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Diversity of nectariferous and polliniferous bee flora of Bundelkhand

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Abstract

The survey of bee foraging angiosperm which provide floral rewards *viz.* nectar and pollen or both were recorded incessantly by workers. To identify the nectariferous, polliniferous bee flora and lean period, survey were conducted in Bundelkhand for two years (2020 and 2021). The 40 foraging plants of honey bees were recorded in Bundelkhand. The identified flora was further divided into nectariferous, poliniferous and both pollen and nectar producing bees; flora. The maximum bees' flora blooms were observed during March whereas minimum bee's flora blooms were observed during August. Hence, honey flow period was determined from November to February and lean period was determined April to September in Bundelkhand. The eleven bees' foraging plants identified which provide floral rewards and their promotion may overcome from lean period and make colony strong ensued enhance the productivity of beehive produces. December to February months were identified as honey flow period.

Keywords: Diversity, honey bees, bee' flora, lean period

Introduction

Apiculture is a promising venture for peasantry of Bundelkhand. Honey bees and pollinators have a mutual symbiotic relationship with their flora. Bees' flora is food source for sustaining beekeeping. Honey bees collect nectar from the nectary gland of flower and after processing convert in to honey. The honey bees visit on flowers to gather floral rewards as food; nectar and pollen. Generally, high volume of nectar with high sugar concentration ideal preference of honey bees in their foraging ranges to avoid loss of extra energy and time both. All angiosperm species do not provide same amount and quality of food source for apiculture. Some flora produces plenty of nectar and pollen both. However, some flora produces plenty of nectar but little or no pollen and they are called nectariferous flora. Some floras produce plenty of pollen but only trace amount or no nectar are known as polliniferous flora. In order to flourish and enhance the beehive produce, rich nectariferous and poliniferous bee flora must be prevailing in vicinity of apiary. Angiosperm and their blooming period differ from place to place due to variation in topography, climate condition and other cultural practices (Harugade and Chaphalkar, 2013) [4]. The beekeepers migrate honeybee colonies in such area where adequate number and density of bee flora exists throughout the year, within the economical flight range of honeybee. The importance of flora for apiculture has been recorded worldwide as well as our country; the directory of world honey sources (Crane *et al.*, 1984) [3]. The delve on type of flora, density of flora and quality of flora and their floral rewards in a niche are prerequisites for successful apiculture. Numerous workers recorded the various aspects of botanical sciences, with special emphasis on anthecology, taxonomy, and palynology (Muttoo, 1941) [10].

The lean period refers to that time when honey bees suffer from insufficiency of floral rewards; nectar and pollen due to unavailability of nectariferous and polliniferous angiosperm. The blooming period of honey bee flora species differs from niche to niche due to variation in topography and climate. Bee floras and their pollinators are greatly affected by abiotic factors (Kearns and Inouye 1993) [7]. The information about bees' flora of the vicinity of apiary is a key for successful apiculture and play vital role to make lucrative entrepreneurial venture. Every niche has its own bees' flora, honey flow period and lean periods. The compilations of bee-flora are still far from complete and these studies have been neglected. Hence, present study was conducted to detect the existing honeybee-flora resources and make floral calendar of Bundelkhand.

Methodology

A incessant survey was carried out from Jan 2020 to December 2021 to identify prevailing honeybee flora endowing nectar and pollen to honey bees and their flowering period. The survey was completed in Bundelkhand, Uttar Pradesh which is situated at an altitude of situated at 24.8773° N, 79.0193° E longitude. The visual observations of honey bee foraging were observed based on forging attributes viz. collection of nectar or pollen or both from flowers by honey bees. The observations were recorded at weekly interval in each year from January to December. The data observations were recorded as per visual observation, especially on those plants' blooming periods which were visited by honey bees.

The honey bees floras were categorized in to nectariferous flora or polliniferous flora or both nectariferous and polliniferous flora. The worker honey bees seat calmly on the flower and insert their labium thereafter collect nectar by virtue of lapping from nectary glands of the flower was classified as nectariferous flora. Most of the bee flora were recorded as rich source of pollen. On such flowers the honey bees become hyperactive during collecting pollen. Thereafter, the volume of nectar and pollen produced were visually observed and categorized in three categories; N1, N2, N3, P1, P2 and P3 as per volume of nectar secretion, pollen produce anthers of flowers.

