Chapter Four

Discussion

The importance of a taxon as geographical or regional indicator is a function of the frequency of its occurrence in the total contingent of honey samples (Ramanujam and Kalpana, 1995). In other words the importance of a taxon as a chief nectar source for the honeybees can be assessed by taking into consideration the frequency representation of its pollen in the pollen spectrum of individual honey.

In this study a total of 25 unifloral honeys (36.9 %) were recognised with the following taxa as predominant pollen types in different seasons of honey flow periods:

SUMMER SEASON:-

Citrus spp., *Rosa* spp., *Rubus ellipticus, Buddleja asiatica, Prunus* spp., *Calendula* sp., *Primula* spp., *Schima wallichii, Fragaria* spp., *Potentilla* sp., *Trifolium repens.*

WINTER SEASON:-

Aristolochia sp., *Rosa* spp.

AUTUMN SEASON:

Ageratum sp., *Schima wallichii, Michelia* spp., *Brassica* spp., *Sedum* sp. *Prunus* spp.

Of these the majority (4samples) were derived from the nectar of *Schima wallichii* during autumn (3) and summer (1). *While Schima wallichii* flollowed by *Calendula, Prunus* spp., *Citrus* spp., *Buddleja* sp., *Rosa* spp., and *Ageratum* spp. and *Trifolium* as the chief nectar sources during summer and autumn *Schima – Prunus – Rosa – Calendula-Trifolium* complex based upon frequency of occurrence, can be considered as regional indicators of summer honeys of Sikkim and sub-Himalayan area.

The other plants which provide the major sources of nectar in different seasons for the honey bees constituting the secondary pollen types in the honeys of the area include as follows-

SUMMER HONEYS:-

Tithonia diversifolia, Bidens pilosa, Chrysenthemum sp., *Centaurea* sp., *Solidago* sp., *Aconogonum molle, Jasminum* sp., *Cardamine* spp., *Raphanus sativus, Strobilanthus* sp., *Fragaria* sp., *Clerodendrum* sp., *Strptosolen jamesonii, Milletia* sp.

AUTUMN HONEYS:

Camelia spp., *dalbergia sisoo, Ammomum subulatum, Symplocos* spp., *Selinum* sp., *Drymaria villosa, Brassica* spp.,

WINTER HONEYS:

Tropaeolum sp., *Nicotiana* sp., *Bellis perennis, Porana* spp., *Clematis* sp., *Dahlia* sp., *Bauhinia* spp.

Other plants representing the noteworthy suppliers of nectar and pollen in different seasons include as follows:-

SUMMER HONEYS:

Asystasia macrocarpa, Embelia sp., *Nemophilla* sp., *Petunia* sp., *Michelia* spp., *Saxifraga* sp., *Poaceae, Tropaeolum* sp., *Phaseolus* sp., *Syzygium* sp., *Gladiolus* sp., *Pimpinella* sp., *Erigeron karwinskinanus, Euphorbia pulcherrima, Coccinea grandis, Begonia* sp.

AUTUMN HONEYS:-

Papaver spp., *Passiflora foetida, Spirea micrantha, Trifolium repens, Lindenbergia* spp., *Iberis* sp., *Solanum* spp., *Cestrum* spp., *Linaria* spp., *Saxifraga* spp., *Duranta* sp., *Eupatorium* sp., *Rubus* spp., *Holboelia* sp., *Schium eduli, Cyphomandra* spp.

WINTER HONEYS:

Datura spp., *Euphorbia* sp., *Cleome* sp., *Plectranthus* spp., *Spergula* sp., *Veronica* sp., *Galinsoga* sp., *Magnolia* sp.

Pollen analytical studies of honeys coupled with critical field observations help in providing data regarding the bee plants of an area and also the favourable period of honey production on commercial basis (Ramajunam and Kalpana, 1995).

The nectar or pollen calendar (Fig. 3.3.7.1) furnishes information on month – wise chief and alternate sources of nectar of pollen for the honey bees as well as honey flow periods. Sometimes pollen of previous seasons are stored in the honeycombs. So in microscopical study of such honey samples sometimes pollen out of seasons were also encountered.

