Ageratum conyzoides L. an important Bee Forage plant in Kumaon Region, Uttar Pradesh

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Pollen analysis of four honey samples of Ramnagar and Nainital and 49 honey bee pollen loads from Bhimtal area of Kumaon region, of Uttar Pradesh were analysed during the months of September and October. The analysis revealed that *Ageratum conyzoides* L. is a promising forage source of honey bees in this area.

Key-word: *Ageratum conyzoides*, honey, pollen loads, honey bee, Kumaon region.

INTRODUCTION

THE bee keeping industry thrives solely upon bee-plant interaction which depends on a favourable bee flora consisting of both nectar and pollen sources. The Compositae taxa which constitute important oilseed crops also serve as important sources of nectar and pollen for the honey bees. The copious pollen and nectar production by the variously coloured flowers aggregated in heads attract the bees. One such taxon, *Ageratum conyzoides* L. which blooms from September - November in Kumaon region serves as the most important plant for honey bees in terms of bee pasture.

The Indian honey bees, *Apis cerana indica* F., are commonly domesticated in movable frame hives which are placed in such locations where there is lavish flora for the bees to collect pollen and nectar and produce plentiful honey. The pollen contents of honey serve as indices of nectar sources of the bees and those of the pollen loads, the pollen sources.

In Kumaon regions, honey is harvested twice a year, in autumn and in spring season. The analysis of autumn honeys from some of the Kumaon regions such as Kausani, Almora, Ranikhet, Bhowali, Jeolikote and Haldwani was made by Chaturvedi (1983). The present investigation of four honey samples pertain to Ramnagar and Nainital. The study of 49 honey bee pollen loads from Bhimtal was made earlier by Garg (1996) and is referred here for highlighting the potential of the common herb *A. conyzoides* for bee pasture.

METERIAL AND METHODS

The study is based on four squeezed honey samples of the Indian honey bee *Apis cerana indica* F. - two from Ramnagar and two from Nainital. The analysis is supported by a brief reference of analysis of 49 honey bee pollen loads of the Bhimtal area (adjoining Ramnagar; Garg 1996). The period of study covered the autumn season (September - October).

The honey samples were obtained by removing the honey chambers from the movable frame hives and squeezing out the honey. Thus pure honey was obtained. The pollen recovery from honey was carried out in accordance with the procedure laid down by Louveaux *et al.* (1978). From the acetolysed honey samples one drop was mounted on brass stubs with a cover glass affixed on it, for scanning electron microscopy (SEM). The remaining part was mounted on microslides for Light microscopy (LM). The pollen loads were obtained directly from the returning worker bees hind legs by placing a 5—mesh hardware metal sheet with 4.7 mm holes and a receptacle to collect the dislodged pellets at the hive entrance when the worker bees return to the hive. The pollen loads were scraped away by the mesh and were collected in the

receptacle without causing any harm to the bees. These loads were dispersed in 70% alcohol, acetolysed (Erdtman, 1960) and divided into two parts. One part was mounted on microslides for LM while the second part was mounted on brass stubs for SEM. The material for SEM was gold coated and observed under JEOL-JSM 35 C SEM of the Institute and photographed.

Pollen identification were based on reference pollen slides prepared from the flowering species of the study area in the autumn season. Help from the *Flora Nainitalensis* (Gupta 1968) was also taken.

For calculating percentages of various pollen types, all the grains contained in 10 ml honey were examined, identified for their biological origin and counted. As per the procedure laid down by Louveaux *et al.* (1978) the entire pollen content of these samples was classified under four different frequency classes viz. Predominant pollen (>45%), secondary pollen (16-45%), important minor pollen (3-5%) and minor pollen (<3%) based on the percent representation of each pollen type in the respective samples. The pollen types represented below 1% were stated as present. Samples with one predominant pollen type was categorised as unifloral while that with no single predominant pollen species as multifloral. The pollen purity in the unifloral pollen loads was upto 95%.

OBSERVATIONS

Honey analysis- Pollen spectrum of honeys is shown in table 1.

Sample 1 - (From Ramnagar, Pl. 1, fig. 3): Unifloral honey containing five pollen types, with pollen of *Ageratum conyzoides* represented predominantly (54%). The secondary pollen types were Myrtaceae (25%) comprised of *Syzygium* (16%), *Eucalyptus* (7%) and *Psidium* (2%). The important minor sources were Cruciferae - *Brassica* (10%), Cucurbitaceae (9%) comprised of *Cucurbita* (5%) and *Luffa* (4%) while *Bombax* represented the minor pollen content of the spectrum (2%).

Sample 2- (From Ramnagar, Pl. 1, fig. 4): Unifloral honey containing four pollen types. The pollen of *Ageratum conyzoides* was again predominant (51%). The secondary pollen were those of Myrtaceae - *Eucalyptus*, (25%) followed by Cruciferae (19%) comprised of *Cardamine* (10%) and *Brassica* (9%) besides some minor pollen contents of Leguminosae, Cucurbitaceae - *Cucurbita*, *Cassia*, and *Helianthus* and *Chrysanthemum* together constituting 5%.

