International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 14, Issue 1 (Jan.-Feb. 2025), PP. 23-28

Floral Pollen Resources for Apis dorsata Honeybees in the Summer from the Forests of Warora Taluka, Chandrapur

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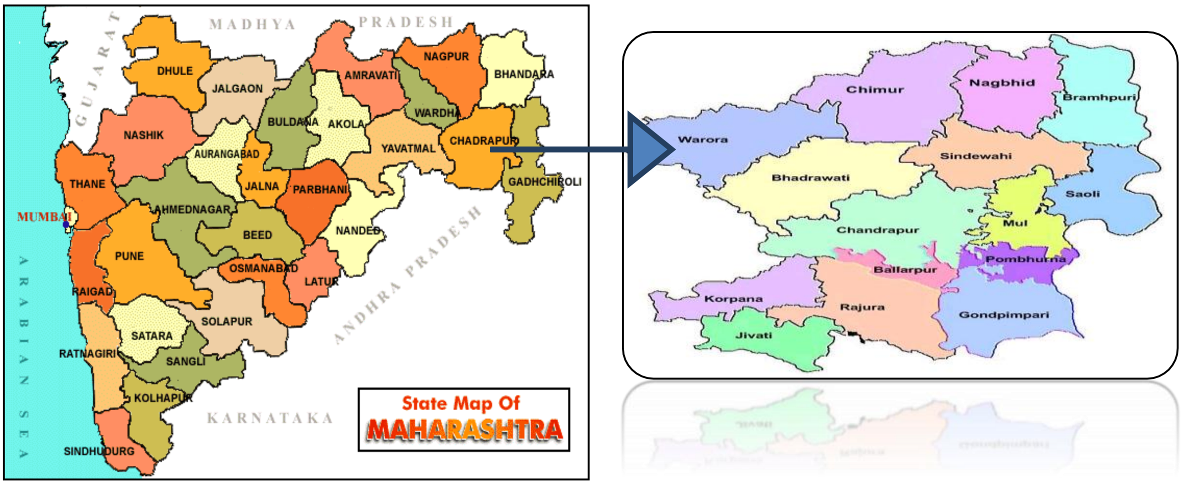
ABTRACT
70 pollen loads recovered directly from the honeycombs of Apis dorsata (Rock Bee) collected in 31 May 2012 to 24 April 2013 from Maisa and Soet forest area of Warora Tahsil of Chandrapur District of Maharashtra State, were analysed. 19 (27.14%) pollen loads were found to be Uniforal, 14 (20 %) bifloral and 37 (52.85%) multifloral. The Unifloral pollen loads were contained Mangifera indica. The pollen of Terminalia sp. was recovered from 57 (81.42 %) of the total pollen loads studied. The study high lights Terminalia sp. (combretrceace) and Delonix regia (Caesalpiniaceae) do the major pollen sources. Mangifera indica (Anacardeaceae), Citrus (Rutaceae) , Careya arborea (Lecythidaceae) and Mimosa Sp.(Mimosaceae) as fairly important sources of pollen of the honeybees during the summer period.
Keywords *– Pollen Sources, Honeybee, Warora Tahsil. forest area*

Date of Submission: 17-01-2025 Date of acceptance: 31-01-2025

I. INTRODUCTION

Honey bees visit plants for nectar and pollen. Nectar consisting predominantly of sources often associated with limited quantity of glucose and pollen grains provide the chief source of protein requirement of the bees essential for building their body tissues. (Rahman khan 1941) particularly during the early embryonic growth, bees prefer the nectar of a plant species that has the maximum sugar concentration. (Ramanujam 1991) Similarly they prefer pollen type with the maximum nutritive values and palatability. Melittopalynological investigation involving honey samples and pollen loads furnish reliable information on the relative preferences of the honey bees among the floral sources available within their foraging ranges. (Ramanujam 1994) Analysis of pollen load unravels the floral fidelity of fixity of the bees to a particular plant species in any floristic community, by highlighting the numerical status of the pollen type in the individual loads. The quantification of the data would help us to recognize the major and minor sources of pollen in any particular area. (Chaudhari 1978)

