $km^2$, of which 40% is in India and 60% is in Bangladesh. The Indian Sundarban lies between 21°31' to 22°53'N and 88°37' to 89°09'E and comprises 19 community development blocks under the north and south 24 Parganas district of West Bengal. The Indian Sundarban cover a total area of 9,630 $km^2$. In 1989, the Government of India (GOI) declared the entire Sundarban a Sundarban Biosphere Reserve (SBR), and later, UNESCO recognized its Man and Biosphere (MAB) Programme in 2001. The Sundarban Biosphere Reserve covers the delta south of the Dampier-Hodges line and includes the Sundarban Tiger Reserve (STR), the Reserve Forest (RF), and human settlements.

Sundarban Tiger Reserve is a part of SBR and established in 1973, it covers an area of 2,584.89 $km^2$, and is located a little south of the Tropic of Cancer between 21° 32'–22° 40' N and 88° 05'–88° 10' E. It has two designated zones: the core zone and the buffer zone. In 1984, the core zone was declared a national park; it is a UNESCO World Heritage Site inscribed in 1987; and it has been designated as a Ramsar site since 2019.

The Sundarbans is famous for its salt-tolerant world largest mangrove forests, tidal waterways, mudflats, and wide variety of flora and fauna, including birds, spotted deer (Axis axis), Bengal tigers (panthera tigris tigris), estuarine crocodiles (crocodilus porosus), Ganges and Irawadi dolphins (platanista gangetica and oracaella brevirostris), snakes, and an abundance of mangrove *vegetation like Sundri* (Heritiera fomes), *Gewa* (Excoecaria agallocha), *Goran* (Ceriops decandra), and *Keora* (Sonneratia apetala) etc. (Kothari, 2015). This forest provides various non-wood forest products like thatching materials, honey, beeswax, fish, crab, and molluscs on a regular basis. Among them, honey is one of the natural resources. This honey is highly valued for its unique flavour derived from mangrove flower nectar. In India and even outside of India, there is a high demand for the Sundarbans' pure natural honey. Most honey collectors live in the Gosaba, Hingalgangue, and Basanti blocks of the Sundarbans. However, collecting honey is a difficult and dangerous task, as it involves attacks by man-eating royal bengal tigers.-Therefore, this research paper discussed the traditional knowledge, experience, and practices of honey collectors as well as camouflaged challenges, uncertainty, coping mechanisms, and their struggle to survive in the dense forest before and after honey collections.

## Methods

**Study area:** The study was carried out in various villages situated in the Sundarbans area of West Bengal, especially in the Satjelia and Lahiripur Gram Panchayats, situated within the Gosaba block of South 24 Parganas district (Figure.1). These areas are located along the banks of the Garal and Datta rivers, and are at risk for environmental issues like storms, floods, and animal attacks. Marginalized and economically disadvantaged communities live in these hamlets, which means they are particularly sensitive to ecological changes. The ecology of this area is highly dynamic and sensitive to the impacts of climate change and human activity, making it an important location for ecological studies and conservation efforts. According to Tomlinson (1986), the study area is classified as an intertidal wetland, which is typical for tropical and subtropical monsoon regions.

