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Honey

GUARDIAN SPECIAL REPORT

Exports take one sixth of bees' output

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THE honey that is bought and sold on the world honey market is made by the European honeybee apis mellifera, whose ancestors evolved ten million or twenty million years ago in the Old World. The bee was taken by early settlers from Europe to the New World, and most export honey is now produced there.

It is only during the last few million years, at most, that man has existed and has taken the bees' honey. There is direct evidence for this from the end of the last Ice Age, and the earliest known representation is not much later: a painting in a rock shelter at Bicorp in Eastern Spain: Here, around 7000 BC, an artist depicted the perilous ascent up ropes to a bees nest in the rock face. The transition from honey hunting to beekeeping proba-

The transition from honey hunting to beekeeping probably occurred when swarms of bees took possession of vesse's such as clay water pots or upturned wicker baskets. In wooded areas, where people harvested honey from bees nests in hollow trees, toois were developed that could cut through a tree trunk, and a log containing

a nest could then be removed and placed near the dwelling; log hives in a primeval apiary. The earliest surviving illustrations of hives are in the Temple of the Sun at Abusir in Egypt (c. 2400 BC), and the earliest known written reference is in the Hittite Code (c. 1300 BC).

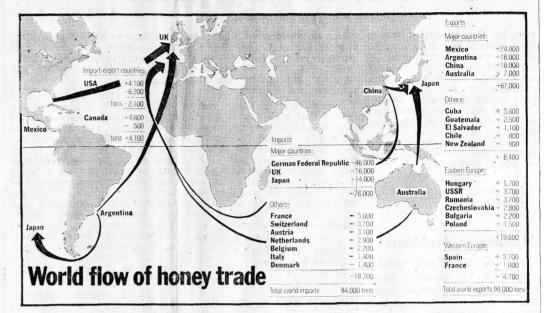
In some parts of the world honey is still harvested by honey hunting. Honey-getting from hives changed astonishingly little through the centuries. but after 1500 greater knowledge brought modest improvements.

In the early "fixed-comb" hives the bees attached the combs to the top and side walls, and the beekeeper cut the combs out. The revolution that changed this was sparked off in 1851, when the Rev. L. L. Langstroth in US devised a hive that has since formed the basis of modern beekeeping throughout the world. This hive was a wooden box, opened from the ton, with parallel frames suspended on runners by a lug at each end, spaced out at the same distance apart as the bees' natural comb spacing, and with a "beespace"—about 6mm—botsween the frames and the hive walls.

Modern beekeeping is thus not much more than a century old. Today, there are about 50 million hives of bees in the world, worked by 65 million beekeeners and producing an average of 600 thousand tons of honey a year, of which 100 thousand tons are exported. The levels of production and consumption for the years around 1970 are shown right; weights are in kg.

Most of the major honey-amorting countries (such as

Most of the major honeyexporting countries (such as Mexico, Argentina, Australia), straddle one of the two 23½deg latitudes that bound the tropics, Most of the importing countries are in Europe (German Federal



Republic, United Kingdom etc), are all at higher latitudes.

Northern and Central Europe, with it, strong tradition of beekeeping — and honey eating — since early times, is characterised by a relatively high honey consumption, and the same is true of countries colonised from that area (North America produces about as much honey as it consumes and is thus not a net importer). There are two very interesting exceptions to the above: Japan is a major importer, and the Chinese People's Republic a major exporter.

Honey consumption averages out at about 1.2 per cent of the sugar consumption in most continents. But in Latin America which grows sugar cane and which was peopled from Southern Europe, it is only 0.2 per cent. In Asia it is much lower still, and sugar consumption is also low: the whole pattern is different. Africa shows ye' another pattern; sugar consumption is low and honey consumption high in proportior; at any rate until recently, in tropical regions the honey was not eaten but converted into alco-

hol by making honey beer—except in Muslim areas where alcohol is forbidden

What of the bees that make the honey? Their performance is truly astonishing. The fuel consumption of a flying bee is about 1 mg, of honey a mile, or 7 million miles to the gallon In providing one pound of surplus honey for marke, the colony has nad to consume something like a further 8 pounds to keep itself going, and the foraging bees have probably covered a total flight equal to three orbits round the earth — at a fuel consumption of about an ounce of honey for each orbit.

In finding the nectar or other raw material from which the colony can make noney, foraging bees learn and remember the scent, colour, and location of flowers that are currently yielding. The location is identified by distance from the hive, in terms of flight energy expenditure, and by distortion from the hive in relation to the sun's direction, varying as this does throughout the day.

Nectar carried into the hive in the forager's honey sac is likely to contain only 20-40 per cent sugar, and

much of this sugar is of the wrong type for honey. In making honey from the nectar, the bees have to evaporate off most of the water, and carry out some specific sugar chemistry. They evaporate water in several ways: by creating a forced draught through the hive as they fan with their wings at the hive entrance; by "hanging drops up to dry" on the upper surface of cells in the comb; and by stretching a drop of nectar into a film by movements of the proboscis.

Of the final honey, 80 per cent or more is sugar, which is dissolved in the remaining 17-20 per cent of water. This extraordinarily high concentration is attainable only because of a certain peculiarity of sugar solutions at 30-35deg C, the temperature in the hive. Most of the sugar in honey has been inverted into glucose and fructose, a process that is mediated by the enzyme invertase, secreted by hypopharvngeal glands in the heads of worker bees.

At the hive temperature (enly), the solubility of glucose in a solution of fructose increases abruptly if the fructose concentration is raised above 1.5g per gram of water. Thus, by inverting the sucrose in the nectar into glucose and fructose, at hive temperatures, the bees are able to produce a supersaturated solution containing only about 18 per cent water, more highly concentrated than they could achieve with sucrose.

This has two clear advantages for the bees: their stored food is resistant to spollage by fermentation. even during year-long storage, and it represents a high-energy pack, occupying minimal space. These are qualities that we value, too, more especially in a food made without human intervention.

0.2	12.5	370 95	0.38	46
0.2				46
0.09	35	2.000	0.5	57
		50	0.1	42
2012	26	300	0.7	49
0.5	9	64	0.13	15
	6		0.26	11
	12	70	0.004	7
	11	90	0.5	45
2.8	9	90	0.4	36
q. Kill		bcckeeper	Honey	Sugar
	Honey/	Honey/		
Annual production		Annual consumption per capita		
	2.8 0.4 0.2 0.4 0.5	Hives/ Honey/ sq. km Honey/ hive 2.8 9 0.4 11 0.2 12 0.4 6 0.5 9 0.24 26 0.19 25	2.8 9 90 0.4 11 90 0.2 12 70 0.4 6 30 0.5 9 64 0.24 26 300 0.19 25 50	Hives/ Honey/ hive beekeeper Honey 2.8 9 90 0.4 0.4 11 90 0.5 0.2 12 70 0.004 0.4 6 30 0.26 0.5 9 64 0.13 0.24 26 300 0.7 0.19 25 50 0.1