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## Floral sources for the insect pollinators with special reference to honeybees in Kangra region of Himachal Pradesh

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### Abstract

Pollinators and angiosperms have co-evolved and exhibit symbiotic relationship. Angiosperms are the main source of food for majority of insect pollinators. These may include entomophilous agricultural crops as well as fruit, vegetable, spice, ornamental, weeds, fiber, medicinal, timber or avenue plants etc. Insects pollinate angiospermic plants and help in self/cross pollination which ultimately enhances crop productivity. In return, they obtain their food from plants in form of pollen, nectar and fruits. These plant parts are important food resources for various commercially and agriculturally important insects such as honeybees, butterflies, aphids, wasps etc. Pollen is the protein-rich food used mostly to feed the brood whereas nectar is used as fuel for performing various activities like flight, foraging, rearing brood and other hive activities. Nectar is carbohydrate rich substance which honeybees used to gain energy by transforming it into honey. Both pollen and nectar after transforming into various useful products are utilized by human beings in their day to day life activities. There are specific insects which convert floral sources into useful products which are otherwise unobtainable by man. Essential factors for insect attractiveness should be studied and incorporated into new varieties/cultivars of desired crops. Beekeepers, farmers, extension workers, bee scientists, plant breeders and environmentalists will have to work together for management of floral sources. Therefore, present study was carried out to compile the floral plants available in district Kangra so that to strengthen floral calendar in the Himalayan region.

**Keywords:** bee flora, honeybees, pollinators, beekeeping, pollen, nectar

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### Introduction

The symbiosis of anthophilous insects and entomophilous flowering plants has evolved in millions of years. These angiosperms have developed highly specialized flowers with rewards (nectar and pollen) to attract bees, which increase the reproductive capabilities of plants through pollination. This symbiotic interaction has resulted in a high level of complexity and diversity among these distantly related organisms. Honeybees have evolved structural, physiological, and behavioural adaptations to take advantage of the nutritional benefits provided by blooms, which are the mainstay of their life. The co-evolution of floral attributes in angiosperms with honeybees and other pollinators is thought to be a primary factor in flowering plant morphological divergence and speciation. Honeybees are constantly collecting nectar & pollen throughout the year in order to (i) sustain the population of hive (ii) produce honey. However, it is only practicable in locations with abundant bee flora throughout the year. In our country, there is continuous succession of flowering plants for honeybees and large variety of floral plants is available for bees, although floral scarcity is always present for two to three months. In tropical areas, there is a dearth of flora during summers i.e. from May to September. However, in temperate areas, winter is a period of unavailability of flora. During scarce period, bees' field activities are impeded by extremely low or extremely high temperatures. Sometimes heavy mortality of bees takes place which ultimately causes heavy damage to the beekeepers/beekeeping industry.

Knowledge of bee flora is the pre-requisites for establishing an apiary in any locality because it directly affects colony performance and honey production. The knowledge of bee flora not only helps the beekeeper to have an idea on availability and abundance of pollen and nectar sources in a particular region but it also helps in standardizing the seasonal management practices for bee colonies. Successful beekeeping is only possible in those areas where there are plenty of flowering plants are available. It is valuable to know that a single honeybee visits about 75 to 100 flowers while collecting single nectar/pollen load. Therefore, a large number of flowers are essential for good beekeeping and honey production. All the flowers available on this planet cannot be stated good for beekeeping as many of them do not have enough nectar and pollen. Sometimes bees are not able to collect the nectar as flowers have very deep nectarines/complex floral morphology. Survey of bee flora of the respective area may help in variety of ways in successful beekeeping management. Systematic floral calendar of Himachal Pradesh has been published long back by Mishra (1995) <sup>[29]</sup>. Some work on beekeeping and bee flora

has also been carried out by Kumar and Kundal, 2016<sup>[23]</sup> and Kumar and Kumari 2017<sup>[24, 25, 26]</sup> in district Kangra, Himachal Pradesh.

With the background mentioned above, the main goal of this chapter is to provide information on bee flora, floral rewards, honeybee foraging behaviour on various flowering plants, assessment of bee plants, the status of other blossoms as bee flora, floral calendar, the biology of honey production, and strategic directions for bee flora management for promoting beekeeping venture and sustaining domestic as well as wild honeybee species by protecting them from nutritional stress.

