Original Research Article

Studies on the bee flora's availability for *Apisceranaindica* in the ~~k~~Kashmir ~~v~~Valley during spring season

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*Apiscerana*, out of ~~-~~which 34 bee flora species were identified as ~~a~~ sources of both pollen and nectar, 5 species as ~~a~~ sources of pollen and 5 species as a source of nectar.TheBee 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 (~~0~~1). The maximum ~~number of bee flora species were~~number of bee flora species was recorded in April followed by May and the lowest in March.The honey flow season normally persist~~ed~~ up to the end of May, therefore artificial feeding should be provided to get maximum advantage of the forthcoming floral rich season.

Key Words: *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 [6].Nectar and pollen plants are crucial for beekeeping and honey production; thebee forage calendar is one of the most useful tools in the sector of apicultural operations ~~that~~ 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.* [11] and Hosmani*et al.* [8]).The present studies were planned to determine whether thestudy area was ideal for beekeeping; identifying ~~the~~ 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 biodiversityconservation~~s~~(Lobreau-Callen andDamblon, [12]).

2. Material and Methods

Random surveys, sampling and field observations were donefor the identification of important pollen and nectar sources of *Apiscerana* in the experimental area. The identified bee flora was grouped into pollen, nectar and both pollen and nectar ~~yielding~~ producing plants and were noted for their botanical name, common names in English and ~~their~~ flowering period. ~~.~~The type of foraging plant viz. ~~a 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 ~~as~~ nectaries are present which secrete nectar). If the bee roamed near the anthers in different patterns, the plant ~~were~~ was categorized as a pollen-producing plant~~s~~. 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~~plant ~~.~~ (Ara*et al.*, [3]; Hosamani*et al.*,[8] &[9]).Floral specimens were recorded and identified ~~with~~ bytaxonomic experts at the Division of Environmental Science, SKUAST-K Shalimar.

Comment [H1]: Full name followed by abbreviated name in bracket

3. Results and discussion

The floral sources at and around the apiary site maintained at Harwan area,in the vicinity of the University campus,~~was~~weresurveyed during the spring seasons of 2021 and 2022. The available bee flora was ~~got~~ identified ~~from~~ by thetaxonomic experts at the Division of Environmental Science, SKUAST-Kashmir~~;~~,and ~~were~~ wascategorized 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 ~~species~~ were wild plants and the remaining species were cultivated for different purposes: floriculture (11 species), agriculture (1), horticulture (10) and social forestry (~~0~~1). The results further revealed that out ofthe 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 ~~a~~ sources of only pollen and 5 species as sources of only

nectar (Table 1).

The ~~family~~ families Fabaceae and Asteraceae were represented by 05 species of ~~the~~ bee flora each and had a collective share of 12 percent. 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 percent and were represented by ~~0~~2 species each. Scrophulariaceae, Caryophyllaceae, Colchicaceae, Violaceae, Brassicaceae, Sapindaceae, Asparagaceae, Paulowinaceae, Punicaceae, Solanaceae had a share of 2 percent and were represented by ~~0~~1 species each**(Fig. 1~~.~~)**

The bee floral plants bloomed as early as the end of February, with the onset of the early spring season~~With the onset of early spring season, the bee floral plants bloomed as early as in the ending February~~(Fig. 2). The floral species blooming in February were *Sternbergialutea, Veronica persica*; whereas, the species ~~which bloomed~~blooming in ~~the month of~~ March were *Stellaria media, Narcissus poeticus, Colchicum luteum, Forsythia* sp., *Viola tricolor, Calendula officinalis, Brassica compestris, Prunusarmeniaca, Prunusavium, Prunusamygdalus, Prunusdomestica, Prunuspersica, Pyruscommunis, Malusdomestica and Muscariarmeniacum.* However, the species that bloomed in the month of April were *TaraxacumofficinaleJasminum*sp., *Spiria*sp., *Rosa webbiana, Rosa brunoniiTrifolium pretense, Trifoliumrepens, Robiniapseudoacacia, Thymus linearis, Aesculusindica, Cercissiliquastrum, Viciafaba, Paulownia tomentosa, Eschscholziacalifornica, Salvia moorcroftiana.* The species blooming in the month of May were *Punicagranatum, Allium cepa, Solanumtuberosum, Cichoriumintybus, Anthemiscotula, Allium sativum, Rosa sp.* and *Rubusantennifer.*

The present results are corroborated with the findings of Adhikari and Ranabhat [1], Bhalchandra*et al.* [5],Degaga[7],Rijal*et al.* [13], Ara*et al.* [2] , Jaiswal*et al.* [10],Ara*et al.*[3] and Arifie*et al.* [4], Kumar *et al.* [11] who have documented different bee flora from different parts of world and India.

