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Floristic studies with reference to Honey bees of Baramati, Pune District

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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 a Baramati region enable beekeepers to utilize them at the maximum level, so that they can harvest a good yield of honey 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. Such 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 were developed. To conserve these floras, attention must be given to maintain and multiply the existing flora. Considering these facts, the present study is carried out to prepare an inventory of existing bee flora and develop floral calendar for that particular region.

Keywords: Apiculture, Bee floral Calendar, and pollen availability.

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. 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.

Materials and Methods

This study was undertaken during 2009-10 around Baramati in Pune district is located at
18^0 8′ 60 N latitude and $74^0$34′60 E longitude. The average altitude of this area is 1765 feet. The mean minimum temperature during 2009-10 was 28^0c but it dropped down to 20^0c during winter. Dec and Jan are the coldest months with average minimum and maximum temperature of 28^0c and 35^0c .The hottest days of the year are during mid-Apr to mid-Sept, where the mean maximum temperature reached up to 44^0c.During the study period the annual rainfall was 400mm. Over 90% of total rainfall was received during the months of June-Sept.

Survey was made mainly for common or local names of different flowering plants of that area, their flowering season and duration, habit, nectar or pollen yielding ability and their abundance in the area.

Observations were made during 3 consecutive seasons. These were based on nectar and pollen source as well as activities performed by honey bees on different flowers.

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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 Baramati region 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.

Temperature and relative humidity were recorded continuously during the experimental work.

Results and Discussion

Honeybee species and bee keeping practices

Different honeybee species were founding in Baramati region. The natural colonies were *Apis florea*, *A.cerana*, *A. dorsata* and *Trigona iridipennis and* the model colony of *Apis cerena* in our Baramati 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. (S. Bista and G Shivkoti)

Temperature and rainfall have a marked effect on honey bee activity. At 20 -30 ^{0}c bee activity is at high level. Colony strength is directly related to temperature at which bees forage. With rainfall flight activity stops. Optimum conditions for pollen release are temperature of 20^{0}c and over and humidity 70% or less. In summer season low temperature and high humidity reduces the effect of reducing bee activity and slowing release of pollen from fruit blossom.

Wind particularly strong wind tends to reduce the ground speed of bees and hence reduce number of flights per day.

In Baramati region temperature, humidity and wind all affect the quantity, sugar concentration of nectar and as a result the attractiveness to bees.

Honey bee flora-

There is diversity of plants flowering 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 of Baramati area. Based on frequency, number of bee visits and abundance, they were further classified into 3 groups.47 plant species were recognized as major source, 45 as medium source and remaining 27 as minor one.

Among major plant species, *Guizotia abyssinica, Sunflower and Brassica* as cultivated as important bee flora. Somme of the medium and minor source plant species show flowering for about 5-6 months longer period were *Aegeratum conyzoides, Oxalis corniculata, Vitex negundo* are some important floral species.

Summer is the time for storage surplus food as there is more flora in the field and days are long. They 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. (A. Garg)

Mid-nov-Feb(winter season) and June-Aug (rainy season) were identified as the dearth period with low temperature flowering plants like *Caesalpinia spp., Zea mays, Phaseolus spp., Lagerstromia spp., Curcuma aromatic*a and some vegetables show flowering during rainy season. Because of continuous rain and thereby fluctuation in temperature this period also found unfavorable for honeybee foraging. However the pollen requirement during the rainy season fulfilled by *Zea mays, Phaseolus spp*. and *Glycine max*.

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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.(Figure 1) This calendar is as per the month of flowering and distributed in Major, Medium and Minor bee flora.(S. Bista and G Shivkoti)

Recommended honey bee plants

Due to high variation in climatic conditions and temperature, this region is suitable for growing various multipurpose plants *Azadirachta indica, Grewellia robusta, Morus alba, Albizzia spp., Bauhinia spp. And Eucalyptus spp.,* which are maximum in number. Horticultural trees such as *Citrus spp., Phyllanthus emblica, Musa paradisiaca, Syzygium spp. and Psidium guajava* and ornamental plants like *Hamelia patens, Cuphea hyssopifolia, Wedelia chinensis* and *Lantana* could plant with increased number. (Partap 1992). *Hamelia Wedelia,Lantana* and *Cuphea hyssopifolia* has a long flowering duration from 6 months to whole year as compare to other plants, so we prefer this plant.(Annexure1)

Success of Apiculture is related to apiary- the availability of bee plants. However to maintain bee flora its multiplication of plant spps. 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 through out the year, but Jan-Apr and July-Aug are major whereas Apr-May is minor flow period of pollen while June is dearth period. This study gives the general idea of range of plant spps. In Baramati area and their to honeybees as important resource.

