



Eva Crane Trust

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Harvesting sweet materials from plants without the aid of honey-storing insects

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It is easy to forget that honey is not the only natural sweetener traditionally used by humans. Dr Eva Crane, IBRA's founding Director, tells us about these alternative 'sweets' from around the world.

In many parts of the world honey has been obtained from nests of bees, honey wasps or honey ants, as well as from hives¹³. In addition, substances containing sugar were sometimes harvested directly from certain plants — especially in regions without native honey-storing insects (the Americas outside the tropics, New Zealand and parts of Australia), and where there were plants with much accessible sugar. In parts of the Old World tropics some plants contain sap with a high sugar content; in the Old World tropics and also in Australia and New Zealand, flowers of some other plants secrete copious nectar. On certain trees in both the temperate zones and the tropics, sweet honeydew is excreted by plant-sucking insects feeding on the sap.

The substances collected by man are considered here in the order: nectar, honeydew, manna, plant sap. Nectar is actively secreted by nectaries, and the other materials are produced as a result of the plant being wounded — honeydew and manna after certain insects have pierced the plant tissues, and other materials after man has wounded the plant, usually by 'tapping' trees or cutting stalks. Sweet fruits and roots constitute other large groups, which are not dealt with here.

Nectar

Flowers yielding large amounts of nectar have been utilized by man in various parts of the world. The nectar is secreted by nectaries in flowers or, less commonly, in other parts of plants.

Many records (e.g. Best⁵) show that in New Zealand, where there were no native honey-storing bees, the Maori obtained nectar from flowers that secrete it freely, for instance:

- rewarewa, *Knightia excelsa*
- pohutukawa, *Metrosideros excelsa*
- rata, *M. robusta*
- korari or flax, *Phormium tenax*

All these are important sources of honey where honey bees are present^{14,22}.

For immediate consumption, nectar was sucked out of the flowers. W C Cotton, who published a beekeeping book in the Maori language in 1849¹², wrote in 1842 after honey bees had been introduced to New Zealand¹¹: 'The flowers of the plants abound with honey, which the natives frequently suck. ... The bees will do more effectively for them with their small proboscis what the natives now do for

themselves with their large mouths.' The collection of nectar for later use was often done by young people; the picked flowers had to be tapped lightly on the side or rim of a gourd bowl. The Maori used nectar from *Metrosideros excelsa* to treat inflamed throats²³.

On Elcho Island off the north coast of Australia, 'the *Grevillea excelsior* flowers are so full of nectar in August that they ooze; the children love them, and come to school smelling strongly of them'¹⁹ (fig. 1). Aborigines used this nectar to make an alcoholic drink, and they also collected nectar from flowers of *Callistemon* (bottlebrush), *Cassia* and *Hakea*.

The Indian butter tree, *Madhuca butyraceae*, grows in many parts of Nepal, and Chepang and other peoples shook its flowers to collect the nectar. The same was done with flowers of *Rhododendron arborea*, whose nectar — unlike that of some other species

of the genus — is not toxic to man. In North America a single flower of the tulip tree (*Liriodendron tulipifera*) can contain over a gram of nectar, and in a breeze the tree may 'rain' nectar.

In the 1880s, native people near the Cape of Good Hope in South Africa were reported to use spoons to take nectar from flowers of *Protea mellifera* (Planta, quoted by Dadant¹⁵); see figure 2. Nigerian children nowadays suck nectar from the flowers of *Combretum smeathmannii*⁷.

Edlin¹⁶ said that the true heather ale in the Scottish highlands was flavoured with water in which nectar-bearing flowers of heather (*Calluna vulgaris*) had been steeped.

Honeydew

Honeydew is produced by certain aphids which pierce the tissues of their host plant, usually a tree²⁰. Bees, wasps and ants collect



FIG. 1. *Grevillea excelsior* in Australia.



FIG. 2. *Protea* flowers in South Africa.

the honeydew, which was probably also sought out by early man where it occurred on accessible parts of a tree. In the Himalayas the chir pine, *Pinus roxburghii*, has very long needles which become covered with sweet honeydew in some areas, and in Himachal Pradesh, India, women become skilled in collecting the honeydew into bowls, and children suck the needles²⁴.

Manna

The word manna has been used popularly for various sweet substances; here it means crystallized honeydew, which is produced in certain circumstances on some plant species when water evaporates from the honeydew. The manna may solidify into a whitish mass, as on larch (*Larix decidua*); in the French Alps it was known as *manne de Briançon*. Manna is also produced in dry deserts and mountain steppes, and Bodenheimer⁶ discussed references to it in the Middle East. For

instance 'manna from the skies' (*man-es-simma*) was produced in Kurdistan from the honeydew of an aphid on various oaks (*Quercus* spp.). It was bought by confectioners for use in the production of a sweetmeat also known as manna; about 30 tonnes of it were sold annually in Iraq.

