International Journal of Plant & Soil Science

Volume 35, Issue 19, Page 1008-1014, 2023; Article no.IJPSS.104776
ISSN: 2320-7035

Studies on the Bee Flora's Availability for *Apis cerana indica* in the Kashmir Valley during Spring Season

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2023/v35i193637

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/104776

Original Research Article

Received: 18/06/2023
Accepted: 26/08/2023
Published: 30/08/2023

ABSTRACT

The present study was carried out to investigate the diversity of nectariferous and polleniferous bee flora and to create a floral calendar for Harwan, Srinagar in 2021-2022. The number of flowering plants in and around the apiary; and the foraging behaviors of honeybees were noted. A total of 44 bee flora species in and around the apiary were foraged by *Apis cerana*, out of which 34 bee flora species were identified as sources of both pollen and nectar, 5 species as sources of pollen and 5 species as a source of nectar. The Bee flora identified included 44 species, out of which 17 species were wild plants and the remaining species were cultivated for different purposes: floriculture (11 species), agriculture (1), horticulture (10) and social forestry (1). The maximum number of bee flora

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species was recorded in April followed by May and the lowest in March. The honey flow season normally persists up to the end of May, therefore artificial feeding should be provided to get maximum advantage of the forthcoming floral rich season.

Keywords: Apis cerana indica; bee flora; spring; Kashmir.

1. INTRODUCTION

Jammu and Kashmir, owing to its varied agro-climatic conditions, has a variety of bee forage sources which provide the basis for the development of beekeeping industry. A thorough knowledge and understanding of honeybee foraging behavior and floral sources is vital for beekeeping management Dalio [1]. Nectar and pollen plants are crucial for beekeeping and honey production; the bee forage calendar is one of the most useful tools in the sector of apicultural operations and demands a comprehensive understanding of seasonal variations in an area's floral patterns, bee foraging behavior, and how honeybee colonies interact with their floral surroundings (Kumar *et al.* [2] and Hosmani et al. [3]). The present studies were planned to determine whether the study area was ideal for beekeeping; identifying dearth periods of food scarcity that could be countered by appropriate feeding or bee colony movement and migration to forage-rich areas. Knowledge of bee flora will aid in increased availability of nectar and pollen to native honeybees and the protection of these insect pollinators in an area that will help in species identification, agricultural maintenance, beekeeping practices, industries and biodiversity conservation (Lobreau-Callen and Damblon, [4].

2. MATERIALS AND METHODS

Random surveys, sampling and field observations were done for the identification of important pollen and nectar sources of *Apis cerana* in the experimental area. The identified bee flora was grouped into pollen, nectar and both pollen and nectar producing plants and were noted for their botanical name, common names in English and flowering period. The type of foraging plant viz. pollen and nectar producing plants was recognized on the basis of bee flora plants visited by *A. cerana* bees. If the bee stayed at the base of the petal and pierced its proboscis towards it, the plant was categorized as the nectar producing (at the base of petals, glands called nectaries are present which secrete nectar). If the bee roamed near the anthers in different patterns, the plant was categorized as a pollen-producing plant. When both the foraging behavior of insect visitors was observed for the flowers of a particular plant, they were categorized as pollen-nectar-producing plant (Ara et al., [5]; Hosamani et al.,[3] & [6]). Floral specimens were recorded and identified by taxonomic experts at the Division of Environmental Science, SKUAST-K Shalimar.

3. RESULTS AND DISCUSSION

The floral sources at and around the apiary site maintained at Harwan area, in the vicinity of the University campus, were surveyed during the spring seasons of 2021 and 2022. The available bee flora was identified by the taxonomic experts at the Division of Environmental Science, SKUAST-Kashmir, and was categorized either as pollen or nectar sources or both nectar and pollen sources. The bee flora identified (Table 1) included 44 species, out of which 17 were wild plants and the remaining species were cultivated for different purposes: floriculture (11 species), agriculture (1), horticulture (10) and social forestry (1). The results further revealed that out of the total number of 44 plant species belonging to 18 families identified in the vicinity of bee colonies at village Harwan, 34 species were identified as sources of both pollen and nectar, 5 species as sources of only pollen and 5 species as sources of only nectar (Table 1).

The families Fabaceae and Asteraceae were represented by 05 species of bee flora each and had a collective share of 12 per cent. The family Rosaceae was represented by 12 species and had a share of 27 per cent in the total bee floral composition. The families Liliaceae, Papavaraceae, Alliaceae, Oleaceae had a share of 6 per cent and were represented by 2 species each. Scrophulariaceae, Caryophyllaceae, Colchicaceae, Violaceae, Brassicaceae, Sapindaceae, Asparagaceae, Paulowinaceae, Punicaceae, Solanaceae had a share of 2 per cent and were represented by 1 species each (Fig. 1).

