There are numerous modified and subsidiary processes connected with refining, as well as with all branches of the sugar industry, regarding which it is not possible here to enter into detail. The industry is essentially progressive and subject to many changes.

Sorghum Sugar.—The stem of the Guinea com or sorghum (*Sorghum saccharatum)* has long been known in China as a source of sugar, and the possibility of cultivating it as a rival to the sugar-cane and beetroot has attracted much attention in America. The sorghum is hardier than the sugar-cane ; it comes to maturity in a season ; and it retains its maximum sugar content a consider­able time, giving opportunity for leisurely harvesting. The sugar is obtained by the same method as cane sugar. The cultivation of sorghum sugar has not found much favour in the United States ; the total yield from that source in 1885 did not exceed 600,000 lb.

Maple Sugar.—The sap of the rock or sugar maple, *Acer saccharinum,* a large tree growing in the United States and Canada, yields a local supply of sugar, which also occasionally finds its way into commerce. The sap is collected in spring, just before the foliage develops, and is procured by making a notch or boring a hole in the stem of the tree about 3 feet from the ground. A tree may yield 3 gallons of juice a day and continue flowing for six weeks ; but on an average only about 4 lb of sugar are obtained from each tree, 4 to 6 gallons of sap giving 1 lb of sugar. The sap is purified and concentrated in a simple manner, the whole work being carried on by farmers, who themselves use much of the pro­duct for domestic and culinary purposes. The total production of the United States ranges from 30,000,000 to 50,000,000 lb, prin­cipally obtained in Vermont, New York, Ohio, and Pennsylvania. In Canada also a considerable quantity of maple sugar is collected for domestic use.

Palm Sugar.—That which comes into the European market as *jaggery* or *khaur* is obtained from the sap of several palms, the wild date *(Phœnix sylvestris),* the Palmyra *(Borassus flabelliformis),* the cocoa-nut *(Cocos nucifera),* the gomuti *(Arenga saceharifcra),* and others. The principal source is *Phœnix sylvestris,* which is cultivated in a portion of the Ganges valley to the north of Cal­cutta. The trees are ready to yield sap when five years old ; at eight years they are mature, and continue to give an annual supply till they reach thirty years. The collection of the sap (toddy) begins about the end of October and continues, during the cool season, till the middle of February. The sap is drawn off from the upper growing portion of the stem, and altogether an average tree will run in a season 350 lb of toddy, from which about 35 lb of raw sugar—jaggery—is made by simple and rude processes. Jaggery production is entirely in native hands, and the greater part of the amount made is consumed locally ; it only occasionally reaches the European market.

Starch Sugar.—This, known in commerce as glucose or grape sugar, an abundant constituent of sweet fruits, &c. (see p. 623 above), is artificially elaborated on an extensive scale from starch. The industry is most largely developed in Germany, where potato starch is the raw material, and in the United States, Indian corn starch being there employed. The starch is acted on by a weak solution of sulphuric acid, whereby soluble starch is formed, which ulti­mately results in a mixture of glucose aud dextrose in varying proportions, constituting the starch sugar of commerce. The operations embrace the boiling of the starch with water containing the requisite proportion of acid, the neutralization of the acid with lime, and the formation of a precipitate of sulphate of lime, which is separated by filtration in a filter press. The filtered liquid is, when necessary, deprived of colour by passing it through a bed of animal charcoal, and then it is concentrated to a density of from 40 to 45 Baumé in a vacuum pan. If the resulting syrup contains little dextrin it will on cooling slowly solidify into a granular con­cretionary mass ; but if much dextrin is present it remains in the condition of a syrup. Starch sugar is very largely used by brewers and distillers, and by liqueur makers, confectioners, and others for making fruit and other syrups. Burnt to caramel, it is also employed to colour beverages and food substances. As an adul­terant it is largely employed in the honey trade and for mixing with the more valuable cane sugar. In 1885 there were about fifty factories in Germany engaged in starch sugar making, in which 10,000 tons of hard sugar, 20,000 tons of syrup, and 1250 tons of “colour” were made.

*Commerce.*

At the present time, judging by the amount sent to the market, cane and beet sugars are produced in about equal amount ; but, since vast quantities of cane sugar are grown and consumed in India, China, and other Eastern countries of which we get no account, there cannot be a doubt that the annual production of cane far exceeds that of beet sugar. Still, as a growth of not more than forty years, the dimensions to which the beet sugar trade has attained are certainly remarkable. But these dimensions would not have been so suddenly attained had it not been for the system of protection established in the producing countries and of bounties paid to the beet manufacturers on exporting their produce. The

United Kingdom is the only open market for sugar, which is con­sequently sold there at an unprecedentedly low price. The follow­ing table shows the relative proportions of the beet and the cane sugar trade and the principal sources of the supply for 1880-85 :—

