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Pollen Sources of *Apis Dorsata* and *Apis Florea* in Winter Season

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Abstract:
Honey bees visit plants for nectar as a major source of carbohydrate and pollen for protein. The study and identification of pollen present in honey and pollen loads is concerned with the melissopalynology. Total 95 pollen loads collected directly from honey combin winter season from different forest areas in Gadchiroli district, Maharashtra. 47 pollen loads of Apis dorsata and 48 pollen loads of Apis floreawere studied. Cajanus cajan (n=20), Ageratum conyzoids (n=16), Citrus spp(n=8) and Alternanthera sessilis (n=7) were found to be predominant. The study highlights important bee forage sources during winter season.

Keywords: *Nectar, pollen, pollen loads, melissopalynology, Apis dorsata, Apis florea.*

1. Introduction

Pollen is a male reproductive part and a fine powder like material produced by flowering plant. Pollen is the major source of proteins, fat, minerals and vitamins for honeybees Pollen for growth-promoting protein, vitamins, and sugars for energy. The pollen encountered in honey and pollen load constitute the only reliable source of recognition of bee forage plants(Agashe 2006).Honey bees collect pollen from anthers in the flowers by active movements of the legs and proboscis. During this process, pollen gets stick to the hairy legs and body which are deposited in special 'pollen baskets'. These pollen baskets are transferred to the comb cells with their legs and cover this pollen with honey. This granular pollen is called 'pollen loads'. Collected pollen loads by bees for the purpose of feeding its larvae in the early stage of development. It was determined that an average value of 145 mg of pollen is required to rear just one worker bee (Leblank*etal*., 2009).

The two species of *Apis* considered in the present work were- *Apis dorsata* and *Apis florea*. *Apis dorsata*is commonly called as Rock bee or Giant bee and found almost all over India. They build single large honey comb and pollen load size also bigger. *Apis florea* is the small or little bee builds single, small comb.

2. Material and Methods

Study area: - Winter pollen loads were collected from different forest ranges of Gadchiroli district of Maharashtra. Gadchiroli district is economically backward because population of people is 'scheduled tribes' which includes 'Gonds'. The land is covered by forest and hills, Main profession of the people is farming, they also cultivate seasonal plants. Selected areas from Gadchiroli forest included in study were -Gadchiroli, Alpalli, Aheri, Ashti, Dhanora Bothali, Etapalli, Mulchera, Markhanda, Ranwhai, Gundapalli, Sironcha, Chamorshi, Armori, and Kurkheda (Fig.1).

Sample collection: - Field trips were undertaken during winter season in January 2013 to January 2015 for collection of honey bee pollen loads. Vegetational survey was made to collected pollen during the study period and reference slides were prepared for identification. For pollen preparation acetolysis method by Erdtman (1960) was used.

Pollen load analysis: -Pollen loads were carefully removed with needle without any damag from hive portion. Pollen loads of *Apis dorsata* were collected from trained workers. Collected pollen samples were dried in sunlight and kept in zip lock bags in freezer or desiccators properly to avoid any infection. Collected samples labeled by including the first letter of season i.e. W for winter, second letter for type of species i.e. D for *A. dorsata* and F for *A. florea*whereas the number of pollen load is followed by species for ex, WD1.Pollen loads were analyzed by qualitatively and quantitatively. Pollen spectra of pollen loads were identified with help of reference slides and standard literature Flora of Maharashtra (Almeida, 1998; Singh *et al.,* 2001), Flora of Nagpur District (Ugemuge, 1986). The term used for describing the type of pollen loads was unifloral, bifloral and multifloral (Sharma, 1970). For determination of frequency classes, the pollen grains were counted (100 per slides as per the method recommended by International Commission for Bee Botany (Loveaux *etal*., 1978).

3. Result and Discussion

Total 95 pollen loads were studied which includes unifloral (n=21), bifloral (n=2), and multifloral (n=22). Various unifloral pollen loads were recorded -*Cajanus cajan* (n=20), *Ageratum conyzoides*(n=16), *Citrus* spp.(n=8), *Alternanthera sessilis* (n=7), *Sida cordifolia* (n=5), *Cassia siamea* (n=5), *Tectona grandis*(n=5), *Punica granatum*(n=4) and Coriandrum *sativum*(n=4) (Table.1, Fig.2).

