

THE MEXICAN AND CENTRAL AMERICAN SPECIES OF SAPIUM.

By HENRY PITTIER.

INTRODUCTION.

Among the Costa Rican species of *Sapium* there is one common in the central valley of San José and known to the natives under the name of *yós* or *íos*, a word that probably originated in the extinct Güetarú language. The milk of this species is used by boys as a bird-lime.^a Small sticks are smeared with the fresh milk and placed near some food that will attract the birds, and if any of these happens to alight on one of the sticks, its feet adhere so strongly that it can not fly away. With the object of ascertaining the presence or absence of rubber in the milk of that species, I started a few years ago some preliminary investigations. The subject of my first few experiments was a tree growing in a hedge near San José. Its trunk was about 30 centimeters in diameter, and it measured nearly 3 meters from the ground to the limbs, but it had been kept cut back with the hedge, so that the ramification was all new growth with very large, fleshy leaves. These furnished an abundance of a watery latex which, after desiccation, was found to contain traces of rubber and a very large amount of a sticky, resinous substance. Later I realized through personal experience the fact, already very well known, that the milk of young *Castilla* trees and other rubber plants also yields mostly resinous substances and comparatively little rubber, so that the conclusiveness of these first experiments against the utility of the Costa Rican *Sapium* became doubtful.

I had no opportunity, however, to continue my researches under better conditions and had almost adopted the opinion that none but the high Andean species of *Sapium*, known from Colombia and Ecuador, were rubber-producing trees, when my attention was attracted by various articles from different sources, all of which contributed to throw new light on the really important rôle of several species of this genus as contributors to the supply of South American rubber.

^a The milk was used for the same purpose in Jamaica. (See footnote, p. 162.)

As early as 1901 Dr. J. Huber, at present director of the Museu Goeldi at Para, called attention to several rubber-yielding species of *Sapium* from the Amazon basin.^a His paper was apparently ignored by Professor Jumelle, who nevertheless gives in his book^b an excellent account of the Brazilian rubber-yielding *tapurú*, or *murupita*, which he also places, although with doubt, in the genus *Sapium*. According to this author, much of the *borracha*, *fina* and *entrefina*, coming into market through Manaus, and heretofore considered a product of several species of *Hevea*, actually proceeds from the *tapurú*, or *murupita*, tree.

Further investigations of Doctor Huber^c confirmed Professor Jumelle's inferences and contributed several important additions to the facts already known. At about the same time Dr. Ernst Ule^d increased by two the number of the Brazilian species of *Sapium* known to produce rubber. In Ecuador and Colombia no less than five species of this genus are known to yield good rubber, and in a recently written article Mr. A. W. Bartlett^e states that the milk of *S. jenmani* Hemsl., growing in the lowlands of British Guiana, yields a rubber of excellent quality, long known to the natives, and that this constitutes to-day the bulk of the rubber supply of the colony. Thus at least nine South American species of the genus *Sapium* are to-day known to yield rubber, while the Central American species that have scarcely been investigated botanically may contribute important additions to the list.

Shortly before leaving Costa Rica I received a small sample of an apparently excellent rubber, said to have been extracted from *Sapium*, or *yós*, trees, the exact location of which could not be given. This of course had the effect of renewing my interest in the matter, and I felt also stimulated to further investigations in that line by Doctor Preuss's discovery of several new rubber-yielding species of *Sapium* on the Pacific coast of tropical South America.^f A large number of botanical specimens were collected both by myself and by my former assistant, Mr. A. Tonduz, most of which were found to constitute new species. They were turned over to Dr. Karl Schumann for determination, but their systematic study was unfortunately interrupted by the untimely death of that botanist, while my departure from Costa Rica put an end to any further attempt on my part to ascertain the economic value of these species.

^a Bol. Museu Paraense (Goeldi) 3: 365-368. 1901.

^b Jumelle, Henri. Les plantes à caoutchouc et à gutta, exploitation, culture et commerce dans tous les pays chauds. Paris, 1903.

^c Bol. Museu Goeldi (Paraense) 4: 485. 1904-1906.

^d Ule, Ernst. Kautschukgewinnung am Amazonenstrom. Berlin, 1904. The same, Kautschukgewinnung und Kautschukhandel am Amazonenstrom. Beiheft zum Tropenpflanzer, Januar, 1905.

^e Journ. Board Agr. Brit. Guian. 1: 1-12. 1907.

^f Published in his Expedition nach Central- und Südamerika, 384-391. 1901.

This is, I believe, enough to show on the one hand that the apparent scarcity of *Sapium* species in and north of Costa Rica must be attributed mainly to our deficient knowledge of the flora, and on the other that there is really no reason why some of these unknown or little-known Central American species should not also be found to yield commercial rubber. It is in anticipation of further researches on the subject that the present revision of the species known from Middle America has been undertaken.

In the preparation of this paper I have used the material in the United States National Herbarium, and also in the collections that were kindly loaned me by the Gray Herbarium, the Field Museum of Natural History, Capt. John Donnell Smith, of Baltimore, and the Instituto físico-geográfico, of Costa Rica. The last collection contained no less than seven new species, five of which had been named, although not described, by Dr. Karl Schumann. Although it is not unlikely that upon further investigation the number of these Costa Rican species will need to be reduced, I prefer to maintain here the specific divisions established by the lamented Berlin botanist. Not long ago one of the forms distinguished by him under the name of *S. pycnostachys* was described by Huber,^a who gave it the less desirable name of *S. pittieri*.

Regarding the general systematic treatment of the genus *Sapium*, it must be said that it is still very imperfectly known. Not only are the differences between the numerous species often very vaguely defined, and many species have been included under one name, but even the limits of the genus do not seem to be always understood, as there has been a continual confusion between *Sapium*, *Excoecaria*, *Sebastiania*, and *Stillingia*.^b This is due, without doubt, to the absence in most herbaria of sufficiently extensive material.

^a Bull. Herb. Boiss. II. 6: 350. 1906.

^b As understood to-day, the genus *Excoecaria* is limited to the Eastern Hemisphere, with *E. agallocha* as the type species. It differs from *Sapium* by characters of seemingly little importance and perhaps not yet well defined. Most of the species are dioecious; the divisions of the male calyx are distinct, very narrow, and usually three in number; the clusters of the male flowers and the pistillate flowers are pedicellate, each cluster of the first seldom containing more than three flowers; the seeds are smooth. Mueller of Argau (in Mart. Fl. Bras. 11²: 611-630) includes all the American species in this genus, of which *Sapium* is then only a subdivision. But this view has not been sustained by Bentham and Hooker and the more recent writers.

Sebastiania is also a very near related genus, mostly from extratropical America. It differs at first sight from *Sapium* by the reduced size of the plant, the absence of petiolar and bracteal glands, the smooth seeds, and the bivalvate dehiscence of the capsules. In *Stillingia*, another member of the same group, we note the absence of the persistent axial column of the capsule and marked differences in the glandular apparatus; also the American species of that genus are mostly extratropical and somewhat distinct in their habits.