4. Conclusion

The discovery of new floral species that support native insect pollinator populations is critical because such plant species can be used to reproduce, establish, and conserve these native insect pollinator populations, which will help to maintain the dwindling numbers of native insect pollinators. ~~The present results are corroborated with the findings of Adhikari and Ranabhat [1],~~

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~~Bhalchandra*et al.* [5], Degaga [7], Rijal*et al.* [13], Ara*et al.*[2] , Jaiswal*et al.* [10], Ara*et al.*[3] and Arifie*et al.* [4], Kumar et al . [11] who have documented different bee flora from different parts of world and India.~~

Table 1 List of Pollen and Nectar plants for *ApisCeranaindica*

Sl. No.	Common name	Scientific name	Family	Period of bloom	Utility to honeybee
1	Lily of the Field	*Sternbergialutea*	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	*Prunusarmeniaca*	Rosaceae	March, April	PN
11	Cherry	*Prunusavium*	Rosaceae	March, April	PN
12	Almond	*Prunusamygdalus*	Rosaceae	March, April	PN
13	Plum	*Prunusdomestica*	Rosaceae	March, April	PN
14	Peach	*Prunuspersica*	Rosaceae	March, April	PN
15	Pear	*Pyruscommunis*	Rosaceae	March, April	PN
16	Apple	*Malusdomestica*	Rosaceae	March, April	PN
17	Grape hyacinth	*Muscariarmeniacum*	Asparagaceae	March, April	NC
18	Broad bean	*Viciafaba*	Fabaceae	April	NC
19	Empress tree	*Paulownia tomentosa*	Paulowniaceae	April	PN
20	Californian poppy	*Eschscholziacalifornica*	Papavaraceae	April	NC
21	Juda's tree	*Cercissiliquastrum*	Fabaceae	April	PN
22	Indian horse Chestnut	*Aesculusindica*	Sapindaceae	April	PN
23	Dandelion	*Taraxacumofficinale*	Asteraceae	April	PN

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S. No.	Common name	Scientific name	Family	Period of bloom	Utility to honeybee
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	*Trifoliumpratense*	Fabaceae	April, May	PN
29	White Clover	*Trifoliumrepens*	Fabaceae	April, May	PN
30	Black Locust	*Robiniapseudoacacia*	Fabaceae	April, May	PN
31	Himalayan thyme	*Thymus linearis*	Lamiaceae	April, May	NC
32	Salvia	*Salvia moorcroftiana*	Lamiaceae	April, May	PN
33	Rubus	*Rubusantennifer*	Rosaceae	May	PN
34	Pomegranate	*Punicagranatum*	Punicaceae	May	PN
35	Onion	*Allium cepa*	Alliaceae	May	PL
36	Potato	*Solanumtuberosum*	Solanaceae	May	PN
37	Cornflower	*Cichoriumintybus*	Asteraceae	May	PL
38	Sticking chamomile	*Anthemiscotula*	Asteraceae	May	PL
39	Garlic	*Allium sativum*	Alliaceae	May	PL
40	Rose	*Rosa sp.*	Rosaceae	May	PN
41	Indian barberry	*Berberislycium*	Chenopodiaceae	May	PN
42	Opium poppy	*Papaversomniferum*	Papavaraceae	May	PN
43	Lavender	*Lavandulaofficinalis*	Lamiaceae	May	*PL
44	Scottish Thistle	*Onopordumacanthium*	Asteraceae	May	PN

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

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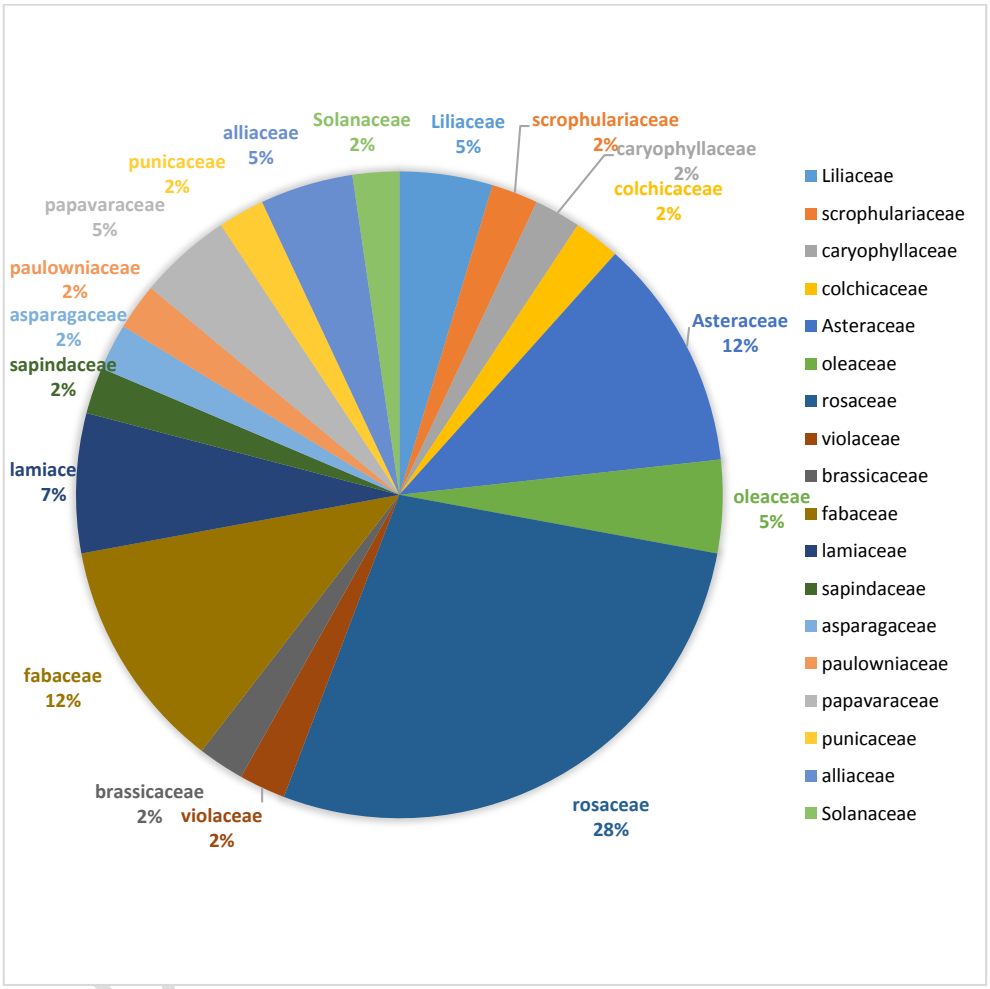