### **Bee flora**

Bee flora refers to the blossoms from which bees gather nectar and pollen in large quantities. Honeybees do not visit every plant species during bloom because the quantity and quality of forage may be inadequate or even nonexistent in some flowers, or bee foragers may be unable to gather food due to improper floral structure. Bees have an amazing ability to distinguish between flowers with differing numbers of tips without having to visit them (Heinrich, 1979; Marden, 1984; Wetherwax, 1986; Kato, 1988)<sup>[18, 28, 46, 21]</sup>. To distinguish between species, they use morphological signals such as colour, size, UV reflectivity, and floral symmetry (Inouye, 1983; Kearns and Inouye, 1993; Conner and Rush, 1996; Moller and Sorci, 1998)<sup>[19, 22, 7, 31]</sup>. They collect pollen and nectar from a variety of angiosperm species, including fruit, vegetable, oilseed, attractive, medicinal, spice, weed, wild, or avenue plants, as well as many crops, to meet their nutritional needs.

Forage collection is a year-round process; the flowering sequence in the area of the apiary is essential, allowing bees to seamlessly shift from one type of bloom to the next and use a variety of floral sources without any gap. Another factor that attracts more bee foragers than small patches of flowers is an abundance of blooms (greater area under blossoming crop). Good nutrition for large bee floras apiaries has been found as a vital aspect in maintaining the health and flourishing of bee colonies for commercial apiculture and wild honeybee conservation throughout the year. Habitat loss, unsustainable agriculture, a lack of crop variety, dwindling natural reserves, and unplanned development all contribute to nutritional stress, lowering the carrying capacity of honeybees in many ecosystems, especially in developing nations. Bee flora varies by location and during different seasons of the year. Floral abundance and scarcity occur in every place at different times. It is essential to find and develop suitable bee plants to cover the gaps in the floral shortage. Localities with a variety of plant species that produce pollen and nectar-rich flowers for a longer duration are ideal for beekeeping. Still, every ecosystem has long or short duration of floral scarcity, which is a major issue in apiculture. Due to obstructions in floral morphology, bees are often unable to acquire rewards that are rich in flowers. For example, flowers of many cultivars of *Aloe vera* have a large quantity of high-quality nectar. Despite this, bee foragers are unable to obtain it due to androecium's obstruction of the long and thin corolla tube. The carrying capacity of bee colonies and the potential for honey production is determined by the status of bee flora in each particular region. Knowledge of flora of bee interest is essential for effective beekeeping, as the number of such flowers has a direct impact on colony performance and honey supply. More information about the area's nectariferous and polleniferous plant sources at different times of the year offers recommendations for standard apiary management procedures. The first thing to consider when choosing an apiary site is bee forage and agricultural rotation patterns. Bee colonies are sustained not only by primary sources, but also by the presence of minor and subsistence flora. Because some flowering plants are specific to particular locations, plants of interest to bees can sometimes be found even in small patches of a given area. Categorization, geographic range, the status of floral rewards (quantity and quality of nectar and pollen), blooming season, length of flowering season, level of attractiveness of bees to its flowers, flower density, foraging behaviour of *Apis* species on its bloom, and feasibility in taking rewards are all aspects of the plant that should be investigated (suitable floral morphology). This information allows colony manipulation duties to be adjusted in accordance with the blooming time of local plants.

The availability of bee pasture, an important subject of research for biologists and apiculturists, is essential for the production of honey and other hive products. Because different groups of plants bloom at different months of the year, so the accessibility of floral rewards and their collection by honeybees varies throughout time. The abundance of key nectar plant species near apiaries causes honey flow at large scale, as gathering of nectar induces honey production. In North India, 2-3 honey flows have been observed per year, however monoculture of the crops that are not of bee interest causes protracted periods of scarcity in some locations. In such areas, diversification of the flora of bee interest could be extremely beneficial. Honey flow period varies from one agro-climatic zone to the next, so beekeepers should conduct a survey and study floral calendars of various areas before engaging in migratory beekeeping to increase honey yield, keep honeybee colonies healthy, and make this small cottage industry more profitable, as proper management ensures a constant supply of pollen and nectar.

### **Qualities of good bee flora**

For commercial beekeeping, ample bee flora is required in the vicinity of apiary. A beekeeper should have the details about the availability and suitability of bee flora to manage the colonies in proper manner. Following are the qualities of good bee flora:

- Good quality & quantity of nectar
- Long flowering period
- High density of flowers per unit area

- Simple floral morphology that ease in collection of nectar
- Availability of bee flora in the close vicinity of the apiary.