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1880-81. | 1881-82. | 1882-83. | 1883-84. | 1884-85. |
| 1. Beet Sugar | Tons. | Tons. | Tons. | Tons. | Tons. |
| German empire .... | 594,223 | 644,775 | 848,124 | 986,000 | 1,155,000 |
| Austria-Hungary .. | 498,082 | 411,015 | 473,002 | 446,000 | 558,000 |
| France | 333,614 | 393,269  308,779 | 423,194  284,991 | 474,000  308,000 | 308,000  387,000 |
| Russia and Poland. | 250,000 |
| Belgium | 68,626 | 73,136 | 82,720 | 107,000 | 88,000 |
| Holland and other |  |
| countries | 30,000 | 30.000 | 35,000 | 40,000 | 50,000 |
| Total.... | 1,774,545 | 1,860,974 | 2,147,031 | 2,361,000 | 2,546,000 |
| 2. Cane Sugar. Cuba | 484,000  57,100 | 500,300  80,000  53,400  53,000 | 485,000  70,000  54,000  52,000 | 560,900  65,000  59,800  56,000 | 627,800  60,000  65,700  60,700 |
| Porto Rico |
| Trinidad | 43,600  45,000 |
| Barbados  Jamaica |
| 17,000  16,800 | 27,000  23,000 | 25,000  16,000 | 20,000  23,000 | 18,000  20,000 |
| Antigua & St Kitt’s |
| Martinique | 42,000  43,000 | 47,800 | 46,800  52,000  117,000 | 49,400  55,300  126,000 | 38,800  41,200  96,000 |
| Guadeloupe | 57,000  124,200 |
| Demerara' | 92,300 |
| Réunion | 27,100 | 25,000  118,000  273,000  66,000  304,400  151,500 | 34,000  116,700 | 37,800 | 37,000  128,000  380,000  45,000  269,000  203,400 |
| Mauritius | 119,000  210,500  45,000  344,600  199,000 | 120,400  311,400  60,000  359,000  123,000 |
| Java | 283,600 |
| British India | 87,000  218,000 |
| Brazils |
| Manila, Cebu, Iloilo Louisiana | 211,600 135,300 31,000 21,000 |
| 121,900  40,000  32,000 | 71,400  40,000  29,000 | 128,400  25,000  30,000 | 94,500  35,000  40,000 |
| Peru |
| Egypt |
|  |
| Total.... | 1,979,900 | 2,044,000 | 2,056,000 | 2,210,400 | 2,260,100 |
| Beet and Cane.. | 3,754,445 | 3,904,974 | 4,203,031 | 4,571,400 | 4,806,100 |

The relative values of beet and of a low quality of raw cane sugar for 1879-86 are shown in the following table:—

|  |  |  |
| --- | --- | --- |
| Average Price each Year. | | |
|  | 1879. | 1880. 1881. 1882. 1883. 1884. 1885. 1886. |
| Unclayed Manila (taal) on spot | s. d.  14 8  21 3 | s. d. s. d. s. d. s. d. s. d. s. d. s. d.  15 3 15 0 13 11 12 9 10 0 10 01/4 9 101/4  22 3 22 9 22 0 20 2 14 0 14 0 1/4  13 1 |
| German beet ; basis 88 per cent. f.o.b |
| Average Price of the Fourteen Years 1872 to 1885. Price, August 1886.  Unclayed Manila (taal) 14s.111/2d. per cwt. 8s. 3d. per cwt.  German beet; basis 88 per cent. f.o.b. 21s. 63/4d. ,, ∣ 11s. „ | | |

(J. PA.)

SUGAR-BIRD, the English name commonly given in the West India Islands to the various members of the genus *Certhiola* (generally regarded as belonging to the Family *Cœrebidæ@@*1) from their habit of frequenting the curing-houses where sugar is kept, apparently attracted thither by the swarms of flies. These little birds on ac­count of their pretty plumage and their familiarity are usually favourites. They often come into dwelling-houses, where they preserve great coolness, hopping gravely from one piece of furniture to another and carefully exploring the surrounding objects with intent to find a spider or insect. In their figure and motions they remind a northern naturalist of a Nuthatch, while their coloration—black, yellow, olive, grey, and white—recalls to him a Titmouse. They generally keep in pairs and build a domed but un­tidy nest, laying therein three eggs, white blotched with rusty-red. Apart from all this the genus presents some points of great interest. Mr Sclater (*Cat. Β. Br. Museum,* xi. pp. 36-47) recognizes 18 “species,” therein following Mr Ridgway (*Proc. U.S. Nat. Museum,* 1885, pp. 25-30), of which 3 are continental with a joint range extending from southern Mexico to Peru, Bolivia, and south-eastern Brazil, while the remaining 15 are peculiar to certain of

@@@1 Known in French as *Guit-guits,* a name used for them also by some English writers. The *Guitguit* of Hernandez *(Rer. Medic. N. Hisp. Thesaurus,* p. 56), a name said by him to be of native origin, can hardly be determined, though thought by Montbeillard *(Hist. Nat. Oiseaux,* v. p. 529) to be what is now known as *Cœreba cærnlca,* but that of later writers is *C. cyanea.* The name is probably onomato­poetic, and very likely analogous to the “Quit” applied in Jamaica to several small birds.