Table 1: Nectariferous and Polliniferous flora of Bundelkhand

S. No.	Common name	Scientific name	Blooming period (2020-2021)	Polliniferous	Nectariferous	<i>Apis dorsata</i>	<i>Apis mellifera</i>	<i>Apis cerana</i>	<i>Apis florea</i>
1	Aonla	<i>Emblica officinalis</i>	March-April	P1	N1	Yes	Yes	Yes	Yes
2	Ash Gourd	<i>Benincasa hispida</i>	Oct-Nov	P1	N1				Yes
3	Ban Tulsi	<i>Ocimum gratissimum</i>	Sept-Oct		N2	Yes	Yes	Yes	
4	Bel	<i>Aegle marmelos</i>	May	P1	N1				Yes
5	Babul	<i>Acacia nilotica</i>	May	P1	N1	Yes	Yes	Yes	Yes
6	Ber	<i>Ziziphus mauritiana</i>	Oct	P1	N1				Yes
7	Berseem	<i>Trifolium alexandrinum</i>	April	P1	N1	Yes	Yes		
8	Bitter gourd	<i>Momordica charanta</i>	March-Sept	P1	N1				Yes
9	Blanket Flower	<i>Gaillardia aristata</i>	Jan-Dec		N1	Yes	Yes	Yes	Yes
10	Bottle brush	<i>Callistemon lanceolatus</i>	Jan-March	P1	N1	Yes	Yes	Yes	Yes
11	Copperpod	<i>Peltophorum pterocarpum</i>	May-June	P1	N1	Yes	Yes	Yes	Yes
12	Coriander	<i>Coriandrum sativum</i>	Jan-Feb	P1	N1	Yes	Yes	Yes	Yes
13	Cucumber	<i>Cucumis sativus</i>	March-April	P1	N1				Yes
14	Drum stick	<i>Moringa oleifera</i>	March	P1	N1	Yes	Yes	Yes	Yes
15	Eucalyptus	<i>Eucalyptus spp.</i>	Dec-Feb		N1	Yes	Yes	Yes	Yes
16	Guava	<i>Psidium guajava</i>	May-June	P1		Yes	Yes		
17	Indian Neem	<i>Azadirachta indica</i>	March-May		N1				Yes
18	Jamun	<i>Syzygium cumini</i>	Feb	P2	N1	Yes	Yes	Yes	Yes
19	Jhar Ber	<i>Ziziphus nummularia</i>	May	P1	N1				Yes
20	Kaitha	<i>Rutaceae</i>	May	P1	N1				Yes
21	Kanphuli	<i>Tridax procumbens</i>	March-May	P1	N1	Yes	Yes	Yes	Yes
22	Karanj	<i>Pongamia pinnata</i>	May-June	P1	N2	Yes	Yes	Yes	Yes
23	Lemon	<i>Citrus spp.</i>	March-April	P1	N1	Yes	Yes	Yes	Yes
24	Maize	<i>Zea maize</i>	May-June	P2		Yes	Yes	Yes	Yes
25	Molshree	<i>Mimusops elengi</i>	May-July	P1	N1	Yes	Yes	Yes	Yes
26	Mulberry	<i>Morus serrata</i>	April-May	P1	N1				Yes
27	Mustard	<i>Brassica rapa</i>	November	P2	N3	Yes	Yes	Yes	Yes
28	Mustard	<i>Brassica juncea</i>	December-Jan	P2	N3	Yes	Yes	Yes	Yes
29	Mustard	<i>Brassica napus</i>	Jan-Feb	P2	N2	Yes	Yes	Yes	Yes
30	Palas	<i>Butea monosperma</i>	March-April		N3	Yes	Yes	Yes	Yes
31	Onion	<i>Allium cepa</i>	Dec-Jan	P1	N1	Yes	Yes	Yes	Yes
32	Rice	<i>Oryza sativa</i>	Sept-Oct	P1			Yes	Yes	Yes
33	Sesamum	<i>Sesamum orientale</i>	May-June		N1		Yes		Yes
34	Sorghum	<i>Sorghum bicolor</i>	Sept to Oct	P2		Yes	Yes	Yes	Yes
35	Shisham	<i>Dalbergia sissoo</i>	April-May		N1		Yes	Yes	Yes
36	Sweat orange	<i>Citrus sinensis</i>	March	P1	N1	Yes	Yes	Yes	Yes
37	Sunflower	<i>Helianthus annuus</i>	May to Jun, Oct to Nov	P1	N1	Yes	Yes	Yes	Yes
38	Tulsi	<i>Ocimum basilicum</i>	Oct-Nov		N2	Yes	Yes	Yes	Yes
39	Tulsi	<i>Ocimum sanctum</i>	Oct-Nov		N2	Yes	Yes	Yes	Yes
40	Watermelon	<i>Citrullus lanatus</i>	March-April	P1	N1	Yes	Yes	Yes	Yes

