

SEASONAL IMPACT ON COMB PRODUCTS OF LITTLE HONEY BEE, *APIS FLOREA* FARB (HYMENOPTERA - APIDAE)

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ABSTRACT

The comb products, particularly, wax, honey and pollen of the little honey bee, *Apis florea* were analysed from the combs collected at ten different places in Wardha district (Maharashtra, State, India) during winter and summer seasons of the year 2003-2004. Content of these products per comb varies from one place to other and from summer season to winter. All comb products are found in higher quantity during winter than summer. The honey of *Apis florea* often unifloral and is characterised with a specific acidity, moisture, sugar and pollen content.

INTRODUCTION

Most of the studies on the little honeybee, *Apis florea* are attributed to distribution (Kshirsagar *et al.*, 1983) and pollinating plants (Aluri, 1990), while no substantial efforts have, perhaps, been made till now, to analyze and assess the economic importance of the honey comb products (Verma, 1999).

The present work was, therefore, undertaken to explore physico-chemical properties of the comb products of the honey bee, *Apis florea*.

MATERIALS AND METHODS

The honey combs of *Apis florea* were collected from ten places in Wardha district, viz. Wardha, Rotha, Pipri, Sukali, Yelakeli, Anji, Seloo, Kelzar, Sindhi and Khadki during winter and summer seasons of the year 2003-2004. The honey, wax and pollen were extracted and qualitative as well as quantitative properties were analyzed by using Indian Standard specifications, IS : 8464 - 1977 and IS : 4941 - 1974.

The pollen slides were prepared by using, acetolysis technique of Erdtman (1960).

RESULTS

Analysis of comb products

After collecting ten combs from various places of Wardha district Maharashtra, State, India (Fig. 1) during winter season of the year 2003 and equal number of combs during summer season of the year 2004, the amount of wax, honey and

pollens was estimated regularly (Table 1).

The amount of wax per comb ranged from 200 to 292 g indicating an average value of 213.8 g/comb.

The wax content of the comb was often higher in those collected during winter than those collected during summer season even from the same locality and nesting plant (Fig. 2).

The honey per comb was found to be ranging from 30 to 160 g indicating the average honey content of about 103.8 g/comb.

In case of honey content per comb was also higher in winter than that in summer season (Fig. 2).

The pollen content per comb was estimated during winter and summer seasons in range of 7 to 44 g with average pollen content, 22.8 g/comb.

The pollen content per comb was found higher during winter than that in summer season.

Chemical analysis of honey

From the combs collected at various places during winter, 2003 and subsequently during summer, 2004, the chemical analysis of honey was carried out (Table 2).

Acidity (pH)

The acidity of *Apis florea* honey ranged from 0.14 to 0.39 % during winter and from 0.11 to 0.3% during summer season.

Moisture

The moisture contents of honey ranged from 23.40 to 29.80 % of the total weight of honey during winter and from 19.60 to 29.80 % during summer season.

Total reducing sugar

The total reducing sugar content of the honey ranged from

60.49 to 78.84 % during winter and from 62.58 to 75.46% during summer season.

Leulose or fructose

The total leulose and fructose content of the honey ranged from 35.80 to 47.80 % during winter and from 29.28 to 47.87 % during summer season.

Dextrose or glucose

The total dextrose or glucose content of the honey ranged from 29.70 to 34.54 % during winter and from 28.78 to 38.11 % during summer season.