Sample 3- (From Nainital, Pl. 1, fig. 5). Unifloral honey represented by three major and three minor pollen types. The predominant pollen type was *Ageratum conyzoides* (48%). This was followed by *Eucalyptus* (Myrtaceae) - 20% and *Brassica* 17% (Cruciferae) as secondary pollen constituents. The important minor pollen constituents were those of Leguminosae (8%) and Poaceae (3%) while Chenopodiaceae (2%) represented the minor pollen type. Besides these, pollen of *Cassia*, *Syzygium*. *Helianthus* and *Poa* were also present.

Sample 4- (From Nainital, Pl. 1, fig. 6) : Multifloral honey with two secondary and five important minor pollen constituents. The secondary pollen types comprised of *Ageratum conyzoides* (40%) and *Eucalyptus* sp. (26%), whereas the minor constituents are *Pisum* (10%), Cucurbitaceae (9%), *Brassica* (7%), *Poa* (3%). Other pollen present were those of *Zea mays*, *Casia*, *Acacia*, *Albizzia*, *Rumex*, *Cucurbita*, *Primula* and *Urtica*.

All the bee pollen loads were found to be unifloral with 95% pollen purity (Garg 1996). Table 2 shows the percentage pollen incidence of the bee pollen loads. The Compositae pollen were most dominant in the spectrum (17 out of 49 loads; 35%). Among the Compositae loads the maximum were of *Ageraum conyzoides* (7 out of 17 loads -41%). However, these constituted only 14% of the entire pollen load spectrum. The other pollen constituents of the spectrum were those of Leguminosae, Graminae, Labiatae, Liliaceae, Solanaceae, Myricaceae, Polygonaceae etc.

Plate 1

SEM photographs

Figs 1-2: Pollen of *A. conyzoides* showing 3 colporate, spinulate grains, scale lines = 10 µm. 1. Polar view. 2. equatorial colpus view - colpus with lolongate endocolpium; Figs 3-6: Honey samples, scale lines = 20 µm. 3 & 4. Sample nos 1&2 : Ramnagar honey; Figs. 5 & 6: Nainital honey.