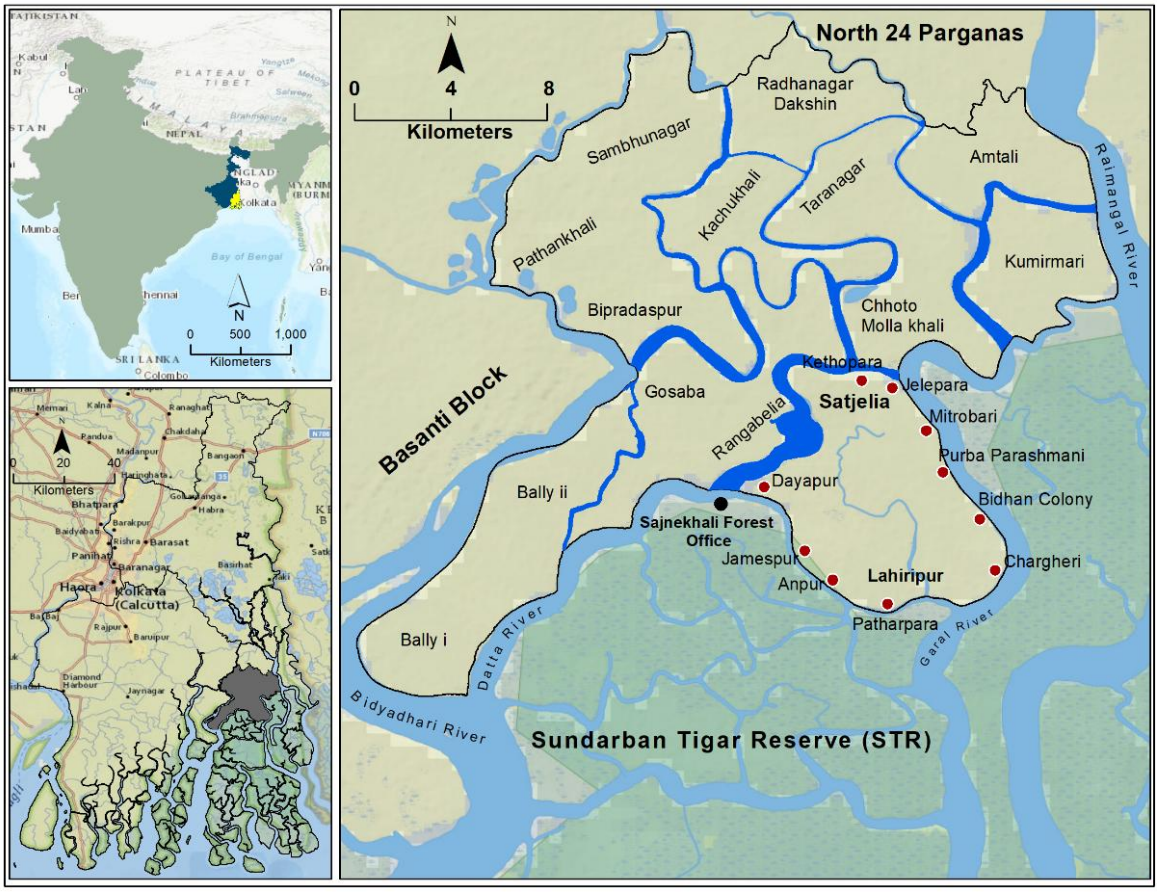


**Figure 1: The study area is Satjelia and Lahiripur that are encircled by forest fringe villages.**

**Data collection:** This study utilized a mix of primary and secondary data collection methods to gain a comprehensive understanding of traditional honey extraction knowledge (THEK). The collection of primary data was achieved using focused group discussions, household surveys, personal observations, and participatory rural appraisal, which allowed for direct insights from honey collectors. Secondary data was collected from relevant printed and digital documents to enhance the analysis of the challenges, coping strategies, and livelihoods of honey collectors.

