Chapter 37

Honeydew Honey in Nepal

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Honeybees produce honey from nectar (secreted by floral and extrafloral nectaries) and honeydew (excretions of plant-sucking insects). Honeydew is derived from phloem sap not from actively secreted nectar. Phloem sap is inaccessible to bees unless it seeps from a surface wound. Some insects belonging to the order Rhynchota are able to puncture plant tissues with special sucking apparatus through which they gain access to plant sap. From the sap they extract the nutrients they require. Excess food passes through the insect's gut and is found on leaves, twigs, etc. in small droplets known as honeydew (Crane, 1980, 1990; Maurizio, 1975). Honeydew contains enzymes such as invertase and diastase derived from secretions of the salivary glands and gut of the plant-sucking insects (Kloft, 1965; Kloft and Ehrhardt, 1962; Maurizio, 1965, 1975). It also contains amino acids, amides and organic acids, especially citric and more rarely malic, succinic and fumaric acids (Gray, 1952; Tamaki, 1964, 1968). This means that honeydew honey differs in its composition from phloem sap and from nectar honey. It has a higher total content of minerals than nectar honey (0.58% compared to 0.26%) and is darker in colour (Crane, 1990).

The origin of honey (floral or honeydew) can be determined by measuring its electrical

Cure for high blood pressure with honey from blossoms of *Carissa*

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Studies were conducted on the effects on high blood pressure (HBP) of honey derived from different flora. In trials, honey produced from *Carissa* plus medicinal plants (2 tablespoons in 2.2 l of water daily) proved useful for normalising HBP. It was tested on 75 patients. During treatment, HBP became normal in most patients in 1–3 days. Treatment was continued for 35 days. Some 11–42 days after stopping treatment, patients' BP started rising. It was normalised again with honey treatment for 1–2 days. When BP rose again after 4–12 weeks, honey treatment for 1 day was sufficient for normalising it. This treatment cured HBP in 83% of patients.

Some 9% of patients suffered from abnormalities in diastolic and systolic BP. Treatment with honey normalised both types of abnormalities in 6–23 days. Treatment was continued for 35 days. The abnormalities again started in some patients and treatment with honey cured them in 3–11 days. Later, the abnormalities did not occur. Whenever BP started rising it was normalised by honey treatment for 1 day. Honey treatment did not show any curative action in 8% of patients possibly owing to allergies or some other reasons. However, in 92% of patients the cost of curing HBP was reduced by 82–95% with honey treatment as compared to allopathic medicines.

conductivity. Vorwohl (1964) proposed the use of electrical conductivity measurements with pollen analysis for identifying honey sources and for detecting the proportion of honeydew. Electrical conductivity values will depend on the concentration of mineral salts, organic acids, protein and polyols (Crane, 1990; White, 1975a, 1975b). Pure floral honey shows electrical conductivity <700 µS/cm and pure honeydew honey shows electrical conductivity >1200 µS/cm; electrical conductivity of 700–1200 µS/cm indicates that the honey is derived from a mixture of nectar and honeydew although there are some exceptions (Bogdanov *et al.*, 1997). Other honeydew indicators such as algae and sooty moulds (Maurizio, 1975), pollen grains of wind-pollinated plants, and soot and dust (Crane, 1975), fungal spores and hyphae can be seen in honey pollen slides.

Most honey from high altitudes is all or partly from honeydew whereas that from valleys is from nectar. Plachy (1944) reported that samples of honey produced at altitudes over 1000 m had at least twice the bactericidal activity of samples from lower areas. Buchner (1966) found that honeydew honey has greater bactericidal activity than floral honey. Although in Nepal there are reports of honeydew plants, there are no reports as yet of honeydew-excreting insects or honeydew honey (Partap, 1997). To close this gap, the present study was carried out to determine the source (floral or honeydew) of honey harvested from different bee species and from different ecozones.

Materials and Methods

Honeydew samples were collected from Jumla district (2500 m) in western Nepal in May 1994. Honeydew-producing insects from these samples were identified at the Institut fur Toxikologie, Berlin, Germany. Honey samples from *Apis cerana* bees were collected from Langtang, Jumla (2000 m), Dadeldhura (600 m), Kathmandu valley (1500 m) and Chitwan (250 m) during field visits made between January 1994 and September 1997. Some samples were collected from commercial beekeepers associated with the ICIMOD apiary and Himalayan Bee Concern. Also samples from different bee species (*A. cerana, A. dorsata* and *A. mellifera*) were collected at one time and from the same locality in Chitwan district. All samples were kept in a deep freezer and analysed at the Institut fur Bienenkunde, Lunz am See, Austria.

