

Towards Green and Socially-Sound Recovery in Rural and Farm Sector

CASE STUDY OF WILD HONEY HARVESTING IN MAHARASHTRA



ABOUT US

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INTRODUCTION

In India, honey is produced through beekeeping and extraction from natural or wild hives in the forest. Honey production in the country has increased from 76,150 MT in 2013-14 to 1,20,000 MT in 2019-20. There are around 10,000 beekeepers' collectives with 16 lakh bee colonies registered with the National Bee Board (National Bee Board, 2022) (PIB, 2021). Major varieties of wild honey include Multi-flora Himalayan, Acacia, Wild Flora, and Multi/Mono floral honey. The key areas for natural honey production in India are the North East Region, the Himalayan states, the Sahyadri mountain range, and the deciduous forest regions of the Deccan plateau. The value chain of wild honey is largely untraceable as the separate data regarding wild honey collection is not being collected and production data is an aggregate of wild honey as well as honey from beekeeping. Wild honey is almost always gathered by tribal communities and sold through informal channels to tourist consumers, and sometimes, to aggregators and to the processing industry as well. The value chain of wild honey includes beekeepers, aggregators/traders, honey-processing industries, and consumers. The tribal communities involved in honey harvesting are unaware of sustainable harvesting methods, hygienic aspects, and techniques of clean honey collection. They are unable to market this natural, precious honey at the right price (NAIP, 2014). Therefore, these tribal communities sell wild honey at low prices directly to tourists who are visiting their locality. In addition, the wild honey bee habitat has also been impacted by the use of pesticides and weedicides, deforestation, and habitat loss (Chakrabarti et al., 2015). To promote sustainable harvesting of honey, it is required to strike a balance between wild honey bee conservation and the livelihood protection of honey gatherers. Therefore, this study was conducted to understand the status and the value chain of the wild honey production system. The aim was also to assess the possibilities of green and socially-sound recovery strategies. A market study was conducted to understand various honey brands and products, their selling points and prices. This study covered 29 brands, both by visiting local stores as well as using online information.

STUDY AREA

This article presents findings from studies in two clusters in Maharashtra; the first cluster comprises three blocks of the Pune district and the second cluster is the Akole Block of the Ahmednagar district. Both clusters fall within the northern Western Ghats region in Maharashtra, a biodiversity hotspot and a landscape with UNESCO World Natural Heritage status. The study was done in two phases. The first phase was focused on the clusters in the Pune and Ahmednagar districts. The second phase involved a wider sample of wild honey gatherers in three major



forested landscapes, the Sahyadris (Western Ghats), Melghat and deciduous forests (*Jhadipatti*), and aggregators and local processing units.

APPROACH

To understand the production system of wild honey, a quick assessment was conducted of the Sahyadri and Vindhya mountain pockets of Maharashtra, and of the deciduous forests of the Vidarbha region of Maharashtra. The data was collected from honey gatherers, village-level aggregators, processing industry owners, and roadside honey sellers. Focussed group discussions (FGDs), in-depth interviews and mapping exercises were conducted with the *Mahadev Koli* tribal group in Fofosandi village in the Akole block of Ahmednagar district and with the *Katkari* tribes of Bhor, Velhe and Mulshi blocks of the Pune district. Three quadrat studies were conducted to understand the diversity of flora of wild honey and the production capacity of community forests. Secondary information was collected from various published documents of the Government of India.

National and State-level Findings

1. Types of Wild Honey Bees



Apis cerana: It is also known as the Asiatic honey bee and it is found throughout Asia, including India. It is the most common species of the honey bee in the region. These bees build their nests in natural cavities, such as tree hollows or rock crevices.



Apis dorsata: It is also known as the giant honey bee or rock bee. This species is found in Southeast Asia, including India. They are known for their large size and their ability to build nests on high cliffs, trees and buildings. They are also known for their aggressive behaviour.



Apis florea: It is also known as the dwarf honey bee or little honey bee. This species is found throughout Southeast Asia including India. They are small and build their nests in trees, bushes and other vegetation. They are known for their high reproductive rates and their ability to forage on a wide range of plants.



Melipona irridipennis: These bees do not have a sting. They are found in tropical regions throughout the world, including India. They are much smaller

than honey bees and are known for their ability to produce a variety of flavoured honey.

