A New Rubber Tree: Palo Amarillo. (*Euphorbia fulva*, Stapf; Syn. *E. elastica*, Altamirano and Rose, Not of Jumelle.)

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similar, there ought to be no difficulty in distinguishing the two plants, particularly when they grow, as is frequently the case, side by side. To facilitate comparison the more salient characters are set out here in parallel columns.

Parthenium argentatum.

A small *shrub* with a short stem and very numerous, much divided branches, from less than 1 to over 3 feet high; woody persistent branches short, more or less gnarled, covered with a rather smooth, dark grey bark; young shoots silvery grey all over.

Leaves lanceolate, acute, entire or more often with 1-3 coarse acute teeth or lobes, 1-2 in. long, 2-6 lin. wide, densely covered with a fine, silvery grey tomentum, gradually narrowed into an often long and slender petiole.

Flower heads subsessile, subglobose, 2 lin. in diam., 3-7 in a cluster; clusters at the ends of 2 or 3, rarely more, slender branches, collected into a very imperfect corymb, rarely solitary.

Involucre silky pubescent; outer bracts broadly herbaceous on the back.

Parthenium incanum.

A small *shrub*, 1-2 feet high, much branched; woody persistent branches, elongate, slender, covered with a somewhat rough bark, cracking longitudinally; young shoots finely whitish or greyish woolly.

Leaves obovate to obovate-oblong in outline, crenate (the smaller) to deeply pinnatifid, $\frac{1}{2}$ -1 in. long (rarely more), $\frac{1}{2}$ - $\frac{3}{4}$ lin. wide, lobes 1-2 on each side, entire or the terminal crenate, all very obtuse, the whole leaf densely covered with a white woolly tomentum when young, then greyish; petiole very short.

Flower heads shortly peduncled, or subsessile, 2 lin. in diam., in terminal, often much branched corymbs, 1-4 in. in diam.; branches slender.

Involucre finely villous; outer bracts slightly herbaceous on the back above the middle.

Specimens of the Guayule plant (*P. argentatum*) and of Mariola (*P. incanum*), presented by the Foreign Office, also a sample of Guayule rubber, presented by the Compania Explotadora Coahuilense, are exhibited at Kew in Case 68, Museum No. I.

XLVII.—A NEW RUBBER TREE: PALO AMARILLO.

(*Euphorbia fulva*, Stapf; syn. *E. elastica*, Altamirano and Rose, not of Jumelle.)

OTTO STAPF.

In July, 1905, Dr. Altamirano, Director of the Instituto Medico Nacional, Mexico, and Dr. J. N. Rose, Assistant Curator of the National Museum, Washington, published a description and illustrations* of a new species of *Euphorbia* (*E. elastica*) known in Mexico as El Palo Amarillo. From the name, a footnote, and the description of the plates, it could be gathered that the plant was used and recommended for the production of rubber. A fuller memoir on the subject by Dr. Altamirano† appeared in the

* Dr. F. Altamirano, El Palo Amarillo (*Euphorbia elastica*, Altamirano and Rose, sp. nov.) pp. 1-3, tt. I-IV. (Secretaria de Fomento, Colonizacion e Industria. Instituto Medico Nacional, Mexico, 1905).

† Dr. F. Altamirano, El Palo Amarillo como productor de caucho. Primera memoria (Mexico: imprenta y fototipia de la Secretaria de Fomento, 1905).—Not seen.

same year. An abstract of this was published by Dr. R. Endlich* of Mexico, and the notes given below on the tree and the rubber production from it are taken from this article.

Unfortunately the name *Euphorbia elastica* was, a few months previously, viz., in April of the same year, given by Professor Jumelle to a totally different species of *Euphorbia*, a native of Madagascar. The Mexican plant had therefore to receive a new name and, as "Amarillo" corresponds to the Latin "fulvus," I propose for it the name *Euphorbia fulva*.

Euphorbia fulva is a tree 8-10 metres high, with a yellow, smooth, shining bark; hence the name Palo Amarillo†, that is "yellow tree." It occurs in the States of Michoacán, Guanajuato, Jalisco, and in the western parts of the State of Mexico, usually at an altitude of 1500-1900 m. The annual rainfall of that area is between 550 and 750 mm., and the mean annual temperature between 17° and 20° C. (62.5°-68°F). The tree thrives well also on stony or rocky soil. Attempts to produce rubber from its latex were made in Michoacán some time ago, but given up as no process was known to separate the rubber from the resin, which occur in the proportion of 18-20 per cent. and 40 per cent. respectively. Recently, however, Professor Lozano succeeded in separating completely the two substances and producing very good rubber, according to some, even better than "caucho negro" (Central American rubber), and, from the resin, an excellent varnish. The process of separation has, however, so far not been made public, and at the time when the article was written the whole matter was still in the experimental stage, although plans for working the Palo Amarillo in Michoacán were under consideration. Since then an application for a concession to establish and work factories for the extraction of rubber from the tree in the States of Guerrero, Jalisco, Michoacán, Guanajuato, Oaxaca, Puebla, Lower California, Colima, and the Territory of Tepic has been made by Senor Carlos Llaguna y del Hoyo, of Michoacán.‡

