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PREFACE.

The object of the volumes of "Selected Papers from the Kew Bulletin," to which the present one belongs, has been explained in the preface to the first selection of the kind, which deals with "Vegetable Fibres" and was issued eight years ago.

The practical value of previous selections has been so great that the issue of the present volume, which deals with "Rubber," requires no explanation.

The arrangement of the papers here reprinted from the pages of the *Kew Bulletin* is that adopted in the selection which deals with "Fibres"; the notes and papers regarding individual rubber-yielding plants are given in the sequence adopted in the *Genera Plantarum* of Bentham and Hooker, of the natural families to which the various species belong. Those few papers, of a general character, which cannot in their entirety be allocated to particular natural families, and at the same time cannot conveniently be divided into sections, precede the more special articles.

D. P.

Royal Gardens, Kew,
August, 1906.

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ROYAL BOTANIC GARDENS, KEW.

SELECTED PAPERS

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III.—RUBBER.

I.—SOURCES OF RUBBER SUPPLY.

[*K.B.*, 1892, pp. 67–71.]

Para rubber is the produce of *Hevea brasiliensis*, Muell. Arg., a tree belonging to the natural order *Euphorbiaceae*. The rubber is obtained from incisions cut through the bark, from whence the sap trickles into small bowls and is finally cured by being ladled on to a paddle-shaped implement and held over a stove in which Urucury Nuts (*Maximiliana regia*) are burnt as the fuel. In Museum No. 1, Case 94 [now Case 105], will be found a fine series of articles used in collecting and preparing this rubber for export, and also numerous samples of the rubber. In 1891 the estimated export of Para rubber amounted to 17,700 tons, of which 6,000 tons were imported into this country.

A sample of rubber from *H. brasiliensis*, grown at Mergui, India, was reported upon in this country in 1889 as worth 1*s.* 11*d.* per lb.

Ceara rubber or "Ceara Scrap" is afforded by *Manihot Glaziovi*, Muell. Arg., a tree native of South America and belonging to the natural order *Euphorbiaceae*. The imports of this rubber into this country amounted to 180 tons in 1891. In Case 96 [now Case 106], Museum No. 1, will be found samples from Brazil, and also from plants introduced into Ceylon, Zanzibar, and Natal.

Mangabeira or Pernambuco rubber is extracted from a small tree (*Hancornia speciosa*, Gomez) of the natural order *Apocynaceae*. Specimens of this rubber are shown in Case 72 [now Case 76], Museum No. 1.

The principal source of Central American rubber is *Castilloa elastica*, a large forest tree of the tribe *Artocarpeae* of the natural order *Urticaceae*. It affords the Ule of British Honduras as well as Nicaragua, Guatemala, Mexico, and Guayaquil rubbers. The total imports of Central American, West India, Colombian, Carthagena, and Guayaquil rubbers during the year 1891 amounted to 100 tons. *See* Case 100 [now Case 115], Museum No. 1.

Esmeralda of Guiana may perhaps be afforded by *Hevea* sp. or *Sapium* sp. of the natural order *Euphorbiaceae*.

Colombian india-rubber and "Carthagena" are one and the same thing, as is pointed out in the *Kew Bulletin*, 1890, p. 149 [p. 132]. The tree yielding this rubber is *Sapium biglandulosum* of the natural order *Euphorbiaceae*, a widely spread and variable species; it is also the source of Touckpong or Cumakaballi rubber of British Guiana. Case 96 [now Case 108], Museum No. 1, contains specimens of these rubbers.

Assam rubber is the produce of *Ficus elastica*, a large tree of the *Artocarpeae* tribe of *Urticaceae*. The imports of Assam and Rangoon rubber (also from *F. elastica*) amounted to 350 tons in 1891. Specimens may be seen in Case 99 [now Case 114], Museum No. 1.

Borneo rubber is afforded by species of *Willughbeia* and *Leuconotis*, allied genera of the natural order *Apocynaceae* (*see* Kew Report, 1880, p. 43); 200 tons of this rubber were imported into this country during the year 1891. Samples will be found in Case 71 [now Case 75], Museum No. 1.

African rubber is furnished by several species of the genus *Landolphia*, woody climbers of the natural order *Apocynaceae*. The best quality from the Zanzibar coast is derived from *L. Kirkii*; two other species, viz., *L. florida* (the chief source of Mozambique rubber), and *L. petersiana* are also sources of the East African supply.

On the west coast *L. owariensis*, which has a very wide distribution, is the principal species furnishing Congo and Sierra Leone rubbers. *L. florida*, which occurs on the east coast, and *L. Mannii* also afford part of the West African supply. Liberian rubber is perhaps in part afforded by the "Abba" tree (*Ficus Vogelii*), of the *Artocarpeae* tribe of *Urticaceae*, which has already been fully discussed in the *Kew Bulletin* for November 1888 [p. 141] and May 1890 [p. 150].

Messrs. Hecht, Levis, and Kahn give the following statistics concerning these rubbers for 1891, viz.:—African imports, 4,350 tons; Mozambique, 380 tons; Madagascar, 300 tons. Case 71 [now Case 75], Museum No. 1, contains samples of these rubbers.