As a general rule, the species of *Sapium* are exceedingly polymorphic. As in *Ficus*, the habit of the younger trees and the size and texture of their leaves are quite distinct from those of old individuals. On the same tree we have often large thick leaves on the young shoots, medium-sized and rather coarse leaves on the branchlets of older growth, and again small, narrow, and thin leaves at the base of the new inflorescences. The general shape, the indentation of the margin, and the glandular apparatus vary correspondingly. And again, between trees of the same species but growing in distinct stations, we note striking variations in the same series of characters. But this is not all; it is very likely that most of the species, if not all, are proterandrous, the first flowers of the season being exclusively staminate, while a second flowering that immediately follows shows the usual androgynous spikes. This fact has given rise to the belief that some species are dioecious, which is certainly not the case, at least in the species of the subgenus *Eusapium*.

The generic name *Sapium* was used for the first time by Patrick Browne in 1756,^a being applied to one of the Jamaican species, although without specific designation. In the second edition of the same work, published in 1789, the Linnæan name of *Hippomane glandulosa*^b is given as corresponding to Browne's "gum tree," but as early as 1762 Jacquin^c had upheld *Sapium* as a generic name and

^aThe Natural History of Jamaica 338. 1756. Browne gives the following account of the genus without reference to any species:

"SAPIUM 1.—Arboreum, foliis ellipticis, glabris, petiolis biglandulis, floribus spicatis.

"THE GUM TREE.

"Flores alii masculini, alii feminini, in iisdem spicis; illi e superiore spicae parte, oriuntur; hi vero infra enascuntur.

"Mas.

"Periantium nullum. Corolla nulla. Stamina: E singula lacuna biglandula emergunt filamenta quatuor, quinque, vel sex, brevissima; antheris globosis instructa.

"Femina.

"Periantium: E lacunis paucis biglandulosis, circa basim spicae digestis, emergunt periantia totidem ventricosa, minima quadridentata. Corolla nulla. Pistillum: Germen oblongum, intra calicem situm; stylus brevis tripartitus, stigmata simplicia. Pericarpium: Capsula subrotunda, obtuse triloba, trilocularis, seminibus tribus solitariis referta.

"This tree grows to a very considerable size and yields a great quantity of resin of a thick, sticky consistence, dirty color, opaque, and of little smell, which generally serves for the boiling-house lamps in every part of the country where the tree is frequent, and is much used for bird lime, which purpose it is observed to answer extremely well. The wood is soft and coarse and not much esteemed."

^bL. Sp. Pl. 1191. 1753.

^cEnum. Pl. Carib. 31. 1762; Select. Stirp. Am. 249. 1763.

identified the Jamaican *Sapium* with his *S. aucuparium*. So it happens that although Browne's publication was not made with all the technical requirements, *Sapium* is generally accepted as a well-founded genus, and the Jamaican species, *S. caribaeum* of the modern botanists, is perhaps entitled to be considered as the typical one, unless Jacquin's true *S. aucuparium*, from Cartagena, be taken, on the ground that it seems to be the first to receive a definite binomial name under the genus. Later, several extra-American genera—among them *Triadica*, *Falconeria*, and *Conosapium*, none of which I intend to discuss here—were referred to this genus as subgenera. This is the view taken by Doctor Pax in his treatment of *Sapium* in Engler and Prantl's *Pflanzenfamilien*.^a

In its restricted sense (*Eusapium*) the genus under consideration includes large trees, with alternate smooth leaves usually bearing a pair of glands at the base of the lamina and provided with caducous stipules. Most species, if not all, are proterandrous, having a first bloom with only male flowers, while in a second flowering, directly following, occur both pistillate and staminate flowers. The inflorescence consists of spiciform, glanduliferous, terminal or axillary racemes, growing either solitary or in clusters. On the androgynous spikes the pistillate flowers are always at the base.

The staminate flowers are in clusters of at least three, but mostly more in the Central American species, each cluster under a more or less developed bract, with a pair of large, discoid, sessile glands. The calyx is irregularly indented or lobed and includes two or three stamens (always two in the species here described).

The pistillate flowers are solitary under each bract, but in variable numbers (1-16) at the base of each spike. The calyx is usually bottle-shaped and more or less deeply divided. The ovary is superior, three-celled, with three styles, adnate at the base, or completely free.

The fruit is a three-coccos capsule, smooth outside, dehiscent. The seeds are single in each cell, rather rounded or lentiform, and with a more or less distinct caruncle. The albumen is carnose.

At present the genus *Sapium* includes about fifty-eight recognized species, distributed all over tropical America from Mexico to Argentina, with altitudinal ranges varying between 0 and 2,500 meters. It is likely that a goodly number of other forms have hitherto escaped the attention of botanists. The present paper deals only with the nine Middle American species known to-day.

^a 3⁵: 97.

DESCRIPTIONS OF SPECIES.

ANALYTIC KEY.

- Spikes in clusters of 3 to 5 at the ends of the branchlets.
- Petiole glands fully developed..... 1. *S. pleiostachys*.
 - Petiole glands none or rudimentary..... 2. *S. anadenum*.
- Spikes single on each branchlet.
- Leaves distinctly lanceolate.
 - Capsules sessile..... 3. *S. mericanum*.
 - Capsules pedicellate.
 - Apical glands well developed..... 4. *S. thelocarpum*.
 - Apical glands none..... 5. *S. pedicellatum*. - Leaves short and rather broad.
 - Petiole glands distinctly on margin of blade..... 6. *S. pittieri*.
 - Petiole glands on petioles.
 - Spikes thick and rather short..... 7. *S. pachystachys*.
 - Spikes rather long and slender.
 - Leaves small, oval-elliptic, acumens reflexed.... 8. *S. oligoneurum*.
 - Leaves medium, broadly ovate, acumens unguiform..... 9. *S. subtrijugum*.

1. *Sapium pleiostachys* Schumann & Pittier, sp. nov. PLATE X. FIGURE 7.

A medium-sized or even large tree, with ascending limbs and elongated crown; young shoots reddish, short; leaves more or less coriaceous and thick according to age; petioles rather thick, 1.5 to 3 cm. long; petiole glands short and obtuse; leaf

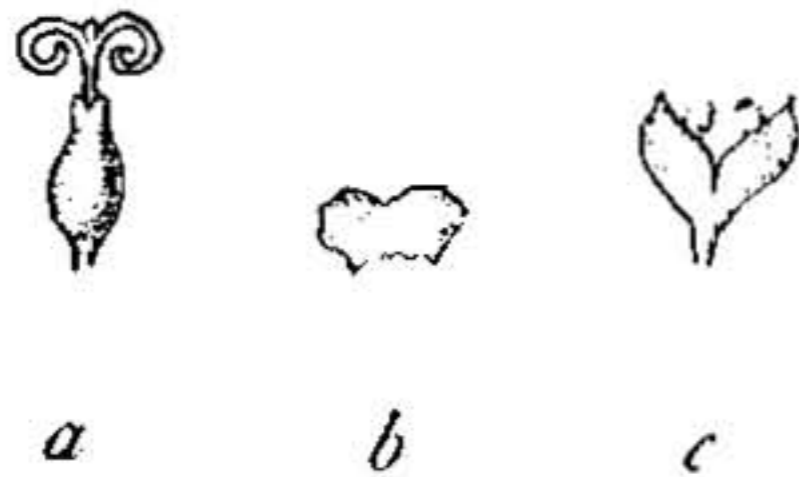


FIG. 7.—*Sapium pleiostachys*. a. Pistillate flower; b. bract; c. staminate flower.