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Figure 1 Different available honeybee plants and floral calendar in different months of the year in VSBT area of Baramati, Pune Dist.

S.N.	Plant Name	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
a.	Major Bee Flora												
1.	Sunflower												
2.	Mustard												
3.	Coriander												
4.	Cucumber												
5.	Double bean												
6.	Radish												
7.	Jowar												
8.	Maize												
9.	Aster												
10.	Cosmos												
11.	Tuberose												
12.	Marigold												
13.	Zinnia												
14.	Amla												
15.	Bor												
16.	Khair												
17.	Bael												
18.	Kadamba												
19.	Lal Sawar												
20.	Citrus												
21.	Subabul												
22.	Moha												
23.	Shevaga												
24.	Karanj												
25.	Chinch												
26.	Jambhul												
27.	Nilgiri												
28.	Coconut												
29	Shevari												
30.	Rajgira												
31.	Guava												
32.	Kale Til												
33.	Gahu												
34.	Neem												
35.	Gulmohar												
36.	Tulshi												
37.	Hirada												
38.	Bakul												
39.	Keli												
S. N.	Plant Name	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
40.	Karle												
41.	Chandan												
42.	Ekdandi												
43.	Kenna												
44.	Gulab												
45.	Methi												

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46.	**Kanda**												
47.	**Lasun**												
48.	**Amba**												
49.	**Kobi**												
50.													
b.	**Medium Bee Flora**												
51.	**Shirish**												
52.	**Artemissia**												
53.	**Kanchan**												
54.	**Pichkari**												
55.	**Soyabean**												
56.	**Sweet potato**												
57.	**Nirgudi**												
58.	**Rose**												
c.	**Minor Bee Flora**												
60.	**Tur**												
61.	**Bottlebrush**												
62.	**Shevanti**												
63.	**Strawberry**												
64.	**Dalimb**												
65.	**Chinch**												
66.	**Pea**												

ANNEXURE1 HONEY BEE FLORA OF BARAMATI

1. Agricultural crops

A. Vegetables

S. No.	Botanical name	Vernacular name	Family	Flowering season	Utility to Honeybees	
1	*Coriandrum sativum*	Coriander	Apiaceae	Yearly	P	N
2	*Cucurbita maxima*	Winter squash	Cucurbitaceae	Sept- Oct	P	N
3	*Allium cepa*	Onion	Liliaceae	Dec-Feb, Mar- May		N
4	*Pisum sativum*	Peas	Fabaceae	Sept-Oct	P	N
5	*Raphanus sativus*	Muli	Brassicaceae	Yearly	P	N
6	*Brassica oleracea*	Cabbage	Brassicaceae	Jan-Apr	P	N
7	*Logenaria siceraria*	Bottle gourd	Cucurbitaceae	Yearly	P	N
8	*Lycopersicon esculentum*	Tomato	Solanaceae	Yearly	P	
9	*Cucumis sativus*	Kakadi	Cucurbitaceae	Yearly	P	N
10	*Solanum melongena*	Brinjal	Solanaceae	Yearly	P	

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11	*Luffa cylindrical*	Sponge gourd	Cucurbitaceae	Yearly	P	N
12	*Moringa oleifera*	Shevga	Papillionaceae	Apr		N
13	*Vicia faba*	Double bean	Leguminoseae	Sept-Oct	P	N
14	*Allium sativum*	Garlic	Liliaceae	Aug-Sept	P	N
15	*Momordica charantia*	Karle	Cucurbitaceae	Sept-Oct	P	N
16	*Amaranthus*	Kate math	Amarantha ceae	Sept-Oct	P	
17	*Trigonella foenum*	Methi	Fabaceae	Jan- Apr	P	N
18	*Abelmoschus esculentus*	Bhendi	Malvaceae	Sept-Oct	P	
19	*Spinacia oleracea*	Spinach	Chenopodiaceae	Yearly	P	
20	*Daucus carota*	Gajar	Umbelliferae	Aug-Sept		N
21	*Beta vulgaris*	Sugarbeet	Chenopodiaceae	Sept-Oct	P	
22	*Brassica campestris*	Mohari	Brassicaceae	Apr-May	N	P
23	*Amaranthus caudatus*	Rajgira	Amarantha ceae	Jan-Mar	P	
24	*Phaseolus lunatus*	Double bean	Fabaceae	Sept-Oct	P	N
25	*Cucumis sativa*	Cucumber	Cucurbitaceae	June-July	P	N