Other honey bee species: There are several other species of honey bees found throughout the world, including the western honey bee (*Apis mellifera*), which is native to Europe and has been introduced to many other parts of the world including India. There are also several other native species of honey bees found in India, including *Apis laboriosa* and *Apis dorsata breviligula*.

2. Wild Honey and Beekeeping

In India, wild honey is mainly harvested from three different species of native honey bees - Rock Bees (*Apis dorsata*), Asian honey bees (*Apis cerana*) and Dwarf honey bees (*Apis florea*). A very small quantity is harvested from the fourth type, which is stingless bees or Melipona bees. Apiculture or beekeeping is mainly dependent upon Italian or European bees (*Apis mellifera*). Asian honey bees (*Apis cerana*) too can be domesticated and in Maharashtra, especially in the forest region of the Western Ghats, a small number of colonies of *Apis cerana* have been domesticated. Recently, there have been some efforts to promote stingless/melipona beekeeping by the Central Bee Research Training Institute (CBRTI), Pune.

According to a report by the Indian Council of Agricultural Research, the production of honey in

India increased from 64,000 MT in 2011-12 to 1,25,000 MT in 2020-21, with the majority of the production coming from beekeeping honey. The report also states that there is a growing demand for natural or wild honey in India due to its unique flavour and medicinal properties but the proportion of the wild honey collection is comparatively low (ICAR, 2019).

The data presented on APEDA's website regarding honey production and export from Indian states lacks information about its source production system. Although the title suggests that it pertains to natural honey, the data includes aggregated information on both wild and beekeeping honey.

3. Production at the National and State Levels

In the year 2020-21, a total of 1,25,000 MT of honey was produced in India. The production figures indicate total production from beekeeping and wild honey gathering. The disaggregated data for wild honey production in India is not available. Uttar Pradesh, West Bengal, Punjab, Bihar and Rajasthan are the top five highest honey-producing states. The production from beekeeping has a larger share in these states. Honey production in Maharashtra is much lower, as compared to these states. There are very few honey bee keeping colonies in Maharashtra and there is no system to measure the quantity of production from wild honey bees.

State-wise noney production (thousand WT) (2018-2021)



India has low per capita honey consumption of 0.02 kg annually compared to 1.70 kg in Austria and many European nations and 0.53 kg in the USA. Therefore, India's honey production is a major contributor to the global honey market, with over half of its production being exported to 83 nations. In 2021-2022, India

exported 74,413 MT of honey for Rs. 1,221.17 crores, making it one of the world's top honey exporters. This is around 3.85 per cent of the global honey export. The export of honey has increased by 188.6 per cent between the years 2012-13 and 2021-22 (APEDA, 2022).

State-wise honey production (thousand MT) (2016-2021)



Findings from the study clusters

Status of wild honey in major forested landscapes of Maharashtra

1 This rapid study was undertaken in the absence of any accessible data on wild honey harvesting across the major landscapes of the Sahyadris, (Western Ghats), Melghat and Jhadipatti (deciduous forests) in Maharashtra. The districts and blocks in which this rapid assessment has been conducted and the names of the data collectors are listed in the Appendix. In this study, 81 direct honey gatherers from 57 villages, 17 honey aggregators (who collect honey from primary honey gatherers), 4 roadside honey sellers, and 6 processing unit personnel were interviewed to gather information on the wild honey value chain of various districts of Maharashtra.



Blocks from Maharashtra covered under the study

- 2. The participants of the study were mainly honey gatherers engaged in agricultural activities as their primary occupation. The wild honey collection is their secondary source of income. However, a noteworthy 25 per cent of the surveyed population was found to depend solely on collection of non-timber forest products (NTFPs), particularly honey, as a primary source of livelihood. The honey gatherers cultivate a diverse range of crops including rice, wheat, chilli, coriander, horse gram, red gram, sorghum, soybean, black gram, green gram, pearl millet, onion, tomato, marigold flowers, finger millet, proso millet, cotton and an assortment of bean varieties.
- 3. The total quantity of wild honey collected in 2020-21 and 2021-22 was highest in the districts of Wardha, Nashik and Amaravati. The quantity of honey collected in the Pune, Palghar and Gadchiroli districts is also substantial. The annual collection of honey in the Nashik district has increased by 121 per cent while in the remaining districts, it has increased only marginally. In analysing block-wise collection, the largest amount of wild honey was collected in the blocks of Surgana, Ashti, Karanja, Chandur Bazar and Arvi.