Foraging bees are specialists either in nectar or pollen collection, although they do change over from one to other depending upon the need of the hive and the availability of the grub (Suryanarayana, 1986). The honeybees are polytropic and therefore collect food even from anemophilous flowers such as those of *Poaceae, Papaver* sp., *Castanopsis* sp., *Fagopyrum* sp., *Hattuynia* sp. Some times diverses of flowers particularly 4-5 parted to 5 pointed star shaped flowers and different colours specially yellow, violet, orange, blue, pink play important role in changing the behavioural pattern of both the species of *Apis* (table 3.1.1).

Unifloral honeys of Sikkim and Sub-Himalayan West Bengal merit critical palynological studies to facilitate recognition of all such key plants which constitute the chief source of nectar and pollen to the honeybees.

Once such type of honey and the regions producing them are recognised, attempts should be made to assess their market potential and the apiary keepers may accordingly be advised to undertake their production on a commercial scale.

A total number of 1052 species of angiospermic plants were recorded form Drjeeling Himalyas and adjoining areas (Das and Chandra, 1987). Of these 388 secies are entomophilous, 58 species Amphiphilous 61 species. Anemophilous and the flowering period of 51 species remained unrecorded. A total of 505 species of plants are found to flower throughout the year.

A total number of ±310 'Bee-forage-plants' have been recognised so far from the present investigation in the study area, out of these ±262 plant species are of entomophilous taxa, ±41 plant species are of amphiphilous taxa whereas 9 plant species are of anemophilous taxa (Table 2.2.1).

During summer, plants belonging to 142 genera were found to be foraged by *Apis cerana indica* F. and *Apis florea* F.

Similarly during autumn plants of 91 genera and during winter 60 genera were found to be foraged by these species of bees.

On analysis of 67 honey samples a total of 166 pollen types referable to 77 families have been recognised.

Most of the bee-forage-plants represented in the honey samples had other economic uses too in addition to being good honey plants. A few had ethnomedicinal uses in the region of present study. Some such examples are as follows:-

The entire plant of *Rubia cordifolia* is used to cure stomach ache and that of *R.. manzith* is used for paralysis and jaundice. *Cardamine hirsuta* is used against heart diseases, low blood pressure and gout (Yonzone *et al.*, 1985). *Drymaria villosa* is used in curing nasal infection and cold.

The young shoots of *Artemisia vulgaris* are used for headache, nose – bleeding and eye- infections. The similar parts of *Eupatorium adenophorum* is used to heal cuts and to check haemorrhages as an antiseptic and blood coagulating agent.

Ageratum conyzoides (leaves) is used for fever, *Brassica juncea* (leaves) is used for earache, *Cannabis sativa* (leaves) is used for indigestion, acidosis and food poisoning, *Eupatorium odoratum* (leaves) is used for cuts and abrasions, *Lantana camara* (leaves) for skin itches, *Prunus persica* (leaves) is used for vermifuge. The stem of the *P. cerasoides* is used for bone- fracture and toothache. (Yonzone *et al.,* 1985 and Bhujel, 1995). *Camellia sinessis* (root) is used for mumps, *Clerodendrum viscosum* (root) for dysentery, *Dahlia pinnata* (root) for mumps, *Dichroa febrifuga* (root) for fever and malaria. *Plantago major* (root) for toothache, *Rubus ellipticus*

(root) for fever, *Rhododendron arboreum* (flowers) is used for dysentery and throat infection, *Woodfordia fruticosa* (flowers) for dysentery, *Coriandrum sativum* (fruits) for difficulty in passing urine, *Datura metel* (fruits) for hydrophoebia insanity, convulsions. *Fragaria indica* (fruits) for mouth and tongue sores, *Luffa cylindrica* (friuts) for diarrhoea in cattle, *Momordica charantia* (fruits) for diabetes, *Zanthoxylym hamiltonianum* (fruits) for flatulence, digestive disorders. *Clematis montana* is used as decongestant in the treatment of cough and cold, *Tropaeolum majus* for colites and inflammation of kidney (publication and information directorate, CSIR, 1986) *Torenia peduncularis, Centauria cyanus, Cineraria grandiflora*, *Calendula officinalis, Papaver rhoeas* are used as common ornamental in the study area. Some more informations may be added in this respect.