In Bifloral loads, *Cajanus cajan*loads were found in combination with *Ocimum* spp. *Cajanus cajan*is found cultivated as agriculture crop in the study area.

Pollen taxa found in 22 multifloral pollen loads were -*Celosia argentea, Oryza sativa, Cassia tora,* Poaceae*, Lantana camera, Hyptis suaveloens,Portulaca oleracea, Tridax procumbens*, *Sonchus* spp. and *Mimosa* spp. The present investigationhasexplored various sources of pollen to two of *Apiz*viz. *A. dorsata* and *A. florea* in winter season from Gadchiroli district of Maharashtra.

Kalkar and Shende (2006) worked out an analysis of 70 honey bee pollen loads of *Apis dorsata* from Kharangana villagein forests of Wardha district, Maharashtra. They reported that 55 pollen loads were unifloral of *Cajanus cajan* and 15 were bifloral of *Cajanus cajan* and Asteraceae. Sharma (1970 a, 1970b) analyzed bee pollen loads from Kangra valley, Himachal Pradesh during the months June-September. Further studies on bee pollen load from Banthra near Lucknow were carried out by Chaturvedi (1973, 1976 and 1977) reported uni, bi and multifloral loads, of which unifloral loads were found to be predominant.

The pollen loads give us information about the local floristic composition and geographical origin. Analysis of pollen loads lead to exploration of pollen sources of honeybees. Among 95 pollen loads 28 pollen sources were encountered. Total nine pollen taxa were recorded in 72 unifloral loads. All these primary and secondary pollen sources can be recommended for cultivation to conserve bee flora.

Sample	Date of Collection	Type	Frequency % of pollen loads
WD-1	15 Jan13	Unifloral	P-*Cajanus cajan* 100%
WD-2	15 Jan 13	Unifloral	P-*Cajanus cajan* 100%
WD-3	15 Jan13	Bifloral	P-Nil S-*Cajanus cajan* 43% - *Ocimum* spp40% I- *Alternantherasessilis*10% *Acacia* spp.6% M-*Mangiferaindica*1%
WD-4	15 Jan 13	Unifloral	P-*Ageratum conyzoides*100%
WD-5	15Jan 13	Unifloral	P-Poaceae100%
WF-6	20 Jan 13	Unifloral	P-*Alternanthera sessiles* 100%
WF-7	20 Jan 13	Multifloral	P-Nil S-*Sapindus emarginatus*43%, - *Oryza sativa* 39%, I-*Ageratum conyzoides* 14%, M-Poaceae4%
WF-8	20 Jan13	Unifloral	P- *Ageratum conyzoides*100%
WF-9	20 Jan 13	Unifloral	P-*Cajanus cajan* 100%
WF-10	20 Jan 13	Unifloral	P-*Sapindus emerginatus* 100%
WD-11	2 Octo13	Multifloral	P-Nil S- *Astraceae* 40% - *Ageratum conyzoides* 37%, I-*Oryza sativa* 13% *Celosia argentea*9% M-Poaceae 1%
WD-12	2Octo13	Multifloral	P-Nil S- *Oryza sativa* 35%, *Ageratum conyzoides* 32%, I- *Hyptis suaveolens* 14%, *Portulaca oleracea* 13% M- *Cassiatora* 3% -*Cassiaoccidentalis* 3%
WD-13	2Octo13	Unifloral	P-*Ageratum conyzoides*100%
WD-14	24Octo13	Unifloral	P-*Citrus spp.*100%
WD-15	24Octo13	Unifloral	P-*Sida cordifolia* 100%
WD-16	24Octo13	Multifloral	P-Nil