## Background and Cultural Significance

Traditional honey extraction has been practiced for generations by various communities around the world, often relying on sustainable and time-honoured techniques that respect both the bees and the environment. These methods vary by region and culture but generally follow a common practice. For instance, the Gurung community of Nepal follows an ancient technique of harvesting honey from wild Himalayan cliff bees (*Apis laboriosa*). Skilled honey hunters climb steep cliffs using handmade rope ladders and bamboo poles, carefully cutting honeycombs while enduring bee stings (Paudel and Parajuli, 2014). Similar methods are observed among the Konyak tribe in Nagaland, Maldhari in Gujarat and Kattunayakan or Jenu Kurumbas in Karnataka, India, where traditional smoke techniques are used to calm bees before harvesting honey (Ao, 2019). Many traditional communities practice beekeeping using log hives, clay pots, or wooden boxes. Ethiopian beekeepers use cylindrical hives made from woven bamboo or hollowed logs, placed high in trees to mimic natural hive locations (Kebede et al., 2020). In India, traditional beekeeping with *Apis cerana indica* involves wooden hives with removable frames, allowing honey extraction without destroying the colony (Verma, 1990). Beekeepers often use smoke from burning leaves or twigs to pacify bees before honey extraction. In India, the Kurumba and Jenu Kuruba tribes use torches made of resin-rich wood to extract honey from the forests. Instead of mechanical extraction, traditional methods involve cutting honey-laden combs using simple tools like knives, sickles, or bamboo sticks. In some cultures, like the Hadza tribe of Tanzania, honey hunters follow bird species like the Greater Honeyguide (Indicator indicator), which leads them to wild beehives (Spottiswoode et al., 2016). Many traditional honey gatherers follow ethical harvesting, taking only part of the honeycomb to ensure the colony survives. Some indigenous communities, such as the Gond and Baiga tribes in Central India, observe seasonal harvesting to allow bee populations to recover. Similarly, traditional communities of Sundarbans follow a seasonal group activity for honey collection. They collect honey in the forest for one month of the year. From 1st April to 30th April with proper license. This license is issued from the Sajnekhali Range office and the Bagna Beat office under the Basirhat Ranges. These traditional methods emphasize sustainability, community knowledge, and cultural heritage, ensuring honey production remains a vital practice for future generations. Additionally, honey collection is deeply connected to their cultural and spiritual beliefs, with many tribes offering prayers before undertaking the harvest. The Sundarbans region honey collectors, called "Moulis," perform pre-harvest rituals to seek protection from tigers and ensure a successful collection (Samanta et al., 2013).

**Figure 2: Showing the rubber musk.**
**Photo source: Sundarban forest department**

The Sundarban forest is especially harmful and dangerous for humans, and honey harvesting is one of the most challenging professions compared to other professions. This region is surrounded by danger from both land and water. The real picture here is "a crocodile in water and a tiger on land." Every year, most Moulis accidents are caused by tiger attacks during honey collecting. As a result, all things considered, it can be said that searching for honey and searching for tigers in the forest are the same. Aside from that, there are poisonous snakes, bees, wild animals, and insects in the forest, as well as grasses as sharp as knives that injure their feet and bodies while they are walking in the jungle. Without taking into consideration the risk to their own lives, the locals continue to gather resources for their daily needs. Moulis face challenges at every step in the mangrove forest. So, the forest department has some customary statutory instructions for the safe return of the honey collectors from the forest. They have been advised to wear rubber masks on the back of their heads. These rubber masks that resemble human faces are attached to the back of the head to confuse tigers into thinking that they are being watched as humans and therefore would hesitate to attack from behind (Figure.2). Moulis enters the forest with their will, courage, excitement, and strength, as well as strong faith in forest deities. They worship the forest deities to ensure their safe return from the forest. Before venturing the forest, pray at the shrines of the deities. Particularly Ma Banabibi, they pray for salvation from Banabibi's arch-rival, the demon King Dakshin Ray (Figure.3). The locals believe that Dakshin Rai attacks them in the form of a demonic tiger.

**Figure 3: Forest gods and goddess.**
**Photo source: Author**

Sundarban moulis adhere to certain rituals and believe in them. When gathering honey from the forest, they do not use rude language and avoid using words like "bleeding" (Bengali known as *raktopat*), which is considered inauspicious in the forest and no one fights or quarrels with one another and assists one other in difficult situations. There is no caste or religious discrimination there. Hindus and Muslims alike worship Ma "Banabibi". On the other hand, Moulis respects the forest and avoid spitting, urinating, and defecating on it because they believe it to be sacred (Jalais, 2010).