P1- rich pollen source, P2- average pollen source, P3- poor pollen source

N1- rich nectar source, N2- average nectar source, N3- poor pollen source

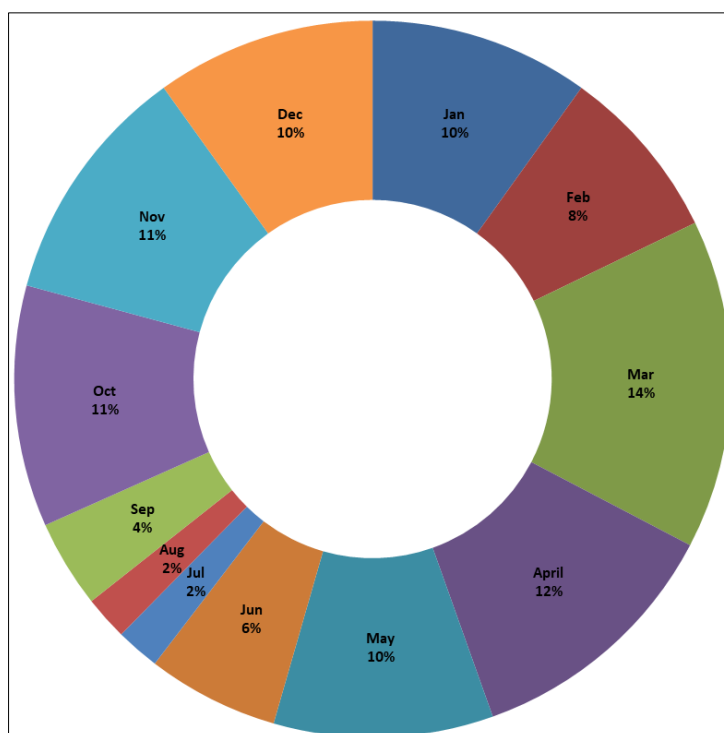


Fig 1: Month wise number of Bee flora

Results and Discussion

Nectariferous and polliniferous bee flora

The honey bees visited on 40 bee flora species and collected nectar or pollen or both from their flowers were observed from January to December 2020 and 21 presented (Table 1). Among these, honey bees were collected only nectar from 6 floras; *Ocimum gratissimum*, *Eucalyptus* spp., *Butea monosperma*, *Sesamum orientale*, *Ocimum basilicum* and *Ocimum sanctum* and categorized as nectariferous flora. Whereas bees collected only pollen from 5 floras; *Gaillardia aristata*, *Psidium guajava*, *Zea maize* and *Oryza sativa* and *Sorghum bicolor* and categorized as polliniferous flora. Both nectar and pollen were collected by honey bees from 29 floras were categorized nectariferous and polliniferous flora. The monthly per cent abundance of bee flora were 10, 8, 15, 12, 10, 6, 2, 2, 4, 11, 11 and 10 during January, February, March, April, May, June, July, August, September, October, November and December respectively presented (Fig. 1). The data reveals that the maximum blooming of honey bees flora was recorded during January, 2020 to May, 2020 and October, 2020 to December, 2020 therefore, this period considered as honey flow period. The minimum blooming of bee flora was recorded during June, 2020 to September, 2020, therefore, this period considered as lean period. The similar results was observed in 2021.

The honey flow period in Bundelkhand was recorded during November to February, due to availability of dense nectariferous and polliniferous with maximum floral rewards with favorable climatic condition. This result corroborate by Akum *et al.* (2012) [2]. Similar blooming period of bee flora viz. *Peltophorum* spp., *Eucalyptus* spp. and *Mimosa pudica* (Kalpana *et al.* 1997) [5]; *Citrus sinensis*, *Abelmoschus esculentus*, *Ageratum conyzoides*, *Cucumis* spp., *Eucalyptus* spp., *Litchi sinensis*, *Prunus* spp. and *Rosa macrophylla* (Noor *et al.* 2009) [11]; *Litchi chinensis* by Kitroo and Abrol (1996) [8] also reported. Our result of lean period corroborated by Waykar and Baviskar 2015 [15] stated that lean period

reported; Mid-May to mid-August and Adhikari and Ranabhat, 2011 [1] reported lean period from June to July in Nepal.