			S-*Sida cordifolia*42%, - *Tridax procumbens* 34% I-*Sonchus* spp 12% - *Punica granatum*9% M- *Alternanthera* 3%
WD-17	24Octo13	Unifloral	P-*Punica granatum* 100%
WF-18	31Octo13	Unifloral	P-*Cajanus cajan* 100%
WF-19	31Octo13	Unifloral	P-*Cassiea siamea* 100%
WF-20	31Octo13	Unifloral	P-*Cajanus cajan* 100%
WF-21	31Octo13	Multifloral	P-Nil S-*Cajanus cajan* 38%, *Brassica* spp.35%, I-Poaceae12%, *Cassia siamea* 10% M-*Mimosa* spp.3% -*Ageratumconyzoides* 2%
WF-22	5Nov13	Unifloral	P-*Cajanus cajan*100%
WF-23	5 Nov13	Unifloral	P-*Corindrum sativum*100%
WF-24	5 Nov13	Unifloral	P-Poaceae100%
WF-25	19 Nov13	Unifloral	P-*Alternanthera sessiles* 100%
WF-26	19 Nov 13	Unifloral	P-*Cajanus cajan* 100%
WF-27	19 Nov 13	Multifloral	P- Nil S-*Cassia tora* 42%, *Hyptis suaveolens* 41%, I-*Ageratum conyzoides*14% M-*Oryzasativa* 3%
WF-28	28 Nov 13	Unifloral	P-*Cajanus cajan* 100%
WF-29	28 Nov 13	Unifloral	P-*Sapindus emarginatus*100%
WF-30	28 Nov 13	Unifloral	*P-Cassia occidenatlis*100%
WF-31	28 Nov 13	Multifloral	P-Nil S-*Cajanus cajan* 42%, *Ocimum* spp 39%, I- *Brassica* spp.15% M-*Alternantherasessilis*2%
WF-32	3Dec13	Unifloral	P-*Ageratum conyzoides*100%
WD-33	3Dec13	Unifloral	P-*Cajanus cajan* 100%
WD-34	3Dec13	Unifloral	P-*Sida cordifolia*100%
WD-35	12Dec 13	Multifloral	P-Nil S-*Cajanus cajan* 42%, *Ocimum* spp 39%, I- *Brassica* spp.15% M-*Alternantherasessilis*2%
WD-36	12Dec 13	Unifloral	P-Poaceae100%
WD-37	12Dec 13	Unifloral	P-*Sapindus emrginatus* 100%
WD-38	29Dec 13	Unifloral	P-*Corindrum sativum* 100%
WD-39	29Dec13	Unifloral	P-*Brassica spp.*100%
WD-40	29Dec 13	Multifloral	P-Nil S-*Cajanus cajan* 42%, *Ocimum* spp 39%, I- *Brassica* spp.15% M-*Alternantherasessilis*2%
WD-41	29Dec13	Unifloral	P-*Sida cordifolia* 100%
WF-42	6Jan 14	Unifloral	P-*Sonchus*spp *60%*, S-*Corindrum sativum* 29 %, I-*Alternanthera sesslies* 11%

WF-43	6Jan14	Unifloral	P- *Cajanus cajan* 100%
WF-44	6Jan 14	Multifloral	P- Nil S- *Brassica spp* 37%, -*Tridax procumbens* 26%, -*Ageratum conyzoides* 20%, I- *Sonchus* spp 15% M-Poaceae 2%
WF-45	16Jan14	Unifloral	P-*Punica granatum* 100%
WF-46	16Jan 14	Unifloral	P-*Hygrophila auriculata* 100%
WF-47	16Jan 14	Multifloral	P-Nil S- *Cajanus cajan* 43%, *Ocimum* spp 35%, *Mimosa* spp 12% I- *Alternantherasessilis* 7% M-Poaceae 3%
WF-48	16Jan 14	Unifloral	P-*Adhatoda vasica* 79%, S-*Gomphorena* 21%
WF-49	30Jan 14	Bifloral	P-Nil S-*Cajanus cajan* 43% - *Ocimum* spp40% I- *Alternantherasessilis*10% *Acacia* spp.7% M-Nil
WF-50	30Jan 14	Unifloral	P-*Feronia elephantum*100%
WF-51	30Jan 14	Unifloral	P-*Cajanus cajan* 100%
WD-52	4Octo 14	Unifloral	P-*Oryza sativa* 100%
WD-53	4Octo 14	Unifloral	P-*Ageratum conyzoids* 100%
WD-54	4Octo 14	Unifloral	P-*Alternanthera* 100%
WD-55	13Octo14	Multifloral	P- Nil S-*Cassia tora* 40%, *Hyptis suaveolens* 39% I -*Ageratum* conyzoides15% M-*Oryzasativa* 3% *Cassiasamiea* 3%
WD-56	13Octo 14	Unifloral	P-*Ageratum conyzoids* 100%
WD-57	13Octo14	Multifloral	P-Nil S-*Cassia tora* 44%, -*Cassia occidetalis* 41% I-*Oryza sativa* 14%, M- *Altenantherasessilis1%*
WD-58	13Octo 14	Unifloral	P-Amarathceae100%
WF-59	26Octo14	Unifloral	P-*Cajanus cajan* 100%
WF-60	26Octo 14	Multifloral	P- Nil S-*Oryza sativa* 30%, -*Sida cordifolia* 27%, - *Ageratum conyzoides* 19%, I-Poaceae12%, -Amaranthaceae 12% M-Nil
WF-61	26Octo 14	Unifloral	P-*Punica granatum* 100%
WF-62	26Octo14	Unifloral	P-*Sida cordifolia* 100%
WF-63	7Nove14	Unifloral	P-*Cassia tora* 100%
WF-64	7Nove 14	Unifloral	P-*Cajanus cajan* 100%
WF-65	7Nove 14	Unifloral	P-*Portulaca oleracea* 100%
WF-66	7Nove 14	Unifloral	P-*Ageratum conyzoids* 100%