District-wise honey collection in the years 2020-21 and 2021-22

4. In a month-wise record of wild honey collection across the span of a year, it was observed that wild honey collection is the highest in two seasons i.e., summer and winter. In the summer season, the production is at its peak during April when flowering is maximum. The honey collection is also substantial in May. During the winter season, the honey collection is highest in October and November.



Month-wise honey collected by indirect honey collectors in the years 2020 and 2021

5. Data related to the species-wise honey collection was also collected. Wild honey collection is highest during the summer for all types of species and second highest during the winter season. The collection during the monsoon months is minimum. Throughout 2021-22, 20,118 kg wild honey of *Apis dorsata* and 13,418 kg wild honey produced by the *Apis cerana* was collected.



Honey collected by honey bee type and season in the year 2021-22

Types of Honey	Summer	Winter	Monsoon	Total
Apis cerana	10390	2262	766	13418
Apis dorsata	13130	5813	1175	20118
Apis florea	2549	241.5	55.5	2846
Stingless	610	5	107	722
Other Honey	963	0	0	963
Total Honey	27642	8321.5	2103.5	38067

Species wise honey collection in study clusters in 2021

6. In this study, the research team interviewed the owners of six small-scale processing units. The major source of energy for these processing units is gird electricity. Two of these owners have acquired their machinery from Punjab, two from Paliwal in Wardha, one has a self-designed machine and one obtained the machinery from Aurangabad. The decision to procure small-scale machinery was based on the availability of honey in their respective regions. However, due to a shortage of honey, most of the owners were forced to shut down their processing units for an extended period of 6 months in 2020 during the COVID-19 lockdowns.

Quantity of honey processed by various processing units (kg)



BHOR, PUNE DATTAPUR, WARDHA SOCIETY, DHARNI, AMBAD
7. As per the experiences of wild honey gatherers, 93 per cent of honey gatherers reported that honey availability in their region is decreasing, and 6 per cent reported that production is the same. Similarly, out of the total wild honey aggregators surveyed from the villages, 88 per cent are of the opinion that wild honey collection has decreased by 40-50 per cent in the last ten years; 6 per cent said that the collection is the



ten years.

same while the remaining 6 per cent are of the opinion that wild honey production has increased in the last



The majority of honey gatherers exhibit awareness regarding the declining numbers of honey and honey bees in the region. The decline in quantity of honey collection is attributed to prohibition imposed on collection of wild honey in tiger reserves. The decline in bee population is attributed to predation of bees by *Anjani* flies/wasps, overharvesting of honey leading to a decrease in bee population, fewer trees, flowers, water sources, migration of bees from one place to another, increased competition among honey gatherers, the overuse of pesticides, non-seasonal rainfall, and the use of fire to harvest honey.

8. The price of honey collected by honey gatherers in Maharashtra ranges from Rs. 80 to Rs. 1,000 per kilogram, with an average price of around Rs. 500 per kilogram. The price is dependent on various factors, such as the quality, type, season, total production of honey and the channel of sale. On the other hand, larger honey brands and companies sell honey at a higher price range, ranging from Rs. 360 to Rs. 8,000 per kilogram.



District-wise prices of wild honey received by primary collectors in the year 2020-21

Case studies of Katkari and Mahadev Koli honey gatherers

CASE STUDY 1: KATKARI HONEY GATHERERS IN PUNE DISTRICT

• *Katkaris* are one of three Particularly Vulnerable Tribal (PVT) communities in Maharashtra. This is a special status with special budgetary provisions.



Katkari Wasti (hamlet) at Shekhadi village, Bhor, Pune

- Historically, in the northern Western Ghats region, this tribe was forced into making kattha from the Acacia catechu (Kattha) plant, which explains why they are called 'Katkari' (Kat + Kari). Most of the Katkari population is in the Raigad, Thane, Ratnagiri, Pune and Nashik districts of Maharashtra. About 5 per cent of the total Katkari population resides in the Pune district, mostly in the hilly villages of Velhe, Bhor and Ambegaon tehsils.
- The *Katkari* communities in the Bhor and the Velhe blocks usually stay in a group or in a hamlet near the village. There are six hamlets totalling 90 families in the Velhe block, 11 communities totalling 305 families in the Bhor block and 317 families in the Mulshi block of Pune district. Out of these, eight hamlets are larger in size with on average 25 or more families per group or hamlet.
- Their livelihoods include fishing, wild honey harvesting and agricultural labour. *Katkaris* in

these regions are landless and earn their livelihood through labour work in agriculture and usually get day wages of Rs. 300 for men and Rs. 200 for women. They have traditional knowledge about honey bee habitats and habits and they visit forest areas at night to gather honey, mainly from the largest and most dangerous of all beehives—those of rock bees.

