

Original Research Article

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Bee Floral Diversity of Medicinal Plants in Vidya Pratishthan Campus, Baramati, Pune, District (M.S.) India

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ABSTRACT

Honeybee and plant have a special symbiotic relationship. Bee flora is important for establishing bee keeping industry. The awareness to maintain the existing bee flora and multiplication of plant species is important for its sustainability. Plant types and their flowering duration differ from one place to other due to variation in topography, climate and other cultural and farming practices. The knowledge of bee flora of medicinal plants enable beekeepers to utilize them at the maximum level, so that they can harvest a good yield and quality of honey with medicinal importance and other bee products in addition to effective pollination, which enhances crop yields. This region has its own honey flow and floral dearth periods of short and long duration. The knowledge on bee flora help in the effective management of bee colonies during such periods. Based on available flora, major characteristics of these plant species, pollen and nectar availability and flowering duration, a bee floral calendar as per the season was developed. To conserve these floras, attention must be given to maintain and multiply the existing flora. Considering these facts, the present study was carried out to prepare an inventory of existing medicinal bee flora and develop a floral calendar for that particular region. We analysed 50 species of medicinal plants were promising as potential bee foragers for honeybees. Some of the common and important medicinal bee forage plants are the species of *Azadirachta indica*, *Mangifera indica*, *Cassia fistula*, *Cassia occidentalis*, *Albizia spp.*, *Bauhinia spp.* and *Prosopis juliflora* etc. This information is useful for bee keepers and is helpful to improve quality of honey and sustaining medicinal biodiversity.

Keywords

Apiculture, Bee floral Calendar, pollen availability, medicinal plants and India.

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Introduction

Bee keeping is farming related and forest based activity. Honey bee flora is very important for this activity. Bees obtain nectar, pollen or both from flowers which is the necessity for its survival. The value of flora in bee keeping has been observed in many parts of the world.

For instance, the directory of world honey resources of Hindu Kush-Himalayan region (Verma, 1990; Partap, 1997) and bee flora of India (Kaur and Sihag, 1994) are some existing examples of such efforts. Plant types and their flowering duration differ from one place to another due to variation in

topography, climate and other farming practices. The extensive knowledge on type, density and quality of bee flora are the important factors for successful bee keeping. Every region has its own honey flow and floral dearth periods of short and long duration. The bee foraging medicinal plants were collected in their natural habitats and all the plants were identified to the species level using local names and scientific references (Flora). Such knowledge on bee flora help in the effective management of bee colonies during such periods. Considering all the facts, study was made to prepare an inventory of existing bee flora and develop floral calendar for this type of climate with rainfall, temperature range, soil type etc.

Honeybees are one of the most important pollinators of angiosperms because of their vegetarian diet, flower visiting habits, hairy bodies that readily pick up pollen grains and visit many flowers of the same species during a single trip thus affecting pollination (Deodikar). The objective of this study is to document medicinal plants that could serve as bee foraging floral species.

Materials and Methods

This study was undertaken during 20015-16 in Vidya Pratishthan campus, Baramati, Pune district is located at 18.181° N latitude and 74.6097 ° E longitude. The average altitude of this area is 1765 ft. The mean minimum temperature during 20015-16 was 28°C but it dropped down to 20°C during winter. Dec and Jan are the coldest months with average minimum and maximum temperature of 28°C and 35°C .The hottest days of the year are during mid-Apr to mid-Sept, where the mean maximum temperature reached up to 44°C.During the study period the annual rainfall was 400 mm. Over 90% of total rainfall was received during the months of June-Sept.

Identification of bee-flora

The identification of bee flora in the region was mainly by observing the bee visitation. The flower species were identified as a bee plant only after visual confirmation and collection of food by honey bees (Sivaram, 1995, Naim and Phadke, 1976).

Observations were made during summer, winter and rainy seasons. These were based on nectar and pollen source as well as activities performed by honey bees on different flowers.

Pollen and nectar plants divided into major and minor categories. Bees collect nectar and pollen from many different plant species and its production by a particular plant species may vary under different soil and climatic conditions. Plants considered a major nectar source in one region may be only a minor source in others. Yearly variations may also cause minor honey plants to occasionally yield heavily or major plants to yield poorly.

Again, the beekeeper must become familiar with the peculiarities of his or her own region through observation of flowering plants and dates, and weather and colony record. So the bee floral calendar will be helpful for him or her to record all the observations.

The status of flowering plants whether they are major or minor was determined by the frequency and the number of honey bees visits. The density of those plants found around the campus determined the abundance of bee plants. Finally plants visited by honeybees were later on collected, identified and then compared with published reports (Partap 1997, Polunin and Stainton, 1997, Shrestha, 1998) for their uses by Honeybees.