Fig 1:Pie diagram representing per cent share of different bee floral plant families

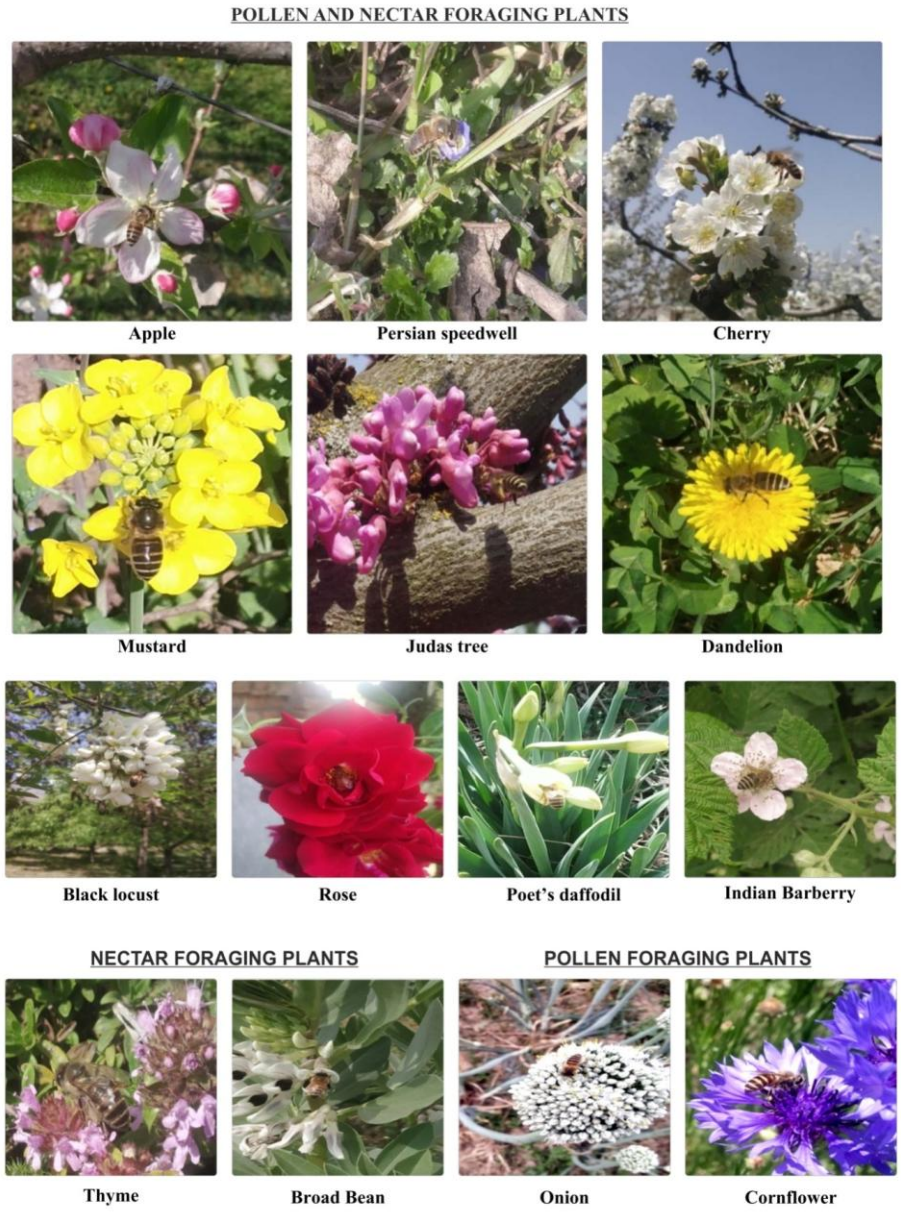

Fig 2 : Blooming of the flower plants during spring season

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