### Material and Methods

A preliminary survey on flora of bee interest was carried out in district Kangra for better management of bee colonies. *Dalbergia sissoo*, *Albizzia Stipulata.*, *Adhatoda vasica*, *Bauhinia vahli*, *Cannabis sativa*, *Cassia fistula*, *Eucalyptus* spp., *Psidium guajava*, *Mangifera indica*, *Litchi chinesis*, and *Acacia* spp. are the important bee flora of Kangra district.

### Results

Flora wise description is as under:

*Dalbergia sissoo* DC (*Leguminosae*), also known as North Indian rosewood, is an evergreen tree that blooms in Punjab (India) from March to May. *Dalbergia sissoo* is a plant which belongs to family Fabaceae and order Fabales. Commonly it is called as 'Tahli/Shisham'. It is an essential bee plant, found abundantly in Kangra district of Himachal Pradesh. Flowers of this plant bloom from March to June and range in colour from pale to pink. Honeybees may easily reach nectar because the flowers are pale yellowish, aromatic, and have a thin tubular corolla. When these trees are abundant near the apiary, they become the primary bee flora, resulting in tremendous honey flow. Honey produced is viscous, dark amber in colour, and contains more fructose than glucose, with a strong flavour. Bees produce raw, monofloral honey from rosewood blooms, which has medicinal qualities for digestion, menstrual cycle, and oral cavity (Sharma, 1989; Sharma and Gupta, 1993) [39, 40]. *Albizzia stipulata* is a member of the same *Delbergia sissoo* family and order. 'Oee' is the common name for *Albizzia stipulata*. It's a small bush. In the winter, white pinkish blooms in bundles appear (Sharma and Raj, 1985; Garg, 1989) [41, 10]. The *Adhatoda vasica* is known as the "Maker." It is a little tree that grows in a natural way. It is a member of the Acanthaceae family and the Lamiales order. It's a lance-shaped perennial wild plant with lance-shaped leaves. Flowers are most often white in colour. The flowers of this bee flora bloom from May to September (Chaubal and Deodikar, 1965) [4]. *Bauhinia vahli* is a member of the Leguminosaceae family and the Fabales order. 'Taur' is its common name. It is a perennial shrub that grows wild and is widely used in India. Typically, the flowers are tiny and pale in appearance. Taur blooms in the months of April to June (Sharma and Raj 1985) [41]. *Cannabis sativa* is a plant that belongs to the Cannabaceae family and the Urticales order. It is commonly referred to as 'bhang.' It's an annual wild plant that can be found all over India. Cannabis grows organically without the need for any particular conditions or care. Cannabis grows best in non-crop barren ground or wasteland with moderate temperature. (Sharma and Raj, 1985; Sharma and Gupta, 1993) [41, 40]. *Cassia fistula*, often known as 'Amaltas,' is a species of Cassia. It's also known as the "golden rain tree." It belongs to the Fabaceae family and the Fabales order. It's a tall tree with a rapid growth rate. Flowers are yellow in colour and produced in a pendulous, unbranched shape. It blooms during the summer months (Parmar, 1995). *Eucalyptus* spp. (*Marantaceae*) are evergreen trees native to Australia but often found in India; belong to the family Myrtaceae and order Myrtales. It's a single-stemmed, tall tree with a fast growth rate. Most of the *Eucalyptus* spp. are evergreen. It is most commonly used to make timber products. They can grow to be enormous, and the majority of their species blossom in the spring. For honeybees, these beautiful blossoms are a reliable source of pollen and nectar. A flower's cup-shaped base stores a plenty of nectar. In nectar, there contain traces of eucalyptol chemicals, which give honey its distinct flavour, scent, and look. From sunrise to sunset, *A. mellifera* can be observed foraging. Pollen and nectar are both collected, but nectar gathering is more common (Sharma and Gupta, 1993) [40]. According to estimates (Jhaji *et al.*, 1996) [20], a fully developed *Eucalyptus* tree can produce 4 lakh flowers, providing 15.5 kg of nectar with a greater sugar concentration (54.7%), resulting in the high sugar content.