Table 1. List of pollen and nectar plants for *Apis cerana indica*

Sl. No.	Common name	Scientific name	Family	Period of bloom	Utility to honeybee
1	Lily of the Field	*Sternbergia lutea*	Liliaceae	Feb, March	*PN
2	Persian speedwell	*Veronica persica*	Scrophulariaceae	Feb, March	PN
3	Chickweed	*Stellaria media*	Caryophyllaceae	March	PN
4	Poet's daffodil	*Narcissus poeticus*	Liliaceae	March	PN
5	Yellow colchicum	*Colchicum luteum*	Colchicaceae	March	PN
6	Forsythia	*Forsythia sp.*	Oleaceae	March, April	PN
7	Pansy	*Viola tricolor*	Violaceae	March, April	*NC
8	Pot marigold	*Calendula officinalis*	Asteraceae	March, April	PN
9	Mustard	*Brassica compestris*	Brassicaceae	March, April	PN
10	Apricot	*Prunus armeniaca*	Rosaceae	March, April	PN
11	Cherry	*Prunus avium*	Rosaceae	March, April	PN
12	Almond	*Prunus amygdalus*	Rosaceae	March, April	PN
13	Plum	*Prunus domestica*	Rosaceae	March, April	PN
14	Peach	*Prunus persica*	Rosaceae	March, April	PN
15	Pear	*Pyrus communis*	Rosaceae	March, April	PN
16	Apple	*Malus domestica*	Rosaceae	March, April	PN
17	Grape hyacinth	*Muscari armeniacum*	Asparagaceae	March, April	NC
18	Broad bean	*Vicia faba*	Fabaceae	April	NC
19	Empress tree	*Paulownia tomentosa*	Paulowniaceae	April	PN
20	Californian poppy	*Eschscholzia californica*	Papavaraceae	April	NC
21	Juda's tree	*Cercis siliquastrum*	Fabaceae	April	PN
22	Indian horse Chestnut	*Aesculus indica*	Sapindaceae	April	PN
23	Dandelion	*Taraxacum officinale*	Asteraceae	April	PN
24	Jasmine	*Jasminum sp.*	Oleaceae	April	PN
25	Meadow sweets	*Spiria sp.*	Rosaceae	April	PN
26	Wild rose	*Rosa webbiana*	Rosaceae	April	PN
27	Himalayan Musk rose	*Rosa brunonii*	Rosaceae	April	PN
28	Red Clover	*Trifolium pratense*	Fabaceae	April, May	PN
29	White Clover	*Trifolium repens*	Fabaceae	April, May	PN
30	Black Locust	*Robinia pseudoacacia*	Fabaceae	April, May	PN
31	Himalayan thyme	*Thymus linearis*	Lamiaceae	April, May	NC
32	Salvia	*Salvia moorcroftiana*	Lamiaceae	April, May	PN
33	Rubus	*Rubus antennifer*	Rosaceae	May	PN
34	Pomegranate	*Punica granatum*	Punicaceae	May	PN
35	Onion	*Allium cepa*	Alliaceae	May	PL
36	Potato	*Solanum tuberosum*	Solanaceae	May	PN
37	Cornflower	*Cichorium intybus*	Asteraceae	May	PL
38	Sticking chamomile	*Anthemis cotula*	Asteraceae	May	PL
39	Garlic	*Allium sativum*	Alliaceae	May	PL
40	Rose	*Rosa sp.*	Rosaceae	May	PN
41	Indian barberry	*Berberis lycium*	Chenopodiaceae	May	PN
42	Opium poppy	*Papaver somniferum*	Papavaraceae	May	PN
43	Lavender	*Lavandula officinalis*	Lamiaceae	May	*PL
44	Scottish Thistle	*Onopordum acanthium*	Asteraceae	May	PN