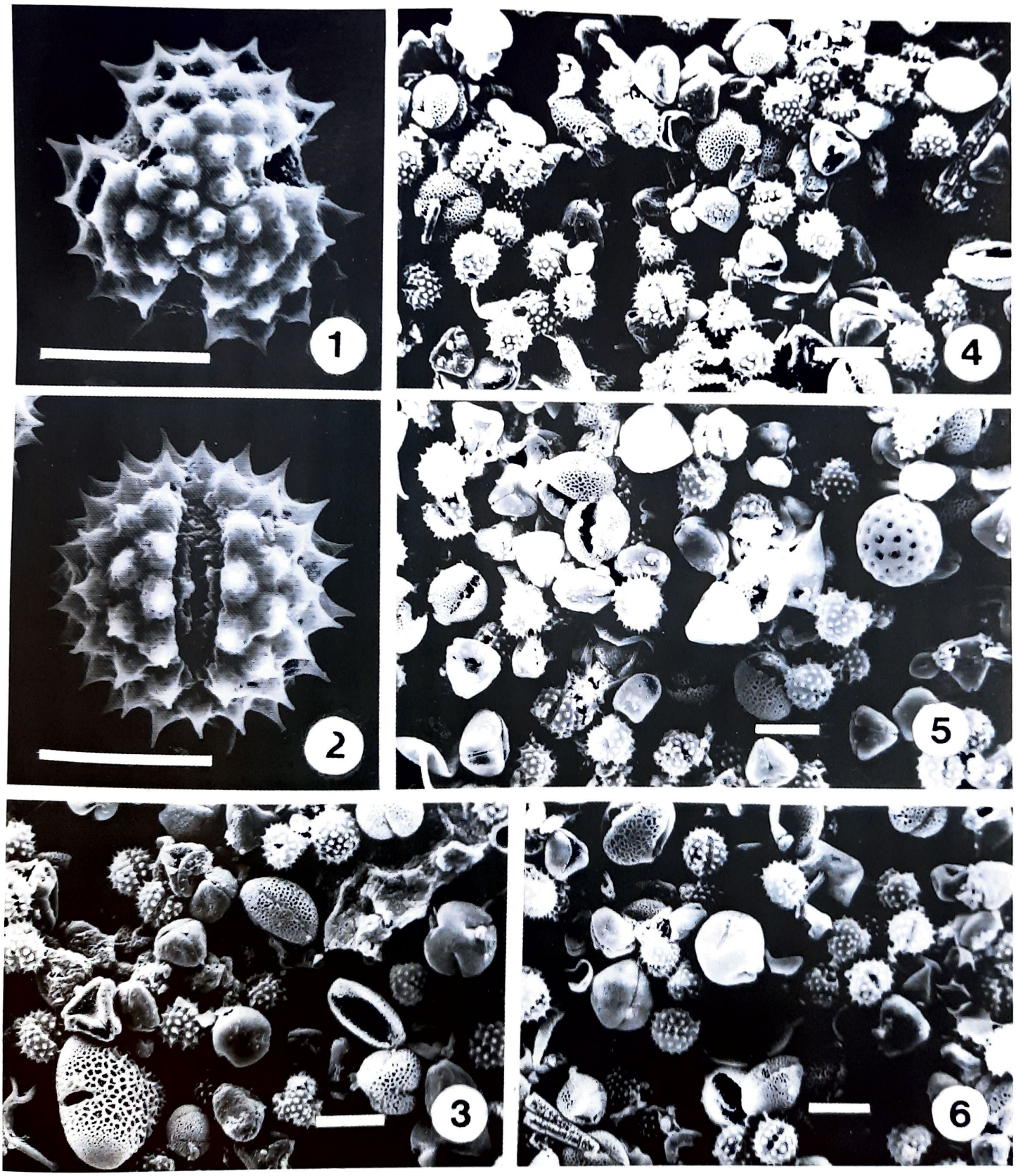

Plate 1

Table 1. Break up of Honey samples showing dominant pollen types

Family	Taxa	S. No:	Ramnagar Honey % occurrence 1	2	Nainital Honey % occurrence 3	4	Frequency class
Compositae:	*Ageratum conyzoides*		54	51	48	40	Predominant
Myrtaceae:	*Eucalypus Psidium Syzygium*		25	25	20	26	Secondary
Cruciferae:	*Brassica Cardamine*		10	19*	17*	07	Important minor
Cucurbitaceae:	*Cucurbita Luffa*		09	—	—	09	"
Leguminosae:	*Cassia Psidium*		—	—	08	10	"
Bombacaceae:	*Bombax*		02	—	—	—	Minor
Type of Honey			Unif	Unif	Unif	Mulf	

Notes: "Unif" - Unifloral, "Mulf" - Multifloral, * - secondary

DISCUSSION

The pollen grain present in the honeys and honey bee pollen loads are the only indices of plants visited by the bees. This not only reflects upon the floral assemblage of a region but is also of immense importance in establishing the exact botanical and geographical origin of honeys.

The analysis of honey samples and bee pollen loads of the Indian hive bee *Apis cerana indica*

Table 2- Break up of pollen loads

Family	Taxa	No. of loads	% age
Aquifoliaceae	**	1	2
Betulaceae	*Alnus nepalensis*	1	2
Bignoniaceae	*Jacaranda mimosaefolia*	1	2
Cannabinaceae	*Cannabis sativa*	1	2
Compositae	*Aster* sp.	8	16
	Ageratum conyzoides	7	14
	Xanthium strumarium	1	2
	Chrysanthemum sp.	1	2
Cucurbitaceae	**	1	2
Gramineae	*Cymbopogon* type	5	10
Labiatae	*Plectranthus* sp.	5	10
Leguminosae	*Cassia* sp.	5	10
Liliaceae-type	**	3	6
Myricaceae	*Myrica esculenta*	2	4
Polygonaceae	*Polygonum chinense*	2	4
Smilacaceae	**	1	2
Solanaceae	*Solanum* sp.	3	6
Urticaceae	*Urtica parviflora*	1	2

Note: ** indicates unidentified genus

during the month of September and October in Ramnagar, Nainital and Bhimtal has unequivocally brought to light that *Ageratum conyzoides* comprised a fairly promising source of pollen and nectar for honey bees in Kumaon regions in association with a limited consortium of other taxa (see tables 1 & 2). This species grows abundantly in almost all parts of the region. Out of four honey samples three were unifloral *Ageratum* Honeys and one was multifloral honey with *Ageratum conyzoides* as secondary pollen source constituting the major proportion of honey-pollen spectrum. However, the bee pollen loads of Bhimtal contained only 7 (14%) *Ageratum conyzoides* pollen loads out of the 49 loads studied, suggesting the species to serve as an important pollen supplier to the honey bees ranking second in terms of bee forage plants (*Aster* with 16% pollen loads ranks first). At family level, Compositae with 34% pollen loads (17 out of 49) is the chief pollen forage source of honey bees (Garg 1996).

In the light of these studies it is strongly recommended that the beekeepers should place their hives in such locations where there is abundant growth of *A. conyzoides* to provide plentiful bee pasture. The plantation of *A. conyzoides* primarly, in association with other taxa, in vicinity of beekeeping centres is also recommended for sustainable growth of bee colonies and honey production. The present study may, therefore, be profitably utilized in productive beekeeping ventures of temperate regions in Kumaon Himalaya.

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