Sweet crumbly white 'manna', said to be exuded from the bark of the river or manna gum (*Eucalyptus viminalis*), was eaten by Australian Aborigines¹⁸; it might have been produced by aphids or lerp insects. The production of 'manna' by insects feeding on other species of *Eucalyptus* in Australia has also been reported; see e.g. Basden¹². Daisy Bates³ referred to 'sweet white manna' from certain eucalypts which Aborigines prized for its sweetness. In studies between 1965 and 1972, Basden found that honeydew was produced on eucalypts and some other trees by various insects, including lerps (Psyllidae) which are widespread in Australia (fig. 3); their nymphs excrete a protective



FIG. 3. Lerp on leaves of *Eucalyptus* in Australia.

scale or lerp of waxy material or starch, and Basden¹ suggested that enzymes in the insect saliva synthesize certain sugars. Bodenheimer⁶ referred to a similar 'manna' in Africa.

Sap

Sap is the direct source of sugar most widely harvested from plants, and in many regions is man's main source of sugar. In areas where sugar cane (*Saccharum officinalum*) is cultivated, the canes are cut to obtain the sap, and the sugar extracted from it. The comprehensive book by Baxa and Bruhns⁴ describes sugar industries throughout the world. Cut stalks of sugar cane are still widely sold for direct human consumption, by chewing it (fig. 4). In addition, certain trees, especially species of palm¹⁰, were and are sugar sources. The sugar palm, *Arenga pinnata*, grows wild in tropical Asia from Malaysia to the Philippines. It was one of

man's early sources of sugar, and was later sometimes cultivated. The stalk of the male flowers was tapped daily for 2–3 months; the sap, which contains up to 15% sucrose, was collected and boiled down to make a sticky sugar known as jaggery; it was also fermented to make toddy or palm wine.

In some regions where the coconut palm (*Cocos nucifera*) was grown, the unopened flower spathes were bruised slightly, tied tightly to prevent them opening, and bent over gradually so that their sap could be collected in a bamboo pot placed to receive it. In 1986 I saw the process at Bangkhantak near the mouth of the Mae Khong river in Thailand, in a plantation also used as an *Apis cerana* apiary/ (fig. 5). To prevent bees going into the collecting pots and drowning, bark of *Shorea floribunda* was floated on the sap in each pot, and acted as a repellent. Water was evaporated from the sap by heating this in large woks, producing a kind of fondant.

Palmyra, the fan or sugar palm, *Borassus flabellifer*, grows in tropical Africa, India and Malaysia. Some 2 litres of sap per day are obtained by tapping the unopened inflorescence in trees between about 25 and 55 years of age. The sap is drunk fresh, or evaporated into palm sugar, or fermented into palm wine which can itself be distilled into a spirit, arrack.

Aborigines in Tasmania — now extinct — obtained sugar from *Eucalyptus gunnii*, which grows at altitudes between 600 m and 1000 m. They used a sharp stone to cut a hole in the trunk near the ground, and carved out a basin at the foot of the tree, in which over 1.3 litres of sap might collect. Sometimes the sap dried to a white paste, which was eaten⁹.

Maple sugar was made by evaporating water from sap of the sugar maple (*Acer saccharinum*). It was a main source of sugar for early European settlers in colder parts of North America, and was often referred to as

competing with honey there. The sap can be tapped in early spring, when it rises in the tree.

The following are examples of other sources of sugar, some of which are mentioned by Chittenden⁸, Howes¹⁷ or Wickens *et al.*²⁵. The first six are palms:

- *Caryota urens*, the toddy palm, is cultivated in India, Malaysia and Thailand. A mature tree is said to yield 15 litres of toddy a day.
- *Hyphaene thebaica*, the doum palm, is cultivated in Egypt and other dry regions. It is widely tapped for sap to make palm wine, and the palm heart is edible.
- *Jubaea spectabilis*, the coquito palm, grows in Chile. Sap is obtained by felling the tree, and is boiled to produce 'palm honey'.
- *Phoenix dactylifera*, the date palm, is widely cultivated for its fruit. It is also tapped for



FIG. 4. Sugar cane on sale by the Muar River, Johore, Malaysia, 1967.

the sap which may be drunk fresh, evaporated to produce palm sugar, or fermented into palm wine. When the tree is felled, the palm heart is eaten.

- *Phoenix sylvestris*, the wild date or East Indian wine palm, is grown in India for its sap. When about seven years old, the stem of the tree is notched at the top, and subsequently yields 75–90 litres of sap a year, which contains about 3.5 kg of sugar. The yield continues for 20–25 years.
- *Raphia vinifera*, the bamboo or wine palm, grows in tropical Africa; the sap was used by native peoples to produce a wine, *bourdon*.
- *Pinus lambertiana*, the sugar pine, is native to Oregon and California, USA.
- *Protea mellifera* and other species of sugar bush grow in South Africa, especially the Cape region; they are small trees and bushes whose flower heads were soaked

in water to remove the nectar, and the solution evaporated to a syrup.

Sugar-containing sap was also collected from still other sources. For instance the Maori in New Zealand used the sap of the daisy flower, *Lagenifera pumila*, to treat mouth ulcers²³. Native Americans in what is now Arizona, USA, gathered flower stalks of *Agave parryi*, and used their 'nectar' as a syrup²¹. In Mexico, sap of some *Agave* species was fermented to produced alcoholic drinks, and the national drink *pulche* was produced by cutting out the inflorescence just as it began to develop; the sweet sap was exuded from the plant for 3–4 months, and was collected and fermented.

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FIG. 5. Bamboo pots being taken to collect sap from coconut palms; see text.

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