The women of honey collectors carry out certain rituals for their husbands' safe return while he is away. When a male member of the household visits the *"mahal"* (wild honey harvesting cycle both before and after leaving the forest), his mother and wife are required to adhere to certain customs. For instance, no laundry with soap and detergent is done in the home during that time. The family does all of its cooking before the sun comes up and does not do any cooking at all throughout the day. At that point, any beggar who approaches the house must be turned away. However, a family can feed a person suffering from mental illness. Throughout the *"mahal"* era, the wives did not wear their hair open, did not comb it or do any hairstyling, did not close the doors and did not use vermillion during the day. But after dusk, they can engage in both activities. Should not visit any crematory until their husbands return from the forest (Chakrabarty, 2007).

## Traditional Honey Harvesting Process

**Locating the beehives:** The Moulis do not use any scientific methods to gather honey. But all of their methods for collecting honey are indigenous (Mukul, 2008; Datta et al., 2012; Basit, 1995). To find a beehive, they first attempt to follow a bee. There are two types of bees identified: one is an empty bee, and the other is a full bee. The goal of the Moulis is to pursue the full bee. Moulis reaches their destination only by targeting full bees (Mustari, 2013). In addition, hive locations are determined by monitoring wind speed, the presence of bees, and the flying directions of bees. Hive can usually be found by looking at bee excrement or bee movement on tree leaves, placing of sweet water pot in the forest, or by behavioural study of Rhesus monkey (Macaca mulatta). Moulis generally avoids dense mangrove forest and try to locate areas of the forest where the trees are tall and spaced widely apart. Skilled honey collector S. Mondal (69 years old) spoke in the local Bengali dialect: *'Amra unchu ban dike dike hanti, jekene patla ban oo baro baro gachh rueche se diki takiye hanti'* (Figure.4).

**Figure 4: Searching for beehives in the mangrove forest. Photo source: Dhritiman Mukherjee**

**Honey extraction time:** Moulis generally believes that during the five to six lunar days between the new moon and full moon, when the tide is weaker, the forest is not inundated with water. Best time in the Sundarbans to search for and cut beehives. Moulis collect honey during the daytime, start working in the forest at 7 a.m., and continue until 1 p.m.; from 1 p.m. to 3 p.m. is extra time, during which time Moulis do not work in the forest because they are busy with other work. From 3 p.m. until the evening, Moulis resumed their work in the forest.

**Practical tools for extraction:** People mainly use a non-motorized wooden boat (dinghy), large sharp knife like a *"Katari"* or *"Hansua"* with them to cut the beehive, and during honey collection from the tree, Moulis use a vessel like an aluminium pot (*handi*) and in which the honey is to be stored. Chopper (*Da*) and Axe (*kurul*) are used to cut tree branches, shrubs, and leaves and to clear paths in the forest. They carry 15–20 plastic barrels and 8-10 urn-shaped aluminium pots to store honey in their dinghies.