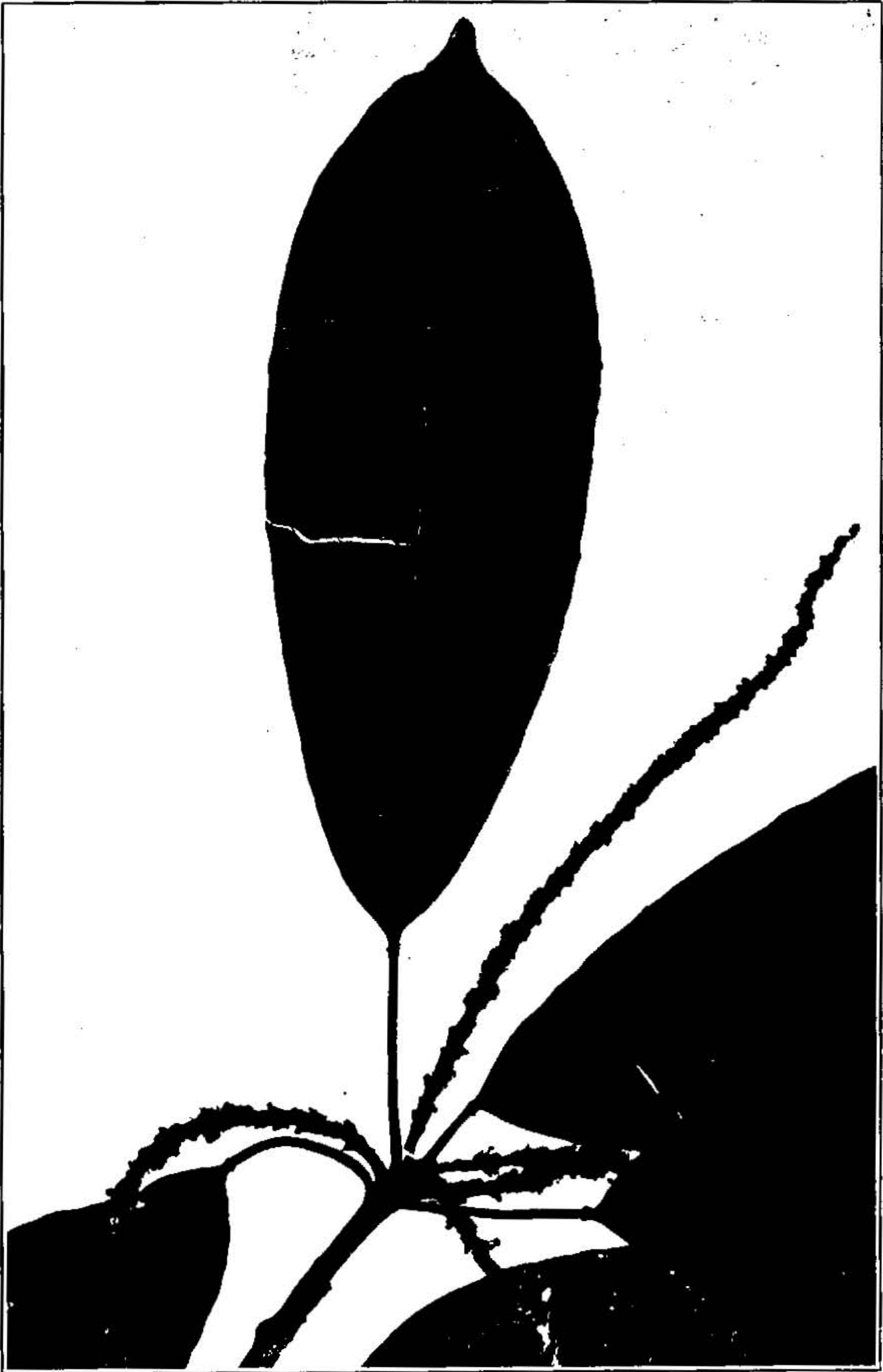
blades 6 to 15 cm. long, 3 to 5.5 cm. broad, obovate or oval-elliptic, cuneate or slightly rounded at base, acuminate but with rounded, flat tip; margins smooth at blooming time, distinctly sinuate on fructiferous twigs; secondary nerves rather close, arcuate, very salient on lower face; stipules small, scarious, ovate-acuminate; floral spikes androgynous, 7 to 9 cm. long, in terminal clusters of 3 to 5; rachis and other parts of inflorescence purplish-tinged; floral glands paired, discoid; pistillate

flowers 6 to 8 at base of spikes, their involucre bracts broadly obovate, the calyx bottle-shaped, inclosing the whole of ovary and style; ovary sessile or very shortly stipitate, ovate-elongated; style rather long, persistent, stigmas well-developed, spiral; staminate flowers 6 to 8 in each cluster, the calyx of the open flowers elongated at base in a pedicel-like tube; filaments short; anthers rather small, half-inclosed, deep purple; anthesis successive, beginning at center of cluster; capsules sessile, smooth, 7 to 8 mm. high, 8 to 9 mm. in diameter; seeds lenticular, black, obscurely verrucose, 4 to 5 mm. in diameter and 3.3 to 5 mm. thick, with a slender caruncula at the apex.

Costa Rica: Forests of Golito de Osa, close to seashore, H. Pittier, March, 1896, flowers (Inst. fis.-geog., Costa Rica, no. 9906; U. S. National Herbarium, no. 578902, type). Guatemala: San Felipe, Departamento Retalhuleu, altitude 700 meters, fruit, April, 1892 (John Donnell Smith, no. 2607).

2. *Sapium anadenum* Pittier, sp. nov. PLATE XI. FIGURE 8.