L/D ratio

Table 1: Seasonal effect in bee comb products

S.No.	Locality	Season	Wax (g)	Honey (g)	Pollen (g)
1 (a)	Wardha	Winter	250	105	45
1 (b)	"	Summer	200	110	7
2 (a)	Rotha	Winter	215	119	16
2 (b)	"	Summer	225	89	30
3 (a)	Pipri	Winter	239	160	20
3 (b)	"	Summer	205	80	30
4 (a)	Sukali	Winter	240	131	16
4 (b)	"	Summer	205	30	20
5 (a)	Yelakeli	Winter	292	139	13
5 (b)	"	Summer	207	82	21
6 (a)	Anji	Winter	215	119	16
6 (b)	"	Summer	204	80	31
7 (a)	Seloo	Winter	217	121	17
7 (b)	"	Summer	210	80	20
8 (a)	Kelzar	Winter	221	123	16
8 (b)	"	Summer	207	82	28
9 (a)	Sindhi	Winter	225	149	16
9 (b)	"	Summer	220	85	25
10 (a)	Khadki	Winter	252	108	45
10 (b)	"	Summer	217	84	24



Figure 1: Survey of comb products. (a) Location of Wardha District in India; (b) Location of survey villages in Wardha District

The total L/D ratio (leulose/dextrose ratio) of the honey ranged from 1.03 to 1.55 during winter and 0.82 to 1.53 during summer season.

Sucrose

The total sucrose content of the honey ranged from 0.88 to 5.95 % during winter and 1.65 to 6.21 % during summer season.

From the chemical analysis of honey samples it becomes evident that the honey and sugar contents vary from winter to summer season (Fig. 3).

Qualitative Analysis of Honey Comb Pollens

Table 2: Seasonal effect on chemical analysis of honey samples

S. No.	Locality	Season	Parameters						
			Acidity (%)	Moisture (%)	Total reducing sugar(%)	Leulose or fructose(%)	Dextrose or glucose(%)	L/D ratio	Sucrose (%)
1 (a)	Wardha	Winter	0.14	29.80	68.33	38.59	32.63	1.03	2.56
1 (b)	"	Summer	0.17	24.00	71.09	43.77	30.77	1.41	2.84
2 (a)	Rotha	Winter	0.26	23.40	78.84	47.88	34.54	1.38	2.99
2 (b)	"	Summer	0.18	27.40	71.51	42.81	31.90	1.34	2.45
3 (a)	Pipri	Winter	0.15	26.00	60.49	40.11	32.38	1.23	2.86
3 (b)	"	Summer	0.28	19.60	62.58	31.85	38.11	0.83	2.18
4 (a)	Sukali	Winter	0.16	26.08	67.58	35.80	34.46	1.03	2.56
4 (b)	"	Summer	0.31	29.80	62.75	29.28	35.66	0.82	3.54
5 (a)	Yelakeli	Winter	0.39	27.00	72.35	42.25	33.26	1.27	4.29
5 (b)	"	Summer	0.16	22.00	75.46	47.87	31.17	1.53	6.21
6 (a)	Anji	Winter	0.30	25.00	75.92	45.43	33.90	1.34	0.90
6 (b)	"	Summer	0.11	26.80	72.35	42.25	33.26	1.27	1.65
7 (a)	Seloo	Winter	0.27	26.00	73.21	43.20	33.25	1.29	0.88
7 (b)	"	Summer	0.31	27.00	64.06	31.19	35.20	0.88	2.64
8 (a)	Kelzar	Winter	0.16	27.00	65.42	38.60	29.70	1.29	2.76
8 (b)	"	Summer	0.23	25.80	69.49	39.86	32.61	1.22	3.12
9 (a)	Sindhi	Winter	0.16	29.00	75.00	47.86	30.72	1.55	2.24
9 (b)	"	Summer	0.19	24.60	74.54	46.13	31.86	1.44	1.75
10 (a)	Khadki	Winter	0.33	24.00	71.09	42.11	32.14	1.31	5.94
10 (b)	"	Summer	0.26	27.60	66.48	40.76	28.78	1.41	3.60