**Moulis's role of honey extraction:** Seven to twelve skilled honey collectors meet in one place and select a team before venturing to forest. This meeting is headed by the team leader (*sajondar)*, who decides the overall plan, including the place of visit, the proper way to gather honey in the forest, traditional rules, being cautious, and directing everyone. The *sajondar* is entirely responsible for organizing a *Mahal*. He bears the total expenses for a period of one month and the entire cost of a *Mahal*. For example, he arranges the food, like rice, pulses, vegetables, and other items, and the accommodation in dinghy in the forest. Besides that, *"sajondar"* provides each member of the team with new clothes such as shirts, pants, and a fresh towel on the day of mahal. On returning from the *mahal*, the *sajondar* makes a list of the expenses of the entire journey, which is divided equally among the *moulis*. After they paid the cost of the *sajondar*. During the 30-day honey collection period, a clay pitcher (*sajon-kalsi*) that can hold up to 20 kg of honey is also placed in front of the boat. Every day, the moulis pour some amount of honey into that *kalsi* owned by the *sajondar*. After the completion of the *"mahal*," the *sajon-kalsi* is offered to the *"sajandar*." The *sajondar* also sells some of this honey, which helps him partially recoup the cost of setting up a *mahal*. Another one of them puts his hands on the ground as a sign of prayer (*mal*) to the forest deity Banabibi to seek her blessings in protecting the group from any impending danger. During the *"mal,"* he will recall the names of his parents, five pirs, and five bibis (Jalais, 2010). At this time, he searches for tiger footprints (pugmarks) on the forest floor; if he sees such footprints, he alerts the entire team, and they immediately leave the spot (Ghosh, 2014). He is a 'Tiger Charmer' (Jalais, 2010), also referred to as a "Bable," in his own region who also performs exorcisms, is knowledgeable in mantra tantra (secret religious Durk ceremonies), and has extensive knowledge and expertise in the forest. The strong belief of the Moulis is that *Bable* possesses the mystic power to use magic spells to predict where tigers will be found in the forest, control the tigers' movements, save people from tiger attack, and shut their open mouths in the forest by mantras. On the other hand, another pitcher like the *"sajon-kalsi,"* which can hold up to 5 kg of honey, is placed in front of the boat, which is known as the *"bable-kalsi."* While gathering honey in the forest, the moulis store a small amount of honey in that clay pitcher every day. Preserving the honey in the clay it is known as *"Fakirer Bhikkhe"* (a donation to the beggar).


**Figure 5: Showing the Khalshe flower**

**Moulis's experience:** According to the respondents who go to the "*mahal*" to share their own indigenous experience, the Moulis know that honey production is closely related to the blooming of flowers. Bees collect nectar from the flowers of mangrove trees such as "*Khalshe* (Aegiceras corniculatum)" (Figure.5), "*Garjan* (Rhzophora mucronate lamk)", "*Baen* (Avicennia sexangula)" (Figure.6), "*Kakra* (Bruguiera gymnorrhiza)", "*Tara* (Aegialitis rotundifol)", "Golpata (Nypa fruticans)", "Hental (Phoenix paludosa)" and others. Most of these plants bloom between March and July. The honey of the *Khalshe, Goran, garjan, Baen, Kakra,* and *Tara* flowers is better than that of other flowers. The honey dense in April, of the highest calibre, and tastes delicious. It has a sort of creamy white appearance. In May, the flowers of the "Keora" (Figure.7), and "Goran" trees are a source of nectar for bees. *This honey has a kind of reddish tint and golden colour, but it is slightly acidic, spicy, and less flavourful than April's honey.* The honey of the May is called "Dalkar Madhu," by the moulis because of its light quality. *Bees collect nectar from the flowers of the "gewa" tree that bloom in June.* The nectar from this flower is too thin, and moulis claims that this honey is unpalatable despite the fact that bees consume it in the hives. However, various types of flower honey are found in the Sundarbans, but among them, the white honey of the "*Khalshe*" flower and the golden honey of the "*Goran*" flower are always in high demand.