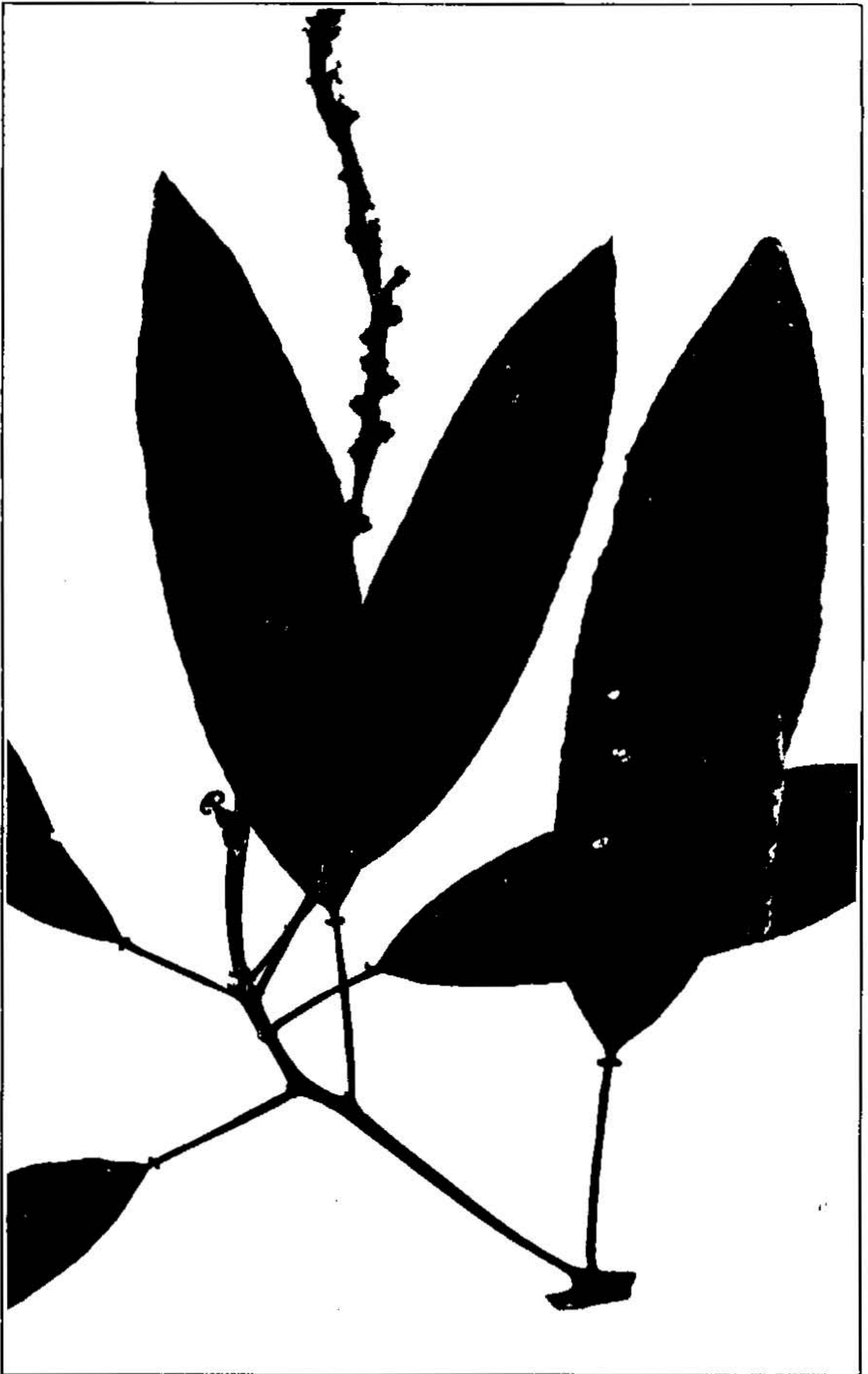
A tree 15 to 20 meters high, with horizontal limbs and rounded crown; petioles slender, 1.5 to 3 cm. long; petiole glands mostly absent or rudimentary; leaf blades oval-elliptic or lanceolate, rounded at base, narrowing into a slightly incurved tip, chartaceous, shiny on both faces, 4 to 9 cm. long, 2.5 to 4 cm. broad, obscurely sinu-



SAPIUM FLEKOSTACHYS SCHUMANN & PITTIER.



SAPIUM ANADENUM PITTIER.



SAPIUM MEXICANUM HEMSL.

ate on the margin; floral spikes in terminal clusters of 3 to 5, androgynous or sometimes only staminate; floral glands discoid or transversely elliptic; pistillate flowers pedicellate, 5 to 7 at base of spikes; the bracts scarious, broadly cordiform, the calyx greenish yellow, closely contiguous to the ovary, with two acute tips, the ovary ovoid with a short style and smaller, nearly erect, exserted stigmas; staminate flowers 6 or 7 in each cluster, pedicellate, the calyx divisions oval, pale yellow; stamens long-exserted; filaments thick, clavate; anthers small, reniform, pale yellow or tinged with purple; capsule and seeds not known.

Costa Rica: Hacienda Valverde at Orosí, altitude 1,200 meters, H. Pittier, March, 1902, flowers (Inst. ffs.-geog., Costa Rica, no. 16366; U. S. National Herbarium, no. 578045, type).

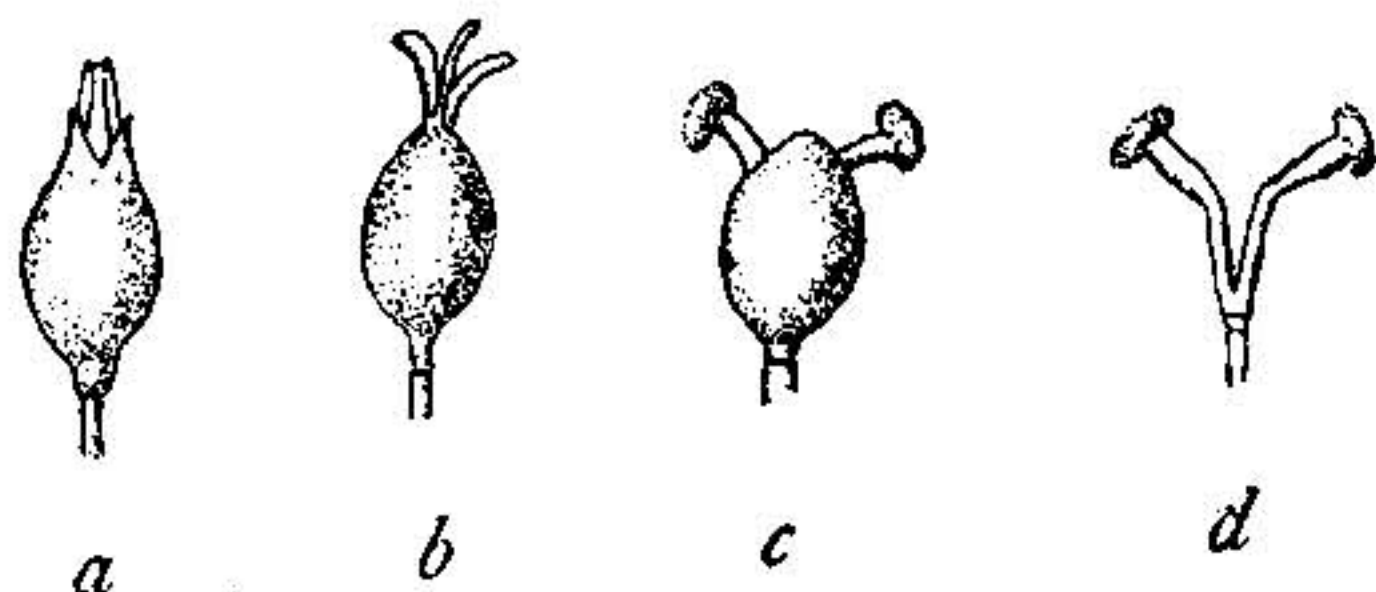


FIG. 8.—*Sapium anadenum*. a, Immature pistillate flower; b, pistil; c, staminate flower; d, stamens.

These specimens were placed with *S. pachystachys* by Professor Schumann, but they differ widely from that species in the form and texture of the leaf, their clustered spikes, and the characters of the pistillate flowers. I would rather place it near *S. pleiostachys*, with which it may prove identical upon examination of more complete material.

3. *Sapium mexicanum* Hemsl. in Hook. Ic. Pl. IV. 27: pl. 2680. 1901. PLATE XII.