Bauhinia spp. (roots) is used as carminative. Bark of the same is used for tonic purpose and anthelmintic, flowers laxative. Roots of *Buddleja asiatica* are used in the preparation of fermented liquor. The flowers of *Bassia butyracea* are used in the preparation of distilled liquors and vinegars. Flowers of *Citrus* spp. yield an essential oil, Nerdi oil. Leaves *of Cleome icosandra* are used as rubefacient.

Leaves and flowering tops *of Datura stramonium* constitute the drug Stramonium which is used as narcotic, antispasmodic. Leaves of *Digitalis purpurea* are used for cardiac stimulant. The barks and leaves of Jacaranda are used for syphilis and mennorrhagia. The flowers of *Jasminum* are the important source of fragrant *Jasminum* oil. Bark *of Holarrhena antidysenterica* is astringent, anthelmintic and stomachic, antipyretic. Flowers of *Lantana camara* yield and essential oil, the entire plant is credited with carminative and antispasmodic properties. Leaves of *Leuncaena glauca* are a good source of protein and carotene and can be employed as supplement to alfa alfa leaf used in poultry rations.

The bark of *Magnolia grandiflora* is stimulant, diaphoretic and tonic used for malaria and rheumatism. Roots of *Mucuna prurita* are used as tonic, stimulent, diuretic, purgative and emmenagogue. The fruits *of Prunus*

communis are crushed to produce juice to produce beverages and wines. Bark of *Symplocos racemosa* is used as astringent and also used for dysentery, liver complaints, dropsy, opthalmia and conjunctivities. Its docoction is employed to stop bleeding of gums. *Solidago virga-aurea* is diuretic, carminative and is mixed for whooping cough, dropsy, chronic eczema.

Leaves of *Strobilanthes* are astringent, diuretic. The alcoholic extract of *Solanum khasianum* affect the contraction of isolated ileum of guinea pig and also influence central nervous system. *Solanum nigrum* is antiseptic and antidysenteric, fruits of S. torvum is antiseptic useful in liver as well as spleen problems and their decoction is used for cough (Biswas and Chopra, 1940).

From the overall chemical analysis of 25 samples *of Apis cerana indica* F. honeys it was found that among the high hills honeys Rimbick honey (RIMH – 2) collected in the month of October 1997 contained highest amount of amino acids (14.0 mg/gm). The significant amount, *ie,* 0.392 % does not tally properly with its dark amber colour. This honey is unifloral in nature (Table 3.4.1a) with its predominant pollen type *Sedum multicaule* (Crassulaceae) (50.0 %). Moreover slight bitter taste of the honey sample might be due to the presence of some unidentified factors (1.20 %) or nature of pollen chemicals which needs further investigation.

Lava honey (LH-1) is although matched with its minimum ash content (0,131 %) it did not corroborate with the idea of Paine *et al.,* (1934) as mentioned earlier having high amount of amino acids (13.5 mg/gm). The honey is multifloral in nature (Table 3.4.1a).

Dzongu honey sample with its amber colour did not correlate with its minimum ash value (0.217 %) (Schuett and Remy, 1932) but on the contrary, the sample having high amount of amino acids (13.5 mg/gm) in it matched properly with its colour (Paine *et al.,* 1934).

Among the mid-hills honey samples Damthang honey collected in May 1997 (DAMH-2) highest protein content (102.5 mg/gm) which did not corroborate with Pryce-Jone's finding in 1936 by not having thixotropic

property in the sample as mentioned earlier. Its pale yellow colour also rarely matched with its high ash content (0.421 %) in it. The sample with its APC 50700 is graded as Gr II (Louveaux *et al.,* 1978).