B. Cereals and Millets

S. No.	Botanical name	Vernacular name	Family	Flowering season	Utility to Honeybees	
1	*Zea mays*	Makka	Poaceae	Yearly	P	
2	*Sorghum vulgare*	Jowar	Poaceae	Feb-Mar	P	
3	*Helianthus annus*	Sunflower	Asteraceae	Yearly	P	N
4	*Glycine max*	Soyabean	Leguminoseae	July –Oct		N

C. Legumes and Nuts

S. No.	Botanical name	Vernacular name	Family	Flowering Season	Utility to Honeybees	
1	*Cajanus cajan*	Tur	Fabaceae	Sept-Oct	P	
2	*Phaseolus aureus*	Moong	Fabaceae	Sept-Oct	P	
3	*Lens culinaris*	Masoor	Fabaceae	Sept-Oct	P	N
4	*Cocos nucifera*	Coconut	Arecfaceae	Yearly	P	

D.Fruit Plants

S. No.	Botanical name	Vernacular name	Family	Flowering Season	Utility to Honeybees	
1	*Musa paradisiaca*	Banana	Musaceae	Yearly	P	
2	*Mangifera indica*	Mango	Anacardiaceae	Apr-May	P	
3	*Psidium guajava*	Guava	Myrtaceae	Yearly	P	N
4	*Vitis vinifera*	Grapes	Vitaceae	Dec-Jan		N
5	*Citrus sinensis*	Sweet orange	Rutaceae	Feb-Mar	P	N
6	*Citrus lemon*	Lemon	Rutaceae	Feb-Mar	P	N
7	*Citrus reticulate*	Santra	Rutaceae	Feb-Mar	P	N
7	*Syzygium cumini*	Jamun	Myrtaceae	Apr-May	P	N

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8	*Punica granatum*	Dalimb	Punicaceae	Feb-Apr	P	N
9	*Tamarindus indica*	Tamarind	Caesalpinc aea	Apr-July	P	N
10	*Fragaria spp.*	Strawberry	Rosaceae	May-June	N	P
11	*Zizyphus mauritiana*	Bor	Rhamnacea e	May-June	N	P

2. Forest and Avenue trees

S. No.	Botanical name	Vernacular name	Family	Flowering Season	Utility to Honeybees	
1	*Eucalyptus spp*	Nilgiri	Myrtaceae	Jan-Feb	P	N
2	*Terminellia arjuna*	Hirada	Combretac eae	Apr-May	P	N
3	*Cassia fistula*	Bahava	Caesalpina ceae	Apr-May	P	
4	*Azadirachta indica*	Neem	Meliaceae	Apr	P	N
5	*Pogamia pinnata*	Karanj	Fabaceae	Mar-Apr	P	N
6	*Bombax ceiba*	Red silk cotton	Bombacace ae	Apr-May	P	N
7	*Albizia lebeck*	Shirish	Mimosacea e	Apr-May	P	N
8	*Grevillea robusta*	Silverboak	Proteaceae	Oct-Nov		N
9	*Hevea brasilensis*	Rubber	Euphorbiac eae	Aug-Oct	N	
10	*Delonix regia*	Gulmohar	Caesalpina ceae	Apr-May	P	N
11	*Anthocephalus cadamba*	Kadamb	Rubiaceae	Jan-Mar	P	N
12	*Acacia niloctica*	Subabul	Mimosacea e	Apr-Aug	P	N
13	*Madhuca indica*	Moha	Sapotaceae	Mar-Apr	P	N
14	*Sesbania sesban*	Shevari	Fabaceae	Jan-Feb	P	N
15	*Mimusops elangi*	Bakul	Sapotaceae	Oct-Nov	P	N
16	*Jatropha curcas*	Jatropha	Euphorbiac eae	May-Sept	P	N
17	*Acacia catechu*	Khair	Mimosacea e	Oct-Nov	P	N
18	*Aegle marmelos*	Bael	Rutaceae	Dec-Jan	P	N
19	*Emblica officinalis*	Amla	Mimosacea e	Mar-May	P	N
20	*Santalum album*	Chandan	Santalaceae	Oct-Nov	P	N
21	*Casurina equisetifolia*	Casurina	Casurinace ae	Sept	P	N
22	*Gliricidia sepium*	Giripushpa	Boraginace ae	Dec-Feb	P	N
23	*Butea monosperma*	Palas or Flame of forest	Fabaceae	Apr-May	P	N
24	*Pithecellobium dulce*	Vilayati chinch	Fabaceae	Mar-Oct	P	N
25	*Jaccaranda mimosifolia*	Neelmohar	Bignoniaca e	Oct-May	P	N
26	*Callistemon citrinus*	Bottlebrush	Myrtaceae	Mar-Apr, Sept-Oct	P	N