“An entirely glabrous tree, the fructiferous branchlets being rather thick and smooth; leaves long-petiolate, coriaceous, flexible, pale green, oblong-lanceolate, 10 to 20 cm. long, including the petioles, and up to 3.5 cm. broad [petioles 2.5 to 3.5 cm., leaf blades 6 to 12 cm. long, 2.5 to 3.5 cm. broad, as seen by me.—H. P.], sub-obtuse and eglandular at the apex, cuneate or rounded at the base; margin minutely callous-crenate in its whole length; primary lateral veins numerous, slender, curved, obscurely connected near the margin; petioles slender, 2 to 3 cm. long, with 2 thick, subglobose glands at the summit; stipules broad, squamiform, long-persistent; spikes androgynous, simple, terminal or pseudoterminal, solitary, longer than the leaves; bracts small, provided with peltate, oval, geminate glands; pistillate flowers 3 or 4 at the base of the spikes, solitary in the axils of the bracts, sessile, the remaining flowers staminate, in clusters of 9 to 12 under each bract; styles free from the base, thick, recurved, soon deciduous; capsules very shortly pedicellate, ligneous, subglobose, loculicidally dehiscent from a persistent axis, about 38 mm. in diameter when expanded, the valves at length very spreading, long-persistent; seeds ovoid, 10 to 13 mm. long [8.1 to 8.2 mm. long, 6.1 to 6.2 mm. thick, as seen by me.—H. P.], slightly corrugated under the cinnabar-red testa; embryo central; cotyledons orbicular.”—Hemsley, loc. cit.

Mexico: Lava fields near Cuernavaca, Morelos, altitude 1,500 meters, C. G. Pringle, no. 6336, June 17 and September 23, 1896, flowers; C. G. Pringle, no. 13195, June 8, 1904, flowers and fruit; E. W. D. Holway, no. 3517, September 28, 1899, fruit (Gray Herbarium). Huber^a has suggested the substitution of the name *S. macrocarpum* Sw. for *S. mexicanum* Hemsl. But I do not feel altogether convinced that the short and incomplete description of Swartz applies more to the very complete materials of the species collected by Pringle and Holway than to Huber's new species, *S. pedicellatum*. In view of the doubt, I find it advisable to maintain Hemsley's name.

Until better material has been supplied, *Sapium lateriflorum* Hemsl.^b must be considered as a species of doubtful standing. Hemsley himself hesitates as to the

^a Bull. Herb. Boiss. II. 6: 352. 1906.

^b Hook. Ic. Pl. IV. 27: under pl. 2680. 1901.

validity of the main specific character given by him, i. e., the laterality of the spikes, and in referring to a genus that is so noteworthy for individual variations in the form and size of the leaves still less weight should be given to characters taken from these. The remaining parts of the description apply in a general way to several of the Central American species.

4. *Sapium thelocarpum* Schumann & Pittier, sp. nov. PLATE XIII.

A tree often reaching 20 meters in height, with horizontal or slightly ascending limbs; new growth leaves rather large; petioles slender, 1.5 to 3 mm. long, with petiolar glands 1 mm. long, some 2 mm. distant from the lamina; lamina broadly elliptic, 7 to 14 cm. long, 4 to 7 cm. broad, rounded at base, obtusely acuminate, its margin obtusely sinuate; leaves of floral twigs obovate, 7 to 14 cm. long, 2 to 4 cm. broad, long-cuneate or rounded at base, abruptly acuminate with a well-developed gland on upper surface of incurvate tip; margin obscurely sinuate-serrate and revolute; larger secondary nerves rather distant, arcuate, forming a fine, prominent network on the lower, paler green face of the blade; spikes single, terminal, reaching 22 cm. in length, androgynous, with 3 to 4 pistillate flowers at base of each spike or only male; bracts not over 1 mm. long, ovate-acuminate; ovary distinctly pear-shaped; style persistent; staminate flowers very small, in clusters of 5 or less, with orbicular glands at base; capsules stipitate, 4 or less on each spike, pyriform, apparently with only 2 fertile cells; mature seeds not known.

Costa Rica: Along Río Ciruelas, on the southern slope of Barba Volcano, altitude about 1,800 meters, A. Tonduz, young shoot with unusually large leaves (Inst. fís.-geog. Costa Rica, no. 2219); hedges at La Verbena, near San José, altitude 1,100 meters, A. Tonduz, August, 1894, fruit (U. S. National Herbarium, no. 578901, type; Inst. fís.-geog. Costa Rica, no. 8857); along Río Torres near San José, altitude 1,100 meters, A. Tonduz, July, 1896, young fruits and male flowers (Inst. fís.-geog. Costa Rica, no. 10112).

The late Doctor Schumann labeled with the above name only no. 8857, while he named no. 10112 *S. biglandulosum* Müll. Arg. This last number does not agree with Müller's description, and I fail to find a difference between the two specimens except that in 10112 the leaf indentation is perhaps less obtuse and the base of the blade more rounded and broader. The specimens of both numbers agree in their other characters and to my knowledge both represent the one common species met with almost everywhere in the valley known as the Central Plateau of Costa Rica. The same can be said of no. 2219, placed by Schumann in a third species, *S. aucuparium* Jacq. This specimen consists merely of young leaves of what is certainly, according to my experience, the species just described. Insufficient attention has perhaps been paid to the fact that *Sapium*, like *Ficus*, *Castilla*, and some other trees, has much larger leaves on shoots or on young specimens than on the adult individuals.

5. *Sapium pedicellatum* Huber, Bull. Herb. Boiss. II. 6: 352. 1906. PLATE XIV.

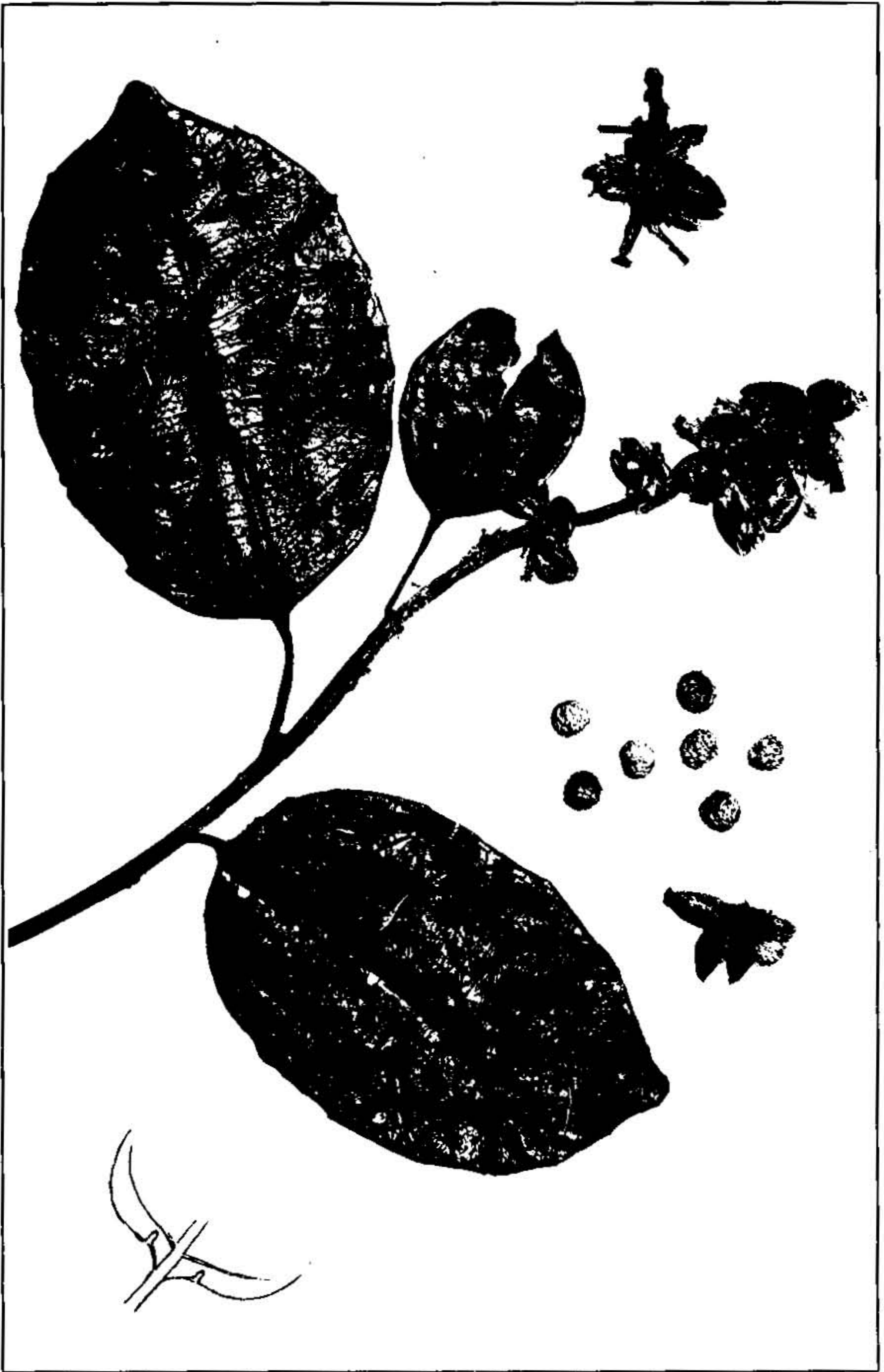
A medium-sized tree with generally elongated crown, the limbs ascending; petioles 8 to 18 mm. long, the glands elongate, cylindrical; leaf blades membranaceous and tender on the young floral shoots, coriaceous later, almost uniformly elliptic-lanceolate, 4 to 9 cm. long, 1.5 to 3 cm. broad, more or less acute at base and pointed at the glandless tip; the margin smooth in young leaves, distinctly serrulate in the mature ones; the secondary nerves numerous, more or less prominent on the upper face according to the age of leaf; floral branchlets slender and not ramified, growing profusely on the thick, succulent twigs of the preceding year; floral spikes lateral or terminal, androgynous or only staminate, probably in part caducous, 7 to 9 cm. long; floral glands oval; staminate flowers generally 5 in each cluster, the bracts broad and very short, the perianth divisions acute, the stamens connate only at base, their filaments thickened at the middle, the anthers cordate; pistillate flowers, when present, 1 to 4 at base of each spike; ovary distinctly stipitate and shortly mucro-