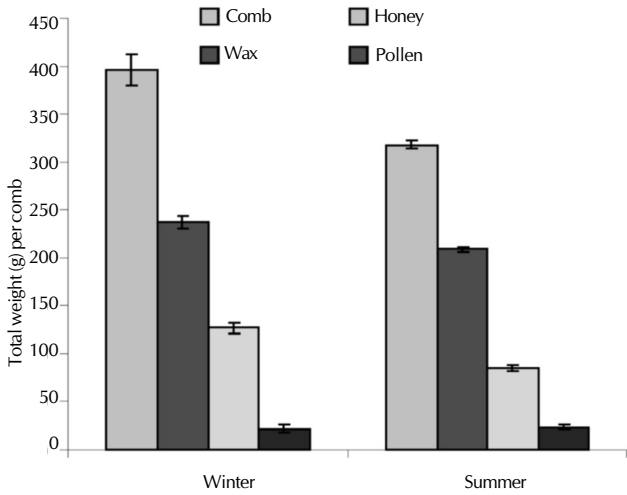


Figure 2: Wax, honey and pollen per comb collected during winter and summer seasons

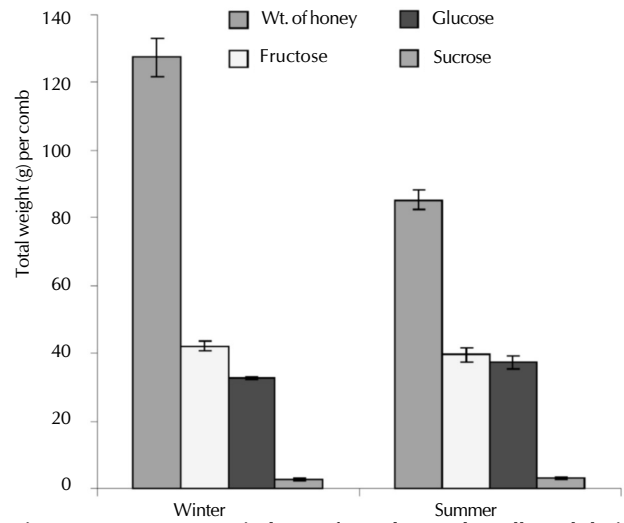


Figure 3: Sugar content in honey from the combs collected during winter and summer seasons