The seed farm honey from Kalimpong (SFH-1) collected in the month of April 1996 showed highest amount of sugars (762.5 mg/gm) in it. The high percentage of undetermined factor (2.64 %) in this sample is responsible for nutritive and medicinal value for honey (Phadke, 1962). Moreover, the highest APC (absolute pollen content) of 350609 (Table 2.3.1A) in the sample place the honey in Group III category (Louveaux *etal.,* 1978).

KHAMH, the honey sample from Khamdong (West Sikkim) collected in July 1997 showed minimum content of sugars (130.0 mg'gm) but highest amino acid content 14.0 mg/gm. The honey is unifloral one with its predominant pollen type *Michelia* sp. (85.36 %) (Table 3.2A). The undetermined factor present in significant level (2.02 %) and APC (25500, Gr II) need special mention from nutritional and medicinal point of view.

The Fifth Mile honey sample of Kalimpong (FH) collected in June 1996 with its dark amber colour well suited with the high ash content (0.421 %) in it. Same is the case with the Gangtok honey sample (GANH) (collected in March 1997) with its amber colour correlating with the high ash content (0.440 %) (Paine *et al.,* 1934). Both the samples were multifloral in nature and graded as Gr. II with APC 9475 and 5556 respectively per 10 gms of the samples.

The foot-hills honey samples from Chalsa (CH, May 1996) and Mitiali (MH, June 1996) showed high amount of total sugars 602.5 mg/gm and 727.5 mg/gm respectively which fulfil the prescribed range of 'Agmark' specification for sample with considerable high amount of protein content (88.75 mg/gm) showed its high thixotropic property. This corroborated with the research findings of Pryce-Jones in 1936. Moreover, the same honey sample with yellow colour, high ash content (0.413 %) and undetermined factors present (0.99 % in amount) place the honey in medium nutritional status. The honey is unifloral one with its predominant pollen type Gr. I with

APC 3059/10 gm of honey. On the contrary Chalsa honey is multifloral one with Gr. II having APC 27369/10 gm of honey.

Overall physio-chemical analysis of the selected honey samples revealed that honeys of higher hills contained high amount of amino acids although the same is tru for some mid hills honeys also e.g. Khamdong sample (14.0 mg/gm), Payong sample (10.5 mg/gm) Mungpoo sample (9.0 mg/gm),Sansay sample - 2 of July 1996 (9.0 mg/gm) etc. (table 3.4.1).

The higher amino acid content associated with higher undetermined factors and ash content as observed in the cases of Rimbik sample of October 1997, Lava sample of May 1996, Dzongu sample of North Sikkim (June 1996), exception as content minimum (0.217 %). Damthang samples of South Sikkim (March 1996 and May 1997) Seed Farm sample of Kalimpong (April 1996) Khamdong sample of West Sikkim (July 1997), Gangtok sample of March 1997, Fifth Mile sample of Kalimpong (June 1996) place them in nutritionally and medicinally higher status in comparison to other samples. However, the higher moisture content above the Agmark specification, 1959 (22 %) in cases of Khamdong, Damthang – 1 & 2, Seed Farm and lava samples with their corresponding values 30.0 %, 30.0 %, 22.5 %, 22.4 % respectively indicate that the samples might be unripe and are liable to get fermented. Another probable cause is that due to low temperature and humid climate condition at the time of collection of the honey samples the moisture content in the latter became high.

Chemical analysis of the samples of *Apis florea* F. honeys revealed the more acidic nature of the same in comparison to the *Apis cerana indica* F. samples. High amino acid content (14.2 mg/gm in LPH and 13.6 mg/gm in PABH) and relatively moderate sugar content in the former (*Apis florea* F. honey) place them in nutritionally higher status in comparison to *the Apis cerana indica* F. samples.

There was some deviation from Pryce-Jone's view (1936) having low thixotropic property in these two honeys although the percentage of protein content was found to be higher. The same observation had been made in

Damthang honey (DAMH-2), one of the *Apis cerena indica* F. samples which showed no thixotropic property although protein content was found to be relatively high (102.5 mg/gm) as mentioned earlier (Table 3.4.1).