SAPIUM THELOCARPUM SCHUMANN & PITTIER.



SAPIUM PEDICELLATUM HUBER.



SAPIUM PITTIERI HUBER.

nate; capsules slightly rugose outside, ligneous, dehiscent, rather large, the pedicels 6 to 8 mm. long; seeds ovoid, 5 to 6 mm. long, 4.5 mm. thick, finely tuberculate, carinate at the end, this marked in the middle by a spiny tip.

Mexico: Colima, altitude about 500 meters, Dr. F. Palmer, no. 92, July, 1897. (Econ. Herb. U. S. Department of Agriculture; U. S. National Herbarium, no. 305158.)

The salient character of this species seems to be its extreme variability, making it difficult to give a very accurate description. Still, the rather long pedicels of the mature capsules and the form of the seed are pretty constant and constitute a sharply defined departure from the other Central American species. The seed characters appear again, with more or less variation, in *S. mexicanum* and in the only species known from Guatemala, the close affinity of these forms being thus made evident.

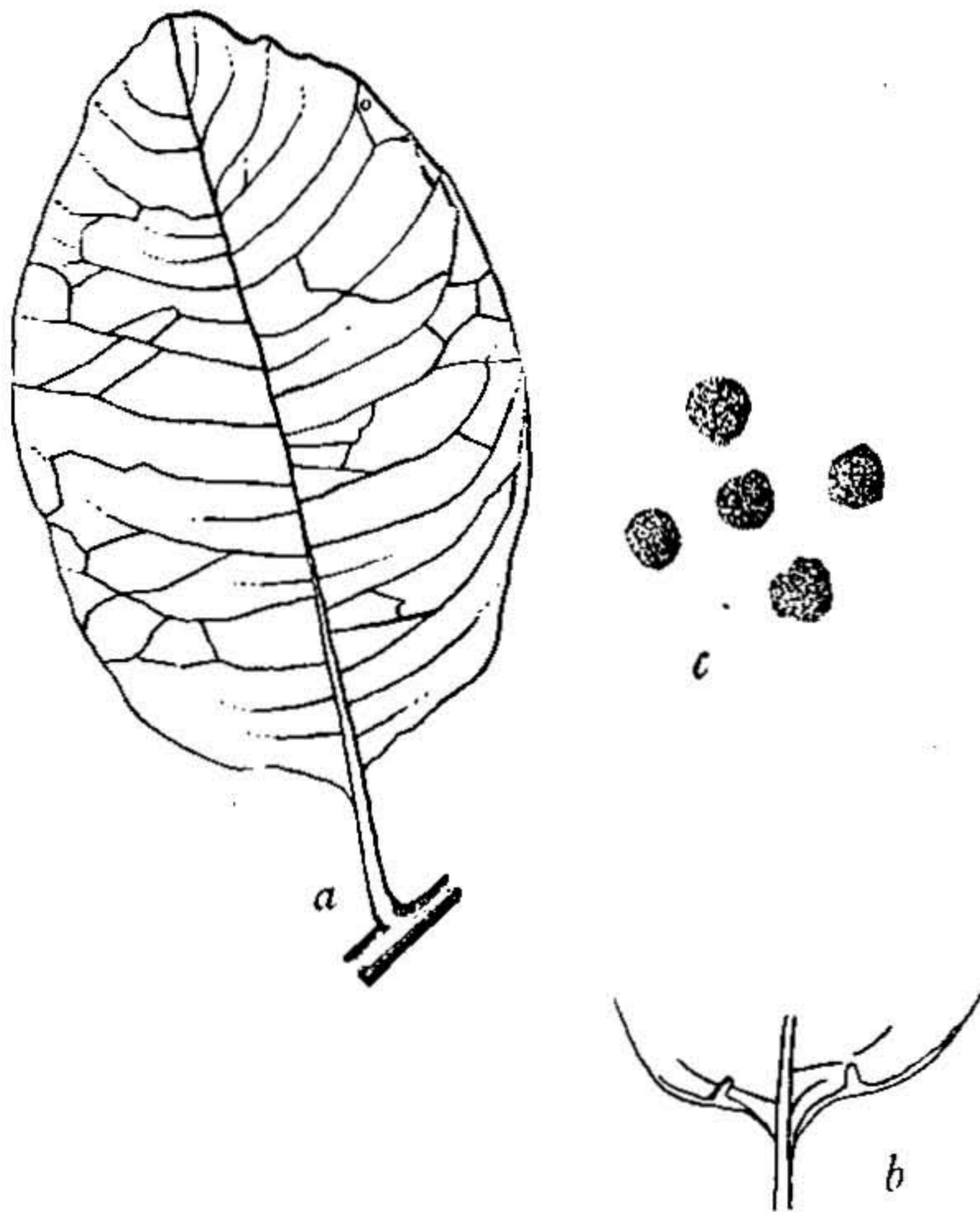


FIG. 9.—*Sapium pittieri* a, Leaf; b, leaf base, showing glands; c, seeds.