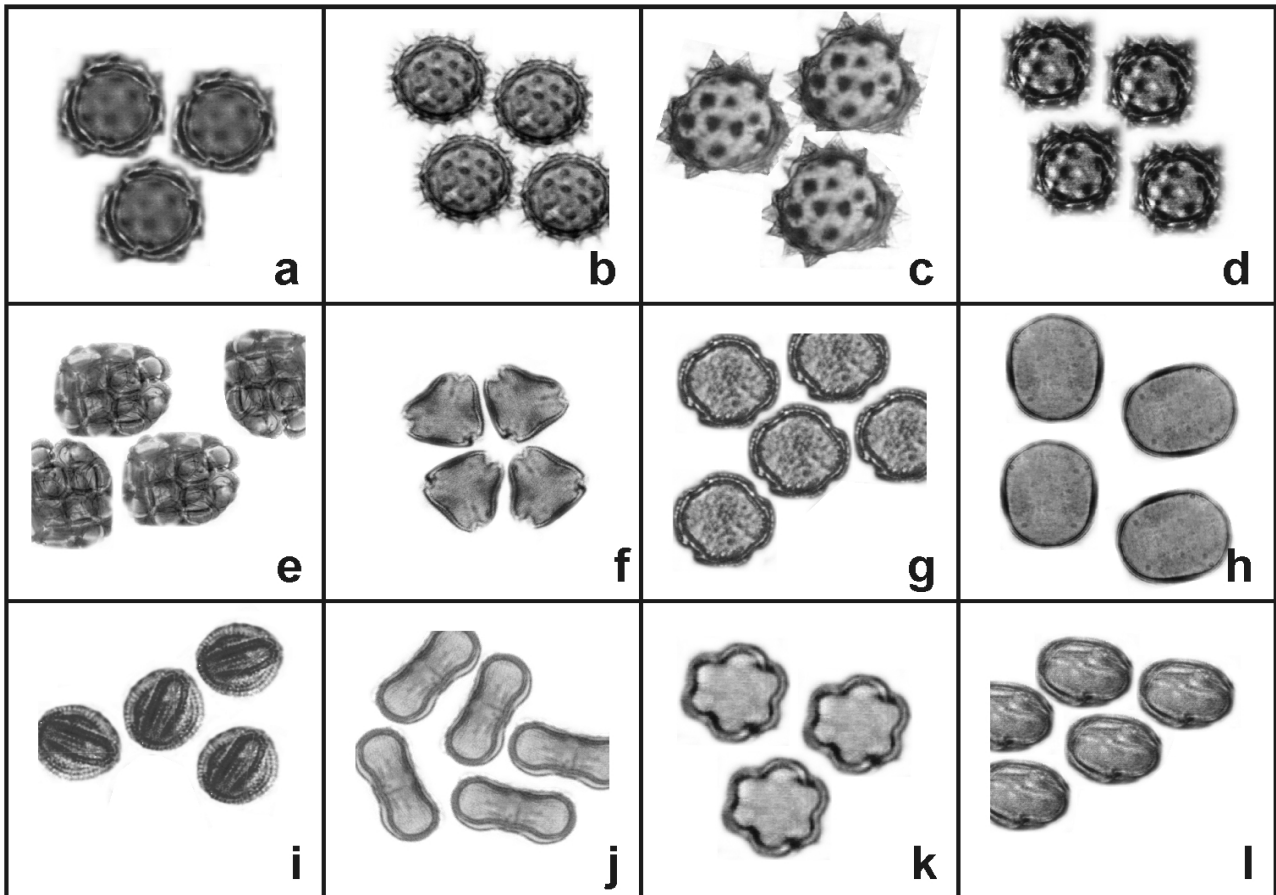


Figure 4: Pollen analysis in *Apis floreae* honey. (X800) a: *Parthenium* b: *Sphaeranthus* c: *Lagascea* d: *Bedens* e: *Acacia* f: *Sapintus* g: *Citrus* h: *Sorghum* i: *Raphanus* j: *Coriandrus* k: *Terminali* l: *Mangifera*

From the combs collected at various places during winter, 2003 and subsequently during summer, 2004, the qualitative analysis of honey comb pollens was carried out.

It is interesting to note that each comb of *Apis florea* contains

pollens of only a single species of plants indicating unifloral honey irrespective of the comb bearing plant and place (Table 2). In the winter combs, the pollens represent their native plants such as *Sphaeranthus indicus*; *Lagascea mollis*, *Bedens pilosa*, *Acacia nilotica* and *Sapindus emarginatus*. On the other hand,

in the summer combs the pollens represent their native plants such as *Citrus sp.*, *Sorghum vulgare*, *Raphanus sativum*, *Coriandrum sativum*, *Sphaeranthus indicus*, *Terminalia arjuna* and *Mangifera indica* (Fig. 4). *Sphaeranthus indicus* pollens are found commonly in the combs of some places during both the winter and summer seasons. These pollen plants, however, represent easily accessible flora of that place.

DISCUSSION

The *Apis florea* comb products are similar to that of other bees such as wax, honey, pollen, royal jelly and propolis (Joshi, 1993). The bee's wax production is recorded in the proportion of 1 kg to 4 kg of honey in *Apis mellifera* and *Apis cerana* bees (Joshi, 1993). While in *Apis florea* it is found to be occurring in 1: 2 wax - honey proportion suggesting just double quantity of wax produced by *Apis florea* and thus showing superiority in wax production than *Apis mellifera* and *Apis cerana* bees. Phadke (1962) perhaps for the first time analyzed the physico-chemical composition of the honey of the combs of *Apis florea* from Mahabaleshwar and he noticed unifloral type of honey extracted from majority of combs. The present study also reveals singularly the formation of unifloral honey by *Apis florea* supporting observation of Phadke (1962, 1968, 1986). He reported the leulose / dextrose ration (L/D) from 1.03-1.36. During the present study it is observed the L/D ratio of 1.03-1.55 during winter and 0.82-1.53 during summer season suggesting production of the sweetest honey by *Apis florea* amongst the Indian bees. Suryanarayana (1975), also made the similar comments from the samples of honey analyzed from Coorg district of Karnataka and Phadke (1962, 1968) from Mahabaleshwar locality.