3. Ornamental plants

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S. No.	Botanical name	Vernacular name	Family	Flowering Season	Utility to Honeybees	
1	*Cosmos*	Cosmos	Asteraceae	Mar-May	P	N
2	*Calendula officinalis*	Calendula	Asteraceae	Mar-May	P	
3	*Aegeratum conyzoides*	Aegeratum	Asteraceae	Annual	P	
4	*Celosia*	Celosia	Amaranthaceae	Annual		N
5	*Ocimum sanctum*	Tulasi	Lamiaceae	Jan-Feb	P	N
6	*Ocimum basilicum*	Sabja	Lamiaceae	June-July	P	N
7	*Duranta*	Duranta	Verbenaceae	June-July	P	N
8	*Adhatoda vasica*	Adhulsa	Acanthaceae	Annual		N
9	*Vitex negundo*	Nirgudi	Verbenaceae	Nov-Dec	P	N
10	*Rosa indica*	Roses	Rosaceae	June-Sept	P	
11	*Asparagus officinalis*	Shatavari	Liliaceae	May-June	P	
12	*Aster spp.*	Aster	Asteraceae	Sept	P	N
13	*Bauhinia purpurea*	Kanchan	Leguminosae	Dec-Mar	P	N
14	*Caryota urens*	Fish tail palm	Arecaceae	Through out year	P	N
15	*Hibiscus rosasinensis*	Jaswand	Malvaceae			
16	*Chrysanthemum segetum*	Shevanti	Asteraceae	Aug-Sept	P	N
17	***Hamelia patens***	Fire bush	Rubiaceae	Apr-Nov	P	N
18	***Cuphea hyssopifolia***	Cuphea	Lythraceae	Jan-Dec	P	N
19	*Mussaenda roxburghii*	Mussaenda	Rubiaceae	May-Aug	P	N
20	***Wedelia chinensis***	Wedelia	Asteraceae	Jan-Dec	P	N
21	*Polyatnhes*	Tuberose				

4. Weeds

S. No.	Botanical name	Vernacular name	Family	Flowering Season	Utility to Honeybees	
1	*Commelina*	Kenna	Lamiaceae	Sept-Oct	P	N
2	*Tridax procumbens*	Ekdandi	Asteraceae	Yearly	P	
3	*Vernonia cinerea*	Vernonia	Asteraceae	Mar-Apr	P	
4	*Boerrhavia diffusa*	Punarnava	Nyctaginaceae	June-July	P	
5	***Lantana camara***	Tanatani	Verbenaceae	Jan-Dec	P	N

5. Medicinal plants

S. No.	Botanical name	Vernacular name	Family	Flowering Season	Utility to Honeybees	
1	Bixa orellana	Bixa	Bixaceae	Apr-May	P	N
2	Strychnos nuxvomica	Kajara/ Kuchala	Loganiaceae	Sept-Nov	P	N
3	Ocimum sanctum	Tulasi	Lamiaceae	July-Sept	P	N
4	Cinnamomum cassia	Pink peeper	Lauraceae			

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