PL=Pollen; NC= Nectar; PN=Pollen and nectar

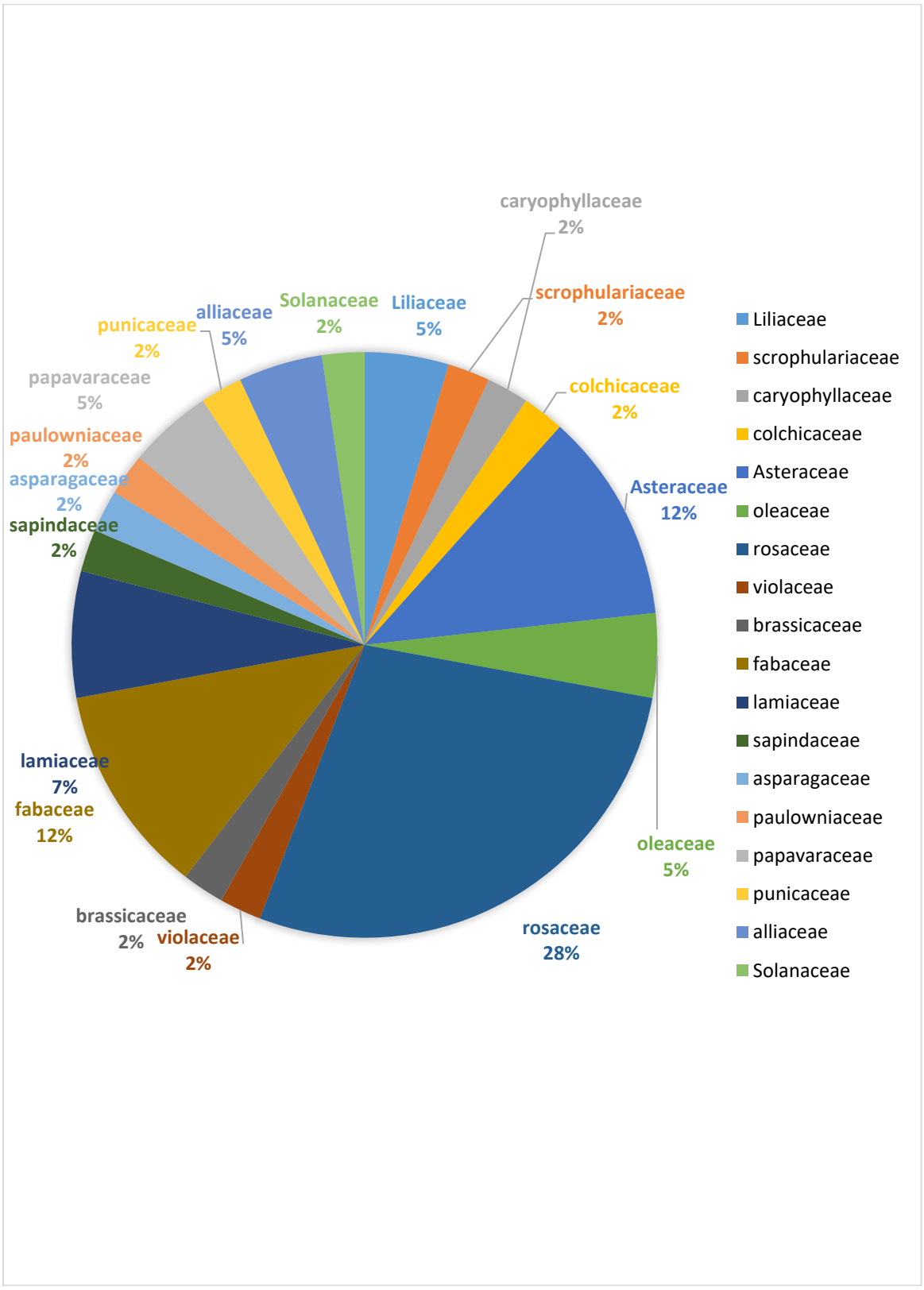

Fig. 1. Pie diagram representing per cent share of different bee floral plant families