Studies involving the analysis of pollen loads are few when compared to those of honeys, in the Indian context. Sharma (1970 a & 1970 b, 1972) and Chaturvedi (1973) studied the pollen loads of *Apis cerena*, the Indian hive bee, from Kangra in Himachal Pradesh and Banthara in the vicinity of Luckhnow. Seethalakshmi and Perey (1980) recognized Borassus flabellifer as a good pollen sources in Tamilnadu by analysing 900 pollen loads of *Apis cerena* at Vijayarai in West Godawari District of Andra Pradesh and recognized potential of this region for apiculture Kalpana, Khatija and Ramanujam (1990) and Ramanujam and Kalpana (1990) provided information on the pollen sources of *Apis florea* and *Apis cerena* honey bees in Hydrabad and Ranga Reddy District. Recently Borkar Laxmikant and Mate Devendra (2014,2024) provided information on the pollen source of *Apis dorsata* Honeybees in the bramhapuri and Saoli forest area of chandrapur District of Maharashtra state and Cherian *et al.* (2011) provided information on the pollen sources of *Apis cerena* honeybees in Nagpur District of Maharashtra. This study is aimed to recognize the major and minor sources of pollen to *Apis dorsata* bee in these forest during summer period (Honey flow season) on the basis of qualitative and quantitative analysis of numerous pollen loads recovered directly from various honeycombs.



Map Showing Warora Tahsil of Chandrapur district from where the pollen loads were collected.

II. MATERIAL AND METHOD

Pollen loads (Comb loads) 70 in number of *Apis dorsata* were obtained from two Honeycombs collected on 31 May 2012 to 24 April 2013 from Maisa and Soet forest area of Warora Tahsil of Chandrapur District of Maharashtra State. (CHN-WAR-MAI), (CHN-WAR-SOE).

The pollen grains of each pollen load were dispersed in 1 ml of glacial acetic Acid and later on subjected to acetolysis. Erdtman (1960) One slide prepared for each pollen load and microscopically examined. All such pollen loads consisting of a single pollen type represent unifloral loads, with two pollen types bifloral and with more than two, multifloral Sharma, (1970 a). Identification of the pollen types was based upon the reference palynoslides of the forest flora and the relevant literature. The pollen productivity of the significant taxa was computed using haemocytometer.

III. RESULT

The analysis has brought to light that 19 (27.14 %) loads were unifloral, 14 (20 %) were bifloral and the remaining 37 (52.85 %) loads multifloral (Table 2).

The pollen grain of 13 taxa referable to 12 families were recorded. These are *Terminalia* sp. (Combratrceace), *Mangifera indica* (Anacardeaceae), *Delonix regia* (caesalpiniaceae), *Citrus* Sp. (Rutaceae), *Bombax ceba* (Bombiaceacea), *Careya arborea* (Lecithydiceaea), *Mimosa* Sp.(Mimosaceae), *Sorgum vulgare* (Poaceae) and *Blumea* Sp. (Asteraceae) are herbaceous weeds which represent the undergrowth, the remaining taxa are either arborescent member or shrub of the forest range.