The high APC value of PABH sample (463767/10 gm) and its corresponding Gr III. status with significant amount of undetermined factors (2.20 %) need special mention from nutritional and medicinal point of view (Phadke,1962).

The ripe nature of the samples as indicated by moisture content level being below level of Agmark specification (22 %) revealed that these are less liable to ferment.

From the study of heavy metal content in the three honey samples from three target zones with a view to observe the impact of random use of pesticides in the crop fields, tea gardens, orchards, research fields of the study area it was found that Zinc (Zn) was present in significantly in high amount (1.13 mg/100gm) in Dudhia Tea Estate sample DUDH). This exceeded the average quantity of Zinc content (0.2 – 0.5 mg/ 100 gm) in honey (Crane, 1975). Similar was the case with copper (Cu) also in all the three samples. The average amount of Cu as found by Crane in 1975 range from 0.01 mg to 0.1 mg per 100 gm of honey. But in the present investigation the quantity of Cu (0.14 mg/ 100 gm in MH, 0.17 mg/ 100gm in DUDH and 0.15 mg/ 100 gm in SFH-1) exceeded the said level.

The amount of cadmium (cd) and lead (Pb) was found to be negative though Manganese (Mn) was present in trace amount. But its quantity in Dudhia Tea Estate sample (DUDH) was found to be comparatively higher (0.76 mg/ 100 gm) than those in the other two samples (0.15 mg/ 100 gm in MH and 0.36 mg/ 100 gm in SFH-1). These findings indicated that amount of Manganese in Dudhia Tea Estate sample and Mitiali sample exceeded the normal value of Mn in honey (0.02-0.15 mg/ 100 gm of honey). Studies on some trace element content in Polish – made food products (in some bee honey grades) were already made by Bulinski *et al.,* 1995 by Flame Atomic Absorption Spectrometry. In their studies lead was determined 0.004 mg/kg

– 0.118 mg/kg, Cadmium from 0.004 mg/kg – 0.016 mg/kg, Nickel from 0.042 mg/kg – 0.500 mg/kg, copper from 0.14 mg/kg – 1.37 mg/kg, Zinc from 2.69 mg/kg to 19.37 mg/kg, Iron from 2.30 mg/kg – 9.46 mg/kg, Manganese from 0.51 mg/kg – 10.43 mg/kg and chromium from 0.017 mg/kg - .053 mg/kg. The amount of Zinc, Copper and Manganese fell within the above range as studied by Bullinski *et al.,* 1995. But the amount of Cadmium and Lead was found to be negative.

The comparative study of the above metals in respect to normal and experimental values has been represented in figures 4.1a, b, c.

On local survey and proper investigation it was found that the local farmers are using the pesticides in the crop fields, tea garden areas, orange orchard areas to kill the weeds, insects and fungal pathogens. The name of some of the pesticides with their corresponding chemical contents and groups are mentioned in the table 4.1.

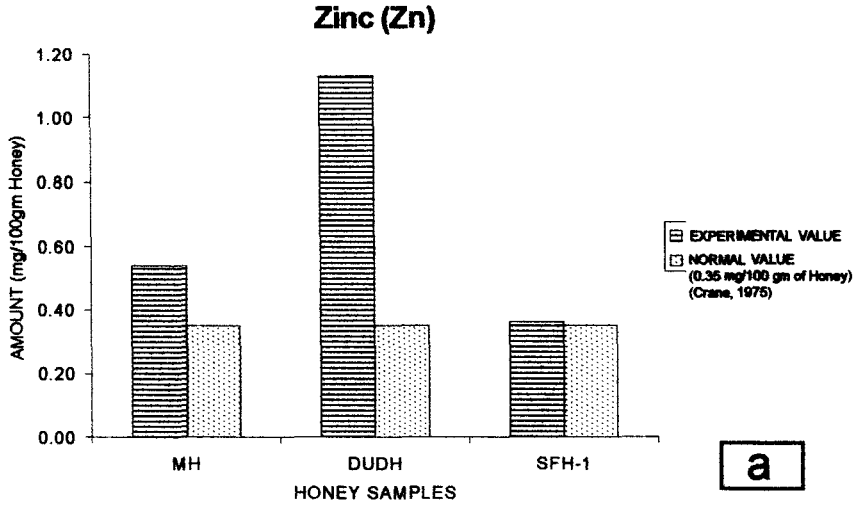
It is most probable that random use of above mentioned pesticides in the crop fields, tea garden areas, orange-orchard areas etc. during their flowering seasons has a very negative impact on the production of honey either from qualitative or from quantitative point of view.