The latex of Palo Amarillo is yellowish white, thin, and does not coagulate readily. To effect this it is exposed to the sun. If not subjected to Lozano's process the product is dark yellow, dough-like and neither resilient nor viscous. If boiled the latex turns very sticky and whitish grey. Experimental tapping in Guanajuato and Michoacán resulted in an average yield of 1 lit. (1.75 pint) of latex per tree. It is recommended to proceed with the tapping from the branches downwards, and to use sharp tools. If the tapping is done judiciously the tree may be ready for another yield after three months, and it is expected that it will stand three tappings per annum for 10 years. In Atecucario hatchets or "machetes" (large knives) are used, and the incisions are made in an oblique direction parallel to each other, or in spirals. The latex is collected in petroleum cans or small pots. A certain portion coagulates on the tree and is removed with knives. It

* Der Tropenpflanzer, 1906, pp. 525-531.

† The name Palo Amarillo is also applied to *Berberis pinnata*, Lag. (*Mahonia pinnata*, Fedde), and to two species of *Bocconia*, viz.:—*B. arborea*, Wats., and *B. frutescens*, Linn.—See Ramirez, Sinon. Plant. Mex. p. 52.

‡ Diario Oficial, dated March 8th, 1907, according to an official despatch to the Foreign Office by Mr. R. Tower, Envoy Extraordinary and Minister Plenipotentiary, Mexico, dated March 12th, 1907.

has been calculated that 100,000 trees would yield 300,000 Kg. (about 294 tons) latex per annum, from which 54,000–60,000 Kg. (53–58 tons) rubber and 120,000 Kg. (116 tons) resin might be obtained. The price of the rubber is estimated at 2 pesos (about 4s.), and that of the resin at 75 cms. (1s. 6d.). The scattered occurrence of the tree, however, and the great distance of the areas where the tree is fairly common are a considerable drawback. It has therefore been proposed to lay out plantations of the tree, the more so as it is easily propagated by cuttings and grows fast. Large tracts of waste land might in this way be made productive.

A valuable by-product of the Palo Amarillo is the oil (about 30 per cent.) extracted from the seeds. It is a good drying oil for varnish, and, like the oils of other *Euphorbiaceae*, a purgative.

Considering the favourable nature of Dr. Altamirano's and Dr. Endlich's accounts, it may be useful to point out that Mr. George Kennedy, H.M. Vice-Consul at Mexico, reports as late as February 28th, 1907, that no satisfactory process has yet been discovered to separate these two substances at a sufficiently low cost to give the "Palo Amarillo" a commercial value as a rubber producer. He also gives the proportion of rubber and resin (desiccated ?) contained in the latex of *Euphorbia fulva* as 40 and 60 respectively.*

Finally it may be added that *Euphorbia fulva* belongs to a small group (*Laurifoliae*, Boiss.) of arborescent Euphorbias extending from Mexico to Peru and the West Indies. One of these species, *E. calyculata*, H. B. K., locally known as Chupire or Tencuante, in some parts of Mexico, occurs with *E. fulva*. Its latex is very inferior and Dr. Altamirano suggests that the unsatisfactory result of the examination of certain samples of "Palo Amarillo" rubber may be due to a confusion of the two species. *E. fulva* can be easily distinguished from *E. calyculata* by its smaller leaves (3–6 cm. by 1–2 cm.) which are woolly beneath, its short, stout, leafless flowering branches, dividing into 4–5-rayed umbels, of which, however, only one ray is properly developed bearing a flower or fruit. The West Indian species is *E. punicea*, Sw., a native of Jamaica, Cuba, and the Bahamas. Nothing is known as to its economic value.

XLVIII.—MISCELLANEOUS NOTES.

Sir J. D. HOOKER.—His Majesty the King has been graciously pleased to confer the Order of Merit on Sir J. D. Hooker, G.C.S.I., C.B., F.R.S., formerly Director of the Royal Botanic Gardens, Kew.

Mr. A. W. HILL, M.A., Fellow and Dean of King's College, Cambridge, and University Lecturer in Botany, has been appointed Assistant Director of the Royal Botanic Gardens, Kew.

* Report, enclosed in Mr. Tower's despatch, Commercial No. 13, of the 1st of March, 1907.