Table 1- Pollen morphological characters of the Taxa recorded

S.N.	Pollen Type	Size, Shape & Symmetry	Aperture Pattern	Pollen Wall (sporoderm) structure & sculpture
Combrataceae				
01	***Terminalia*** Sp.	19-22 µm, Amb spheroidal; 21-24 x20-22 µm, subprolate; Radially symmetrical	Tricolporate, colpi alternating with pseudocolpi colpi linear, tips acute pseudocolpi almost equal the size of colpi, ora more of less circular	Exine 1.5 µm thick, tectae, surface psilate to locally finely granular
Anacardiaceae				
02	***Mangifera indica*** Linn.	27-31 µm, Amb subtriangular; 29-32 ×26-28 µm , subprolate; Radially symmetrical	Tricolporate colpi long, tips acute ora prominently lanlongate	Exine 2.5 µm thick, subtectate, surface striatoreticulae, striations more or less parallel in equatorial view, lumen generally elongated in polar direction, murisimplibaculate
Asteraceae				
03	***Tridax procumbens*** Linn.	31-38 µm, Amb rounded triangular to squarish; 30-35x 32-38 µm, oblate spheroidal; Radially symmetrical	Tri to tetra colporate, colpi linear, sharply tapering, ora faint, circular	Exine 5 µm (without spines) thick, tectate, surface echinate, spines 6 µm long, 2.5 µm in diam, at base

04	***Blumea*** Sp.	21-24 µm, Amb spheroidal, isopolar, Radially symmetrical	21-24 µm, Amb spheroidal, isopolar, Radially	Exine 3 µm thick, surface echinate, spines 5-6 µm long, 4 spines in the interapertural region interspinal area psilate
Mimosaceae				
05	***Mimosa*** Sp.	Pollen grains in polyads rarely in tetrads, 4-6 celled, 18-20 ×12-14 µm, elliptic; monad with hemispherical outer and conical inner portions; Radially symmetrical	Apertures faint to indistinct	Exine 0.5 µm thick, tectate, surface psilate
06	***Prosopis juliflora*** (Sw.) DC	36-39 µm, Amb rounded triangular; 38-42× 30-35 µm, prolate to subprolate; Radially symmetrical	Tricolllporate, occasionally syncolpate, colpi tapering towards poles, tips acute, ora lalongate	Exine 3.2 µm thick, tectate surface faintly reticulate
Lecythidaceae				
07	***Careya arborea*** Roxb.	52.1× 40.1 µm (48-54× 37.5 -43.5) µm, subprolate, isopolar, radially symmetrical	Hexacolpate, syncolpate with crassimarginate colpi, col. Length 43.5 (42-46.5) µm	Exine thick , 3 µm, undulating, considerable thick at the poles sexine-nexine not differentiated medium reticulate, more coarse at the poles.
Bombiaceae				
08	***Bombax ceba*** Linn.	51 µm (49.5×52.5) µm, peroblate, isopolar, Radially symmetrical	Tricolprate, col. length 12 (10.5-13.5) µm	Exine thick 3 µm, coarsely reticulate, mesh 4.1 µm (3-4.5 µm) in the major part except at the angles showing medium reticulations 1-8 µm (1.5 -3 µm), greater number of baculae are found in the lumen. Muri simplibaculate, faint LO pattern.
Rutaceae				
09	***Citrus*** Sp.	27-29 µm, Amb squarish, 26-30 ×25-27 µm, prolate spheroidal radially symmetrical	Tetracolporate, colpi linear, tips acute, ora lalongate	Exine 2 µm thick subtectate, surface Reticulate. Heterobrochate, meshes smaller near the apertural regions and larger elsewhere, lumina hexa to pentagonal or irregular, psilate, muri simpli to locally duplibaculate
Caesalpiniaceae				
10	***Delonix regia*** (Boj. ex. Hoof.) Ref.	59.62 µm, Amb more or less spheroidal to subtriangular; 53-56× 57-60 µm, oblate to suboblate; Radially symmetrical	Tricolporate, colpi long with blunt ends, ora faint, more or less rounded	Exine 5.2 µm thick, subtectate, surface coarsely reticulate. Heterobrochate, meshes smaller near the apertural regions & larger elsewhere , lumina poly to hexagonal with a number of free bacules, muri thick, sinuous, simpli to locally duplibaculate
Poaceae				
11	***Sorghum vulagare*** Pers.	51-55 µm, spheroidal; Radially symmetrical	Monoporate, pore circular provided with annulus, pore diam with annulus 4.1 µm without annulus 3.3 µm	Exine 1 µm thick, tectate , surface faintly granular to almost psilate
Pedaliaceae				
12	***Sesamum orientale*** Linn.	(42-51× 61.5-67.5) µm large grains, isopolar, radially symmetrical	Polycolpate, 13 colpii colpus length (34.5-37.5) µm	Exine thick 4.5 µm, sexine is thicker than nexine, sexine 3 µm, nexine 1.5 µm, rather finely reticulate, mesh 1-1.5 µm clear LO patteren
Capparidaceae				