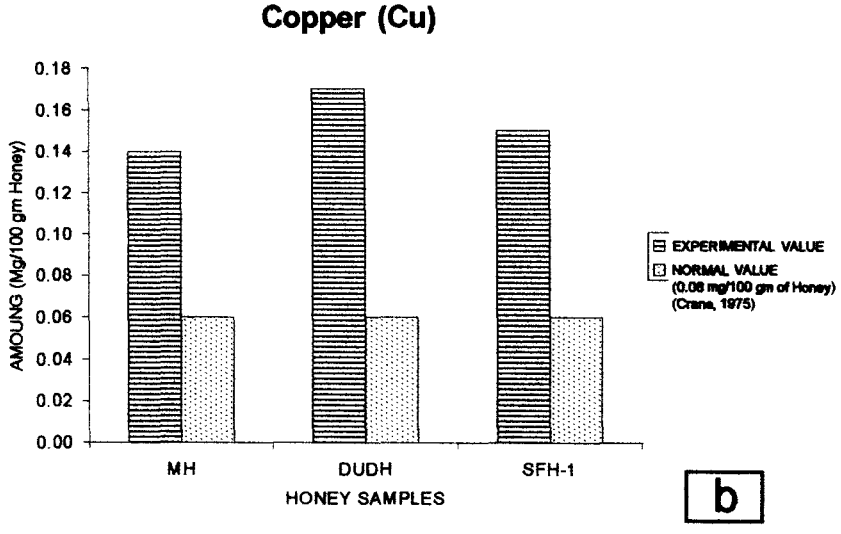
The chemical ingredients like Zn-ion and Mn-ethylene bisdithiocarbamate, Cu-oxychloride within the fungicides like Indofil M-45, Dithane M-45, Blitox-50 W etc. sprayed over the flowers might have reached through the nectar collected by the bees and ultimately stored in the honey combs of bee-hives. Consequently there might be greater chances of increasing the level of toxicity of honey or honey-poisoning. This phenomenon degrades the quality of honey on one hand whereas large scale destruction of honey bee colonies due to pesticidal poisoning causes low quantity of honey production on the other (Singh *et al.,* 1974).

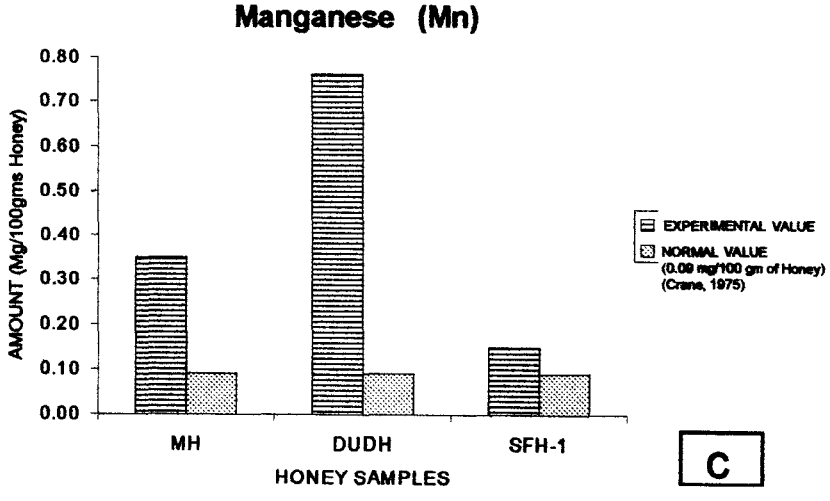
Now-a-days several countries like France, Sweden, U.K., New Zealand etc. have come forward to adopt legislation to protect the honey bees and other pollinating insects from pesticides. (Abrol, 1997). In India a similar approach is made by section 11 of "Code for conservation and