Findings of the study with honey gatherer groups belonging to the *Katkari* community at Malegaon, Bhor, Pune

- The Katkari community usually starts venturing into the forest in November, December, January and February. The harvesting season usually ends on Shimga/Holi (Indian Festival) in March. They have the opportunity for some additional income when they are called to remove honeycombs formed by rock bees on buildings of planned cities near hillsides, like Lavasa City. This is a good source of honey for the Katkaris. The honey collected from these sites is three times more than the honey collected from the forests. There are three wild honey gatherer groups in the Bhor, Velhe and Mulshi blocks of Pune district.
- Honey from all types of honey bees i.e., Apis dorsata, Apis florea and Apis cerana is collected and sold to a processing unit in Kikavi (a village in Bhor) or Panchagani (a town in Satara district). The honey collected from stingless bees is consumed locally and used for eye treatment. The average yearly collection and price received for each type of honey is as follows:

Type of	Quantity Pr	ice received
Honey bee	(Kg)	(Rs)
Apis dorsata	14500	300
Apis cerana	100	500
Apis florea	400	400

- Honey production from all three species of honey bees i.e., *Apis dorsata*, *Apis florea* and *Apis cerana* has been decreasing in this region. From each site of *Apis dorsata*, honey gatherers used to collect 25-30 kg of honey but now the yield is only 17-18 kg.
- The reduction in forested areas and the occurrence of forest fires are hurting the honey bee population. As a result, honey bees are migrating from trees and agricultural fields to more rugged, mountainous terrains within the region. Honey gatherers report that the rock bee population and harvest are on the decline. Forest fires are mentioned as a major cause for this reduction.
- The recent increase in the population of the *Anjani poli* or hornet wasp poses a threat to honey gatherer groups due to its infamous poisonous stings.
- A Forest Rights Committee or Van Hakk Samiti has been established in Donje village in Mulshi and a member from the Dhangar community is president. However, their implementation of policies was opaque and Katkari members were unaware of their rights, especially of the Community Forest Rights of collection of Minor Forest Produce (MFP) in their traditional habitat.
- The Katkaris have to face suspicion and at times physical violence by villagers who mistake them for thieves. Honey collection is a risky occupation with the possibility of falls from trees and bee stings especially as there is no usage of safety gear. They lack the safety net of life insurance, and often face the risk of falling from trees or rocks or getting stung by honey bees. This not only impacts the community members themselves but also their families who lose their primary earner during such episodes.

CASE STUDY 2: WILD HONEY GATHERERS OF MAHADEV KOLI COMMUNITY IN VILLAGE FOFSANDI

• Fofsandi village is situated in the lap of the Sahyadri Mountains ranges in the Akole block of the Ahmednagar district of Maharashtra. The nearest market town to Fofsandi is Kotul at a distance of 25 km. The population of the village is around 1,200. Most households are from the *Mahadev Koli* Scheduled tribal community and a few are from a Scheduled Caste community.



- The major sources of livelihood in this village are farming and collection of non-timber forest produce such as wild berries, honey and *hirda (Terminalia chebula).* The Mandavi river flows along the village. Kharif crops such as wheat, chickpeas, barley, and onion are cultivated in this area. Water availability is scarce in the rabi season and the villagers migrate to Kotul, Akole and Sangamner in search of livelihoods.
- The village has 1,200 ha of forest land and was awarded community forest rights over 800 ha of land. The villagers are demanding forest rights over the remaining forest land as well.
- The main sites of honey bee colonies are Aagya Kada to the east of the village, Kalubai Devrai (sacred grove) and Kombad Killa to the north of the village, Mankhanda to the south of the village and Niraoli and Karkai Devrai to the west of the village.
- This region has three types of honey bees, namely Apis dorsata, Apis cerana and Apis florea. This region is bestowed with shrubs of Strobilanthes callosa. This shrub is locally called Karavi and it has a peculiar life cycle. This endemic species flowers once every seven years. The mass blooming of Karavi is locally called Inda. The Inda year is also the peak season for honey production and usually around 1,200 kg of honey is collected during this year.