The following review of the sources of rubber supply from the commercial side has appeared in *The India Rubber and Gutta Percha and Electrical Trades Journal*, January 8, 1892:—

There are merchantable in New York between 30 and 40 different sorts of india-rubber, the variations determining the selection by manufacturers in the purchase of stocks, says I. A. Sherman in the *India-Rubber World*. Of course, rubber in all its variations is essentially the same, differing somewhat in the same degree as the pumpkin in South Dakota from that in New England—one large and another small, one with little flavour and the other richer in food qualities. The difference between sorts of rubber, however, is due in large measure to the methods employed in gathering the sap. It happens that the natives of the

Amazon Valley have always taken pains in the curing of rubber. While climatic conditions in that country may have had their influence upon the character of "Para," the condition in which this rubber is exported has become a prime factor in making it a favourite with manufacturers. On the other hand, some of the African sorts are so full of bark and stones as to make them almost unfit for use. At one time "Assams" were almost unmarketable in New York, the price sinking as low as 10 cents per pound, and not wanted at that. One firm, after long experimenting, discovered a chemical solution in which the rubber was washed, the process being that the bark and other impurities absorbed the chemicals, making them so heavy that they separated from the gum and fell to the bottom and away. This company made a fortune in a moderate space of time; but they put up gradually the price of Assams, from the fact of their creating a demand for that sort of rubber, until the profits became comparatively small, when they disposed of the privilege of washing to some leading rubbermen, who use the process at the present day.

Para rubber is more largely consumed in the United States than any other. It may be noted, also, that the larger share of the rubber exported from Para comes to this country. There are three grades—fine, medium, and coarse. Fine Para is the standard by which all other grades are measured; it brings the best price, and probably is more used than any other. Should it become irregular in quality in the operation of curing over the smoke of palm nuts—as when little strips of virgin gum occur in the grain—it is called "medium," and its price is lessened by a cent or two per pound.

The "coarse" is imperfect, being composed of the scrapings and refuse of the fine sorts, and sells for about two-thirds of the price of the better grade. It shrinks considerably, having much water in it, and the importer generally is in a hurry to turn it over to the manufacturer. There are again many variations in Para rubber coming from different localities on the Amazon. This subject is involved in some obscurity; but the best rubber is supposed to be found on the River Purus, a tributary of the Amazon, having its source in the Andes. Brazilians, however, are apt to believe that the locality of the best sorts is unknown to Americans, and possibly the Purus may not be the locality.

There comes from Peru, at the sources of the Amazon and its tributaries, a rubber resembling the Nicaragua sheet, and called Caucho. This rubber is very wet, and consequently shrinks very much, which is a serious drawback. It is considered a good strong rubber, and it is utilised to a considerable extent by the boot and shoe manufacturers.

Of Ceara rubber, there are three grades, numbered one, two, and three respectively. It is called a "mule gum," the significance being that it is neither one thing nor the other, it being so deficient in elasticity as to cause some to argue that it is not rubber. It is a very dry rubber, its gathering being peculiar. The tree is incised at the beginning of the dry season, and as the gum oozes from the wound it forms on the outside of the bark, to be pulled off at the end of the season. The gathering of this

rubber seems to be on the wane, for every year there is an extensive migration of Ceara people to Para, bound for the forests of the Amazon.

From Bahia and Pernambuco, in Brazil, comes a rubber of a different grade from that of Para. It is cured with alum and salt water. The Pernambuco comes in sheets, and is of a yellowish-white tinge. That from Bahia is not so good, and comes in round balls. The principal objection to it is that it is very damp, entailing a large loss to the importer from shrinkage.

Of Mangabeira rubber, there are three grades, very similar to the Bahia and Pernambuco sorts. A grade that has a red look is considered superior, and sells for 5 or 10 cents per pound higher than the others.

From Central America comes a variety of rubbers, distinctive in name theoretically, but owing to the lines of transportation centering at Greytown, and the trans-shipment at that point to New York, there is much confusion, one sort often getting substituted for another. The Pacific mail steamers gather also different varieties at Panama with the same confusion. That which comes from Nicaragua is called Nicaragua "sheet" and "scrap." The latter comes in pieces about 2½ feet long, weighing from 10 to 40 pounds. In the gathering of rubber in the forest, around the cuts in the tree a residuum is left, which is given to the man as a perquisite, and this forms "scrap." As in the peculiar mode of gathering, it is very dry, there is little loss in shrinkage, and this quality makes it a favourite with manufacturers. It contains some bark, but not so much as the "sheet." The sheet, after it is milled and washed, is the same rubber as the "scrap." Both are cured by the use of a vine from which a soapy [? alkaline] substance is formed.

There is another grade which comes from Central America, containing a considerable amount of ashes, due to its being smoked over the latter. It comes in thin sheets ⅛ to ¾ inch thick. It is a dry rubber, there not being so much loss in shrinkage; but it is not so firm as the other grades, and it is difficult to work. There also comes from Central American ports a rubber which is chiefly grown in New Granada, and is called "Carthagena strip." It is from 1½ to 2 inches thick, and there is a great deal of sand and dirt in it. It is a black, tough rubber.

Honduras furnishes a great deal of rubber of the Tuno sort, which is found in many other sections of Central America. Guatemala ranks low in the American varieties, containing a resinous substance which gives it a tarry appearance. It comes in sheets pressed together. There is a rubber which comes from Angostura as good as Para. When cut it is found to contain little spots of white as large as a pea. Tuxpan, Mexico, once sent a fine grade of strip rubber; but as the trees have been destroyed by cutting them down instead of tapping for rubber, the imports from there are now very small. The rubber is gathered by scraping from the bark.

Guayaquil comes in large flakes or lumps of a whitish colour in the best sorts, the inferior sorts being porous and exuding a black liquid which stains the knife and hands. As in a great many "Centrals" the name is often confounded with the sorts.