13	***Capparis grandis*** Linn.	10-12 µm , Amb spheroidal; 14-16 ×9-12 µm prolate to subprolate; Radially symmetrical	Tricolporate, colpi linear to narrowly elliptic, ends tapering, tips acute, ora faint lalongate	Exine 1 µm thick, tectate, surface faintly granular to almost psilate

The unifloral pollen loads include 19 unifloral loads 7(10.52%) of *Terminalia* sp., 12(63.15%) of *Mangifera indica* (Fig.1) and bifloral 14 (20%) include *Terminalia* sp., *Mangifera indica, Bambax ceba, Blumea* sp., *Capparis grandis, Prosopis juliflora, Delonix regia, Careya arboreya* in combination.

The multifloral loads which are encountered showed the pollen types of *Terminalia* Sp., M*angifera indica*, *Blumea* Sp., *Delonix regia*, *Careya arboreya*, *Bombax ceba*, *Prosopis juliflora*, *Mimosa* Sp., *Capparis Grandis, Sorgum vulgare, Sesamum orientale* and *Citrus* Sp. (Fig. 2).

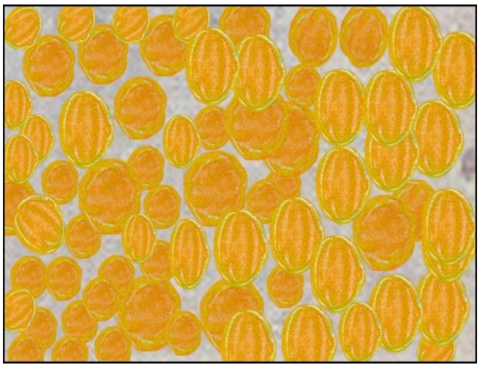
When the representation (Irrespective of percentage) of the various pollen types in the total number of pollen loads studied was considered & the percentages of pollen types recorded in each bifloral and multifloral loads were determined by counting 200 pollen grains at random, (Sharma 1970a) pollen of *Terminalia* Sp. were noted in as many 57 loads (81.42%) followed by *Delonix regia* in 38 loads (54.28%), *Mangifera indica* in 37 loads (52.85%) and *Citrus* Sp. in 26 loads (34.28%).

- **Table 2 - Analysis of pollen loads from honeycomb**

Warora Tahsil							
Comb	**Total Po Pollen Loads**	**Unifloral Loads**		**Bifloral Loads**		**Multifloral Loads**	
		Number	**Composition**	**Number**	**Composition**	**Number**	**Composition**
CHN-WAR-MAI	38	19	12 – Ma 7 – Te	14	8-Te(68,15), Ma(85,32) 4-Te(66,32) Sor(68,34) 1-Ma(56), De(44) 1-Te(80), De(20)	04	3-De(4,13), Ma(6,45), Te(6,58), Bl(13,55) 1-Ma(2), Pr(6), Bo(22), Te(70)
CHN-WAR-SOE	32	NIL	-------	NIL	-----	33	12-Ma(24,26), Te(35,40), De(27,28), Ci(7,13) 8-Te(46,47), De(42,43), Ci(10,12) 6-De(27,28), Ci(35,40), Te(24,26), Mi(7,13) 4-Te(50,57), De(11,30), Car(10,14), Bo(3,25) 2-Ca(5,6), Tri(9,12), Car(15,17), De(31,32), Te(36,37) 1-Ses(5), Bl(2), Tri(2), Te(72), De(19)
Total	70	19 (27.14%)		14 (20%)		37 (52.85%)	