 The Apis dorsata is locally called Aagya and these bees collect nectar from Bombax ceiba (Kate sawar), Terminalia chebula (hirda), Mangifera



indica (mango) and *Syzygium cumini* (jamun). Approximately 3-4 kg of honey is collected from one colony of *Apis dorsata*. There is a steep mountain and waterfall on the east side of Fofsandi village called *Aagya Kada*. This place has been named after *Apis dorsata* bees as it has been home to several *Apis dorsata* colonies. The honey from *Apis dorsata* is sold at Rs. 400 per kg.



Aagya Kada in Fofsandi village

 The Apis cerana is locally called Sateri because they usually build nests with seven combs. These honey bees collect nectar and pollen mainly from Terminalia elliptica (Aain), Terminalia arjuna (Sadada), Mangifera indica (Mango), Terminalia chebula (hirda), Syzygium cumini (Jamun), Heterophragma quadriloculare (Waras), and Ficus racemosa (umbar). They build their honeycombs in the cavities of rocks and trees. The colonies of these honey bees were found near the Kalubai temple, the Aagya Kada, and farms near Fofsandi village and Mankhanda. Out of the three types of honey in this region, the highest quantity of honey produced is from Apis cerana and it is sold for Rs. 550 per kg.

11



Karvi Flower (Strobilanthes callosa)

- The Apis florea is locally called Mohol and the main source plants are Karvand, Kusar, Sabar, Dhayati, Malawa and Mango. One colony of Apis florea typically produces 0.5 kg of extremely sweet honey. The usual sites for this honey bee are Mankhanda and the forest near Aagya Kada. This honey is sold for Rs. 600 per kg.
- There are around 17 honey gatherers in Fofsandi village who collect honey from forests around villages and from trees near farms. Each of the honey gatherers on average collects around 15-20 kg of honey in the peak season. There are two seasons of honey production. The first season is in October/November when flowering happens both in the forests as well as in farms of wheat, barley and warai. The second season begins in the month of March when the flowering of rabi crops in farms and of various trees in forests starts. Generally, honey from this village is sold to a local aggregator named Shri Budha Wale for Rs. 500

per kg. He sells this honey to tourists and customers (mainly government officials at the block level) for Rs. 550 per kg.

Type of honey	Price (Rs/kg)
Apis dorsata	400
Apis cerana	550
Apis florea	600

 The research team conducted two honey extraction expeditions with local honey gatherers. The process of honey extraction is very primitive and all the honey gatherers were unaware of sustainable harvesting practices. The honey gatherers usually destroy the whole colony of honey bees and squeeze out honey by pressing the honeycomb by hand. The honey is collected in domestic metal pots and then filtered using a cotton cloth. The filtered honey is poured into empty mineral water bottles and sold as it is to the customers.



Quadrat study to study floral sources of wild honey

 A quadrat study was conducted at three sites near the village to quantify flowering species and the total honey production potential of the region. Two quadrats of 50 x 50 m and one of 25 x 25 m were set up to determine floral plant population density. The various floral species and the frequencies of their occurence were noted. They have been represented in the appendix.



Quadrat study to determine floral plants population

unareaam spinosa)



Karambu (*Olea dioica*)



Gadhurli/Janali San (Crotalaria spectabilis Roth)



tulas (Ocimum sonctum)



Karvi (Strobilanthes callosa)



Toran (Ziziphus rugosa)



Aasawala (Pavetta crassicaulis)



Dhaman (Grewia tiliifolia)



Hirda (Terminalia chebula)



Ranjai (Clematis ligusticifolia)



Dhavati (Woodfordia fru



Jambhul (Syzygium cumini)

In all the quadrats, the research team observed that Hirda is a major flowering plant for honey bees, but could not find young saplings, which may indicate that natural regeneration is not occurring.

Some of the flowering species recorded during the study

It was also found that the quadrat study method is useful in identifying various species of flora and their population but the method is not suitable to determine the honey production capacity of the forest as the research team could find only one honeycomb in three quadrat studies.