Data collection

Both primary and secondary sources of data were used in this study. Secondary data in the form of reports and other published and unpublished materials. Primary data were collected using informal discussion with groups and key informants. In addition direct observation was used (Nigire Gebru).

Results and Discussion

Honeybee species and bee keeping practices

Different honeybee species were found in Baramati region. The natural colonies were *Apis florea*, *A. dorsata* and *Trigona iridipennis* and the model colony of *Apis cerena* in our Campus region. Swarming and absconding were the major problems. Cutting off the drone brood and cleaning up of the hive during summer season to minimize swarming were the main management practices followed (Bista and Shivkoti).

Temperature and rainfall have a marked effect on honey bee activity. At 20 -30 °C bee activity is at high level. Colony strength is directly related to temperature at which bees forage and rainfall flight activity stops. Optimum conditions for pollen release are temperature of 20°C and humidity 70% or less. In summer season low temperature and high humidity reducing bee activity and slowing release of pollen from fruit blossom. Particularly strong wind tends to reduce the ground speed of bees and hence reduce number of flights per day. In our campus area temperature, humidity and wind all affect the quantity of sugar concentration of nectar and as a result the attractiveness to bees.

Honey bee visits

In all studied plant species, different species of honeybee were found to be regular visitor

to the flowers. They visited 2 to 6 flowers per min. The frequency of honeybee visitor was found to be more. Honeybee visits the flower during morning hours 09:00 h to 10:30 h and in evening 5:00 h to 7:00 h. The activity of honeybee varied according to floral types and its seasonal availability. The movements of honeybees between flowers are strongly influenced by the amount of pollen and nectar present (Tidke and Nagarkar).

Honey bee flora

There is diversity of flowering plants in different seasons and honey bees visited these plants for pollen and nectar. Based on source status 100 plant species were identified as important bee flora from our campus area (Table.1). Based on frequency, number of bee visits and abundance, they were further classified into 3 groups. 23 plant species were recognized as major source, 17 as medium source and remaining 10 as minor one. Beekeepers reported that they depend on many kinds of medicinal flowering plants. Some of the abundant honey plants with their scientific, local names, family, flowering season and pollen, nectar content. Flowering season are given based on field observations and local knowledge.

Among major plant species *Azadirachta indica*, *Mangifera indica*, *Cassia fistula*, *Cassia occidentalis*, *Albizia* spp., *Bauhinia* spp. and *Prosopis juliflora* are cultivated as important bee flora. Some of the medium and minor source plant species show flowering for about 5-6 months during longer period, *Adhatoda vasica*, *Lantana camera*, *Sesamum indicum*, *Vitex negundo* and *Tridax procumbens* were some important floral species.

Summer is the time for storage surplus food as there are more floras in the field and days

are long. Honeybees store sufficient honey for the winter. April and May are usually considered to be the period of nectar flow. After honey flow, there comes the hot months of June and July when most of the colonies stop brood rearing in the lower hills and in the plains. Major flora of summer season showing highest number of plants as compare to other and Compositae family members were more dominant in the bee flora. Mid-Nov-Feb (winter season) and June-Aug (rainy season) were identified as the dearth period with low temperature during rainy season. Because of continuous

rain and thereby fluctuation in temperature this period was also found unfavorable for honeybee foraging.

Bee floral Calendar

Based on the availability of different plants along with their flowering time, a bee floral calendar has been developed of this region.(Table 1) This calendar is as per the month of flowering and distributed in Major, Medium and Minor bee flora.(S. Bista and G Shivkoti)

Table.1 Honey bee flora of Medicinal plants

S. No.	Botanical name	Vernacular name	Family	Flowering Season	Utility to Honeybees	
1	<i>Abrus precatorius L.</i>	Gunj	Fabaceae	June -Aug	P	N
2	<i>Acacia catechu(L.) Willd</i>	Khair	Mimosaceae	Oct-Nov	P	N
3	<i>Adhatoda vasica Nees.</i>	Adhulsa	Acanthaceae	Annual		N
4	<i>Aegle marmelos (L.) Correa</i>	Bael	Rutaceae	Dec-Jan	P	N
5	<i>Albizia procera Benth</i>	White Shirish tree	Mimosaceae	Apr-May	P	N
6	<i>Alstonia scholaris(L.) R. BR.</i>	Satwin	Apocynaceae	Oct-Jan	P	
7	<i>Andrographis paniculata L.</i>	Kalmegh	Acanthaceae	Apr-July	P	N
8	<i>Annona squamosa L.</i>	Custard apple	Annonaceae	Apr-May	P	N
9	<i>Anthocephalus cadamba (Roxb.) Miq.</i>	Kadamb	Rubiaceae	Jan-Mar	P	N
10	<i>Artocarpus heterophyllus Lam.</i>	Jackfruit	Moraceae	Feb-Mar		N
11	<i>Asparagus racemosus Wild</i>	Shatavar	Asparagaceae	May-June	P	
12	<i>Azadirachta indica A. Juss,</i>	Neem	Meliaceae	Apr	P	N
13	<i>Bacopa monieri L.</i>	Brahmi	Scrophulariaceae	June-Oct	P	
14	<i>Bauhinia purpurea L.</i>	Kanchan	Caesalpinaceae	Dec-Mar	P	N
15	<i>Bauhinia racemosa Lam.</i>	Apta	Caesalpinaceae	Mar-Apr	P	N
16	<i>Bixa orellana L.</i>	Bixa	Bixaceae	Apr-May	P	N
17	<i>Boerhavia diffusa Linn.</i>	Punarnava	Nyctaginaceae	June-July	P	
18	<i>Bombax ceiba L.</i>	Red silk cotton	Bombacaceae	Apr-May	P	N