**Figure 6: Showing the Baen flower**

**Figure 7: Showing the Keora flower**
**Photo source: Author**

Moreover, moulis informed that beehives are most commonly found in trees such as "*Sundri," "Dhudul* (Xylocarpus granatum koen)," "*Garjan," "Baen," "Gewa," "Keora*," and so on. On the other side, hives are less likely to be found in shrubs or trees like "*Hental," "Golpata,*" and *"Bon Lebu*" (merope angulata). The hives are small during the first spring season. The hives appear to shrink at the end of the summer season after being large in the midst of spring and summer. The size of the beehive depends on when the flowers in the mangrove forests bloom. Size of the hives determines how much honey can be harvested from them. Small size hives (0.028 cubic meter) yield about 3 kg of honey; small to medium size hives (0.035 cu. m.) yield about 5–6 kg; medium to large size hives (0.042 cu. m.) yield about 10 kg; and large size hives (0.056 cu. m.) yield about 14 kg of honey (Chakrabarti, 1985; Mustari, 2013), but large size hives are not always available. The amount of honey depends on the worker bees and how they can deposit honey from the flowers. The quality of honey depends on which flower the bees are depositing it on (Roy, 2011). Among Moulis, there is disagreement regarding the height of the beehive. However, bees form hives more often on the bent branches of trees. Although the common mangrove trees of the Sundarbans are about 10 to 15 meters tall, only a few hives are built above 4-5 meters from the ground. About 98% of these hives are 1.5–2.0 meters above ground (Chakrabarti 1985). According to the field survey data obtained from the Moulis, the maximum honey yield is obtained from hives with a height of 2.5 meters.

**Procedure for searching and cutting the beehive:** After entered the forest ground, *moulis* search for beehives (Figure. 8). Searching for beehives is called '*madhu chhanta'* and people who search for beehives are called '*chhanta'*. Moulis enters the jungle wearing brand-new shorts, a towel over their heads, with a t-shirt. They each have a *Garan* stick. One individual carries an aluminium pot, while others carry sickles or small axes. Every, one team member remains in the dinghy, and his job is to cook for all Moulis, store honey in the dinghy, and guard the dinghy. Local Moulis calls this person "Bhorel." His work is rowing the boat toward the movement of the other teammates. Bhorel keeps a singhe (a horn made of buffalo skin) with him. He periodically blows the singhe so that his team members in the forest can hear the sound and can determine the position of the boat in the river. Moulis in the forest keep a minimum horizontal distance of 30 hands between each other while moving. They make sounds like "Hoon" or "Koo" to alert the others if they come across a beehive. All of the Moulis assembles as soon as they hear the sound. All around, they observed very carefully for a demonic tiger attack. The next step is taken by Moulis after locating a beehive (chak) on a tree. They construct a bullen or mashal using some raw *Hental leaves, Golpata* leaves, and some dry branches or leaves. Three to four *bullens* are needed to extract the honey from a one chak. The *bullen* emits a thick cloud of smoke that drives the bees out of their *chak*. To extract the chak, one of the Moulis climbed the tree. However, only the portion of the *chak* where the honey has been gathered is taken. Another person stands below the tree and holds an aluminium pot below the *chak* (Figure. 9). This aluminium pot is called *aari* and the person who holds the pot is called *aariwala* in local dialect. After the *aari* is filled with honey, the *aariwala* and one other person take the *aari* back to the dinghy. Therefore, the process of gathering honey will never end. Following the successful honey extraction from one *chak,* one of the Moulis makes the *"hoon"* sound once more, and the others Moulis begin looking for another chak.

**Figure 8: Hive of Apis dorsata**
**Photo source: Dasgupta et al., 2020**

**Figure 9: Honey extraction from hive**
**Photo source: Sundarban forest department**

**Filtration and preservation:** Filtration and preservation of honey are another challenge for Moulis. After returning in the dinghy in the evening, they squeeze the honey from the beehive and separate the beeswax from the honey. Additionally, they remove larvae, pupa, and dead bees from the raw honey using a fine net or *nyakra* (a piece of cloth), store the honey in plastic barrels and aluminium pot, and keep the separated beeswax in a gunny bag. Moulis do not waste the beeswax. The heat helps melt the beeswax, turning it into a transparent beeswax. This beeswax is a good source of income for the Moulis (Gani 2001). When Moulis returns from the Mahal, the females play a crucial role in preserving honey in a container and separating beeswax from honey. Additionally, they also refine the beeswax for sale in the market and assist their families.