Guava is the common name for *Psidium guajava*. It is a member of the *Eucalyptus* family. It's a little, evergreen shrub that grows quickly. *Psidium guajava* flowers are white in colour. It flowers during the springtime (Chaubal, P.D. and Kotimire, S.Y. 1980) [5]. *Mangifera indica* can be found all throughout India. It is India's national fruit. It belongs to the Anacardiaceae family and the Sapindales order. It is commonly referred to as 'Mango.' It's a fruit tree that grows tall and rapidly. In the months of April and May, it blossoms. Mango flowers are white in colour (Anonymous, 1959; Sharma and Raj 1985) [1, 41]. *Litchi chinesis* is an evergreen tree that grows tall and slowly. It belongs to the Sapindaceae family and the Sapindales order. Flowers come in a variety of colours, including white, yellow, and greenish hues. Flowers are arranged in clusters (Nair, 1983) [32]. The bloom of *Acacia species* (*Leguminosae*) is a significant source of honey and pollen for bees. During the months of March and April, *A. catechu* flourish. The vivid yellow flowers of *A. nilotica* bloom from October to December and March to April, whereas the flowers of *A. juliflora* bloom from March to May. These flowers are rich in nectar and pollen (Devi and Mattu, 2015; Kumar and Sharma, 2016) [8, 27]. Flower heads and extrafloral nectaries are a food source for *A. pycnantha* and are frequently visited by *A. mellifera* foragers (Giovanetti *et al.*, 2015) [11]. *Acacia* pollen and nectar greatly increase brood rearing activities. Another species, *A. ataxantha*, is important to Nigerian apiculture because it produces a large amount of honey during its flowering season. Bees visit the bloom throughout the day, but peak foraging activity is observed between 1000 and 1300 hours, and they appear to prefer this plant's blossoms (Dukku, 2003) [9]. *Carissa spinarum* belongs to the family Apocyanaceae and order Gentianales. Its common name is Garna. *Carissa spinarum* are thorny bushes with forked branches found very commonly in the forests and wastelands. They are highly drought resistant. White

color flowers bloom during month of April to May. *Albizzia Lebbeck* commonly known as Siris. It belongs to the family Fabaceae and order Fabales. It is a tree of long life span. Flowers are white yellowish in color. The fruit are pod, containing six to twelve seeds. It grows naturally in the forest and wasteland. It is a fodder tree. Wood of this tree used to make different timber products. Flower occurs in the wet season (Sharma and Raj 1985) <sup>[41]</sup>. *Bombyx ceibd* is a tall tree with numerous prickles/spines on the trunk region. Commonly it is known as Simbal/Cotton tree. It belongs to the family Malvaceae and Malvales. Flowers bloom from January to February. Flowers are of cup shaped and dark crimson in color. Seeds are black or grey in color and packed in white cotton (Parmar, 1995). *Prunus domestica* called as plum. It is the bee flora of great importance. It belongs to the family Rosaceae and order Rosales. It is a large shrub or small tree. It is a slightly thorny shrub with white flowers. It blooms usually in early springs. Plum grown commercially in orchards and required a sheltered spot. *Pyrus communis* belongs to the same family and order as *Prunus domestica*. Its common name is Pear. It is a medium sized tree. Leaves are alternately arranged. Flowers are white and have five petals, flowering month of Pear is from April to May. Fruits are edible and sweet in taste (Chandran and Shah, 1974) <sup>[3]</sup>.

*Pyrus pashia* Commonly known as Kainth/ wild pear. It belongs to the family Rosaceae and order Rosales. It is a medium sized deciduous tree with spiny branches. Flowers are of white color with five petals. Blooming period varies between February and April. Fruits are of green color in earlier stage but at maturity they turn to brownish black color with various dots on its surface (Sharma and Gupta, 1993) <sup>[40]</sup>. *Prunus persica* is a medium sized tree. Leaves are lanceolate. Flowers are produced in early spring. Flowers are of pink color with five petals. Fruits has whitish yellow flesh. Seed of peach is single red brown color and is surrounded by a wood like husk. It is an important and major bee flora of the distt. Kangra.