19	<i>Butea monopserma</i> (Lam.)Taubert	Palas or Flame of Forest	Papillionaceae	Apr-May	P	N
20	<i>Calotropis gigantea</i> (Linn). R. Brown	Rui	Asclepediaceae	Nov-Dec	P	N
21	<i>Cassia fistula</i> Linn.	Bahava	Caesalpinaceae	Apr-May	P	
22	<i>Cinnamomum cassia</i>	Pink peeper	Lauraceae	Mar-May	P	N
23	<i>Cissus quadrangularis</i> Linn.	Hadsandhi	Vitaceae	May-June	P	N
24	<i>Citrus limon</i> Linn.	Lemon	Rutaceae	Feb-Mar	P	N
25	<i>Citrus aurantifolia</i> L.	Kaghzii nimboo	Rutaceae	Mar-May	P	N
26	<i>Cocos nucifera</i> L.	Naral	Arecaceae	Yearly	P	
27	<i>Gmelina arborea</i> Linn.	Shivan	Verbenaceae	Feb-Apr	P	N
28	<i>Gymnema sylvestre</i> R.Br.	Gudmar	Asclepediaceae	Apr-May	P	N
29	<i>Hibiscus rosa-sinensis</i> L.	Jaswand	Malvaceae	Through out year		
30	<i>Lantana camara</i> Linn.	Tantani	Verbenaceae	Jan-Dec	P	N
31	<i>Leucas aspera</i> Linn. (Willd.) spreng.		Lamiaceae	June-Sept	P	N
32	<i>Madhuca longifolia</i> (J.Konig) J.F.Macbr.	Moha	Sapotaceae	Mar-Apr	P	N
33	<i>Mangifera indica</i> Linn.	Amba	Anacardiaceae	Apr-May	P	
34	<i>Melia azadirach</i> Linn.		Meliaceae	Feb-May	P	
35	<i>Michelia champaca</i> Linn.	Chapha	Magnoliaceae	June -Sept	P	N
36	<i>Mimusops elengi</i> Linn.	Bakul	Sapotaceae	Oct-Nov	P	N
37	<i>Moringa oleifera</i> Lamk.	Shevga	Moringaceae	Apr		N
38	<i>Ocimum sanctum</i> L.	Tulasi	Lamiaceae	July-Sept	P	N
39	<i>Ocimum basilicum</i> L.	Sabja	Lamiaceae	Sept-Oct	P	N
40	<i>Phyllanthus emblica</i> Linn.	Amla	Euphorbiaceae	Mar-May	P	N
41	<i>Pongamia pinnata</i> (Linn.)Pierre	Karanj	Fabaceae	Mar-Apr	P	N
42	<i>Prosopis juliflora</i> (Sw.)DC	Shami	Fabaceae	May - June,Sept-Oct	P	
43	<i>Santalum album</i> L.	Chandan	Santalaceae	Oct-Nov	P	N
44	<i>Saraca asoca</i> (Roxb.)Wilde.	Ashoka	Caesalpinaceae	Feb-Apr	P	N
45	<i>Sesamum indicum</i> Linn.	Til	Pedaliaceae	May-Oct	P	N
46	<i>Syzygium cumini</i> (L.)Skeels	Jamun	Myrtaceae	Apr-May	P	N
47	<i>Strychnos nuxvomica</i> Linn.	Kajara/ Kuchala	Loganiaceae	Sept-Nov	P	N
48	<i>Terminellia arjuna</i> (Roxb. ex DC)	Arjun	Combretaceae	Apr-May	P	N

49	<i>Tribulus terrestris</i> Linn.	Sarata	Zygophyllaceae	July-Sept	P	N
50	<i>Tridax procumbens</i> L.	Ekdandi	Asteraceae	Yearly	P	
51	<i>Vitex negundo</i> Linn.	Nirgudi	Verbenaceae		P	N
52	<i>Withania somnifera</i> (L.) Dunal	Ashwagnadha	Solanaceae	Dec onwards	P	N
53	<i>Zingiber officinalis</i> Roscoe.	Ale	Zingiberaceae	Nov-Feb	P	N

P- Pollen, N- Nectar.