Tab.4.1 **LIST OF PESTICIDES WITH THEIR CORRESPONDING INGRADIENTS, GROUP AND SITES OF USE**

Sl. No.	Name of pesticide	Chemical ingredients	Group	Site of use
1	Blitox-50W	Copper-oxychloride	Fungicide	Crop fields of paddy, zea, wheat, tomato, chillies, orange orchads, tea belt, tobacco fields, etc.
2	Indofil M-45 (Mancozeb 75% WP)	75 % of co-ordination product of Zn-ion and Mn-ethylene bisdithiocarbamate	-do-	-do-
3	Dithane M-45 (Mancozeb 75% WP)	-do-	-do-	-do-
4	Glycel 41% SL	Isopropylamine salt of Glyphosphate	Weedicide	Tea belts
5	Rogor 30E (Dimethoate 30% EC)	0,0 – di-methyl S-(N-Methylcarbamoyl methyl) – phosphorodithionate	Insecticide	Tea, chillies, orange, vegetables, tobacco growing areas
6	Roundup	Glyphosphate	Herbicide	-do-
7	Leader	Isoproturon (IPU)	Weedicide	-do-







[Fig. : 4.1]

[HONEY SAMPLES :

	MH	=	Mitiali Honey (Jalpaiguri District)
	DUDH	=	Dudhia Tea Estate Honey (Kurseong)
	SFH - 1	=	Seed Farm Honey (Kalimpong]

maintenance of honeybees" (India, Indian Standards Institution, 1973). Indian Standard No:IS6695, 28 pages. This appoach stresses that beekeepers and farmers should enter into voluntary agreement so as to maximise crop yields and minimize bee damage in context of their own conditions. In 1968, Indian Government set up a registration committee for Registration of Pesticides and importers and manufactures were required to test toxicity to human being, animals, fish, birds and also to honey bees.

It is the high time that strict legislation be enforced to save the honeybees which will not only produce honey, bees-wax, improve crop-productivity, provide employment but also help in the maintenance of stable ecological system.

INTOXICATING HONEY-

During the local survey and present investigation in the study area it has been observed that some taxa add intoxicating properties to the honeys. The nectar and pollen sources of such types include *Gynocardia odorata* (local name "Gantay": Fl. Period Apr.-June) of family Flacourtiaceae, *Bassia butyracea* (local name: 'Chewri'Fl. Period Feb.-Apr.) of family Sapotaceae, *Bauhinia vahlii* (local name 'Varala') of family Caesalpinaceae, Fl. Period May-June, *Leucosceptrum canum* (local name 'Ghurpis' Fl. Per. Dec-March) of family Lamiaceae etc.

The intoxicating property within such honeys is more prominent, if the honey is of unifloral type (i.e. for predominant of >45% pollen) for these taxa especially. The local people give the name for these honeys collected during the flowering seasons of the above plants according to their local names eg. 'Guntay honey', 'Chewri honey', 'Ghurpis honey', 'Varala honey', etc.

Although in the present study of the honey samples predominant nature of such pollen taxa had not been found still some of these had been recovered as secondary (i.e. 16-45%) important minor (i.e. 3-15%) and minor (i.e. below 3%0 pollen types. *Gynocardia* had been found in 12 samples ranging from 0.01% (in SURH) to 28.81% (in SANG-3). Similarly *Bassia* had

been found in 3 samples (0.86% in SBH, 3.4% in MIBH- and 4.8% in FH), *Bauhinia* in 3 samples (3.4% in SORBH, 9.78% in GANH and 10.5% in SURH) and *Leucosceptrum* in only one sample (1.35% in HTH).

It is most probable that the nature of the sugar present within the nectar of such taxa add to the intoxicating property of the honey and this needs further investigation in respect of fermentation of sugars in the nectar into some alcoholic compounds.