Study of honey brands available in the market

- 1. This study examined 29 brands of raw honey, processed honey, honey by-products and honey-based products in the Indian market. The study primarily utilized information from the brands' websites, private label products available in stores in Pune and other sources such as Economic Times and Business Standard to determine their market share.
- 2. As in the case of other products, the market offers a range of honey and honey products catering to wider consumer preferences - from cost sensitivity to those who prefer packaging and hygiene standards to those valuing the originality and purity of honey.
- 3. A large range of honey prices exists- from the lowest of Rs. 350 per kg to Rs. 7,000 per kg. While Patanjali sold the cheapest honey in the market, brands like Honey and Spices sold

Ceylon cinnamon sticks along with honey weighing 50 grams for Rs. 350 which amounts to Rs. 7,000 per kg. Honey and Spices also offers Honey Roasted Cashews, Walnuts, and Almonds in a 100-gm package priced between Rs. 300 to 320. Additionally, specific floral honey types, such as Litchi, Jamun, Tulasi, Acacia, Ajwain, and Coriander are sold at a price range of Rs. 2,500 to 3,000 per kg.

- 4. The study identified three main types of honey in the Indian market. These include specific pollen-based honey and honey with almond and other dry fruits.
- 5. The study found that various nectar sources, such as litchi, jamun, hirda, moringa, mango, eucalyptus, acacia, sunflowers and mustard are utilized by honey brands in India.

Various Types of Branding of Honey and Honey Products

Acacia Honey	Ghats Beeswax pellets	Lemon Honey
Ajwain Honey	Ginger Honey	Litchi Flowers
Amla in Honey	Himalayan Forest Raw Honey	Litchi Tree Honey
Ashtamrut Infused Honey	Himalayan Wild-Multi floral	Little Bee Honey
Ashwagandha Honey	Honey	Mangroves Honey
Basswood Honey	Honey and Cranberries	Moringa Honey
Ber Tree Honey	Honey and Nuts	Mustard Honey
Blackberry Honey	Honey Comb	White Cream Honey
Blueberry Honey	Honey Crunch Muesli	Neem Honey (Unheated)
Cacao Honey	Honey Dew NMR Tested	Orange Blossom Honey
Central Indian Wild Honey	Honey Roasted Almonds	Organic Certified Honey
Cerana Honey	Honey Roasted Cashews	Peppermint Honey
Ceylon Cinnamon Sticks Honey	Honey Roasted Walnuts	_ Polyflora Honey
Cinnamon Infused Honey	Honey Rose Gulkand	Rosa Honey: Imbued Raw Honey
Cliff Honey	Honey with Fig	Saffron Imbued Raw Honey
Coffee Blossom Honey	Indica Honey From Valley of	Santhal Tribal WIId Honey- Single
Coriander Honey		_ Origin
Curcumin Imbued Raw Honey		_ Sesame Honey / Til Honey
Curry Patta Honey	- Jhandi Honey	Sidr Honey
Dates in Honey	- Kangra Wild Forest 100% Raw	Sulai Honey
Eucalyptus Honey	Karani Honey	Tropical Blossom Honey
Fennel Honey	Kashmir Honey	- Tulasi Honey
Forest Flowers Honey	Kashmiri White Cold Heney	Turmeric Honey
		Vansaar Madhu (Honey)

6. Packaging is an essential aspect of branding honey products as raw honey can be sold at higher prices. The study revealed that most brands highlight purity and non-adulteration in their branding and packaging. Honey brands differentiate themselves by sourcing their honey-collection sites from rich biodiversity areas. For instance, *Etopia Honey* uses photos of children consuming honey in their branding. *Bee Himalaya* educates consumers on honey bees, honey hives and the role of bees in pollinating plants and maintaining biodiversity. The Mango Tree brand sources honey directly from farmers.

RECOMMENDATIONS

- There is a need to incentivise sustainable wild honey harvesting by integrating the value of ecosystem services provided by honey bees as pollinators of a wide range of forest flora.
- 2. Special focussed programmes towards supporting Scheduled Tribal Communities including Particularly Vulnerable Tribal Groups (PVTGs) are needed to better utilize their traditional and experiential knowledge about wild honey bees and habitats by providing safety equipment, insurance cover and training in sustainable harvest techniques.
- 3. Honey has the high potential to bring in significant economic benefits to gatherer groups by way of aggregation, value addition and better marketing.
- 4. Collectivization of these communities is challenging given their socio-economic situation, discrimination against them, and their shyness to assert their rights. This makes it essential to have a long-term developmental, capacity building and handholding programme, especially in the case of the *Katkari* community.
- 5. Native bee species of *Apis cerana* need to be promoted for beekeeping on a larger scale. especially in forest regions, where they are better adapted and resilient compared to the exotic species of *Apis mellifera*. Smaller-sized bee boxes and lightweight honey-extractor machines are needed to promote native bee