Abbreviations for pollen types recorded from pollen loads
Te- *Terminalia sp.* Ma- *Mangifera indica* Bl- *Blumea sp.* Ci- *Citrus sp.* Bo- *Bombax ceiba* Pr- *Prosopis juliflora* Tri- *Tridax procumbens* Car- *Careya arborea* Mi- *Mimosa* Sp.
Ca- *Capparis grandis* Se- *Sesamum orientale* So- *Sorghum vulgare*

Fig. 1 – Pollen types in unifloral Pollen Loads

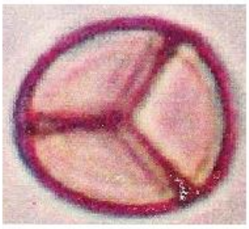


***Terminalia* sp.**

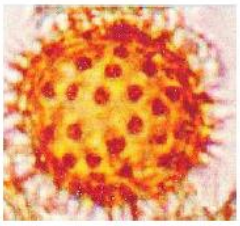
Mangifera indica

Fig. 2 – Light Microscopic photograph of pollen grain in pollen loads

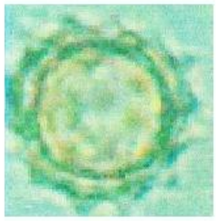
Capparis Grandis



***Mimosa* Sp.**

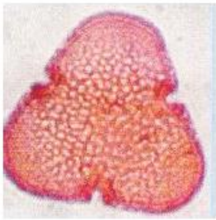


Tridax procumbens

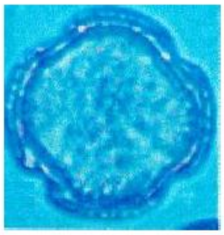


***Blumea* sp**

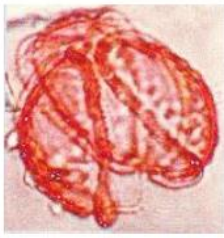
Prosopis juliflora



Bombax ceba

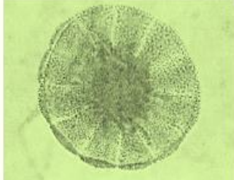


***Citrus* sp**



Careya arborea

Delonix regia



Sesamum orientale

Sorghum vulgare

IV. DISCUSSION

The analysis showed that the pollen loads obtained from the beehives of *Apis dorsata* in the Maisa and Soet forest area of Warora Tahsil of Chandrapur District of Maharashtra State, originated predominantly from some of the characteristics arborescent and shrubby plants of this forest area. Viz. *Terminalia* sp, Mangifera *indica*, *Delonix regia*, *Bombax ceba*, *Citrus* Sp., *Careya arborea*, *Mimosa* Sp., *Tridax Procumbens*, *Capparis* *grandis, Sesamum orientale.* The contribution to herbaceous weeds such as *Blumea* Sp., *Tridax procumbens* and *Sesamum orientale* as pollen source to *Apis dorsata* bees is very meagre.

The quantification of the data revels unequivocally the predominance of the pollen of *Terminalia* Sp. as evidenced by its very high representation of 75 (10) % in the Unifloral loads and 57 (81.42%) in the totality of the pollen loads material studied.

It can therefore be concluded that *Terminalia* sp constitutes the major source of pollen to the honey bees during the summer period. The other fairly significant source of pollen to the honeybees of this area are *Mangifera indica* 37 (52.85%), *Delonix regia* 38 (54.28 %), *Citrus* Sp. 26 (37.14%), *Careya arborea* 6 (8.57%) and *Mimosa* Sp. (8.57%).

All these taxa also constitute important pollen source during the summer season for the honeybees of this forest area.

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