WF-67	15Nove 14	Unifloral	P-*Tectona grandis* 100%
WF-68	15Nove 14	Unifloral	P-*Cajanus cajan*100%
WF-69	15Nove 14	Multifloral	P-Nil S- *Cajanus cajan* 43%, *Ocimum* spp 35%, *Mimosa* spp 12% I- *Alternantherasessilis* 7% M-Poaceae 3%
WD-70	27Nove 14	Unifloral	P-*Cajanus cajan*100%
WD-71	27Nove 14	Multifloral	P- Nil S- *Brassica spp* 37%, -*Tridax procumbens* 26%, -*Ageratum conyzoides* 20%, I- *Sonchus* spp 15% M-Poaceae 2%
WD-72	27Nov 14	Unifloral	P-*Ageratum conyzoides* 100%
WD-73	3Dec14	Multifloral	P- Nil S- *Cajanus cajan* 43%, *Mimosa* spp 31% *Ocimum* spp20% I- *Alternantherasessilis* 5% M- Poaceae 1%
WD-74	3Dec 14	Unifloral	P-*Cajanus cajan* 100%
WD-75	3Dec14	Unifloral	P-*Coriandrum sativum* 100%
WD-76	3Dec14	Unifloral	P-*Sida cordifolia* 100%
WD-77	22Dec14	Unifloral	P-*Portulaca oleracea* 100%
WD-78	22Dec 14	Multifloral	P- Nil S- *Cajanus cajan* 40%, -*Ocimum spp.* 38%, I-*Mimosa* spp 14%. *Alternantherasessilis*5% M- Poaceae 2%
WD-79	22Dec14	Unifloral	*Alternanthera sessilis*100%
WD-80	22Dec 14	Unifloral	*Cajanus cajan* 100%
WD-81	29Dec14	Unifloral	*Punica granatum* 100%
WD-82	29Dec14	Multifloral	P- Nil S-*Brassica* spp34%, *Ageratum conyzoides* 32%, *Lantana camera* 22% I-Poaceae 6% M- Mimosa spp-3% -Cyperus3%
WD-83	29Dec14	Unifloral	P-*Astraceae 100%*
WD-84	29Dec14	Unifloral	P-*Ageratum conyzoides*100%
WD-85	2January15	Unifloral	P-Cajanun *cajan* 100%
WD-86	2January15	Unifloral	P-*Ageratum conyzoides*100%
WD-87	2January15	Unifloral	P-*Coriandrum sativum*100%
WD-88	2January15	Multifloral	P-Nil S- *Sida cordifloia* 40%, *Brassica* spp.,34%, I-*Coriandrum sativum*13% -*Brassica* spp.10% M- *Lantana camera* 3%
WF-89	18January15	Unifloral	P-*Cajanus cajan*100%
WF-90	18January15	Multifloral	P-Nil