species. Stingless bees of the *Melipona* bee species offer similar opportunities for beekeeping. There is a special demand for the honey made by stingless bees as it is traditionally considered to have medicinal properties; it is used in various preparations. Its honey is being sold at Rs. 20,000/kg (Honeyhunters, 2023).

- 6. Habitat restoration is a long-term requirement for the mutual survival of forests and wild honey bee species and other pollinators. In the case of *Apis cerana* and *Apis dorsata*, large tree species are critical for nest building inside trunk cavities of appropriate size and on high branches respectively. Developing water sources in higher, rocky, forest habitats is another emerging need from this study and community consultation.
- 7. Testing and certification of wild honey need a review of the production system and quality parameters. Since purity and trustworthiness of the brand are critical from the consumers' point of view, special efforts are needed to create a network of small-scale gatherers and provide value addition, branding and marketing opportunities so that larger portions of profits are accrued by these gatherers who come from poor and highly-disadvantaged community backgrounds.

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APPENDIX 1

Field Research Team for rapid assessment of the understanding of the status of wild honey in major forested landscapes of Maharashtra

Name	District	Taluka
Puja Shelkande	Pune	Ambegaon
Shripad Konde	Pune	Bhor, Mulshi, Velhe
Vijaya Padekar& Ravi	Ahmednagar	Akole
Thombade	Pune	Junnar
	Nashik	Satana, Surgana
	Thane	Murbad,
	Palghar	Jawhar, Mokhada
Shailesh Murkute	Gadchiroli,	Dhanora, Korchi
	Chandrapur	Pombhurna, Ballarpur
Vijay Ghodaki	Wardha	Chikhaldar, Dharni
	Amravati	Ashti, Arvi, Higanghat, Karanja

APPENDIX 2

Sr No	Local Name of Plant	Botanical Names
1.	Aakada	Cynarospermum asperrimum
2.	Aambgul	Elaeagnus conferta
3.	Aarsul	Canthium dicoccum
4.	Aaswala	Pavetta crassicaulis
5.	Aliv	Meyna laxiflora
6.	Amba	Mangifera indica
7.	Ashind	Not Available
8.	Awala	Phyllanthus emblica
9.	Bhalvand	Not Available
10.	Bhoma	Glochidion ellipticum
11.	Bhusar	Not Available
12.	Burandi	Nanothamnus sericeus
13.	Chichurdi	Solanum carolinense
14.	Chikana	Not Available
15.	Dasai	Colebrookea oppositifolia
16.	Dawana	Artemisia pallens
17.	Devhirad	Terminalia chebula
18.	Dhaman	Grewia tiliifolia
19.	Dhasai	Colebrookea oppositifolia
20.	Fangulani	Pogostemon benghalensis
21.	Gadhurli	Crotalaria spectabilis Roth
22.	Ganjwa	Not Available
23.	Gel	Catunaregam spinosa
24.	Handarfod	Leea rubra
25.	Hirad	Terminalia chebula
26.	Idlimbu	Citrus aurantium Linn
27.	Jambhul	Syzygium cumini
28.	Karambu	Olea dioica

Flowering species identified in the Fofsandi Forest region

Sr No	Local Name of Plant	Botanical Names
29.	Karap	Memecylon umbellatum
30.	Karavand	Carissa spinarum
31.	Karavi	Strobilanthes callosa
32.	Karvand	Carissa spinarum
33.	Katesawar	Bombax ceiba
34.	Kohambal	Not Available
35.	Kusar	Jasminum malbaricum
36.	Lokhandi	Cornus capitata
37.	Malawa	Not available
38.	Narangi	Not Available
39.	Niwadung	Opuntia elatior
40.	Pandhari	Murraya paniculata L.
41.	<u>Pimpar</u>	Ficus amplissima
42.	quadriloculare	Ramethi Gnidia glauca
43.	Sabar	Opuntia cochenillifera
44.	Sadada	Terminalia tomentosa
45.	Sambarat	Not Available
46.	Sawa	Not Available
47.	<u>Shendari</u>	Mallotus philippensis
48.	Sonaki	Senecio bombayensis
49.	Tambat	Not Available
50.	<u>Toran</u>	Ziziphus rugosa
51.	<u>Umbar</u>	Ficus racemosa
52.	Varas	Heterophragma
		quadriloculare
53.	Velu	Bambusa bambos
54.	Waghati	Capparis zeylanica