*Toona ciliata* (Meliaceae) is a popular forest and avenue tree in northern India's plains and lower hills. It has small, cream-colored flowers that bloom from March to April and provide a lot of nectar but not much pollen (Singh, 1948; Chaudhari, 1977) <sup>[6, 43]</sup>. Nectar sugar concentration in freshly bloomed flowers was 26%, increasing to 72 percent in 48 hours old flowers, nectar sugar value is 2.38 mg/flower/day, and nectar is produced for four days, according to observations (Mishra, 1995) <sup>[29]</sup>. Honey made from its nectar has a distinct flavour and is white to light amber in colour. The honey flow is brief but powerful. *Terminalia arjuna* (Combretaceae) flowers are greenish to yellowish-white, sessile, and bloom from May to June, providing nectar for *A. mellifera* and wild honeybees throughout the summer drought. Flowering provides enough nectar for bees to create surplus honey (Singh, 1948) <sup>[43]</sup> of amber to dark amber colour with a firm flavour in specific locations where plants are huge. It has also been reported by few researchers that honeybees also visit some weed plants in the dearth of pollen especially during summer season (Kumar and Kumari, 2017, 2019) <sup>[24, 25, 26]</sup>.

**Table 1:** List of bee flora available in Kangra region of Himachal Pradesh

S. No.	Scientific Name	Common Name	References
1	<i>Adhatoa vasica</i> Nees	Maker	Garg (1989)
2	<i>Albizzia stipulata</i> Boivin	Oee	Garg (1989)
3	<i>A. Lebbeck</i> Linn.	Siris	Sharma and Raj (1985)
4	<i>Bauhinia vahli</i> Wt & Arn	Taur	Sharma and Raj (1985)
5	<i>Berberis lycium</i> Royle	Kashmal	Thakur and Gupta (1987)
6	<i>Bidens pilosa</i> L.	Spanish Needle	Sharma and Gupta (1993)
7	<i>Bombax ceibd</i> L.	Simbal	Sharma and Gupta (1993), Parmar (1995)
8	<i>B. campestris</i> L. var. toria	Toria	Sharma and Raj (1985)
9	<i>B. oleracea</i> L. var. botrytis	Cauliflow-er	Sharma and Gupta (1993)
10	<i>Callistemon lanceolatus</i> DC	Bottle brush	Bhat <i>et al.</i> (1987)
11	<i>Cannabis sativa</i> L.	Bhang	Sharma and Gupta (1993)
12	<i>Carissa spinarum</i> Linn.	Garna	Sharma and Raj (1985)
13	<i>Cassia fistula</i> Linn.	Amaltas	Sharma and Raj (1985)
14	<i>C. reticulate</i> Blanco	Mausmi	Sharma and Raj (1985)
15	<i>Dalbergia sissoo</i> DC.	Shisham	Sharma and Gupta (1993)
16	<i>Ehretia acuminata</i> R. Br.	Punna	Rehman and Singh (1940)
17	<i>Eruca sativa</i> Mill	Tarmaria	Gupta <i>et al.</i> (1986)
18	<i>Eucalyptus</i> spp.	Safeda	Sharma and Gupta (1993)
19	<i>Fagopyrum esculentum</i> Moench.	Buck Wheat	Saraf (1973)
20	<i>Litchi chinesis</i> Sonner.	Litchi	Nair (1983)
21	<i>Litsea stocksii</i> Hook. F.	Chirandi	Sharma and Raj (1985).
22	<i>Machilus</i> spp.	Kardel	Chandran and Shah (1974), Sharma and Raj (1985)
23	<i>Malus domestica</i> Borkh	Apple	Singh (1962)
24	<i>Mangifera indica</i> L.	Mango	Anonymous (1959), Sharma and Raj (1985)
25	<i>Plectranthus rugosus</i> Wall Benth	Shain	Gupta <i>et al.</i> (1984)
26.	<i>Prunus amygdalus</i> Batsch	Almond	Sharma and Gupta (1993)
27.	<i>P. armeniaca</i> L.	Apricot	Sharma and Gupta (1993)