TOXIC HONEY-

Mention has already been made regarding the toxicity of honey due to toxic nectar and pollen sources and different authors' views in this respect in the introduction chapter. Florido-Lopez *et al.,* studied in Spain in 1995 on allergy to natural honeys and camomile tea. On their studies, pollen studies showed high level of sunflower pollen (23.6 %) in the honey from Andujar. The allergological test and the inhibition studies suggested that the pollen Compositeae may be responsible for allergic reactions to such an natural foods and that the reactions are mediated by an IgE-related mechanism. Similar study on food allergy to honey was made by Bauer *et al* in 1996 in Vienna, Austria.

Immunoblot analysis of the patients showing alergic symptoms after injection of honey or honey containing products revealed IgE bindings to protein at the molecular mass of 54 kd, 60 kd or to a 30 kd/33kd double band or to both in sunflower honey extracts. The three bands corresponding to higher molecular mass protein could also be detected in three other kinds of honey (locust tree, European chestnut and forest honey). Both proteins derived from secretion of pharyngeal and salivary glands of honey bee head and pollen protein content in honey cause allergic reactions to honey.

In the present investigation four such pollen taxa which have been recognised as having toxic properties had been recovered from different honey samples. *Papavar* had been recovered from five honey samples

ranging from 0.77 % in Lava honey (LH-2) to 17.7 % in eleventh mile honey in (ELEH) The other three samples having *Papavar* pollen were Monsng honey (MONSH-1) having 8.5 %, Deolo hills honey (DH) having (DH) 1 %. Sangsay honey (SANGH-1) having 4.7 % *Rhododendron* had been recovered from two samples as minor pollen type *i.e.* 1.00% each in both Damthang (DAMH-2) and Payong (PH-1) honeys. Aesculus had been recovered in single sample as minor pollen type i.e. 0.5% in Monsong honey (MONSH-2) only. Croton had been recovered as minor pollen type in Mitialu honey (MH) of the quantity of 1%.

It might be that the floral gap periods at different seasons compelled the bees to forage on such poisonous plants (Chauhal and Deodikar, 1965).

According to study of Abrol in 1997 *Rhododendron arboreum* and *Aesculus californica* in honey pose a serious problem in USA.

In the present investigation it was found that Damthang sample (DAMH-2) had the highest amount of protein (102.5 mg/gm). It contains *Rhododendron* of 1 %. There are several species of *Rhododendron* whose nectar and pollen may not be toxic to the bees. Still it is doubtful for human consumption from safety point of view. Similar is the case in Monsong honey (MONSH-2) with *Aesculus* pollen. Toxic honeys collected during the blooming period of such poisonous plants should be avoided.

"PUTKA" HONEY

Honey is so named by the local people not because of its floral sources but for the name of honey causing agent, *Apis florea* F. (local name ("Putka"). This honey is 10 times costlier than the *Apis cerana indica* F. honeys in the local areas because of the poor availability ad high medicinal value of the former as per the information obtained from the local bee keepers.

In the present investigation of two such honey samples it was found that Pabong honey (PABH) was of unifloral nature with *Trifolium repens* as the predominant pollen type (82.7 %), whereas Lathpancher honey (LPH)

was of multifloral nature with *Spirea* (43.28 %), *Buddleja* (20.10 %), *Primula* (18.03 %) and *Desmodium* (14.02 %) as secondary pollen types.

On chemical analysis of the two samples it was found that both the samples were of more acidic nature in comparison with the *Apis cerana indica* F. samples having high amino acid content (14.2 mg/gm in LPH and 13.6 mg/gm in PABH) and protein content (93.5 mg / gm in LPH and 96.8 mg/gm in PABH) as mentioned earlier. The ripe nature of the honeys (moisture level below the Agmark specific level, 22 %) high APC value 463767/10 gm in PABH and 25862/10 gm in LPH and considerable quantities of unidentified factors (2.20 % in PABH and 2.01 % in LPH) also add some more incentives in favour of their higher nutritional and medicinal status and this needs more attention of future researchers in this field.