It was often observed that *Apis florea* honey is characterized by higher moisture and acidity. The higher acidity prevents bacterial infection and in this respect also the honey of *Apis florea* is similar to that of *Apis mellifera*, *Apis indica* and *Apis dorsata* (Phadke, 1968) and according to him *Apis dorsata* and *Apis cerana* honeys are also similar in chemical composition while *Apis florea* and *Trigona sp.* have exhibited high L/D ratio and dextrin contents.

Apis indica, *Apis mellifera* and *Apis dorsata* often produce multifloral honey while *Apis florea* is seen to be producing unifloral honey exclusively showing its specific characteristics which is used in medicines since long (Singh, 1962; Chakrabarti, 1987). Recently, Bhusari (2002) analyzed about 65 *Apis florea* honey samples and more than 72% samples of the total samples were found to be unifloral, 10% samples bifloral and 18% multifloral and recorded about 52 types of pollens belonging to mostly melliferous taxa. He further noticed 10 pollen types as predominant once the unifloral honey collected from various places in Nagpur district during winter season from the plants: *Alternanthera*, *Allium*, *Bidens*, *Brassica*, *Lagascea*, *Parthenium*, *Prosopis*, *Sapindus*, *Sphaeranthus*, *Tridax*. The present study reveals the presence of pollens of *Parthenium*, *Sphaeranthus*, *Lagascea*, *Bedens*, *Acacia*, *Sapindus* from winter honey samples collected from various places in Wardha district.

Similarly, Bhusari (2002) analyzed 48 summer honey samples of *Apis florea* and recorded 77% samples as unifloral once and 57 pollen types mostly melliferous referable to 25 families.

According to him pre-dominant pollen types includes 13-pollen types such as *Alternanthera*, *Blumea*, *Brassica*, *Citrus*, *Coriandrum*, *Lagascea*, *Parthenium*, *Pongamia*, *Raphanus*, *Sonchus*, *Sphaeranthus*, *Syzygium* and *Terminalia* from the Nagpur district. The present study, however, reveals the presence of various types of pollen in 10 samples collected during summer season from *Apis florea* colonies nested at various places in Wardha district. These pollen types include *Parthenium*, *Citrus*, *Sorghum*, *Raphanus*, *Coriandrum*, *Sphaeranthus*, *Terminalia* and *Mangifera*. These plants occur commonly at large scale. Most of the plants are known to have medicinal value.

It was observed in the field that most of the taxa supplying forage to *Apis florea* bees besides *Apis cerana* and *Apis dorsata*, indicating a high degree of overlapping in the foraging behaviour of these three species of honey bees. The earlier studies on honeys and pollen loads of *Apis cerana* recognized the relevance of a number of taxa recorded and / or pollen sources for this bee (Phadke, 1962; Sharma, 1970; Chaudhari, 1979; Seethalakshmi, 1980; Chaubal, 1982; Chaubal and Kotmire, 1983; Chaturvedi, 1989; Gaur and Nanwani, 1989; Khatija and Ramanujam, 1989; Jhansi and Ramanujam, 1990; Ramanujam, 1994; Soman et al., 1995; Lakshmi and Suryanarayana, 1997). Further most of the bee forage plants recognized in the present study was listed out as significant bee plant (Singh, 1962; Crane, 1980; Crane et al., 1984).

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