## Challenges and risks

Honey collection in the Indian Sundarbans is a hazardous activity due to multiple environmental, socio-economic, and legal challenges. The risks associated with honey collection arise from the unique ecosystem, presence of dangerous wildlife, climate change impacts, and livelihood vulnerabilities of the local communities. Here are the key challenges and risks:

**Human-Wildlife Conflict:** Tiger attacks are a daily occurrence in the "Sundarbans Tiger Reserve." Over the past few years, tiger attacks in forested areas have significantly increased. According to National Geographic, tiger-versus-human (2009) encounters are a regular event in the Sundarban, and every year, about 40 people are attacked by tigers. Tiger attacks (82%) are more common in dense forests and narrow creeks where people are engaged in group activities like fishing (for crabs and fish) and honey collection, followed by crocodile attacks (10.8%) and shark attacks (7.2%) in the shallow water of canals and river tributaries (Chowdhury et al., 2016). Venomous snakes such as the King Cobra and Russell's Viper add to the risks.

**Harsh and Unpredictable Environment:** Mangrove forests are dense, swampy, filled with aerial roots or lateral roots, and difficult to navigate. Walking through mud and waterlogged areas increases fatigue and the risk of injury. Cyclones, tidal surges, and heavy rainfall make honey collection more difficult and hazardous. The rising sea levels and frequent cyclones (such as Amphan and Yaas) have further intensified these challenges.

**Livelihood Vulnerabilities and Economic Hardships:** The Sundarbans Forest Department has banned fishing and crab hunting for three months, from mid-March to mid-June, in order to ensure the reproduction of aquatic animals. Consequently, many fishermen have lost their jobs. They are compelled to go honey collecting because there is no other work in the villages. Honey collection is seasonal and risky income, leaving collectors with no stable income for the rest of the year. Honey collectors often work under middlemen who offer low prices for their harvest, reducing their earnings. Many moulis also take loans at high interest rates, trapping them in debt cycles. Also, according to the rules of the Sundarbans Tiger Reserve, the collected honey is forced to be sold to the forest department at a low price, at a rate of Rs. 225-250 per kilogram (2023-2024 financial year). The same honey could be sold in the local Mohajan (storekeepers) at a rate of Rs. 300-350 per kilogram. Mohajan sell that honey in open markets an additional Rs. 600-800 per kilogram. The forest division purchases honey from Moulis each year for a predetermined low cost. As a result, there was a strong disagreement over the sale and purchase of honey between Moulis and the staff members of the forest department. After taking a lesson from the first time, they get involved in illegal activities in the hope of making money a second time. Some of the harvested honey is hidden, the remainder is mixed with adulterants, and it is sold to the forest department. The Forest Department's defiance of the traditional knowledge held by forest workers reflects its lack of interest in acknowledging "alternative knowledge claims from actors," who are disregarded in the development of dominant "environmental narratives" (Forsyth, 2005). Several fishermen's unions have asked for a two-month extension, but it has not been approved by the Forest Department. There is no justification provided by the department for taking the entire amount of honey collected.

**Climate Change Impacts:** Rising temperatures, habitat destruction, and saline water intrusion due to sea-level rise are reducing the population of Apis dorsata (Giant Honeybee), which is the main source of wild honey in the Sundarbans. The flowering of

Khalsi and goran, an important nectar source for bees, is affected by erratic rainfall and temperature changes, leading to lower honey yields.

**Legal and Regulatory Challenges:** Honey collectors require a permit from the Forest Department, which adds bureaucratic hurdles. Many poor collectors are unable to afford the fees or face harassment from officials. Some areas of the Sundarbans are protected zones (e.g., Sundarbans National Park), restricting access to traditional honey collection areas. This forces collectors to venture into more dangerous zones. Most people's accidents or deaths remain unreported. As a result, they are deprived of compensation. Many others, to ensure compensation, take out local 'Janata insurance' from the district block level council and the fisheries department (Sen and Patnaik, 2017). Janata provides life insurance policies in exchange for a regular monetary deposit. It costs 100 rupees per year (Ghosh, 2014). However, in reality, the forest department has paid very little compensation. The payment from the district-level council requires high-level political connections to procure the money. Most of the fishermen or honey collectors are unaware of the Fisheries Department's insurance and lack a biometric card identifying their profession. After an accident, the village council office does not certify them as fishermen. However, the entire claiming process is very complicated and frequently fraudulent, and in the majority of instances, the victim's family is defrauded of their claim.