Recommended honey bee plants

Due to high variation in climatic conditions and temperature, this region is suitable for growing various multipurpose plants *Azadirachta indica*, *Grewillia robusta*, *Morus alba*, *Albizia* spp., *Bauhinia* spp. and *Prosopis juliflora* which are maximum in number. Trees such as *Citrus* spp., *Phyllanthus emblica*, *Syzygium* spp. and *Lantana* could plant with increased number. *Lantana* and *Tridax procumbens* has a long flowering duration from 6 months to whole year as compare to other plants, so we preferred this plant.

Success of apiculture is related to apiary- the availability of bee plants. However to maintain bee flora multiplication of plant sps. is important to make it sustainable. Such studies also need to be carried out in other parts of the country.

The bee plants are available throughout the year, but Jan-Apr and July-Aug are major flow period whereas Apr-May is the minor flow period of pollen and June is dearth period. This study gives the general idea of range of plant sps. in Vidya Pratishtan area and honeybees as important resource.

In conclusion, the present study provides preliminary information on diversity and foraging medicinal plants. This knowledge will be helpful to beekeepers and farmers. With this data we can understand bee importance and their mutual relationship with plants. So farmers and beekeepers need

to be trained on this aspect. Medicinal bee flora with their scientific and local names, flowering seasons and pollen nectar content are given based on field observations and local knowledge of beekeepers. After survey most of the bee plants flowered between September and November, some in March and May and some in June. Many tree species are found to be a good source of forage.

In this study different plant species and pollen nectar content were identified as major bee flora. There is a variation on seasonal availability of honeybee forages. High availability of honeybee shrubs and herbs plants was found from September to November while most important trees flowered in March and may. The highest scarcity of bee forage was observed in June. Therefore it is concluded that in order to increase honey yield and quality management of honeybee flora and floral calendar is critically important to study area.

References

- Ahmed, A.F.L. Evaluation of various honeybee foraging activity for identification of various honeybee foraging activity for identification of potential bee plants, Riyadh, Saudi Arabia.
- Bista, S. and G. Shivkoti. *Nepal Agric. Res, J.*, Vol 4 & 5, press, New Delhi.
- Delaplane, K.S., Daniel, F.M. 2000. Crop pollination by bees. CABI Publishing,

- New York [http:// www.cabi-publishing](http://www.cabi-publishing).
- Deodikar, G.B., Thakar, C.V. 1966. Utilization and Improvement of the local floras as bee pasturage. Proc. Autumn School Bot. Mahabaleshwar. Dept. Bot. Poona Univ., 122-128.
- Harugade, S. 2013. Floristic studies with reference to Honey bees of Baramati, Pune District, *Int. J. Advancements in Res. Technol.*, (ISSN:2278-7763 Volume2, issue 8.
- Kaur, G., R.C. Sihag. 1994. Bee flora of India: A review.
- Naim, N. and Phadke, R.P. 1976. Bee flora and seasonal activity of *Apis cerana indica* at Pusa (Bihar). *India Bee J.*, 38(1-4): 13–19.
- Nigure Gebru, *et al.* 2015. *J. Biol.*, 2015. Agriculture and Healthcare Vol. 5no. 1.
- Noor, M.J., M.A. Khan and F.S. Camphor. 2009. Palynological analysis of pollen loads from pollen sources of honeybees in Islamabad, Pakistan. *Pak. J. Bot.*, 41(2): 495.
- Ohioline.ag.ohio-State.edu- your link to information, News and education.
- Partap, T. 1992. Honey plant sources in mountain areas: some perspectives. Pp. 155-162.
- Partap, U. 1997. Bee flora of the Hindu Kush-Himalayas: Inventory and management. ICMOD, Kathmandu, Nepal.
- Polumin, O. and A. Stainton. 1997. Flowers of Himalayas. Oxford University
- Shreshtha, K. 1998. Dictionary of Nepalese plant names. Mandala Book Point, Kathmandu, Nepal.
- Tidke, J.A., S.S. Nagarkar. 2015. Pollen Spectrum and Biochemical Analysis of Dominant Pollen Types Represented by Local Honey Samples, *Int. J. Pharma Res.*, 4(5): 21-33. In: Honeybees in mountain Agriculture(LR Verma, ed.)ICIMOD Kathmandu, Nepal.
- Verma, L.R. 1990. Beekeeping in integrated mountain development: Economic and Scientific perspective. Oxford and IBH Publishing, New Delhi.

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