In Hemsley's description of *S. lateriflorum* several particulars are mentioned that can be found also in specimens of *S. pedicellatum*, as the thick floriferous branchlets with thick pith, the lateral spikes with leafy peduncles, etc. But the former species decidedly differs by the striking size of its leaves and its axillary spikes.

6. *Sapium pittieri* Huber, Bull. Herb. Boiss. II. 6:350. 1906.

PLATE XV. FIGURE 9.

Tree 6 to 8 meters high, with yellowish gray branchlets; petioles about 1.5 cm. long, canaliculate, the glands on the margin of the base of the lamina; leaf blades 5 to 7 cm. long, 4 to 5 cm. broad, subcoriaceous, broadly elliptic, abruptly contracted at base, shortly but broadly acuminate with a slightly inflexed acumen; margin revolute, entire; secondary nerves moderately distant, prominent on the upper face; spikes terminal; capsules sessile, or with very short (1 mm. long) pedicels, mucronate,

3-celled, smooth and crustaceous, its polar axis apparently longer than or nearly equal to the equatorial diameter; seeds lenticular, 3.7 mm. thick, 5.1 mm. in diameter, white; tubercles disposed on upper surface of seed in prominent, concentric lines.

Costa Rica: Western slope of La Carpintera, between Tres Rios and Cartago, at an altitude of about 1,700 meters, H. Pittier and A. Tonduz, May 2, 1891, fruit (Inst. fis.-geog. Costa Rica, no. 4344).

Professor Schumann (in schedula) called this species *S. pycnostachys*, and it is unfortunate that this name can not be retained, as it referred to the thick-set appearance of the fructiferous spike. The species is closely allied to *S. oligoneurum* and *S. anadenum* and consequently to *S. aereum* and its South American associates; it differs from the first two by the peculiar disposition of the petiolar glands, and from *S. anadenum* in particular by its sessile, longer capsule, the outer shell of which is also thinner and smoother.

7. *Sapium pachystachys* Schumann & Pittier, sp. nov. PLATE XVI.

Small tree with thick, short trunk, 40 cm. in diameter, and more or less depressed crown, the primary limbs mostly horizontal; stipules ovate-lanceolate, acuminate; petioles thick, sulcate, 1 to 2 cm. long; petiolar glands rather short and thick, contiguous with the blade; leaf blades 8 to 9 cm. long, 4 to 5 cm. broad, coriaceous, oval-elliptic, rounded at base and with obtuse acumen, paler below; margin revolute; secondary nerves arcuate, prominent on both faces; floral spikes terminal, single, androgynous, thick; floral glands elliptic, 2 at base of each pistillate flower and at base of each group of staminate flowers, the latter in clusters of 3 to 5; stamens half-included in calyx; filaments thick and short; anthers as broad as long; pistillate flowers 8 to 10 at base of spikes, each flower with ovate-acuminate scales 3 to 3.5 mm. long and 4 mm. broad, their margins membranous and transparent; calyx tubiform, yellowish white, enveloping the ovary and style as far as the forking of the stigmas; ovary slightly depressed, 2.5 mm. in diameter, 1.5 mm. high, distinctly pedicellate; style 2 mm. long; stigmas thick, rather long (about 3 mm.), nearly straight, spreading; capsule and seed unknown.

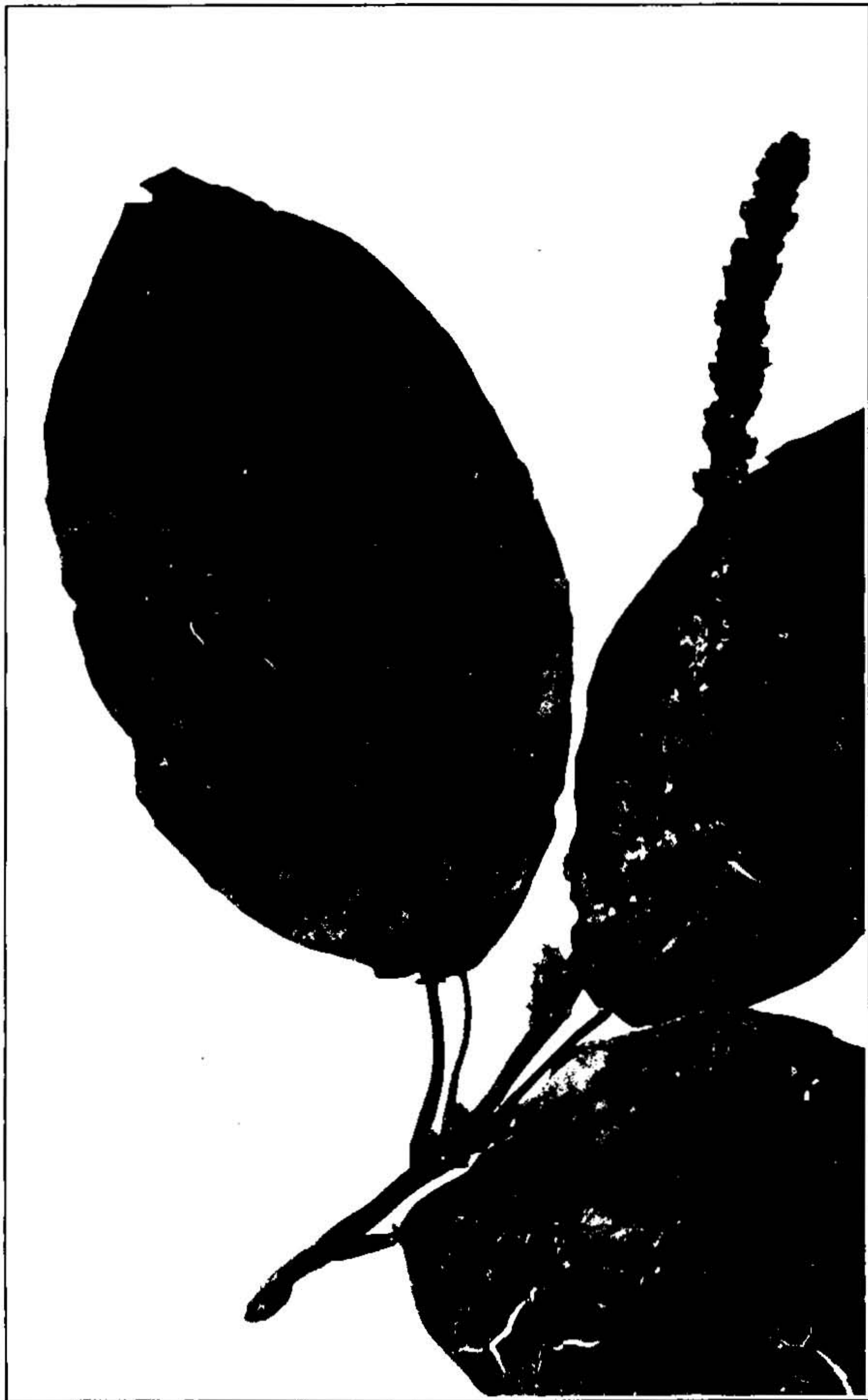
Costa Rica: Small tree growing isolated in pastures at El Copey, Dota Mountains, altitude 1,800 meters, A. Tonduz, February, 1898, flowers (Inst. fis.-geog. Costa Rica, no. 11875; U. S. National Herbarium no. 333961, type).