28.	<i>P. domestica</i> L.	Plum	Sharma and Gupta (1993), Chandran and Shah (1974)
29.	<i>P. puddum</i> Roxb.	Pajja	Gupta <i>et al.</i> (1990), Reddy and Gupta (1987)
30.	<i>Psidium guajava</i> L.	Guava	Chaubal and Kotmire (1980) Garg (1989)
31.	<i>Pyrus communis</i> L.	Pear	Sharma and Gupta (1993), Chandran and Shah (1974)
32.	<i>P. pashia</i> Buch Ham	Kainth	Sharma and Gupta (1993),
33.	<i>P. persica</i> L.	Peach	Sharma and Gupta (1993), Sharma and Sohi (1985),
34.	<i>Robinia Pseudacacia</i> L.	Kikar	Saraf (1973), Shah (1972), Shah and Shah (1976), Gupta <i>et al.</i> (1992)
35.	<i>Rosa moschata</i>	Wild rose	Sharma and Raj (1985)
36.	<i>Rubus ellipticus</i> Smith.	Akhan	Gupta and Thakur (1987b)
37.	<i>Sapindus detergens</i> Roxb.	Ritha	Sharma and Raj (1985)
38.	<i>S. mukrossi</i> Gaertn.	Ritha	Singh(1962), Goyal(1974), Sharma(1958)
39.	<i>Syzgium cumini</i> (L.)Skeels	Jamun	Sharma and Raj (1985)
40	<i>Terminalia chebula</i>	Hirda / Inkut	Anonymous (1959) Chaubal and Kotmire (1980), Sharma and Raj (1985)
41	<i>Toona ciliata</i>	Tun	Goyal (1974), Gupta <i>et al.</i> (1990) Ramesh (1980) Saraf (1973) Chaudhri (1977) Chandran and Shah (1974)
42	<i>Vitex negundo</i> L.	Banah	Garg (1989), Gupta and Thakur (1987a)
43	<i>Woodfordia floribunda</i> Salisb.	Dhai	Mishra <i>et al.</i> (1987)

### Conclusion and future strategies

A bee's livelihood revolves around flowers. Flowering plants (Angiosperms) and honeybees have a mutualistic connection in which both parties get the benefit: bees acquire nectar and pollen from flowering plants and help to pollinate them. Honeybees gather nectar and pollen from a variety of plant species known as bee flora. Long blooming periods, higher flower density, nectar with more sugar concentration, easily accessible rewards in flowers, and richness in the areas surrounding the apiaries are all characteristics of good bee flora for commercial apiculture. More pollen availability leads to increased brood raising and colony growth. Pollen supplies are needed for fully exploiting the honey flow, as substantial honey stocks necessitate a big force of foragers. Nectar is primarily a carbohydrate mixture that provides energy for flight, foraging, hive activity, brood-rearing, and other activities, as well as a raw ingredient for honey production. Honey is a nutritive, sweet, and vicious hive product generated miraculously by the collaboration of honeybee field and housekeeping members. The gathering of floral nectar, the inclusion of enzymes, and the drying of the nectar by frequent movement, heat, and fanning behaviour are all part of this intricate process. The number, distribution, and flowering of bee plants of various kinds that occur in the area determine the potential of bee flora in any habitat. The study of such flora, including its identification, floral biology, and degree of appeal to honeybees, is an important element of beekeeping. Small-scale beekeeping may have fewer floral needs, but more bee colonies are needed to promote it as an employment-generating activity and to boost yields of entomophilous crops through pollination, which is directly linked to food security. The management of bee pasture is necessary in order to support such a large number of communities. Sugar syrup and pollen substitutes are fed to the domesticated colonies during lean periods of the year, but an artificial diet cannot meet *et all* nutritional needs. Because the duration of dearth and honey flow varies per region, migratory beekeeping is essential to guarantee a steady supply of natural fodder.

A fundamental constraint to apicultural development is a lack of knowledge about beneficial plants for bees. Efforts should be directed to identify or produce plants with more appealing and beneficial flowers for honeybees. Nectar, scent, colour, flower morphometrics, and other essential variables for bee attractiveness or foraging cues should be explored and incorporated into new varieties/cultivars of various crops. The selection of plant stock based on honeybee foraging behaviour is very important. When producing novel cultivars, pollen and nectar yield, as well as nutritional quality, should be taken into account. More research into what makes pollen appealing to honeybees might be conducted, and the chemicals involved could then be sprayed on selected crops to entice bee foragers to collect more pollen. Apiculturists should have a thorough understanding of the floral calendar, honeybee foraging behaviour, and bee flora management for more successful beekeeping. Efforts should be made to create flower calendars for all states or regions, as this would provide guidance for migratory beekeeping. More study on nectariferous and polleniferous plants, as well as multiplication of appraised flora, crop diversification with an emphasis on apiculture, and the planting of flora of bee interest, could boost the area's beekeeping potential. To promote apiculture and conserve wild honeybees, beekeepers, farmers, extension workers, honeybee scientists, plant breeders, and environmentalists will have to work together to manage bee forage.

**Conflict of Interest**

It is declared that there is no competing interest among the author.

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