**Piracy and Theft:** Lately, tiger attacks aren't the only threat in the Sundarbans — pirate activities in the rivers and canals have also gone up. This has caused a lot of fear among honey collectors and fishermen. Many of them now feel unsafe and don't want to risk their lives to collect honey or catch fish and crabs in the forest. People say that even after asking the authorities for more security, pirate attacks haven't stopped (Hossain, 2024). The pirates beat up fishermen badly and steal everything — their money, mobile phones, fishing nets, and even boats. One such incident happened on April 13, 2022, when pirates attacked 11 Indian honey collectors in the Pirkhali forest in the Sajnekhali sector (Puttunda, 2022). They took away around four quintals of honey, some money, mobile phones, and important documents. Later, on January 25, 2024, pirates captured four fishing boats and robbed 16 fishermen. Again, on August 25, they stole a boat and 150 kg of crabs (Bengal Info, 2024). Every year during honey collection season, attacks by Bangladeshi pirates increase. They often target honey collectors while collecting honey from the forest. According to the forest department, 18 Bangladeshi pirates have been caught in the Sundarbans in the last one year (Saha, 2024).

## Conclusion

This study describes Traditional Honey Extraction Knowledge (THEK) related to the challenges, coping strategies, and uncertainties of moulis and identifies linkages between the legal price, marketing and compensation system; and political strategies between the forest guards, and local Mohajan. Through case studies and document analysis, this study catalogs and interprets traditional forest knowledge (TFK) related to the livelihood strategies of moulis, especially with regard to forest conservation rules and regulations such as licenses, using the principles and criteria for Sustainable Forest Resource Management (SFRM). According to information found in historical texts and obtained through a contemporary field survey, traditional knowledge is still being transmitted from one generation to the next, even though it is evolving. These findings shed important light on the interaction between people and forests as well as the cultural history of rural communities. The cataloging of THEK offers a basis for applying traditional practices to present-day challenges, including effective man-animal conflicts and local antagonists.

The ethnographic field study has allowed us to learn about indigenous people's customs, rules, and rituals regarding information gathering, timing, practical tools, moulis roles, particularly sajondar and bable, and hive searching and cutting procedures related to people's experiences. Examples include the main plant species responsible for best honey production, honey production seasons, the best size and height of the hives from the ground level that yield the most honey, and more. Economically significant, the findings should enable better forest management and the development of a honey collection schedule.

This study also clarifies THEK, which is divided into three categories and associated with a number of social factors, such as: **I.** before venturing into the forest. It involves some expenses, so moulis take a loan from Mohajan, keep some money with their family to cover family expenses in their absence, and carry a pillow, katha, mosquito net, rice, pulse, vegetables, oil, salt, spices, medicines, and drinking water for their safety and survival in the mangrove forest. Select team and group members, collect permits from the forest department, and offer prayers at the shrines to their deity, dotted among the palm trees and thatched houses of the quiet villages. **II.** After venturing into the forest, they follow some statutory instructions of the forest department for a safe return, like wearing a rubber mask on the back of their heads. To fend off the tiger, they use locally made clubs made from the trimmed stems of "Garjan" and "Goran" trees, and they begin by looking for and cutting beehives. **III.** Returning from the forest, they sold honey at a low price to the forest department and faced political harassment. Finally, honey marketing is another challenging job for them. As mouli take loans from "mohajans," after returning them, they have to sell the honey to them at a fixed rate, but mohajans cheat the customer and sell at a higher price.

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