Key bees' flora

The key bees' flora determined based on the productivity of nectar and pollen of the flora. The lean period determined based on scarcity of bee flora and honey flow period determined based on density and production of floral rewards for honey bees and climatic condition. The eleven key bees' flora (*Ocimum gratissimum*, *Peltophorum pterocarpum*, *Moringa oleifera*, *Syzygium cumini*, *Tridax procumbens*, *Pongamia pinnata*, *Zea maize*, *Butea monosperma*, *Sesamum orientale*, *Dalbergia sissoo*, *Citrus sinensis*, *Helianthus annuus*) were identified for over come from lean period and enhance the beehive produces' productivity presented (Table 1). All these plants were provided maximum floral rewards; nectar or pollen or both nectar and pollen to honey bees. Another side they were also provided fruits, vegetables, food grains, forest wood and aesthetic values. In the observation, more foraging competition was observed between population and community of bees on these plant species.

The competition on guilds between population and communities of bees might be due scarcity of bees' flora in the niche or provide high floral rewards to the bees. This result corroborated with the result of Adhikari and Ranabhat, 2011 [1], key bees flora; *Citrus* spp., *Eucalyptus* sp. recorded as major source of nectar and pollen. Kumari, P.K. 2004 [9] reported *Peltophorum* spp., *Tamrindus indica*, *Eucalyptus* spp. *Citrus* spp. were key bee flora.

The Bundelkhand endowed with diverse flora; 40 floras of honey bees with various blooming period show inordinate potentials for apiculture. Our result concluded based on blooming period of bees' flora, honey flow period determined month of January to February and November to December whereas lean period April to September. The eleven key bees' flora were identified. Promotion, augmentation and

conservation of these bee flora may overcome from lean period and enhance the productivity of beehive produces. Therefore, month of January to February and November to December were determined as appropriate time for honey and pollen harvesting.

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References

1. Adhikari S, Ranabhat NB. Bee flora in mid hills of Central Nepal. *Botanica Orientalis - Journal of Plant Science*. 2011;8:45-56.
2. Akum Z, Singh HK, Seyie K, Singh AK. Biometrics and forage studies on stingless bees in Nagaland. *Indian Journal of entomology*. 2012;74(4):343-347.
3. Crane E, Walker P, Day R. Directory of important world honey sources. IBRA Publication, London; c1984.
4. Harugade S, Chaphalkar S. Floristic studies with reference to Honey bees of Baramati, Pune District. *International Journal of Advancements in Research & Technology*. 2013;2(8):178-187.
5. Kalpana TP, Ramanujan CGK. Melittopalynology bee plants and beekeeping potential in some coastal districts of Andhra Pradesh, India. *Indian Bee journal*. 1997;59(1):1-8.
6. Kaur G, Sihag RC. Bee flora of India: A review. *Indian Bee journal*. 1994;56:105-126.
7. Kearns CA, Inouye DW. Techniques for Pollination Biologists. University Press of Colorado, Niwot, Colorado, USA; c1993.
8. Kitroo A, Abrol DP. Studies on pollen carrying capacity and pollination efficiency of honey bees visiting litchi flowers. *Indian Bee journal*. 1996;58(2):55-57.
9. Kumari PK. Floral resources of honeybee plant species at Visakhapatnam, Andhra Pradesh, India. *Korean Journal of Apiculture*. 2004;19(1):43-50.
10. Muttoo RN. Bee flora of Jeolikote, *Indian Bee Journal*. 1941;8:77-78.
11. Noor MJ, Khan MA, Camphor ES. Palynological analysis of pollen loads from pollen sources of honeybees in Islamabad, Pakistan. *Pakistan Journal of Botany*. 2009;41(2):445-450.
12. Partap U. Bee flora of the Hindu Kush- Himalayas: Inventory and management. ICIMOD, Kathmandu, Nepal; c1997.
13. Roubik DW. Stingless bee nesting biology, *Apidologie*, 2006;37:124-143. DOI: 10.1051/apido:2006026
14. Verma LR. Beekeeping in integrated mountain development: Economic and scientific perspective. Oxford and IBH Publishing, New Delhi; c1990.
15. Waykar B, Baviskar RK. Diversity of bee foraging flora and floral calendar of Paithan taluka of Aurangabad district (Maharashtra), India. *Journal of Applied Horticulture*. 2015;17(2):155-159.