			S- Tridax procumbence 43% *-Sonchus* spp 37%, -Poaceae 16% I-*Ageratumconyzoides*3% M- *Cajanuscajan* 2%
WF-91	18January15	Unifloral	P-*Ageratum conyzoides*100%
WF-92	31January15	Unifloral	P-*Cajanus cajan*100%
WF-93	31January15	Unifloral	P-*Coriandrum sativum*100%
WF-94	31January15	Unifloral	P- *Citrus spp* 100%
WF-95	31January15	Multifloral	P- Nil S-*Cajanus cajan* 43% *- Ageratum conyzoides* 40% I-Poaceae 14% M-*Leucaenaleucocephala* 3%

Table 1: Inventory of winter pollen loads

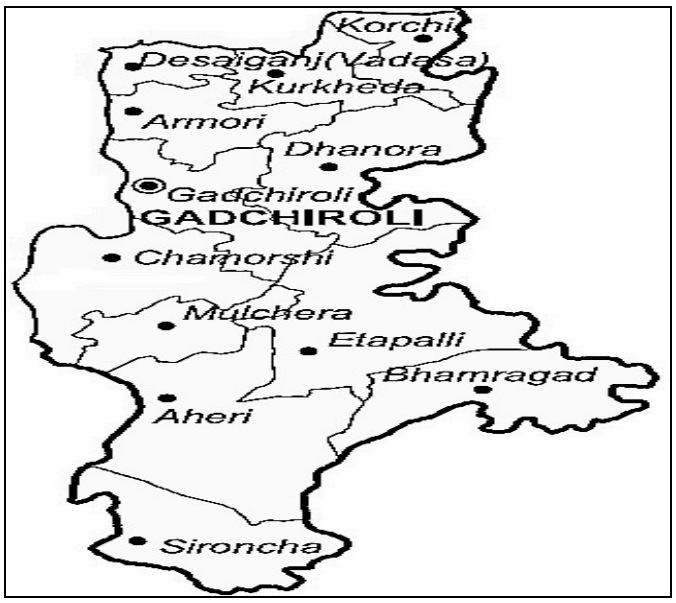

Figure 1: Map of Study area

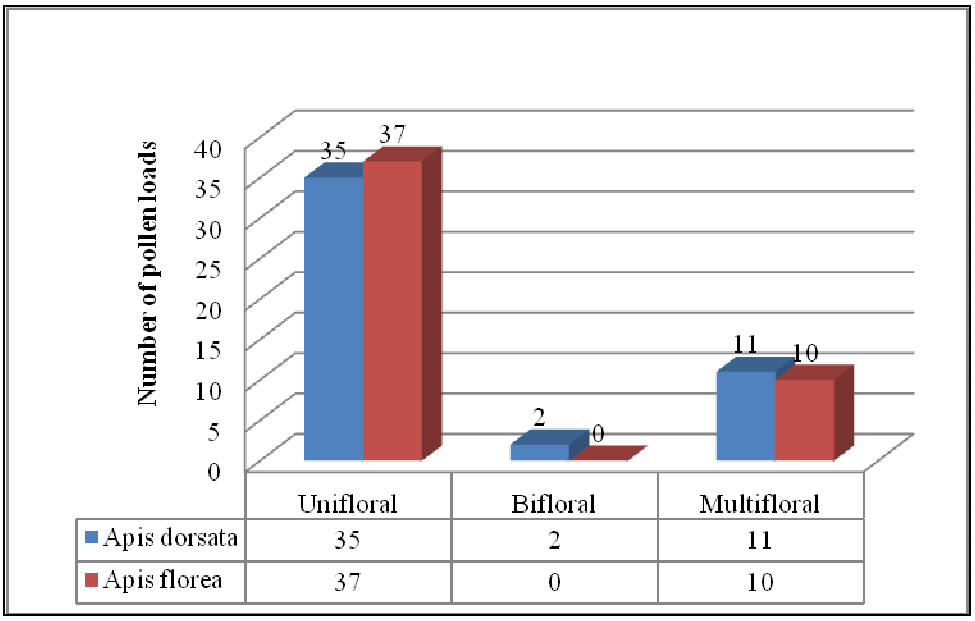

Figure 2: Pollen loads type in winter season

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