Pollen analysis was carried out according to the method published by the International Commission of Bee Botany (Louveaux *et al.*, 1978). Identification was made by comparing pollen grains found in the samples with those collected by hand from known plants.

Electrical conductivity, pH and water content were measured according to the harmonised methods published by the European Honey Commission (Bogdanov *et al.*, 1997).

Results and Discussion

Three honeydew-secreting insect species were identified: *Cinara eastopi* (Pintera) on *Pinus wallichiana* (Jackson), and *Cinara comater* (Doncaster) and an unidentified *Cinara* species on *Picea smithiana* (Wallich). Many plant sources of honeydew honey reported in other parts of the world are also found in Nepal (e.g., *Larix* spp., *Quercus* spp., *Populus* spp., *Abies spectabilis, Pinus sylvestris, Cedrus deodara, Tsuga dumosa, Sapium insigne, Saccharum officinalis*); but whether insects that produce honeydew are found on them is still unexplored (Partap, 1997). Of these plants, most are found at high altitudes (above 1500 m); only *Saccharum officinalis* and *Populus* spp. are found at low altitudes.

The electrical conductivity of honey harvested from different ecozones is shown in Table 1. The electrical conductivity of Langtang honey averaged 1295.5 ± 517.6 µS/cm; Jumla honey averaged 862.8 ± 145 µS/cm; Dadeldhura honey averaged 851 ± 323 µS/cm; Kathmandu honey averaged 814.8 ± 550 µS/cm; and Chitwan honey averaged 693 ± 465 µS/cm. Honey collected from commercial beekeepers averaged 495.7 ± 273 µS/

Table 1: Electrical conductivity, pH and water content of *Apis cerana* honey collected from different ecozones of Nepal

Locality	EC (μS/cm)			PH			Water content (%)		
	Mean ±SD	Min. value	Max. value	Mean ±SD	Min. value	Max. value	Mean ±SD	Min. value	Max. value
Langtang (n = 8)	1295.5 ± 517	324	1767	4.52 ± 1.14	3.05	6.76	21.3 ± 1.8	17.2	22.6
Jumla (n = 52)	862.86 ± 145	476	1092	3.69 ± 0.26	3.21	4.21	20.96 ± 2.5	15.8	26.0
Dadeldhura (n = 56)	851 ± 339	304	1290	3.74 ± 0.61	2.99	5.65	22.8 ± 3.2	17.0	26.0
Kathmandu (n = 61)	814.8 ± 550	182	1898	3.81 ± 0.78	2.27	6.5	22.3 ± 1.98	19.0	25.4
Chitwan (n = 16)	693.1 ± 465	211	1568	3.74 ± 0.34	3.2	4.37	19.17 ± 1.96	17.0	21.4
Commercial beekeeper (n = 12)	495.7 ± 273	186	819	3.59 ± 0.38	3.0	4.11	17.98 ± 2.0	14.0	20.4

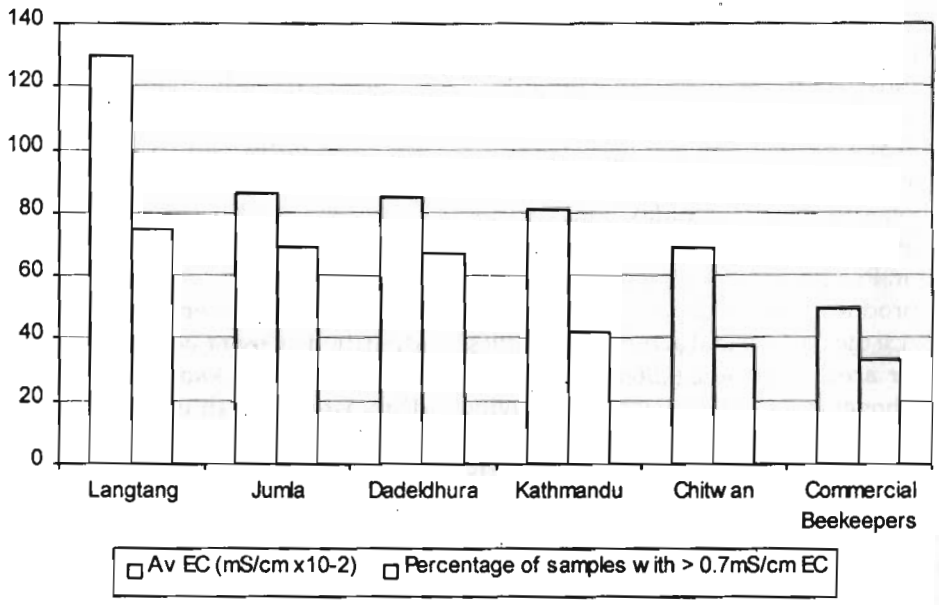

Fig. 1. Electrical conductivity of *Apis cerana* honeys from different altitudes in Nepal

cm. These results indicate that honey harvested from high altitudes has higher electrical conductivity than that from low altitudes.