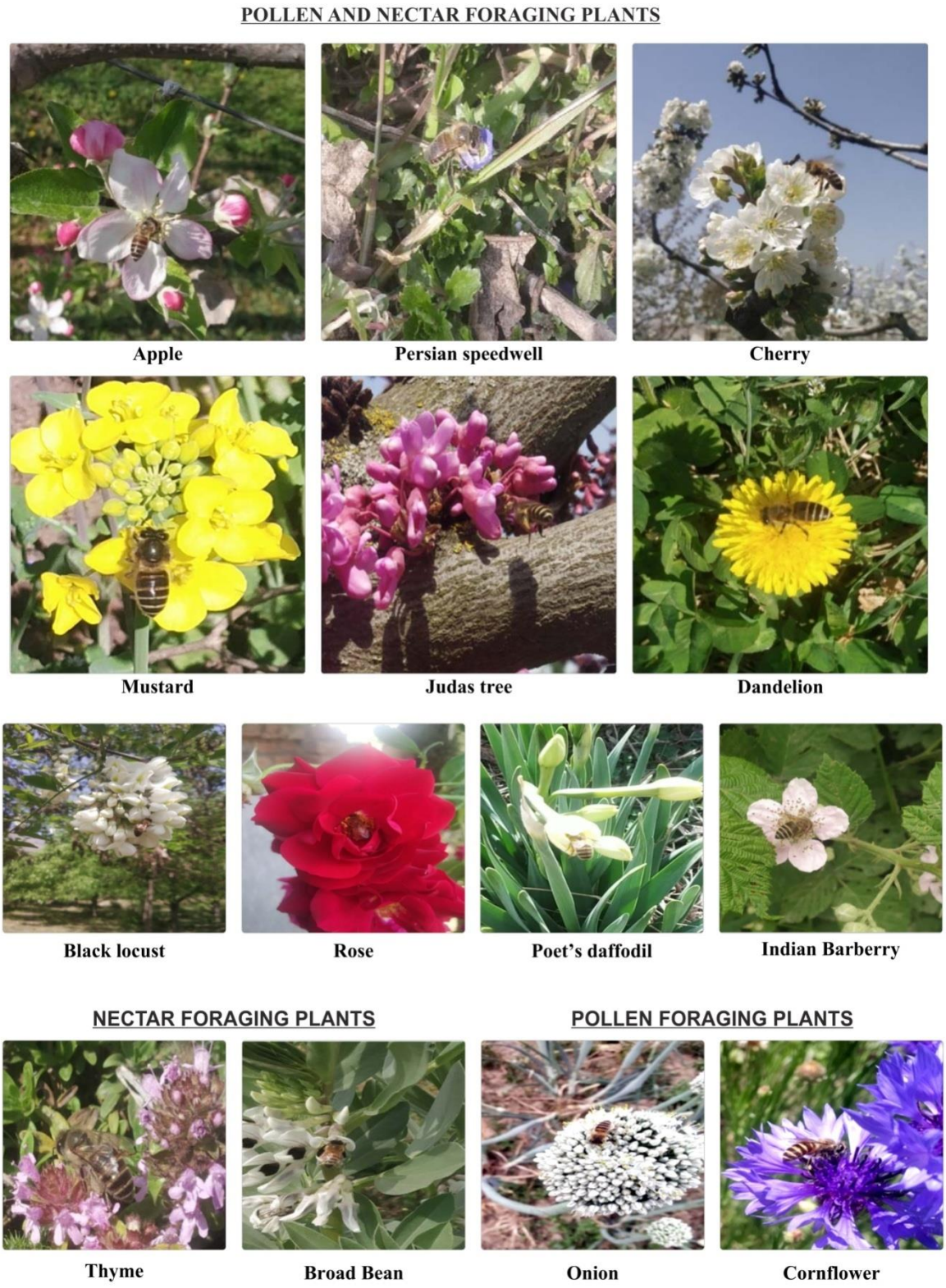

Fig. 2. Blooming of the flower plants during spring season

The bee floral plants bloomed as early as the end of February, with the onset of the early spring season (Fig. 2). The floral species blooming in February were *Sternbergia lutea, Veronica persica*; whereas, the species blooming in March were *Stellaria media, Narcissus poeticus, Colchicum luteum, Forsythia* sp*., Viola tricolor, Calendula officinalis, Brassica compestris, Prunus armeniaca, Prunus avium, Prunus amygdalus, Prunus domestica, Prunus persica, Pyrus communis, Malus domestica and Muscari armeniacum.* However, the species that bloomed in the month of April were *Taraxacum officinale Jasminum* sp*., Spiria* sp*., Rosa webbiana, Rosa brunonii Trifolium pretense, Trifolium repens, Robinia pseudoacacia, Thymus linearis, Aesculus indica, Cercis siliquastrum, Viciafaba, Paulownia tomentosa, Eschscholzia californica, Salvia moorcroftiana.* The species blooming in the month of May were *Punica granatum, Allium cepa, Solanum tuberosum, Cichorium intybus, Anthemis cotula, Allium sativum, Rosa sp.* and *Rubus antennifer.* The identification of novel floral species that support native insect pollinator populations is crucial because these plant species can be utilised to reproduce, develop, and conserve these native insect pollinator populations, aiding in the preservation of the native insect pollinators' declining numbers. The present results are corroborated with the findings of Adhikari and Ranabhat [7], Bhalchandraet al. [8], Degaga [9], Rijal et al. [10], Ara et al. [11], Jaiswal et al. [12], Ara et al. [5] and Arifie et al. [13], Kumar et al. [2] who have documented different bee flora from different parts of world and India.

4. CONCLUSION

In Kashmir, during the springtime, the highest number of bee flora species were noted in April, followed by May, and the lowest in March. To take full advantage of the upcoming floral rich season, artificial feeding should be provided as the honey flow season often lasted until the end of May. Apis cerana foraged on a total of 44 species of bee flora in and around the apiary, of which 34 were found to be sources of both pollen and nectar, five to be sources of pollen, and five to be sources of nectar.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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The peer review history for this paper can be accessed here:
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