Appendix 3

Floral species and their frequency in a quadrate of 25 x 25m at Karadai region in Fofasandi Forest

Sr No.	Local Plant Name	Scientific Names	Numbers
1	Burandi	Nanothamnus sericeus	650
2	Dawana	Artemisia pallens	240
3	Gadhurli	Crotalaria spectabilis Roth	1100
4	Sabar	Opuntia cochenillifera	14
5	Lokhandi	Cornus capitata	9
6	Karvi	Strobilanthes callosa	430
7	Fangulani	Pogostemon benghalensis	290
9	Aaswala	Pavetta crassicaulis	15
10	Karap	Memecylon umbellatum	2
11	Karambu	Olea dioica	1
12	Jambhul	Syzygium cumini	2
13	Aakada	Cynarospermum asperrimum	25
14	Chikana	Not Available	1
15	Aarsul	Canthium dicoccum	1
16	Dasai	Colebrookea oppositifolia	1
17	Narangi	Not Available	3
18	Sonaki	Senecio bombayensis	2
19	Chichurdi	Solanum carolinense	3
20	Ganjwa	Not Available	2
21	Niwadung	Opuntia elatior	13

Appendix 4

Floral species and their frequency in a quadrate of 25 x 25m at *Daryabai Mata Devrai* (Sacred Forest) in Fofasandi Forest

Sr. No.	Local Names	Botanical Name	Number
1	Ashind	Not Available	5
2	Amba	Mangifera indica	7
3	Aliv	Meyna laxiflora	4
4	Awaa	Phyllanthus emblica	3
5	Asola	Pavetta crassicaulis	1
6	Karambu	Olea dioica	48
7	Karap	Memecylon umbellatum	2
8	Karvand	Carissa spinarum	1
9	Katesawar	Bombax ceiba	4
10	Kusar	Jasminum malbaricum	1
11	Jambhul	Syzygium cumini	4
12	Tambat	Not Available	1

Appendix 5

Floral species and their frequency in a quadrate of 25 x 25m at *Kalamjai Devrai* (Sacred Forest) in Fofasandi Forest¹

Sr. No.	Local Names	Botanical name	Number
1	Aliv	Meyna laxiflora	1
2	Ashind	Not Available	6
3	Amba	Mangifera indica	3
4	Aambgul	Elaeagnus conferta	11
5	Arasul	Canthium dicoccum	3
6	Asola	Pavetta crassicaulis	22
7	Idlimbu	Citrus aurantium Linn	1
8	Umbar	Ficus racemosa	6
9	Karambu	Olea dioica	43
10	Karap (small)	Memecylon umbellatum	110
11	Karap	Memecylon umbellatum	105
12	Karvand	Carissa spinarum	5
13	Karavi	Strobilanthes callosus	2
14	Kusar	Jasminum malbaricum	8
15	Kohambal	Not Available	5
16	Ganjwa	Not Available	2
17	Gel	Catunaregam spinosa	18
18	Jambhul	Syzygium cumini	88
19	Tambat	Not Available	1
20	Toran	Ziziphus rugosa	16
21	Dasai	Colebrookea oppositifolia	5
22	Devhirad	Terminalia chebula	2
23	Dhaman	Grewia tiliifolia	1
24	Fangulani	Pogostemon benghalensis	25
25	Bhoma	Glochidion ellipticum	9
26	Bhalvand	Not Available	1
27	Malawa	Not Available	30
28	Ramethi	Gnidia Glauca	22
29	Waghati	Capparis zeylanica	1
30	Velu	Bambusa bambos	1
31	Shendari	Mallotus philippensis	6
32	Sambarat	Not Available	1
33	Sambar	Euphorbia nivulia	15
34	Sawa	Not Available	1
35	Handarfod	Leea rubra	30
36	Hirad	Terminalia chebula	23

¹In this quadrate research team found one hive of *Apis florea* on a *karvanda* (Carissa spinarum) shrub.



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