The percentage of samples derived at least in part from honeydew is shown in Fig. 1. The majority (75%) of honey samples from Langang had >700 μS/cm followed by Jumla (69.23%), Dadeldhura (67.3%), Kathmandu (42%) and Chitwan (37.5%). Honey from commercial beekeepers had only 33.3% samples with >700 μS/cm. The results show that at higher altitudes honey is more likely to be derived from pure honeydew or a mixture of honeydew and nectar.

The electrical conductivity of honey harvested from different bee species (*A. cerana*, *A. dorsata* and *A. mellifera*) on the same day and from the same locality are shown in Table 2. The results show that conductivity values differ from species to species. The electrical conductivity value of the wild bee species, *A. dorsata*, averaged 1167 ± 758 μS/cm, and the native hive-bee, *A. cerana*, averaged 693 ± 465 μS/cm and *A. mellifera*,

Table 2. Electrical conductivity, pH and water content of honey harvested from different bee species in Chitwan, Nepal

Bee species	EC (µS/cm)			PH			Water content (%)		
	Mean ±SD	Min. value	Max. value	Mean ±SD	Min. value	Max. value	Mean ±SD	Min. value	Max. value
Apis cerana (n = 16)	693.1 ± 465	211	1568	3.79 ± 0.65	3.2	4.37	20.98 ± 2.5	17.0	21.4
Apis dorsata (n = 24)	1167 ± 758	378	2230	3.79 ± 0.34	3.4	4.31	20.9 ± 1.94	17.2	24.2
Apis mellifera (n = 17)	316.8 ± 167	148	711	3.38 ± 0.29	3.0	4.22	18.21 ± 2.6	14.0	21.9

averaged 316.8 ± 167 µS/cm. The highest percentage (41.1%) of honey samples produced from pure honeydew was recorded from *A. dorsata* followed by *A. cerana* (18.7%). There were no pure honeydew samples from *A. mellifera* (one sample recorded 711 µS/cm). In *A. dorsata*, 8.3% samples were mixed honey and in *A. cerana* 18.7 % samples were mixed honey.

Water content and pH values are also shown in Tables 1 and 2. In general, the results show that the higher the electrical conductivity the higher the pH value. However, this was not the case with all samples. The pH value also depends on the range of variation in electrical conductivity. The pH value for Langtang averaged 4.52 ± 1.14, for Jumla 3.69 ± 0.26, for Dadeldhura 3.74 ± 0.61, for Kathmandu 3.81 ± 0.78, for Chitwan 3.74 ± 0.34 and for commercial beekeepers 3.59 ± 0.38. Water content percentage averaged for Langtang 21.3 ± 1.8, for Jumla 20.96 ± 2.5, for Dadeldhura 22.8 ± 3.2, for Kathmandu 22.3 ± 1.98, for Chitwan 19.17 ± 1.96 and for commercial beekeepers 17.98 ± 2.However, the water content at high altitudes was slightly higher than at low altitudes. The lowest water content (18.2%) was recorded in *A. mellifera* honey. This may be because all *A. mellifera* colonies were reared in movable-frame hives and so it was possible to collect only sealed-comb honey. The pH value for *A. cerana* is slightly lower than the value recorded by Shrestha (1996) and the water content of many samples is higher than the Codex Alimentarius standard (<21%) of the European Honey Commission (Bogdanov *et al.*, 1997). Shrestha (1996) recorded pH 4.17–5.5, water content 17–21%, and EC 360–1060 µS/cm for Nepalese honey (source of honey not mentioned). Phadke (1967,1968) in India recorded water content of 20 ± 2% in *A. indica* (*cerana*) honey and 20.9 % in *A. dorsata* honey. Mitra and Mathew (1968) in Calcutta, India, also recorded water content of 20.5% for *A. cerana* honey and 23.5% for *A. dorsata*.

Pollen spectra of Chitwan honey were also analysed. The results show that bee species have different foraging preferences. While the foraging distance of *A. mellifera* is more or less equal to *A. dorsata*, it preferred cultivated crops mainly *Brassica* and *Fagopyrum*. *Apis cerana* foraged on both cultivated plants and wild plants such as *Eupatoreum odoratum, Zizyphus jujuba*, etc. *Apis dorsata* preferred wild plants such as *Eupatoreum odoratum, Dalbergia sissoo, Albizzia* spp., *Bombax ceiba*, etc.

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