8. *Sapium oligoneurum* Schumann & Pittier, sp. nov. PLATE XVII.

A tree about 12 meters high, with elongated crown and slender habit; petioles thin, 1 to 2 cm. long; petiolar glands rather long and cylindrical, inserted at the beginning of the expansion of the lamina; leaf blades 3 to 7 cm. long, 2 to 3 cm. broad, ovate to ovate-elliptic, the base shortly cuneate, then rounded, the apical gland well developed on a narrow involute acumen, the margin sinuate, obscurely crenate, the nerves few; spikes often as much as 14 cm. long, single, terminal with a few pistillate flowers at base; floral glands elliptic-elongate; staminate flowers in clusters of 5 to 7, one of them opening at a time; bracts broad and short, with rounded scarious upper margin; perianth broadly open; filaments slender; anthers small.

Costa Rica: Along upper road going from the railroad station at Cartago to Cot, near San Rafael, altitude 1,500 meters, H. Pittier, July, 1899 (Inst. fis.-geog. Costa Rica, no. 13403; U. S. National Herbarium, no. 578903, type).

This species is maintained, subject to revision when better information is secured, on the authority of Schumann, notwithstanding the deficient material at hand. The form of the leaves, if not their reduced size, and the apical gland suggest *S. aereum* Klotzsch, but for the metallic sheen, which seems to be a constant character of the leaves in the latter species. Also, the wide distance between the reported stations is opposed to the identity of the two species, the known forms having almost always very limited ranges.



SAPIUM PACHYSTACHYS SCHUMANN & PITTIER.



SAPIUM OLIGONEURUM SCHUMANN & PITTIER.

9. *Sapium sulciferum* Pittier, sp. nov.

FIGURE 10.

A medium-sized tree with flattened crown; branchlets grayish, longitudinally striate; stipules small, ovate; petioles 1 to 2 cm. long, and rather slender; petiolar glands small, roundish, at the attenuate base of the blade; leaf blades 5 to 8 cm. long, 2.5 to 4 cm. broad, coriaceous, paler on the lower side, oval-elliptic, shortly attenuate, ending in an obtusely angular tip, the margin obscurely sinuate; spikes androgynous, lateral or in clusters (generally 4) at the ends of limbs; floral glands deciduous; pistillate flowers numerous (16), part remaining undeveloped; staminate part of spike caducous, the fructiferous part 5 to 8 cm. long; capsules 9 to 10 mm. in diameter, 7 to 8 mm. high, coriaceous, distinctly pedicellate, depressed, ending with the terete base of the style; seeds lenticular, 3.5 mm. thick, 5 mm. in diameter, tuberculate, reddish brown.

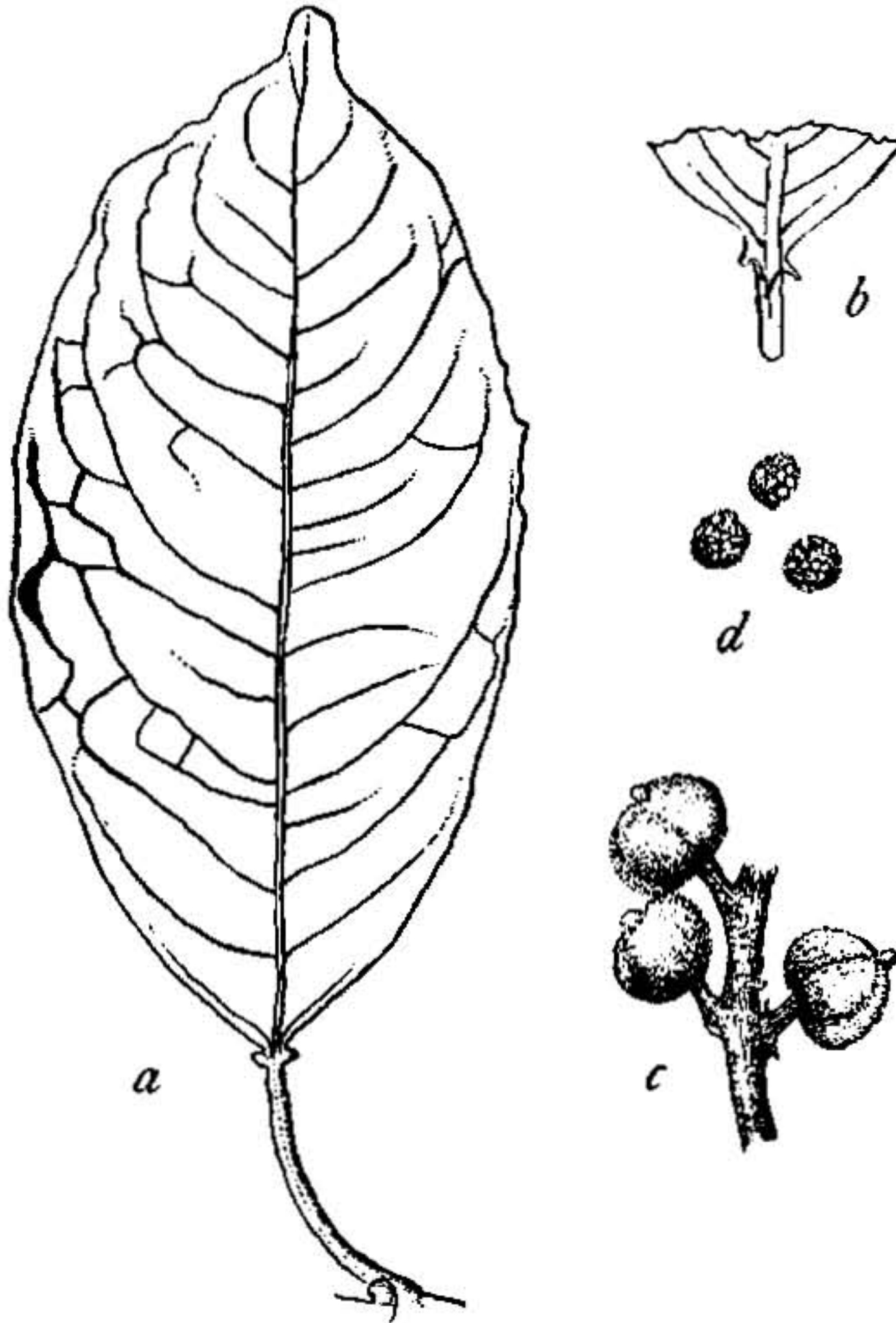


FIG. 10.—*Sapium sulciferum*. a, Leaf; b, leaf base, showing glands; c, fruits; d, seeds.

Costa Rica, along the main road at La Palma, in the zone of perennial rainfall, altitude 1,500 meters, A. Tonduz, August 15, 1898, fruit (Inst. fís.-geog. Costa Rica, no. 12428; U. S. National Herbarium, no. 577588, type).

This number is cited by Hemsley^a as near to *S. acreum* Klotzsch, from Peru, "but the leaves want the metallic sheen, the persistent base of the styles is terete, and the brown seeds are only about half as large as those of *S. acreum*." Moreover, the leaves are smaller and their apical glands less developed, the union of the petiole and the lamina forms a small, infundibuliform groove, on the margins of which the petiolar glands stand, and the capsules are smaller with a shorter polar axis.

^aHook. Ic. Pl. IV. 27: under *pl.* 2682.